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Global bauxite, alumina and aluminium trends

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AWAC Joint Venture (Alumina Ltd 40% interest)

BAUXITE PRODUCTION (million BDT#)

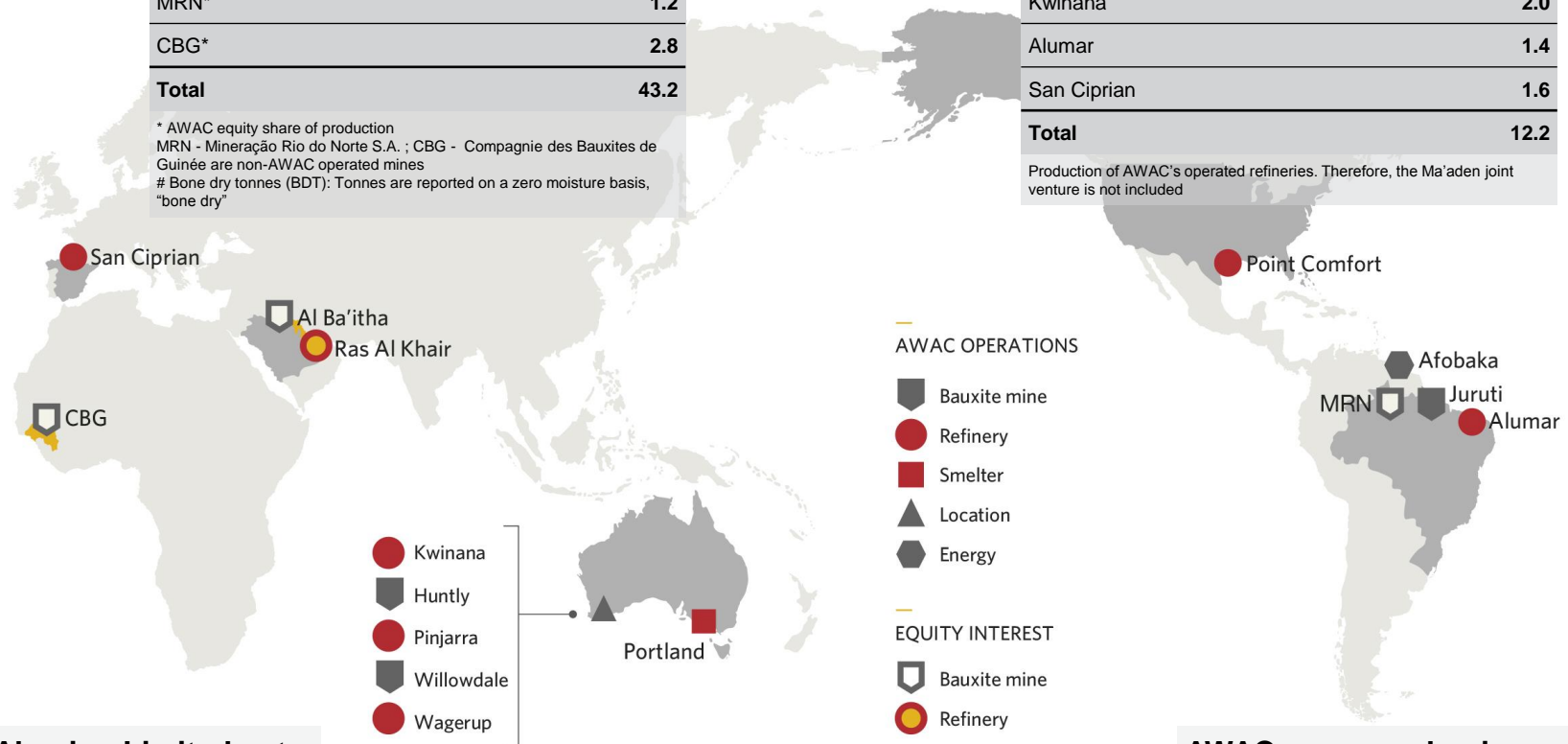
	2018
Huntly & Willowdale	33.5
Juruti	5.7
MRN*	1.2
CBG*	2.8
Total	43.2

* AWAC equity share of production
MRN - Mineração Rio do Norte S.A. ; CBG - Compagnie des Bauxites de Guinée are non-AWAC operated mines
Bone dry tonnes (BDT): Tonnes are reported on a zero moisture basis, "bone dry"

ALUMINA PRODUCTION (million tonnes)

	2018
Pinjarra	4.5
Wagerup	2.7
Kwinana	2.0
Alumar	1.4
San Ciprian	1.6
Total	12.2

Production of AWAC's operated refineries. Therefore, the Ma'aden joint venture is not included



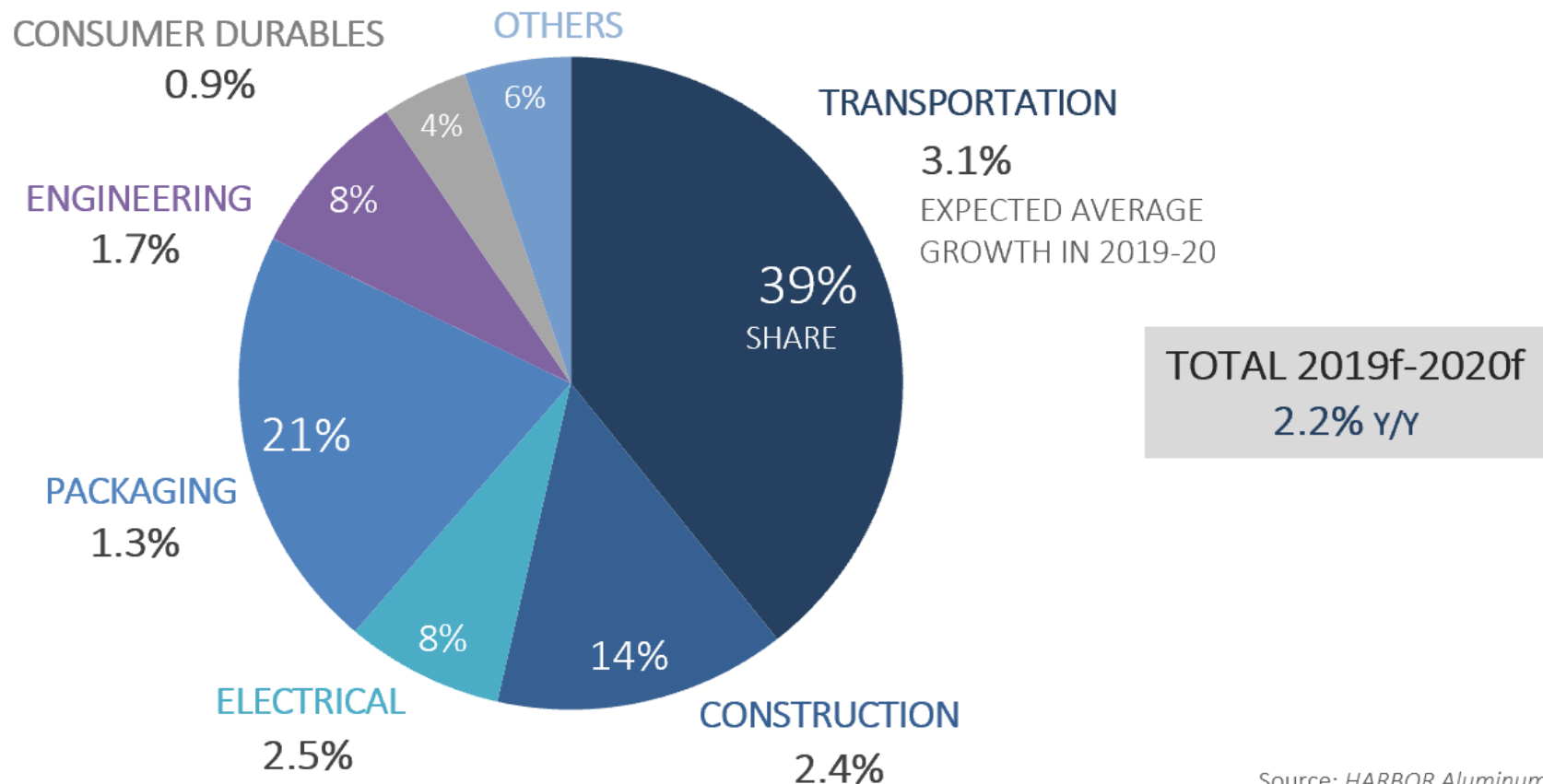
Alumina Limited net profit after tax of \$635.4 million (2018)

