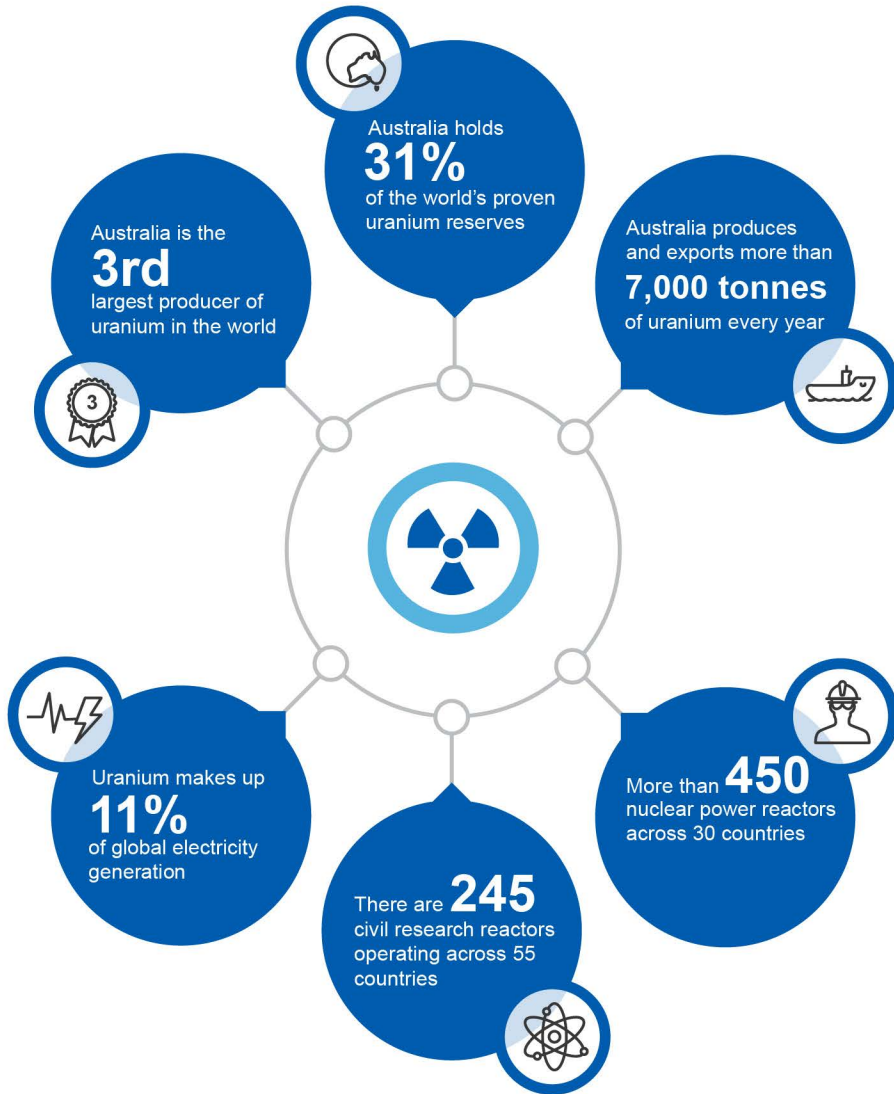


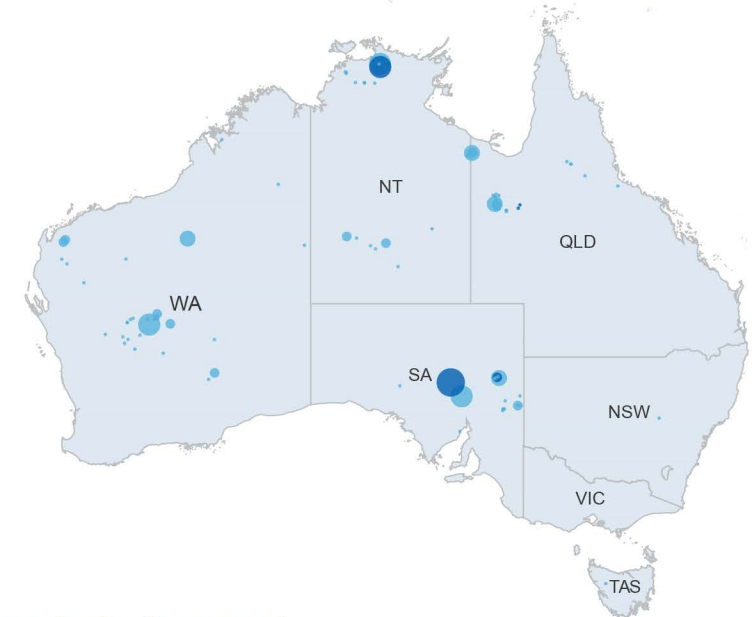
# Uranium

Resources and Energy Quarterly December 2019

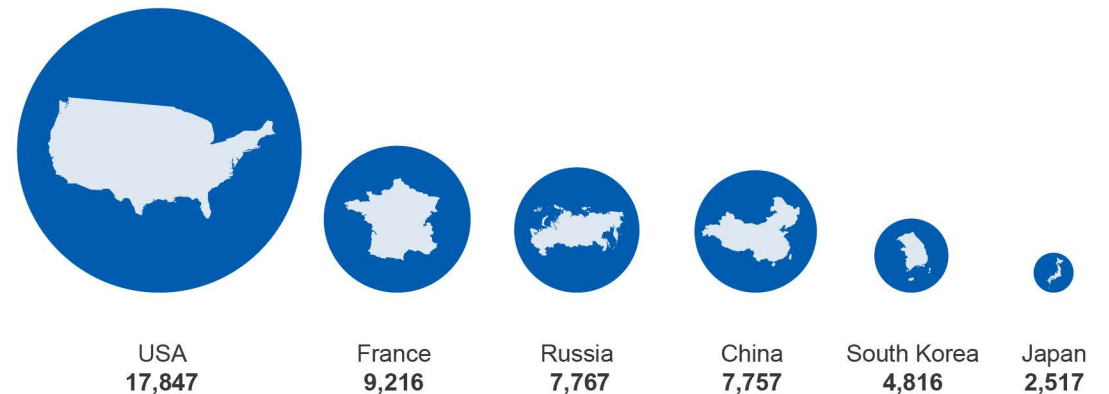


## Major Australian uranium deposits (tonnes)

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



## Key consumer markets (tonnes)



## 9.1 Summary

- Uranium prices are expected to lift gradually over the outlook period, driven by supply cuts and slow growth in demand. Prices are forecast to rise above US\$35 by the end of 2021.
- Uranium production in Australia is expected to decline over the outlook period, as output winds down at the Ranger mine ahead of its scheduled closure at the start of 2021.
- Australia's uranium export earnings will likely be affected by falling production, with lower volumes offsetting the impact of higher prices, leading to a small decline in export values (to \$555 million) by 2020–21.

## 9.2 Prices

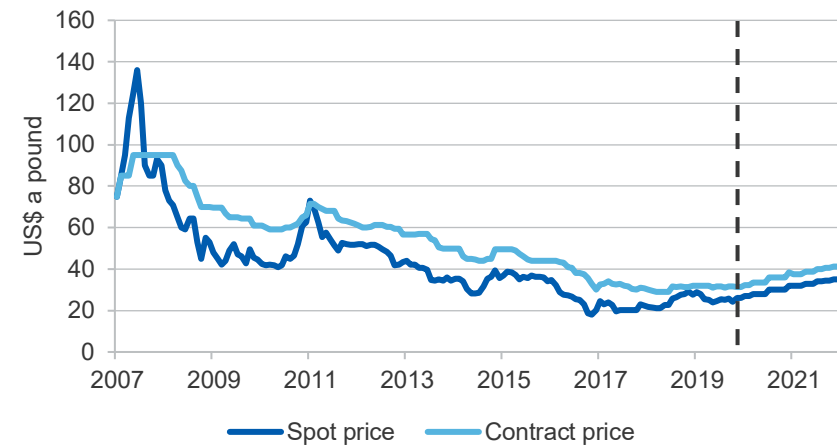
### Uranium prices are largely stable, but change is in prospect

Uranium prices remained at around US\$25 a pound in November, where they have been since large producers in Kazakhstan and Canada cut their output in 2018. The resulting large cut in global supply led to a structural lift from the historical price lows of 2017, but prices remain modest, with upward momentum having petered out.

This may change in coming months. Utilities around the world — but especially in the US — have held back on significant buying in recent months amidst uncertainty around US policy and potential changes in tariffs. It is likely that this will reverse in the near future, with a shift towards more active buying leading to some small upward pressure on spot prices towards the end of 2019. Risks to this prospect include the possibility that the US refuses to grant further waivers to Russia for ongoing engagement with Iran's nuclear power program, which would lead to greater uncertainty and instability.

