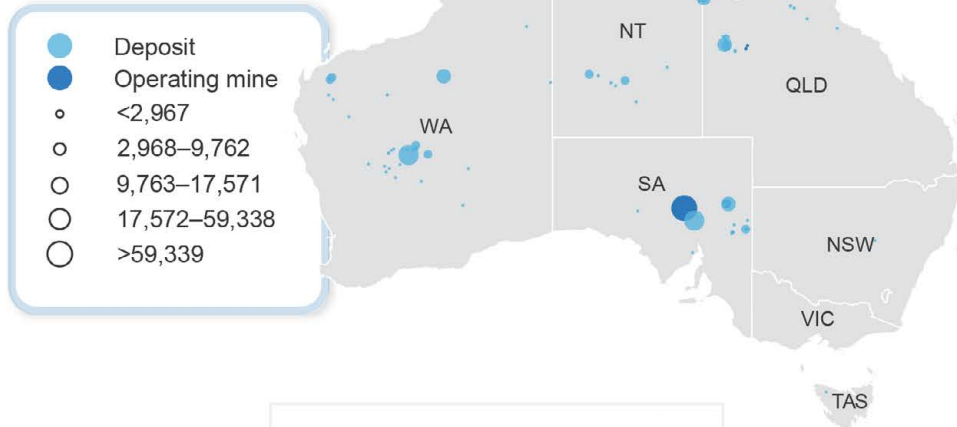


# Uranium

## Major uranium deposits (tonnes)



## Uranium facts



Originally formed in supernovae more than **6 billion years ago**



Uranium is the **biggest source of heat** within the earth



**Uranium powers** around 450 nuclear plants, with 50 more under construction



Nuclear is the **safest power source**, with the lowest death rate per unit of power generated

## Consumer markets



27%  
EU



26%  
USA



21%  
Others



15%  
China



9%  
Russia



2%  
Japan

## Australia's Uranium



**Ranked no 1**  
for uranium  
resources



**3rd largest**  
uranium producer  
in the world



**Exports**  
worth **\$734m**  
in 2018–19

## 9.1 Summary

- Uranium prices remain low, but tight supply conditions are expected to force a lift in prices as demand edges up. Spot prices are expected to rise from around \$US25 per pound in early 2020, to over US\$40 per pound by 2025 in real terms.
- Uranium production in Australia is expected to decline, following the scheduled closure of the Ranger uranium mine in 2021. However, new prospects, including Boss Resources' Honeymoon mine, could help to lift production towards the end of the outlook period.
- The value of Australia's uranium exports is forecast to lift from a low of \$558 million in 2019–20 to \$652 million (real terms) by 2024–25.

## 9.2 Prices

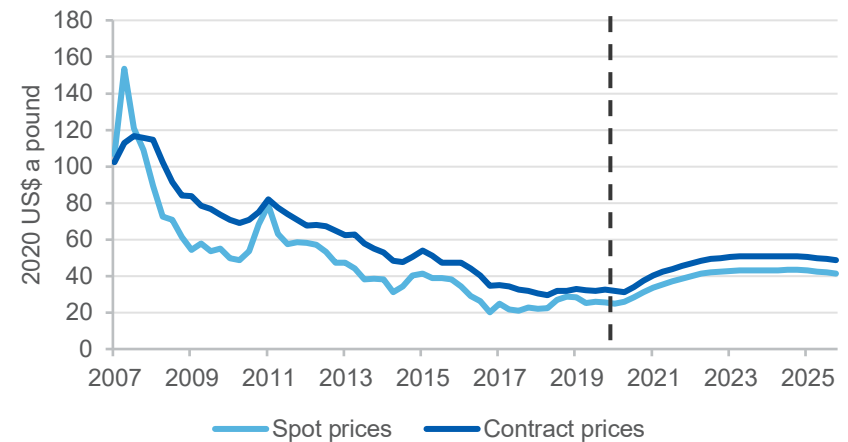
### Uranium prices are largely stable, but change is in prospect

Uranium prices have hovered at around US\$25 a pound since large producers in Kazakhstan and Canada cut their output in 2018. While this price remains relatively low, risks around further falls have abated in recent months. Buying has picked up among smaller firms, and recent geopolitical tensions appear not to have led to any policy interventions which significantly affect uranium trade and prices.

With supply remaining constrained, reactor constructions in Asia, the Middle East and Eastern Europe should push prices up slowly, with a levelling out above \$US40 a pound by 2024 (Figure 9.1). Nuclear constructions are rising (see Figure 9.2), but large inventories of uranium and planned reactor closures in 2024 and 2025 will offset some upward pressure on prices.

