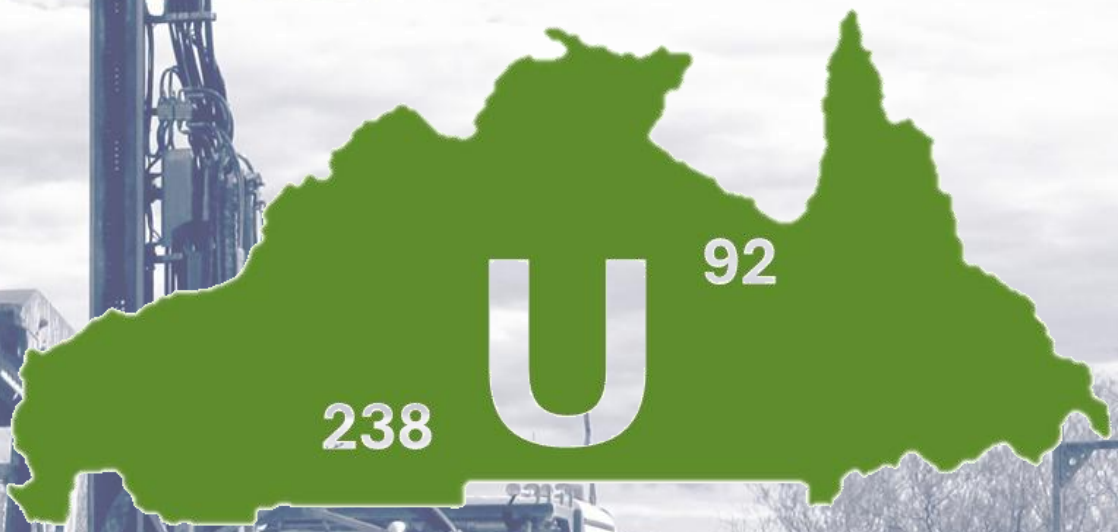
cauldron energy

Preparing for emerging industries across Northern Australia



Submission to Joint Standing Committee on Northern Australia

Cauldron Energy Limited

(ASX:CXU)

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30 January 2026

Joint Standing Committee on Northern Australia ("JSCNA")
PO Box 6100
Parliament House
Canberra ACT 2600

By email: northernaustraila.joint@aph.gov.au

Dear members of the JSCNA,

Further to the establishment of the committee inquiry into *Preparing for emerging industries across Northern Australia* I am pleased to provide this submission on behalf of Cauldron Energy Limited (ASX:CXU), specifically focused on the significant role uranium export could play (an emerging industry) in helping the global transition to net zero., if the uranium mining bans currently in place across large proportions of Northern Australia (Western Australia and Queensland) were lifted. Lifting the bans in those jurisdictions would also help the uranium industry in the NT through greater recognition and government approval (if not outright support!).

Should the opportunity arise I would greatly appreciate the opportunity to additionally provide evidence in person to the Committee.

Yours sincerely,



Jonathan Fisher

For any inquiries related to this submission please contact:

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cauldron energy

URANIUM

GOOD FOR THE PLANET



Fuel for zero-emissions nuclear energy

Helps global decarbonisation

cauldron energy

GREAT FOR NORTHERN AUSTRALIA



New jobs

Increased royalties and taxes

Diversification of economic base

Exploration boom

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Figure 1 Cauldron CEO Jonathan Fisher and Chairman Ian Mulholland onsite at Yanrey, WA, 2024

1. Submission and Terms of Reference

1.1. Further to the establishment of the Joint Standing Committee on Northern Australia inquiry into *Preparing for emerging industries across Northern Australia*, I am pleased to provide this submission on behalf of Cauldron Energy Limited (CXU, Cauldron or the Company), ASX Code ASX:CXU.

1.2. Cauldron is a uranium exploration and development company listed on ASX with a world class uranium project (the Yanrey Project) located on Thalanyji lands in the north of WA, approximately 70kms inland from Onslow, close to essential mining and industrial supply chains and within the region defined as Northern Australia.

1.3. I am currently the CEO of Cauldron, and I disclose I am a current shareholder of Cauldron.

1.4. I am providing this submission on the basis of my relevant experience across the radiological value chain which has included:

1.4.1. Experience in uranium exploration / mining; uranium being the front end of the value chain and the fuel source for nuclear energy; an extremely important source of emissions free baseload energy which is relied on by many countries across the globe to hit their decarbonisation objectives.

1.4.2. Involvement in the financing and M&A of existing nuclear power stations and participation in the nuclear new build process in the UK and Europe.

1.4.3. Negotiation of the approvals for; financing; and developing Australia's first commercially operated radioactive waste repository, being the Tellus Holdings Limited owned Sandy Ridge facility in WA. Tellus is also progressing a large facility in the NT. I was previously the CFO and Company Secretary of Tellus.

1.4.4. Specific experience in the uranium exploration space in WA while running Cauldron since late 2022.

1.4.5. Further, I have previous experience in the development of both critical minerals projects as well as renewable energy projects across the NT and northern WA.

1.5. With respect to the terms of reference, my submission is focused on:

- a) the global transition to net zero and furthering renewable energy, decarbonisation and carbon abatement;
- b) developing the critical minerals industry (discussing the potential of inclusion of uranium on Australia's critical minerals list);
- c) supporting the development of export industries;
- e) supporting the defence industry; by way of comment on how development of the uranium industry can actually be beneficial for AUKUS;
- h) Training, attracting and retaining a skilled workforce;
- i) Empowering and upskilling local First Nations people; and
- k) Research and development

as well as matters incidental to the above.

1.6. I have also provided some introductory commentary on the global growth in the nuclear sector, which is relevant to understanding the scale of the opportunity in the uranium mining and export industry and the role Northern Australia can play in helping its major trading partners and world more broadly ahieve their goals towards transition to net zero, through the supply of high ESG, concentrated green energy in the form of uranium yellowcake (see Figure 2 below).

1.7. The export of uranium is, by far, the highest impact activity Ausralia can do to help in the global energy transition. It is imperative that the industry is allowed to flourish while maintaining the highest standards of safety and environmental performance. Essentially, South Australia already does this; its now just time for Northern Australia to catch up!



Figure 2 Uranium yellowcake drums; produced via ISR at Boss Energy Honeymoon project, SA

2. Think Global, Act Local

The Terms of Reference are essentially asking us to consider how emerging industries across Northern Australia can assist the most important global issue of our time (climate change), what is needed to be achieved to address the issue (global transition to net zero) and then what actions or initiatives can be implemented by either the Federal Government or in conjunction with State and Territory governments, to support private enterprise, to ensure priority industries are developed locally to achieve those global goals.

Mining and exporting uranium is the highest impact activity Northern Australia can do to help the global transition to net zero.

2.1. Think Global:

- Nations across the Globe are turning to nuclear for reliable, zero-carbon baseload to meet their decarbonisation objectives and their future significantly increased power requirements.
- Utilities and tech giants are signing long-dated large, clean-power deals to secure reliable energy to underwrite their future business.
- Energy security and diversified supply chains matter more than ever given the current geopolitical environment. Supply from high ESG strategically aligned partners is preferred.



Figure 3 Think Global, Act Local – Uranium export is the best way to help global decarbonisation

2.2. Act Local (Northern Australia):

- Overturn the uranium mining bans in WA and Queensland and support the industry to flourish.
- Leverage Northern Australia's world-class geology and mining capability to supply safeguards-compliant uranium for civilian applications to responsible buyers.
- Utilise the NT's historic radiological expertise gained from decades of uranium mining, and WA's existing radiation expertise from Mineral Sands and Rare Earths industry; and broadened through the AUKUS projects, to ensure best practice radiation management solutions.
- Deliver regional jobs, royalties, and long-term diversified revenue—while avoiding real tonnes of CO_2 offshore; which is the greatest contribution Northern Australia can make to the global transition to net zero.
- Build long term indigenous and local community partnerships, recognising uranium projects tend to be long life assets. Building social licence is crucial for the industry; and additionally recognising the damage past practices in the mining industry (or in separate but related fields such as nuclear weapons testing) have caused and setting out a pathway forward to restore social licence and ensuring industry best practice
- Recognise that despite troubling historical precedent in Northern Australia; this should not preclude the industry from contributing to global carbonisation and regional development now and into the future



Figure 4 SA Minister Tom Koutsantonis speaking at the Global Uranium Conference, October 2025, Adelaide

"This is the industry that will lead the decarbonisation charge. This is the industry that will decarbonise energy"

– Tom Koutsantonis (referring to uranium mining!)

3. Summary of Submission

The major points of this submission can be summarised as follows:

3.1. Northern Australia is a broad jurisdiction, governed by legislation and policies from two states (WA and QLD) and one Territory (NT). Of these jurisdictions, uranium mining is essentially banned in QLD (implemented 2015) and WA (implemented 2017, subject to one project in WA that has current grandfathered approvals, although this is further south in WA, not in Northern Australia). While discussing the opportunity for the development of the uranium mining industry across Northern Australia, this submission highlights the need for policy / legislative change in WA and QLD to enable the industry to flourish.

3.2. This submission provides more detailed modelling and data on Western Australia; where more detailed modelling, research and polling has been undertaken. Queensland information is at a higher level although conceptually consistent.

3.3. Inclusion of Uranium on Australia's critical minerals list would be in line with global trends and help ensure the industry is given the same opportunity as other critical minerals to flourish. See Section 6. Whilst there remains a question regarding the inclusion of fuel sources on the Critical Minerals list, other jurisdictions have begun recognising it this way due to the growing realisation of the strategic importance of the mineral. That said, inclusion on the list is not necessary and the industry could flourish if relevant bans were removed.

3.4. The question of mining uranium for export is a completely separate question to whether Australia builds nuclear reactors; it is extremely important not to conflate the two issues and instead consider each on their merits. Northern Australia can mine and export uranium without needing to consider the issue of changing policy on domestic use. See Section 7.

3.5. Global nuclear is growing strongly given its broad recognition as a clean energy source. Whilst Australia chooses not to build nuclear reactors for power generation domestically, many countries are relying on nuclear to meet their net zero objectives as well as their hugely increased future electricity needs driven by energy hungry technologies.

3.6. As the fuel source for the globally recognised baseload green energy source of nuclear energy, it logically follows that uranium is classified as a green fuel source that helps the global transition to net zero and hence within the scope of the Terms of Reference despite not being specifically named. See Section 8.

3.7. In 2017 when the most recent uranium ban was enacted (in WA), nuclear (and hence uranium's) status as "green" was nowhere near as widely accepted as it is today; a fundamental change in global perception that warrants a revisiting of the mining policy. The bans may have been appropriate in 2017; but now they must be revisited.

3.8. Echoing the words of the WA Premier recently when talking about increasing gas exports, WA (and Northern Australia more broadly) arguably has a moral obligation to sell our uranium to our trusted allies and trading partners to support their own decarbonisation efforts. If we are serious about fighting global warming, we must put our best foot forward – and this means ensuring high ESG uranium supply for our trading partners.

3.9. Exporting Green Energy in the form of uranium is the highest impact activity Northern Australia can do to help the world decarbonise. Under the CCIWA modelled scenario (which

focuses on WA only) involving 10,800t of annual production, this suggests WA alone could help mitigate ~415Mt of CO2, or ~ 4.5x WA's entire emissions of 89.4Mt. See Section 17.6. Whilst exact production forecasts may differ between sources, the broad quantum of the impact on emissions is undeniable. Inclusion of QLD production would increase these numbers further.

3.10. Almost all of Australia's major trading partners are expanding their nuclear energy programmes; which will lead to increased needs for uranium in the future. See Section 14 for a summary and the Appendix for more detail. Most of these major trading partners are net short uranium – they use it, but don't produce any or nowhere near enough. See Section 11. They desperately need more uranium to help achieve their targets for the global transition to net zero (consistent with the Terms of Reference, criteria a).

3.11. Since the most recent ban was enacted in 2017, projections for future uranium demand have increased from 94kt tonnes (the 2017 forecast of needs in 2035) to 150kt tonnes (the 2025 forecast of uranium needs in 2040 – unfortunately WNA no longer reports a 2035 number so direct comparison is not straight forward); but this still demonstrates the significant turnaround that has occurred in the expected future prospects of the nuclear industry in the approx. eight years since the most recent ban has been in place. See Section 11.7

3.12. Not only are our major trading partners short of uranium for their decarbonisation objectives; there is also a serious global issue of bifurcation in the market; with security of supply of uranium now considered a national security issue. Initiatives such as the Sapporo 5 have been set up to encourage western led nuclear fuel chains. This presents a significant opportunity for Northern Australia to step up and help not only with the global transition to net zero (a focus of this inquiry) but also help them with their national security issues as well. See Section 12.

3.13. Australia is already a material exporter of uranium from South Australia (and has historically been so from the NT and has also previously exported from QLD), but with the most uranium resources of any country on earth, we could be doing so much more. If South Australia can do this safely (with a proven ~40 year track record of safe operations), there is no question about WA and QLD's ability to do the same with contemporary approvals and regulatory saefeguards and hence bans in these jurisdictions are viewed as unnecessary and unsustainable.

3.14. Australia can do so much more - and the biggest opportunity for increases in production come from Northern Australia, through removing bans in WA (affecting Northern Western Australia, where the majority of WA resources and projects are) and QLD.

3.15. Northern Australia already holds large uranium resources; with substantial exploration upside although there has been limited exploration conducted in the recent decade due to low pricing and the mining bans across WA and QLD; Lifting of the bans in these jurisdictions is expected to result in an exploration boom commencing relatively rapidly. See Section 16.

3.16. Northern Australia is blessed with a mix of uranium deposit types, which provide the opportunity for traditional mining; as well as for ISR (In Situ Recovery), recognised as the lowest environmental impact method of mining. The appropriateness of each mining type depends on many factors including geology, hydrology, weather (rainfall), etc. See Section 19.

3.17. Current mining practices for operating uranium mines in SA, and Northern Australia's strong established mining practices and approvals regimes means uranium can be mined today in in an environmentally and socially responsible manner. Whilst there is historical precedent of historical poor environmental practices in the early days of the uranium mining industry in Australia (for example, at Rum Jungle in the NT and at Ranger Mine in the NT); opportunities should be considered relative to current mining practices and approvals, not what occurred in industry many decades ago. Poor practices in the past were present in basically every industrial activity, but standards increase over time which has been the case in uranium mining, as South Australia has demonstrated.

3.18. Western Australia especially already handles significant volumes of radioactive materials (for example from mining - minerals sands and rare earths, oil & gas and healthcare sectors) and has existing infrastructure in place including radiation monitoring and reporting, and disposal. The Tellus facility in Western Australia is a world class, strategic advantage for the Nation, which is able to accept radioactive waste from across Australia. Given this, waste handling from uranium mining is not an issue for Northern Australia. See Section 23

3.19. Whilst mining is largely a State or Territory matter; the Federal government can provide supporting assistance to the industry and has a role to play in facilitating the uranium industries to flourish. The Federal Government is effusive of its praise for the Critical Minerals sector and the opportunities that industry provides. A similar level of public support should be provided to the uranium industry. See Section 24.

3.20. Uranium isn't the only solution to how Northern Australia can help the global transition to net zero – but clearly it has a COMPLEMENTARY role to play alongside other Northern Australian initiatives and industries aimed at helping global decarbonisation.

3.21. Uranium mining can be delivered with relatively low technical risk – this is today's technology – uranium is not subject to step change technology improvement assumptions like some other proposed forms of green fuel export (eg green hydrogen or green ammonia). We can make a policy decision; and benefits can start quickly flowing.

3.22. The economic benefits to Northern Australia from uranium mining are significant:

3.22.1. Broadening each State and Territory's royalties base and providing diversification to protect against cyclicality in commodity revenues

3.22.2. Up to 9,000 jobs and >$1bn a year in direct economic benefits in WA alone, with those benefits increased proportionately with production coming from QLD – see Section 18.2.5. Most immediately would be significant increases in the crucial minerals exploration sector with a boom in uranium related exploration expected in addition to project development works.

3.22.3. Specifically with respect to the future of Mount Isa; uranium could play a meaningful role in helping underwrite a new chapter for Isa as its commodities base transitions from its typical mix. See Section 5.6.

3.22.4. Helps support the broader AUKUS radiological competencies as well as provides ideological consistency and would be well appreciated by our AUKUS allies; which therefore inherently supports the defence industry.

3.23. Uranium market pricing has recovered significantly since previous lows which historically made uranium mining in Australia difficult economically (as it did around the world – see Section 11.9). For example, when the ban in WA was enacted on 20 June 2017, the spot price of uranium was ~$20 per pound. As of the date of writing this report the spot price is >$80, a 4x increase since the ban was in place. At current and projected market prices, driven by fundamental demand and supply issues, the sector would be highly profitable, sustainable and a large contributor to regional economic activity. See Section 21.7.

The uranium price today is already >4x HIGHER than it was when the ban was enacted in 2017. Further price rises are projected. Based on today's and forecast pricing, Northern Australia can develop a sustainable and profitable industry



Figure 5 Benefits of overturning the uranium ban in WA (similar benefits for QLD!)

4. The "Unique role" of WA in the global transition to net zero



"We have our own role to play as part of the global fight against climate change and we will play that role, but it will be a unique role."[1]

Premier Cook, June 2025.

4.1. As a significant component of the region defined as Northern Australia, its worthwhile considering the current policies of Western Australia relevant to the global transition to net zero. Current WA policy recognises the importance of reducing emissions, but focuses on the importance of reducing GLOBAL emissions, not just emissions in WA.

"Yes, we will continue to decarbonise the WA economy, but our greater responsibility lies in helping our higher emitting trading partners to decarbonise, even if it doesn't make a good hashtag or look good on a bumper sticker,"[2]

– Premier Cook, July 2025

4.2. Part of that role, the Premier says, is to provide gas to countries moving away from coal but who aren't replacing it directly with renewables. Hence initiatives have focused on increasing exports of GAS from WA; which will help our higher emitting trading partners wean themselves off COAL. This rationale was publicised as part of the life extension granted to the Karratha Gas Plant, a critically important project for the WA economy.[3]

4.3. And absolutely, greater use of gas globally, on the assumption it reduces the use of coal would be overall beneficial for global decarbonisation. Whilst not emissions free, gas can help. As they say, "*Don't let the perfect be the enemy of the good!*"

[1] https://www.abc.net.au/news/2025-06-08/wa-role-in-reducing-global-emissions-woodside-karratha-project/105384694
[2] https://thewest.com.au/politics/state-politics/premier-roger-cook-warns-wa-in-danger-of-missing-out-on-incredible-chance-to-lead-worlds-energy-transition-c-19301830
[3] Ibid footnote 1

4.4. BUT: There is a much more effective method of decarbonisation; and that is uranium (nuclear) substitution for COAL: Lets look at the numbers at a high level:

4.4.1. From the IPCC's 2014 data[4]:

4.4.1.1. Coal (pulverized coal): median = 820 gCO2e/kWh

4.4.1.2. Natural gas (combined-cycle gas): median = 490 gCO2e/kWh

4.4.1.3. Nuclear (using uranium): median = 12 gCO2e/kWh

4.5. So how do these compare?

Replacement Fuel	Life-Cycle Emissions (gCO_2e/kWh)	Emissions Avoided (versus coal)	% Emissions Reduction	Relative Benefit Ratio
Coal	~820	0	0	0
Natural Gas	~490	~330	~40%	Baseline (1×)
Nuclear (Uranium)	~12	~808	~98%	~2.5× more beneficial per KWh

Figure 6 Comparison of gas for coal and uranium for coal substitution

4.6. What other factors make this comparison relevant?

4.6.1. This comparison considers reduction on coal dependence for our highest emitting trading partners, which tend to be in Asia (China, India, Indonesia, etc).

4.6.2. All of China, India, and Indonesia are actively promoting their nuclear industries as a means of decarbonising and weaning themselves off coal. (see Section 0 for further discussion on this). They are major electricity generators from coal.

4.6.3. Assumptions on the contribution from nuclear to global decarbonisation tend to be increasing – see latest demand forecasts from WNA (discussed at Section 11.6).

4.6.4. Sufficient availability of uranium (and moreover, uranium from high ESG jurisdictions) is recognised as a potential constraint on future nuclear growth (and hence decarbonisation). See Section 11.

4.7. This does not suggest that in all instances uranium for coal substitution is possible. But, in many instances it is possible (given many of our trading partners are growing their nuclear industries as a way to help decarbonise) and can be seen as COMPLEMENTARY to other initiatives such as the gas for coal substitution strategy; or indeed other options such as green hydrogen or ammonia export; should they be commercially proven.

4.8. In order for WA to maximise its potential to deliver meaningful outcomes to global decarbonisation, it MUST overturn the ban on uranium mining. This is also true for the ban currently in place in Queensland.

[4] https://en.wikipedia.org/wiki/Life-cycle_greenhouse_gas_emissions_of_energy_sources

5. Defining Northern Australia and status of uranium mining in those jurisdictions

5.1. Mining is generally a State (or Territory) based matter; and given the area defined by Northern Australia encompasses areas of WA, NT and Queensland, its necessary to consider factors from each jurisdiction.

5.2. Note some information provided in this paper may be more relevant to one particular jurisdiction (ie to Northern Western Australia, when discussing WA specific laws) and less relevant to others, although many concepts such as the broad type of economic benefits available are applicable across the region.

5.3. Northern Australia is defined under the Australian Infrastructure Facility Act 2016 as outlined below in Figure 7.

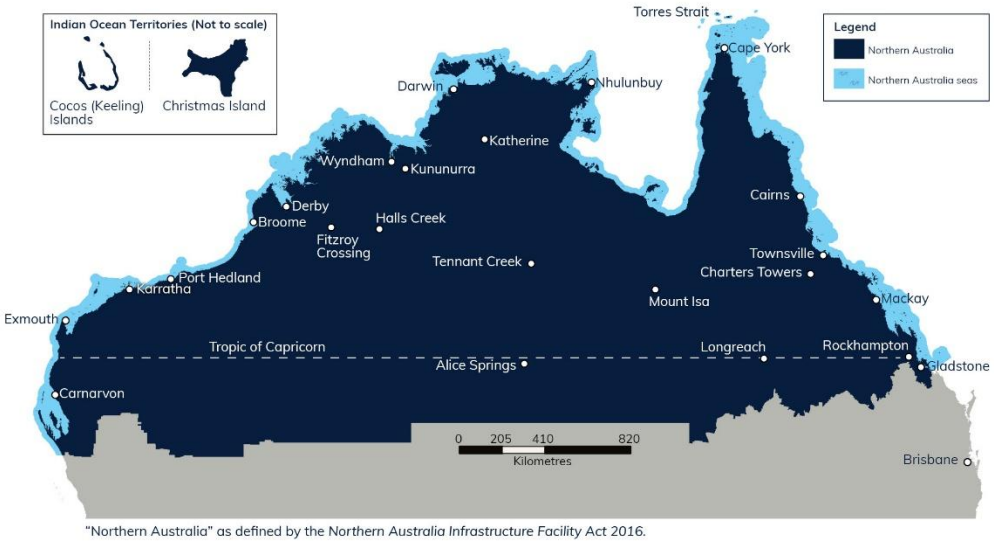

Figure 7 Area of Northern Australia relevant to the Inquiry

5.4. These areas of Northern Australia contain significant deposits and further exploration potential for uranium; including:

5.4.1. WA: Cauldron's Yanrey project, Paladin's Manyginee Asset, Cameco's Yeelirrie and Kintyre projects, Toro Energy's Lake Maitland project all occur within the area considered Northern Australia. WA has other major uranium projects such as Mulga Rock which fall outside the definition of Northern Australia, but are subject to the same WA wide legislative situation.

5.4.2. Northern Territory: Former producing area around Ranger, major exploration areas of the Alligators River region, federal clean up area around the former Rum Jungle area. Northern Territory has significant exploration potential; although issues of remoteness, site access, and indeed high rainfall do provide unique challenges and costs for northern NT exploration (and potential future production).

5.4.3. Queensland: Four regions with known uranium mineralisation are all in

Northern Australia, including the McArthur Basin (Westmoreland), the Mt Isa Province (Mount Isa to Cloncurry), the Gilberton Basin (near Georgetown) and the Charters Towers Province (west of Townsville, Ben Lomond).

5.5. The current status of uranium mining in those jurisdictions is as follows:

5.5.1. Able to be mined in the NT and there is a long history of commercial production (although there are no currently operating mines). To be clear, there is also a history which requires remediation and that provides lessons for any future uranium industry.

5.5.2. Banned in Queensland, although there is a past history of commercial production in that State;

5.5.3. Generally banned in WA although there is one approved project which was grandfathered in prior to the WA uranium mining ban (3 other projects had been approved but have not reached their substantial commencement obligations which means their approvals are in a grey area). No further mining approvals in WA is possible due to a ban – although exploration is allowed, (see Section 16 for specific discussion about WA).

5.6. Considering the future of Mt Isa

5.6.1. Mt Isa is an important regional hub for Queensland, with a long history of mining expertise. However, after many decades of operations, substantial parts of the operations that underpin Mt Isa are reaching end of life.



Figure 8 Mount Isa – needing to transition to new commodities

5.6.2. Underground copper mining at major Glencore mine ceased in mid 2025, directly impacting hundreds of Glencore workers and indirectly affecting many more.

5.6.3. Recently, a deal was reached between Glencore and the Queensland government to continue operating the Mt Isa smelter and the Townsville

refinery for the next three years via a support package of up to A$600 million.[5]

5.6.4. Whilst this smelter deal provides welcome relief for the next few years for Mt Isa, it is only short term and therefore reinforces the fact that new opportunities and commodities are needed to help drive Mt Isa into the future.

5.6.5. Uranium has played a significant part in Mount Isa's history. The closed Mary Kathleen uranium mine is a significant local tourist attraction[6], and local uranium deposits are the largest in Queensland.[7]

5.6.6. With such substantial uranium projects around the region, future planning for Mt Isa recognises the potential for uranium to once again contribute significantly to Mt Isa's economy, subject to the ban on uranium mining being lifted in Queensland. As noted elsewhere, a lifting of the ban would in the first instance crate an exploration boom, with Mt Isa expected to benefit significantly from that activity even before projects are brought into development and operation.

5.6.7. In addition to large scale projects that have already been defined (eg Paladin's ~150mlb Valhalla project), exploration activity is already increasing around the region. For example;

5.6.7.1. Antares Metals (ASX:AM5) recently accounted the discovery of multiple high grade uranium prospects at its Mt Isa North project.[8]

5.6.7.2. Basin Energy (ASX:BSN) has purchased tenements around Mt Isa from NeoDys targeting uranium and rare earth mineralisation. Exploration work is already underway.[9]

5.6.7.3. This is just the tip of the iceberg, with the Mt Isa region expected to be one of the most prospective areas in Australia for new discoveries.

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[5] https://www.glencore.com.au/media-and-insights/news/agreement-reached-on-mount-isa-copper-smelter-and-townsville-copper-refinery

[6] https://www.abc.net.au/news/2019-08-20/former-uranium-mine-now-an-instagram-hotspot-for-tourists/11412040

[7] https://www.mountisa.qld.gov.au/files/assets/public/v/4/council/documents/future-ready-economy-roadmap.pdf

[8] https://discoveryalert.com.au/antares-metals-high-grade-uranium-prospects-mt-isa/

[9] https://kalkinemedia.com/au/stocks/energy/basin-energy-asxbsn-expands-mount-isa-uranium-and-ree-presence-with-neodys-acquisition

6. Potential Inclusion of uranium on Australia's critical minerals list

6.1. Whilst part A of the Terms of Reference considers projects that aid global decarbonisation; part B considers critical minerals, specifically considering the development of the critical minerals industry in Northern Australia.

6.2. So while inclusion on the Critical Minerals list is not a requirement to be within the scope of this Inquiry, and indeed the industry could flourish without being on the Critical Minerals list if relevant bans were removed, it is worthwhile considering if uranium should be included in Australia's critical minerals list. It is not currently included.

6.3. The Australian government regularly reviews the Critical Minerals list, hence it is de facto possible to add uranium to it. There are no absolute barriers.

6.4. In the past, the Government has reacted to the request or needs of industry, for example when nickel was added to the Critical Minerals list. This provides precedent for a review process instigated by industry, not by regular review.

6.5. The Government publishes a policy document which provides criteria for inclusion in the list. This is the Critical Minerals List 2023 Update Report[10] and provides the following criteria:

6.5.1. essential to modern technologies, economies or national security, specifically the priority technologies set out in the Critical Minerals Strategy

6.5.2. for which Australia has moderate to high geological potential for resources

6.5.3. in demand from our strategic international partners

6.5.4. that is vulnerable to supply chain disruption.

6.6. Specific recent correspondence with the Minister's office noted that during the 2023 review, uranium was considered however was judged not to meet the 3rd and 4th criteria – in demand from our strategic international partners, and vulnerable to supply chain disruption. Further, it was noted by the Minister that Australia, like many countries, does not consider fuel sources (incl uranium) to be a critical mineral or a strategic material.

6.7. Without questioning whether that was the right decision at the time, it is now abundantly clear that uranium absolutely meets these third and fourth criteria.

6.8. This document provides a comprehensive overview of the projected uranium shortfall for our strategic partners; and indeed the importance of developing western aligned sources of supply.

6.9. Vulnerabilities in the supply chain are discussed multiple times; highlighting:

6.9.1. There is already a primary supply deficit in the industry; globally the world uses around 180-190m lb of uranium, but only produces around 140m-150m lb.

6.9.2. Over 40% of the market comes from Kazakhstan; which during the current and expected market bifurcation that is occurring, is not seen as an acceptable

[10]https://storage.googleapis.com/converlens-au-industry/industry/p/prj2807d5847ce2bae3896d1/public_assets/critical-minerals-list-2023-update.pdf

supplier from a security of supply perspective.

6.9.3. Notwithstanding the current primary supply deficit, major producers are coming to the end of life of their production (especially in Kazakhstan and some major Canadian mines) necessitating significant new supply into the market; and

6.9.4. All at a time where uranium demand is projected to grow strongly based off the global nuclear renaissance.

6.10. With respect to the inclusion of uranium on other countries critical minerals lists:

6.10.1. After many years of not recognising fuel sources as critical minerals, the US has now reversed course and indeed as of the 2025 update, includes uranium; recognising the importance of the mineral to its future energy security.[11]

6.10.2. As the country most aggressively developing new nuclear technology and grid capacity, China includes uranium as a critical mineral.[12]

6.10.3. Canada has included uranium in its critical minerals list since inception in 2021.[13]

6.10.4. Japan has now included uranium on its critical minerals list as of 2023.[14]

6.10.5. Many other countries, even if they do not recognise uranium on the critical minerals lists (perhaps, due to its status as a fuel mineral), they do provide other mechanisms of support for uranium. This was the case for example for the US before adding it to the Critical Minerals list. The EU, for example, does not currently include uranium on its critical minerals list, however provides various policies aimed at providing support to the industry, for example with respect to the strategic supply of nuclear materials.

6.10.6. If Australia decides not to include uranium on its critical minerals list; it could still adopt other policies that show support for the industry and that could assist the industry to develop. Lifting bans would be a good first step.

6.11. The potential benefits of inclusion in the critical minerals list include access to potential project funding assistance (such as the Critical Minerals Loan Fund) but perhaps most importantly, it would assist in coordination across government agencies (through the Critical Minerals Facilitation Office). Whilst funding support would be appreciated, many uranium projects actually have relatively lower capex bills than other critical minerals projects, so the funding support might be less necessary – if allowed to be built, these projects stand on their own. However, the benefit of coordination through government approvals would be very important. See Section 24.9.1.

[11] https://www.usgs.gov/news/science-snippet/interior-department-releases-final-2025-list-critical-minerals
[12] https://elements.visualcapitalist.com/the-critical-minerals-to-china-eu-and-u-s-national-security/#:~:text=Among%20some%20of%20the%20unique,fuel%20production%20for%20those%20plants .
[13] https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.html
[14] https://www.mining.com/japan-adds-uranium-to-list-of-critical-minerals/

7. Uranium export and building reactors in Australia are independent

7.1. The question of mining and exporting uranium is a completely separate question to whether Australia builds nuclear reactors for its domestic energy requirements.

7.2. At the recent Federal Australian election, there was a lot of debate about the potential costs and timeframes of building nuclear reactors in Australia. This proved to be a polarising issue, although there were many other factors which resulted in the emphatic victory of the current Government. At the end of the day, Australia is not expected to build civilian nuclear under the current Government nor in the near future, but is progressing with nuclear submarines as part of AUKUS.

7.3. The matters considered as part of the Federal election are not relevant to the issues subject to this Inquiry – this Inquiry is concerned, amongst other matters, about whether the nuclear industry will grow internationally (not whether generators are being built in Australia) as part of helping the globe decarbonise and whether there is an opportunity for Northern Australian jurisdictions who currently ban uranium (WA and QLD)to export yellowcake to help fuel the future global zero emissions nuclear fleet, with existing reactors and newbuild spread out across the globe as shown in Figure 9 below.

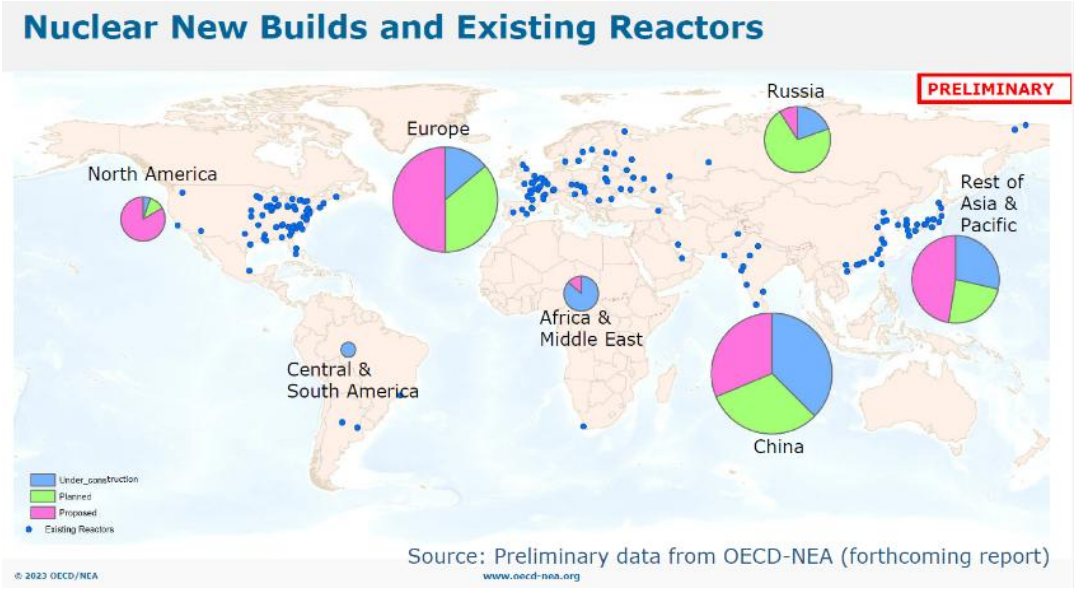


Figure 9 Global distribution of existing reactors and new nuclear projects, 2025 NEA data

7.4. The Federal election did not pass judgement on mining and exporting uranium.

7.5. Further, the recent WA State election was a resounding success for Premier Roger Cook and the Labor Government, against a WA State liberal party that did include the potential of overturning the WA uranium ban as part of the broad set of its election policies. However, the uranium question was not at all a central issue to the election result and would not have been considered by the vast majority of the electorate (and in fact the issue enjoys high community support – see Section 21.9.)

7.6. Each issue must be independently considered on its merits. WA and QLD can mine and export uranium without needing to consider the issue of changing policy on domestic use for civilian purposes.

8. Uranium is not scary. A few facts

"Uranium is born in supernovas. Which is why it's pretty much everywhere. The naturally radioactive mineral is in rocks and seawater, as well as our teeth and bones. It's just that it's usually in very low concentrations. Deposits were mainly formed by groundwater leaching the dense metal out of rocks and depositing it in ancient aquifers. It's actually one of the less radioactive minerals, which is why it takes so long to decay. That radioactivity can be used to generate heat at the heart of a nuclear reactor."

