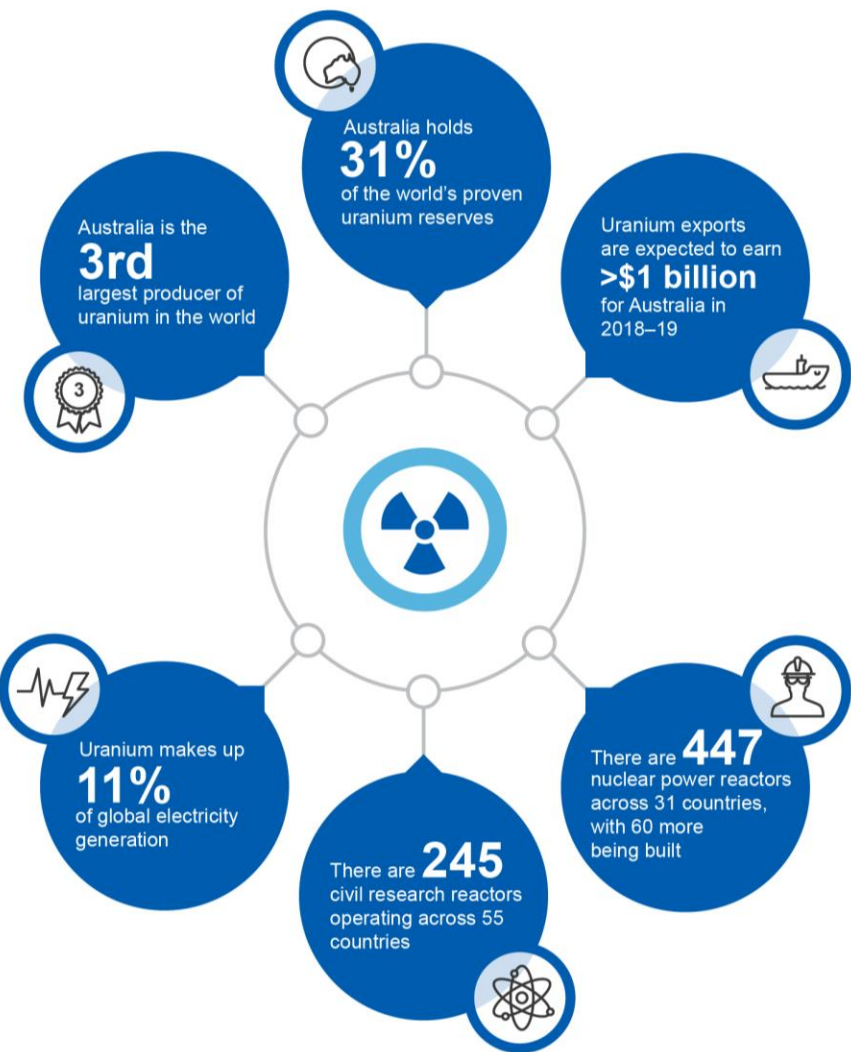


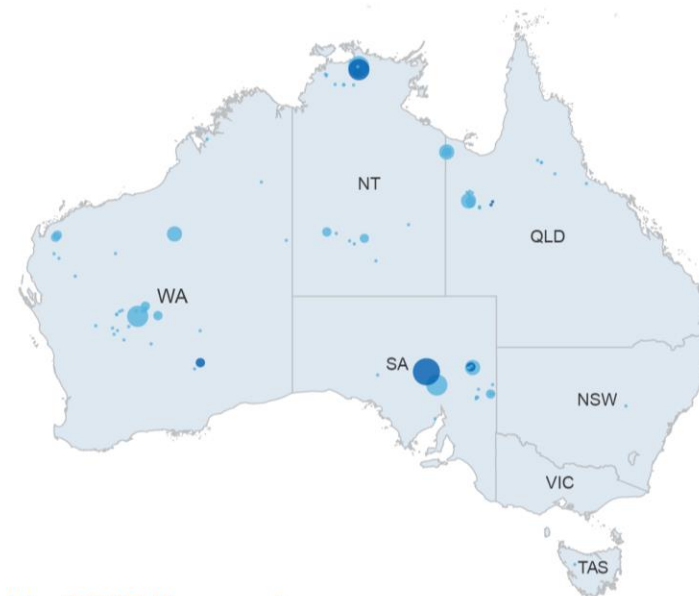
Uranium

Resources and Energy Quarterly September 2017

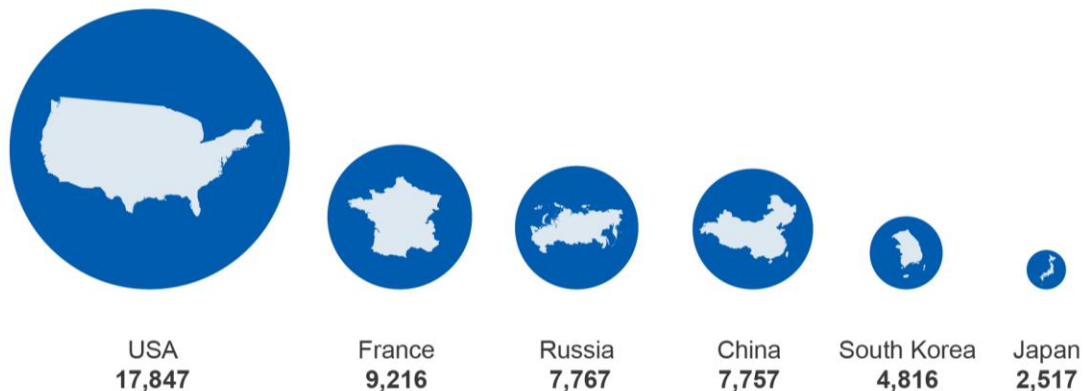


Major Australian uranium deposits (tonnes)

- <2,967
- 2,968–9,762
- 9,763–17,571
- 17,572–59,338
- >59,339
- Deposit
- Operating mine



Uranium required in 2017 (tonnes)



Summary

- Uranium markets remain oversupplied, with prices expected to remain low, averaging \$US22 a pound in 2017. Prices are expected to recover to \$US25 a pound in 2018 and \$US29 a pound in 2019, as production cutbacks slowly take effect and Asian demand rises.
- Supply disruptions are expected to reduce Australian uranium production to 6,986 tonnes in 2017–18. However, rising demand in Asia and a resumption of normal production should support a rebound to 7,950 tonnes produced in 2018–19.