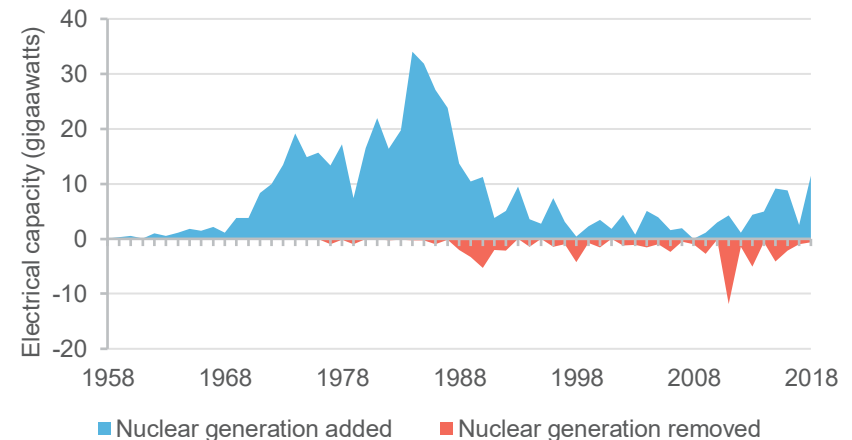
Overall risks to prices have shifted to the upside, with many mining projects having been abandoned or placed in hiatus in recent years. Uranium mines can take significant time to start or restart, and may be slow to respond to growth in demand. This creates a risk of price surges in the mid-2020s, though this is contained, in part, by the ability of large suppliers to increase production, and by the scale of current inventories.

Figure 9.1: Uranium real price outlook



Source: Cameco Corporation (2020) Uranium Spot Price; Ux Consulting (2020) Uranium Market Outlook

Figure 9.2: World nuclear power generation



Source: International Energy Agency (2019); World Nuclear Association (2019); Department of Industry, Science, Energy and Resources (2020)

### 9.3 World consumption

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

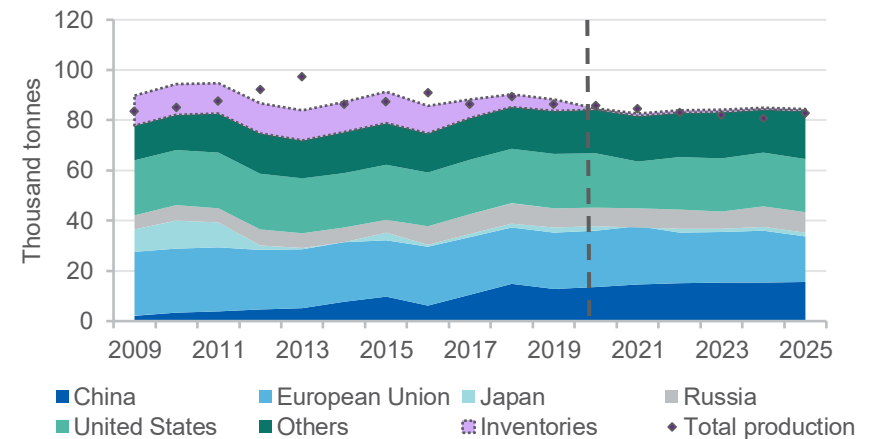
Global nuclear generation capacity edged down slightly in 2019, from 393 to 392 Gigawatts electrical. Six new reactors were connected over the year, and construction commenced on a further three. Of the six newly connected reactors, two were in China, and two were in Russia. One of the Russian reactors was the world's first floating nuclear plant, and is intended to be a working prototype for floating modular plants.

However, nine aging reactors were formally closed in 2019. These included Taiwan's Chinshan 2 reactor, Japan's Genkai 2, Russia's Bilibino 1, and the Three Mile Island 1 and Pilgrim reactors in the USA. Germany and South Korea also closed reactors in 2019, with both countries committed to a phase-down of nuclear power.

China, India and Russia remain the most significant developers of nuclear power. China has built a formidable nuclear export industry in recent years, and Russia and India have signalled new cooperation in constructing power plants in Africa, following previous cooperative work by both countries in Bangladesh. The United Arab Emirates and Belarus continue to progress their nuclear programs, with both countries set to connect their first nuclear plants in 2020. Bangladesh and Turkey also commenced their first nuclear reactor constructions in 2019, though connection to the electricity grid will be some years off.