- *South Australian Chamber of Minerals and Energy (SACOME)*[15]

8.1. What exactly is uranium?

8.1.1. Uranium is a naturally occurring metallic element in the actinide series of the periodic table with an atomic number of 92. This means **its incredibly heavy – almost 2.5 times the density of iron in its solid form.**



Figure 10 Uranium in metallic form

8.1.2. Uranium has a number of different isotopes, which means slightly different forms which have a different number of neutrons in its atomic nucleus. In nature it is predominantly uranium-238 (~99.3%) which cannot directly be used to support a nuclear fission reaction; and is the main ingredient in "depleted

[15] https://www.sacome.org.au/resourcefulsauranium.html

uranium" referred to below. **A small fraction of the element in nature is uranium-235 (~0.7%)—this is the fissile isotope that supports a sustained nuclear chain reaction and is enriched for inclusion in nuclear fuel** assemblies for power stations. There are a number of other isotopes as well (eg U-232, U-233, U-234 and U-236, although these are in trace quantities only).

8.2. Different uses of uranium

8.2.1. Energy production is uranium's main use.

8.2.2. Uranium is also used to make critically important radio-isotopes for a broad range of medical applications. Indeed, Australia's ANSTO is one of the world's leading suppliers of various isotopes such as Molymbedum-99 which are manufactured using the OPAL reactor.[16] Every Australian is likely to benefit from nuclear medicine, and on average will have at least two nuclear medicine procedures in their lifetime. Without uranium; production of these critical medical supplies would not occur.

8.2.3. Uranium is obviously also used for military purposes; including in nuclear weapons. Additionally, uranium's density leads to alternative military applications such as armour and in munitions for amour piercing properties. In this form, depleted uranium (essentially uranium without the more radioactive isotopes included, is used).

8.2.4. Note, **Australian uranium can only be used for civilian peaceful purposes**[17] and hence would not be used for any of these military purposes.

8.2.5. Historically, uranium was also used in certain glass making, due to its fluorescent effects. However, with the advent of its use as a nuclear material and hence designation as a strategic mineral, uranium glass making essentially ended. Note dose rates from such glassware are very low and pose no threat to human health.[18]

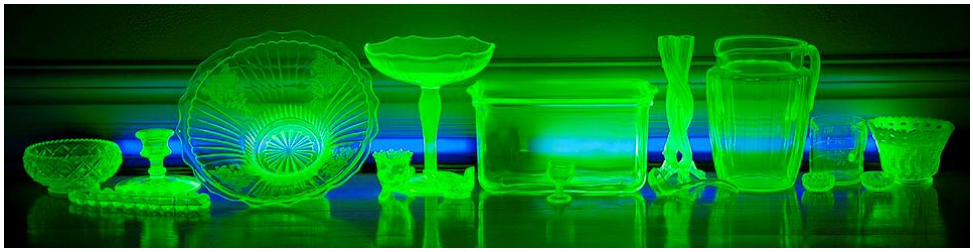


Figure 11 Uranium glass under ultraviolet light.

8.3. Where did it come from and where is it found on earth?

8.3.1. Uranium on earth was formed many billions of years ago in intense cosmological

[16] See https://www.ansto.gov.au/products/nuclear-medicine
[17] https://www.dfat.gov.au/international-relations/security/non-proliferation-disarmament-arms-control/policies-agreements-treaties/australias-uranium-export-policy
[18] https://en.wikipedia.org/wiki/Uranium_glass

events and has been transferred to earths crust.

8.3.2. **URANIUM IS NOT RARE**. It is widely distributed in the Earth's crust, rivers, and oceans; being 40 times more common than silver and 500 times more common than gold. Traces of uranium are even found in the human body, food, and enormous amounts are dissolved in sea water; just in low concentrations. (See Figure *59* in Section 17.4.1 for a diagram outlining how widely distributed uranium is throughout Western Australia!)

8.3.3. Whilst it is almost everywhere, the key for commercial extraction is finding places where it has been concentrated to the point, and in a form, which can be economically extracted. Moden day mining focuses on traditional hard rock mining of natural deposits of concentrated material, or ISR mining (see Section 19 for a discussion of ISR).

8.4. How radioactive is uranium? Is it safe to handle?

8.4.1. Uranium is actually classed as a **MILDLY RADIOACTIVE ELEMENT,** which is evidenced by its extremely long natural half-life (U-235 has a natural half-life of approx. 700 million years, whereas U238 has a half-life of approx. 4.5 billion years.

8.4.2. Generally speaking, elements with shorter half-lives are more radioactive, that is their rate of radioactive decay is greater.

8.4.3. Uranium in solid metallic form, in yellowcake or UO2 civilian fuel pellets is relatively safe to handle or be near with simple PPE; as long as precautions are taken with respect to protecting against dust inhalation and dose monitoring is undertaken in accordance with regulations. This is practically demonstrated in Figure 80 on page 99 which shows typical PPE required by certain uranium workers on sites in Australia and how the product is safely exported. Further, Figure 18 on page 32 shows a worker being able to manually inspect a new fuel assembly.

8.4.4. Exposure safeguards and practices for uranium mines are carefully monitored and enforced in Australia through the regulator ARPANSA.

8.5. Radiation in our everyday lives

8.5.1. We receive radiation everyday from natural as well as artificial sources. From a natural perspective, according to ARPANSA[19], Australians receive approx. 1.7mSv (consistent with the range of 1.5-2.0mSv described by ANSTO[20]) as outlined in Figure 12 below. These natural sources are the sum of terrestrial, radon, cosmic, potassium in the body and uranium / thorium in the body, whereas artificial sources are medical and remnants from atmospheric weapons testing.

[19] https://www.arpansa.gov.au/sites/default/files/2021_ionising_radiation_and_health.pdf
[20] https://www.ansto.gov.au/education/nuclear-facts/what-is-radiation

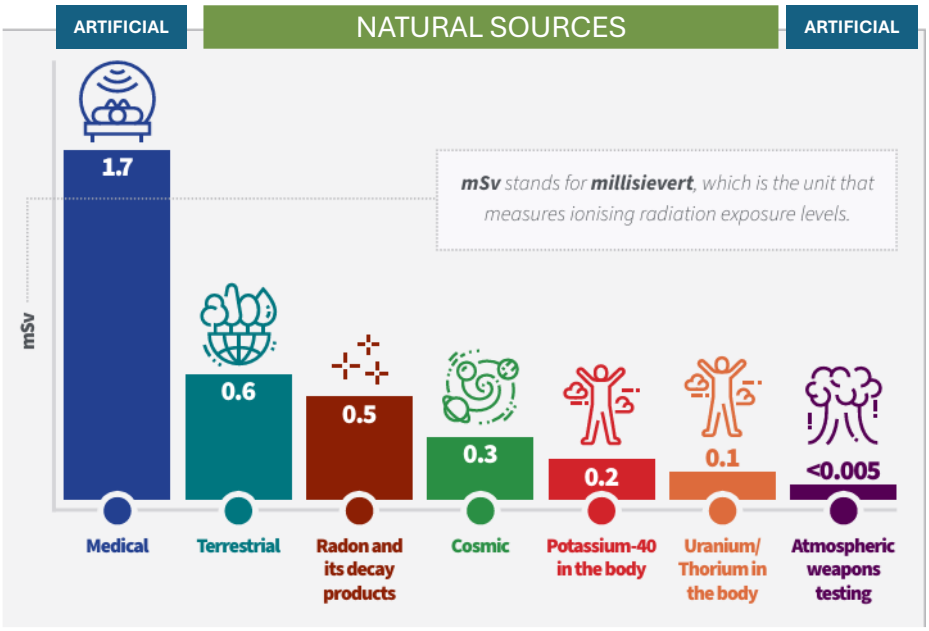


Figure 12 Average yearly radiation exposure in Australia[21].

8.5.2. Some surprising radiation facts include:

8.5.2.1. As granite emits more radiation than other materials, a home with granite tiles or benchtops would exposure the occupants to an extra 1,000 µSv (or 1mSv) of background radiation annually.[22]

8.5.2.2. Because Australian Parliament House is covered in so much granite, it actually emits more radiation than a nuclear power station.[23]

8.5.2.3. Eating a banana will provide you with a dose of 0.1 µSv from the naturally-occurring potassium-40 isotope.[22]

8.5.3. As a light hearted way to understand relative levels of radiation; relative radioactivity of every items has been described in the "banana index", ie relative to the level of exposure from eating one banana. Uranium miners receive on average a dose of 2.0 mSv per annum, which would equate to approx. 20-25,000 bananas on the banana index! This is orders of magnitude lower than where any effects on human health could arise.

[21] Note medical radiation is an average annual figure; with some medical procedures resulting in much higher doses yet assumed to not occur very often.
[22] https://www.ansto.gov.au/education/nuclear-facts/what-is-radiation
[23] Source: World Nuclear Association as cited in https://minerals.org.au/wp-content/uploads/2022/12/Untapped-Potential-The-case-for-nuclear-energy_2020.pdf

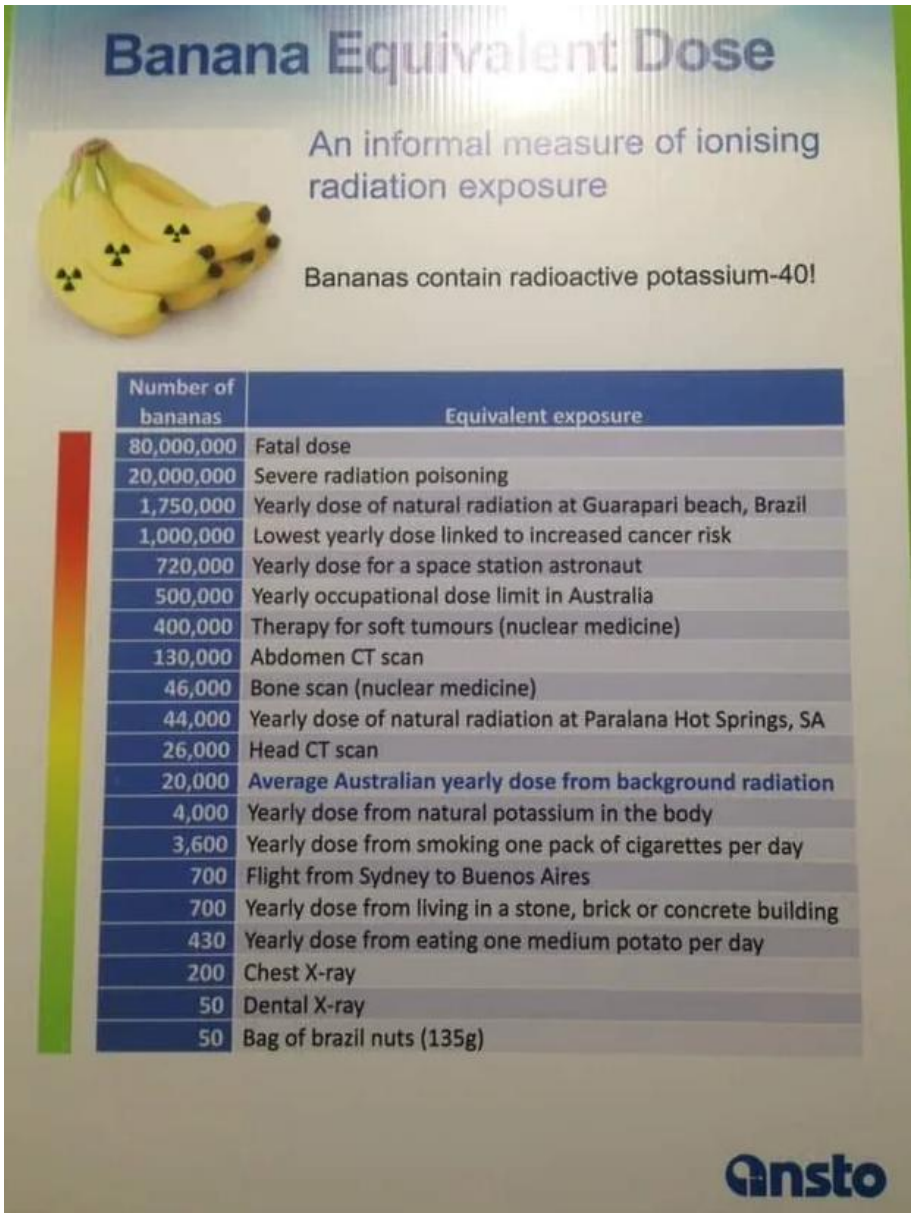


Figure 13 The Banana equivalent dose[24]

8.5.4. Its important to understand that sources of radiation are naturally around us in our every day lives; and in terms of total radioactivity, those natural sources far outweigh the radiation caused by poor past industrial practices (eg Chernobyl, Fukushima) or by military uses (eg weapons testing). This comment does not aim to undermine the seriousness of those past practices; but simply highlights that naturally occurring radiation is a consequence (and integral part of) life on earth.

[24] Source: ANSTO. Note the BED is an educational exercise only and not a formal measurement, as the dose from eating multiple bananas is not cumulative given the radioactive potassium is excreted in urine.

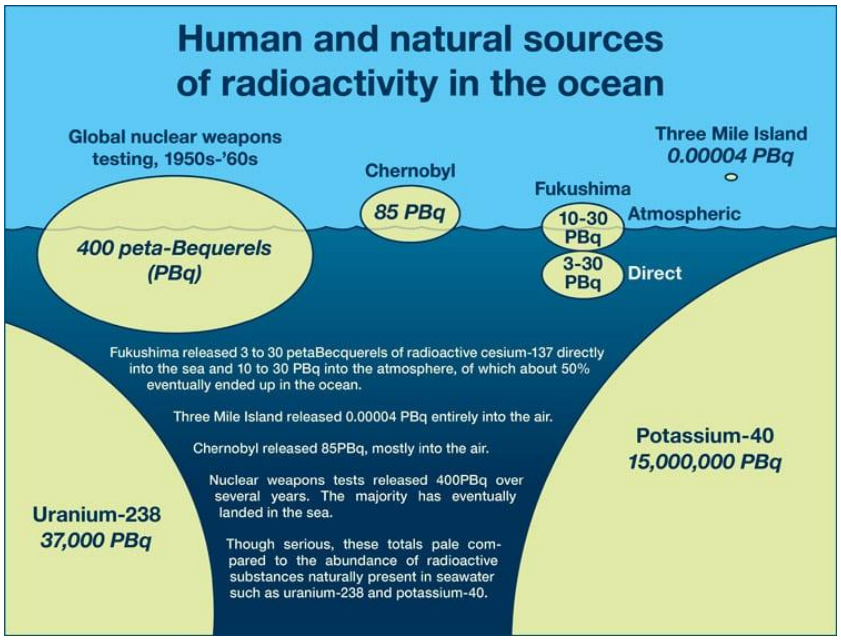


Figure 14 Human generated and natural sources of radioactivity in the ocean[25]

8.5.5. See Section 0 for a discussion of various radiation exposure levels for Australians compared to uranium mine workers.

8.6. What exactly is Yellowcake?

8.6.1. Yellowcake is the form of uranium (U_3O_8) that is proposed to be exported from Western Australia to customers overseas.

8.6.2. Its gets its name from the powdery but slightly cakey appearance of the product, See Figure 15 below.



Figure 15 Yellowcake coming off the belt during production[26]

[25] Source: https://www.whoi.edu/ocean-learning-hub/multimedia/source-of-radioactivity-in-the-ocean/
[26] Source: https://www.orano.group/en/unpacking-nuclear/mining-recipe-for-yellowcake/yellow-cake---2

8.6.3. Yellowcake is the first practical processing step to enable export of a product, and is shipped out at a specification of a minimum of 65% mass uranium, roughly equalling ~95% U3O8[27].

8.6.4. Whilst the specification is ~95% U3O8; remember it is not enriched, therefore the isotopic ratio is still only ~0.7% U-235 (which is the part of the product that is enriched for use in fuel).

8.6.5. Yellowcake is a stable product that can be readily packaged, handled, transported and stored safely for future use. Yellowcake is stored in drums at key locations around the world.

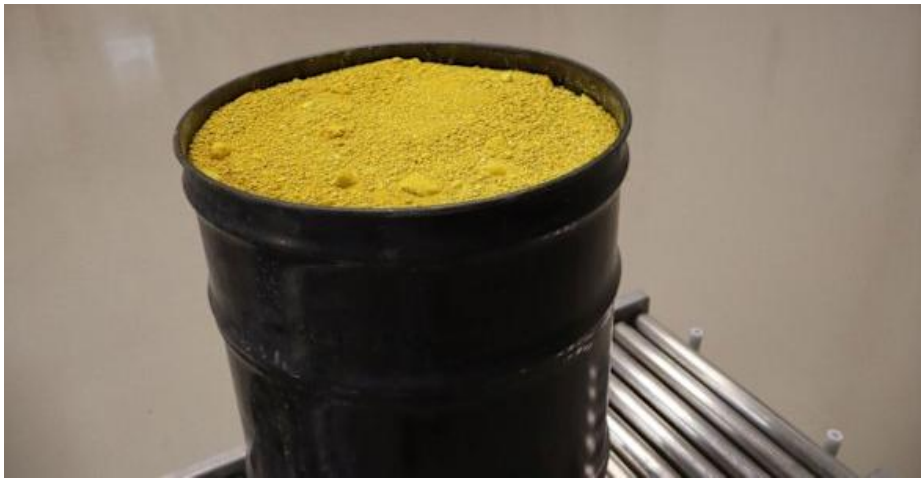


Figure 16 Yellowcake in a drum in Wyoming Sept 2025 (Source: Peninsula Energy)

8.7. What does enrichment mean?

8.7.1. As discussed above, the isotope U-235 is required to sustain a nuclear reaction; and that is only found in ~0.7% concentration in the natural environment and in the yellowcake produced at uranium mines.

8.7.2. Reactors commonly require this U-235 to be *enriched* from its natural concentration to higher levels for use in fuel:

8.7.2.1. Most civilian reactors (standard PWR reactors) use fuel in the order of 3-5% enriched U-235.

8.7.2.2. Many SMR designs as well as some research reactors such as the existing OPAL reactor at Lucas Heights in Sydney run by ANSTO use HALEU, which is enriched up to ~19.9%.

8.7.2.3. Some reactors such as the Canadian designed CANDU are able to operate with natural uranium (so no enrichment required).

8.7.2.4. For comparison, enrichment levels for submarines are much higher,

[27] Note yellowcake also includes various other minor uranium compounds in its mix; it's not entirely U3O8 but is often referred to as such. There are strict impurity standards imposed – see ASTMC967-25 https://store.astm.org/c0967-25.html

estimated to be between 40 - >80% (actual rates classified); with newer submarines utilising higher levels of enrichment which mean they never have to be refuelled during their operational lives. Older designs with lower levels of enrichment required mid-life refuelling.

8.7.2.5. The highest levels of enrichment are used for nuclear weapons which are estimated to be >90%.

8.8. The nuclear fuel fabrication process

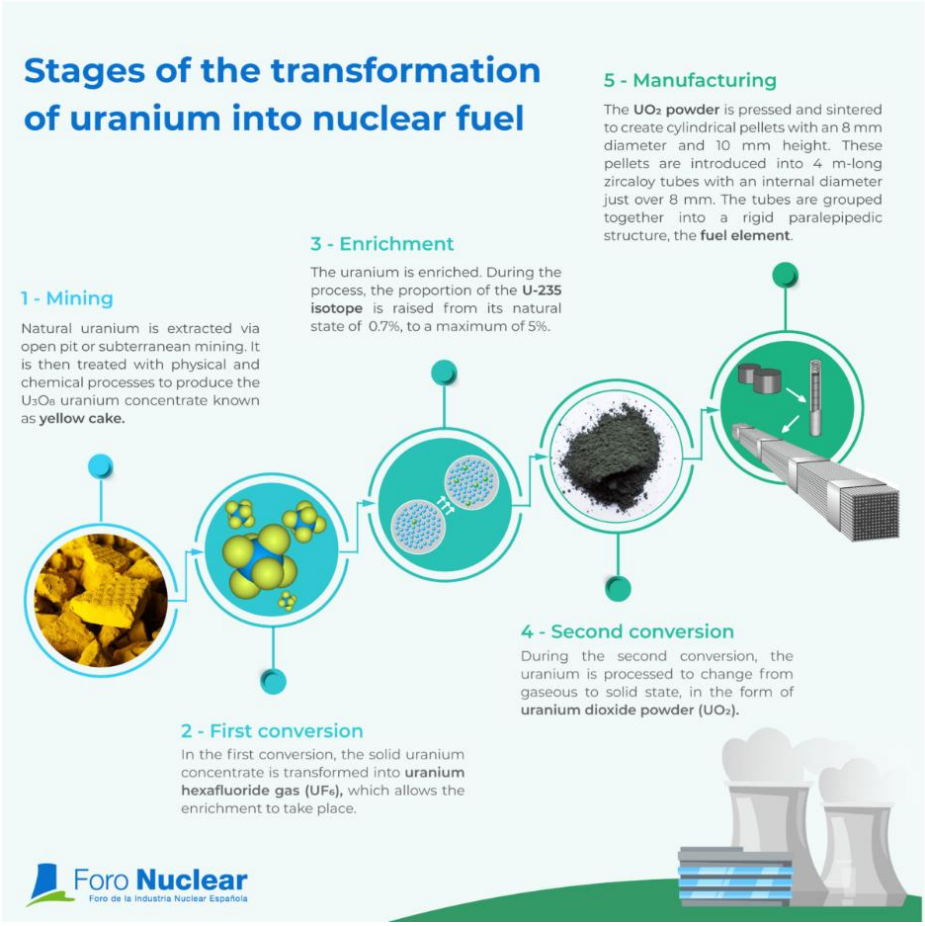


Figure 17 The Nuclear fuel chain (Credit Foro Nuclear)

8.8.1. Unfortunately, with existing technologies, once yellowcake is produced, it cannot be directly enriched, and instead must be CONVERTED to a different, gaseous form known as uranium hexafluoride (UF6).

8.8.2. Once in gaseous form, the gas can be spun in powerful centrifuges, which can separate out the different isotopes due the tiny differences in the weight of the different gaseous isotopes; thereby enriching the proportion of U-235 in the product.

8.8.3. Once the desired level of enrichment is reached, the product is converted back into solid form, this time as UO2; for further fabrication into final fuel pellets and then final fuel assembly. Note, contrary to popular belief, new fuel assemblies are relatively safe to handle with gloved hands – see Figure 18.



Figure 18 Inspecting a new nuclear fuel assembly containing uranium. Its safe to be this close!

8.8.4. Emerging technologies such as laser enrichment are looking to directly enrich product without the intermediate conversion step; with Australian company Silex Systems (ASX:SLX) being one of the world leaders in developing this technology.

8.8.5. The only stage proposed to be undertaken in Northern Australia is the first step of the fuel cycle – the production of yellowcake for export. This is the same as is currently undertaken in South Australia.



9. Recognising nuclear as Green and hence uranium as a Fuel that helps the global transition to net zero

9.1. The Terms of Reference do not specifically mention uranium, but they do mention opportunities for emerging industries with reference to the global transition to net zero, to furthering … decarbonisation, and developing the critical minerals industry.

9.2. Hence the question is – does uranium fit the bill? Does uranium help fuel an industry that helps the global transition to net zero? (A separate question, of whether uranium should be considered a critical mineral and added to the critical minerals list for Australia is discussed at Section 6.)

9.3. The recognition of nuclear as a "green" energy source is a relatively recent move across the globe. Whilst various groups retain long held, deeply ideologically ingrained views against nuclear energy; the overall trend is clear.

"In 2017 when the WA uranium ban was enacted (or indeed in 2015 was QLD's ban was reinstated); nuclear's green status was nowhere near as universally accepted as it is today. This represents another shift in market dynamics from when the ban was enacted, further justifying the policy being revisited."

9.4. Recognition has occurred in various major jurisdictions[28] however this is still a moving feast and further movement is expected to clarify or update their positions. The trend is clear – nowhere is downgrading the status of nuclear; but there are still countries moving forward with their definitions.

9.4.1. In 2022 the European Commission announced the establishment of a "Green" label for nuclear plants as part of the EU Taxonomy, recognising their contribution to the fight against climate change.[29] The EU taxonomy is a classification system that aims to channel public and private investment into environmentally sustainable economic activities in order to achieve environmental objectives, such as those in the fight against climate change. [30]

9.4.2. The UK was in the process of developing a new Green Taxonomy (separate to the EU given BREXIT) but these plans were scrapped in July 2025. The plans had intended to specifically include nuclear in the new taxonomy similar to the EU but the UK is yet to formally introduce a replacement as it works through its sustainable finance framework.

[28] https://world-nuclear.org/information-library/appendices/nuclear-energy-and-sustainable-finance
[29] https://www.orano.group/en/unpacking-nuclear/is-nuclear-power-a-green-energy
[30] https://www.world-nuclear-news.org/Articles/A-guide-to-the-EUs-green-taxonomy-and-nuclears-pla?

9.4.3. China's National Green Bonds Catalogue (published 2015, updated 2021) specifically recognise nuclear power as a green project category.[31]

9.4.4. Singapore includes nuclear energy in its recently announced taxonomy.[32]

9.4.5. Russia includes nuclear projects in its Green taxonomy.[33]

9.4.6. South Korea includes nuclear in its classification (K-Taxonomy).[34]

9.4.7. India outlines nuclear's role in its Framework of India's Climate Finance Taxonomy (Draft)[35]

9.4.8. Indonesia also now recognises nuclear in its 2025 updated Taxonomy for Sustainable Finance (see p.89).[36]

9.4.9. USA – the Inflation Reduction Act of the Biden era recognised the Green credentials electricity generated from renewables, from nuclear energy and for the production of clean hydrogen. Since that time the Energy Dominance policy of the current US Administration has wound back incentives for various renewable technologies (such as wind) but has broadly maintained supports and recognition for nuclear.[37]

9.4.10. Canada's Green Bond Framework recognises nuclear as green and Bruce Power and Ontario Power, Canada's largest nuclear electricity producers, have issued green bonds to fund nuclear activities which have been well received by investors.[38]

9.5. There are indeed many different monikers that can be used when describing energy that contributes to the global energy transition – "green", "clean", "emissions free", "sustainable", and "renewable", are all different descriptors used.

"Whilst there may be a number of buzzwords used, it is important to note that NO ENERGY SOURCE CAN BE SEEN AS ENTIRELY RENEWABLE; given all generation technologies require raw materials to produce them, some much more than others."

[31] https://world-nuclear.org/information-library/appendices/nuclear-energy-and-sustainable-finance
[32] https://www.mas.gov.sg/-/media/mas-media-library/development/sustainable-finance/singaporeasia-taxonomy-updated.pdf
[33] The Taxonomy for Green Projects and the Russian Green Finance Guidelines, approved by Resolution of the Government of the Russian Federation of 21th September 2021 No. 1587 as cited https://www.worldenergy.org/assets/downloads/World_Energy_Issues_Monitor_2022_Russia_commentary.pdf
[34] https://www.jipyong.com/en/board/jipyongNews_post.php?seq=5663
[35] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/may/doc202557551101.pdf
[36] https://data.sbfnetwork.org/sites/default/files/survey-attachments/2025-05/INDONESIA%20TAXONOMY%20FOR%20SUSTAINABLE%20FINANCE%202025%20%28version%202%29.pdf
[37] https://www.sciencespo.fr/psia/chair-sustainable-development/2025/03/25/the-us-inflation-reduction-act-is-it-a-green-deal/
[38] https://www.canada.ca/en/department-finance/programs/financial-sector-policy/securities/debt-program/canadas-green-bond-program.html

9.6. For example whilst the sun may not send a bill for the solar energy used, (a favourite saying of Federal Energy Minister Chris Bowen[39]), the process of constructing solar plants is resource intensive, resulting in the need to mine significant amounts of non-renewable materials to generate the electricity. A similar argument exists for wind. This is demonstrated by Figure 19 below which shows materials intensity of use per GWh by generation type. Note battery storage is included in the graph, although this is technically not generation per se, and should be added to intermittent sources to provide a like for like comparison to firmed energy sources.

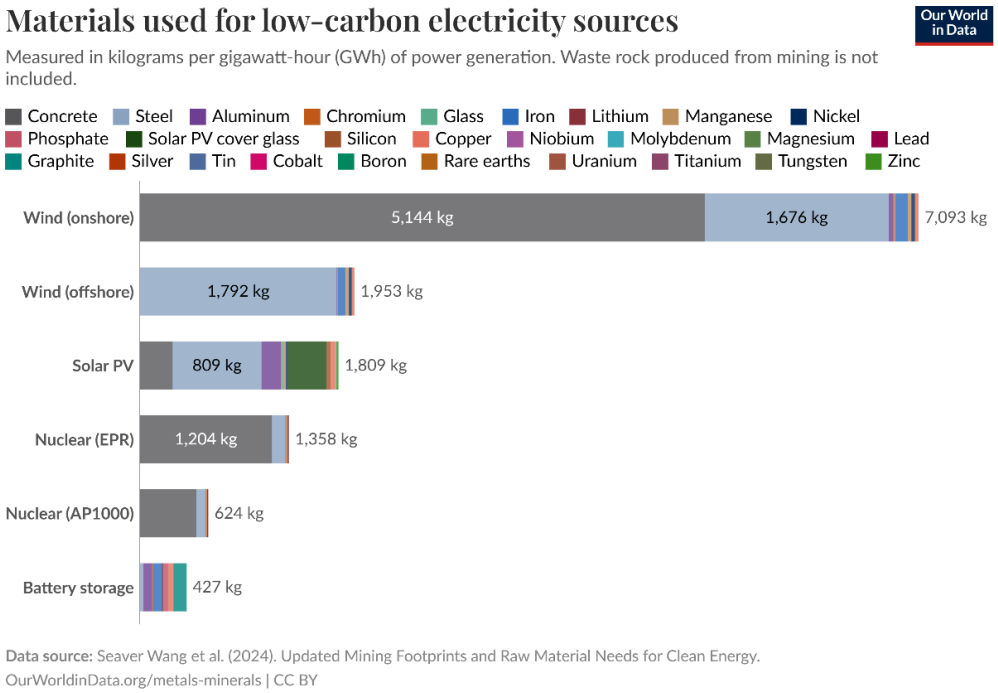


Figure 19 Materials intensity of various generations technologies per GWh

9.7. Further in other sustainability metrics such as land usage, nuclear also ranks extremely favourably versus other generation technologies. The chart below shows relative land use (fuel mining and generating footprint) of electricity generation options per unit of electricity (source: Brook & Bradshaw, 2015)[40]

[39] https://www.dailytelegraph.com.au/news/opinion/the-sun-doesnt-send-a-bill-but-taxpayers-still-cop-them/news-story/4560436fd9929c5edcba8031480b2f0e

[40] As referenced from https://world-nuclear.org/information-library/energy-and-the-environment/nuclear-energy-and-sustainable-development

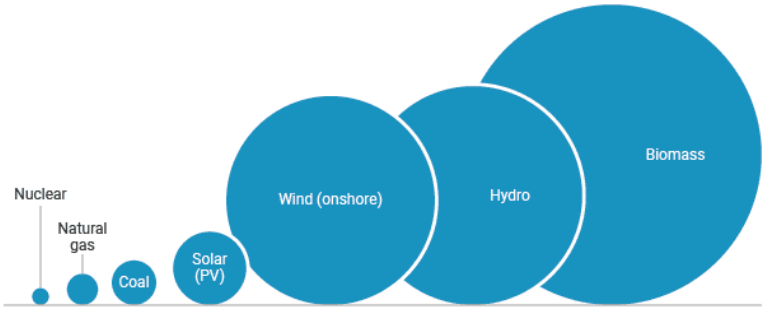


Figure 20 Land use comparison of various generation technologies

9.8. The United Nations has produced a report comparing various sustainability related metrics of various generation types.[41] The first example in Figure 21 compares greenhouse gas emissions per KWh generated.

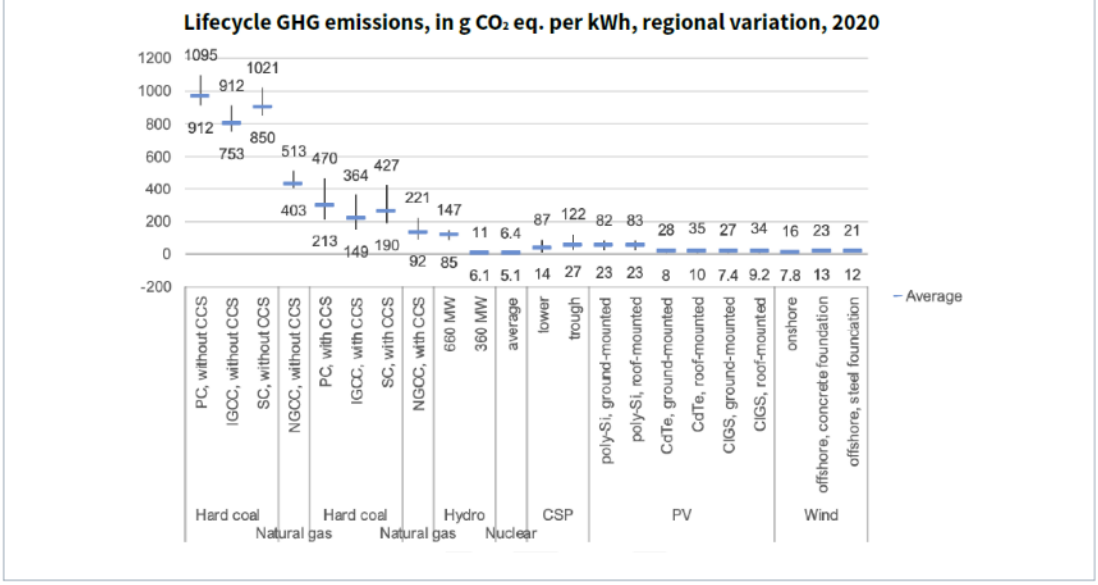


Figure 21 Lifecycle GHG emissions of various generation technologies, UNECE report

9.9. Figure 22 provides an overall, weighted and normalised assessment of environmental impacts of various generation technologies. This includes the costs and impacts of waste management. As can be seen, nuclear energy compares favourably.

[41] Source: https://unece.org/sed/documents/2021/10/reports/life-cycle-assessment-electricity-generation-options

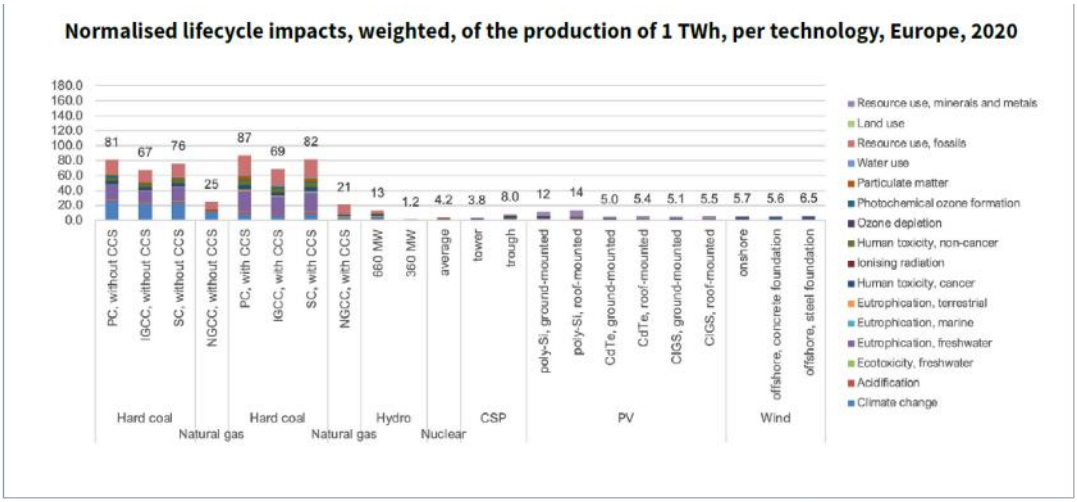


Figure 22 Comparison of overall environmental impacts of various generation technologies

9.10. As the report states (see page 8):

> *"With no exception (sic), every electricity generation technology generates environmental impacts over its life cycle; and these impacts may vary widely with implementation site and other design choices. Proper energy policy should be informed by lifecycle assessments and take account of environmental impacts of all generation technologies and supporting infrastructure of the total energy system."*

9.11. This report is based on a range of European conditions which may differ from Australian conditions both favourably and unfavourably depending on the metric. Whilst many in Australia might want to point out that Australia has various superior renewables resources than Europe, Europe indeed has much offshore and onshore wind, has lower relative distances of transmission to conquer, higher concentration of population which can help in reducing per KWh impacts, has the benefits of a diversified and integrated grid to assist with storage; and has much greater resources for example baseload hydro that can be used to assist intermittent renewables.

