

Aluminium, alumina and bauxite

Resources and Energy Quarterly December 2017

Australia's global ranking



3 stages of producing aluminium

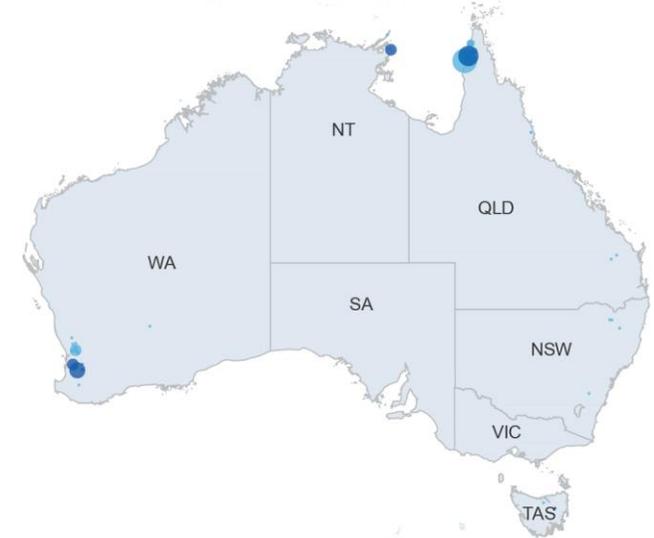


Key consumer markets for aluminium (tonnes)

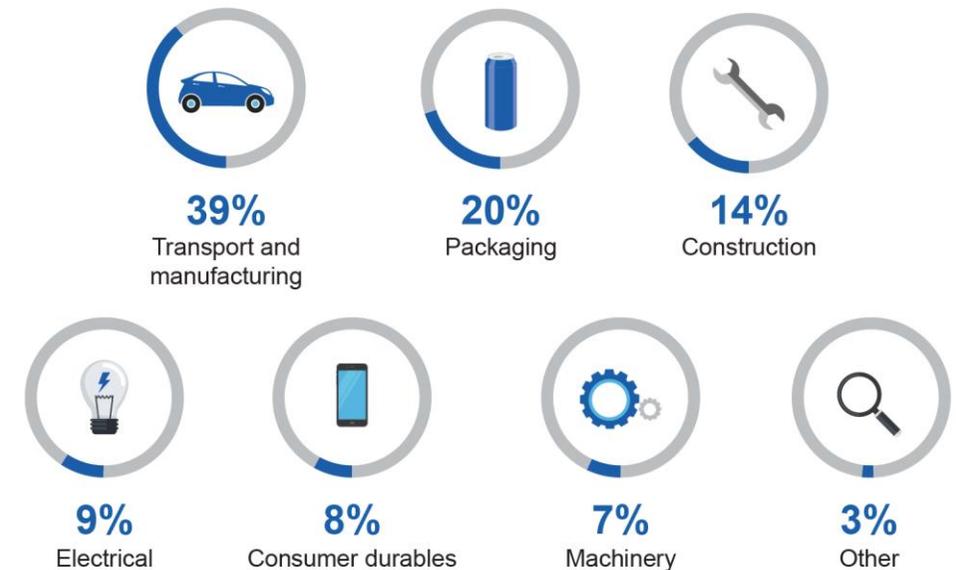


Major Australian alumina deposits (Gt)

- <0.01
- 0.02–0.03
- 0.04–0.09
- 0.10–0.20
- 0.21–0.44
- >0.45
- Deposit
- Operating mine



Global uses of aluminium



Aluminium

11.1 Summary

- The value of Australia's aluminium exports is forecast to increase by 19 per cent in 2017–18, to \$3.8 billion, driven by high prices and stable export volumes.
- Crackdowns on air pollution and illegal capacity in China are likely to push aluminium prices higher in 2018 and 2019.

11.2 Prices

Aluminium prices forecast to grow strongly in 2018 and 2019

Increasing demand and declining supply in China — the world's largest aluminium consumer and producer — has contributed to a surge in the London Metal Exchange (LME) spot aluminium price in 2017. As at 29 December 2017, prices have increased by over 30 per cent from the start of 2017, to US\$2,250 a tonne. Likely reflecting the Chinese production cuts, LME stocks decreased by 46 per cent from the beginning of 2017, falling to 1.1 million tonnes in late December 2017.

The rally in the aluminium price is expected to continue into 2018 and 2019, as the global aluminium market records a supply deficit of 2.8 million tonnes in 2019. A rise in raw material (alumina) prices will lift the global cost curve for aluminium producers, supporting higher aluminium prices.

Compared to the September 2017 *Resources and Energy Quarterly* aluminium prices have been revised up by 5.8 per cent for 2018 and 21 per cent for 2019, reflecting the Chinese Government's decision to extend its 'air pollution control' policy after the 2017–18 winter season. The average LME spot aluminium price is forecast to increase by 6.2 per cent to US\$2,072 a tonne in 2018, and by a further 3.6 per cent to US\$2,146 a tonne in 2019.