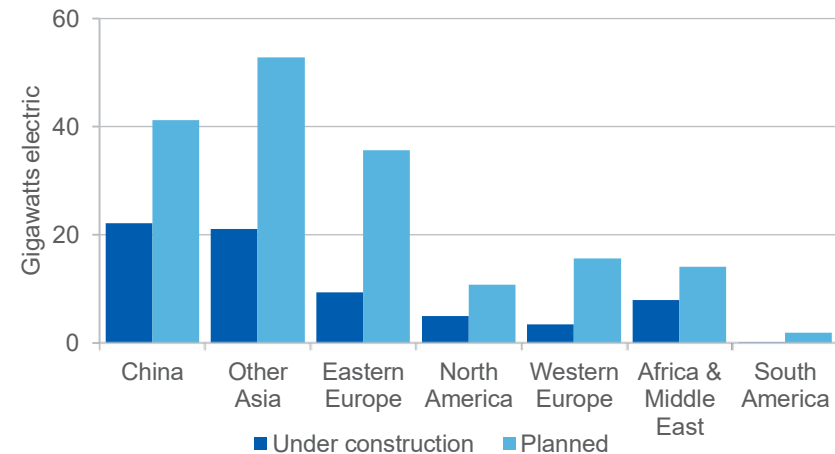
Over the next 5 years, uranium use in nuclear reactors is expected to broadly match supply, though demand sources are expected to diversify (Figures 9.3 and 9.4). Growth prospects remain mixed across much of the world, with nations moving in markedly different directions. In January 2020, the European Commission announced that one trillion euros would be invested in low-carbon energy through its European Green Deal Investment Plan, which aims to make the EU carbon neutral by 2050. However, the final version of this plan excludes nuclear power projects from being funded through the Green Deal mechanism. This cuts off one potential avenue of funding for EU nuclear power over the coming years.

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



Source: International Energy Agency (2019); World Nuclear Association (2020); Ux Consulting (2020)

Figure 9.4: New nuclear capacity: medium-term expansion



Source: International Energy Agency (2020); World Nuclear Association (2020); Department of Industry, Science, Energy and Resources (2020)

The United Kingdom (UK) government has recently commenced a plan to 'turbo-charge' investment in low-carbon energy. The plan, announced on 20 January 2020, will support all forms of low-carbon energy domestically and overseas, and could provide new funding for nuclear power.

In Asia, connection for units 5 and 6 of the Hongyanhe nuclear plant in China has been delayed to late 2021 and early 2022 (respectively), to allow for additional safety measures to be incorporated. This continues a trend towards a slower construction pace in China, with the country expected to connect only four new reactors between 2021 and 2025.

Restarts in Japan have also faced delays. Units 2 and 3 of the Tokai plant will now be kept offline for two extra years, to allow for additional safety measures, while extended inspections are likely to take Takahama units 3 and 4 offline in the second half of 2020.

Technological progress in reactor development continues, with GE Hitachi commencing a licencing process for its new BWRX-300 reactor model. This model, for a small, portable, modular reactor capable of mass production, is now being assessed by the US Nuclear Regulatory Commission.

Nuclear generation has also been utilised recently in other fields, creating new potential avenues for the technology. In Senegal, nuclear techniques have been used to reduce tsetse fly populations, which have long spread serious diseases across farms and cities. The technique does not harm other insects. In the US, a site has been selected for the new Electron Ion Collider, which will expand particle acceleration technology and offer new insights into how atomic nuclei are held together.

Overall, global demand for uranium is expected to remain relatively steady over the outlook period. Downward pressure is expected as a result of slowing construction in China and reconnection delays in Japan. A wave of reactor closures is also expected in Canada, the UK and Belgium over the second half of the outlook period. Offsetting this will be growth from Asia and various new and emerging markets where reactors are being connected for the first time.