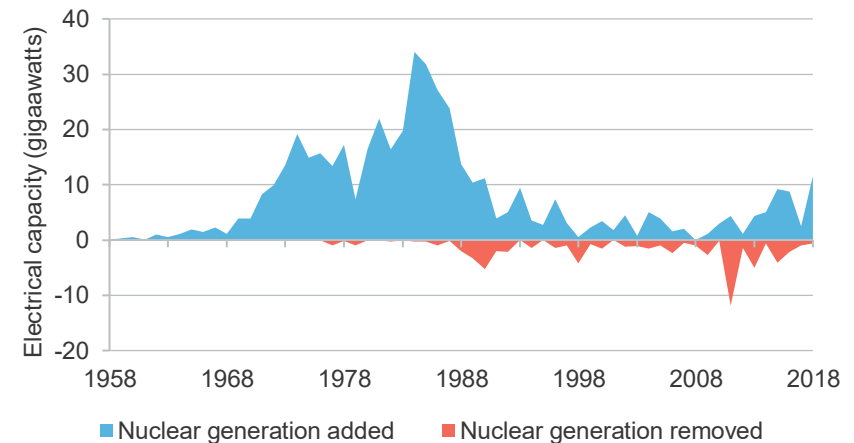
Reactor constructions in Asia, the Middle East and Eastern Europe are expected to lead to sustained but slow upward price pressure over time (Figures 9.1 and 9.2), with a potential for stronger growth should inventories run short before new supply comes online.

Figure 9.1: Uranium price outlook



Source: Cameco Corporation (2019) Uranium Spot Price; Ux Consulting (2019) Uranium Market Outlook

Figure 9.2: World nuclear power generation



Source: International Energy Agency (2019); World Nuclear Association (2019); Department of Industry, Innovation and Science (2019)

### 9.3 World consumption

#### Nuclear power growth faces a significant potential upside

Uranium demand is expected to grow moderately, from 85,300 tonnes in 2018 to 90,400 tonnes by 2021 (Figure 9.3). Most reactor growth in the medium term is driven by Asia (Figure 9.4), but global demand sources are diversifying.

Several countries have progressed long-term plans to expand into nuclear power in recent months. On 23 October, Ethiopia and Russia signed an intergovernmental agreement on cooperation for peaceful use of nuclear energy. The agreement set out a legal framework for cooperation in the development of nuclear infrastructure in Ethiopia, and included regulation and safety, fuel storage, and compliance with international standards.

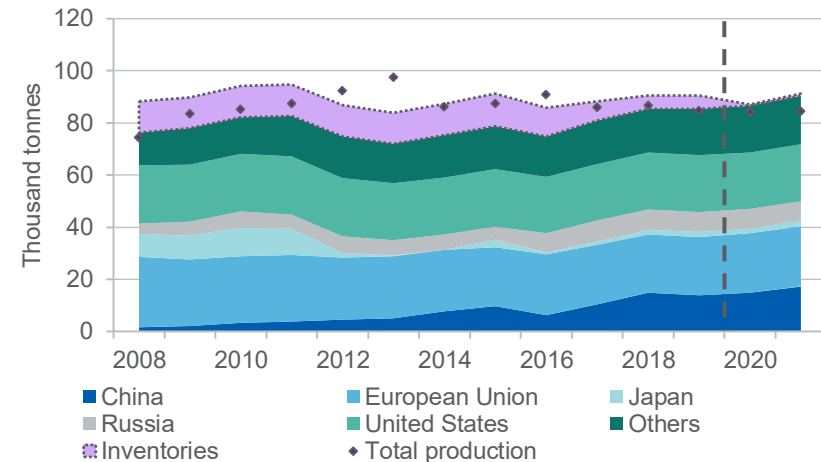
China achieved criticality at its Qixing (Venus) III reactor in October. This is the country's first lead-bismuth alloy zero-power reactor, and criticality represents an important milestone in progressing development of liquid metal cooled reactors. A range of other Chinese reactors are also progressing towards completion after a lull in reactor connections over the second half of 2019. At least eight reactors are now expected to commence commercial operations in China over the next 12 months.

In Pakistan, commissioning for the first of two Hualong One nuclear power reactors has begun. The reactor is expected to commence generation 2021, with construction having started in 2015.

India has announced plans to add 17 more nuclear reactors to its already-substantial construction pipeline. The country will also adopt a 'fleet mode construction' model to improve standardisation and capitalise on scale, with intent to reduce costs and construction times significantly.