AWAC average alumina cash cost of production is \$226/t (2018): lowest quartile global cash cost curve

Aluminium consumption outside China: still growing and diversified...

RoW Aluminium Semis Consumption Growth 2019f-2020f

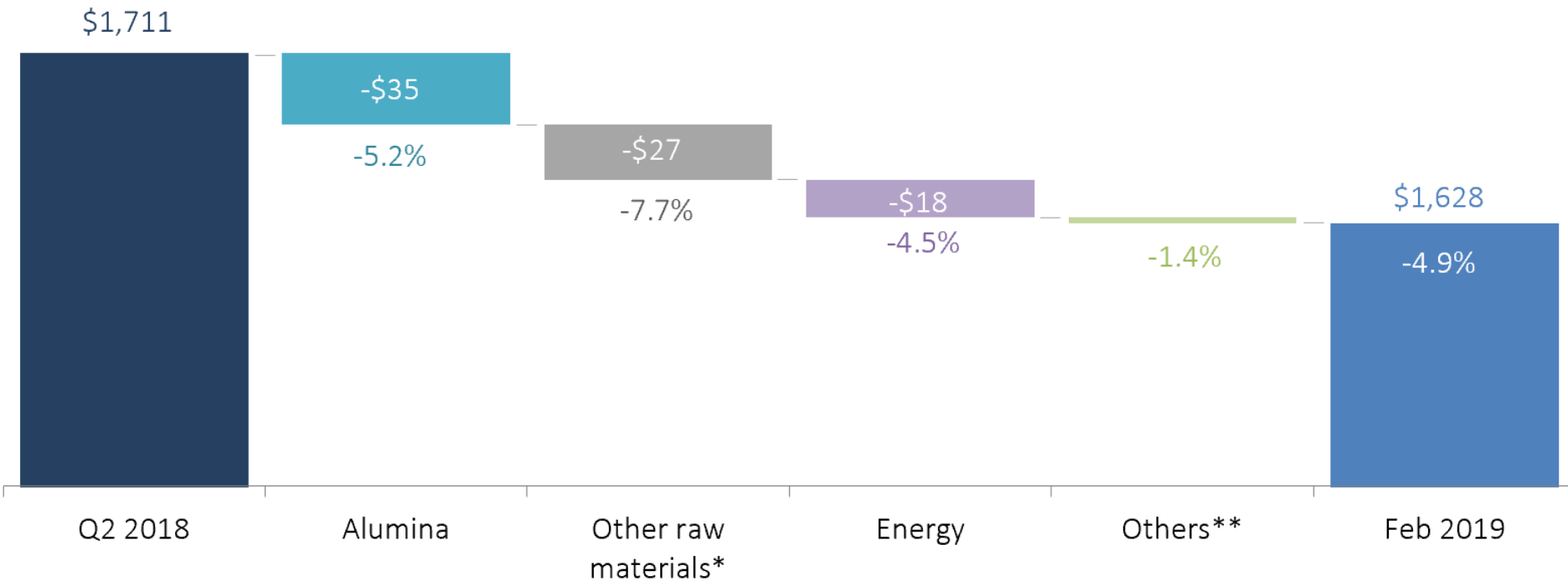
(share of total consumption in 2018)



Source: HARBOR Aluminum, March 2019

As global smelting costs have fallen...

RoW Primary Aluminium Cost Structure Change: Q2 2018 vs. February 2019 (\$/tonne, monthly averages)



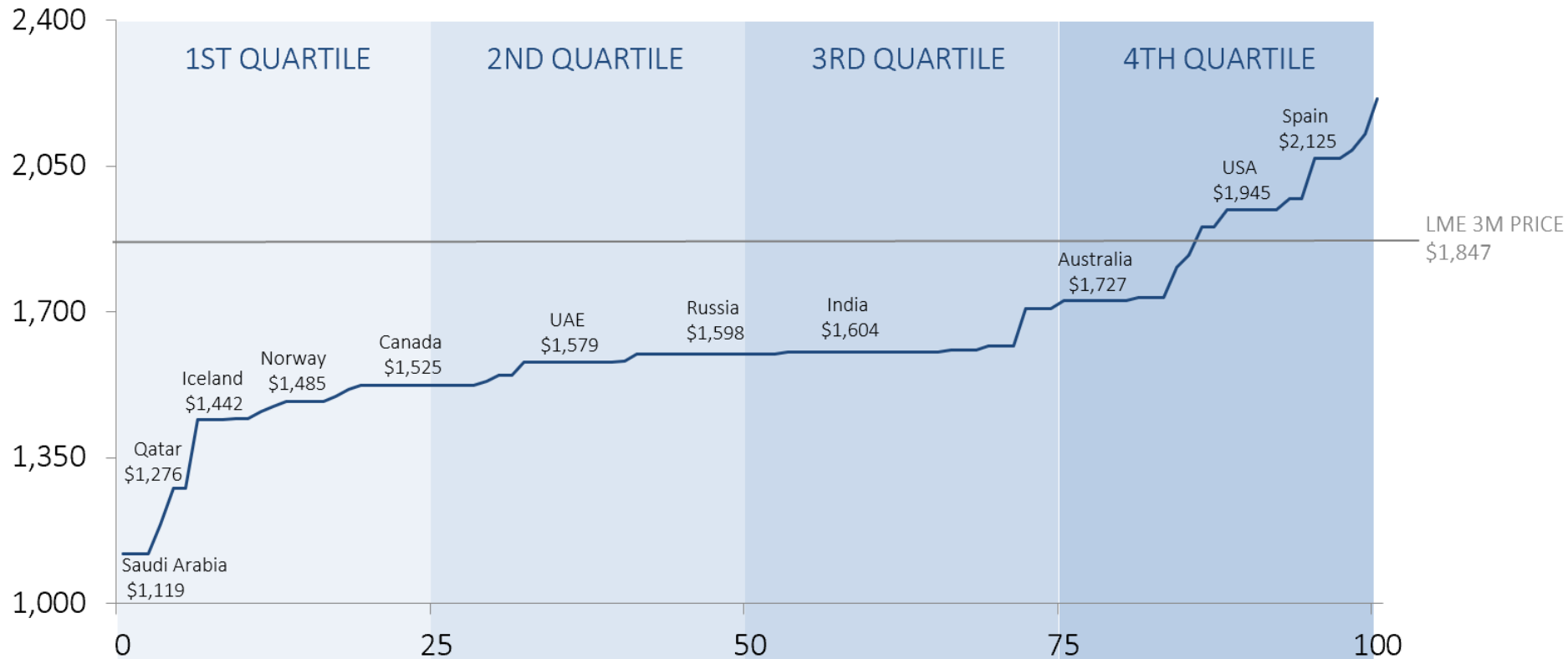
Source: *HARBOR Aluminum, March 2019*. *Includes carbon products, aluminum fluoride, and cryolite.