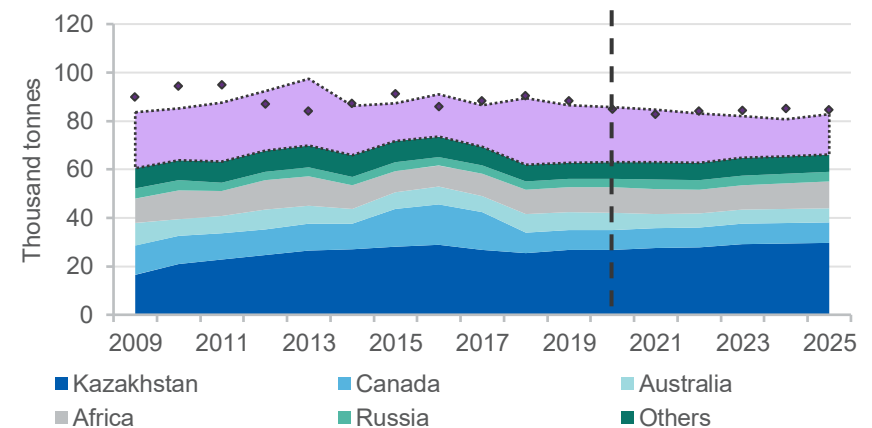
## 9.4 World production

### Production is set to remain tight as producers try to lift prices

Kazatomprom — the world's largest supplier of uranium — has again confirmed that production will be kept lower out to 2021. Constraints on supply may be applied for a longer period should prices remain low. Production cuts by the company have already removed almost 6,000 tonnes of uranium from annual global supply, though prices have thus far risen only modestly. Supply cuts have also occurred in Canada, with the possibility of these cuts being extended too.

These cuts should ensure that overall supply remains tight over the outlook period, with few new mines entering operation, and many remaining in hiatus. However, further gradual increases in prices are expected to see some easing in supply restrictions over the next three years. In aggregate, global mine production is expected to edge up from 62,400 tonnes of triuranium octoxide (U<sub>3</sub>O<sub>8</sub>) in 2019, to 66,200 tonnes by 2025 (Figure 9.5).

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



Source: International Energy Agency (2020); World Nuclear Association (2020); Ux Consulting (2020)

## 9.5 Australia

### Low prices have sharply reduced uranium exploration

Only \$2.3 million was invested in uranium exploration in Australia in the December quarter. This is around 36 per cent below the level of a year ago and well below the peak in 2010, when quarterly exploration was above \$40 million.

### Production is set to decline in the early part of the outlook period

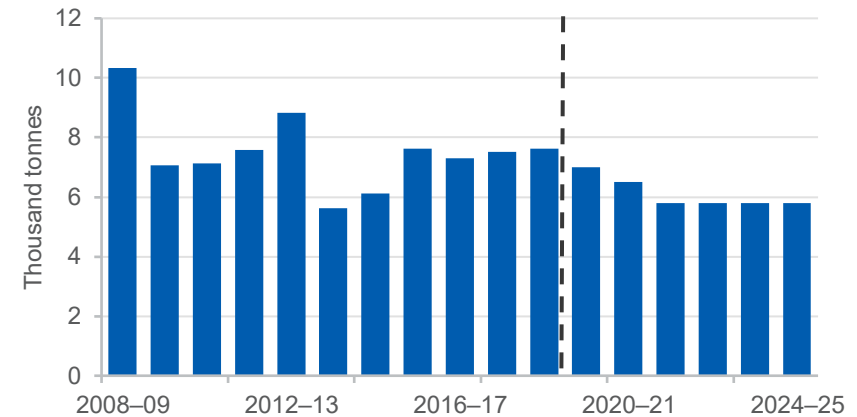
The Ranger uranium mine in the Northern Territory is now entering its final year of operation, with closure scheduled for January 2021. Output is trending down as a result (Figure 9.6), as activity at the site shifts towards rehabilitation. Elsewhere, facilities at Olympic Dam are set to be upgraded over coming years, ensuring more robust long-term production from the mine, which is expected to remain operational for many decades.

A recent feasibility study has been released, which suggests that Boss Resources' Honeymoon uranium mine may become viable in the near future. The mine has been in 'care and maintenance' since 2013, but the company has announced its intention to re-open it. The study suggests that the mine could produce around 770 tonnes of uranium per year over a 12 year lifetime, and Boss Resources has confirmed that the project could be fast-tracked into production within a year of a decision to do so. However, the mine is likely to require a \$US50 per pound uranium price to be viable. A return to prices near this level is expected by around 2023 or 2024, which would provide a solid grounding for the mine to reopen around the end of the outlook period.