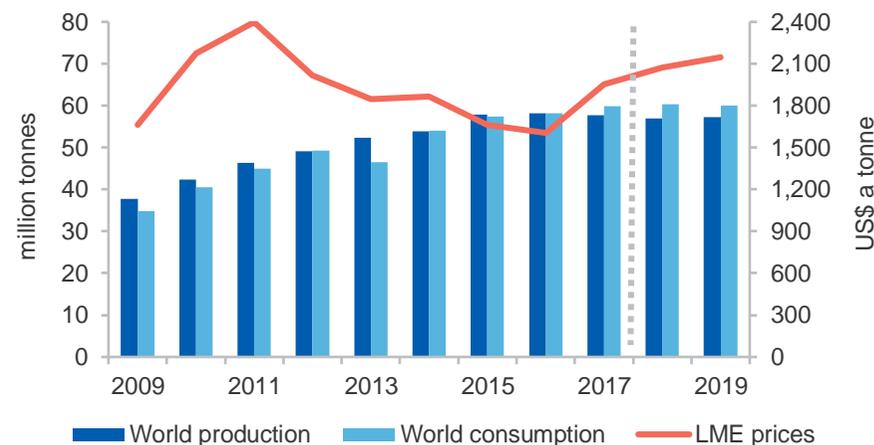
The risk to the price forecast is the level conformity of Chinese aluminium smelters to China's environmental and illegal capacity policies. Some Chinese smelters, such as Weiqiao and Xinfu, have pushed for illegal capacity cuts to be included in winter curtailment volumes. If the Chinese Government pursues this option, aluminium winter cuts in China will be smaller than previously estimated. As new capacity is added, the lack of a substantial winter production curtailment will put downward pressures on aluminium prices in 2018 and 2019.

11.3 World consumption

World aluminium consumption to remain growing

World aluminium consumption increased by 4.3 per cent year-on-year in the first nine months of 2017, to 45 million tonnes. Growth was propelled by demand from China, which grew by 5.2 per cent year-on-year. Demand from China's packaging sector rose by 20 per cent, while demand from real estate, transportation and electronic products grew by 8 per cent, and demand from the power sector by 5 per cent.

Figure 11.1: World aluminium production, consumption and prices



Source: LME (2017) spot prices; International Aluminium Institute (2017); Department of Industry, Innovation and Science (2017)

Vehicle demand remains key to Chinese demand for aluminium, and is expected to stay strong in 2017 as Chinese consumers seek to buy vehicles before the scheduled increase in the tax rate from 7.5 to 10 per cent in January 2018. China's real estate sales continued to grow, while new development investment moderates. As a result, global aluminium consumption is forecast to increase by 3.0 per cent in 2017, to 60 million tonnes.

Global industrial production — a driver of commodity demand — is forecast to grow by 3 per cent a year in 2018 and 2019. Aluminium consumption growth is likely to be firm, supported by an expected rise in Chinese demand (which is outgrowing the country's GDP), and rising global vehicle sales. The trend towards electric cars is likely to increase the aluminium content of vehicles, as carmakers seek to maximise battery range. As a result, world aluminium consumption is forecast to increase by 1.0 per cent in 2018, to over 60 million tonnes, and stay at this level in 2019.

11.4 World production

China's pollution crackdowns reduce world aluminium production

World aluminium production increased by 2.8 per cent year-on-year in the first ten months of 2017, to reach over 51 million tonnes. This was driven by strong growth in China (up 4.8 per cent year-on-year). Chinese aluminium producers have tried to compensate for the winter 2017–18 production cut by increasing output before November 2017. Likely reflecting this increased output, Shanghai aluminium stocks reached a 54-month high at the end of September 2017, at 490,000 tonnes.

The total production cut from the winter curtailment and illegal aluminium capacity policies is estimated to be around 7 million tonnes in 2017. Strict enforcement of production cuts — targeting active rather than just idled capacity — that is not fully offset by new capacity, is likely to lead to a material decline in Chinese aluminium production, which is expected to fall by 4.6 per cent to 30 million tonnes. It also deepened the global aluminium deficit (estimated at 2 million tonnes) in 2017. An expected 16

per cent rise in aluminium production in other Asian countries may act as a partial offset to cuts in China. As a result, global aluminium production is forecast to have declined by just 0.7 per cent in 2017, to 56 million tonnes.

China's pollution crackdown is expected to continue, following an announcement by Chinese Environment Minister at a press conference during the Communist Party's 19th National Congress, in October 2017. This decision is likely to intensify production cuts in China, and was seen as necessary not only to curb air pollution, but also to offset new capacity additions and idled capacity restarts — estimated around 3 million tonnes per year. Other Asian countries are expected to act as the engine of global production growth — notably Iran, which is aiming to increase its annual aluminium production from 450,000 tonnes to 1.5 million tonnes by 2025.