**Includes labour and other costs related to cell relining, maintenance, insurance and property taxes.

Allowing positive cash margins at most smelters outside China...

RoW Primary Aluminium Industry Cash Cost* Curve by country

(\$/tonne, February 2019)



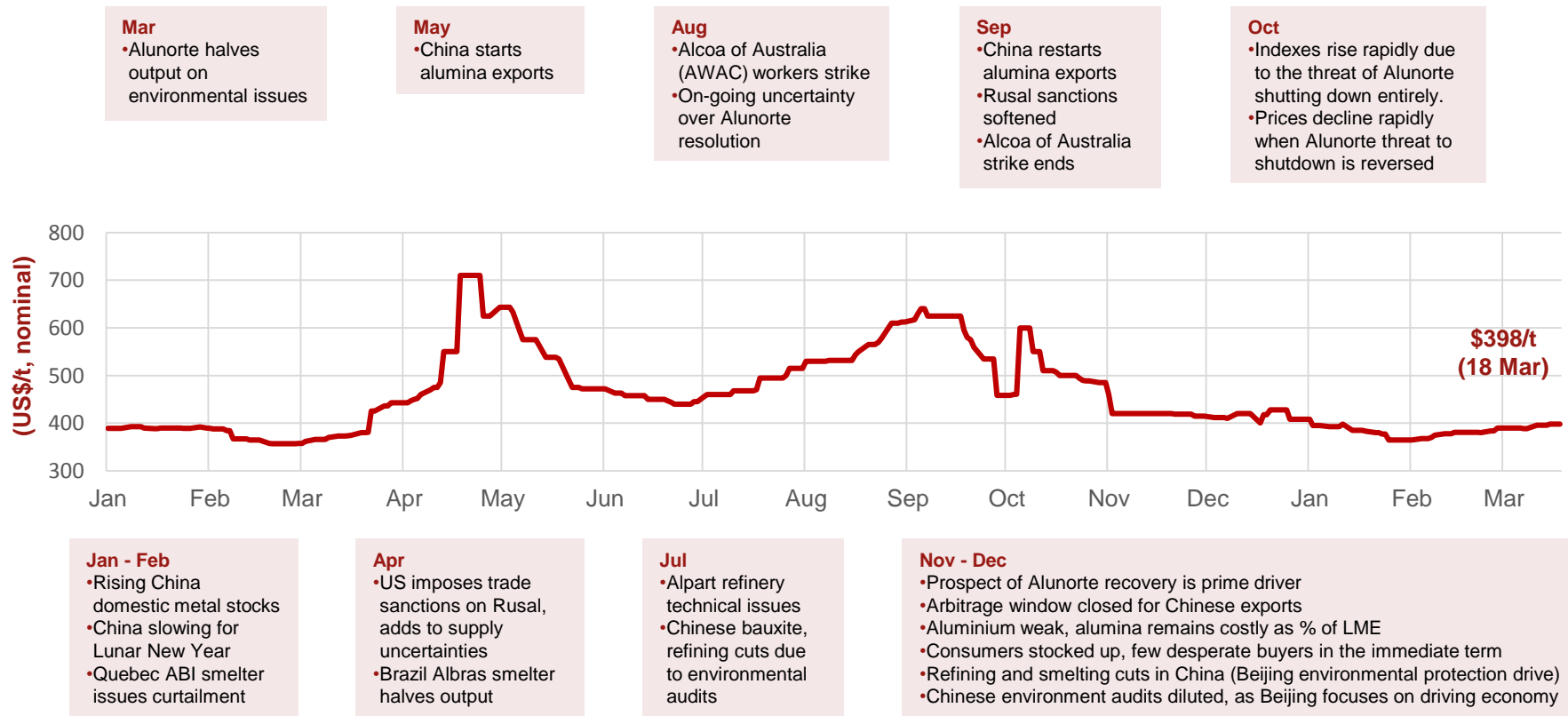
*Cash cost of molten metal before casting. Includes raw materials, energy, labour and other operating costs. Excludes interest payments, depreciation and working capital.

Source: HARBOR Aluminum, March 2019

... and good refining margins as index prices reflected market fundamentals

Alumina price indices continue to reflect alumina supply/demand and cost fundamentals

Platts PAX FOB Australia Prices since January 2018

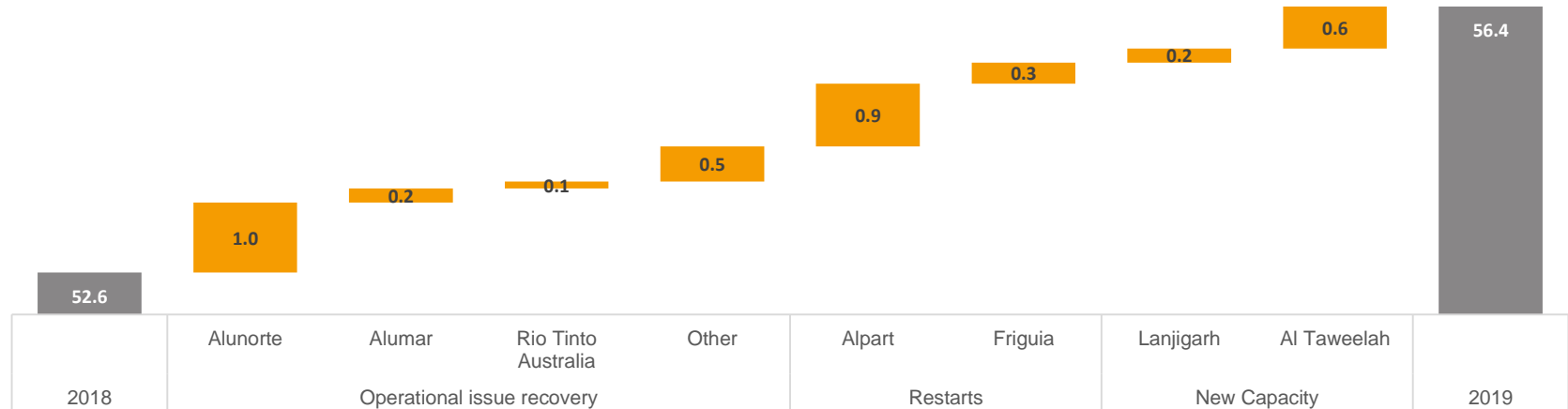


Alumina index price in 2019 averaged \$384/t to 18.3.19 (between \$365 low and \$398 high)