9.12. Whilst there may be disagreements with respect to specific numbers and how they apply from Europe relative to Australia, the key point is clear – **Nuclear has earned its green, and sustainable status, and as such uranium deserves is recognition as a green fuel.** Uranium certainly helps the global transition to net zero!

9.13. Uranium is the fuel source for the largest emissions free, baseload generation technology on the planet. It is the most energy dense source of emissions free energy that is commercially available (see Figure 22 below). With nuclear now recognised as green / sustainable energy it follows logically that its fuel must be recognised as an industry helping the global transition to net zero.

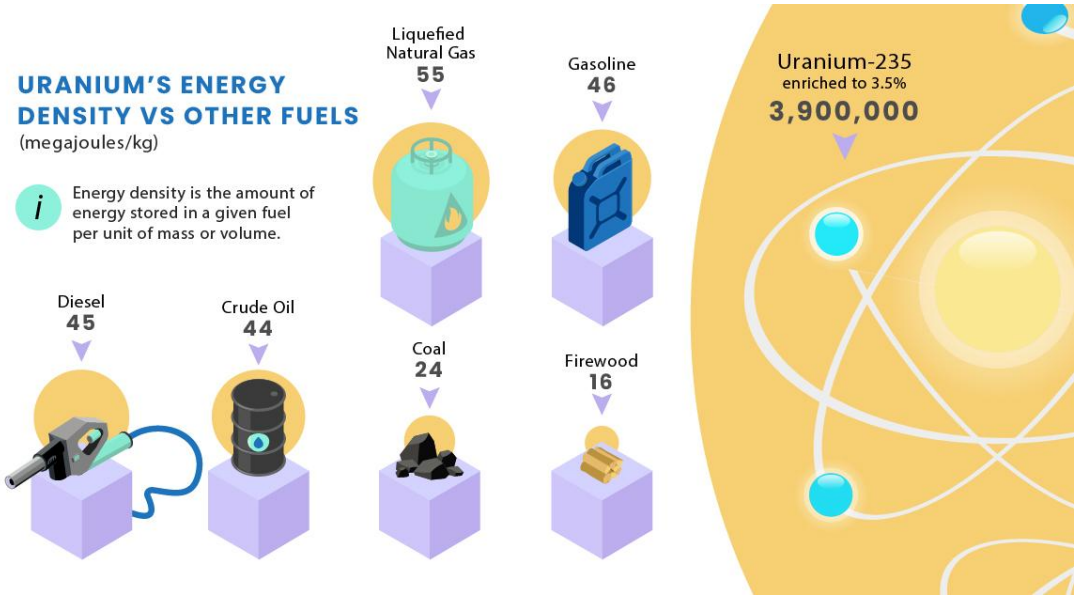


Figure 23 Uranium – the undisputed king of energy density!

10. Global nuclear renaissance driven by decarbonisation and the need for energy abundance

10.1. As we decarbonise our lives, and move from fossil energy to electrification, our need for electricity will become more critical.

10.2. Electricity demand is projected to grow strongly out to 2050; whilst there is a plethora of different forecasts, the International Energy Agency (IEA) in its 2024 World Energy Outlook (WEO) projects global electricity demand nearly doubling in certain scenarios out to 2050.[42] Updated data for the 2025 WEO is due out in November 2025.

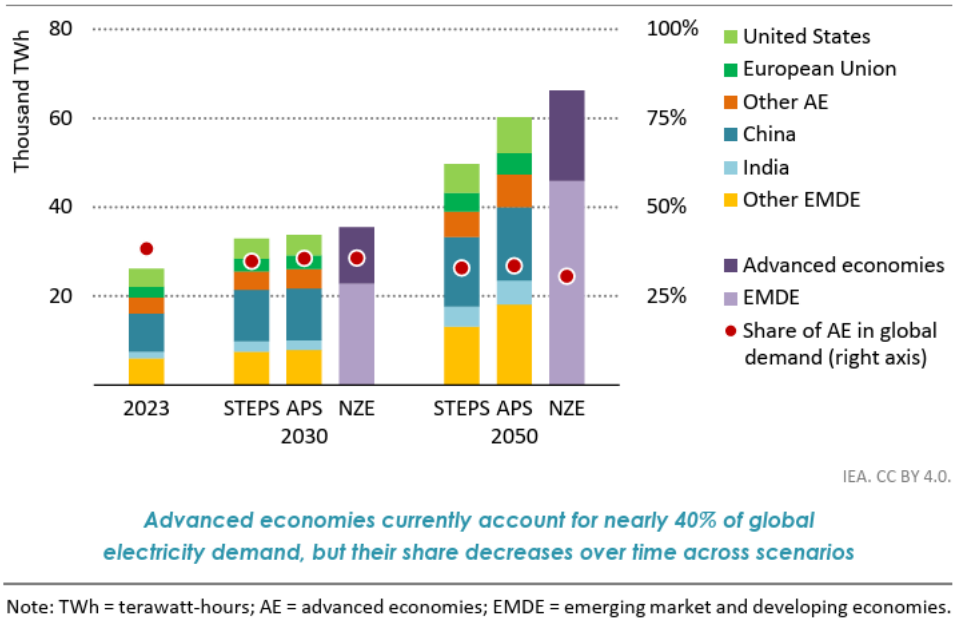
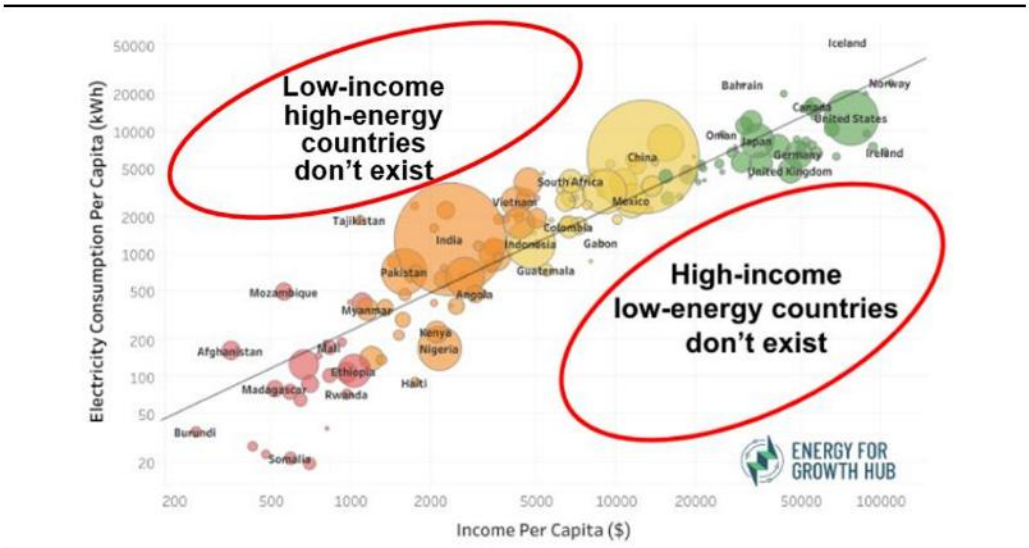


Figure 24 Electricity demand by country / region and scenario, 2023, 2030 and 2050.

10.3. Decarbonising our grids and lives is not sufficient. The main driver of future prosperity and standards of living will be the ABUNDANCE of CHEAP DECARBONISED electricity. Already, the importance of the availability of ample energy can be derived from data, see Figure 25 below.

[42] Figure 3.18, p.122 2024 World Energy Outlook, International Energy Agency. Electricity demand by country / region and scenario, 2023, 2030 and 2050. STEPS =Stated Policies Scenario, APS = Announced Pledges Scenario, NZE = Net Zero Emissions by 2050 scenario



Source: Energy for Growth Hub (2022 data)

Figure 25 Electricity consumption vs Income per capita (2022)

10.4. Furthermore, the rise and rise of artificial intelligence, the extraordinary power forecasts projected for the industry as well as the projected contribution of AI to economic growth demonstrate the importance of abundant, cheap energy.

10.5. The "Big Tech" sector has understandably significantly increased its support of nuclear energy; with the sector taking the view that nuclear is critical to delivering the energy density, scale, reliability and price required for the next generation of data centres and AI technologies. This has included support from and commercial deals from many of the world's largest technology companies such as Microsoft, Google, Amazon, Oracle and OpenAI amongst others. To be clear, this isn't a sole technology strategy - many of these companies continue to invest heavily in renewables related PPAs and investments to supply the clean energy they need, and have been doing that for many years. Their shift to include nuclear energy into their clean energy thinking has been relatively recent; and has become more pronounced as the scale of future energy needs have been more apparent

"Without abundant electricity, we cannot decarbonise and move away from fossil fuels.

Without cheap abundant electricity, we cannot compete."

10.6. This Submission does not aim to take a view on Australia's energy policy per se or whether a renewables centric grid is capable of meeting our future grid needs. Australia's current and future energy policy is not directly incorporated in the Terms of Reference. What is relevant to the Terms of Reference are the energy policies being adopted by our major trading partners and how the broader global economies are looking to decarbonise. And increasingly, **nuclear is an indispensable part of that mix (in addition to renewables).**

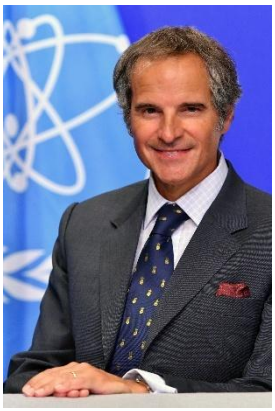
10.7. Although still a contentious issue in Australia, nuclear energy is now recognised globally as a key technology necessary for meeting Net Zero. Momentum is building in the global nuclear industry; with the signing of the Triple Nuclear Pledge at COP28 being a demonstration of that. Originally signed by 25 countries at COP28, in 2024 at COP29 (Baku), another six countries signed up.



Figure 26 Triple Nuclear Pledge at COP28, UAE, 2023

10.8. The driver of the global nuclear renaissance is the need for scalable, baseload emissions free energy; with nuclear recognised as critical in order to achieve 2050 decarbonisation objectives.

10.9. As stated by Rafael Grossi, head of the IAEA and quoting the International Panel on Climate Change (IPCC):



"Without nuclear, it will be almost impossible to decarbonise by 2050"

"Nuclear is already playing a big role in clean energy delivery; more than a third of clean, CO2 free energy produced today in the world is nuclear. In Europe, where I live, it's half. So, it is already part of the solution.

The problem is that for many years, for a variety of reasons that have to do with Chernobyl or, later, Fukushima, there has been a lot of push back and misinformation about nuclear energy.

This has reverberated in the conferences and meetings and policy gatherings about energy in general; at the UN Climate Conferences, nuclear was resisted, not mentioned, and even rejected.

The fact the nuclear energy was included alongside renewables at the

2023 Dubai conference was a major step. A number of important countries pledged to triple their own percentage of nuclear in their energy mix.

I don't think that this is a renaissance of nuclear, but a return to realism. The International Panel on Climate Change, which is a gathering of the greatest and the brightest scientists from all over the world studying climate issues, has recognized that, without nuclear energy, it will be almost impossible to decarbonize by 2050." [43]

10.10. This represents a compelling change from the previous decades where nuclear's emissions free status was not recognised, and the industry fell into historically low activity levels. This change is a relatively recent phenomena; and with the timeframes involved in nuclear development; much of the preparation activity for the renaissance is now only just beginning to flow through into new megawatts to the global grids. But that is now happening with increasing pace.

10.11. According to the WNA, nuclear reactors worldwide generated 2,667 TWh of electricity in 2024, a record year, beating the previous record of 2,660 TWh set back in 2006[44]. And as the reactors currently under construction are grid-connected over the next five to six years, the global nuclear capacity and total nuclear generation is expected to continue to rise; with a number of different cases modelled. High and Low are shown Figure 27 below.[45]

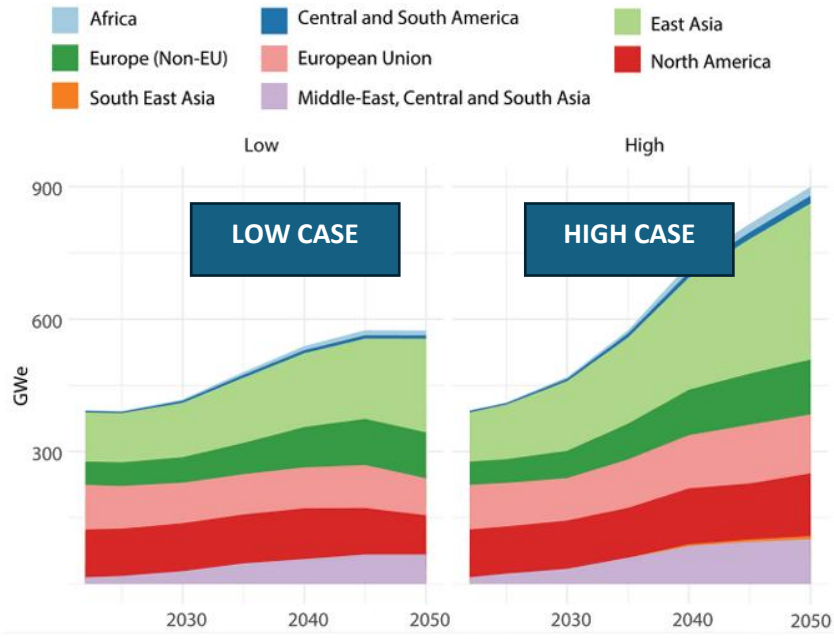


Figure 27 Project nuclear generating capacities to 2050 (NEA, 2024)

[43] https://news.un.org/en/interview/2024/06/1151006
[44] https://world-nuclear.org/images/articles/World%20Nuclear%20Performance%20Report%202025.pdf
[45] https://www.oecd-nea.org/upload/docs/application/pdf/2025-04/7683_uranium_2024_-_resources_production_and_demand_2025-04-22_14-29-2_928.pdf Note these are 2024 projections released in April 2025, slightly updated projections were released in September at the WNA conference.

10.12. There are several distinct aspects to the nuclear renaissance, all of which will be leading to increased demand for uranium in their own manner and in various different timeframes:

- 10.12.1. Restarts of previously closed reactors
- 10.12.2. Life extensions to existing operating reactors
- 10.12.3. Uprates of capacity to existing reactors
- 10.12.4. Completion of partially built reactors that had been discontinued
- 10.12.5. New build activity on brownfields sites; or in jurisdictions with existing nuclear fleets
- 10.12.6. Countries going nuclear for the first time
- 10.12.7. The potential contribution of SMRs, micro reactors and other reactor uses (civilian marine propulsion, industrial heat, etc)

10.13. The global nuclear renaissance is proceeding on the back of new advanced reactor technologies; meaning any comparison to circumstances which created previous well known nuclear accidents is no longer technically relevant, although parties opposed to nuclear energy still try and highlight these historical issues based on old or soviet technology as potential outcomes for future new build.

10.14. Advanced reactor technologies also provide significant improvements over older generation reactors on key issues which were often held out to be limitation for the nuclear industry being:

- 10.14.1. Passive safety
- 10.14.2. Cooling water – various cooling systems possible including air cooled
- 10.14.3. Advanced fuels can reduce any proliferation concerns
- 10.14.4. "Modularity" to improve constructability and improve standardisation between the fleet
- 10.14.5. Improved flexibility allowing load following and fitting into intermittent heavy grids
- 10.14.6. Different scales of reactors (micro, SMR, large) ensuring there is a reactor size fit for purpose

10.15. Importantly, countries are moving ahead from merely signing up at COP conferences with real implementation plans in order to get nuclear new builds progressing; including concrete steps towards developing financing models to encourage new build, which is crucial given financing hurdles have historically represented significant impediment to nuclear new build.

- 10.15.1. Since COP28, a group of the world's largest banks has committed to supporting the Triple Nuclear Pledge; an important aspect given financing has historically

been held out to be a major hurdle for nuclear projects to overcome.[46]

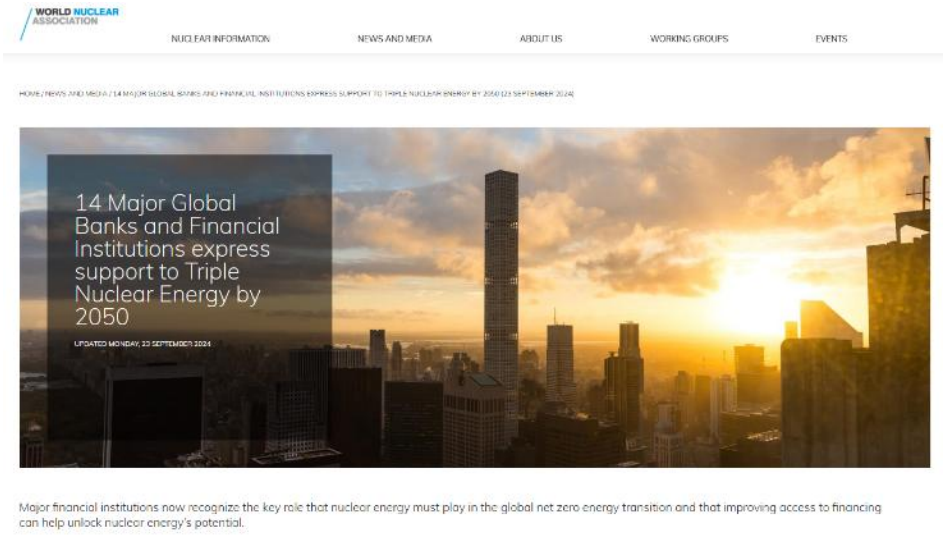


Figure 28 Major banks backing Nuclear Energy

10.15.2. Following the global commercial banks, the World Bank has ended an almost 50 year prohibition on financing nuclear projects.[47]

10.15.3. Following the World Bank move, the Asian Development bank is now expected to change its policy too.[48]

10.15.4. It is important to note that the financing support for nuclear from banks remains robust, even as the broader climate change focused Net Zero Banking Alliance has suffered from significant withdrawals and strategic uncertainty.[49]

10.16. This creates a substantially increased future demand for uranium; at the same time that existing supplies will be coming off through natural depletion (See section 11.8 below) ; and there is an international bifurcation in the market, evidence by the ban on US imports of Russian nuclear fuels; and a growing understanding in the market that much of the supply from the world's largest producer (Kazakhstan) is being funnelled directly to Russia and China. Hence, Western friendly, high ESG sources of uranium are especially important, and Northern Australia could play a vital role in supplying this product to our major trading partners.

[46] https://world-nuclear.org/news-and-media/press-statements/14-major-global-banks-and-financial-institutions-express-support-to-triple-nuclear-energy-by-2050-23-september-2024
[47] https://www.world-nuclear-news.org/articles/world-bank-agrees-to-end-ban-on-funding-nuclear-energy
[48] https://www.afr.com/world/asia/asian-development-bank-mulls-lifting-nuclear-power-funding-ban-20250616-p5m7u5 and https://www.adb.org/sites/default/files/page/571356/adb-energy-policy-review-brief-note-15082025.pdf noting the proposal to remove the ADB's current prohibition
[49] https://www.forbes.com/sites/jonmcgowan/2025/08/28/un-climate-change-banking-alliance-falls-apart-under-legal-pressure

11. Projected supply shortage – a huge problem for the global transition to net zero

11.1. Historically, uranium was produced without particular regard to economics due to its strategic status and importance for military applications. This led to production exceeding requirements in early years (see Figure 29 below) and a number of countries developing stockpiles (inventories) of material; some of which still remain today.

11.2. However, stockpiles of uranium have been consistently drawn down for civilian use in recent decades, with the industry currently operating with a primary production deficit – even with today's level of reactor demands, the uranium mining industry cannot mine enough uranium to satisfy demand. At a very high level, at current levels of activity the industry may use ~180-190M lbs of uranium per year, but the mining industry can only produce 140-150M lbs per annum.

Make no mistake – industry experts including the World Nuclear Association are warning that a shortage of available uranium post 2030 could slow down the uptake of new nuclear; and hence slow down the global decarbonisation effort.[50] Essentially, new uranium supply is on the critical path.

11.3. This requires a substantial increase in uranium mining to satisfy future requirements.

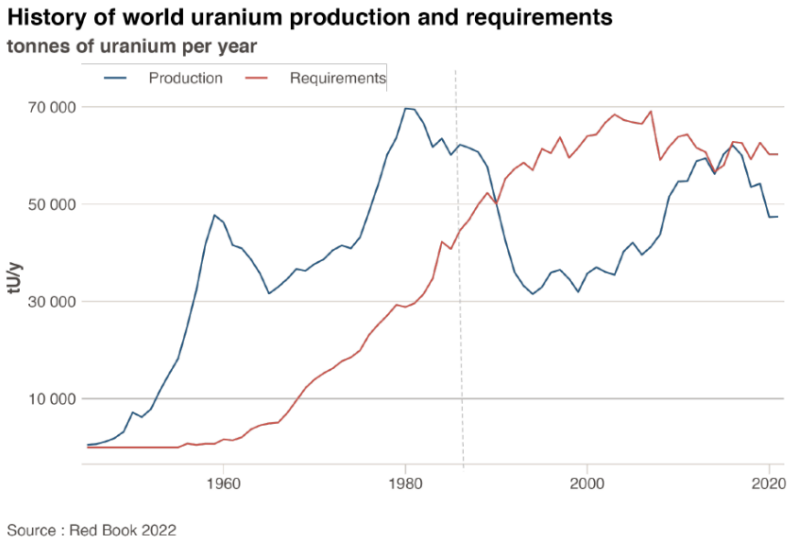


Figure 29 History of uranium production and requirements

[50] https://oilprice.com/Latest-Energy-News/World-News/Uranium-Shortage-Jeopardizes-Nuclear-Renaissance.html and https://www.theenergymix.com/nuclear-renaissance-could-stall-out-as-uranium-supplies-dwindle/

11.4. The significant forecast increases in demand for uranium due to increased nuclear energy generation is coming at the same time as forecast production is projected to decline through existing resource depletion, as shown in Figure 30 below.

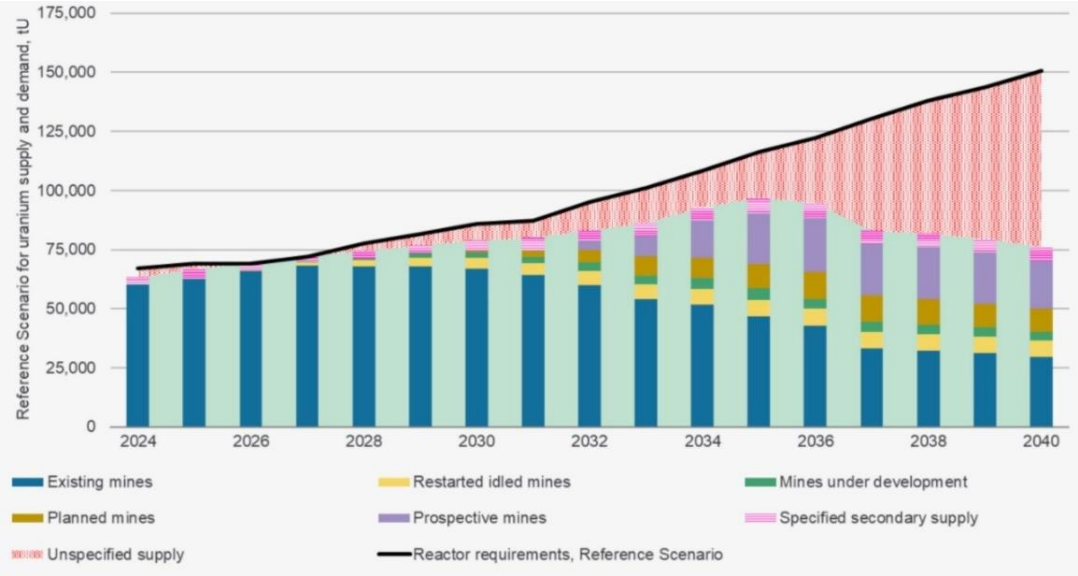


Figure 30 Projected Global demand and supply balance as per WNA reference case

11.5. The gap persists even when considering all planned new production additions that are known to be in the pipeline (for example, the Nexgen project in Canada). Further, the gap obviously gets larger in the high case scenarios (see Figure 31 below).

11.6. Further, industry forecasts are constantly being updated, with the latest updates presented just in September 2025 showing significant increases over prior estimates:

	CURRENT STATE	LOW 2040	BASE CASE 2040	HIGH CASE 2040
INSTALLED CAPACITY	372 GW	582 GW (+210 GW)	686 GW (+314 GW)	966 GW (+594 GW)
CHANGE FROM 2023 report		+66GW	+60 GW	+35 GW
URANIUM DEMAND	~69,000t U	107,000t U (+38kt U)	150,000t U (+81 kt U)	204,000t U (+135kt U)

Figure 31 Changes in the recent WNA Nuclear Fuel Report September 2025

11.7. Its interesting to note that since the WNA Nuclear Fuel Report 2017, which roughly aligns with the imposition of the WA Uranium Mining Ban (QLD had been enacted a couple of years earlier in 2015), the expectation for the amount of uranium required in the future has increased substantially increased. Unfortunately in that timeframe, the years of analysis have changed slightly, making direct comparison impossible on the data to hand, however in the 2017 report, it was expected that by 2035 a total of 94,000tU would be required.[51] In the

[51] https://www.world-nuclear-news.org/Articles/Nuclear-fuel-report-sees-growth-and-gaps

2025 report, it now projects 150,000 tU for 2040. Despite the 5 year change in scenario, its clear that expectations of future uranium demand have increased substantially since the time when the most recent uranium ban in Australia (in WA) was put in place.

11.8. Incredibly, this significant increase in forecast uranium demand is projected to occur at a time when production from existing resources are projected to HALVE (See the blue bar in Figure 30 above); **underwriting the importance of finding new sources of supply**.

11.9. The gap in new production is acute due to historic under investment in uranium exploration which has been an issue for the last couple of decades; driven by a number of factors:

11.9.1. The overall nuclear industry had been in the doldrums until relatively recently, prior to the recognition of its importance to global decarbonisation. With little growth expected in the end use market, there had been reduced incentive for uranium exploration and new production. Obviously with the industry now in growth mode, this factor is no longer relevant.

11.9.2. The ending of the cold war and the introduction of the "Megatons to Megawatts or M2M" programme structurally shifted the market by providing civilian grade product from downblended nuclear weapons, essentially providing very cheap uranium units into the civilian fuel market, structurally impacting pricing for decades to come.

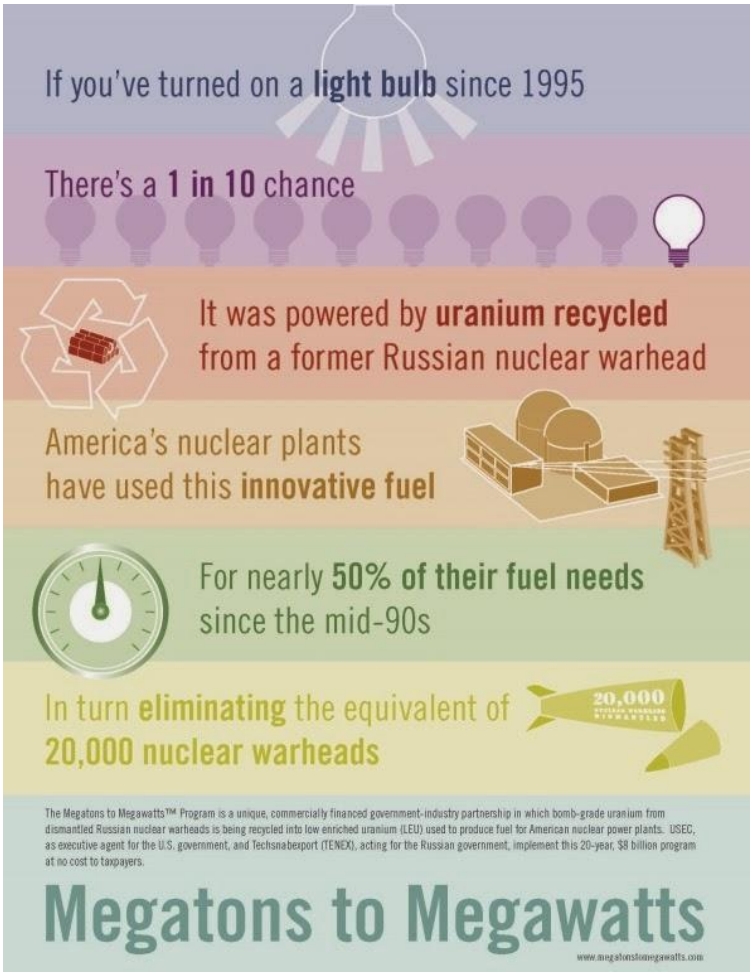


Figure 32 Megatons to Megawatts programme as explained by the US Nuclear Energy Institute

11.9.3. The impact of M2M on the global uranium market can be demonstrated in Figure 33 below; displacing primary uranium for decades.

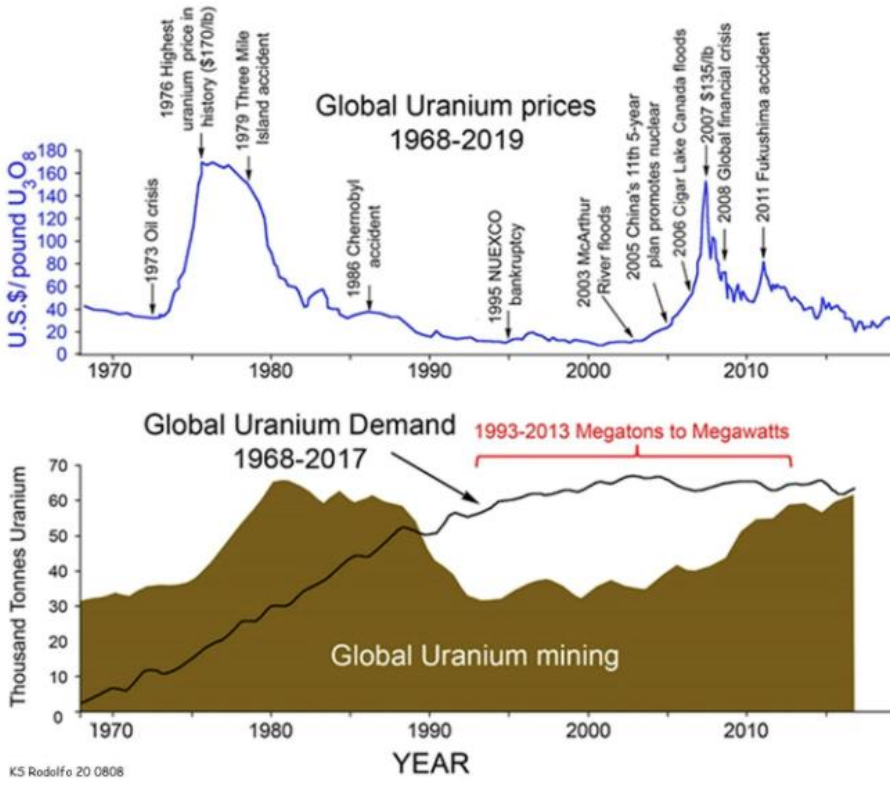
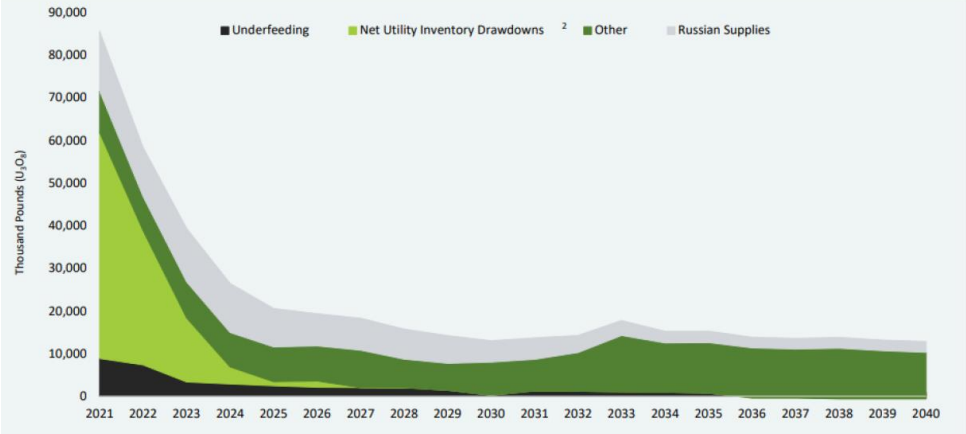


Figure 33 Impact of M2M on primary uranium mining and pricing[52]

11.9.4. M2M was the largest of the "secondary sources" but there are others – including previously mined stockpiles, as well as reprocessed materials. Each pound of secondary supply has resulted in lower demand for primary mined uranium. Going forward, there is expected to be much less secondary product available; reinforcing the need for robust primary supply.



Source: Paladin corporate presentation, UxC market outlook.

Figure 34 Reduced availability of secondary sources of uranium in the future

[52] Source: https://www.rappler.com/voices/thought-leaders/opinion-megatons-megawatts-prices-true-costs-nuclear-energy/

11.9.5. Market discontinuities relating to Fukushima in 2011 caused major impacts in the uranium industry, with exploration levels plunging. Further, with countries such as Germany and Japan shutting down their reactor fleets, this released more product onto the market, again providing downward pressure on pricing. Notably, Japan has now reversed course, is opening back up its reactors and is now looking to rebuild a national stockpile of fuel.

11.9.6. However, the period of low market pricing is now well and truly over, and with significant market shortages projected in the long term and hence higher pricing, once again uranium exploration is attractive and is now desperately needed to fill the pipeline for the next generation of mines.

11.9.7. This low level of uranium exploration globally was exacerbated in WA and Queensland; because in addition to these global headwinds, uranium mining bans implemented in 2015 in QLD and 2017 in WA acted to further reduce interest in exploration in those jurisdictions .

11.10. Much of the commentary in the market focuses on how long it can take to build a nuclear power plant. There is relatively little recognition, however, of how long it can take to discover new uranium deposits and get them into production.

11.10.1. The graph below shows the issue – generally, the timeframe between finding a deposit and commencing a mine has been increasing in recent decades. This issue is exacerbated by under investment in greenfields exploration over the last couple of decades due to the previously explained low uranium pricing (a factor that is well and truly different today!).

11.10.2. The result of this is that a significant increase in uranium exploration is needed in order to bring new product to market to satisfy future global nuclear needs. **And a significant portion of that could come from Northern Australia, for more information on Northern Australia's exploration potential please see Section 17.2.**

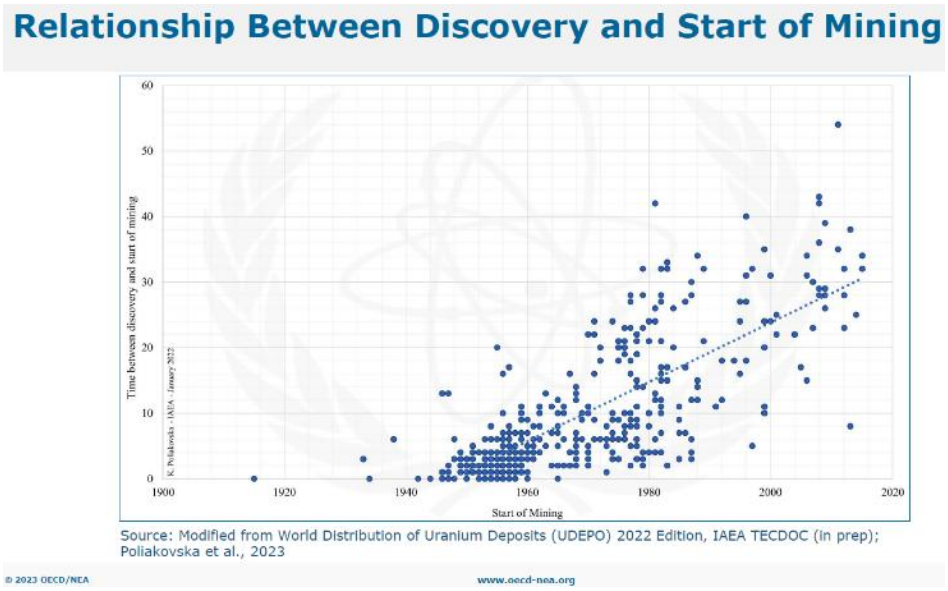


Figure 35 Relationship between discovery and start of mining

12. Market bifurcation and security of supply issues

12.1. The problem is not only to do with quantum of pounds available, but where those pounds are and which geopolitical regime (East vs West) they are aligned to. Figure 36 below shows that many of Australia's major trading partners are on the right of the graph (large users of uranium, net short on supply).