- Australia's uranium exports are expected to pick up from \$857 million in 2017–18 to just over \$1 billion by 2018–19, driven by higher production and a lift in uranium prices from their current historic low.

Prices

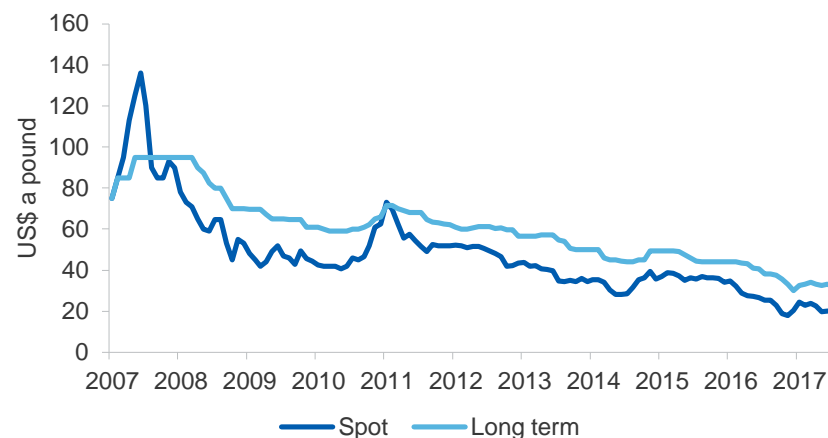
New capacity will support gradual price growth over the next few years

There was little movement in prices during the September quarter, with a lift of 5 cents to \$US20.2 per pound in July and a fall of 7 cents to \$US20.13 per pound in August. At these prices, most producers are making a loss, though thus far production cuts have been relatively contained and slow to take effect. Uranium prices are estimated to average \$US22.01 per pound over 2017.