World production is forecast to decrease by 1.4 per cent in 2018, to 57 million tonnes, and to remain at this level in 2019. This is a downward revision of 5.8 million tonnes from the forecast in the September 2017 *Resources and Energy Quarterly*, taking into account the latest development in China's pollution crackdowns.

The Chinese Government is expected to remove the winter curtailment policy by 2020, since more than three years of winter curtailment would cause damage to the aluminium cells and increase restart costs.

China is both the world's largest producer and consumer of aluminium, but Hongqiao Group — the world's largest aluminium producing company — could find its expansion in China limited by state policy. The company is reviewing the feasibility of moving shuttered illegal smelting capacity overseas, mainly to Indonesia.

11.5 Australia's exports and production

Aluminium exports to rise strongly in 2017–18

Higher aluminium prices and larger export volumes contributed to a 19 per cent year-on-year rise in export values in the first quarter of 2017–18, to \$952 million. The LME spot aluminium price reached a five year high on

20 October 2017, at US\$2,159 a tonne. Export volumes rose by 1.3 per cent year-on-year in the September quarter 2017 to 367,000 tonnes, supported by improved production capacity from Portland aluminium smelter.

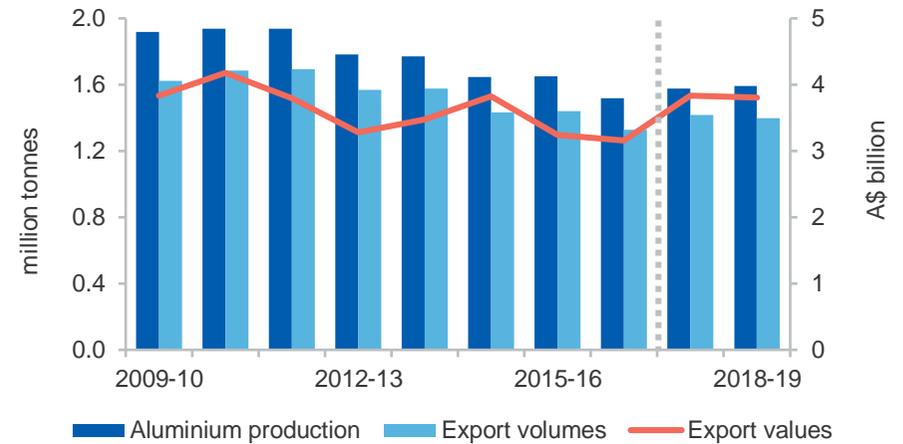
The trend of high prices and sustained export volumes is likely to continue in 2017–18 and 2018–19, as China’s crackdowns on air pollution and illegal capacity show no sign of ending. Portland Aluminium is expected to return to full capacity, following a power outage in December 2016. As a result, Australia’s aluminium exports are forecast to increase by 19 per cent in 2017–18 to \$3.8 billion, and to remain at this level in 2018–19. Export volumes are estimated to return to the normal annual export capacity level of 1.4 million tonnes.

Australia’s aluminium production has recovered from Portland Aluminium’s power outage incident, and is likely to remain at full annual production capacity of 1.6 million tonnes in 2017–18 and 2018–19. There are no expected major additions or closures to capacity over the forecast period.

Australia and other aluminium smelters in the Oceania region use a variety of power sources — coal, natural gas, hydroelectricity and other renewable energy — to produce primary aluminium. Coal and hydroelectricity are the main sources, accounting for around 73 and 27 per cent of total power consumption, respectively. Natural gas and other renewable energy sources have emerged as alternatives to hydroelectricity and coal, but are still not a very popular choice — accounting for just 0.7 per cent of power generation in 2016.

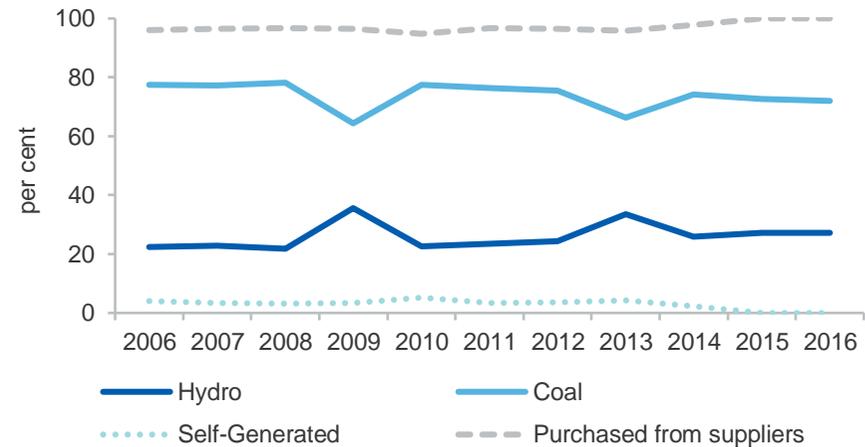
Aluminium smelters in the Oceania region have always been dependent on energy suppliers to power their smelting plants. About a decade ago, around 4 per cent of power was self-generated by aluminium smelters. However, the self-sufficient power supply option is no longer viable, due to building and running cost pressures. Since 2015, all aluminium smelting power has been sourced and purchased from energy suppliers.