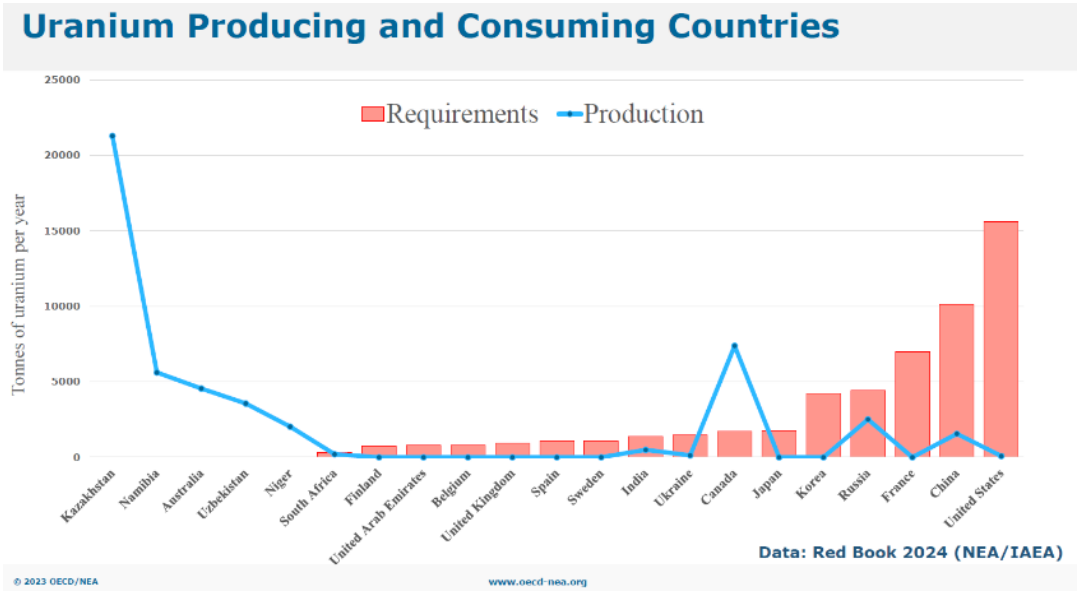


Figure 36 Uranium producing and consuming countries – an imbalance

12.2. Australia's position on the left of the graph is due to supply from SA. The addition of supply from WA and QLD could help provide additional, desperately needed supply to our major strategic trading partners achieve their energy transition goals. (see Section 0)

12.3. **The Russian invasion of Ukraine has elevated existing energy security of supply concerns across the Western world**, including fossil fuels but also nuclear fuel., leading to substantial changes to global energy trade flows.[53] Further, this has stoked existing concerns over China's stranglehold on renewable energy supply chains including rare earths, and associated implications for national security.[54]

12.4. These are paramount concerns when considering future nuclear fuel supply, given the role Russia has played in supplying much of the West with nuclear fuel.

12.5. In the US, Russia has historically been the largest supplier of nuclear fuels. Despite bans being enacted following the invasion of Ukraine, Russia remains the largest supplier of fuel this year to the US, as existing contracts have been "flexed up" by utilities keen to maximise their supply ahead of import deadlines.[55]

12.6. Russia's contribution to US nuclear fuel is represented in Figure 37 below. According to latest

[53] https://www.iea.org/topics/russias-war-on-ukraine
[54] https://www.aspistrategist.org.au/silent-risk-to-net-zero-commitment-climate-policy-meets-national-security/
[55] https://newsukraine.rbc.ua/news/russia-remains-top-supplier-of-nuclear-fuel-1759261837.html

reporting just released, the 2024 figure has declined to 20% (from 27% in 2023).[56]

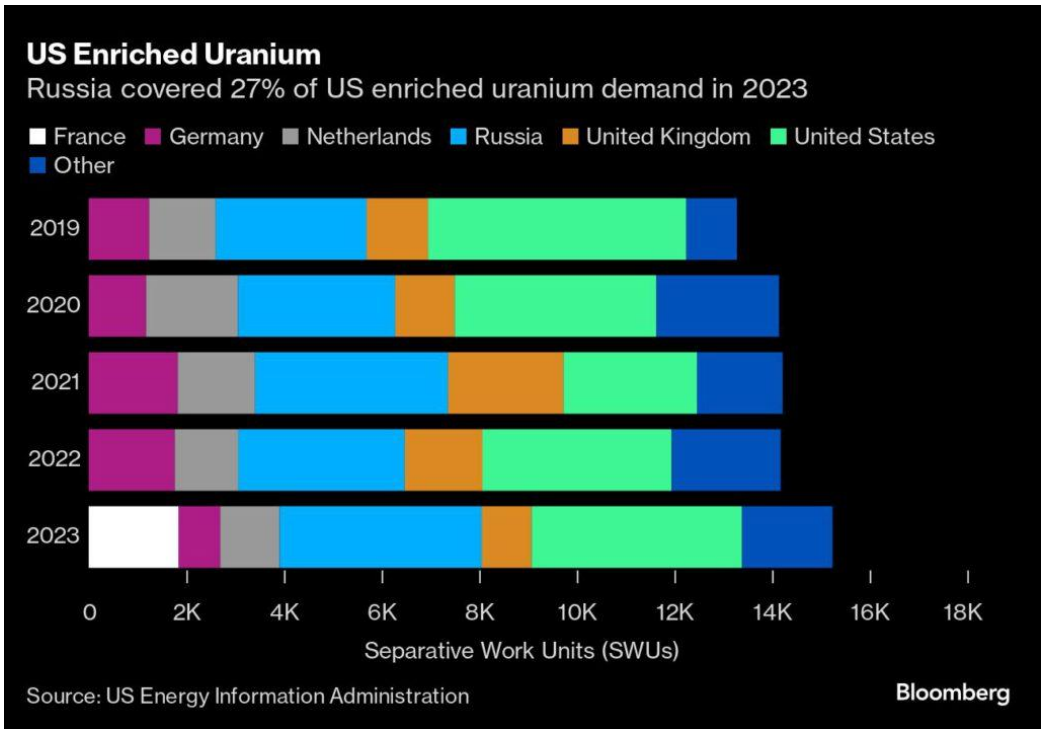


Figure 37 Russian contribution to US enriched uranium requirements[57]

12.7. This situation is clearly not sustainable for the US moving forward; hence the US Administrations significant efforts to develop domestic uranium production[58], deliver new domestic enrichment capacity[59], and secure sources of imported yellowcake from strategically aligned nations. **This is a HUGE opportunity for Northern Australia**.

12.8. The EU is also currently entirely dependent on imports of uranium. Initiatives are underway to generate some EU domestic production, such as from Sweden which is progressing with removing its uranium mining ban, and Finland which is commencing relatively small scale production[60].

12.9. Historically, much of the bloc's uranium has come from geopolitically unstable or unaligned jurisdictions, a position which is no longer tenable for the Union, and hence the Union has developed a roadmap to reduce its reliance on such sources.

[56] Ibid at footnote 55.
[57] From Bloomberg, as quoted in https://www.mining.com/web/russia-temporarily-limits-nuclear-fuel-shipments-to-us/
[58] https://www.energy.gov/ne/articles/9-key-takeaways-president-trumps-executive-orders-nuclear-energy
[59] https://www.urenco.com/news/usa/2025/urenco-usa-expands-u.s-enrichment-capacity-with-second-new-cascade
[60] https://www.uatom.org/en/2024/06/19/finland-starts-uranium-mining.html#:~:text=Finland%20Starts%20Uranium%20Mining%20%7C%20Uatom,According%20to%20Terrafame

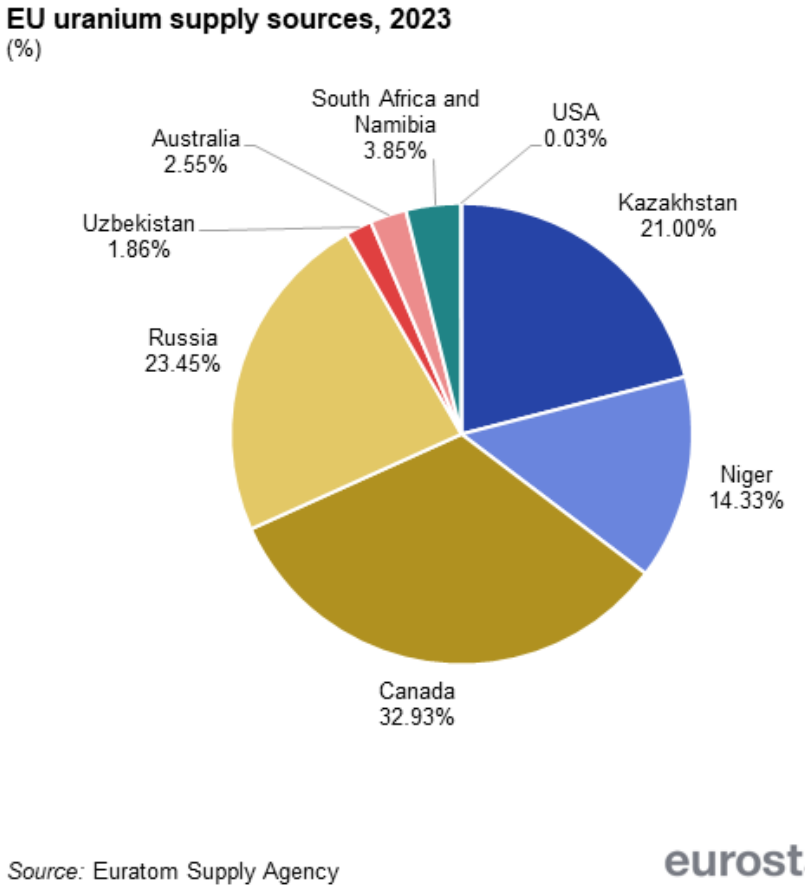


Figure 38 EU sources of uranium, 2023

12.10. The Russian invasion of Ukraine has caused an awakening in the EU regarding its overall reliance on Russian energy sources. The Union has put in place targets to stop all imports of Russian gas from 2027, various actions to ensure no Russian oil is bought by the EU as well as targeting Russia's shadow fleet used to transport oil globally; and to reduce reliance on Russian sourced nuclear fuels and raw uranium products.[61]

12.11. The reliance on Russia for nuclear fuel products including raw uranium is no longer strategically acceptable; however ending that reliance presents unique challenges given the breadth of reliance (see Figure 39 below), a lack of currently available alternatives with excess supply, and the significant timeframes that can be involved in developing new supply partners.

[61] https://commission.europa.eu/news-and-media/news/roadmap-fully-end-eu-dependency-russian-energy-2025-05-06_en

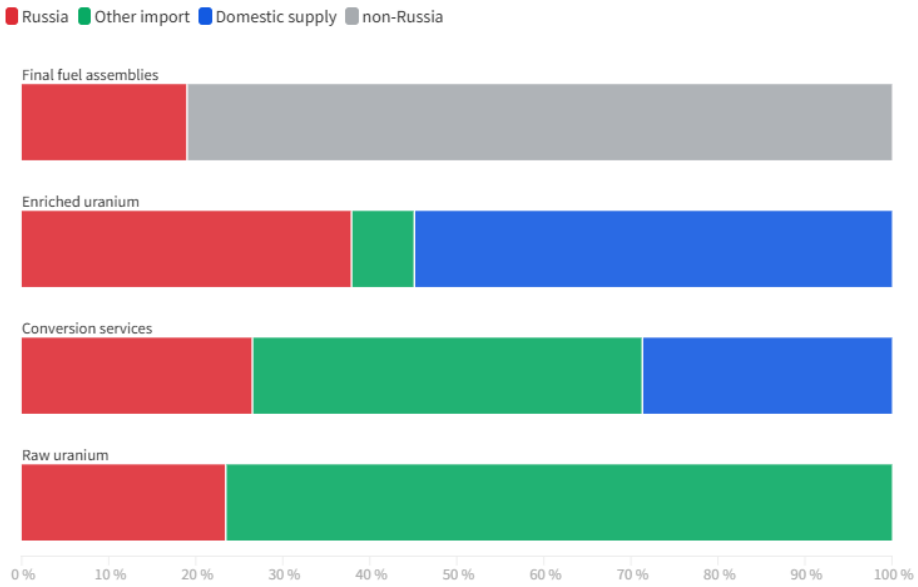


Figure 39 EU nuclear fuel supply origin, 2023[62]

Source: Supply Agency of the European Atomic Energy Community, Market Observatory. Note: the figure shows the proportion of total EU supply from each source. For raw uranium (tonnes), conversion services (tU) and enriched uranium (tSW) this is calculated as an exact proportion. For final fuel assemblies we show the number of reactors of the Soviet VVER-type (19) as 'Russia' and the remainder as 'non-Russia' (specifically domestic, UK and US).

12.12. Again, this presents significant opportunity for Northern Australia to step and satisfy not only the decarbonisation objectives of the EU; but help with their security of supply issues too.

12.13. This is a broader issue than just Russia; encompassing a broader division between East and West. **Whilst there can certainly be trade amongst the blocs (significant trade with China will continue to occur across a broad range of commodities, despite concerns for example, with respect to rare earths strategic supply), the strong desire from Western aligned economies to secure supply in strategically aligned jurisdictions provides particular opportunities for uranium projects in friendly jurisdictions (such as Northern Australia) to secure funding and other support and progress into operation..**

12.14. In order to safeguard our geopolitically aligned trading partners security of supply, its important for more Western aligned uranium projects to come to market. One of the most significant sources of new Western aligned production could come from Northern Australia post lifting of the respective bans and development of local industries. The current projected balance between OECD and non-OECD countries for control of uranium is shown in Figure 37.

[62] https://www.bruegel.org/analysis/ending-european-union-imports-russian-uranium.

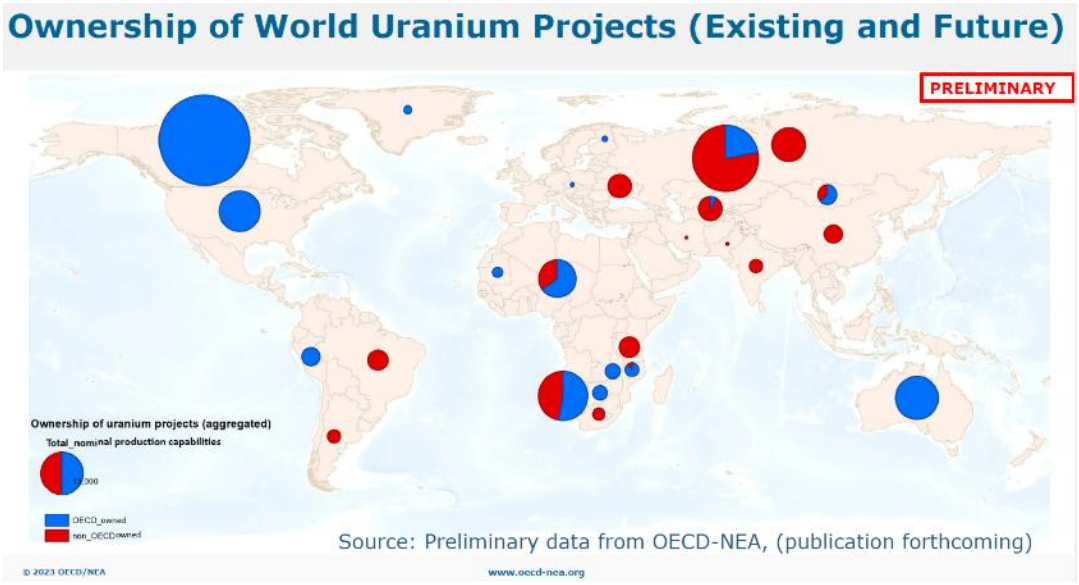


Figure 40 Ownership of world uranium projects (existing and future, OECD v non OECD)

12.15. The issue of energy security and bifurcation in the global uranium market is not expected to resolve in the short term. The US has banned the import of nuclear fuels from Russia; and this also makes it difficult for Kazakhstan, the world's largest supplier, to supply the West, as many of their export routes run through St Petersburg. Additionally, Kazakhstan is under political pressure from Russia and China to directly supply them, meaning availability of pounds for the West is expected to be significantly restricted.

12.16. The issue is of such importance that a group of Australia's major trading partners have set up **the Sapporo 5 initiative.**

12.16.1. Coming out of the COP28 conference in late 2023, the Sapporo 5 (Canada, Japan, France, the UK and the US) resolved to strengthen global nuclear fuel supply chains with a specific target of reducing reliance on Russian sourced or influenced product.



Figure 41 Sapporo 5 announcement on the sidelines of COP28

12.16.2. The agreement and its parties cover various stages of nuclear fuel including uranium supply[63]

12.16.2.1. Resolve to promote public-private investment in enriched uranium production capacity free from Russian material;

12.16.2.2. Resolve to establish a resilient global uranium supply market free from Russian influence and the potential to be subject to political leverage by other countries;

12.16.2.3. Resolve to work towards enabling the investment of government or private-led financial resources necessary to increase our own conversion and enriched uranium production capacity and to advance efforts to secure reliable nuclear fuel suppliers;

12.16.2.4. Underscore our announcements to pursue at least USD $4.2 billion in government-led and private investment in our five nations' collective enrichment and conversion capacity over the next three years, with a view to catalyse private sector finance, without prejudice of open market rules among like-minded nations;

12.16.2.5. Invite nuclear electricity generating utilities or direct nuclear energy industrial end-users of like-minded nations to develop long-term supply strategy that signals and provides confidence to the industry to make the relevant investment to increase their capacity;

12.16.2.6. Invite all likeminded nations seeking reliable nuclear energy partners to join us in securing the global uranium supply chain.

12.16.3. The Sapporo 5 initiative underscore how seriously Australia's major trading partners are taking the issue of security of supply of the nuclear fuel (to ensure their decarbonisation objectives can be met).

12.16.4. Northern Australia should take the initiative (in conjunction with the Federal Government, if required) in order to cooperate with the Sapporo 5. Certain international funding may also be available, especially if downstream conversion and civilian enrichment activities were undertaken, which may be considered as a future opportunity.

[63] https://www.gov.uk/government/publications/nuclear-fuel-supply-multilateral-alliance-between-uk-and-international-partners/civil-nuclear-fuel-cooperation-between-canada-france-japan-united-kingdom-and-united-states-statement

12.17. With significant plans from Western countries to expand their nuclear generation, its important to also expand Western uranium supply. Northern Australia must play its part.

"Our strategic trading partners are desperate for us to supply them with high ESG, western friendly uranium. Australia must remove bans in QLD and WA and step up to help supply; to ensure they can meet not only their decarbonisation objectives but their energy security requirements too."



13. The Importance of AUKUS and helping our defence industry

13.1. The Terms of Reference specifically consider how new emerging industries might assist or support the defence industry.

13.2. The acquisition of a sovereign nuclear powered submarine capability is arguably Australia's most important strategic military programme in history, and certainly the most expensive. It is a major undertaking for Australia, as well as a major investment by our partners the US and the UK through the transfer of nuclear submarine technology. Its colloquially referred to as AUKUS.

13.3. WA especially is set to play a major role in the AUKUS arrangement, hosting half the proposed nuclear submarine fleet at HMAS Stirling on Garden Island just off Perth, as well as being the centre of a major sustainment and maintenance operation.

13.4. From as early as 2027, AUKUS partners will have a rotational presence at HMAS Stirling of, one UK and up to 4 US, nuclear-powered submarines. This presence will be known as Submarine Rotational Force - West (SRF-West).



Figure 42 USS North Caroline (SSN 777) visiting Perth, August 2023

13.5. Australia will obviously benefit enormously from AUKUS. Western Australia itself will specifically benefit significantly from AUKUS – from the creation of tens of thousands of new skilled jobs, investment of billions of dollars into facilities in WA, ongoing maintenance activities, and truly putting WA on the map as a strategic defence hub in the Indo-Pacific region. AUKUS enjoys strong WA and Federal Government support. Most recently, the Federal Government has announced a $12bn investment in the Henderson Defence Precinct to support AUKUS and for continuous shipbuilding.[64]

13.6. It is known, however that AUKUS has recently been under review by the current US Administration (having being approved under the leadership of the former US President Biden).

[64] https://www.navalnews.com/naval-news/2025/09/australia-spends-a12-bn-on-henderson-for-aukus-shipyards/

13.7. With such significant benefits, WA must do ALL that is can to ensure that AUKUS continues to be delivered; regardless of most recent reporting confirming the current AUKUS review has reached a positive conclusion.[65]

13.8. Now whilst the WA main AUKUS base and activities are not within Northern Australia, being focused more just near Perth, this doesn't mean that activities that occur in Northern Australia (ie uranium mining) can't have an important supporting effect on the strength of the AUKUS arrangement and relationships.

13.9. There is no doubt that the US is significantly short of its uranium requirements. The US Administration has also plainly signalled a desire for Australia to "get in the game" with respect to uranium[66]. The ability to help solve an extraordinary strategic security of supply issue for the US could certainly help when negotiating with the US over the continuation of AUKUS and safeguarding WA's participation. The biggest opportunity for increase in uranium production in Australia comes from the Northern Australian region; principally requiring the overturning of the bans in WA and QLD.

13.10. Furthermore AUKUS and uranium mining are complementary, some of the skills base built up for AUKUS could easily be transferable across and assist the uranium industry in Northern Western Australia; and vice versa.

13.11. Finally, its worth mentioning some common sense logic. It would seem completely illogical that over the long term Western Australia would be willing (and indeed, highly supportive) of having nuclear submarines based in its southern regions which are essentially floating nuclear reactors just off our major city; yet not be comfortable with mining uranium in its natural, unenriched form in its Northern regions. Its worth noting that submarines utilised highly enriched uranium (close to weapons grade ~80% U235 – specific enrichment is classified), whereas uranium mining involves only mining unenriched uranium (at ~0.72% U235)., whilst common civilian reactors use ~5% U235, with some SMR's and indeed the Lucas Heights reactors using ~19.9% U-235.

13.12. For a further discussion on the reasons historically put forward for justifying the uranium mining bans, and why those factors are no longer definitive, please see Section 19.

[65] https://www.9news.com.au/national/aukus-pentagon-review-reported-approval/9c563177-f6e2-4bd2-b909-75d0165ba37c

[66] www.theguardian.com/australia-news/2025/feb/18/us-energy-secretary-says-australia-should-get-in-the-game-of-supplying-uranium



Figure 43 *The Henderson Defence Precinct in WA, Image: Australian Defence*

14. The contribution of nuclear to our Partners energy transition goals

14.1. Selected major trading partners for Australia are significantly increasing their exposure to nuclear energy to meet their energy transition and decarbonisation goals.

14.2. See the Appendix for a detailed review of Australia's selected major trading partners and their nuclear and uranium needs. This information is summarised in Figure 44 below:

Country/Region	Nuclear Status & Plans	Uranium Demand & Supply	Relevance for NA Uranium Exports
China	• Largest global new build (>150 reactors by 2035). • Aiming to be world largest nuclear generator	• High import reliance, esp. Kazakhstan/Africa. • Minor domestic production although looking to increase • Aggressively stockpiling uranium - national security	• Cooperation agreement; previous exports • Natural extension for Northern Australia ("NA") from existing commodities • However consideration of current bifurcation issues?
Japan	• Most complex national conscience when it comes to the nuclear sector. • Despite this, restarting reactors; and pursuing new builds.	• Historically a major buyer of Australian uranium. • History of investment in Australian uranium sector.	• Strong strategic ally; resumption of Australian supply highly likely. • Strong history in co-operation through iron ore and oil & gas sectors
South Korea	• Expanding nuclear share (≥30% by 2030); global reactor and technology exporter.	• Entirely reliant on imports.	• Treaties in place; • Logical trade progression from LNG/iron ore where there is s strong history of cooperation with NA.
Singapore	• Exploring advanced nuclear with US support.	• Future demand possible.	• No formal agreement yet; medium-long-term market.
United States	• Largest global operator; aims to triple output. • Aggressive Energy Dominance policy	• Import reliant; Russian supply banned.	• Already a major Australian buyer • AUKUS deepens relevance for WA especially.
India	• 24 reactors, 6 under construction; 100 GW by 2047. • Pursuing a diversified strategy – multiple designs, indigenous and imported	• Historically Limited imports due to NPT status. • Actively considering Thorium as a long term fuel source as well.	• Exports possible from Australia under existing bilateral safeguards arrangement; demand rising.
Hong Kong	• Relies on imports of nuclear power from China.	• Indirect uranium demand via China.	• No direct role; subset of China's market.
Taiwan	• Recently shut down fleet; referendum showed strong public support for restart but didn't quite achieve required number.	• Previously imported via US.	• Uncertain near-term opportunity; conditional on policy change.
Indonesia	• 3 research reactors; plans 7 GW by 2040, 35 GW by 2060.	• Rapidly emerging demand.	• Recent safeguards agreements; • NA well positioned. Our closest neighbour.
United Kingdom	• 6 GW current; 24 GW target by 2050; active SMR program.	• Entirely reliant on imports.	• Already an Aussie customer • Strong cultural alignment. • AUKUS.
European Union	• ~100 reactors; broad policy shift back to pro-nuclear.	• Fully reliant on imports; moving away from Russia.	• NA could play a major role in diversification of supply. • Strategically aligned

Figure 44 Selected major trading partners for Australia, their nuclear status and need for uranium

14.3. **Asia's nuclear expansion** represents the largest current growth pathway in nuclear and hence a substantial opportunity for Northern Australia's uranium. China's unparalleled new-build program, Japan's return to nuclear post-Fukushima, and South Korea's strengthened commitment underpin a sustained regional demand. India is ramping up its already significant programme and Indonesia is looking to go nuclear for the first time. Even Singapore, a tiny State by land area, is in the early stages of evaluating advanced nuclear technologies. These developments collectively highlight Northern Australia's potential to emerge as a cornerstone uranium supplier to our neighbours in Asia.

14.4. **Non Asian Western partners** offer equally significant opportunities. The United States is doubling down on nuclear as part of bipartisan energy policy (Quadrupling, in fact, if you take the Energy Dominance Policy of the White House literally), with an urgent need to secure uranium from trusted allies following bans on Russian supply. The United Kingdom is scaling up both large-scale and SMR nuclear development, while the European Union across its diversified mix of policies overall has reversed its prior decline in nuclear, with countries such as France, Sweden, and Poland leading aggressive expansion programs. The EU's focus on reducing dependence on Russia further strengthens the case for diversified supply from stable jurisdictions like Australia.

14.5. **Specific trade alignment** with Northern Australia reinforces this opportunity. Northern Australian jurisdictions have longstanding, trusted relationships with many of these partners across iron ore, LNG, and other commodities. Expanding this trade portfolio to include uranium is a natural extension, consistent with global decarbonisation goals and Australia's strategic interests.

14.6. Australia has long accepted international partners and capital to build its export industries; such as the initial development of the iron ore export industry with significant contributions from Japanese entities; or the development of the offshore oil & gas industry with large multinational project development consortia.

14.7. Significant interest from large international groups is already present to participate in the development of the uranium sector in Northern Australia (see Section 18.3); either through development capital and operational JVs, direct controlling investment (eg Cameco), or through offtake arrangements to secure high ESG uranium from a strategically aligned partner.

15. The history of uranium mining in Australia

15.1. Uranium deposits are prevalent across Australia; built up by historical exploration, development and operations activities. In addition to the known deposits referred to below, there is significant exploration upside driven by decades of relatively low uranium pricing and various uranium mining bans which lead to a period of significant under-exploration for U.

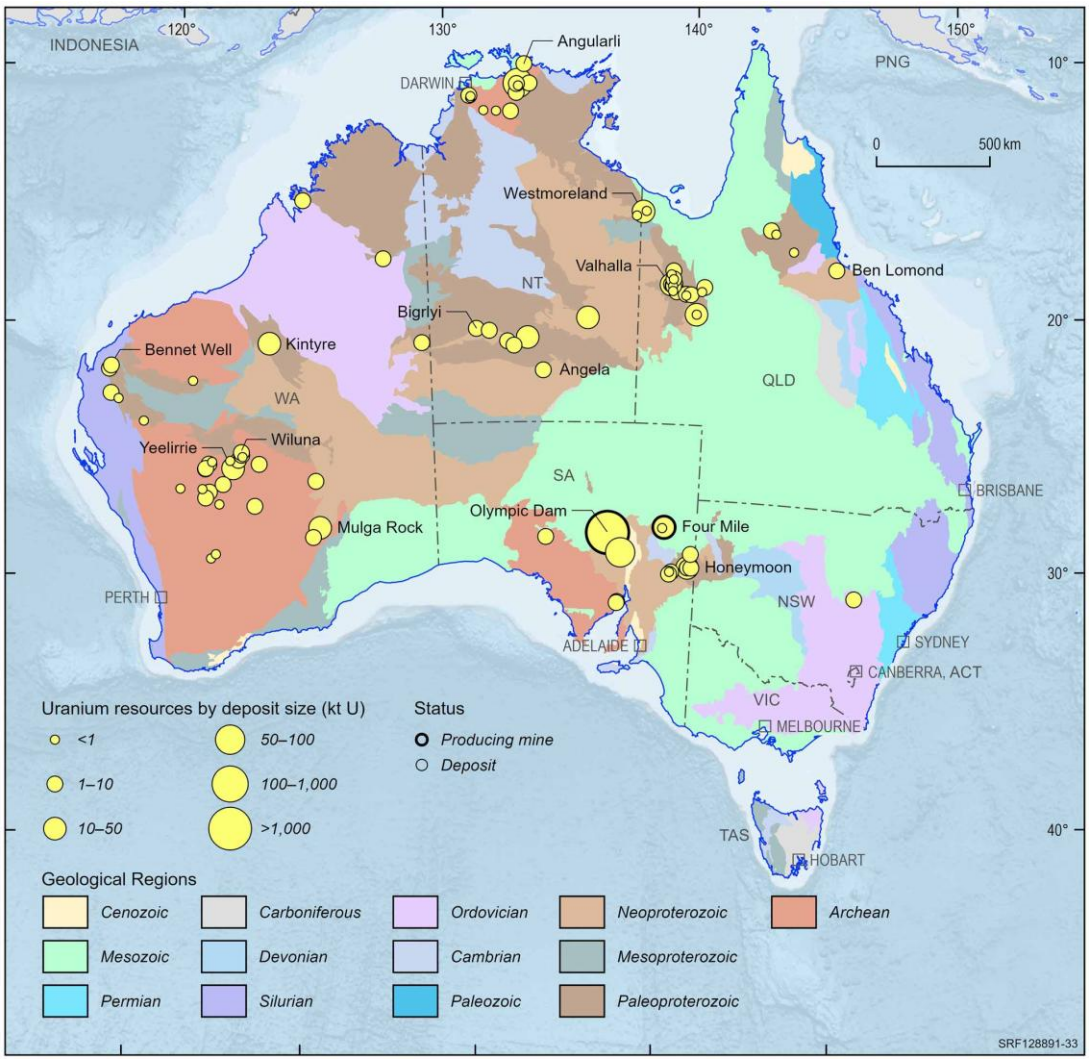


Figure 45 Major existing uranium deposits in Australia[67]

15.2. Australia was one of the first countries globally to mine uranium. Radium Hill in South Australia was originally mined for radium in the early 1900s but then reopened in 1954 to become Australia's first uranium mine.

[67] https://www.ga.gov.au/education/minerals-energy/australian-energy-facts/uranium-and-thorium#gallery-7

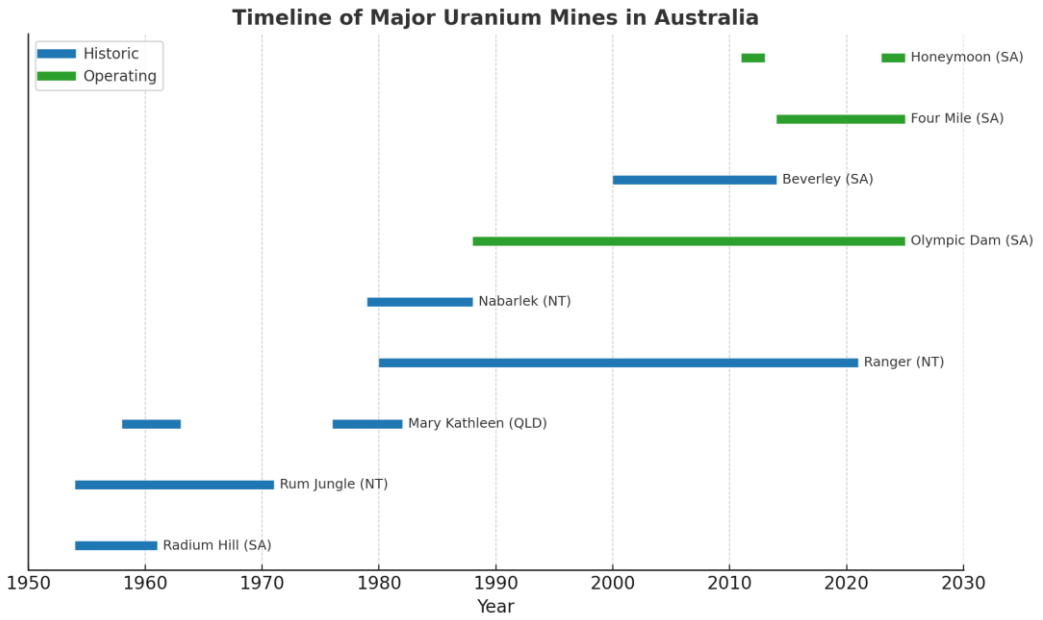


Figure 46 Timeline of major uranium mines in Australia

15.3. These early mining operations were conducted in a manner that was acceptable at the time, but would clearly not pass today's much higher standards. As such, as is with the case of much early industrial activity, there has been a legacy left from these early operations which has to be addressed.

15.4. We should not ignore that there is a history of early uranium mining in Australia that has left a legacy; most recently the Ranger uranium mine in the NT which is currently being rehabilitated by ERA / Rio Tinto) as well as for example the historical Rum Jungle site (which is the subject of a Federal rehabilitation project), amongst others. However, whilst providing lessons to learn from; these prior issues should not be used as an unconditional basis for refusing to develop a future industry;

15.4.1. These prior projects were approved back in a time where materially different approvals conditions were provided. There is simply no way that a mine would be approved and developed today on those same conditions.

15.4.2. Improvement to historical practice is not confined to the uranium or nuclear sector – this is true across all aspects of human endeavour. We must learn from the past; improve our practices; develop different ways of doing things, and ensure a holistic plan is in place from initial development through final remediation.

15.4.3. Approval of any project today would be done in a manner which suitably protects the environment and which meets community expectations.

15.5. Further, its important to recognise that historic nuclear weapons testing in Australia created legacy (physically and culturally) especially amongst certain indigenous groups whose lands were affected. This had a negative impact on the attitudes towards uranium mining in various parts of the community as those issues were conflated; and some of those issues are present to this day.

15.6. However, its important to clearly differentiate uranium mining from weapons testing – as discussed later in Section 21.4 – the industries are quite separate.

15.7. This is an area where clearly the industry must continue to focus; and where attitudes differ significantly across different lands and groups. See Section 21.10.

15.8. Specifically with respect to Northern Australia, Uranium mining has never occurred at commercial scale in WA, although there have been pilot plant operations at Yeelirrie and a field leach trial at Manyingee – see Section 16.1.3. Mining has occurred extensively in the NT (Ranger, Rum Jungle, Nabarlek) and historically also in Queensland (Mary Kathleen).