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

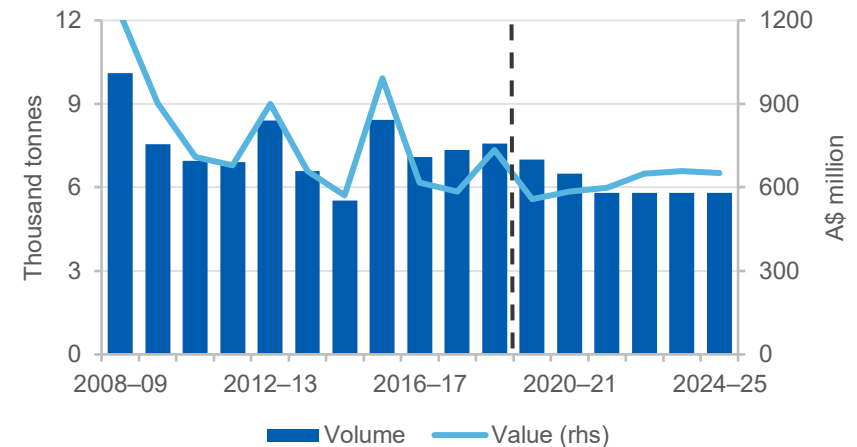
The closure of Ranger will reduce export volumes from 2021, though price growth will help to protect export earnings (Figure 9.7). An opening of the Honeymoon project late in the outlook period would see export values and volumes rise above forecast levels.

Figure 9.6: Australia's uranium production



Source: BHP (2019); Operational Review, Department of Industry, Science, Energy and Resources (2020); Energy Resources of Australia (2018); ASX Announcements — Operations Review; company media announcements (2019)

Figure 9.7: Australia's uranium exports



Source: Department of Industry, Science, Energy and Resources (2020)

**Table 9.1 Uranium outlook**

<b>World</b>	<b>Unit</b>	<b>2019</b>	<b>2020<sup>s</sup></b>	<b>2021<sup>f</sup></b>	<b>2022<sup>z</sup></b>	<b>2023<sup>z</sup></b>	<b>2024<sup>z</sup></b>	<b>2025<sup>z</sup></b>	<b>CAGR<sup>r</sup></b>
Production	kt	62.4	63.0	63.0	62.8	64.8	65.4	66.2	1.0
Africa <sup>b</sup>	kt	10.4	10.4	10.4	9.7	10.2	10.4	10.9	0.9
Canada	kt	8.2	8.2	8.2	8.2	8.6	8.6	8.6	0.8
Kazakhstan	kt	26.8	26.8	27.6	27.9	29.0	29.4	29.7	1.7
Russia	kt	3.5	3.6	3.8	4.0	4.0	4.0	4.0	2.1
Consumption	kt	83.6	84.1	81.7	82.9	83.2	84.1	83.6	0.0
China	kt	12.9	13.5	14.7	15.1	15.2	15.2	15.6	3.2
European Union 28	kt	22.5	22.4	23.1	20.3	20.3	20.9	18.2	-3.4
Japan	kt	1.9	1.9	-0.6	1.4	1.4	1.4	1.4	-5.1
Russia	kt	7.7	7.4	7.6	7.6	6.8	8.3	8.1	1.0
United States	kt	21.8	21.7	18.8	21.0	21.2	21.2	21.3	-0.4
Spot price	US\$/lb	25.7	27.7	37.0	43.3	46.1	47.3	47.2	10.7
real <sup>c</sup>	US\$/lb	26.2	27.7	36.2	41.4	43.1	43.3	42.2	8.3
<b>Australia</b>	<b>Unit</b>	<b>2018–19</b>	<b>2019–20<sup>s</sup></b>	<b>2020–21<sup>f</sup></b>	<b>2021–22<sup>z</sup></b>	<b>2022–23<sup>z</sup></b>	<b>2023–24<sup>z</sup></b>	<b>2024–25<sup>z</sup></b>	
Mine production	t	7,618	7,000	6,500	5,800	5,800	5,800	5,800	-4.4
Export volume	t	7,571	7,000	6,500	5,800	5,800	5,800	5,800	-4.3
– nominal value	A\$m	734	558	597	623	692	719	731	-0.1
– real value <sup>d</sup>	A\$m	748	558	585	598	649	657	652	-2.3
Average price	A\$/kg	96.9	79.7	91.8	107.5	119.4	123.9	126.0	4.5
– real <sup>d</sup>	A\$/kg	98.8	79.7	90.0	103.2	111.9	113.3	112.4	2.2

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2020 US dollars; **d** in 2019–20 Australian dollars; **f** forecast; **r** Average annual growth between 2019 and 2025 or 2018–19 and 2024–25; **s** estimate; **z** projection.

Source: Department of Industry, Science, Energy and Resources (2020); Cameco Corporation (2020); Ux Consulting (2020) Uranium Market Outlook