Smelter-grade alumina and aluminium output expected to balance in 2019

0.66m t deficit at end 2018, and 1.27m t expected alumina exports to China to balance ex-China market

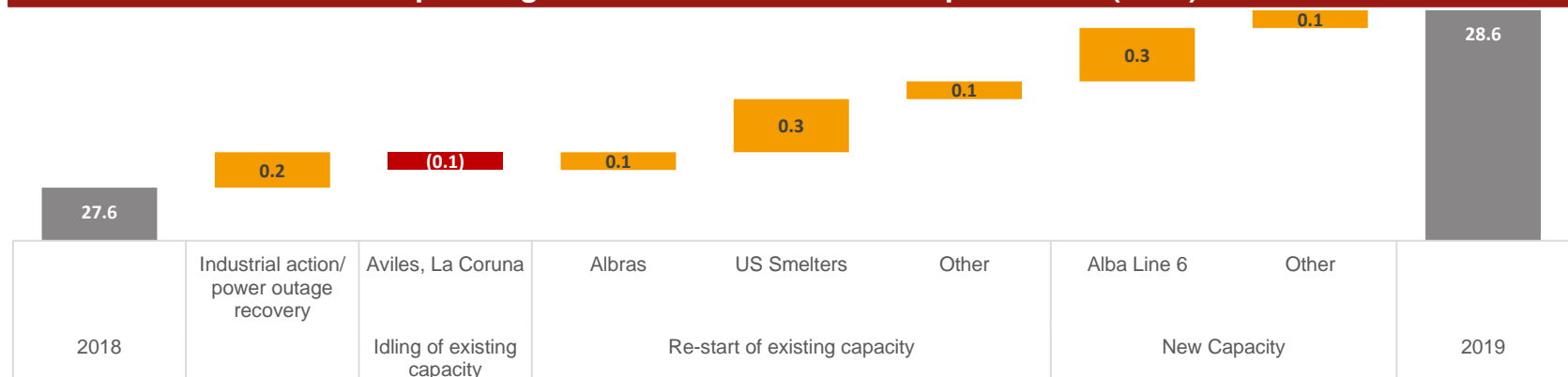
Expected growth of 3.8Mt in alumina production (RoW)



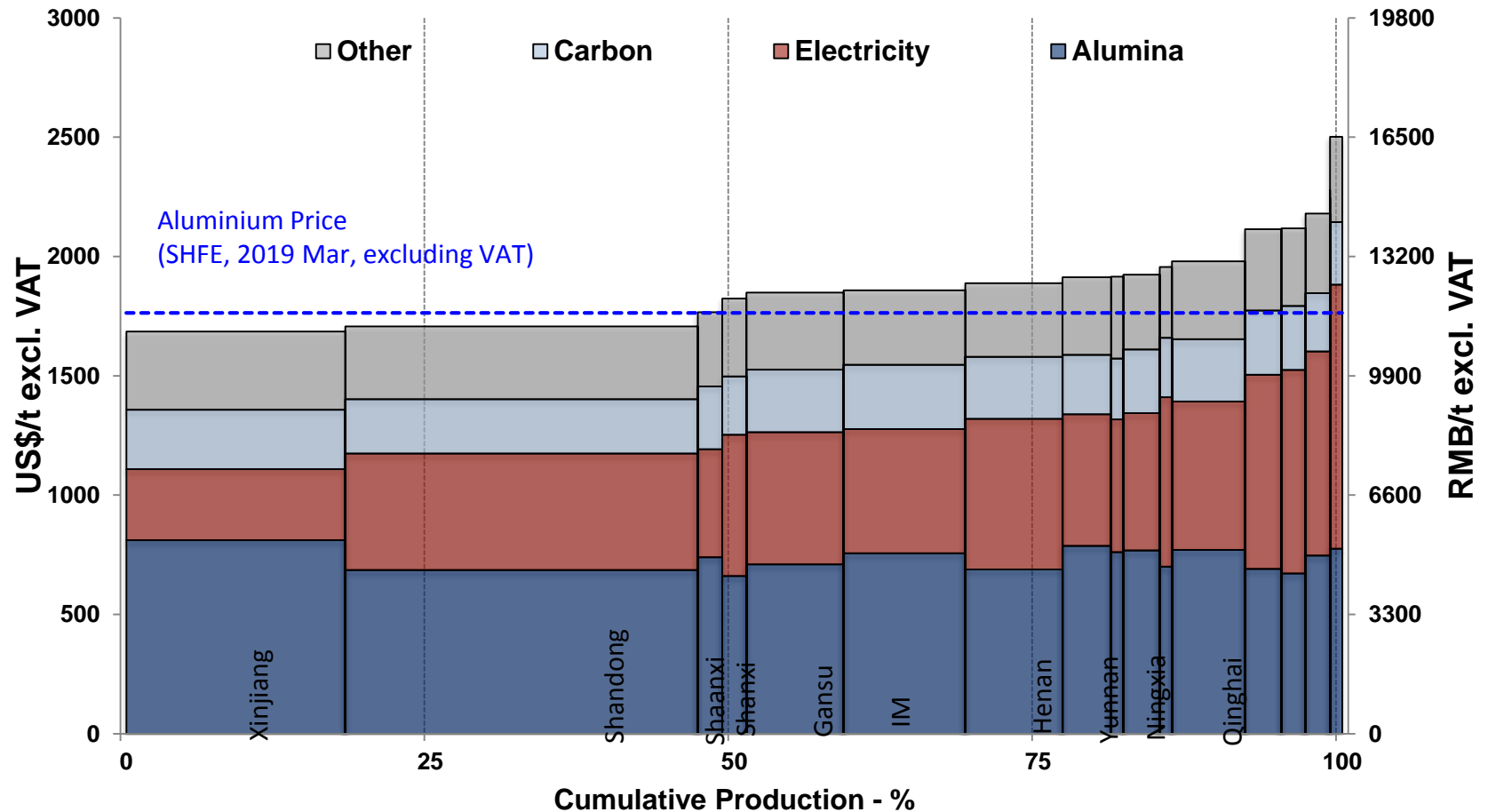
Note: Assumes for the purposes of the calculation that Alunorte receives approval to restart its 50% curtailment at the end of Q1 2019 and ramps up firstly to 75-85% by the end of Q2 2019 and then fully after commissioning of DRS2 and associated press filtration

However, timing of permission for Alunorte to restart remains uncertain and may be slower given authorities' focus post-Brumadinho