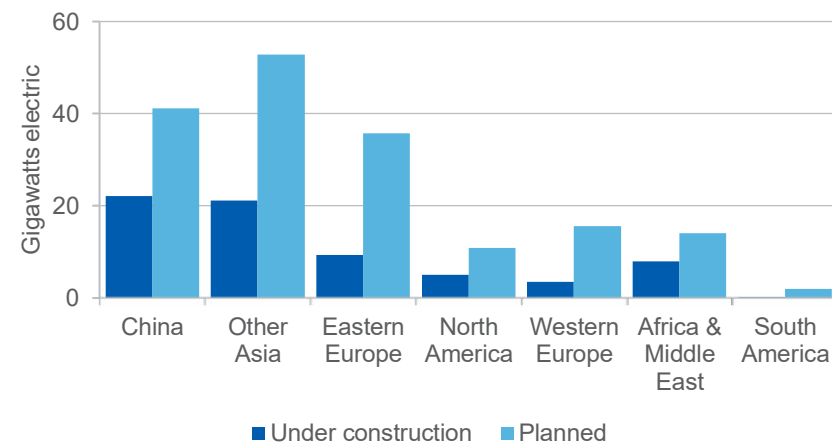
In Bulgaria, unit 6 of the Kozloduy reactor has had its operating licence extended for an additional 10 years, allowing it to run until the end of 2029. Previously, Kozloduy unit 5 was granted a similar extension, extending its operation period out to 2027. A €360 million upgrade to the facility seeks to extend the operating period for a potential further 20 years, ensuring generation continues into the 2040s. The Kozloduy plant provides more

Figure 9.3: World uranium consumption and inventory build (U3O8)



Source: International Energy Agency (2019); World Nuclear Association (2019); Ux Consulting (2019)

Figure 9.4: New nuclear capacity: medium-term expansion



Source: International Energy Agency (2019); World Nuclear Association (2019); Department of Industry, Innovation and Science (2019)

than one-third of total electricity in Bulgaria.

A 20-year operating extension has also been granted to the Koeberg nuclear plant in South Africa. This extends the operation of the reactor out to 2044. The South African Government has also launched a new build program as part of its expanded energy plans, which focuses on a more diversified energy mix. Nuclear power is viewed as a means to reduce reliance on a narrow range of energy sources, with the government now targeting an extra 25,000 megawatts of nuclear generating capacity.

In Japan, two reactors have failed to complete mandatory security upgrades on schedule, and will be closed temporarily next year to complete them. Two more reactors may also face an operating hiatus.

## 9.4 World production

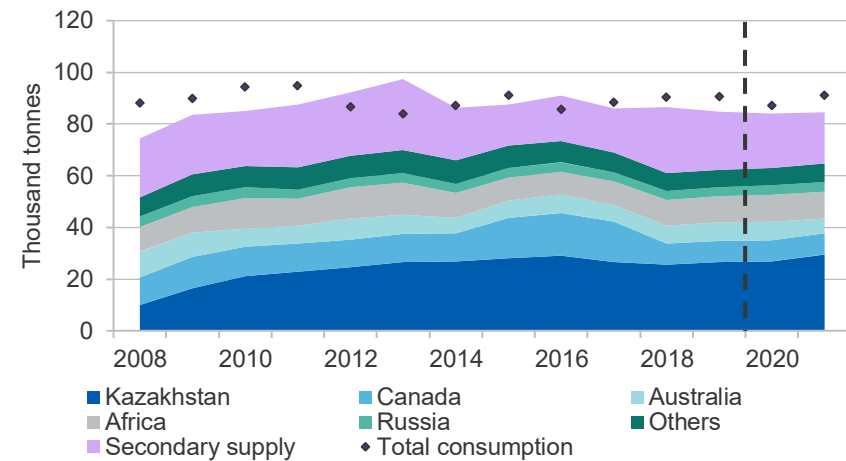
### Conditions for uranium producers are belatedly improving

In aggregate, global mine production is expected to edge up from 62,300 tonnes of triuranium octoxide (U<sub>3</sub>O<sub>8</sub>) in 2019, to 64,800 tonnes by 2021 (Figure 9.5). Large producers in Kazakhstan and Canada remain committed to lower production over the period to 2021, though the large cuts in output enacted over the last 18 months appear now to have ended.

Over the next three to five years, uranium production is projected to shrink further as existing mines including Cigar Lake in Canada, COMINAK in Niger, the Ranger mine in Australia, Rössing in Namibia, and Akdala and Zarechnoye in Kazakhstan all approach the end of their life. At this stage it is not clear where production will come from to fill the supply gap, with low prices acting as a deterrent for any rapid investment in uranium mining.