Prices have remained low, in part, because rising demand has been met by a rundown in inventories. Inventories and secondary markets have proven to be more robust than expected, and the resulting impact on producers has been exacerbated by ongoing market uncertainty and the gradual departure of generalist investor funds from the sector.

With inventories expected to remain substantial, it is likely that prices will continue the gradual, slow increase recorded during the September quarter. Production cuts will continue to feed through the market, and the pace of reactors coming online will continue to rise. Spot prices are expected to lift from their 2017 average of around \$US22 per pound, to \$US25 per pound in 2018 and \$US29 per pound in 2019. Price growth may be slower if construction schedules are not met in China nor India, or if recently announced production cuts take longer than expected to impact on inventories.

Figure 9.1: Uranium prices, monthly



Source: Cameco Corporation (2017) Uranium Spot and Long Term Prices

Figure 9.2: Quarterly uranium spot price and outlook



Source: Cameco Corporation (2017) Uranium Spot Price; Ux Consulting (2017) Uranium Market Outlook

Large uranium producers typically sell most of their output through long term contracts rather than the spot market. The Ux Consulting long term indicator contract price is forecast to have dropped to around \$US33 per pound in 2017, but is expected to recover to \$US37.75 per pound in 2018 and \$US40.6 per pound in 2019. Long term contracts typically vary across producers because of differences in contract lengths, volumes and terms, based on market conditions at the time of signing. Australia's average export returns are generally much lower than the world indicator contract price.

Consumption

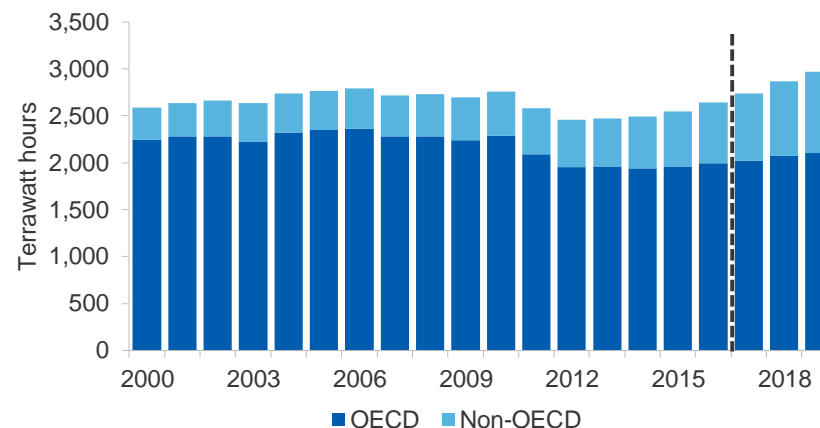
Nuclear power generation is shifting towards developing nations

World uranium consumption is expected to edge up from 83,400 tonnes in 2016 to 88,300 tonnes in 2017, supported by the development of new nuclear power generation capacity. Commissioning a new reactor requires more uranium for its initial core than operating plants. Annual requirements decline as a reactor reaches a steady state level of operation. Most reactors are refuelled at intervals of one to two years, when a quarter to a third of the fuel assemblies are replaced.

Events in the September quarter provide the strongest signs yet that global uranium markets are entering a period of significant change. Research into small modular reactor technology is picking up in Western nations: the Canadian Nuclear Laboratories request for development of small modular reactors attracted more than 70 expressions of interest. August also saw the US Concurrent Technologies Corp and the UK Nuclear Advanced Manufacturing Research Centre announce new R&D facilities to study modular reactor technology.