15.9. Northern Territory mining history

15.9.1. The NT has been home to major historical uranium mines Rum Jungle and Ranger, and the smaller Nabarlek mine. Again, consistent with practices of the day, planning for future rehabilitation and funding of it was negligible.

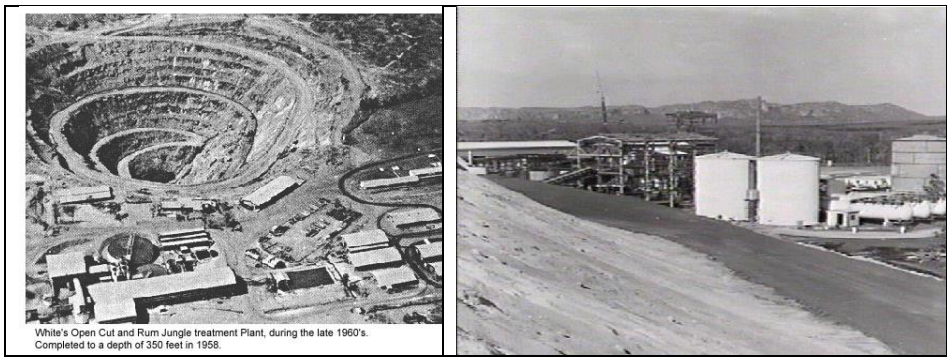


Figure 47 Historical photos of operations of Rum Jungle (L) and Nabarlek (R)

15.9.2. Rum Jungle operated from the early 1950s until cessation of mining operations in 1971; at which point a decision by the Commonwealth Government meant rehabilitation was not undertaken and the site was abandoned. The site has since become infamous as one of Australia's worst industrial pollution areas and is earmarked for significant Commonwealth remediation, now administered through the Rum Jungle Remediation Area. With more comprehensive initial approval conditions (as would be applied today) and contemporary operating practices, these adverse outcomes could have been substantially mitigated.

15.9.3. The Ranger Uranium mine was the largest uranium mine in the NT. Its development actually lead to the formal creation of Kakadu, with creation of the park essentially being provided in exchange for the granting of mining rights.[68]

15.9.4. Ranger operated from 1980 until end of mining in 2012, with processing of stockpiles continuing until 2021. Throughout its life, it faced opposition from various community groups as well as the local Mirarr people, with approvals processes of the day facilitating mine development despite such opposition, a

[68] https://www.themonthly.com.au/december-2023-january-2024/essays/park-covenant

situation which may be different under any mine proposal pursued today. This community opposition also affected adjacent deposits, resulting in the minerals lease over the Jabiluka deposit being ceased in 2024. Whilst the Mirarr did object to this project; one cannot generalise such opposition across all peoples and all projects across Northern Australia. This does not justify a basis of outright banning of industry; but does highlight the importance of consulting with and empowering indigenous and local communities.

15.9.5. Rehabilitation of the Ranger project is currently underway under the direction of parent company Rio Tinto. As is the case with other historic project approvals, remedial action has been necessary to bring rehabilitation up to current standards. The remediation project is extensive, including filling in historic open cut pits, an activity not usually undertaken in minesite rehabilitation. The aims of the Ranger rehabilitation are challenging – with an aim to achieve such as standard that facilitates inclusion into Kakadu, a practical standard higher than previously attempted.

15.10. Queensland uranium mining history

15.10.1. Mary Kathleen remains the only major historical commercial uranium mine in Queensland, having operated in two distinct periods from 1956 before closing in 1982. It was mined in an open pit manner.



Figure 48 View of the old Mary Kathleen open pit

15.10.2. As was consistent with the practices of the time, when the mine initially opened in 1956; minimal approval conditions or thinking was included with respect to rehabilitation. However, on resumption of mining in 1976; approvals and investigations were undertaken, with a full Environmental Impact Study consistent with 1976 requirements completed.

15.10.3. During its operations phase, the Mary Kathleen townsite was a bustling place, home to around 1,000 residents and with a range of amenities. [69]

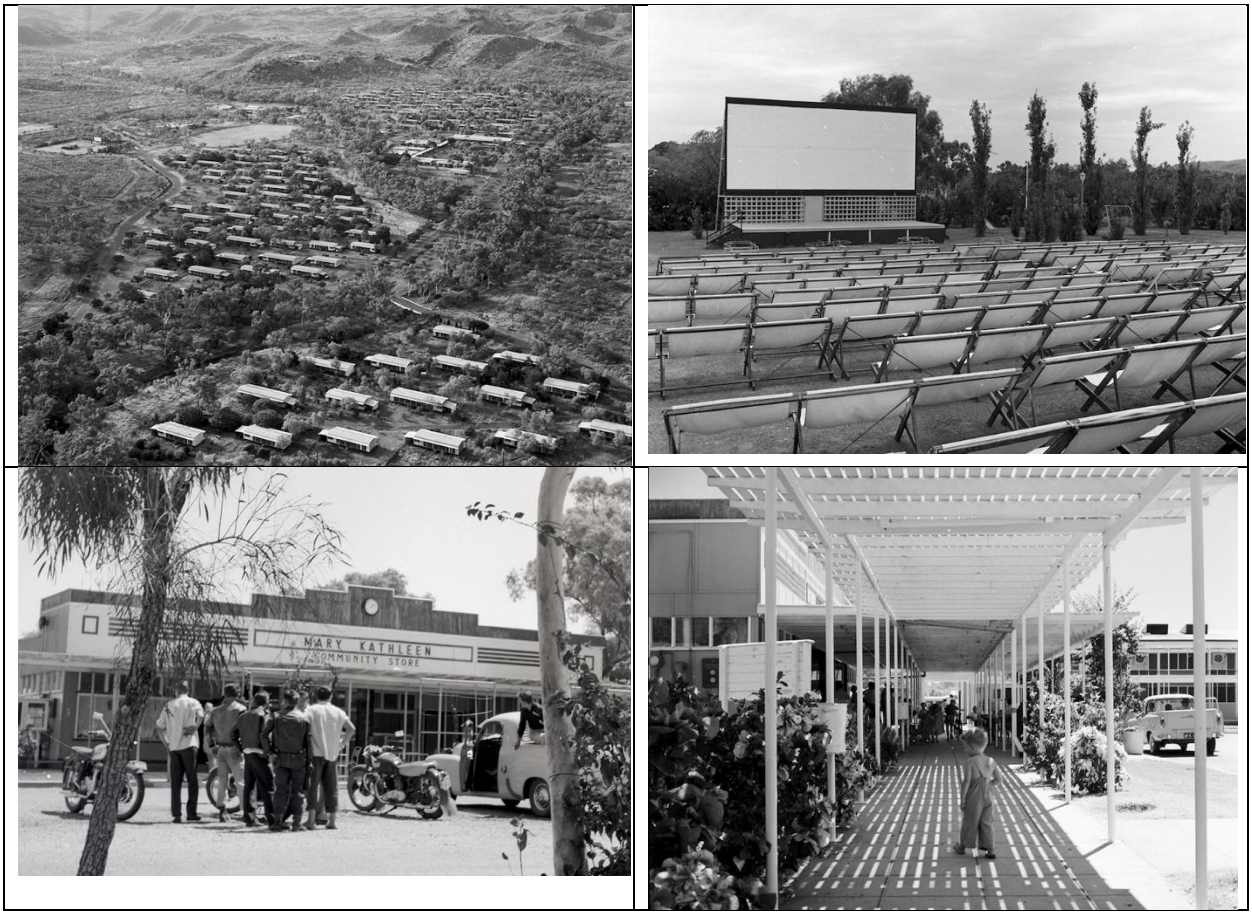


Figure 49 Photos of the Mary Kathleen townsite in its heyday

15.10.4. Upon closure, the Mary Kathleen mine and townsite was rehabilitated to what was considered a high standard for its time (winning an Institute of Engineers Australia award for it in 1986[70]) however with changes in technology and standards, remediation today of a mine would again arguably be undertaken to a higher standard.

15.10.5. Potential recommencement of operations at Mary Kathleen has been investigated, most likely in conjunction with other minerals (REEs), not as a uranium only operation. REE concentration in the tailings stockpile is reportedly high and provides potential for further extraction of value which could also provide economic support for further site remediation.

15.10.6. Further exploration and delineation of projects in other regions of QLD has occurred since yet through a combination of policy settings and prevailing low uranium pricing at the time, no additional projects have yet been developed.

[69] https://www.abc.net.au/news/2024-06-30/mary-kathleen-uranium-mining-town-queensland-nuclear-power/104028546
[70] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Former_Committees/uranium/report/c07

15.11. South Australia mining history

15.11.1. Large scale commercial uranium mining has been done safely in South Australia now for ~40 years. There is bipartisan support from both Labor and Liberal state political parties in South Australia for the industry; proving this does not need to be a political issue.

15.11.2. Further social licence has grown over time; with the industry facing community protest in its infancy but now being a strongly supported industry within the community. This proves that social licence can be built through strong community engagement, provision of accurate information, and world class safety performance.



Figure 50 Image of Honeymoon project showing plant in the background and ISR fields in the foreground

15.11.3. SA production is currently from three mines:

15.11.3.1. Olympic Dam, owned by BHP, underground mining (in conjunction with copper)

15.11.3.2. Beverley / Four Mile, ISR project, owned by Heathgate Resources (ultimately owned by US company General Atomics); and

15.11.3.3. Honeymoon, ISR project, operated by ASX listed BOSS Energy.

"Uranium mining in South Australia has bipartisan support – proving the industry does not need to be a political or election issue."

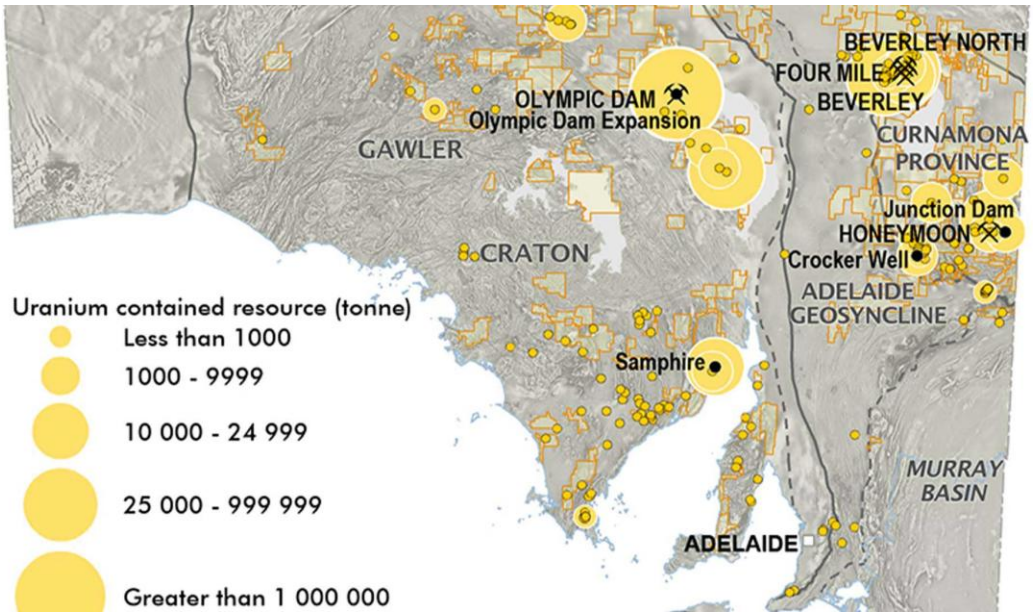


Figure 51 Uranium deposits and mines are throughout South Australia[71]

15.12. In Summary, uranium mining current status is:

15.12.1. Currently safely and sustainably mined in South Australia;

15.12.2. Able to be mined in the NT and there is a long history of commercial production (although there are no currently operating mines);

15.12.3. Legislatively banned in Queensland, although there is a past history of commercial production in that State;

15.12.4. Generally banned in WA although there is one approved project which was grandfathered in prior to the WA uranium mining ban (3 other projects had been approved but have not reached their substantial commencement obligations which means their approvals are in a grey area). No further mining approvals in WA is possible due to a ban – although exploration is allowed, (see Section 16 for specific discussion about WA).

15.12.5. Essentially banned across the rest of the States.

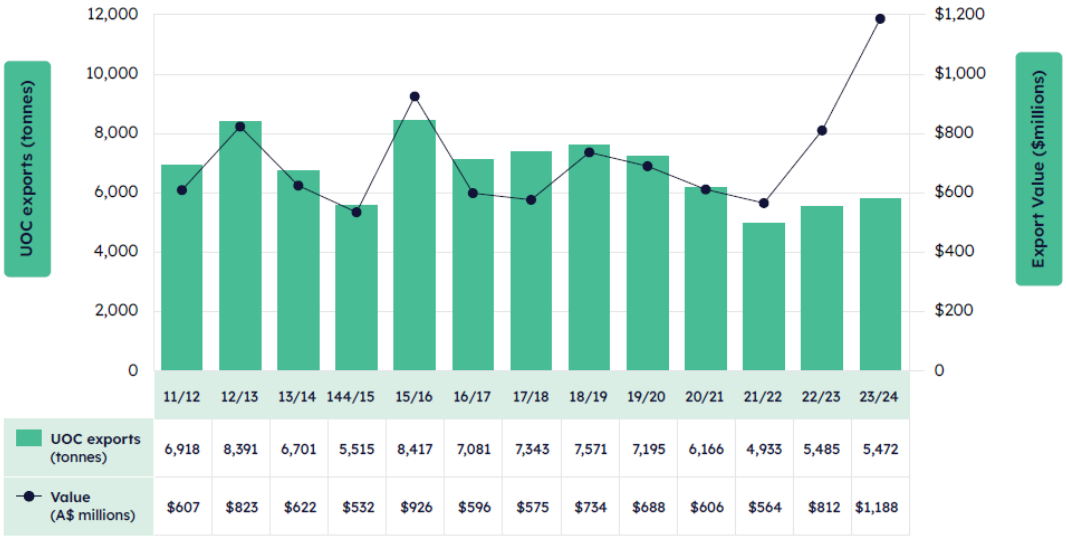
15.13. Australian production

15.13.1. Australia currently exports just over. 5,000t of uranium out of SA as yellowcake. ASNO has historically done a calculation showing the forgone carbon attributable to these exports, which would currently sit at approx. 200 million tonnes per annum[72]; an extraordinary proportion (c. 45%) of Australia's total carbon emissions of 440.2Mt CO2 according to the National Greenhouse Gas

[71] Source: https://www.energymining.sa.gov.au/industry/minerals-and-mining/mineral-commodities/uranium
[72] This is broadly consistent with the calculations of WNA mentioned in Section 17.6.2.

Inventory Quarterly Update: March 2025[73]. The estimate of carbon abatement is an estimate only and is based on the alternative of generation from fossil fuels (coal), as described in ASNO historic annual reports.

15.13.2. Australia's historic production is shown in the graph below. The decline in production from 2019 onwards was a result of the wind down from the Ranger mine in the NT, since that time Honeymoon in SA has restarted operations.



	11/12	12/13	13/14	144/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24
UOC exports (tonnes)	6,918	8,391	6,701	5,515	8,417	7,081	7,343	7,571	7,195	6,166	4,933	5,485	5,472
Value (A$ millions)	$607	$823	$622	$532	$926	$596	$575	$734	$688	$606	$564	$812	$1,188

Figure 52 Australian uranium exports over time[74]

15.13.3. Further summary statistics are provided below from ASNO. In 2023/24, ASNO estimates 193 TWh of emissions free electricity was produced from our uranium exports, which would be enough to cover ~69% of Australia's total generation of 280TWh for 2023/24[75].

Location	Material balance area
Total Australian UOC exports FY2023–24	5,742 tonnes
Value Australian UOC exports	$1.19 billion
Australian exports as percentage of world uranium requirements	8.5%
Power generated by these exports	193 TWh

Figure 53 Australian uranium exports statistic, 2023-24[76]

[73] https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-gas-inventory-quarterly-update-march-2025

[74] Source: ASNO 2024 Annual Report, p.25 https://www.dfat.gov.au/sites/default/files/asno-annual-report-2023-24.pdf

[75] https://www.energy.gov.au/energy-data/australian-energy-statistics/electricity-generation

[76] Source: ASNO 2024 Annual Report, p.25 as referenced above.

16. The history of uranium mining bans in WA and QLD

16.1. Western Australia ban history

16.1.1. Uranium mining has been banned and allowed in WA in various different times throughout history. Despite substantial periods of being legal; no commercial mining has occurred in WA due to historic commercial reasons. These commercial aspects are very different today and are projected to continue being commercially attractive in the long term due to fundamental demand and supply issues in the market discussed throughout this submission.

16.1.2. During the 1970s significant exploration for uranium occurred in WA, resulting in the discovery of the WA's main uranium deposits such as Yeelirrie, Manyingee (both of which are in the Northern Australia region), and Mulga Rock (which is further south). Government policy supported the industry, for example through the creation of the specific Yeelirrie State Agreement.

16.1.3. Exploration activity continued and certain pilot plant operations were conducted at Yeelirrie and at Manyginee:[77]

16.1.3.1. Yeelirrie; which was discovered in 1972 and was mined in 1980 to supply approximately 13,000 tonnes of uranium ore (average grade of 2,200 ppm U3O8) for metallurgical testing at the attendant Kalgoorlie Research Plant (KRP) (Laidlaw, 2006). The KRP was commissioned in 1980 and operated until the test work was completed in 1983 (Crouch, 2003; SKM, 2005)

16.1.3.2. Manyingee; located in the northern part of the Carnarvon Basin, where **pumping testing conducted in 1984 confirmed that the deposit was suitable for solution mining**. Subsequently an in-situ leaching test was carried out in 1985 for 5 months, producing about 470 kg of uranium concentrate before the tests were suspended (Bautin & Hallenstein, 1997). The uranium concentrate was reinjected into the wells, and the project was placed in care and maintenance.

[77] As discussed by Ralph M (2023), p.98



Figure 54 Plaque commemorating historic field leach trial at Manyingee, WA.

16.1.4. However, during this time, community opposition on a national level but also locally strengthened from the growing anti-nuclear movement that was a local reflection of a trend occurring around the world.

16.1.5. This strong community opposition resulted in the Federal "Three Mines Policy" in 1984; which transitioned into a "No New Mines" policy by the 1990s. The No New Mines policy was formally abandoned by the Howard government in 1996, which facilitated the development of the Beverley / 4 Mile and Honeymoon projects in South Australia.

16.1.6. In 2002, the WA Government under Premier Gallop banned uranium mining (Legislatively), and in 2008, newly elected Liberal Leader Colin Barnett repealed the ban. During the following period, increased exploration followed and four of the most advanced projects were granted approval to mine; with only the Mulga Rock project meeting the "substantial commencement" obligation before the approvals sunset date; given during the time the projects were required to make substantial commencement, market conditions were unfavourable and final investment decisions could not be justified. Conditions are clearly very different today and projected moving forward.

16.1.7. In 2017, newly elected Premier Mark McGowan effectively implemented a uranium ban again; although this was not enshrined in legislation but is simply an unlegislated policy of the WA Labor party that has been a continued part of the WA Labor policy platform. See Section 21.7.3.

16.2. Queensland ban history

16.2.1. As outlined in Section 15, Queensland has previously hosted commercial uranium mining operations at May Kathleen which ceased mining in 1982.

16.2.2. In 1989, the Queensland Government formally introduced a state-level ban on uranium mining, aligning Queensland with broader anti-nuclear sentiment prevalent at the time across the country.

16.2.3. Throughout the 1990s and early 2000s, Queensland's uranium ban remained in place despite. During this period, significant uranium resources were delineated in north-west Queensland, particularly near the Northern Territory border, but these resources could not progress beyond exploration due to the legislative prohibition.

16.2.4. The policy position shifted in March 2012, when the Queensland Government lifted the uranium mining ban as part of a broader resources policy reform agenda. The repeal recognised that uranium mining was already subject to stringent Commonwealth safeguards, international non-proliferation agreements, and environmental regulation, and that a state-level prohibition was no longer aligned with national export controls or contemporary regulatory practice. The removal of the ban reinstated uranium mining as a permissible activity under Queensland law, subject to the same regulatory approvals required for other minerals.

16.2.5. Despite the ban being lifted , no new projects were developed into production reflecting the poor prevailing market conditions which have been more fully explained in this Submission (but are now very much outdated).

16.2.6. Queensland reinstated a State level ban in 2015 as the new Palaszczuk Labor government came to power. Whilst Queensland now has a new LNP government lead by David Crisafulli, the ban on uranium in QLD has not yet been lifted.

16.3. So what has changed since the bans have been implemented?

16.3.1. Since the bans in QLD and WA were implemented; market conditions have fundamentally improved:

16.3.1.1. Nuclear renaissance growing in scale and recognition; now seen as a crucial part of delivering the global transition to net zero

16.3.1.2. Pricing has increased ~4X; meaning there are now no questions as to whether Australian uranium can be mined economically

16.3.1.3. Projected strong growth in demand is leading to forecasts of long term, high pricing

16.3.1.4. Community recognition of the importance of nuclear (globally) is growing (see Section 21.9 for a review of recent community polling);

and hence it makes sense to reconsider the appropriateness of the policies now.



Figure 55 Heritage surveys underway with Thalanyji partners prior to uranium drilling at Yanrey, 2024

17. The potential of the Northern Australia Uranium industry

17.1. How much Uranium has been defined so far in WA?

17.1.1. The most current information available on the Western Australian uranium industry as a whole from the WA Department of Mines comes from 2016[78], see Figure 56 below.

Uranium resources in Western Australia

Project name	Project owner	Resources (Mt)	Resources (ppm)	Contained U_3O_8 (Kt)	Contained U_3O_8 (Mlbs)
Yeelirrie	Cameco	36.6	1562	57.24	127.1
Mulga Rock	Vimy Resources	65.6	521	34.19	75.9
Kintyre	Cameco, Mitsubishi	5.3	5583	29.40	65.3
Lake Maitland	Toro Energy	27.4	665	18.22	40.4
Lake Way – Centipede	Toro Energy	30.0	551	16.52	36.7
Yanrey	Cauldron Energy	39.9	357	14.23	31.6
Manyingee	Paladin Energy	13.8	850	11.71	26.0
Oobagooma	Paladin Energy	8.3	1200	9.96	22.1
Ponton	Manhattan Corp.	26.0	300	7.80	17.3
Thatcher Soak	Magnis Res., Gold Road Res.	27.7	279	7.73	17.2
Nyang – Carley Bore	Paladin Energy	22.8	313	7.14	15.9
Nowthanna – Lake Quinns	Toro Energy, Padbury Mining, Australian Vanadium	15.0	405	6.02	13.4
Hillview	P R Gianni	27.6	174	4.80	10.7
Dawson – Hinkler Well	Toro Energy	13.6	315	4.29	9.5
Windimurra	Am-Australian Minerals Expl.	19.0	180	3.42	7.6
Theseus	Toro Energy	6.3	493	3.11	6.9
Anketell	Energy Metals	16.3	167	2.72	6.0
Lake Raeside – Mopoke Well	Energy Metals	10.1	175	1.77	3.9
Lake Mason	Energy Metals	9.1	185	1.68	3.7
Yilgarn – Avon JV	Crucible Resources	6.2	237	1.47	3.3
Wondinong	Zeedam Enterprises, Rio Tinto	6.6	190	1.25	2.8
Lakeside – Lake Austin	Energy Metals	2.7	350	0.96	2.1
Angelo River	S A Macdonald	0.6	1240	0.80	1.8
Jailor Bore	R C Cooper	1.4	500	0.72	1.6
Yuinmery	B R Legendre	1.6	370	0.59	1.3
Yinnietharra – Minindi Creek	South Coast Minerals	3.5	123	0.43	1.0
Turee Creek	Fortescue Metals Group	1.1	350	0.37	0.8
Murchison Downs	No current owner	0.3	633	0.19	0.4
Cummins Range	Navigator Resources	0.7	273	0.19	0.4
Yarrabubba – Cogla Downs	Minex (West)	0.2	630	0.10	0.2
Bellah Bore East	No current owner	0.4	210	0.07	0.2
Lake Way South	Australia Salt Lake Potash	0.2	244	0.05	0.1
Note: Some resource estimates are historic and predate JORC		**445.9**		**249.14**	**553.2**

Figure 56 Major Western Australian uranium resources defined as at 2016
(Colour delineates geological type. Blue – surficial (calcrete hosted), red = sandstone hosted (roll-front and / or tabular, green -= carbonatite hosted and orange – vein type associated with unconformity)

[78] https://geodocsget.dmirs.wa.gov.au/api/GeoDocsGet?filekey=cb86e777-274f-4cf2-b039-fd49829de3aa-4f6ktaorgbxo3dzvl1ckqzssvymmqbqj7bmnskqa

17.1.2. Note this information is now slightly outdated, for example Cauldron Energy's Yanrey project now totals 42M lb in JORC, up from 31.6M lb. This is because post the implementation of the WA Uranium mining ban in 2017, the Department stopped updating the public information on the WA industry and its potential.

17.2. How much uranium has been defined so far in Queensland?

17.2.1. The Queensland uranium data is less diverse than in WA; with major deposits outlined below in Figure *57*.

Project / Deposit	Location	Owner / Reporter	Reporting Code	Resource Category	Contained U_3O_8	Notes
Mount Isa Uranium Project (incl. Valhalla system)	North-west Queensland	Paladin Energy Ltd	**JORC Code (2012)**	Measured + Indicated	**106.1 Mlb** (≈ **48,100 t**)	JORC-compliant Mineral Resource reported by Paladin for the Mount Isa project (Valhalla and associated deposits).
				Inferred	**42.2 Mlb** (≈ **19,100 t**)	As above; reported separately as Inferred.
Westmoreland Uranium Project	North-west Queensland (near NT border)	Laramide Resources Ltd	**JORC Code (2012)**	Indicated	**48.1 Mlb** (≈ **21,800 t**)	Reported at a 200 ppm U_3O_8 cut-off; includes Redtree, Huarabagoo, Junnagunna and Long Pocket deposits.
				Inferred	**17.7 Mlb** (≈ **8,000 t**)	Combined Indicated + Inferred ≈ **65.8 Mlb U_3O_8**.
Ben Lomond Uranium–Molybdenum Project	North-east Queensland (near Townsville)	Paladin Energy Ltd	**NI 43-101 (Canada)**	Indicated	**~8.1 Mlb** (≈ **3,675 t**)	**Not a JORC Mineral Resource**; included for completeness only.

				Inferred	**~2.8 Mlb** (≈ **1,270 t**)	Would require re-estimation by a JORC Competent Person to be reported under JORC.

Figure 57 Queensland uranium resource (source: Web searches)

17.3. How much uranium has been defined in the Northern Territory?

17.3.1. The NT government publishes comprehensive data on the existing uranium resources defined in the Territory as outlined below in Figure 58[79]

17.3.2. These deposits occur in two broad groupings – in the north of the NT (centred on the Alligators River region) and in the south, around the Ngalia basin. There are also significant uranium occurrences in the basal southern McArthur Basin and underlying basement of the Murphy Province, close to the Westmoreland uranium deposit which occurs in adjacent regions of Queensland.

17.3.3. The Aileron Province, Warramunga Province and Tanami Region contain known uranium prospects and locally uranium-enriched granites. These provinces and overlying basins and palaeochannels represent greenfields uranium exploration targets.

Region	Name	Resource	Company
Aileron Province	Napperby	9.5 Mt @ 0.038% U_3O_8	Core Lithium Ltd
Amadeus Basin	Angela	10.7 Mt @ 0.13% U_3O_8	Elevate Uranium Ltd
Murphy Province	Eva	0.54 Mt @ 0.12% U_3O_8	UAU Pty Ltd
Ngalia Basin	Cappers	22 Mt @ 0.015% U_3O_8	Energy Metals Ltd
Ngalia Basin	Malawiri	0.42 Mt @ 0.13% U_3O_8	Energy Metals Ltd
Ngalia Basin	Walbiri	10.98 Mt @ 0.064% U_3O_8	Energy Metals Ltd
Pine Creek Orogen	Thunderball	1.05 Mt @ 0.08% U_3O_8	Patronus Resources Ltd
Pine Creek Orogen	Tin Camp Creek	0.94 Mt @ 0.31% U_3O_8	Alligator Energy Ltd
Pine Creek Orogen	Cleo	6.8 Mt @ 0.035% U_3O_8	Kingsland Minerals Ltd

Figure 58 NT current uranium resources

17.4. What is the Exploration Potential for further discovery in Northern Australia?

17.4.1. Northern Australia has significant exploration potential for uranium as can be shown in the below chart which shows uranium mineralisation intercepted in publicly available drill hole data.

[79] https://resourcingtheterritory.nt.gov.au/minerals/mineral-commodities/uranium

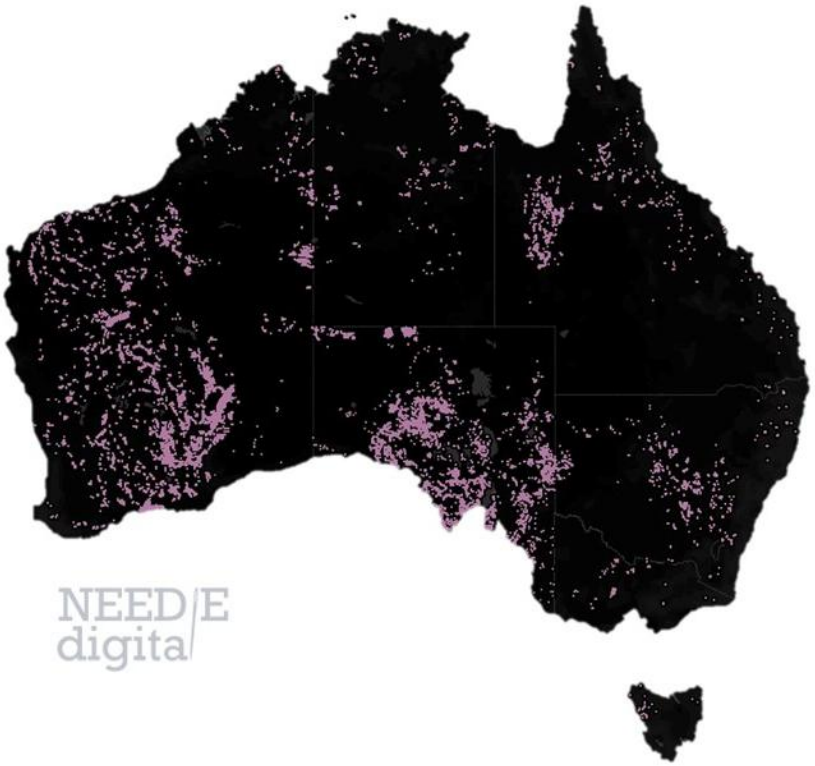


Figure 59 Uranium occurrences in historic drill hole data in Australia[80]

17.4.2. As was discussed previously in Section 11.9, the global uranium industry has suffered from underinvestment due to historical persistent low uranium pricing driven by the Megatons to Megawatts programme (a result of the collapse of the Soviet Union) and market discontinuities relating to Fukushima in 2011. However, the period of low market pricing is now well and truly over, and with significant market shortages projected in the long term and hence higher pricing, once again uranium exploration is economic and is now desperately needed to fill the pipeline for the next generation of mines.

17.4.3. This low level of uranium exploration was exacerbated in QLD and WA; because in addition to these global headwinds, the uranium mining bans implemented in 2015 and 2017 respectively acted to further reduce interest in exploration in the State. Thankfully, the market is once again interested in supporting the investment into exploration in the jurisdictions, making a cautious bet that logic will prevail and the bans will be overturned.

17.4.4. Ahead of future policy change; Cauldron Energy has already been active in WA with large drill campaigns occurring in 2024 and 2025 and further follow up campaign planned for 2026. Exploration activity and hence economic activity includes general site works, passive seismic, laboratory work and of course drilling and downhole logging. Companies with projects in Queensland, such as Laramide Resources, continue to progress their flagship project, the world class Westmoreland Project.

[80] Source: Ahmad Saleem from Needle Digital

17.4.5. Should policy change in WA or legislative change occur in QLD (or more correctly as momentum towards policy change becomes more clear), it would be expected for exploration activity in for uranium to significantly increase; providing immediate economic benefits across various parts of Northern Australia including:

17.4.5.1. Heritage clearance work

17.4.5.2. Site accommodation and servicing

17.4.5.3. Drilling services

17.4.5.4. Laboratory work

17.4.5.5. Geological planning, interpretation and analysis

17.4.5.6. Radiation safety

17.4.5.7. Increased investor interest and M&A in the sector.

17.5. How much uranium could Western Australia alone produce?

17.5.1. Data in this section is constrained to Western Australia, as specific independent modelling was recently done by CCIWA on this issue. The rest of Northern Australia could additionally contribute significant volumes of production (for example on the basis of significant potential production coming from large scale projects at Westmoreland and Valhalla; but this has not as yet been quantified.

17.5.2. WA already holds significant resources from a global perspective and could be a SUBSTANTIAL producer of uranium.

17.5.3. Currently, Western Australia's resources would rank it as the 8th largest in the world according to OECD / NEA Redbook data if it were considered an independent jurisdiction.

Rank	Country	Uranium Resources (t U)	Share of World (%)
1	Australia AU	1,684,000	~28%
2	Kazakhstan KZ	815,000	~14%
3	Canada CA	588,000	~10%
4	Russia RU	486,000	~8%
5	Namibia NA	449,000	~7%
6	South Africa ZA	320,000	~5%
7	Niger NE	311,000	~5%
WESTERN AUSTRALIA WOULD FIT IN HERE			
8	Brazil BR	276,000	~5%
9	Uzbekistan UZ	132,000	~2%
10	USA US	104,000	~2%
—	Rest of world	~450,000	~8%

Figure 60 Global Uranium resources and notional Western Australian position[81]

17.5.4. Additionally, based on the prevalence of uranium in previous historic drill holes (see Figure *59*), WA is expected to have substantial upside on its current

[81] Source: OECD NEA Redbook and CCIWA report

resources with new exploration.

17.5.5. In terms of potential production, the Chamber of Commerce and Industry WA (CCIWA) produced a report that estimated WA could produce 10,800 tonnes per annum (or approx. 24M lb), which would make WA the 2nd largest global producing jurisdiction based on current production levels (see Figure 61 below – noting however that during the time WA could ramp up to these levels, other countries would also be expected to increase their production to help meet the expected global shortfall). As future exploration delivers results, the maximum potential of WA's exploration could grow further. Given that the world is going to need a potential future TRIPLING of uranium to feed the future global nuclear fleet, substantial new producers will be required in addition to other sources of uranium such as recycling of used fuel – known as reprocessing.

Rank	Country / Jurisdiction	Uranium Production (t U)
1	**Kazakhstan**	**21,227**
	WESTERN AUSTRALIA COULD FIT IN HERE	
2	**Canada**	**7,351**
3	**Namibia**	**5,613**
4	**Australia**	**4,553**
5	**Uzbekistan** (est.)	**3,300**
6	**Russia**	**2,508**
7	**Niger**	**2,020**
8	**China** (est.)	**1,700**
9	**India** (est.)	**600**
10	**South Africa** (est.)	**200**

Figure 61 Global Uranium production and notional potential WA position[82]

17.6. How material could WA uranium production be for decarbonisation?

17.6.1. Export of uranium is the HIGHEST IMPACT activity WA can do to help the world decarbonise. According to the WNA, every 22 tonnes of uranium (26 t U3O8) used saves the emission of one million tonnes of CO2 relative to coal.[83]

17.6.2. Based on that WNA calculation, by exporting uranium, WA could offset multiples more than our entire State carbon emissions, with estimated WA annual CO_2 emissions of 89.4Mt[84] and CO_2 mitigation from CCIWA modelled uranium scenario (representing 10,800t per annum U as per CCIWA report) estimated at 415.3Mt.[85]

Whilst specific production forecasts may differ

[82] Source: OECD NEA Redbook CCIWA report
[83] https://world-nuclear.org/information-library/country-profiles/countries-a-f/australia
[84] Latest available data for WA from 2022-23 as per https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-2023/state-and-territory-greenhouse-gas-inventories-annual-emissions
[85] Source: CCIWA report production numbers from p.5 of their report, assumption of every 22 tonnes of uranium (26 t U3O8) used saves the emission of one million tonnes of CO2 relative to coal as per WNA referenced in footnote 83 above.

between sources, the impact of exporting uranium is larger than any other activity under consideration in Northern Australia for helping the world decarbonise.