Expected growth of 1.0Mt in aluminium production (RoW)



China's smelters near break-even with lower demand/prices, higher cost



... however Chinese reforms likely to ensure broad alumina self-sufficiency

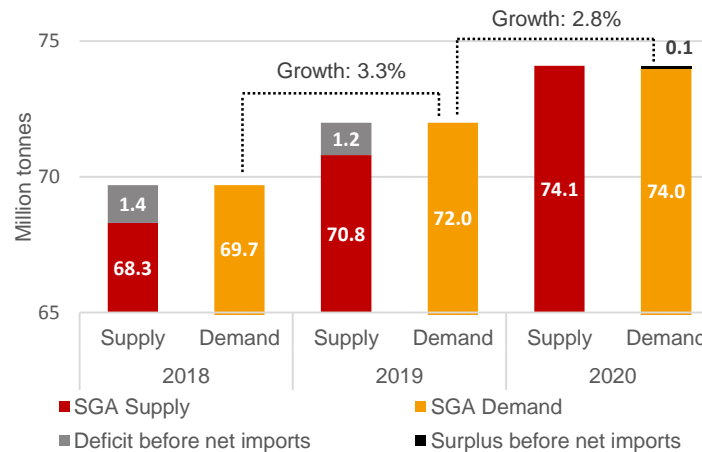
2018 China

- Alumina exports 1.5m t
- Alumina imports 0.5m t
- Chinese alumina stocks drawdown

January 2019 China

- Alumina imports 78kt
- Alumina exports 143kt

China alumina SGA supply/demand balance



NDRC, MIIT Notice/Policy, November 2018

“Notice on Promoting the Orderly Development of Alumina Industry”:

- emphasizes overall guideline for domestic alumina industry development to remain as supply-side structural reform, better government administration, proper resource allocation, strict implementation of safety, environmental protection and energy consumption etc.
- encourages alumina producers to upgrade production lines to meet energy and water consumption requirements
- ultimate goals to regulate market order, promoting transformation and upgrade, achieving a balance of alumina supply/demand, meeting domestic needs

Chinese alumina import parity price* indicative example

Import parity price example (WA to China, assume 13% VAT, from 1 April 2019)	US\$/t
Chinese ExWorks (CMAAX Henan/Shanxi/Shandong), incl VAT, 19 March 2019	404
Less port & handing costs	(15)
Less 13% VAT	(45-47)
Less freight WA to China	(18)
WA equivalent FOB parity price	326-324
Plus typical extra premium paid for quality/foreign exchange/financing/storage benefits (\$5-15 + VAT)	6-17
WA equivalent FOB selling price range	331-341
Current (19.3.19) WA FOB Price (Platts)	398
If RoW had surplus alumina and was forced to sell to China as market of last resort, one would expect the spot price to fall towards \$331-\$341/t, all other things being equal: although prices could be higher if China has alumina deficit (as we forecast in 2019) and needs to import alumina	No arbitrage open for Chinese to import alumina at current RoW price

* Chinese prices and costs would be expected to adjust downwards when VAT reduces from 16% to 13%

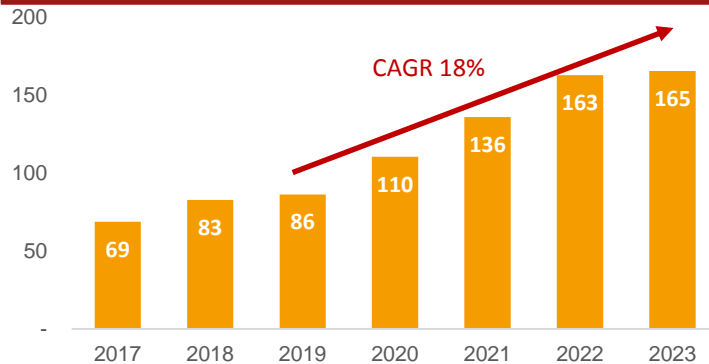
Chinese alumina export parity price indicative example

- *Expect opportunistic Chinese alumina exports when RoW has deficit and prices are high*
- *Do not expect structural long-term exports, given Chinese cost and logistical disadvantages*
- *While a Chinese buyer may import alumina at close to import price parity, a buyer or trader of Chinese alumina to be exported requires a material margin over export price parity for risks*

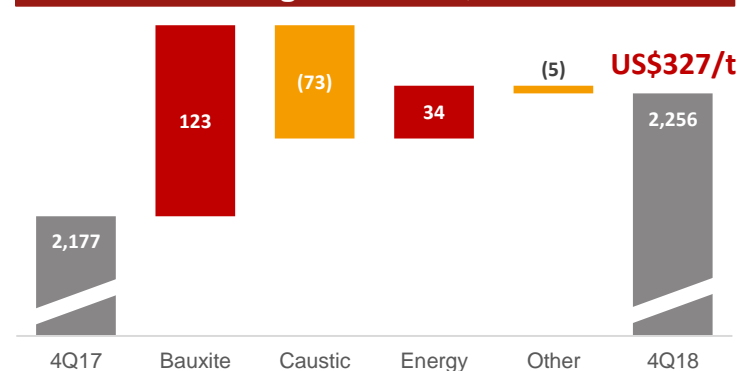
Export parity price example (China to RoW, assume 13% VAT, from 1 April 2019)	US\$/t
Chinese ExWorks (CMAAX Henan/Shanxi/Shandong), incl VAT, 19 March 2019	404
Plus freight ExW to port (very few refineries are on the coast or near a port)	15
Plus port and debagging costs	18
China ExW price + costs to/onto boat = FOB China (nominal export parity price)	437
Plus extra freight to, say, Middle East (versus WA) to China (zero if SE Asia)	3
Plus extra margin buyer/trader typically requires for extra work and risks e.g. discount for alumina quality alumina, logistical risks, extra transfer time	10-70
Incentive export parity price (WA equivalent price)	450-510
Current (19.3.19) WA FOB Price (Platts)	398
<ul style="list-style-type: none"> - If China had surplus alumina and RoW had alumina deficit, one would expect the RoW price to match or exceed the export parity price to incentivise the export of alumina from China - If Chinese refiners had alumina surplus to China's needs, could export if made sufficient margin on costs (average costs \$327 + 13% VAT = \$370) – likely to require RoW price over \$400 	<p>No financial incentive for Chinese refiners to export alumina rather than sell it domestically</p>

China continues to import more bauxite, leading to higher refining cost

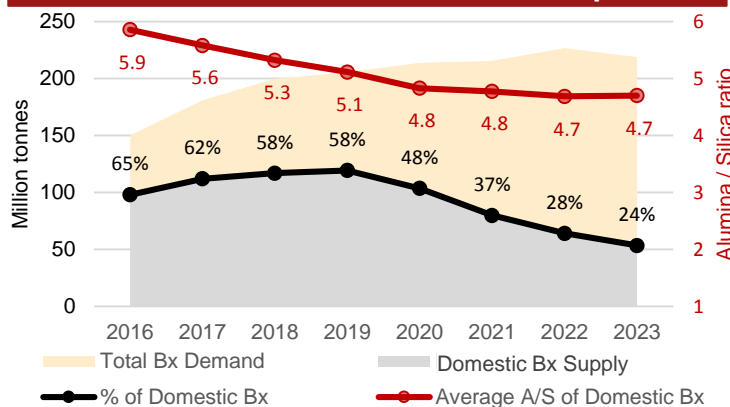
Chinese imported bauxite demand (Mt)