Figure 11.2: Australia’s aluminium exports and production



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 11.3: Aluminium smelting power consumption - Oceania



Source: International Aluminium Institute (2017)

Alumina

11.6 Summary

- The value of Australia's alumina exports is forecast to increase by 11 per cent in 2017–18, to \$7.4 billion, driven by high alumina prices in 2017.
- Continued crackdowns on air pollution and illegal capacity in China are likely to push alumina prices and exports lower in 2018 and 2019.

11.7 Prices

Alumina prices forecast to come under pressure in 2018 and 2019

Rising world aluminium production, particularly in China, has boosted alumina demand and prices in 2017. The average FOB Australia alumina price was US\$469 a tonne in October 2017, up 37 per cent from the start of the year. In the first nine months of 2017, Chinese aluminium smelters ramped up production (resulting in a 6 per cent rise year-on-year), ahead of the 2017–18 winter curtailment. Over this period, aluminium production in other Asian countries increased by 6 per cent year-on-year. Demand for alumina is likely to have declined in November and December, as the winter production cuts in China took effect from 15 November 2017. Despite this fall, the alumina price is estimated to have increased by 28 per cent in 2017, averaging US\$324 a tonne.

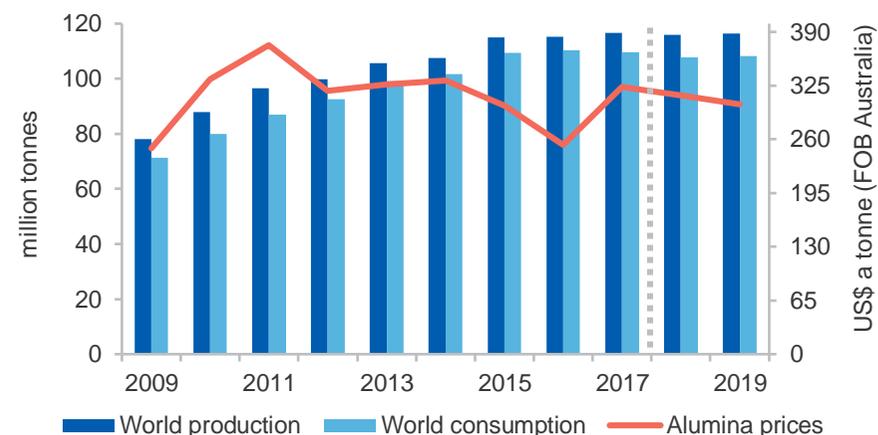
The FOB Australia alumina price is forecast to come under pressure over the outlook period, falling around 3 per cent a year, to US\$313 a tonne in 2018 and US\$302 a tonne in 2019. The continuation of environmental crackdowns in China over coming years is likely to decrease world aluminium production by 1.4 per cent in 2018, thereby pushing alumina demand down by 1.7 per cent. New capacity additions in China and other major alumina producing countries are expected to contribute to lower alumina prices. It is projected that China, India and the UAE will add nearly 10 million tonnes of refinery capacity in 2018.

11.8 World consumption

Reduction in alumina consumption in line with aluminium output

World alumina consumption increased by 4.8 per cent year-on-year in the first nine months of 2017, to 85 million tonnes, propelled by strong growth in aluminium production in China (up 6.1 per cent year-on-year). Demand for alumina is likely to have declined in the last two months of 2017, due to winter aluminium production cuts in China. For 2017 as a whole, world alumina consumption is forecast to have declined by just 0.5 per cent, to 110 million tonnes, as strong consumption growth in the first ten months of 2017 offset an expected decrease in alumina consumption in November and December 2017.

Figure 11.4: World alumina production, consumption and prices



Source: Bloomberg (2017) Alumina monthly price; International Aluminium Institute (2017); Department of Industry, Innovation and Science (2017)

The extension of the air pollution crackdown policy after the 2017–18 winter season is likely to reduce global demand for alumina in 2018 and 2019. China's alumina demand is forecast to fall by 3.7 per cent in 2018, to 57 million tonnes. Offsetting China's slowdown is an expected increase in alumina consumption from the Middle East (up by 7 per cent in 2018,

and by 4 per cent in 2019). Iran plans to increase its aluminium production by 300 per cent within eight years, from 450,000 tonnes to 1.5 million tonnes by 2025 – creating more alumina demand. As a result, world alumina consumption is forecast to decrease by just 1.7 per cent in 2018, to 108 million tonnes, and to remain at this level in 2019.

Reflecting the Chinese Government’s decision to extend ‘air pollution control’ policy after the 2017–18 winter season, world alumina consumption has been revised down by 11 million tonnes from the forecast in the September 2017 *Resources and Energy Quarterly*.