17.6.3. In fact, in combination with production out of South Australia and Western Australia; on this metric the uranium export industry could offset more than Australia's national carbon inventory – estimated as 440.2Mt. [86] On one way of looking at it – Australia could hit Net Zero if this type of offset was recognised! Production from Queensland would obviously add to these figures.

17.6.4. If we are serious about global decarbonisation and doing our part to help the globe, exporting more uranium could have a greater impact on the global transition to net zero than decarbonising our own grid.

17.6.5. This is a concept that WA Premier Roger Cook has used to justify exporting further gas from WA to our major trading partners (ie India, Indonesia, China). He has argued that if we sell them more gas, they will burn less coal; which is good for global decarbonisation even if WA's own emissions might go up in the process. This was previously discussed in Section 4.

17.6.6. If we export uranium – and we can do that with very low emissions, uranium for coal substitution has a much greater reduction in emissions than gas for coal substitution; the relative carbon displacement of nuclear and gas demonstrated in the graphic below from carboncredits.com.[87]

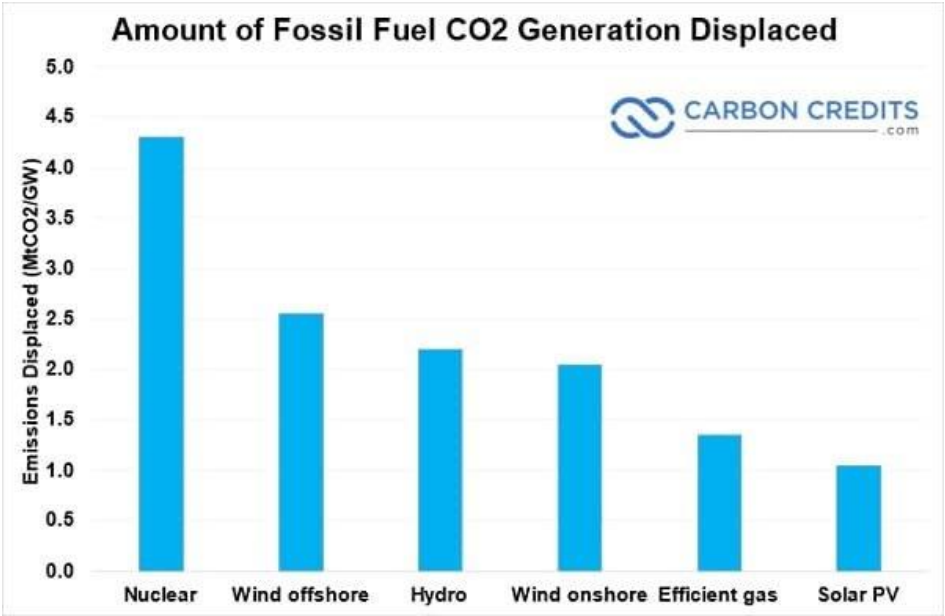


Figure 62 Amount of fossil CO2 displaced per generation type

[86] https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-gas-inventory-quarterly-update-march-2025
[87] https://carboncredits.com/no-net-zero-without-uranium-heres-why/

18. The major benefits to Northern Australia of overturning uranium mining bans in WA and QLD

18.1. Uranium mining can still occur in a part of Northern Australia - the NT - at the moment, and there is some active exploration work underway although no projects there are close to production. The most advanced project in the NT would have been the Jabiluka project, however due to the 2024 decision, this project has effectively been discontinued.

18.1.1. The impact of the Jabiluka decision was not only removing the largest uranium project in the NT; it also demonstrated sovereign risk as companies consider whether to spend exploration dollars and invest in the NT; worried that any expenditure they undertake may ultimately be worthless if similar circumstances applied to them.

18.1.2. In prior discussions, the NT Government has been at pains to point out they welcomed uranium exploration (and future potential development) in the region; but they accepted they had work to do to win back the trust and support of mining industry participants.

18.1.3. This highlights a careful balance – of certainly respecting communities views; but also of being an attractive place to do business.

18.2. Overturning uranium bans in WA and QLD would be expected to significantly increase activity in Northern Australia, bringing an array of advanced projects that are closer to development, and substantial exploration sites into play. Uranium mining could bring a broad range of benefits to Northern Australia including:

18.2.1. Diversification of government royalty revenue away from iron ore; especially important given the impending production commencement at Simandou (Guinea) and expectation that over time, iron ore pricing will fall substantially. The recent disagreement between BHP and China on iron ore pricing[88] highlights the importance of diversifying state revenue.

18.2.2. New mining jobs to replace those jobs that have been lost in other sectors such as nickel, lithium and iron ore, all of which have shed many thousands of jobs and many are continuing to do so. Commodities are inherently cyclical, so diversification of commodities ensures more stable aggregate employment over time.

18.2.3. By exporting significant volumes of green energy in the form of uranium; Northern Australia can be a responsible actor on the global stage and play its role in the global decarbonisation trend.

18.2.4. Natural support between uranium mining in Northern WA and the WA AUKUS industrial base in Southern WA.

18.2.5. The CCIWA released a report last year suggesting the impact of the WA uranium

[88] https://www.bloomberg.com/news/articles/2025-09-30/china-bans-all-bhp-iron-ore-cargoes-as-pricing-dispute-deepens

industry could be >$1bn per year and 9,000 jobs.

18.2.6. Indirect economic multiplier and community benefits as well.

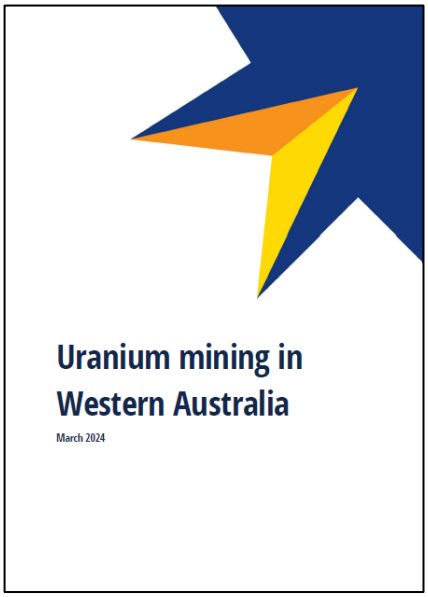


Figure 63 CCIWA Uranium Mining in WA Report, March 2024[89]

18.2.7. As discussed above in Section 17.4.5, the most immediate impact in the regions would likely be a significant increase in exploration expenditure in Northern WA and Northern Queensland, where companies would have confidence that they could monetise any discoveries they make, leading to increases in heritage work, laboratory work, site services, drilling services and other exploration related expenditures.

18.3. Northern Australia has a strong history of attracting international investment interest from global leaders, and as the ban is lifted; further interest from international uranium players is expected; and in fact there are already signs this is happening as policy change becomes more likely.

18.3.1. Cameco

[89] https://cciwa.com/policy-submission/uranium-mining-in-western-australia/

18.3.1.1. Cameco, the Western world's largest uranium producer, is already a major player in WA Uranium, having purchased the Kintyre project for US$495M[90] in 2008 and the Yeelirree Project for US$430M[91] in 2012 (an aggregate investment of over A$1bn in total in those projects incl JV partner interest.) Both of these are in Northern Australia.



Figure 64 Cameco's Kintyre project site, WA

18.3.2. Navoiyuran

18.3.2.1. Navoiyuran, the national uranium company of Uzbekistan, is the world's 5th largest uranium producer and the 2nd largest ISR producer behind Kazatomprom.

18.3.2.2. Indeed Navoiyuran has a longer and more diverse history of ISR than any other company; having been responsible for commercialising the ISR mining technique and continuing to be a world leader in R&D.

18.3.2.3. Navoiyuran has agreements globally with industry leaders such as Orano, Cameco, CNNC, Maruebeni, WMC and JOGMEC.

18.3.2.4. Navoiyuran has recently signed an agreement with Cauldron Energy which may seem them deploying their world leading ISR knowledge and experience to further the development of the Yanrey ISR Uranium project in Western Australia, once policy change allows.[92] Again, this is in Northern Australia.

18.3.3. Orano coming back into Australia

[90] Approx exchange rate of 0.78 in July 2008, totalling ~A$630M. Note acquisition was initially 70% Cameco and 30% Mitsubishi; with Cameco moving to 100% ownership in 2018.
[91] Approx exchange rate of 1.04 in August 2012; totalling ~A$$410M.
[92] See https://yourir.info/resources/24fa3f0ca3538252/announcements/cxu.asx/6A1283306/CXU_NON-BINDING_MOU_WITH_LEADING_URANIUM_PRODUCER.pdf



18.3.3.1. Orano is the French global leader across the nuclear fuel chain, and a major uranium explorer and producer. Its current operations are in Kazakhstan and Canada, with exploration in Canada and Uzbekistan.

18.3.3.2. Orano (or under its previous name COGEMA or other subsidiaries such as AFMCO) has substantial previous experience in WA and more broadly within Australia.

18.3.3.3. Total Mining Australia, a subsidiary of COGEMA, was responsible for the discovery of the Manyingee uranium project in WA in 1974 and Ben Lomond in Queensland in 1975.

18.3.3.4. The Company also discovered the Oobagooma deposit (located in Yampi Sound, WA in 1981.

18.3.3.5. Following a period of inactivity, the Company returned to activity in Australia in the 1990s in the Northern Territory with the acquisition of the Koongarra deposit as well as farm in arrangements in West Arnham land and it also partnered with Mitsubishi during the 2010s for exploration work across Australia.[93]

18.3.3.6. Following on from the Government of Niger's decision to expel Orano from operations within the country[94]; Orano has re-established an operating subsidiary in Australia in 2025 (Orano Mining Australia Pty Ltd) with a view to once again becoming more active in the Australian uranium sector. Orano is a major supplier of uranium to the French nuclear industry amongst others; and the removal of the Niger uranium source has ignited concern across western utilities about sovereign risk and the future supply of western aligned uranium.

[93] https://www.world-nuclear-news.org/articles/areva%2C-mitsubishi-explore-australia-together
[94] https://www.mining.com/web/niger-junta-seizes-french-nuclear-giant-oranos-uranium-mine/

19. An introduction to ISR uranium mining

19.1. Northern WA is blessed with a number of different uranium resource geologies across the State as outlined below in Figure 65. As can be seen from the map, many of the uranium occurrences occur in the north of the State, in the region defined as Northern Australia.

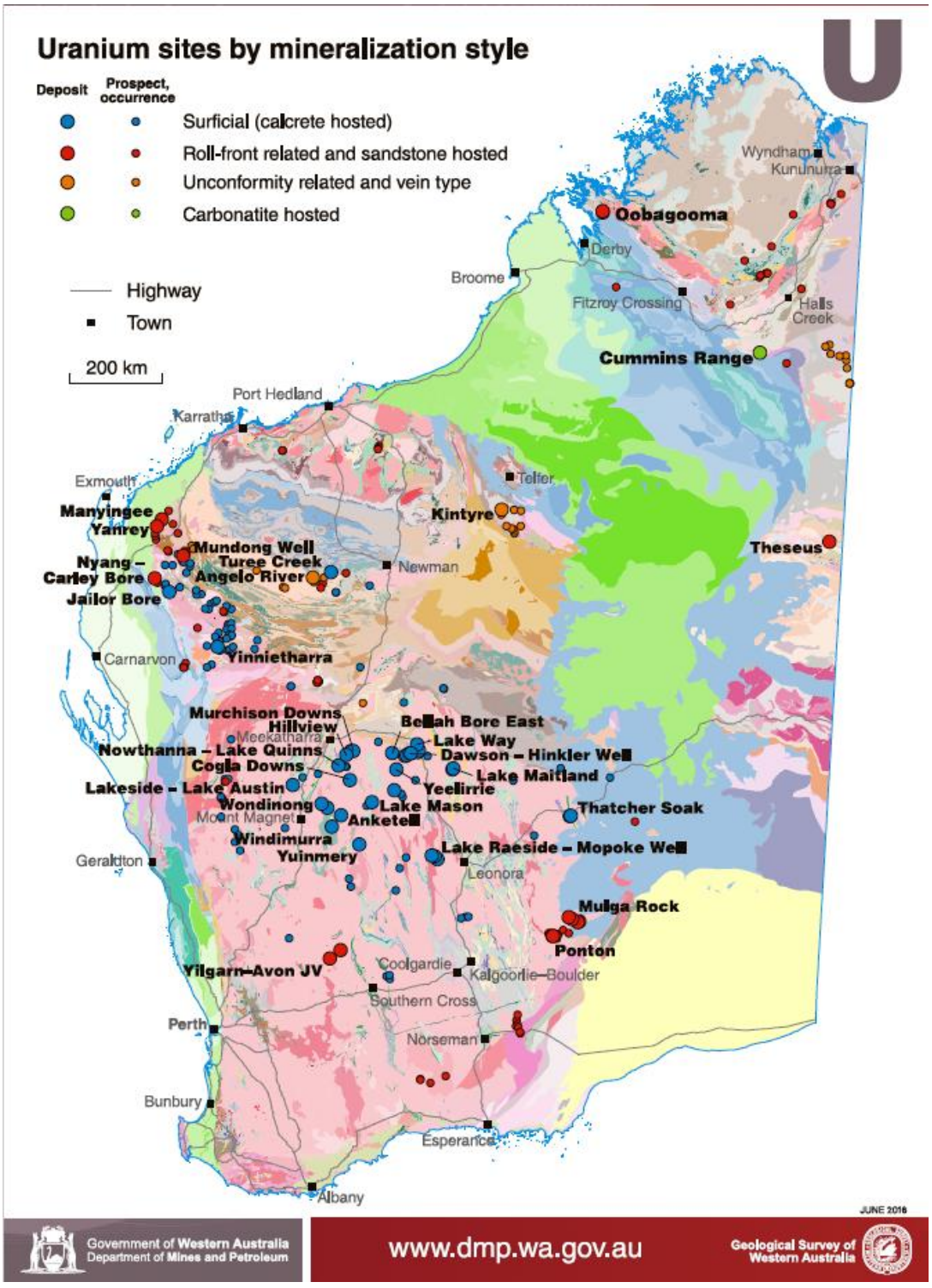


Figure 65 WA distribution of known uranium deposits, by type.

19.2. These deposits may facilitate different mining or recovery methods; including traditional mining (underground or open cut) as well as In Situ Recovery (ISR).

19.3. Traditional mining is obviously well understood across Northern Australia, so no further information needs to be provided here on that option.

19.4. That said, it is worth noting that factors such as high rainfall / wet environments in various parts of Northern Australia may make certain mining activities more difficult, however there are many arid regions of Northern Australia that are more amenable. (Just because there were issues at Ranger with respect to water management doesn't mean this would occur in other, vastly more arid regions like various areas in Northern Western Australia.)

19.5. Further information is provided below on ISR; given there are currently no ISR mines operational in Northern Australia. There are two operational ISR uranium mines currently operating in South Australia (Honeymoon and Beverley / Four Mile); with significant information being made available on ISR by the South Australian Department for Energy and Mining.[95]



Figure 66 A view of the Four Mile wellfields in South Australia (General Atomics)

19.6. Contribution of ISR to global uranium industry

19.6.1. The contribution of ISR to global uranium production has increased from <20% in ~2000, to >50% today.

Method	%
In situ Recovery (ISR)	52%
Underground & open pit	44%
By-product	4%

[95] https://www.energymining.sa.gov.au/industry/minerals-and-mining/mining/major-projects-and-mining-activities/in-situ-recovery-ISR-mining

Figure 67 ISR production by mining method, 2024[96]

19.6.2. ISR operations occur across multiple jurisdictions including Kazakhstan, Australia, the USA and Uzbekistan.

19.6.3. Major drivers of the growth of ISR is that it is lower cost (and therefore, sustainable in lower uranium pricing scenarios such as those that existed in the last decades; and its lower environmental footprint.

19.7. So what is ISR?

19.7.1. ISR uses fluid to recover valuable minerals from the ground without digging and moving tonnes of earth in the same way that you would at an open cut or underground mine.

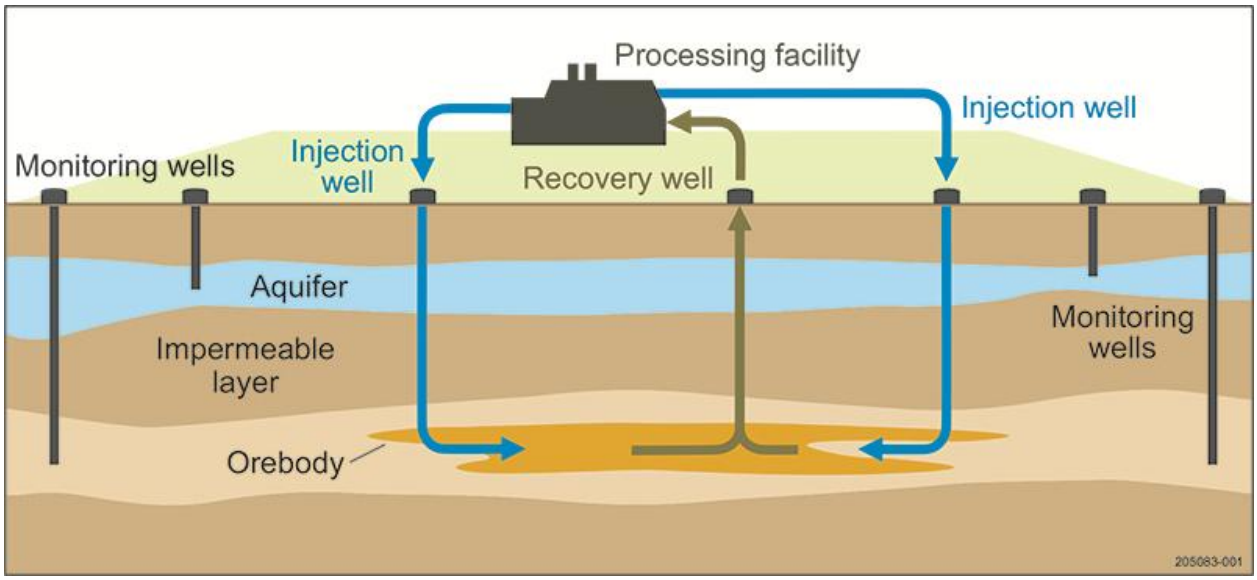


Figure 68 Conceptual ISR diagram

19.7.2. Instead, the ISR mining process involves pumping lixiviant (mining solution) underground to mobilise valuable minerals from the geology that hosts them. The fluid, which is a mix of water and chemicals added to accelerate the mining process, is then pumped to the surface for the minerals to be recovered for sale.

19.7.3. ISR can only be undertaken when natural aspects of the deposit ensure that uranium can be recovered and that no leakage can occur to surrounding areas.

[96] https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production

19.8. Benefits of ISR

19.8.1. Lower environmental impacts

19.8.1.1. Because in situ recovery mining involves the circulation of fluid rather than the movement of rock, there is very little surface disturbance or generation of noise, dust or vibration that can be associated with open cut or underground mining.

19.8.1.2. Once mining operations cease, wellfields can be rehabilitated to natural state with no remaining workings / pits visible.



Figure 69 View of ISR well field at Honeymoon project, South Australia

19.8.2. More financially sustainable

19.8.2.1. Given there is no requirement to physically move rock; the physical costs of rock movement; and rock crushing are not incurred.

19.8.2.2. This leads to less mine fleet capex (yellow fleet), less capital (no need for expensive crushers) and as a result; lower energy requirements (crushing rock is energy intensive).

19.8.2.3. This generally means lower upfront capex than traditional mines, whilst keeping opex competitive, leading to superior IRRs; as can be seen from the Cauldron Scoping Study summary in Figure 82 on page 104.

19.8.2.4. So this lower capex / opex or ISR is despite the fact that ISR grades tend to be much lower than conventionally mined projects. For example, the head grade at a high grade conventional mine (such as Cameco's Cigar Lake in Canada), might be up to 20% U (average

grade of reserves is approx. 16%[97]), or reported differently that might be up to 200,000 parts per million (ppm). Whereas typical ISR uranium grades in ground may be between 300-1000ppm. So that is a factor of many of hundreds of times less concentration in the ore. This can reduce certain risks associated with exposure levels during the mining process.

19.9. Issues to be managed with ISR

19.9.1. A number of factors also need to be evaluated when considering ISR as a mining method.

19.9.2. Given the leaching is happening underground; operationally this is more difficult than controlling recovery conditions in, for example, a tank.

19.9.3. This can be controlled by ensuring adequate knowledge of the underground ore body, which would likely result in a tighter drill spacing than for a traditional mining operation. It is also important to have experienced ISR operators; who are in relatively short supply in WA but may be available internationally. (See Section 18.3.2 for a brief description of world leading ISR company Navoiyuran and their interest in Western Australia.)

19.9.4. The potential dosage exposure pathway is also different for ISR. Risks from dust inhalation are substantially reduced (given no traditional mining or crushing), however other exposure pathways such as radon in the pregnant liquor must be considered. These issues are effectively managed through the Radiation Safety Management Plan and in accordance with Australia's ISR Best Practice guidelines (see Section 19.11).

19.10. Despite its many benefits, not all deposits are amenable to ISR. ISR mining is appropriate in situations where:

19.10.1. Water can move freely through the geology which hosts the minerals

19.10.2. Those minerals are readily mobilised into solution and can be moved using water and other reagents

19.10.3. The minerals can be recovered from that solution

19.10.4. The solution can be contained and strictly controlled in the local environment

19.10.5. The process can be managed without unacceptable damage to the environment

19.10.6. The overall process can be undertaken economically.

[97] https://en.wikipedia.org/wiki/Cigar_Lake_mine

19.11. The South Australian and Commonwealth governments have been regulating in situ recovery mining operations since the late 1990s and are a leading contributor to global regulatory practice for the development, operation and closure of in situ recovery mining operations. This is summarised in the Australian Federal Government publication "Australia's In Situ Recovery Best Practice Guide: Groundwaters, Residues and Radiation Protection" published by Australian Government Department of Resources, Energy and Tourism, Geoscience Australia, and Department of the Environment, Water, Heritage and the Arts.

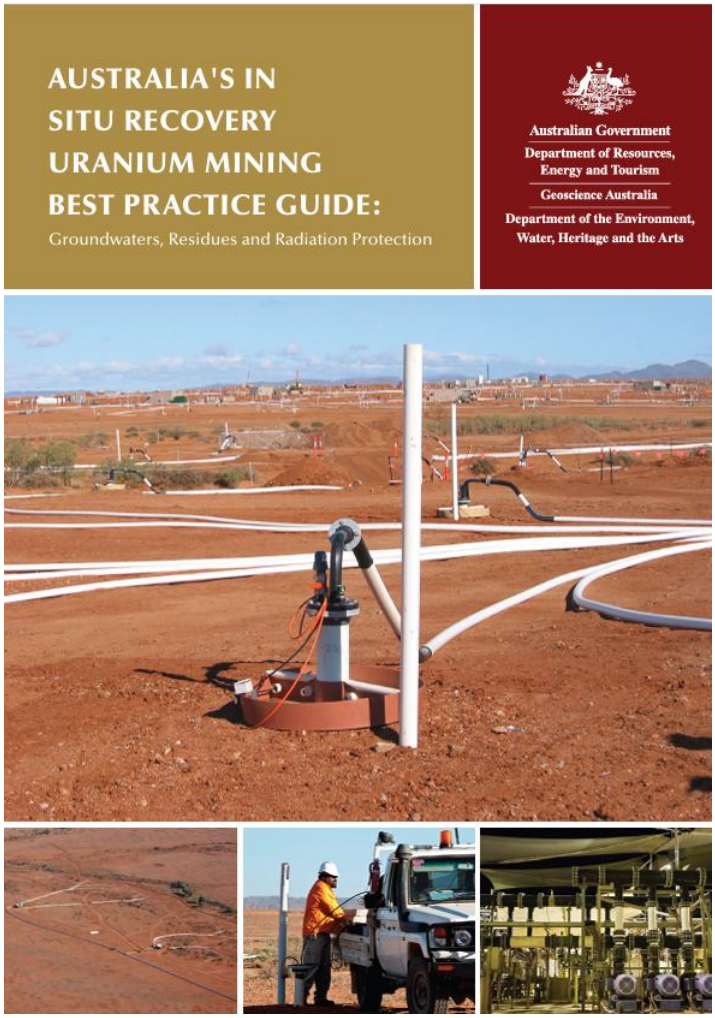


Figure 70 Australia's best practice ISR regulations[98]

19.12. This confirms that, whilst there are no operating ISR mines in Western Australia, the regulation of these projects is well developed and the safety is well understood.

19.13. Indeed WA regulators have previously attended the Beverley ISR Uranium mine in South Australia (operated by General Atomics) in ~2010 to gain a better understanding of the ISR uranium process, a photo of the site visit provided below in Figure 71.

[98] https://d28rz98at9flks.cloudfront.net/70503/70503.pdf



Figure 71 WA regulators visiting Beverley ISR Uranium Mine, SA, 2010

19.14. ISR recovery is well suited to be a major mining method to be undertaken by a future WA uranium mining industry; providing the lowest possible environmental footprint for uranium operations. Suitability for ISR in Queensland is yet to be fully assessed.



Figure 72 An ISR processing plant (Beverley, SA). Relatively compact and low impact.

19.15. ISR technology is still being refined, with improvements being made globally. See Section 20.5 for a discussion of R&D opportunities and benefits for ISR mining.

20. Opportunities for Research and Development

20.1. The support for and development of a uranium mining industry in Northern Australia presents a substantial opportunity to support nationally significant research and development (R&D) projects and outcomes.

20.2. Beyond the direct economic and employment benefits associated with mining for export activity, uranium mining has the potential to catalyse innovation across mining, processing, environmental management, and advanced energy technologies, improving the sustainability and competitiveness of the resources sector whilst also diversifying our industry.

20.3. A number of specific potential areas of opportunity are discussed below.

20.4. Research into modular Uranium Processing plants

20.4.1. One of the most significant R&D opportunities arising from uranium mining in relates to the development of alternative processing technologies suited to remote smaller operations. Conventional uranium processing typically requires large, centralised facilities with substantial capital investment, which can limit the economic viability of smaller or satellite deposits, leaving them stranded.

20.4.2. Modular, mobile, technologies could materially improve project economics by reducing capital intensity, lowering transport requirements, enabling staged development as well as making previously small, uneconomic deposits attractive.

20.4.3. Such innovations would allow a broader range of uranium deposits to be developed responsibly, while minimising surface disturbance and infrastructure requirements.

20.4.4. Activity in this area is gaining interest internationally, with a demonstration plant recently commissioned by Rosatom and JSC Dalur.[99] This involves packaging a mobile plant in shipping container like structures facilitating rapid deployment.

20.4.5. Cauldron is already active in this area; developing research projects and development concepts which could fundamentally change the way uranium is processed globally; whilst providing a competitive advantage for its Yanrey project in WA.

20.4.6. Outcomes from this research could have application beyond uranium, supporting innovation across Australia's wider minerals sector.

20.5. Advancement of In-Situ Recovery (ISR) Technologies

20.5.1. ISR is already discussed above in Section 19, and is actively deployed in South

[99] https://world-nuclear-news.org/articles/first-mobile-sorption-unit-launched-by-rosatom

Australia. WA has several projects (Cauldron Energy Yanrey Project, Paladin Manyingee asset which are intended to be developed through ISR).

20.5.2. While ISR is a well-established mining method internationally, and already recognised as a much lower environmental footprint than traditional mining methods, there remains scope to improve the technology and environmental outcomes further, with further research into leaching chemistry, aquifer management, and recovery efficiency, particularly under Australian environmental and regulatory conditions. Some of this work is already underway at the SA ISR operations of Boss Energy and Heathgate Resources.

20.5.3. Research into alternative lixiviants, including neutral or near-neutral solutions such as modified groundwater or carbonate-based systems, may reduce reliance on acidic reagents (ie, lower reagent usage which would save money) and lower environmental risk profiles. Currently, a major constraint on development model is the source of reagent (usually sulfuric acid); replacement with carbon dioxide / oxygen based systems could be a significant improvement. This technology is currently being researched in China[100] and will be investigated for deployment in Northern Australia.

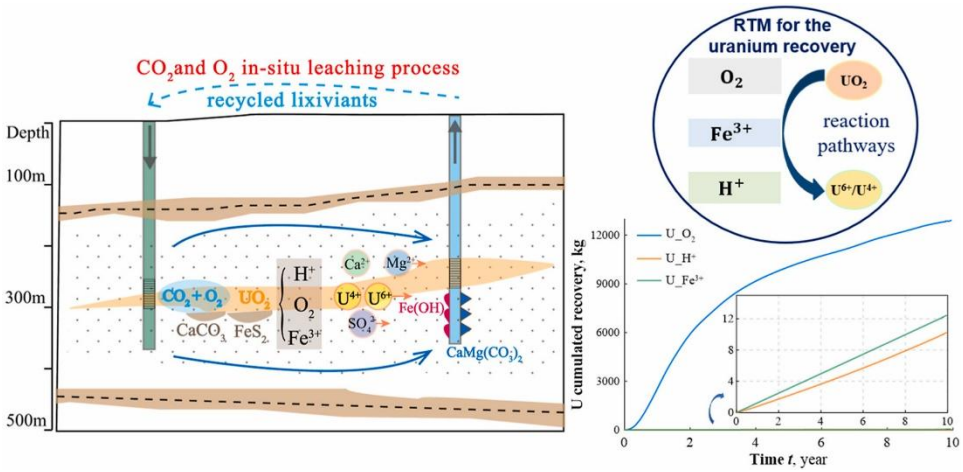


Figure 73 Alternative ISR technology concept.

20.5.4. Additional R&D into real-time monitoring, hydrogeological modelling, and adaptive control systems would strengthen environmental assurance and regulatory oversight while improving operational performance.

20.5.5. Cauldron Energy has signed an initial MOU with Uzbekistan National Company Navoiuyran, who have expertise in ISR, having pioneered the technology globally decades ago.

20.6. Research into Thorium

20.6.1. The establishment of a uranium mining industry in Northern Australia would also support research into the potential future, long term utilisation of thorium.

[100] https://www.sciencedirect.com/science/article/abs/pii/S0883292722003262

Australia holds significant thorium resources.

20.6.2. Thorium is increasingly discussed in the context of advanced nuclear reactor designs and long-term energy security, with first pilot plant demonstrations occurring especially in China and India.

20.6.3. While commercial deployment of thorium-based fuel cycles remains under development globally and is likely still a long way off, early-stage research into extraction, processing, and materials handling would build domestic expertise and optionality. Such research would position Australia to engage meaningfully in future international nuclear technology developments and support long-term strategic planning. Many learnings can be applied across the fuel sources especially when it comes to regulatory, radioactive controls and handling, etc.

20.6.4. Even if a future thorium industry develops, the world will still need uranium for many decades to come

20.7. Opportunities down the value chain – enrichment, medical

20.7.1. Exporting natural uranium in its unenriched form (Yellowcake) is a natural first step.

20.7.2. However, there are other opportunities down the value chain in the fuel fabrication cycle which could be considered, even if Australia continues on its current course of not progressing civilian nuclear energy.

20.7.3. Australia already boasts a number of companies with next generation, world leading enrichment technology, including Silex Systems and Ubaryon Pty Ltd.

20.7.4. Much is often said about Australia doing far too little processing onshore. Enrichment provides an incredible opportunity –given there is an enormous shortfall in enrichment capacity globally. This would, however, require removal of a statutory ban on enrichment that is enshrined in s140A of the EPBC Act (similar to how the ban on civilian nuclear generation is enacted).

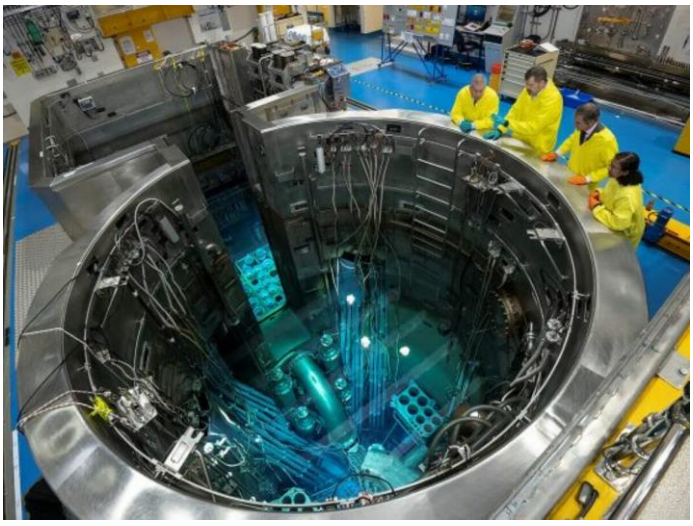


Figure 74 The OPAL reactor at ANSTO, a world leader in R&D.

20.7.5. Its worth noting that Australia is already a global leader in the production of medical isotopes and research and development using uranium derived compounds. This competence is centered at ANSTO in Sydney, see ansto.gov.au/products/nuclear-medicine.

20.8. Environmental Management, Rehabilitation, and Closure Science

20.8.1. Uranium mining in Northern Australia would facilitate continued advancement in environmental management and mine closure science.

20.8.2. Targeted R&D in groundwater protection, radiological monitoring technologies, passive rehabilitation systems, and post-closure land use would improve environmental outcomes and strengthen community confidence.

20.8.3. These innovations would also be transferable to other mining and industrial activities, delivering broader public benefit.

20.8.4.



Figure 75 Rehabilitation and vegetation regrowth on the Jabiluka mine site from 2006 to 2018[101]

[101] https://www.dcceew.gov.au/science-research/supervising-scientist/ranger-mine/closure-rehabilitation

21. Critique of justifications for keeping Uranium mining bans in place

21.1. Whilst varied across different groups and jurisdictions, certain Western Australian anti-uranium groups provide helpful summaries of their justifications for keeping uranium bans in place which are equally applicable to Queensland too, revolving around the assertions that uranium mining is unwanted, unsafe, and uneconomic.



Figure 76 Web articles calling for the continuation of the uranium mining ban and justifications

(Images from https://www.ccwa.org.au/uranium_is_unwanted_unsafe_and_uneconomic and https://nuclearfreewa.com/uranium-is-unwanted-unsafe-and-uneconomic/.

21.2. This section of the Submission therefore interrogates those claims and shows that they are plain wrong, or just outdated.

21.3. Safety concerns about the broader nuclear generation industry

21.3.1. One argument to keep uranium bans in place is that certain parts of the community are not comfortable with the safety of the nuclear industry itself, and therefore are not prepared to support the mining of the fuel source; even if the nuclear generation does not occur in Australia.

21.3.2. These concerns have been built up over many years; and largely based on concerns related to old / outdated / early examples of nuclear technology (such as Chornobyl[102]). The industry has made significant gains in the development of the technology, with passive safety features of all advanced reactors and indeed been retrofitted to existing reactors. By the numbers, Nuclear is recognised amongst the safest electricity generation technologies available.

[102] Note the spelling Chornobyl is the Ukrainian transliteration, reflecting the local language, while Chernobyl is the Russian transliteration. Following the invasion of Ukraine by Russia, there has been a renewed focus on using the correct Ukrainian translation instead of the Russian version to show support for Ukrainian sovereignty. Hence, across different sources, both terms are currently used.