Chinese Refining Cash Cost, RMB/t excl VAT



China's Domestic Bauxite Consumption



China is forecast to import significantly more bauxite as:

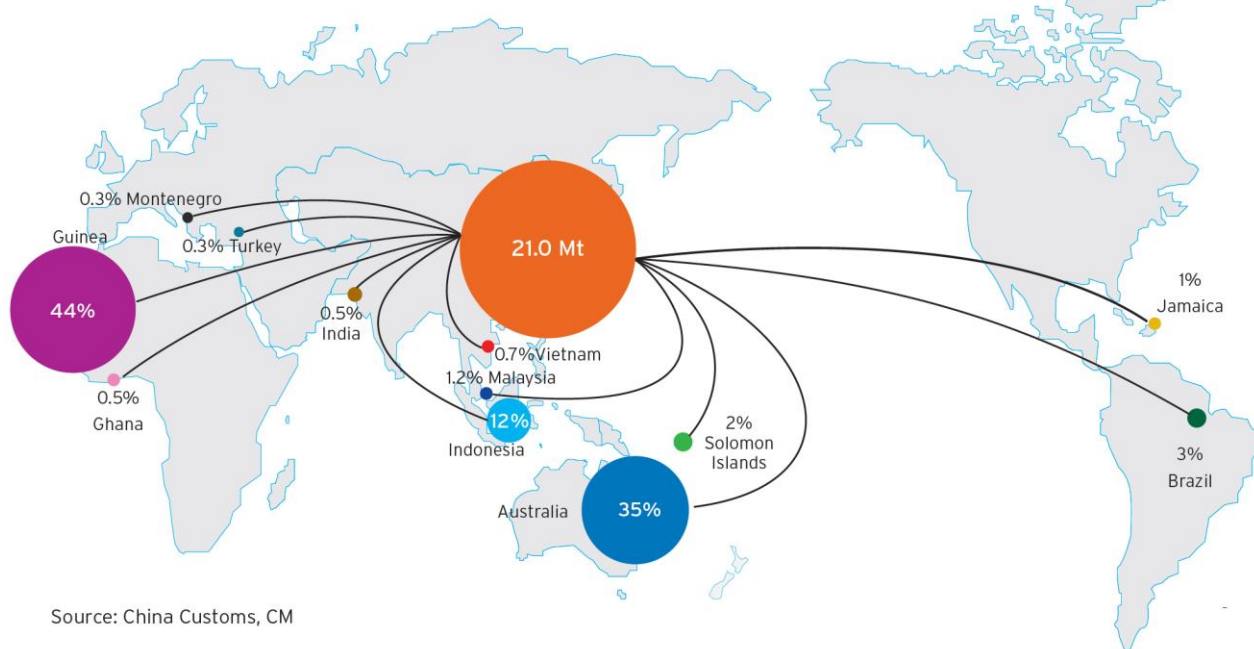
- the quality of China's bauxite deposits declines
- Chinese environmental and safety audits continue
- the market value of the reduced available domestic bauxite rises as a result and
- China's alumina production increases.

Bauxite imports also increased Chinese alumina production costs, despite savings from lower use of caustic, and is expected to continue to do so, as the bauxite import curve steepens.

Most bauxite supply is from Guinea and Australia

- 2018 Chinese bauxite import total 82.6m tonnes, up 21%
- Q4 key exporters Guinea (9.3m tonnes), Australia (7.3m t) and Indonesia (2.5m t)

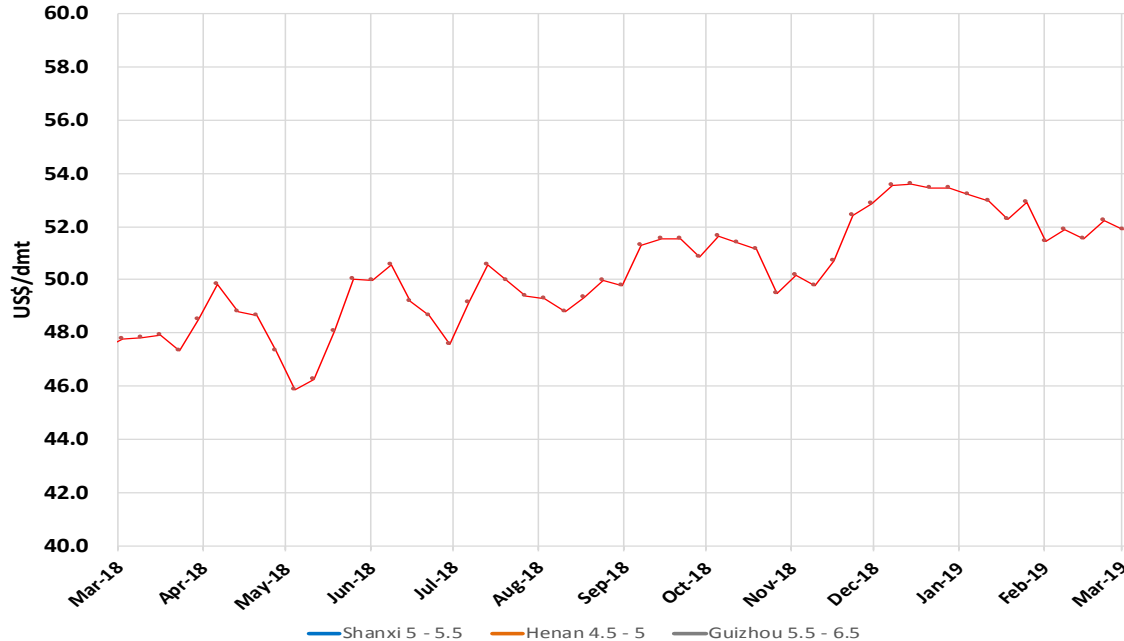
*Bauxite imported into China in the fourth quarter of 2018 (total **21 million tonnes**)*