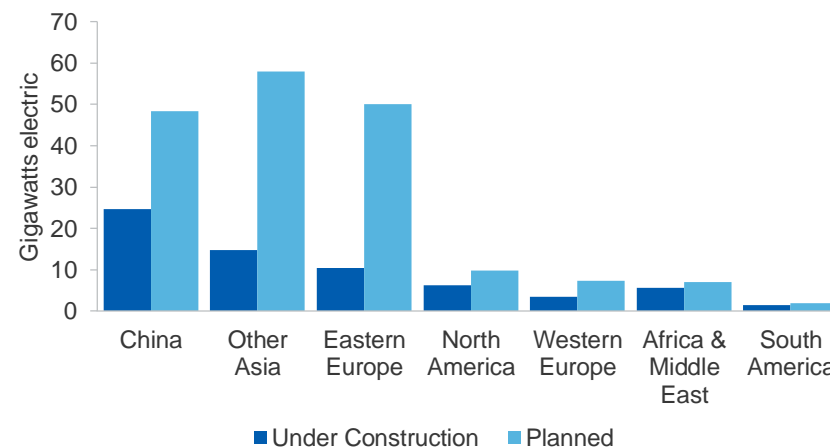
However, although research into new reactor forms is accelerating, actual reactor development has become increasingly stalled in the West. At the start of August, South Carolina Electric & Gas announced that construction of two AP1000 reactors in the US would cease, effectively ending the largest US nuclear construction in over 30 years. The demise of the \$US9.8 billion project has been linked to ongoing delays and cost blowouts, and follows large-scale shutdowns of reactors in Japan and Germany. Several proposed reactors have also been cancelled in South Korea. The fate of a further project — the Vogtle units 3 and 4 in Georgia — remains unclear, although Georgia Power has recommended their completion to the State's Public Service Commission.

Figure 9.3: World nuclear power generation



Source: International Energy Agency (2017); World Nuclear Association (2017), Department of Industry, Innovation and Science estimates

Figure 9.4: New nuclear capacity



Source: World Nuclear Association (2017)

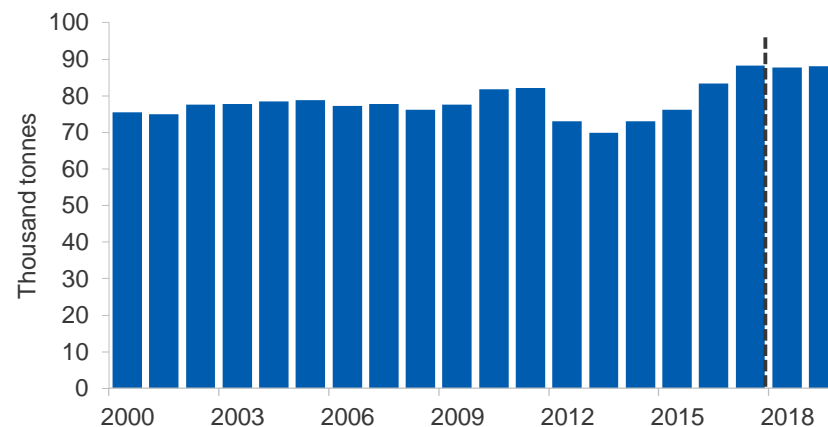
While reactor programs have largely stalled across most developed countries, developing countries are moving to strongly expand nuclear capacity, creating a re-alignment of the global uranium market. Chinese and Russian nuclear industries have stepped up plans to expand and export nuclear technology, capitalising on the advantages of being state-owned enterprises and operating in political environments where the technology is strongly supported. China and Russia have built competitive advantages through the construction of dozens of reactors in their territory over the past 20 years — a pace of construction which sits in marked contrast to the stagnation evident in the US and other Western countries.

China completed the construction of Unit 4 of its Fuqing nuclear power plant in August, with grid connection set to deliver 1,020 megawatts of power. The plant is China's 37th, with a further 20 under development. A number of Chinese reactors under development also achieved important milestones in the September quarter: the Sanmen 1 reactor passed its final safety check in August; the Haiyang 2 reactor passed its containment integrity tests, and the Yangjiang 5 reactor passed cold function tests. All three reactors are expected to be grid-connected in the near future.

India also announced final approval of its plan to build 10 additional large pressurised heavy water reactors. These reactors have a combined capacity of more than 7,000 MWe, and will more than double India's total nuclear capacity. Russia and India's co-development of new units at the Kudankulan plant is also nearing completion, with the 'practical implementation phase' getting underway in the September quarter.