11.9 World production

Alumina production to fall in 2018 and 2019

World alumina production increased by 13 per cent year-on-year in the first ten months of 2017, to 106 million tonnes, propelled by very strong growth in China (up 12 per cent year-on-year) and other Asian countries (up 29 per cent year-on-year). Chinese refineries boosted their production output in anticipation of production cuts in the 2017–18 winter season. Outside of China, other Asian refineries maximised their output to take advantage of rising alumina prices. However, production is expected to fall in the December quarter 2017, due to production cuts in China. As a result, world alumina production is estimated to increase by 1.0 per cent in 2017 to 116 million tonnes.

Global alumina production is forecast to decrease by 0.7 per cent in 2018, to 116 million tonnes, and to remain at this level in 2019. China’s alumina production is expected to fall by 9.5 per cent in 2018, to 61 million tonnes, as the Chinese Government continues to carry out its environmental crackdowns. However, production in ex-China countries is expected to rise. In India, Vedanta has obtained permission from the Odisha State Government to expand its Lanjigarh Alumina refinery from 1 million tonnes per annum to 6 million tonnes per annum. In Tajikistan, the 500,000 tonne a year Tursunzoda alumina refinery project is expected to come online in the first-half of 2019. In Jamaica, China’s Jiuquan Iron and Steel Company

has invested US\$3 billion to expand production capacity at its Alpart alumina plant from 1.65 to 2.0 million tonnes per annum by 2020.

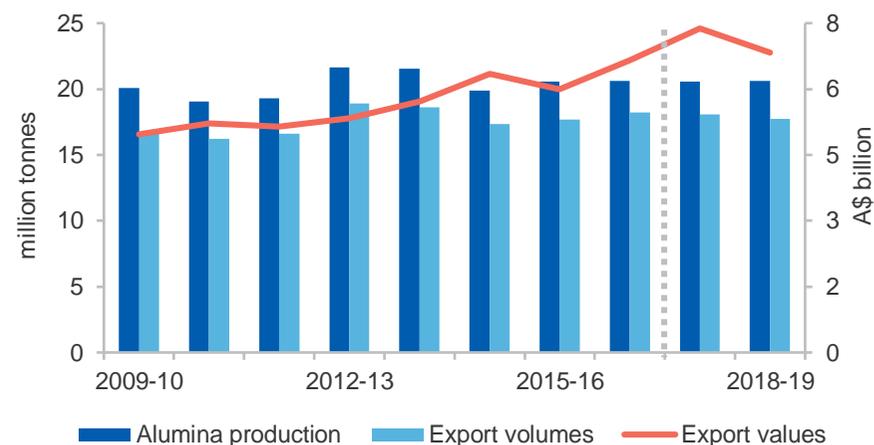
World alumina production has been revised down by 4 million tonnes lower from the forecast in the September 2017 *Resources and Energy Quarterly* — reflecting an expected extension of the air pollution control and illegal capacity policy after the 2017–18 winter season.

11.10 Australia’s exports and production

Alumina exports to rise strongly in 2017–18, but fall modestly in 2018–19

Higher alumina prices contributed to a 28 per cent year-on-year rise in export values in the first quarter of 2017–18, to \$1.8 billion. Over this period, alumina prices increased by 44 per cent year-on-year, to average US\$338 a tonne. Export volumes fell by 4 per cent year-on-year, to 4.3 million tonnes. China imported 403,000 tonnes of alumina from Australia in the September quarter 2017 — a rise of 48 per cent year-on-year. Australia is the largest exporter of alumina to China, accounting for 48 per cent of China’s total alumina imports.

Figure 11.5: Australia’s alumina exports and production



Source: ABS (2017) *International Trade in Goods and Services*, 5368.0; Department of Industry, Innovation and Science (2017)

Due to an expected weaker decline in demand from China in 2018, alumina prices are forecast to decrease by around 3 per cent from the 2017 level. However, with a strong growth in alumina exports in the first half of 2017–18, the impact of lower prices and export volumes is forecast to be minimal. As a result, Australia’s alumina exports are estimated to rise by 11 per cent in 2017–18 to \$7.4 billion. The revised export value is \$400 million lower than the previous forecast.

In 2018–19, the full impact of China’s reforms are expected to materialise on Australia’s alumina exports. Alumina prices are forecast to drop by 3 per cent. Export volumes are forecast to fall by 2 per cent to under 18 million tonnes. As a result, export values are forecast to decrease by 7.5 per cent to \$6.8 billion.

Australia’s alumina export values in 2018–19 have been revised down, and are now \$442 million lower than the forecast in the September 2017 *Resources and Energy Quarterly*. The revision reflects an expected reduction in Chinese demand.