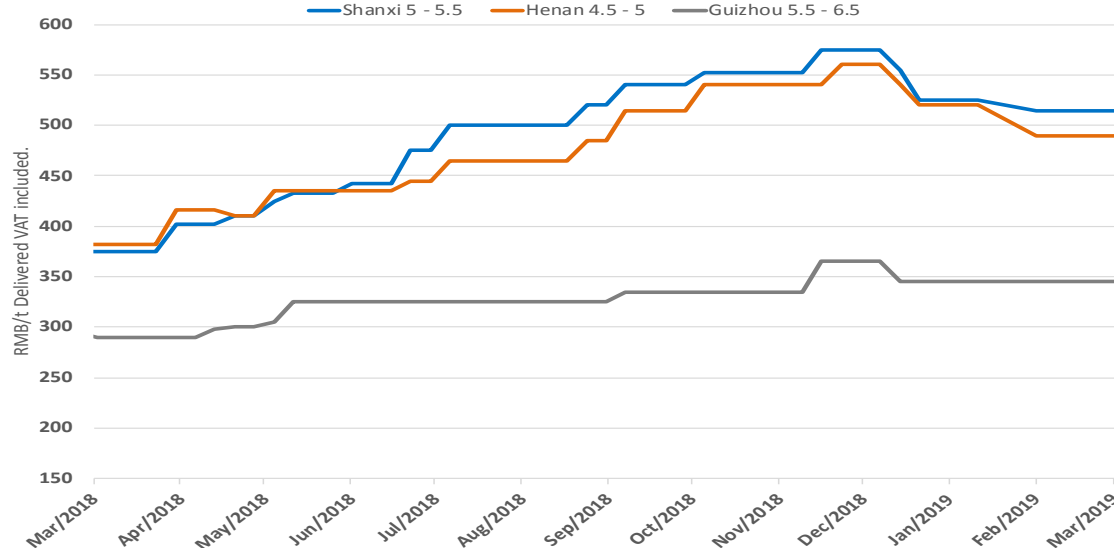
Despite oversupply, Chinese imported and domestic bauxite prices are edging up

Increasing prices based on higher domestic costs, environmental issues and greater demand

Imported
Bauxite
Price Index
(US\$/dmt,
CFR China),
CBIX ViU
adjusted,
normalised

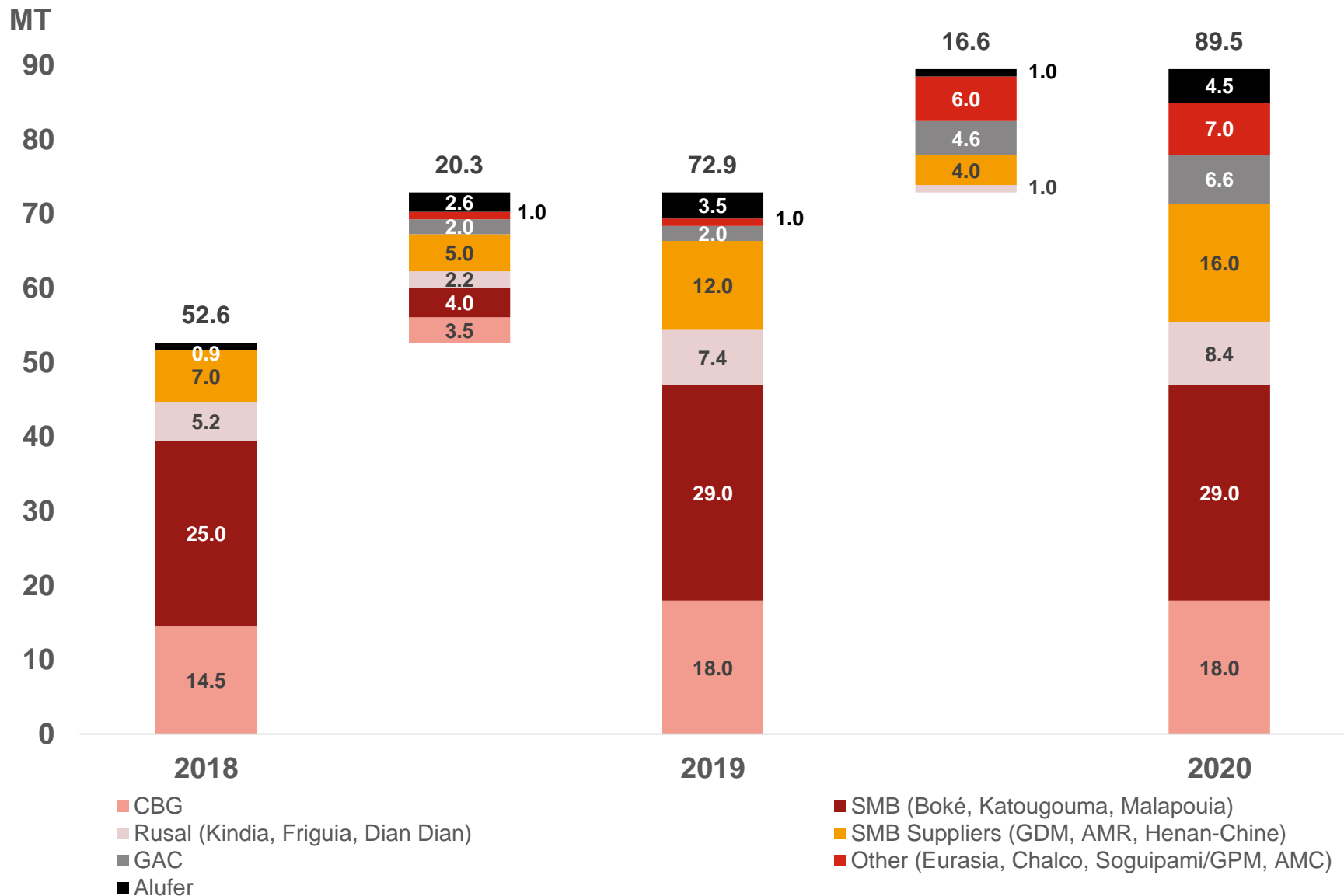


Third Party
Traded
Domestic
Bauxite Prices
(RMB/t incl.
VAT, Delivered),
weekly



Source: CM
Group, March
2019

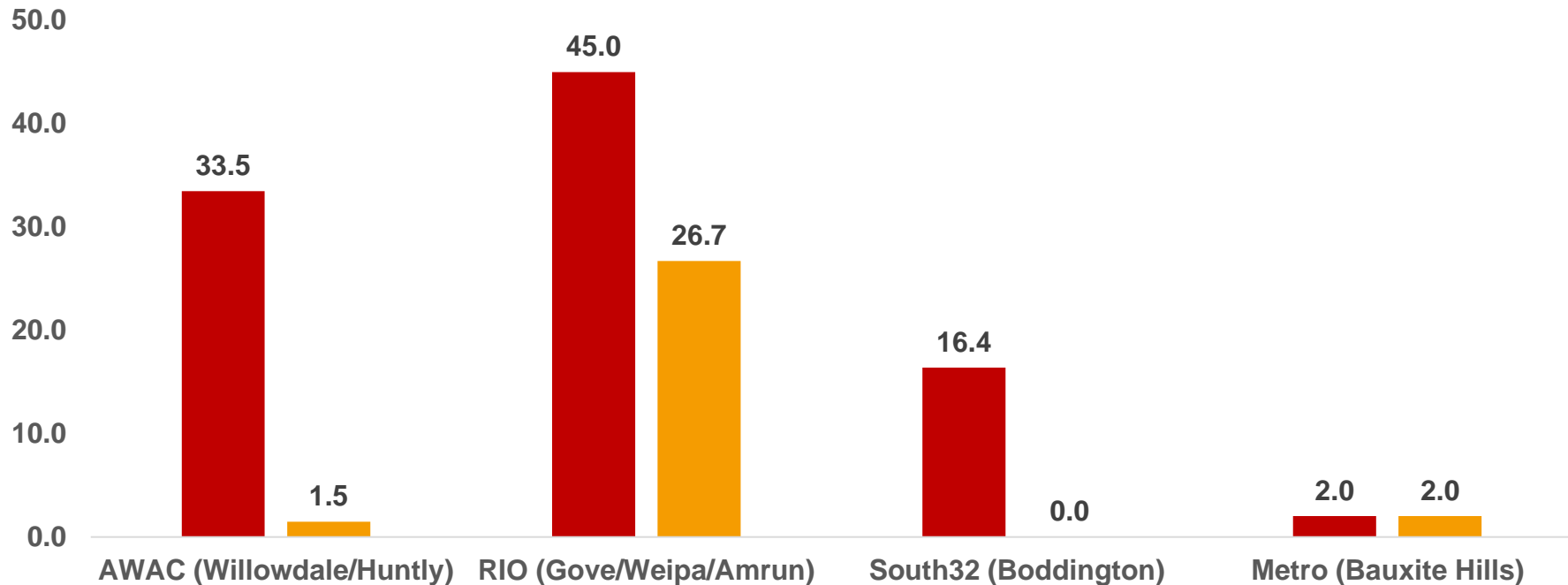
Guinean bauxite marginal suppliers, likely to grow over next two years