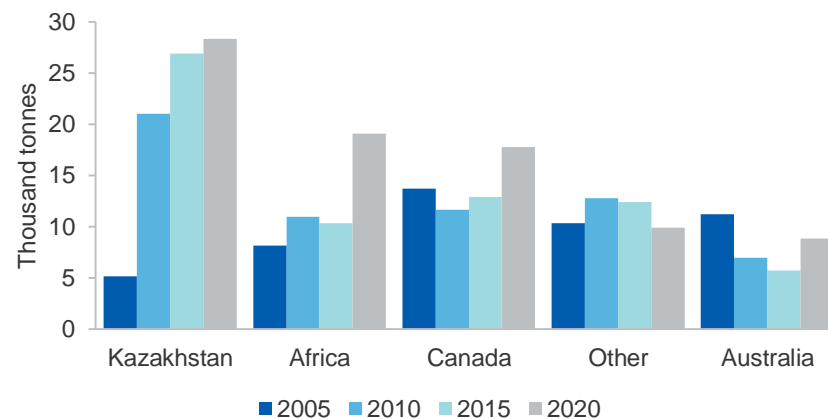
Recent delays and cancellations of reactor projects in developed countries will act as a temporary offset against the longer-term rise in use of nuclear power among developing countries. As a result, uranium consumption is expected to remain largely steady over the next two years, falling slightly to 87,800 tonnes in 2018, then rebounding to 88,100 tonnes in 2019. Beyond this, the outlook for uranium leans towards moderate but steady growth, with the rate of growth rising slowly over time.

Figure 9.5: World uranium consumption (U3O8)



Source: International Energy Agency (2017); World Nuclear Association (2017)

Figure 9.6: World uranium production (U3O8)



Source: Nuclear Energy Agency (2017); Ux Consulting (2016) Uranium Market Outlook World Nuclear Association (2017)

Production

Mine production is expected to increase steadily

In 2017, world production is forecast to remain stable at 73,100 tonnes. Increased production is expected at Rio Tinto's Rössing mine and CGN/Swakop Uranium's Husab mine in Namibia, Peninsula Energy's Lance mine in the US and Cameco's Cigar Lake mine in Canada. Offsetting this, Kazakh production is expected to decline, following the late 2016 announcement of reduced output by Kazatomprom — the largest producer in the country.

Uranium supply is increasingly being met by the rundown of inventories. Over the past 25 years, consumption of uranium has exceeded supply by almost 1.4 billion pounds, with the difference accounted for by a huge and increasingly sophisticated secondary market in recycled and stored product. Ux Consulting has estimated that there are sufficient inventories held by nuclear utilities to cover forward demand for around 5 years in Japan, 30 months in both the United States and Europe, and around seven years in China. The existence of a substantial secondary market has prevented rising demand from pulling prices up immediately. However, the long-term price trajectory is likely to be favourable, with a supply gap growing each year, due to the lack of incentive for new mines to emerge. This supply gap is likely to persist into the 2020s.

As uranium inventories gradually decline, it is likely that primary production will pick up. World uranium production is projected to increase to 79,700 tonnes by 2019. This will be underpinned by continued increases in production at CGN/Swakop Uranium's Husab mine, Peninsula Energy's Lance mine, and Cameco's Cigar Lake mine.

Australia's exploration, production and exports

Australia's uranium exploration expenditure remains low

Australia's uranium exploration expenditure remains minimal, with \$5.2 million spent in the June quarter. This compares to \$5.1 million in the March quarter.

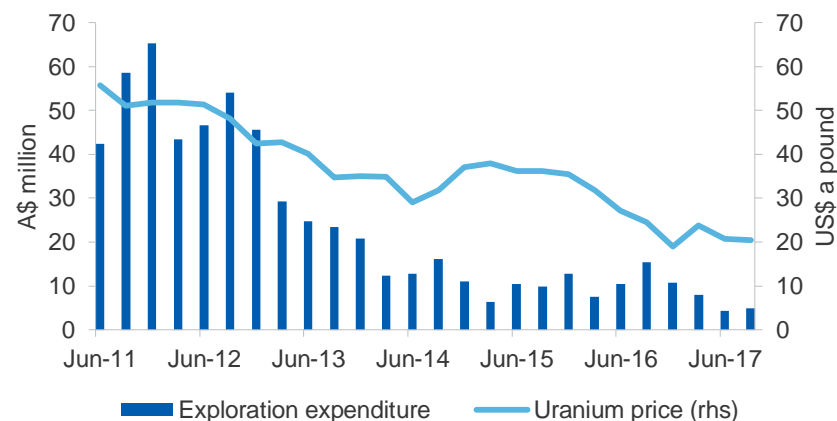
Exploration has fallen progressively, due to historically low prices, and now stands well below levels recorded during the 2010 peak, when exploration spending reached \$190 million over the year. There is little immediate prospect for an increase in uranium exploration, especially in light of the recent decision by the Western Australian Government to cease further uranium mine approvals in the State.