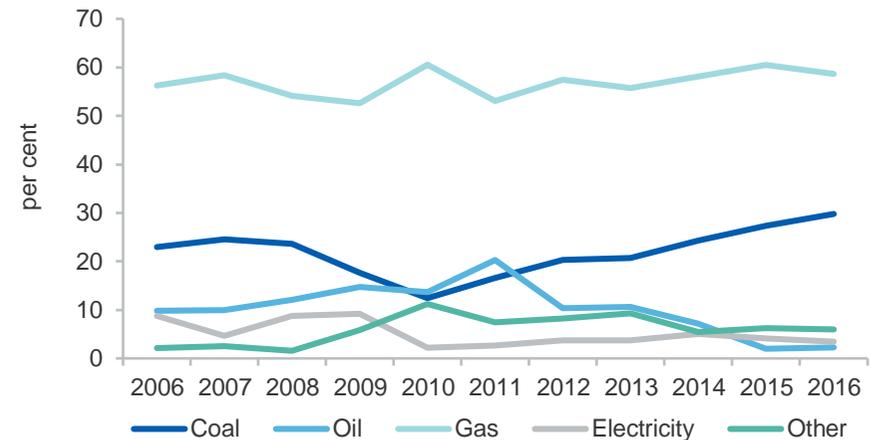
For 2017–18 and 2018–19, Australia’s alumina production is forecast to remain steady at 21 million tonnes, with no planned closures/expansions or major disruptions expected at existing operations. Rio Tinto has added two Queensland alumina refineries to its 2013 Project Lego — a plan to sell its downstream business (alumina refinery and aluminium smelting).

Australia and other alumina refineries in the Oceania region use a variety of energy sources — coal, oil, gas, electricity and other — to process raw bauxite into alumina. Gas and coal are the main sources, accounting for 59 and 30 per cent of total energy consumption, respectively. The use of coal is increasingly popular, rising from 12 per cent in 2010 to 30 per cent in 2016. In contrast, alumina refineries in the Oceania region have moved away from using oil as a source of energy to refine bauxite — with the share falling from 20 per cent in 2011 to 2 per cent in 2016.

Refiners in Oceania (particularly Australia) consume less energy to refine bauxite and produce alumina than those in Africa, Asia, China, Europe,

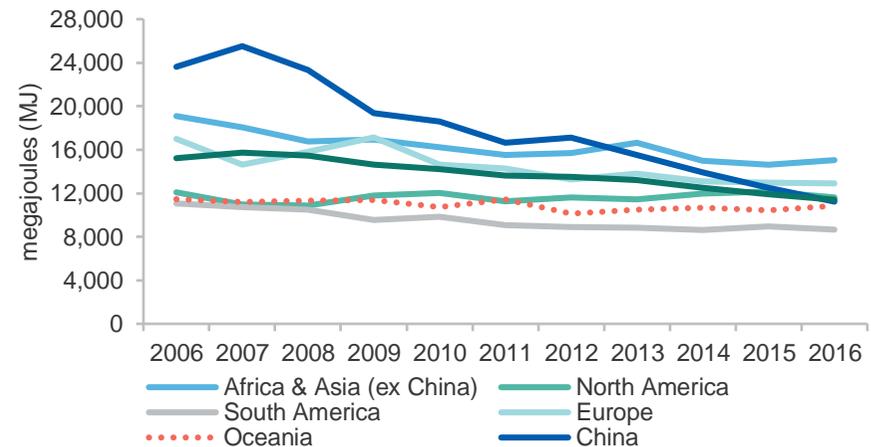
North America and the world as a whole. Lower energy use leads to better competitiveness for Australian refineries.

Figure 11.6: Alumina refining fuel consumption - Oceania



Source: International Aluminium Institute (2017)

Figure 11.7: Energy consumed to produce a tonne of alumina (MJ)



Source: International Aluminium Institute (2017)

Bauxite

11.11 Summary

- Lower volumes are expected to reduce the value of Australia's bauxite exports by 2.1 per cent to around \$1.0 billion in 2017–18.
- Crackdowns on air pollution and illegal capacity in China are likely to reduce bauxite demand in 2018 and 2019.

11.12 World production

World bauxite production to rise strongly in 2018 and 2019

Over the first nine months of 2017, world bauxite production increased by 8.1 per cent year-on-year, reaching 220 million tonnes. This was driven by strong growth in Africa (up 53 per cent year-on-year), and Australia (up 3.9 per cent year-on-year). However, production in China — the world's second largest bauxite producer — fell by 6.5 per cent year-on-year, to just under 46 million tonnes.