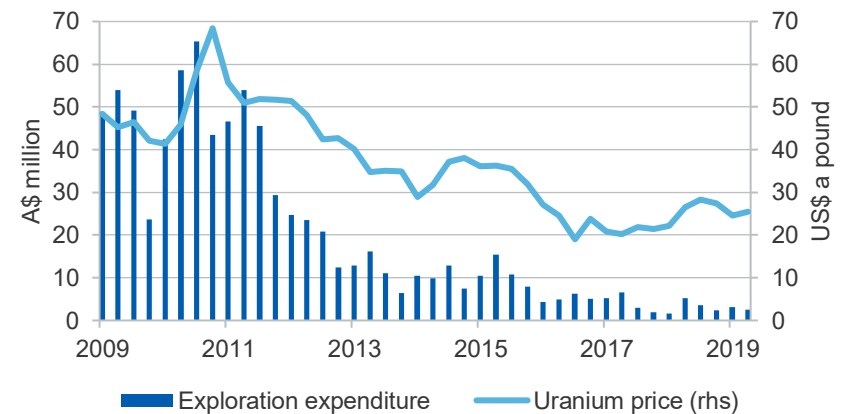
On the technology front, BWX Technologies has announced that production of its high-assay low-enriched nuclear fuel will increase over coming years. To date, material made by the company has largely been limited to specialist applications, with the expansion intended to position the company for an expected rise in demand, notably from the US Department of Defence micro reactors. The fuel has capacity to operate in particularly high temperatures, but is not yet widely used commercially.

**Figure 9.5: World uranium production and secondary supply (U<sub>3</sub>O<sub>8</sub>)**



Source: International Energy Agency (2019); World Nuclear Association (2019); Ux Consulting (2019)

**Figure 9.6: Australia's uranium exploration**



Source: International Energy Agency (2019); World Nuclear Association (2019); Ux Consulting (2019)

## 9.5 Australia

### Low prices have sharply reduced uranium exploration

Only \$2.5 million was invested in uranium exploration in Australia in the September quarter (Figure 9.6). This is around half the level of a year ago and well below the peak in 2010, when quarterly exploration was above \$40 million.

Exploration was mostly limited to the Northern Territory, Queensland and South Australia, and is not expected to ramp up significantly in any state until prices recover noticeably.

### The closure of Ranger will drive a decline in production by 2021

Australian uranium output and production are set to decline from 2020, as the Ranger uranium mine remains on schedule to close in January 2021. The cost for closure and rehabilitation of the site lifted to \$808 million in 2019 as additional water treatment, tailings transfer and revegetation needs were identified. However, closure and rehabilitation remain on schedule.

BHP has announced the discovery of additional mineralised intercepts of uranium, along with copper and gold, following drilling at its Oak Dam site, which is located 65 kilometres south-east of Olympic Dam. Additional drilling and examination of the deposits is ongoing, but the discovery presents an opportunity for further uranium exports from South Australia in the future.

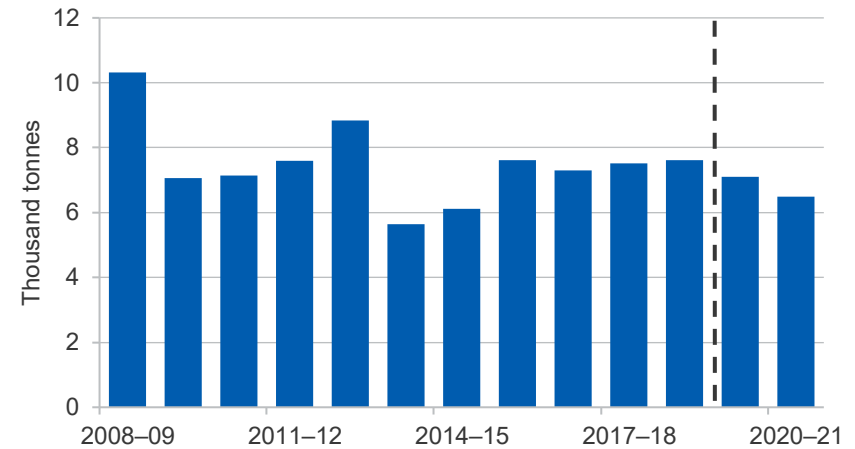
### Conditions for exporters remain difficult, but price growth should help

Following the trajectory of production, export volumes are expected to decline from 2019–20, though price growth may provide some offset (Figures 9.7 and 9.8). Export earnings are similarly expected to decline, to \$555 million by 2020–21, with slow growth in prices failing to offset lower volumes.