Australia's production outlook is mixed, with countervailing pressures

Australia faces a mixed but relatively solid production outlook, with short-term disruptions expected to give way to longer term growth.

The first sample shipment of Australian uranium was dispatched to India in mid-July. Although the quantities being shipped are currently modest,

Figure 9.7: Australia's uranium exploration



Source: ABS (2017) *Mineral and Petroleum Exploration*, cat. No. 8412.0; Cameco Corporation (2017) *Uranium Spot Price*

the recent bilateral agreement on supply and the Civil Nuclear Transfers Act 2016 provide mechanisms for expanding supply.

Although new mines have recently been banned in Western Australia, the Federal Government granted environmental approval for the proposed expansion of Toro Energy's Wiluna project in July, which should lead to rising output from the mine. Four uranium projects approved prior to the election have also been allowed to proceed.

BHP is temporarily shutting down its Olympic Dam project — which produces copper and uranium — for more than three months, starting in August. The shutdown has been planned for some time, and will allow the company to upgrade its copper smelting facilities. However, it is expected to lead to substantially lower uranium output from Olympic Dam during the September and December quarters.

Australia's uranium production is forecast to decrease from 7,320 tonnes in 2016–17 to 6,986 tonnes in 2017–18, affected by the production pause at Olympic Dam. In 2018-19, rebounding production at the Olympic Dam mine and a ramp-up of production in Quasar Resources' Four Mile Mine are expected to support a rebound in production to 7,950 tonnes.

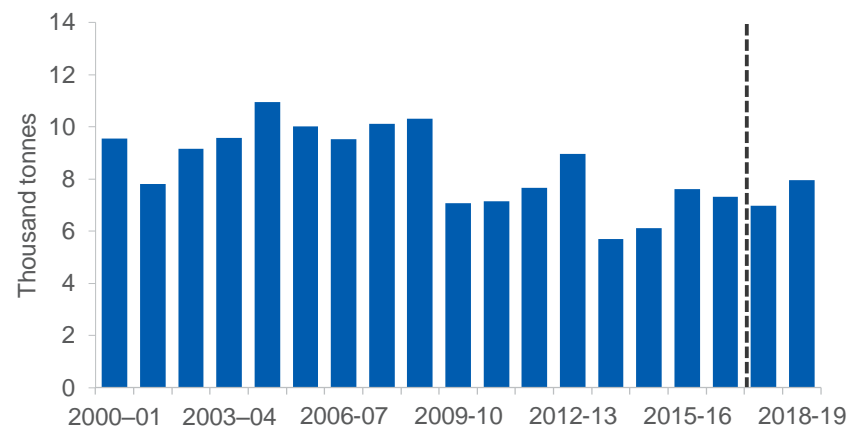
Some long-term supply contracts will expire during 2017, meaning a larger share of global demand will be met from the spot market, where prices are below production costs for Australian producers. Conditions will thus remain challenging for Australian producers in the short-term.

Nuclear power growth across Asia will support uranium exports

Australia exported 7,724 tonnes of U308 in 2016–17, and this is expected to edge down to 7,673 tonnes in 2017–18 before recovering to 8,450 tonnes in 2018–19. Export values fell to \$894 million in 2016–17, reflecting the impact of ongoing weak prices. Prices are expected to continue to weigh on export earnings in 2017–18, with overall export revenue declining to \$857 million. Subsequently, rising prices and increased output at the Olympic Dam and Four Mile mines are expected to support a rise in export values to \$1,004 million in 2018–19.