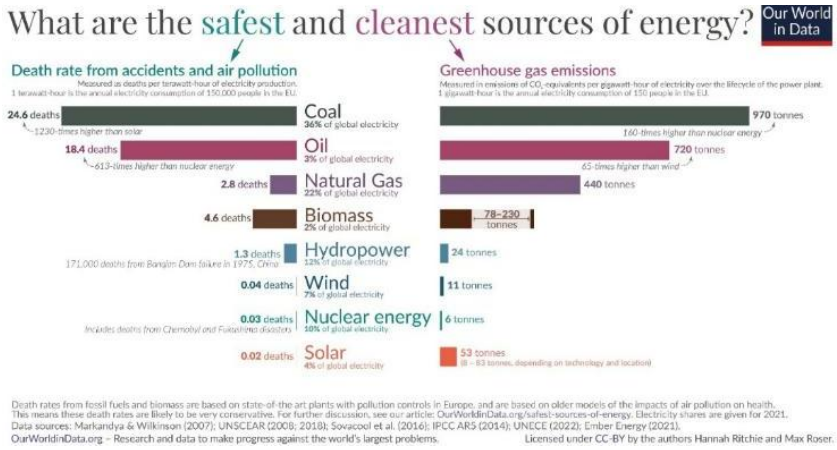


Figure 77 Safety statistics of various generation technologies

21.3.3. There has been demonstrated improvements over the last decade in broader community support for nuclear energy globally; in line with improvements in technology, and the understanding of the importance of using nuclear energy to help the globe decarbonise.[103]

21.3.4. As has previously been noted in this Submission, Nuclear Energy is now recognised by global expert bodies such as the United Nations Panel on Climate Change, that nuclear energy is critical in helping the world achieve its decarbonisation objectives. See Section 8.

21.3.5. Hence, it seems logical that this concern no longer justifies a continued ban on mining the fuel source for clean, green, nuclear energy.

21.4. Non proliferation concerns over the nuclear industry

21.4.1. One misconception held by some members of the community is that there is an inextricable link between civilian nuclear energy and nuclear weapons, and because of that belief, some believe we should not mine uranium.

21.4.2. The graph below shows that this is not the case. Most countries active in the global nuclear industry have only civilian nuclear programmes, a small number have civilian and military programmes and only a couple have nuclear weapons without civilian programmes. Clearly, the mere presence of a civilian programme does not mean a dark march down towards nuclear weapons!

[103] https://world-nuclear.org/information-library/current-and-future-generation/nuclear-energy-and-public-opinion#:~:text=Nuclear%20Energy%20and%20Public%20Opinion%20*%20Opinion,polling%20data%20does%20not%20necessarily%20support%20this.

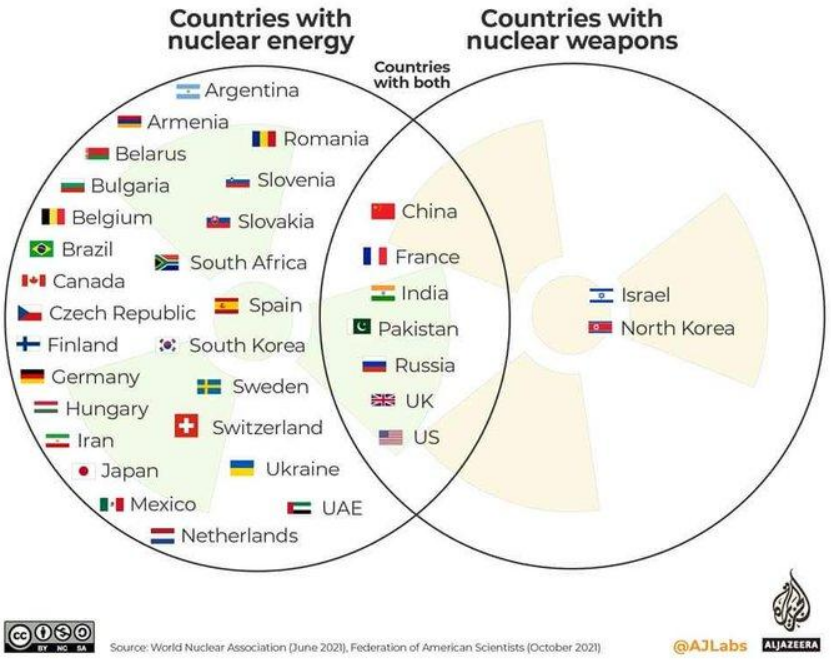


Figure 78 Civilian and military nuclear countries

21.4.3. That said, Australia takes its non proliferation obligations extremely seriously, and we are known as the global gold standard when it comes to how we manage and track our Australian Obligated Nuclear Material (AONM). Australia's non proliferation and safeguards regulator it known as ASNO.

21.4.4. Australian uranium can only be used for peaceful purposes; and to ensure that Australia puts in place bilateral arrangements with each customer country to ensure compliance. Material is tracked and audited from cradle to grave to ensure all material is accounted for.

21.4.5. Australia's uranium export policy can be found here:

https://www.dfat.gov.au/international-relations/security/non-proliferation-disarmament-arms-control/policies-agreements-treaties/australias-uranium-export-policy

21.5. Suggestion that uranium mining can't be done safely

21.5.1. The contention that uranium mining cannot be done safely in Australia, one of the world's premier mining jurisdictions, does not stack up.

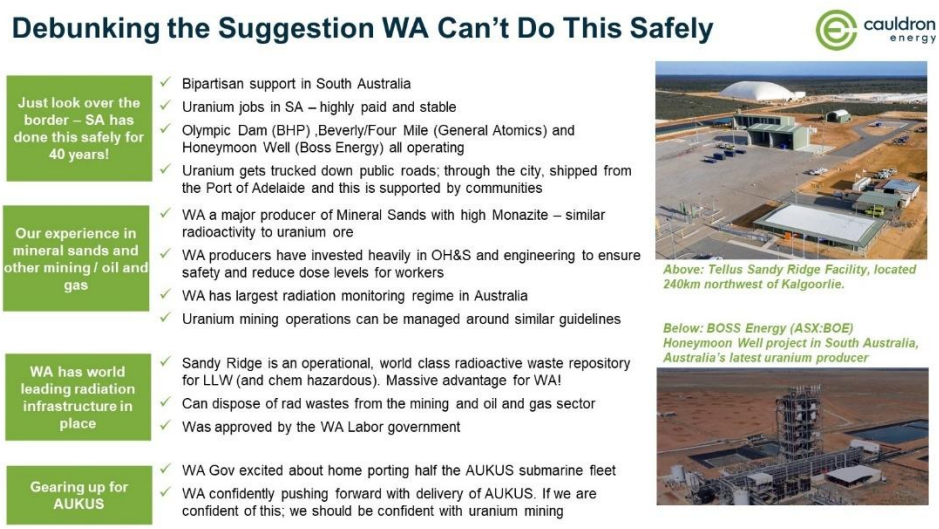


Figure 79 Arguments suggesting WA can't mine safely don't add up

21.5.2. Mining has been done safely in South Australia for ~40 years; just as it has been done in other top tier jurisdictions around the world (such as Canada and the US) who have similarly high levels of regulations. Whilst mining also does occur in lower OH&S regulated jurisdictions (such as Africa), its nonsense to think that mining in Western Australia or Queensland would reflect experience from those less well regulated places. In fact, the market would prefer more uranium from higher ESG jurisdiction; which provides a natural advantage for Australian jurisdictions.

21.5.3. Figure 80 below provides a demonstration of how mining and export occurs safely in South Australia, day in, day out.



Figure 80 How uranium is safely mined and exported in South Australia

21.5.4. Key points to note from the graphic:

21.5.4.1. Uranium is produced in SA in both conventional mining and ISR mining. This is similar to what would be proposed for WA; with a mix of conventional and ISR projects possible. (See Section 19 for further details on ISR). Queensland would be expected to be more conventionally based, with ISR yet to be progressed in the jurisdiction.

21.5.4.2. Raw uranium is processed into yellowcake (U3O8) which is only approx. 0.72% U235. The product is not enriched, meaning the level of radioactivity is actually relatively low. Note at this stage of inspection, relatively minimal PPE is required. See Section 21.10 for discussion around learnings specifically from the WA mineral sands industry (where WA mineral sands are more radioactive than sands from the East coast, for example).

21.5.4.3. Product is secured in standard shipping containers, which is then driven down public highways, through the streets of Adelaide and out to the container port. Whilst in early days of the uranium industry in South Australia there were some levels of protest activity, that is basically non existent now – the industry has proved its safety, and gained its social licence.

21.5.4.4. The material is then loaded on to a standard container vessel and shipped to customers.

21.5.4.5. Note when Uranium was produced in the NT at Ranger, uranium was exported through the port of Darwin, but also railed down and exported through the Port of Adelaide due to cost benefits of container handling there. Further, WA projects would also be able to containerise and inland transport it to Adelaide for export; a specific WA export terminal is not required.

21.5.5. WA has a world leading mining legal structure (the WA Mining Act) which is considered the gold standard the world over. In fact, Kazakhstan, the worlds largest uranium mining jurisdiction; has just implemented a new mining law based on the WA System and the WA DEMIRS even consulted on its implementation. The WA system can handle uranium. As can Queensland, and the NT system already facilitates it although currently no commercial activity is currently undertaken there.

21.5.6. WA already handles significant radiation through the mineral sands sector (WA minerals sands are heavy in monazite – much more so than mineral sands from Queensland, for example) and also from rare earths; and therefore has the largest radiation monitoring programme in Australia that can be expanded to include the uranium sector.

21.5.7. Further, Australian radiation safety regulations today are recognised as among the most comprehensive and most stringent in the world.[104] The full Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing is available for download from ARPANSA website.[105] Compliance is strictly monitored and enforced.

21.6. We doesn't have the capability to handle radiation

21.6.1. Both the Northern Territory and Queensland already have long histories of successfully mining uranium at commercial scale; although do not currently do so.

21.6.2. Despite never mining uranium at commercial scale and notwithstanding the current uranium ban; WA already is a national leader in the handling of radiation for 2 established and 1 emerging reasons:

21.6.2.1. WA has the largest mineral sands mining operations in the country; and those sands are often radioactive. Further it has an established rare earths industry. WA has made great progress in dealing with the risks of handling radiation and those lessons learned can easily be applied to a uranium industry. See Section 21.10.

21.6.2.2. WA already has a low level radioactive waste repository in operation, the Sandy Ridge facility owned by Tellus Holdings Ltd. This is a truly world class facility; and ensures low level radioactive wastes from across a range of different industries ‑ from mining, oil & gas, waste2energy, hospitals and defence can all be safely isolated. This facility is able to take low level radioactive wastes from across Australia. See Section 23.2.

21.6.3. Lessons learned from the development of Sandy Ridge are significant and could

[104] https://world-nuclear.org/information-library/safety-and-security/radiation-and-health/occupational-safety-in-uranium-mining
[105] https://www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series/codes-and-standards/rps9

be applied to the broader uranium industry in the manner in which social licence in WA was gained for this project.

21.6.3.1. There was a comprehensive community consultation programme run.

21.6.3.2. Indigenous Land Use Agreement (ILUA) was executed with the traditional owners.

21.6.3.3. The Sandy Ridge site met appropriate IAEA Site survey and selection criteria for relevant installations.

21.6.3.4. Full radiation safety case was developed; and gold standard peer reviewed (by Eden Environment, the company that developed the safety case for the UK national repository).

21.6.3.5. Many tried to tell the Company they would never get such a facility approved by the government or by the community ‑both were achieved; relatively expeditiously.

21.6.3.6. The facility is an enabler for future growth for WA and more broadly for Australia ‑ given that this critical infrastructure already exists; it can encourage additional new heavy industry into the State; knowing that the incredibly difficult and contentious issue of waste management is already sorted out.

21.6.4. Uranium mining does not produce higher level wastes; it would only produce low level wastes. If these wastes are not able to be managed on site (they are allowed to be managed on site in the minerals sands sector) then such wastes could easily be sent to Tellus.

21.6.5. In addition to SA, WA will be home to one of the largest concentrations of radiation capable workforces due to the establishment and growth of AUKUS; with thousands of long term jobs earmarked for Perth's southern corridor. This will greatly increase the size of the radiation qualified workforce in Perth which could logically be used to support other industries such as uranium mining in the North of Western Australia.

21.7. Uranium mining is uneconomic at today's market pricing

21.7.1. A further argument used to justify the ban is that uranium mining is not economic. [106]

21.7.2. Like many of the arguments against the nuclear industry, there may have been some historical truth to this contention however **this is certainly not true today** nor likely to be true into the future.

21.7.3. One of the clever strategic moves when implementing the ban in 2017 by Premier McGowan is that the ban was implemented when there was no real

[106] https://thewest.com.au/business/mining/very-wrong-explorer-cauldron-energy-arcs-up-over-wa-premier-roger-cooks-uranium-price-remarks--c-13964661

economic cost to it. Due to low uranium pricing at the time, no mines would move forward to operation. See Figure 33 earlier in this submission for a graph showing longer term historical low uranium pricing and Figure 81 below for a price chart since the WA ban has been in place.

21.7.4. The uranium mining ban in WA was enacted on 20 June 2017.[107] At this time, the spot price of uranium was approximately $20 (some slight variations exist depending on which index is used). As of the time of writing this report, the spot price is above $80, more than 4x higher than when the ban was in place. (See Figure 81 below).

21.7.5. As described elsewhere in this submission; the fundamental demand and supply aspects of the nuclear industry have moved substantially, with sustained higher prices forecast now for the long term.

21.7.6. At today's pricing, and at forecast future pricing, mining is very much economic in WA (subject to obvious case by case project factors). I would welcome to make further submissions on the economics of mining uranium should that be of interest.



Figure 81 Uranium price chart since 2016[108]

21.7.7. Evidence supporting the fact that mining is economic at today's pricing is the Scoping Study released by Cauldron; summarised in Figure 82 below.

[107] https://www.wa.gov.au/government/media-statements/McGowan%20Labor%20Government/McGowan-Government-announces-uranium-policy-20170620
[108] Source: Trading Economics 3 September 2025



Figure 82 Yanrey Stage 1 Scoping Study summary economics[109]

21.7.8. The Scoping Study assumes zero government financial support or subsidy is provided. The only government action required is to allow the project to proceed.

21.7.9. These financial metrics, whilst at Scoping Study level and subject to further refinement during further feasibility, suggest robust economics and stack up extremely well against other investment opportunities.

21.7.10. For comparison, current spot market conditions are slightly more attractive than the case assumed in this study, with >$80 spot price and ~$0.66 AUD:USD exchange rate as at 2 October 2025.

21.7.11. These economics are for Cauldron's project only; but other Uranium companies such as Toro Energy (ASX:TOE) and Deep Yellow Mulga Rock (ASX:DYL) and Cameco have scoping studies for their projects also; which show attractive economics at current market conditions. In Queensland, Laramide Resources has previously released a Preliminary Economic Assessment (PEA) on their Westmoreland Project showing strong economics.

21.7.12. At current market prices, if the industry were allowed to proceed, financial benefits would be flowing through the region; with the most immediate benefits being in the form of an expect Exploration industry boom as more advanced players proceed towards construction and operation.

21.8. There is already one project fully approved to proceed in WA so why change the policy if that one isn't currently proceeding

21.8.1. The Deep Yellow Limited owned Mulga Rock project is the only one of the four projects previously approved in WA that met a substantial commencement obligation and can hence still push forward with construction. Notably, that project is NOT in Northern Australia.

21.8.2. The major reason the other projects did not proceed was due to prevailing low uranium pricing during the period; a situation which is certainly now not the case.

[109] https://yourir.info/resources/24fa3f0ca3538252/announcements/cxu.asx/6A1186316/CXU_Bennet_Well_Scoping_Study.pdf

21.8.3. Regardless of current market conditions; the Mulga Rock project has not been moving swiftly through the construction phase. This is a decision for Deep Yellow itself, which is first focusing its finite management and financial resources on the development of its project in Namibia, where there is a long track record of uranium production from a highly supportive government environment.

21.8.4. Whether DYL has higher priority investment opportunities within its portfolio should have no impact on whether other projects should proceed in WA or QLD, or used in any way to justify continued industry wide bans, and is certainly not a reflection of whether other projects are economically viable or not.

21.9. Uranium mining lacks community support (ie its"unwanted")

21.9.1. Another argument put forward to retain uranium bans is that the broader community wants the bans to be continued. Again, whilst historically community views may have been broadly against the nuclear and uranium industry, recent polling suggests broad community support for the mining and export of uranium

21.9.2. As outlined previously in Section 5 its important to separate out the issues of building nuclear reactors in Australia, from the issue of whether we should mine and export uranium to help the world decarbonise. This submission focuses on Uranium for Export only.

21.9.3. WA specific, independent (ie, conducted by a third party, professional organisation) polling has been conducted twice in the last couple of years.

21.9.4. Firstly, polling (which was commissioned by the Minerals Council of Australia but undertaken by a third party poling group) conducted in 2023 showed majority support from the WA public to remove the ban on uranium mining.[110]

[110] https://thewest.com.au/business/mining/minerals-council-push-to-lift-wa-uranium-ban-as-surprise-poll-reveals-voter-support-for-contentious-move-c-11935899

21.9.4.1. A survey of 866 Western Australians, conducted for the lobby group by pollster Insightfully, found 49 per cent supported uranium mining in the State compared to just 16 per cent who were opposed.

21.9.4.2. The remaining 35 per cent were "neutral" on the issue or didn't have a position.

21.9.4.3. Half of the respondents said they would support the "further development" of uranium mining in the State, compared to 18 per cent opposed.

21.9.4.4. Coalition voters were the most likely group to support uranium mining; but additionally a majority of Labor voters (51 per cent) also supported it.

21.9.4.5. This demonstrates that uranium mining policy does not have to be partisan; and its possible to achieve bipartisan support as has been achieved in South Australia.

21.9.5. Then in February 2025 the Association of Mining and Exploration Companies (AMEC) exploration released the results of another independent poll, consisting of 806 respondents aged 18+, from across metropolitan and regional WA. [111]

21.9.5.1. In response to the question 'Would you like to see the current ban on uranium mining, implemented in 2017 in WA, lifted?' - 57 per cent of respondents answered 'Yes'. This figure is up from a previous industry poll in 2023 that had 49 per cent support.

21.9.5.2. When respondents were asked 'Do you support uranium mining as a way of reducing the world's carbon emissions?' - 58 per cent said 'Yes', with only 15 per cent having little or no support for it.

21.9.5.3. Another question that formed part of the poll was 'Did you know that uranium has been mined safely in Australia for over 50 years?' Answering 'Yes' were 54 per cent of West Australians. With 46 per cent of respondents answering 'No' and showing they were unaware that uranium mining has been happening safely in Australia for over 50 years, it points to the need for further education in Western Australia. Too often, the history of uranium mining in Australia is pointed towards the negative aspects of prior early operations at Ranger, and very little is mentioned of the positive aspects of the industry in South Australia.

21.9.6. Since these polls have been conducted; I have been very active in community and am confident that support for uranium mining has continued to grow.

21.9.7. Further the community is increasingly understanding the difference between

[111] https://amec.org.au/wp-content/uploads/2025/02/08.-Right-time-for-U-turn-on-uranium-mining-in-Western-Australia.pdf

uranium mining (state ban) and nuclear energy (Federal ban), and hence its possible to overturn for example the uranium mining ban in the short term and allow that industry to flourish, whilst the federal nuclear ban remains in place. That said, further work and education is needed to ensure the community broadly and fully understands this important difference.

21.9.8. The support for uranium mining in WA makes common sense. The WA community is one of the most mining-literate communities in the world – the State's prosperity is driven off it, it's the reason we enjoy such high standards of living. Mining underwrites businesses and employment, it funds government to build infrastructure and support for the industry creates strong bonds throughout our community. Furthermore, the significant benefits that a diversified commodity can bring to the community resonate. (see Section 18).

21.9.9. Contrary to assertions, recent polling suggests uranium mining is not unwanted. Northern Australia can and should become a uranium mining export powerhouse even if Australia does not build its own reactors.

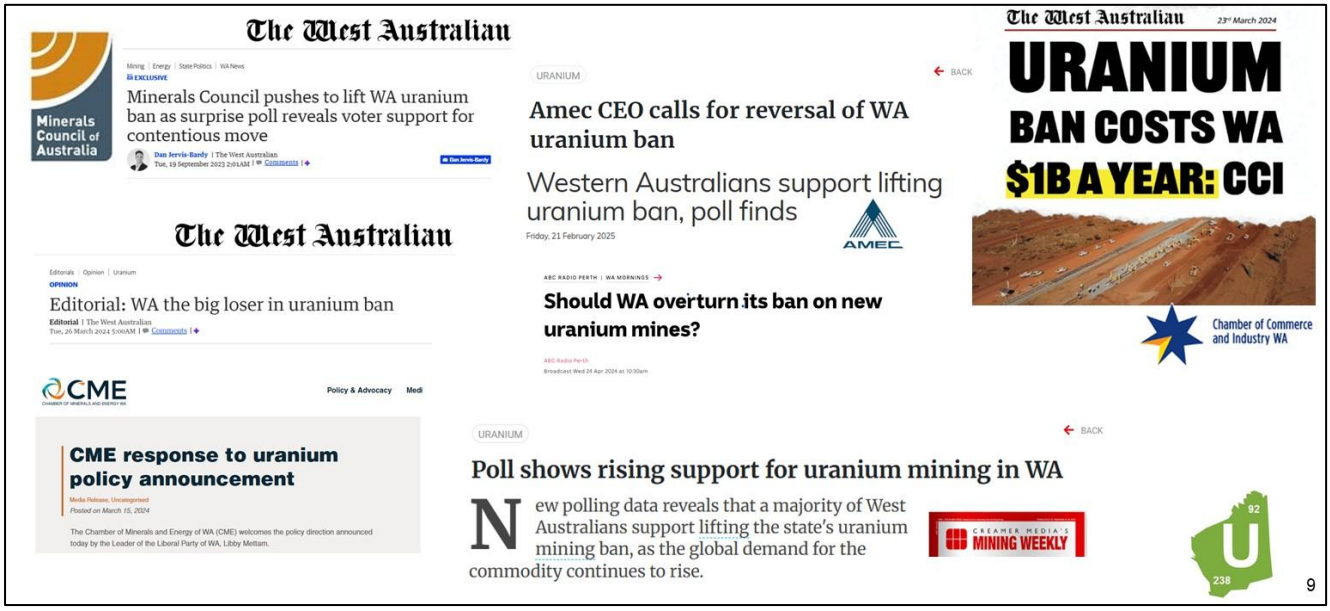


Figure 83 Selection of media headlines indicating broad support for removing the ban

21.10. Indigenous concerns are insurmountable and inconsistent with a future uranium mining industry

21.10.1. As was discussed earlier in the report, past environmental and approvals practices in the mining industry, have at times created negative impacts on land and also created negative impacts for indigenous Australians. Whilst an issue across commodities, this impact has been especially present in many of the prior uranium developments, for example Rum Jungle, and Ranger in the NT. This must be recognised.

21.10.2. Combined with these past practices, and whilst a totally separate issue to uranium mining, historic nuclear weapons testing also had a strongly negative impact on social licence due to the contamination of ancestral lands from the testing process. Given the common link of radioactivity; equating these two separate issues is understandable. Significant investment in consultation and education would be helpful in order to engage with local communities and help them to differentiate these issues, especially in the modern context.

21.10.3. Whilst there are many examples of strong community opposition, driven by poor past practices, there are also numerous examples of positive working relationships amongst native title indigenous groups and the uranium mining and radiation industry more broadly; for example in WA the Tellus Holdings relationship with its native title partners for its radioactive waste repository at Sandy Ridge (the Marlinyu Ghoorlie people) as well as an agreement with the Titjikala native title community in the NT for a future project[112]. Cauldron is also pleased to have a strong working relationship with its traditional owners represented by the Buurabalayji Thalanyji Aboriginal Corporation (BTAC). Over in South Australia, uranium operations at Honeymoon and Beverley / Four Mile are conducted under native title agreements with their respective traditional owners.

21.10.4. Significant local consultations are required; and in some areas this may continue to result in community opposition. However, this is not a blanket situation across the country, and there are areas and opportunities that can proceed. Whilst this is a delicate issue for many, it does not justify a blanket ban on the industry.

[112] https://www.aph.gov.au/Parliamentary_Business/Hansard/Hansard_Display?bid=committees/commrep/28610/&sid=0008



Figure 84 Heritage teams on site at Yanrey, 2025

22. Dosage monitoring in the existing WA mining sector

22.1. Historical opposition from the union movements has variously referred to uranium mining as "a lot like asbestos"[113]. This comparison centres around the risks of airborne inhalation; which were previously and tragically not well understood during the asbestos mining era, for example in WA at Wittenoom until it was closed in 1966.

22.2. With respect to radiation, dose pathways for workers were historically poorly understood and focused on direct exposure to gamma radiation; and (similar to asbestos) ignored the risk associated with inhalation (in this instance, of radioactive dust or gases such as radon.)

22.3. The WA mining industry is already a large player in radiation handling and monitoring; and like many technologies and industrial processes, understanding of the issues and controls required have come a long way since the industry started.

22.4. Existing Reporting Entities (REs) under the WA radiation monitoring regime include Mineral Sands, Rare Earths, Tantalum / lithium and others as outlined below in Figure 85.[114]

Commodity Mined or Processed	Reporting Period	
	2018-19	2019-20
Mineral Sands	7	9
Rare Earths	2	2
Tantalum / Lithium	3	2
Other Activities [1]	3	4
Exempt Operations [2]	2	2
Total REs	**17**	**19**
Reports Received	**15** [3]	**17**

[1] The "Other Activities" mining operations that encounter NORs, but do not fall within the three other categories which are defined by their mineralogy.

[2] Exempt REs are not required to submit a report on an annual basis but are required to keep the RRAM informed of their activities and any increases to worker radiation exposures.

[3] Ralph et al. (2020a) disclosed that annual reports were submitted by 14 REs. However, a further RE (#13) submitted a report, post the article being published.

Figure 85 Current Reporting Entities by Commodity Mined or Processed in WA

22.5. If the uranium mining ban were overturned, the Uranium companies would likely still represent a minority of operations monitored under the regime; dependent on how quickly the industry grows and the number of uranium operations come on line.

22.6. The Mineral Sands industry (MSI) in WA is the largest component of the monitoring system, and is an import export industry for the State. WA Mineral sands tend to be relatively heavy

[113] https://thewest.com.au/politics/federal-politics/aukus-must-not-be-stalking-horse-for-more-uranium-mines-says-australian-manufacturing-workers-union-c-11581094

[114] Source: Ralph, 2023, Table 38, p.198.

in Monazite, which include significant amounts of Thorium (and uranium).

22.7. Figure 86 below outlines typical thorium and uranium concentrations by mass and activity in MSI products from Western Australia[115].

Mineral	Typical ^{232}Th Content [1]		Typical ^{238}U Content [1] [2]		Typical Maximum Activity Concentration (Bqg^{-1}) [3]
	Weight (ppm)	Activity Concentration (Bqg^{-1})	Weight (ppm)	Activity Concentration (Bqg^{-1})	
Ore as Mined	5-15	0.02 - 0.06	~3	~0.04	0.1
HMC	80-110	0.3 – 0.4	<10	<0.1	0.5
Rutile	>50-350	<0.2 – 1.4	<10-20	<0.1 – 0.6 [4]	2.0 [4]
Ilmenite	50-500	0.2 – 2.0	<10-30	<0.1 – 0.4	2.4
Leucoxene	80-700	0.3 – 2.8	20 - 50	0.2 – 0.5	3.3
Zircon	150-250	0.6 – 1.2 [4]	150-300	1.8 – 4.0 [4]	5.2 [4]
Xenotime	15,000	60	4,000	50	110
Monazite	50,000 - 70,000	200 - 280	1,000 - 3,000	12 - 37	320

[1] Head of chain only. Progeny are not included in the cited values. Secular equilibrium is assumed.

[2] The contribution by ^{235}U is negligible and has been omitted from the Table.

[3] Calculated by adding the maximum activity concentrations for ^{232}Th content and ^{238}U content.

[4] The activity concentration has been updated to reflect Appendix VIII of IAEA (2011), however the weight concentration (ppm) is as reported in Koperski (1993b)

Figure 86 Typical thorium and uranium concentrations by mass and activity in MSI products

22.8. As reported by Ralph in his PhD thesis (page 76)

> "As can be seen from the activity concentration data presented in Table 5, all of the mineral sand products, with the exception of the ore as mined and HMC, exceed the 1 Bqg-1 criteria and are therefore deemed as radioactive. It is also evident that two minerals, monazite and xenotime present the highest source of radiation hazard in the MSI due to their elevated NOR content.
>
> Sales of monazite from the Western Australian MSI ceased in May 1994 (Hewson & Upton, 1996). However, the NORMs monazite and xenotime are still present, to some degree, in the ore and accompany the other minerals, through the various processing circuits, thereby making the risk of exposure to NORs omnipresent. Furthermore, as the other minerals become concentrated, monazite and xenotime report to tailings streams, with most operations producing tailings with enhanced activity concentration levels, **often in excess of 15 Bqg-1 (DMIRS, 2019c)."**

22.9. The WA mines department has developed and maintains an extensive system of radiation

[115] Source: Ralph M, Towards establishing a fit for purpose regulatory framework for radiation protection in Western Australia's mining industry: Evaluating mine worker exposure to naturally occurring radionuclides, Edith Cowan University, 2023, Table 5, p.77

monitoring and reporting for workers in conjunction with ARPANSA. This system can be utilised (and, no doubt, improved upon) to ensure dose limits are effectively managed to well under internationally accepted limits, as happens in SA.

22.10. The WA mineral sands sector has invested in capital and processes to ensure worker doses are minimised, and the historic data shows a significant downward trend in average worker dosage over time in WA. These lessons learned can be applied in an industry best practice manner by the WA uranium industry to ensure any risks are appropriately addressed.

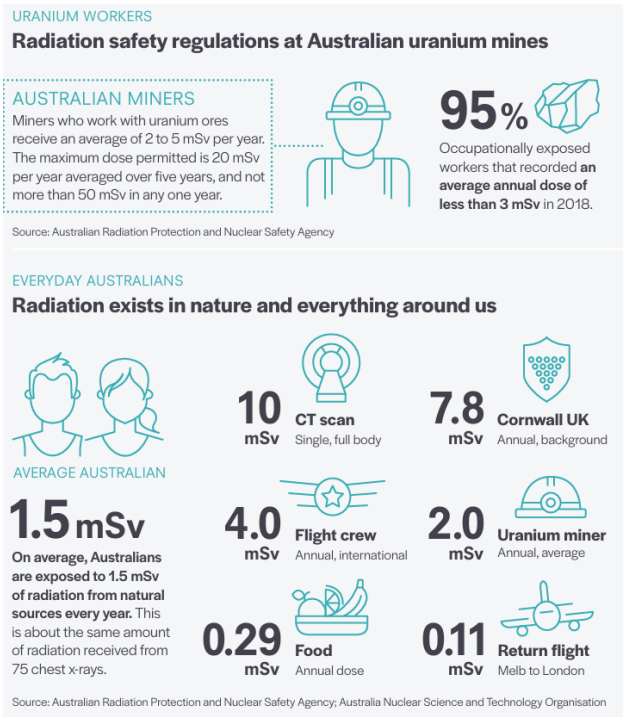
An overview of dose levels of uranium mine workers compared to other every day activity is provided below in

22.11. Figure 87 below[116]. Key points to note from the graphic include:

22.11.1. Radiation is all around us, and just in our daily lives, we obtain a dose of around 1.5mSv from natural sources.

22.11.2. Uranium workers (on average) obtain around 2mSv per annum; which is about half that of long haul flight attendants.

22.11.3. Maximum allowable dose rates recommended by the ICRP are for a maximum of 100mSv per 5 years, so an average of 20mSv per annum and not more than 50mSv in any one year. Uranium mine workers still receive many times lower dosages than these acceptable limits; noting of course that appropriate protections and safeguards should be undertaken at all times.



[116] https://minerals.org.au/wp-content/uploads/2022/12/Untapped-Potential-The-case-for-nuclear-energy_2020.pdf

Figure 87 Comparative radiation dosages in everyday life vs uranium mining[117]

22.12. The Australian regulator ARPANSA provides further information on the risks and potential exposures of uranium mining and milling workers. They state: [118]

22.12.1. "Current industry exposures are low and regulations and controls minimize the risk to health

22.12.2. No health effects have been observed or are expected to be observed at the very low doses normally received in this occupation

22.12.3. At current exposures the risks are very low and comparable with the risks of exposure from background and medical radiation exposure."

22.13. A number of different personal dose measuring devices are utilised ensuring compliance with dose limits; with records audited and complied by ARPANSA.



Figure 88 Different types of personal dose monitoring devices used in the industry.

22.14. A national database is kept by ARPANSA[119]; ensuring workers cannot skip from jurisdiction to jurisdiction and therefore incur multiple doses. This again is one of the learnings from the past, where this activity previously occurred (ie across State boundaries, before the national system was in place) and was to the detriment of worker safety. Lessons have been learned, the system has been put in place, and this issue has been effectively managed.

22.15. Australian radiation safety regulations today are among the most comprehensive and

[117] See https://www.ansto.gov.au/education/nuclear-facts/what-is-radiation; note range for background radiation in Australia provides a range of 1.5 to 2.0 mSv per annum.
[118] https://www.arpansa.gov.au/understanding-radiation/sources-radiation/occupational-exposure/occupational-exposure-uranium-mining#summary
[119] https://www.arpansa.gov.au/our-services/monitoring/australian-national-radiation-dose-register

stringent in the world.[120]

22.16. We can have confidence that we can develop a Northern Australian uranium mining industry that represents global best practice.

23. Is radioactive waste handling an issue for uranium mining in Northern Australia?

23.1. The short answer is no, existing infrastructure is already in place (Sandry Ridge) to handle any material produced in a worlds best practice manner. Notwithstanding that previous mining operations in Northern Australia have created a legacy, this by no means suggests such mistakes would be repeated today under completely different situations.

23.1.1. Note local project conditions are an important consideration; with projects in low rainfall, arid environments much less likely to have complex water management issues to contend with that have, for example, caused many issues at Ranger, which is situated in a very high rainfall area.

23.2. The Tellus Sandy Ridge facility is licensed to accept low level radioactive waste and does not accept higher level wastes. It is a truly world class asset and a significant competitive advantage for Western Australia but can also accept material from across Australia.

23.3. Uranium mining does not produce nuclear waste. The waste streams produced are similar to mining wastes produced by other similar operations, such as mineral sands and rare earths. In terms of radioactivity, that is Low Level Waste (LLW) at its highest, ie, exactly the same classification that Sandy Ridge already handles. Much uranium mining waste does not even meet that level and may be dealt with in a similar manner to any other tailings streams from other mining operations.

23.4. If certain wastes are required to be moved off site, there is no reason to suggest that such waste could not go to the Tellus facility, as similar low level waste from various sectors already goes there.

23.5. The Tellus Facility is clearly a worlds best practice facility, and this submission will take that matter as settled. However, should the Committee want further detail on this aspect this can be provided on request.

[120] https://world-nuclear.org/information-library/safety-and-security/radiation-and-health/occupational-safety-in-uranium-mining



Figure 89 The Tellus Holdings Sandy Ridge facility in WA

24. The roles of the State and Federal Governments and agencies

24.1. Mining is largely a State based issue in Australia.

24.1.1. The clear role of the WA and Queensland governments is to overturn the current policy / legislative bans and allow the industry to flourish at a state based level pursuant to State mining and environmental legislation.

24.1.2. Given the ban in WA is not legislative; a removal of the ban could be achieved on a relatively expedited basis should the Government decide to act. Further, in Queensland, with a unicameral system of Parliament, a change in legislation could have a more straight forward pathway than in other States that legislatively ban the commodity, where negotiation in upper houses would also be required.

24.1.3. Whilst WA and Queensland do not currently have operational uranium mines; the strong track record of South Australia provides a template to learn from should any additional regulations be required.

24.1.4. Whilst this may be led by the States, more explicit Federal support for the uranium mining industry could assist those States in pressing forward with reform in their own jurisdictions. Whilst the Federal Government has been openly and loudly supportive of the Critical Minerals industry, for example, it has been very quiet in its support for the uranium industry.

24.2. Uranium also brings with it additional Federal requirements due to the EPBC Nuclear trigger and the Commonwealth role in radiation regulation and protection.

24.3. The “Nuclear Trigger” under s22 EPBC Act automatically refers any uranium mine for a federal EPBC approval; as its specifically included in s22(1)(d) of the Act. This is different to other commodities – where referrals under EPBC only occur if there are possible matters of national environmental significance. See below paragraph 24.9.2.

24.4. ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) is the Australian federal regulator for radiation safety. ARPANSA already regulates radiation safety on all existing uranium mines in Australia; and would fulfil this role in Western Australia as well.