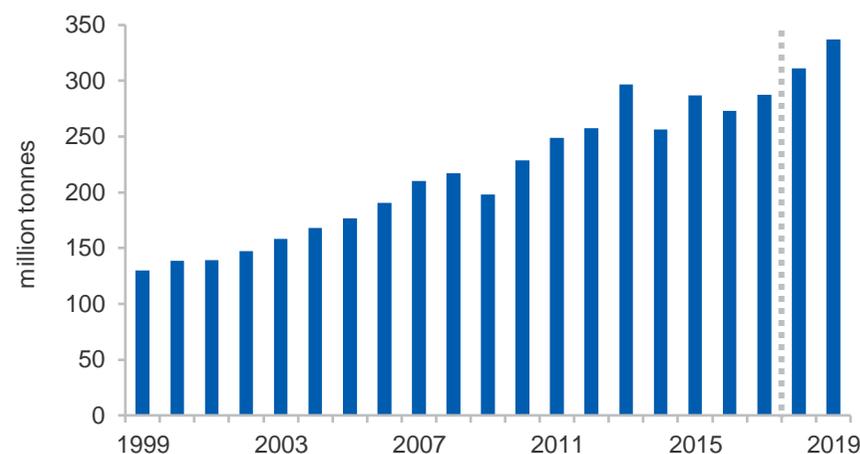
The environmental crackdown by the Chinese Government on aluminium and alumina smelter emissions during the 2017–18 winter season is likely to reduce China's bauxite production by 10 per cent in 2017, to 58 million tonnes. Lower Chinese domestic production and higher imports are expected to continue in the coming years. Offsetting the fall in Chinese production is an expected rise in bauxite output from Australia (up by 1.7 per cent), and Guinea (up 38 per cent). For 2017 as a whole, world bauxite production is forecast to rise by 5.5 per cent to 287 million tonnes.

World bauxite production is forecast to grow at an annual rate of 8 per cent in 2018 and 2019, to reach 337 million tonnes by the end of the outlook period. The gains will be driven by new capacity in Australia — notably the commissioning of Bauxite Hill and Amrun projects — and in Africa. Africa's bauxite production is forecast to reach 70 million tonnes by 2019, with Guinea expected to be the world's fourth largest bauxite producer and the largest bauxite producer in Africa.

Australia-based Alliance Mining Commodities is expected to bring its Koumbia bauxite mine online in Guinea in 2019. This mine holds an estimate 300 million tonnes of bauxite reserves, with an expected output of ten million tonnes per annum.

Indonesia is also expected to contribute to global bauxite production growth, following the relaxation of bauxite mining and export bans in early 2017.

Figure 11.8: World bauxite production



Source: World Bureau of Metal Statistics (2017); Department of Industry, Innovation and Science (2017)

11.13 Australia's exports and production

Bauxite exports lower in 2017–18

Larger export volumes contributed to a 3.7 per cent year-on-year rise in export values in the first quarter of 2017–18. Export values are expected to reach \$276 million for the quarter. China was the largest bauxite exporting market, accounting for 96 per cent (or 6.9 million tonnes) of total Australian bauxite exports. Chinese refineries' strategy of maximising

alumina production ahead of the 2017–18 winter production cuts was the main catalyst for this increased bauxite demand.

The extension of air pollution crackdowns for several more years is expected to decrease alumina production and bauxite demand in China. This has contributed to a downward revision in export earnings, with Australia’s bauxite exports now revised down by \$113 million a year in 2017–18 and 2018–19, to around \$1.0 billion.

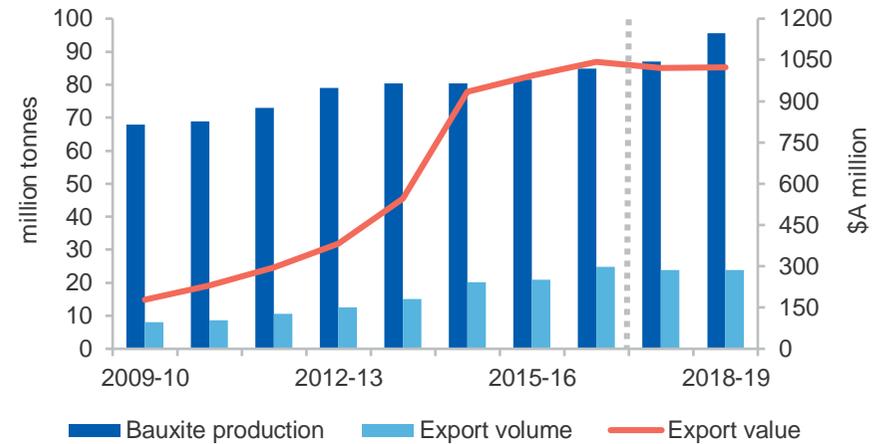
Hongqiao Group of China, the world’s largest aluminium producing company, is rapidly expanding bauxite exports from Guinea into China. The company has established a transport network with logistic companies in order to source bauxite from Guinea, Malaysia and Indonesia to take advantage of low transport costs. This will challenge Australia’s dominant position in global bauxite exports.

In Malaysia, the Government’s attempts to target corruption among bauxite miners appears to be working. Bauxite exports to China fell by 44 per cent from 2.3 million tonnes in the June quarter 2017 to 1.3 million tonnes in the September quarter.

Australia produced 22 million tonnes of bauxite in the September quarter 2017, up 4.9 per cent year-on-year. All bauxite mines recorded year-on-year growth, underpinned by strong performances at Rio Tinto’s Gove (up 11 per cent) and Weipa (up 3.3 per cent) operations. Australia’s bauxite production is expected to rise by 2.4 per cent to 87 million tonnes in 2017–18, and then by a further 10 per cent to 96 million tonnes in 2018–19. Production over this period is expected to be buoyed by new capacity from the Bauxite Hills and Amrun projects.