Australian bauxite exports also likely to grow over a longer period

MT

■ 2018 Total Production¹ ■ 2018 Exports to China²



- Potential for brownfields expansions (including Amrun to expand/Weipa to contract, towards a net increase in exports of 10 million tpa, and AWAC exports forecast to rise to 1.8 million tonnes in 2019)
- Greenfields potential includes:
 - Aurukun, Glencore (could be 6 million tpa from 2023-2024)
 - Urquhart, Metallica Minerals, near Weipa
 - Bald Hill, Tasmania (bauxite sold now for cement) and Goulburn, NSW, Australian Bauxite
 - further northern Australian mines (like Gulkula, Gumatj/Yolngu)

Source: Alumina, RIO and South 32 financial reports, Metro operational update and CM Group/Chinese Customs data

¹ All companies report on a wet tonne basis with the exception of AWAC who reports on a bone dry tonne basis

² Export data was obtained from Chinese customs office and may be understated

Asian bauxite has sovereign resource or sustainability constraints



Kuantan, Malaysia, 2015



West Kalimantan, Indonesia, 2014

- **Vietnam:** prohibits exports of raw materials, including bauxite, aiming to create more value in country
- Small amount of bauxite is being exported from the North of Vietnam to China
- **India:** bauxite access (environmental, social, permit issues); Lanjigarh protests March 2019

- **Indonesia** requires refining of bauxite in-country
- Some permits to export bauxite linked to refining production or progress on refinery projects
- Well Winning Harvest refinery, Kendawangan 1m tpa and Antam chemical grade refinery, Tayan 0.3m tpa only production to date (although Nanshan has started building in Bintan)
- Some bauxite export permits withdrawn due to insufficient progress on refineries (opaque if verification applied consistently)
- On track to export at least 10 million tonnes in 2019
- Some sustainability issues also important if mining is to expand

- **Malaysia,** past issues: environmental, safety: water pollution from wash plants, dust, overloading, heavy traffic, poor rehabilitation; licensing issues, royalty gaps
- Mining ban in Pahang lifted from 31 March provided 435k t bauxite stocks at Kuantan and Kemaman ports are cleared and an environmental impact assessment is completed, after which owners have to wash bauxite and meet yet-to-be published standard operating procedures
- Potential for mining in states of Johor and Terengganu (query reserves)

2019 expect more balanced market, slower growth, higher Chinese costs

Item	Expectations for 2019
Bauxite market outlook	<p>Forecast continuing growth in bauxite exports from Guinea and Australia to China, supplying majority of China's needs</p> <p>Reasonable volumes expected from South-east Asia, partly contingent on Government action</p> <p>Other supply sources likely to fluctuate with freight cost movements</p> <p>Query impact on future supply of bauxite in light of new and potential Brazilian regulations post-Brumadinho</p> <p>Price likely to stay flat in oversupplied market for next year or two</p>
Chinese industry	<p>Chinese alumina supply-side and environmental reforms and domestic bauxite depletions likely to lead to flatter, higher Chinese alumina cost curve and self-sufficiency</p>
Alumina market outlook	<p>Alumina small deficit in 2018 likely to be broadly balanced in 2019:</p> <ul style="list-style-type: none"> - but timing of Court approval for Alunorte restart still uncertain: may be slower given authorities' focus post-Brumadinho - if/when Alunorte restarts, expected to displace Chinese exports - opportunistic Chinese exports tempered by costs and logistics - some additional RoW refining and smelting production

Appendix

Limited new alumina capacity growth outside China

Refinery currently under construction outside China (commenced 2014):

Country	Company	Refinery	Capacity (m tpa)	Type	Status	Bauxite Source
UAE	EGA	Al Taweelah	2.0	Greenfield	Commissioning	Guinea

Reportedly started construction end of 2018 (for bauxite backward integration):

Country	Company	Refinery	Capacity (m tpa)	Type	Status	Bauxite Source
Indonesia	Nanshan	Bintan	1.0	Greenfield	Construction started	Indonesia

Other projects which are under consideration are:

Country	Company	Refinery	Capacity (m tpa)	Type
Indonesia	Hongqiao	Ketapang Phase II	1.0	Brownfield
Indonesia	Inalum/Antam	West Kalimantan	2.0	Greenfield
India	Vedanta	Lanjigarh	5.0	Brownfield
Guinea	SMB/Winning	Dapilon	1.0	Greenfield
Greece	Mytilineos	Distomon	0.85	Brownfield
Laos	Yunnan Aluminum	Paksong	1.0	Greenfield
Iran	SALCO	Persian Alumina I	0.8	Greenfield
Jamaica	JISCO	Alpart	2.0	Brownfield

Limited (ex-China) curtailed refinery response to supply deficit

Curtailed Refineries	Owner	Location	Producing (M tpa)	Nameplate Capacity (M tpa)	Comment
Point Comfort	AWAC	US	0.0	2.3	Curtailed in June 2016
Alpart Alumina	JISCO	Jamaica	1.2	1.7	Acquired in curtailed state mid-2016. Slow ramp. Backward integration re-start
Kirkvine	Windalco	Jamaica	0.0	0.6	On care and maintenance since 2009
Friguia	Rusal	Guinea	0.32	0.60	Re-start commenced June 2018, reportedly helping bauxite backward integration, to take 12 months to ≈600k t and cost at least \$120 million
Anrak	Anrak	India	0.0	1.5	Built in 2014 (not started). Would need financing and bauxite access/supply.
Eurallumina – Porto Vesme	Rusal	Italy	0.0	1.1	Idled since 2009. Reviewing restart from around end 2020
Bauxilum	State-owned	Venezuela	0.0	2.0	Idled. Little production since 2015 (due to asset deterioration)
TOTAL			1.52	9.80	