### Revisions to the outlook

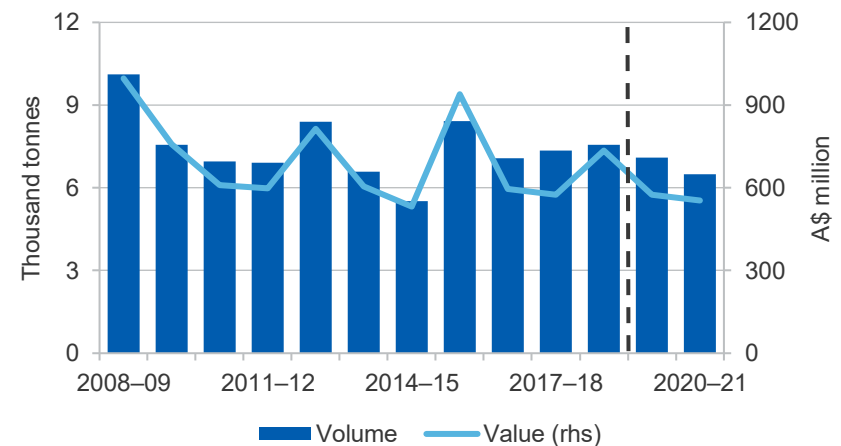
Australia's forecast uranium export earnings are largely unchanged from the September edition of the *Resources and Energy Quarterly*.

Figure 9.7: Australia's uranium production



Source: BHP (2018); Operational Review, Department of Industry, Innovation and Science (2019); Energy Resources of Australia (2018); ASX Announcements — Operations Review; company media announcements (2019)

Figure 9.8: Australia's uranium exports



Source: Department of Industry, Innovation and Science (2019)

**Table 9.1 Uranium outlook**

World	Unit	2018	2019 <sup>s</sup>	2020 <sup>f</sup>	2021 <sup>f</sup>	Annual percentage change		
						2019 <sup>s</sup>	2020 <sup>f</sup>	2021 <sup>f</sup>
Production	kt	61.0	62.3	63.1	64.8	2.1	1.3	2.7
Africa <sup>b</sup>	kt	10.0	10.1	10.4	10.4	0.9	3.4	0.0
Canada	kt	8.3	8.2	8.2	8.2	-1.0	0.0	0.0
Kazakhstan	kt	25.5	26.7	26.8	29.5	4.5	0.3	10.1
Russia	kt	3.4	3.7	3.7	3.8	6.7	0.0	3.1
Consumption	kt	85.3	85.3	86.5	90.4	0.0	1.4	4.4
China	kt	14.8	13.9	15.0	17.2	-6.6	8.0	14.9
European Union 28	kt	22.5	22.5	22.6	23.1	0.0	0.8	2.2
Japan	kt	1.6	1.9	1.9	2.4	18.8	0.0	26.0
Russia	kt	8.0	7.7	7.4	7.4	-3.9	-3.2	-0.4
United States	kt	21.8	21.8	21.7	21.8	0.0	-0.7	0.6
Spot price	US\$/lb	24.1	25.8	29.0	33.5	6.9	12.5	15.5
real <sup>c</sup>	US\$/lb	24.5	25.8	28.4	32.1	5.1	10.1	13.1
Australia	Unit	2017–18	2018–19	2019–20 <sup>f</sup>	2020–21 <sup>f</sup>	2018–19	2019–20 <sup>f</sup>	2020–21 <sup>f</sup>
Mine production	t	7,521	7,618	7,095	6,500	1.3	-6.9	-8.4
Export volume	t	7,343	7,571	7,095	6,500	3.1	-6.3	-8.4
– nominal value	A\$m	575	734	576	555	27.7	-21.7	-3.6
– real value <sup>d</sup>	A\$m	672	732	576	544	22.4	-22.2	-5.3
Average price	A\$/kg	80.0	90.7	81.2	85.3	7.9	-6.1	5.3
– real <sup>d</sup>	A\$/kg	82.8	92.3	81.2	83.7	6.1	-8.1	3.3

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2019 US dollars; **d** in 2019–20 Australian dollars; **s** estimate; **f** forecast.

Source: Australian Department of Industry, Innovation and Science (2019); Cameco Corporation (2019); Ux Consulting (2019) Uranium Market Outlook