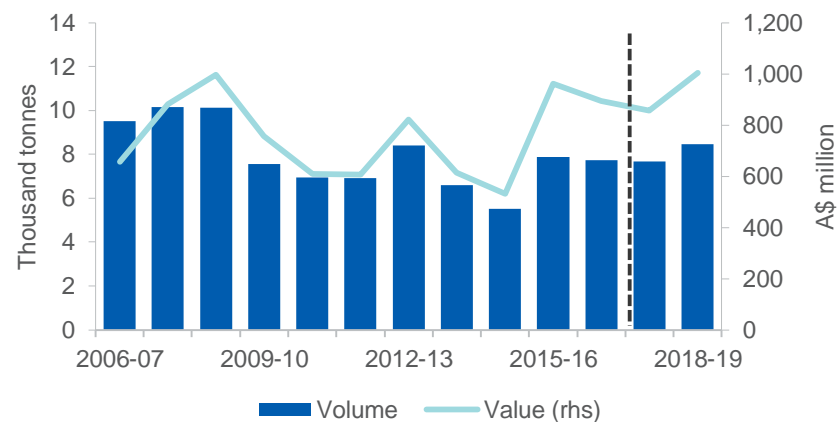
Future consumption growth is likely to be concentrated in developing countries including India and China. Consequently, developments such as the recent agreement on supply to India are likely to become more important, as these nations will be the engine of future demand growth.

Figure 9.8: Australia's uranium production



Source: BHP (2017); Operational Review, DIIS (2017); Energy Resources of Australia (2017); ASX Announcements — Operations Review; company media announcements (2017)

Figure 9.9: Australia's uranium exports



Source: Department of Industry, Innovation and Science (2017)

Table 9.1 Uranium outlook

World	Unit	2016	2017 f	2018 f	2019 f	Annual percentage change		
						2017 f	2018 f	2019 f
Production	kt	73.1	73.1	77.6	79.7	0.1	6.1	2.7
Africa ^b	kt	9.5	11.4	13.1	14.9	20.1	14.7	13.9
Canada	kt	15.9	16.2	16.7	16.7	2.1	2.8	0.0
Kazakhstan	kt	28.1	26.7	27.4	27.4	-5.0	2.7	0.0
Russia	kt	3.6	4.0	4.2	4.3	9.4	5.7	2.7
Consumption	kt	83.4	88.3	87.8	88.1	5.9	-0.6	0.4
China	kt	13.8	17.1	17.5	18.7	24.0	2.3	6.7
European Union 28	kt	22.2	22.4	24.3	22.2	1.0	8.7	-8.9
Japan	kt	0.5	1.2	1.7	2.0	162.9	42.0	17.9
Russia	kt	6.1	6.6	6.9	7.0	7.0	4.6	2.5
United States	kt	23.0	22.5	22.1	22.5	-1.9	-1.9	1.6
Price								
– nominal	US\$/lb	25.6	22.0	25.2	29.0	-13.3	14.7	13.7
– real ^c	US\$/lb	26.2	22.0	24.6	27.8	-15.0	12.3	11.3
Australia	Unit	2015–16	2016–17	2017–18 f	2018–19 f	2016–17	2017–18 f	2018–19 f
Export volume	t	7,889	7,724	7,673	8,450	-2.1	-0.7	10.1
– nominal value	A\$m	963	894	857	1,004	-7.1	-4.2	17.1
– real value ^d	A\$m	1,000	914	857	980	-8.7	-6.2	14.4
Average price	A\$/kg	122.0	115.8	111.7	118.8	-5.1	-3.5	6.4
– real ^d	A\$/kg	126.8	118.3	111.7	116.0	-6.7	-5.6	3.9

Notes: ^b Includes Niger, Namibia, South Africa, Malawi and Zambia; ^c In 2017 US dollars; ^d in 2017–18 Australian dollars; f forecast.

Source: Australian Department of Industry, Innovation and Science (2017); Cameco Corporation (2017); Ux Consulting (2017) Uranium Market Outlook.