24.5. Export of uranium also requires an export permit which is obtained from ASNO, Australia's federal safeguards and non proliferation regulator. Providing all uranium export policies are met – which ensures strict compliance with our international obligations and auditing; obtaining an export permit is relatively straight forward. This process would be identical for Western Australian producers. Australia's uranium export policy can be found here:

https://www.dfat.gov.au/international-relations/security/non-proliferation-disarmament-arms-control/policies-agreements-treaties/australias-uranium-export-policy#:~:text=In%20summary%2C%20Australia's%20policy%20is,prepared%20to%20conclude%20safeguards%20arrangements

24.6. Uranium must be exported through a federally licensed port. Currently, the only federally licensed export terminal is the Port of Adelaide. Should the WA, NT or Queensland industry develop, over time designated export nodes may be preferable; although in the start up phase it would be possible to utilise the South Australia port. Note even when the NT were producing significant material through Ranger, a significant proportion of output was railed south and exported out of South Australia, given advantages in containerised freight rates.

24.7. ANSTO (Australian Nuclear Science and Technology Organisation) provides certain research and development services to uranium mining and exploration companies across Australia. This organisation already provides services to Northern Australian uranium companies and would continue to do so once uranium bans are lifted.

24.8. CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency. CSIRO provides a range of services to uranium companies to assist with research and development; for example laboratory based test work to confirm potential suitability for ISR uranium recovery.

24.9. The Federal Government can also play an important role to encourage further development of the uranium mining industry across Australia. These opportunities include:

24.9.1. Placing uranium on Australia's critical minerals list; which would open up a host of federal government funding and project facilitation services opportunities for uranium projects. Given the need for both state and federal approvals for uranium mining (due to the nuclear action trigger in the EPBC Act), project facilitation services provided by a federal government agency could be extremely beneficial – such as services provided by the Critical Minerals Facilitation Office for Critical Minerals projects or indeed the Major Projects facilitation services provided by projects designated as Major Projects. Major project designation is not only driven by project size; where projects are of national strategic importance then such a designation is possible.

24.9.2. There is potential to remove or reform the Nuclear Trigger in the EPBC Act; such that it is not triggered simply due to the project being uranium based. This would bring the industry in line with other commodities and focus on actual potential impacts on environmental matters, instead of simply having a blanket

trigger for the commodity. No other commodity has this treatment. This has been argued as appropriate by the South Australian government, the government with the most practical experience in approving and managing uranium projects[121]. SA highlights the substantial amount of duplication that occurs across Federal and State approvals due to the current system and the potential therefore for streamlining the process.

24.9.3. Assuming the EPBC trigger stays, then we must ensure the nuclear action triggers in the EPBC are appropriate and the interaction between Federal and State approvals bodies are efficient. There is opportunity for reform here.

24.9.4. Defining a s482 visa category for highly skilled migrants in the radiation space – this may include nuclear engineering, but also uranium mining experienced people, as well as other radiation trained staff. Given the current heightened concern over immigration this needs to be carefully considered.

24.9.5. Resource sharing between federal agencies and state agencies where appropriate and possible to improve approvals timelines, recognising that radiation competencies within the States are under resourced (for example, in WA, the Radiation Health Unit)

24.9.6. Federal government could work with the States to address any concerns of union bodies and the broader community with respect to uranium mining. (ie better education around exposure pathways and demonstrate learnings from the Mineral Sands sector that can be applied to the uranium industry).

24.10. There is further opportunity for the States and the Federal Government to co-operate with participation in the Sapporo 5 initiative. This is discussed further at Section 12.16.

24.11. Finally, whilst within the Terms of Reference of this Northern Australia *Emerging Industries Inquiry*; a dedicated Inquiry into the future of uranium mining in Australia could be warranted.

[121] https://www.aph.gov.au/DocumentStore.ashx?id=1519c7ea-3f47-47a0-a65d-97d691827bf0&subId=671226

25. Further involvement and advocacy

25.1. I am very active calling for education in the community about the current state of the uranium mining ban, most actively in WA but also Queensland.

25.2. Right now; a significant proportion of the population don't know about the uranium bans - for example in WA there is an assumption by many that WA is a powerhouse in mining and many assume that would apply to uranium as well.

25.3. Additionally, there is some view that Australian uranium deposits are not economic to mine at current uranium prices; which is also an outdated assumption which MUST be corrected.

25.4. I would be very happy to provide any further information and specifically request the opportunity to provide oral submissions to the Committee if the opportunity is available.

25.5. Think globally act locally- we have an obligation to help the world deliver on its decarbonisation targets. Removing the bans on uranium mining in WA and Queensland will allow us to supply aligned countries, and mining uranium and exporting it to our strategic partners is the highest impact activity that we can do to help global decarbonisation.

25.6. Separately, with the importance of AUKUS to WA specifically; there is a compelling argument to ensure our major trading partners (US and UK) are supplied with civilian use uranium in order to help ensure the continued maximum participation of WA in the AUKUS arrangement.

25.7. Put simply, mining of uranium is a no-brainer for Western Australia and Queensland specifically and Northern Australia more broadly.

Thank you for the opportunity to make this submission.

Yours sincerely,

Jonathan Fisher
Chief Executive Officer
Cauldron Energy Limited



A. Appendix: Selected Major Trading Partners and their Uranium Needs

The following section provides further detail to the summarised information in Section 0 regarding select major trading partners; and their use of nuclear energy and hence their demand for uranium.

A.1. China



A.1.1. China is actively undertaking the world's largest nuclear new build programme; planning to build >150 reactors by 2035 and aiming to become the worlds largest nuclear generator.

A.1.2. A mix of domestic Chinese designs as well as Western technology are being utilised.

A.1.3. Heavily dependent on imported uranium, part of the "Eastern" supply bloc with major sources coming from Kazakhstan, and various regions in Africa.

A.1.4. Australia already has a Nuclear Cooperation Agreement with the Peoples Republic of China , and has already exported uranium to China with the first cargo occurring in 2008.

A.1.5. With Australia's significant raw materials exports to China already, it would be a logical extension to include uranium in that trade – with arrangements already in place and assurances that Australian export policies will be met. However in the near to medium term, current international bifurcation considerations may be taken into account which may result in Australian companies preferring to sell their product elsewhere.

A.2. Japan



A.2.1. Following the closure of its national reactor fleet post the 2011 Fukushima incident, Japan is now re-opening its nuclear fleet given the recognition they need them to meet their decarbonisation objectives. Reactors are only being reopened once any new safety updates coming out of the learnings of the Fukushima event have been incorporated.

A.2.2. In additional to reopening existing reactors, Japan is also taking its first steps towards new build plants.[122]

A.2.3. Japan was historically a large purchaser of Australian uranium; and indeed Japanese entities have historically been active in investing in the Australian uranium sector. Further, prior reporting has noted that some Australian uranium was present at the Fukushima facility at the time of the 2011 accident.

A.2.4. Now that Japan's nuclear programme is again growth phase; Japanese entities are actively pursuing access to new uranium sources in Australia and I can confirm Cauldron has held discussions with confidential Japanese customers regarding the potential for future uranium supply from Western Australia once

[122] https://edition.cnn.com/2025/07/22/asia/japan-new-nuclear-power-reactor-since-fukushima-intl-hnk

the uranium mining policy is changed.

A.2.5. Similar to the relationship Australia and Japan share in the iron ore and LNG sectors, Australia is recognised as a high quality, reliable supplier of uranium who is a close strategic ally of Japan.

A.2.6. The relationship between WA and Japan remains strong and important – evidenced by the fact that Premier Cook and Mining Minister David Michael conducted a trade visit in September 2025.[123]

A.2.7. With Australia's long term, successful partnerships with Japan in iron ore and LNG and other commodities, and Japan's increasing needs for uranium, it would be a natural extension to supply uranium to Japan from Northern Australia.

A.3. South Korea



A.3.1. South Korea is a global nuclear industry leader.

A.3.2. Internationally, South Korean companies successfully built the Barakah 4x APR1400 reactors in the UAE, and have recently been successful in tendering in Czechia. The Korean conglomerate is seen as one of the leading Western groups capable of constructing large scale nuclear projects.

A.3.3. Domestically, South Korea has recently moved from a prior policy of nuclear phase out; to one targeting a minimum of 30% nuclear contribution to the energy mix by 2030[124]; with new reactors currently in construction and further reactors planned using domestic APR technology (which is similar to the US/Westinghouse AP style of reactors) to increase nuclear's share of energy further into the 2030s.[125]

A.3.4. Korea is basically currently entirely reliant on imported uranium; and Australia is a major exporter to South Korea. All international treaties and agreements are in place to facilitate export of uranium from Northern Australia to South Korea.

A.3.5. With South Korea being a major trading partner in LNG and iron ore; and South Korea's need for imported uranium, it would be a natural progression to expand that trade to include uranium.

A.4. Singapore



A.4.1. Singapore does not currently have nuclear energy; however is moving in that direction.

A.4.2. Singapore has announced it is studying the potential deployment of advanced nuclear reactors; and has signed a civil co-operation agreement with the US to

[123] https://www.wa.gov.au/government/media-statements/Cook%20Labor%20Government/Economic-diversification-the-focus-of-Premier%27s-visit-to-China%2C-Japan-20250921
[124] https://www.world-nuclear-news.org/articles/south-korea-increases-support-for-domestic-nuclear-industry
[125] https://www.enerdata.net/publications/daily-energy-news/south-korea-new-nuclear-renewable-power-plan.html

assist in this regard.

A.4.3. This further investigation for nuclear has come following consideration of other renewable energy sources. In particular, while Singapore has "closely" evaluated the use of low-carbon hydrogen, there are "inherent challenges" in the production, storage and transportation of hydrogen, which make it difficult to scale up in a commercially viable manner, Singaporean Prime Minister and Finance Minister Lawrence Wong said.[126]

A.4.4. Singapore has signed the NPT, but Australia does not yet have a formal nuclear co-operation agreement with Singapore; however it does have a Exchange of Notes constituting an Agreement with Singapore Concerning Cooperation on the Physical Protection of Nuclear Materials[127], which entered into force on 15 December 1989.

A.4.5. Singapore's potential deployment of nuclear technology would still be a way off; but the jurisdiction could become a potential customer for Australian uranium in the medium to long term and over that time necessary international agreements could be put in place to build on the existing treaty base.

A.5. United States



A.5.1. The US is currently the world's largest operator of nuclear plants but is basically entirely reliant on imported uranium as can be seen from Figure 90 below.

A.5.2. Whilst the current US Administration is making efforts to restart some domestic production, at the same time they are also aiming to QUADRUPLE US nuclear output as part of its Energy Dominance strategy; and significant domestic initiatives are already underway to deliver on this strategy.[128]

A.5.3. Its important to note that whilst the personality dynamics of US politics can be off putting for many Australians; nuclear energy policy is the most strongly bipartisan policy of all government endeavours in the US. Former Democratic President Joe Biden signed up to TRIPLE US nuclear generation[129]; whereas current Republican President Trump aims to QUADRUPLE it. Either way, and regardless of whether these aggressive goals are met, the US will need a lot more uranium from its strategic partners.

A.5.4. In practicality, this means there is no chance of the US being self reliant, and in fact the quantum of the supply gap to what will be required will grow.

[126] https://www.channelnewsasia.com/singapore/singapore-nuclear-power-budget-2025-4944536
[127] https://www.austlii.edu.au/au/other/dfat/treaties/1989/34.html
[128] https://www.energy.gov/ne/articles/9-key-takeaways-president-trumps-executive-orders-nuclear-energy
[129] https://www.energy.gov/ne/articles/us-sets-targets-triple-nuclear-energy-capacity-2050

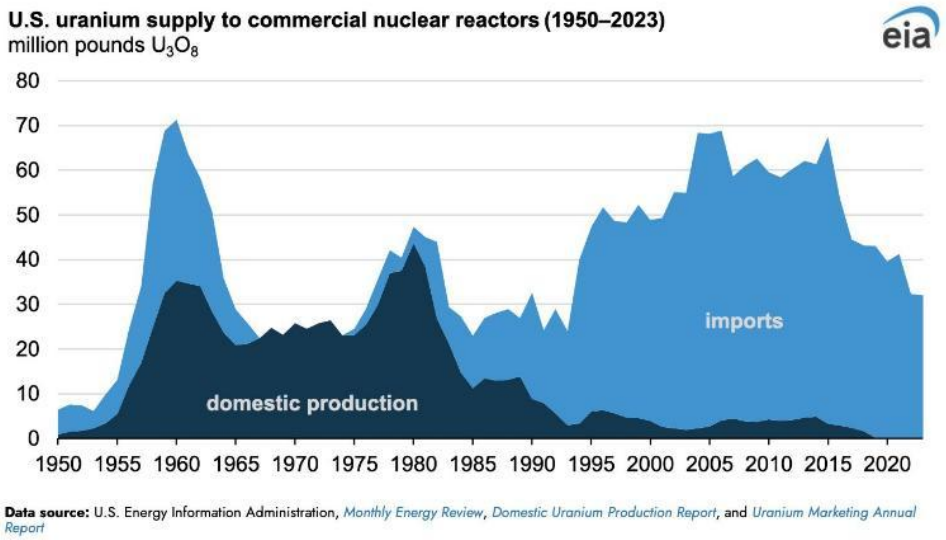


Figure 90 US uranium supply history

A.5.5. The US has also in recent decades been reliant on Russian sources of nuclear fuel; however has now enacted various bans on product coming from that region. This adds to the importance of securing supplies from politically aligned, reliable major trading partners.

A.5.6. Australia is currently a major supplier to the US nuclear industry; and with WA's strong trade ties to the US as well as our significant importance to the AUKUS project, it makes sense that WA in particular step up and supply the US with desperately needed civilian nuclear fuel.

A.6. India



A.6.1. India currently has 25 reactors in operation, 6 under construction and is planning a major nuclear new build programme, aiming to deliver 100GW of reactors by 2047. [130]

A.6.2. India has largely developed its own nuclear technology domestically, given that it has not signed the nuclear non-proliferation treaty (NPT) and therefore this has historically limited transfers of advance nuclear technologies from other countries.

A.6.3. India has significant domestic supplies of Thorium, and part of its domestic programme is researching the development of a thorium based industry alongside the main uranium industry.

A.6.4. Australia has a bilateral nuclear co-operation agreement with India, which does facilitate the export of uranium to India but under strict safeguards and non-proliferation controls which ensure Australian uranium is only used for peaceful purposes and cannot be diverted to India's military programme.

[130] https://world-nuclear.org/information-library/country-profiles/countries-g-n/india

A.6.5. Whilst Australia can sell uranium to India, and has done some initial small shipments, Australia does not currently regularly supply India. As India's uranium needs increase significantly with its fleet roll out, supply from Australia should become more common.

A.7. Hong Kong



A.7.1. Hong Kong doesn't directly have nuclear energy within the special administrative zone, but it does benefit from nuclear energy – as electricity from nuclear energy is supplied to the Hong Kong market from next door provinces in mainland China.[131]

A.7.2. Hong Kong is unlikely to be a customer for uranium itself; instead planning on taking increasingly large power purchase agreements from Chinese nuclear plants as a means to meet its decarbonisation objectives, as well as increasing its electrical supply from local gas fired generation. In fact, power from nuclear is expected to be the largest component of future HK supply at 50% share.

A.7.3. Hence, Kong Kong's implied demand for uranium (indirectly through PPAs with Chinese nuclear firms) can be considered as a subset of China's overall demand.

A.8. Taiwan

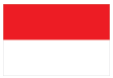


A.8.1. Taiwan is one of the few countries around the world that recently shut down the last of its fleet of nuclear power reactors, with the last reactor shut down in May 2025. Prior to the nuclear phaseout policy, 6 reactors were operational and Taiwan had been planning six more.

A.8.2. Interestingly, due to strong opposition to the nuclear phase out, post the closure of the last plant, a Referendum was hastily agreed to which was held on 23 August 2025. Despite receiving 74.17% votes cast in support of restarting nuclear energy in Taiwan, the Referendum actually failed because the law required a minimum of 25% of all registered voters to approve, with voting not compulsory. Voter turnout was 29.51%, with 74.17% of those voting approving meaning a total of 21.9% of registered voters approved. Despite this failure, this shows a strong level of support remains for nuclear in the country.[132]

A.8.3. Given Taiwan's unique situation with respect to international recognition, Australia has previously exported uranium to Taiwan via the United States[133], and could do so again should Taiwan elect to restart its reactor programme. However**, given the current state of nuclear in Taiwan, this market is unlikely to be of significant opportunity in the medium term.**

A.9. Indonesia



A.9.1. Like Australia, Indonesia does not currently have nuclear power generators but does operate 3x nuclear research reactors.

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[131] https://world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power
[132] https://www.world-nuclear-news.org/articles/low-turnout-invalidates-taiwan-referendum-result
[133] https://www.abc.net.au/news/2006-04-04/govt-confirms-taiwan-uranium-export-deal/1723266

A.9.2. However, unlike Australia, Indonesia is actively gearing up for the deployment of a fleet of civilian nuclear reactors across the country, and has received official proposals from five nations to develop plants. So far, the country has meet with Canadian and Russian interests.[134]

A.9.3. Indonesia's nuclear rollout strategy is still being developed, but current indications suggest 7GW installed capacity by 2040 with a longer term vision of 35GW by 2060, which would include a mix of SMRs and large scale reactors.[135]

A.9.4. Indonesia is a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), having ratified it in 1979. Indonesia also recently joined the Treaty on the Prohibition of Nuclear Weapons (TPNW) in September 2024.

A.9.5. Australia does not yet have a formal nuclear co-operation agreement with Indonesia but in February 2025 signed an agreement between ASNO and Indonesia's nuclear regulatory body BAPETEN focused on nuclear safeguards, security and non proliferation.[136]

A.9.6. Given the momentum towards stronger nuclear cooperation with Indonesia; and Indonesia's compliance with international non proliferation laws, as Indonesia's uranium requirements increase with their nuclear roll out, it would be a logical trade extension for Northern Australia to supply uranium to our closest trading partner.

A.10. United Kingdom



A.10.1. The UK has a storied history in nuclear, being the first country to connect a commercial scale nuclear power plant to the grid (Calder Hill) and since that time has deployed nuclear as a significant portion of its grid supply.

A.10.2. The UK is entirely reliant on importing uranium supplies from trading partners.

A.10.3. Consistent with many existing nuclear operating jurisdictions, the UK's share of nuclear energy in the grid has declined in recent years when the global industry was in decline; currently with installed capacity of around 13GW in the late 1990s to 6GW today.

A.10.4. However the UKs nuclear new build strategy, which is bipartisan supported by both sides of government in the UK, calls for 24GW of new nuclear capacity by 2050 to account for ~25% of the grid.

A.10.5. The UK is currently building 2 reactors at Hinkley C (Hinkley C1 and Hinkley C2), together representing ~3.3GW of baseload capacity, and has just made final decision to build Sizewell C1 and Sizewell C2, which would be another 3.3GW.

A.10.6. The UK has recently focused on the potential of SMR reactors and looks to play

[134] https://www.nucnet.org/news/indonesia-has-met-with-canada-and-russia-on-plans-for-nuclear-power-9-1-2025
[135] https://indonesiabusinesspost.com/5089/energy-and-resources/indonesia-plans-7-gw-nuclear-power-plants-as-part-of-long-term-energy-strategy
[136] https://indonesia.embassy.gov.au/jakt/MR25_011.html#:~:text=The%20Australian%20Safeguards%20and%20Non,area%20of%20nuclear%20non%2Dproliferation

a global leading role in that field, with significant national experience in the design, build and operation of smaller reactors in submarines. Recently, the US and UK signed an agreement specifically on co-operating in SMR development and deployment.[137]

A.10.7. The UK's large reactor new build programme has suffered from significant cost overruns, with clear lessons learned such as the need to finalise the design from a regulatory perspective prior to the commencement of construction. The EPR reactor design being built in the UK has had a poor record of constructability from early examples of the plant; but subsequent plants are demonstrating construction efficiencies in terms of cost and time.

A.10.8. The UK is also a foundational member of AUKUS, the importance of this and the rationale for supporting uranium mining and export to our AUKUS partners is discussed further below at Section 13.

A.10.9. Australia already exports uranium to the UK and hence all international arrangements would be in place in order to allow Northern Australian projects to commence uranium exports to the UK. **It is hard to consider a more historically, culturally and strategically aligned partner than the UK!**

A.11. The European Union as a bloc



A.11.1. The EU has a broad range of energy policies; but overall nuclear is a very important source of electricity generation, providing about a quarter of all electricity across the union from ~100 reactors operating across 12 of the 27 member states.

[137] https://www.theguardian.com/business/2025/sep/15/uk-and-us-line-up-string-of-deals-to-build-modular-nuclear-reactors-in-britain

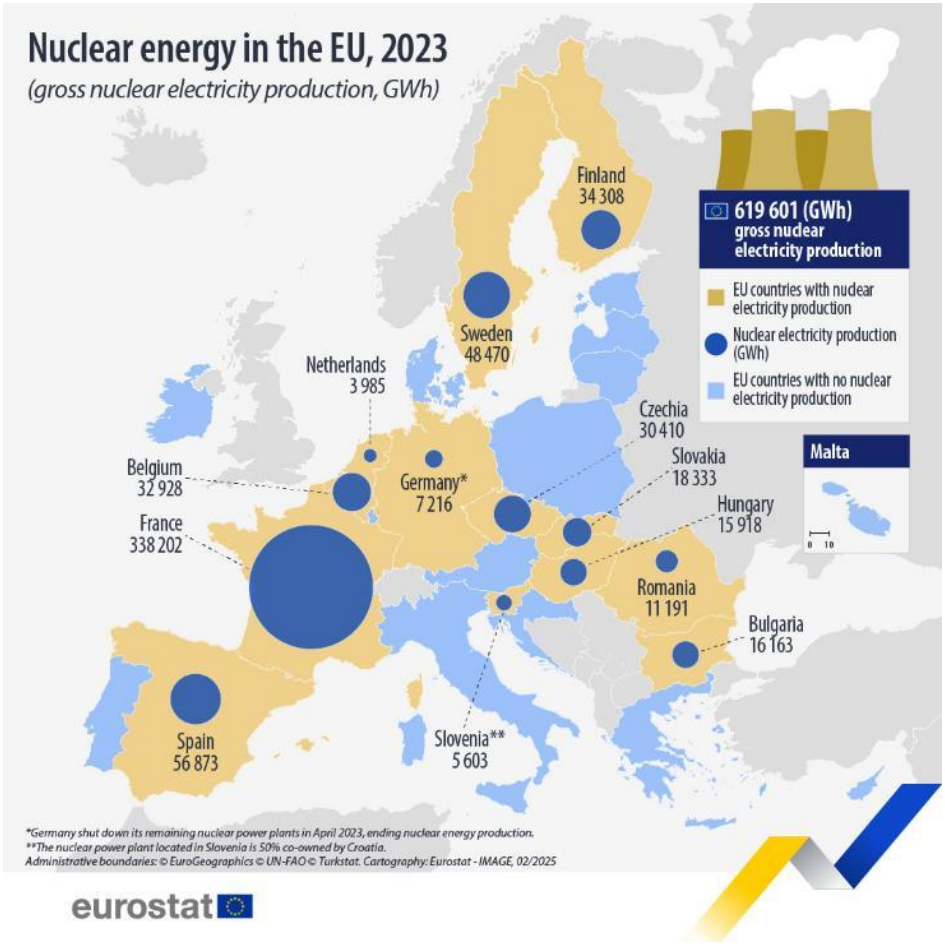

Figure 91 Nuclear Energy in the EU, 2023

A.11.2. There is also strong momentum across the EU towards greater nuclear generation, which is a marked shift from previous policy settings which had resulted in a net decline in nuclear generation in the EU in recent years. But with new policy settings, significant growth is now expected. Some highlights from major players include:

A.11.3. Sweden

A.11.3.1. Currently operates 6 nuclear reactors at 3 separate plant locations, providing approx. 29% of the country's electricity. Vattenfall, the country's state owned utility, is now spearheading a new nuclear build programme aimed at constructing 2 new large scale reactors by 2035 and a further fleet of large and small reactors by 2045.

A.11.3.2. Previously had a nuclear phase out policy, but was one of the first to effectively remove the phase out in 2009/10 by allowing existing reactors to continue.

A.11.3.3. In 2023, the country voted to switch from a 100% renewable energy target for 2045 to a 100% fossil free target, to better reflect the contribution of and potential for new nuclear.

A.11.3.4. Sweden has recently been making progress towards reforming its

uranium mining ban policy, and with sizeable resource, could become domestic supplier to the Union in the future.[138] This is in support of its recent plans to increase its own nuclear generation capacity.

A.11.4. Denmark



A.11.4.1. Denmark has had a ban on nuclear energy for ~40 years.

A.11.4.2. Despite being a world leader in offshore wind, Denmark has put the steps in motion to remove the ban on nuclear energy and begin to consider nuclear in its future generation planning.[139]

A.11.4.3. Whilst these are positive steps, there is a long way to go before Denmark might build a reactor and then potentially become a uranium export customer; however the significant shift in policy direction is symptomatic of moves across the continent towards greater nuclear generation and hence greater opportunity for Australia to export uranium in the future.

A.11.5. Germany



A.11.5.1. Germany previously operated a fleet of nuclear reactors, however as part of its Energiewende policy, all of its reactors were prematurely shut down, reflecting community views at the time that were not supportive of nuclear technology. Ironically though, the German grids still gets certain benefits from nuclear energy, importing electricity from nuclear generation from France in particular.

A.11.5.2. A significant portion of Germany's prior nuclear plants have been dismantled, however a small number (~6) remain in a practical position to be restarted should policy change[140].

A.11.5.3. The topic of nuclear in Germany continues to be contentious; however there have been significant shifts in Germany energy policy recently; now formally dropping its opposition to nuclear energy elsewhere across Europe[141]. Nuclear restart however domestically is considered unlikely in the near term, with the country instead looking to build up to 20GW of new gas plants to help support the grid[142].

A.11.5.4. Most recently though, German Chancellor Merz has finally admitted that the closure of German nuclear plants was a significant strategic error. Whislt this doesn't make restarts in Germany more likely; it

[138] https://discoveryalert.com.au/news/sweden-nuclear-renaissance-uranium-mining-ban-2025/
[139] https://www.world-nuclear-news.org/articles/belgium-reverses-phase-out-policy-as-denmark-reconsiders-nuclear
[140] https://www.reuters.com/world/europe/germanys-nuclear-lobby-says-up-six-reactors-could-restart-2025-03-05/
[141] https://www.ft.com/content/e99efa2b-338a-4065-89c6-0683d5759ed7
[142] https://www.cleanenergywire.org/news/germanys-new-energy-minister-rules-out-return-conventional-nuclear

does highlight a changing view towards the technology in Germany and a softening of opposition to it.[143]

A.11.5.5. Germany of itself is unlikely to be a customer for Australian uranium in the medium term.

A.11.6. France



A.11.6.1. France is the clear leader in nuclear energy in the EU; having aggressively decarbonised its grid in a response to the 1970s oil shocks.

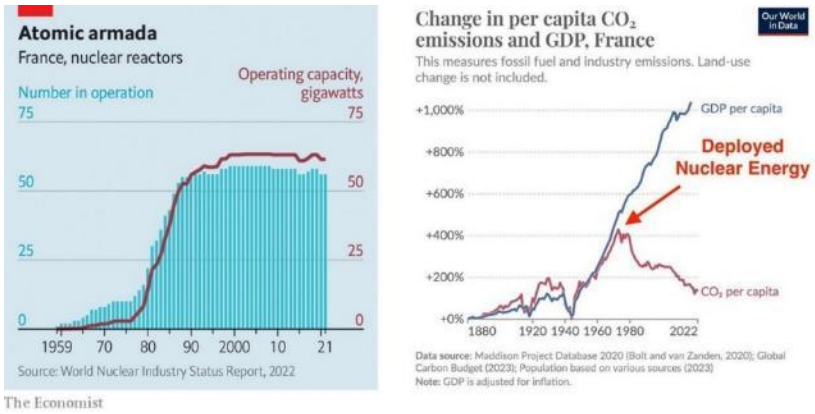

Figure 92 French nuclear rollout and the impact on decarbonisation

A.11.6.2. Similar to much of the Western World, despite having a relatively high level of support for nuclear, the technology had still suffered a decline in popularity until relatively recently, Since then, France has embarked on an aggressive nuclear renaissance focusing on life extensions to existing reactors, as well as up to 14 new EPR2 reactors of 1.6GW each (total ~22GW of baseload power)[144] although much work is needed to ensure the country's industrial capacity is ready for the challenge.

A.11.6.3. The recently approved life extensions are for 20 of its 1.3GW plants (total 26GW) to extend life from their initial 40 year design life to 60 year life, for an expected budget of EUR6 billion, an incredibly cost effective investment.[145]

A.11.6.4. France has historically obtained significant proportions of its huge uranium needs from Africa, where it has strong colonial historical ties. However, these supplies have now become more uncertain, with for example the nationalisation of various French owned assets in Africa (for example, in Niger, and subsequent geopolitical

[143] https://tvpworld.com/91076865/merz-germanys-nuclear-exit-was-strategic-mistake
[144] https://www.theguardian.com/world/2022/feb/10/france-to-build-up-to-14-new-nuclear-reactors-by-2050-says-macron
[145] https://www.reuters.com/sustainability/boards-policy-regulation/edf-spend-estimated-7-billion-extending-life-nuclear-plants-2025-07-03/

realignment of Niger more with Russia[146]). As a result, France has increased its activity in other jurisdictions, with French company Orano reportedly mulling a return to Australia where it has a long and successful record of exploration but where it currently has no active projects. (see Section 18.3.3).

A.11.7. Italy



A.11.7.1. Italy is in the process of amending legislation to facilitate the reintroduction of nuclear energy by 2030 after nearly three decades of banning it.

A.11.7.2. Under this new framework, nuclear energy is expected to contribute between 11% and 22% of the country's electricity supply by 2050. Government projections suggest this shift could save up to €17 billion in decarbonisation costs by mid-century.[147]

A.11.8. Spain



A.11.8.1. Spain has a current policy of nuclear phase out; however in February 2025 the Spanish parliament voted (in a currently non-binding motion) to urge the government to reverse the nuclear phase out.[148]

A.11.8.2. This has been in conjunction with strong local community support to keep plants open. Such concern to keep baseload plants open has increased as a result of the Iberian wide electricity blackout that occurred earlier this year (regardless of the actual technical reasons that triggered the blackout).[149]

A.11.8.3. Despite this recent support; formally Spain is due to retire all its nuclear plants by 2035.

[146] https://www.mining.com/web/niger-junta-seizes-french-nuclear-giant-oranos-uranium-mine/
[147] https://www.euractiv.com/section/politics/news/italy-to-reintroduce-nuclear-power-by-2030/
[148] https://www.world-nuclear-news.org/articles/proposal-to-reverse-spains-nuclear-phase-out-approved-by-parliament
[149] https://english.elpais.com/climate/2025-04-30/massive-blackout-in-spain-reignites-culture-war-over-the-future-of-nuclear-energy.html



Figure 93 Spanish protesting the planned closure of a nuclear plant

A.11.9. Other EU nuclear new build activities

A.11.9.1. Bulgaria building 2x AP-1000 reactors, Citi financing it.[150]

A.11.9.2. Czechia selected Korean KHNP to deliver up to 4x ~APR-1000 style reactors[151]

A.11.9.3. Slovenia moving ahead with plans for ~2.4GW of new capacity with the JEK2 project[152]

A.11.9.4. Estonia – moving forward with plans for an SMR development led by Fermi Energia[153]

A.11.9.5. Hungary – is building two new Russian designed plants at Paks2; which were previously held up by US sanctions on Russian technology but which have now been relaxed.[154]

A.11.9.6. Lithuania previously operated 2x Soviet style RBMK reactors (the same design as the Chernobyl plant). As a condition of entry in the EU, those reactors were required to be closed, such that Lithuania currently operates no plants. However, Lithuania is now considering a return to nuclear with a focus on SMR potential, and has signed an agreement with the US on potential SMR collaboration.[155]

A.11.9.7. Poland is embarking on its first nuclear plants, planning 3x Westinghouse AP-1000s with construction commencing around 2028 and commercial operations in 2033[156]. Poland is also looking into SMR deployment, with approved plans to build a fleet of SMRs, the first of which is planned to be the BWRX-300 from GE Hitachi[157].

A.11.9.8. Slovakia has five operational reactors contributing ~50% of its grid, with one under construction and is considering both Westinghouse AP-1000 as well as BWRX300 SMR technology for its new build plans.

A.11.10. Australia already exports uranium to various EU member states; and as such there would be no impediments to WA commencing supplies.

A.11.11. With its broad range of existing and new nuclear build activities, the EU and its member States represent a significant uranium supply opportunity for Northern Australiam uranium projects if relevant bans were lifted.

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[150] https://www.world-nuclear-news.org/articles/bulgaria-says-citi-to-help-financing-of-new-kozloduy-units
[151] https://www.world-nuclear-news.org/articles/khnp-sets-out-plans-for-usd186bn-czech-nuclear-project
[152] https://www.bscc.si/news/slovenia-moves-forward-with-jek2-while-smrs-emerge-as-a-complementary-option/
[153] https://news.err.ee/1609701240/estonian-government-begins-nuclear-power-station-planning-and-assessment-process
[154] https://mezha.net/eng/bukvy/us-lifts-sanctions-on-hungary-s-paks-2-nuclear-plant-project/
[155] https://www.lrt.lt/en/news-in-english/19/2601150/government-gives-nod-to-considering-nuclear-energy-potential-in-lithuania
[156] https://www.world-nuclear-news.org/articles/polish-supply-chain-gears-up-for-countrys-first-nuclear-project
[157] https://www.euronews.com/green/2025/08/28/poland-to-build-europes-first-of-its-kind-small-scale-nuclear-power-plant-in-wloclawek

Glossary of Terms

AI	Artificial Intelligence
AMEC	Association of Mining and Exploration Companies
AONM	Australian Obligated Nuclear Material
APS	Announced Pledges Scenario included in WEO
ASNO	Australian Safeguards and Non-Proliferation Office
AUKUS	Trilateral security arrangement between Australia, the UK and the US under which Australia will procure nuclear submarine capability
CCIWA	Chamber of Commerce and Industry WA
CMEWA	Chamber of Minerals and Energy WA
CO2	Carbon dioxide
COP	Conference of the Parties, referring to a United Nations Climate Change Conference
CXU	Cauldron Energy Limited
DYL	Deep Yellow Limited
EPBC	Environmental Protection and Biodiversity Conservation Act (Commonwealth)
EPR	European Pressurised Water Reactor
EPR2	Upgraded version of the EPR, with improvements specially made for constructability
ESG	Environmental, Social, Governance
EU	European Union
GHG	Green House Gas
GW(h)	Gigawatt (hour)
HALEU	High Assay Low Enriched Uranium (ie up to <20% U235)
HEU	Highly Enriched Uranium, >20% U235 although often much higher
HK	Hong Kong
HLW	High Level Waste
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
ILUA	Indigenous Land Use Agreement
IPCC	International Panel on Climate Change
ISR	In Situ Recovery
JORC	Joint Ore Reserves Committee
JTSI	Department of Jobs, Training, Science and Innovation
KW(h)	Kilowatt (hour)
LEU	Low Enriched Uranium, typically <5% U235

LLW	Low Level Waste
M2M	Megatons to Megawatts
MCA	Minerals Council of Australia
MW(h)	Megawatt (hour)
NA	Northern Australia
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NT	Northern Territory
NZE	Net Zero Emissions scenario included in WEO
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PWR	Pressurised Water Reactor, the most common form of reactor design
REs	Reporting Entities under the WA radiation monitoring system
SA	South Australia
SMR	Small Modular Reactor
SNF	Spent Nuclear Fuel
SSN	Designation for a Nuclear Powered Attack Submarine
STEPS	Stated Policies scenario included in WEO
TOE	Toro Energy Limited
TPNW	Treaty on the Prohibition of Nuclear Weapons
U	Uranium
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
US	United States
WA	Western Australia
WEO	World Energy Outlook published by IEA
WNA	World Nuclear Association

END OF SUBMISSION