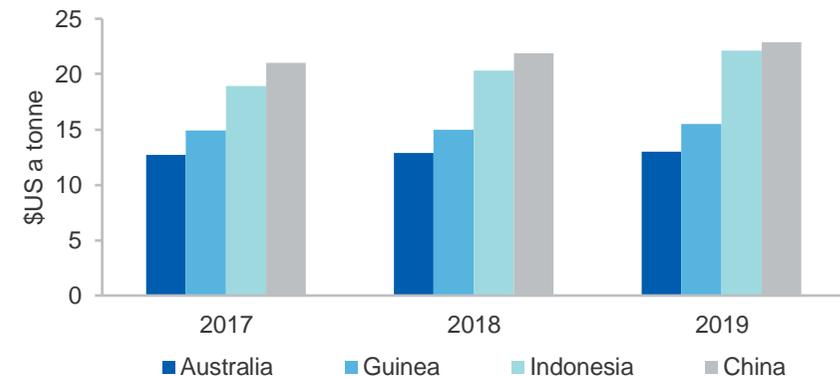
Australia’s bauxite production costs are very competitive, and much lower than other major bauxite-producing countries, such as China, Guinea and Indonesia. On average, production costs in Australia are 13 per cent lower than Guinea, 32 per cent lower than Indonesia, and 38 per cent lower than China.

Figure 11.9: Australia’s bauxite exports and production



Source: ABS (2017) International Trade in Goods and Services, 5368.0; Department of Industry, Innovation and Science (2017)

Figure 11.10: Bauxite average total cash costs by country



Note: Average total cash costs include mining and crushing, administration and transport costs.

Source: AME Group (2017)

Table 11.1: Aluminium, alumina and bauxite outlook

World	Unit	2016	2017 f	2018 f	2019 f	Annual percentage change		
						2017 f	2018 f	2019 f
Primary aluminium								
Production	kt	58,158	57,748	56,921	57,223	-0.7	-1.4	0.5
Consumption	kt	58,099	59,839	60,390	60,076	3.0	0.9	-0.5
Closing stocks b	kt	2,762	2,196	2,152	2,134	-20.5	-2.0	-0.8
– weeks of consumption		7.5	5.4	2.4	1.2	-27.0	-55.3	-50.0
Prices aluminium c								
– nominal	US\$/t	1,604	1,951	2,072	2,146	21.6	6.2	3.6
– real d	US\$/t	1,638	1,951	2,028	2,056	19.1	4.0	1.4
Prices alumina spot								
– nominal	US\$/t	253.2	323.7	313.0	302.1	27.9	-3.3	-3.5
– real d	US\$/t	258.5	323.7	306.5	289.4	25.2	-5.3	-5.6
Australian production	Unit	2015–16	2016–17	2017–18f	2018–19 f	2016–17	2017–18 f	2018–19 f
Primary aluminium	kt	1,649	1,518	1,577	1,590	-7.9	3.9	0.8
Alumina	kt	20,550	20,599	20,586	20,640	0.2	-0.1	0.3
Bauxite	Mt	81.5	84.9	86.9	95.6	4.2	2.4	10.0
Consumption								
Primary aluminium	kt	207	190	161	191	-8.2	-15.5	18.8
Exports								
Primary aluminium	kt	1,442	1,329	1,416	1,400	-7.8	6.5	-1.2
– nominal value	A\$m	3,241	3,165	3,790	3,806	-2.3	19.7	0.4
– real value e	A\$m	3,364	3,231	3,790	3,722	-4.0	17.3	-1.8
Alumina	kt	17,676	18,230	18,050	17,717	3.1	-1.0	-1.8
– nominal value	A\$m	5,995	6,655	7,199	6,825	11.0	8.2	-5.2
– real value e	A\$m	6,223	6,792	7,199	6,674	9.1	6.0	-7.3
Bauxite	Kt	20,971	24,851	23,773	23,910	18.5	-4.3	0.6
– nominal value	A\$m	992	1,042	1,020	1,023	5.1	-2.1	0.3
– real value e	A\$m	1,030	1,063	1,020	1,000	3.3	-4.1	-1.9
Total value								
– nominal	A\$m	10,228	10,863	12,009	11,655	6.2	10.5	-2.9
– real e	A\$m	10,617	11,086	12,009	11,396	4.4	8.3	-5.1

Notes: **b** Producer and LME stocks; **c** LME cash prices for primary aluminium; **d** In 2017 calendar year US dollars; **e** In 2017-18 financial year Australian dollars; **f** Forecast

Source: ABS (2017) International Trade in Goods and Services, 5368.0; AME Group (2017); LME (2017); Department of Industry, Innovation and Science (2017); International Aluminium Institute (2017); World Bureau of Metal Statistics (2017)