

Uranium Sector

16 February 2024

Uranium equities still to catch up

The stronger uptrend in uranium is now three years old, with spot pricing (US\$102.75/lb) at historically elevated nominal levels. Uranium equities have delivered solid returns so far in 2024, following the strong increase in the spot price late in 2023. We place the nuclear market in the mid-stages of its bull cycle, with high prices needed for a longer period to induce more supply. In our view, investors have not missed uranium at this point – equities have not yet re-rated to reflect pricing which will be driven higher by favourable fundamentals. Surprisingly, most equities remain below their 2021/22 peaks, with this gap to close as the uranium price continues to run (Figure 4). We prefer LOT, BMN, GUE, 92E, DEV and EL8.

After a brutal 11-year bear market, the bull market is now 6 years old – but equities are now lagging spot

- The bear market lasted from 2007 to 2018 and saw the uranium price drop below US\$20/lb (Figure 2) - ending all investment and exploration within the sector.
- While the “easy” money has probably been made in larger stocks, the cycle is far from over (Figure 5).
- While the bull market is six years old, it has included periods of correction and consolidation. Twelve months ago, uranium did not feel like it was in a bull market.
- Most equities remain well below highs from 2021-2022, despite a 61% increase in spot since then.

Cost curve is irrelevant to price in the near-term

- For scarce commodities, the cost curve has no relevance, as demonstrated by thermal coal (Figure 7) and European gas (Figure 8) in 2022. This is especially the case for uranium with high demand inelasticity.
- Simply replicating the price increase of 2007 suggests a spot price of US\$174/lb. In our view the uranium market faces superior fundamentals to those of 2007.

1970s points the way for the medium term

- A price spike will do nothing to solve the structural primary supply deficit in the short to medium term.
- On a nominal basis the 1970s look a relatively unremarkable period, with prices elevated for several years; on a real basis, the quantum of the price is clear.
- A repetition of the 1970s uranium price environment would likely prove sufficient to induce the new supply so badly needed (Figure 9).
- A sustained period of high prices will be needed to induce the new supply required, and on a real basis the 1970's provides a historical precedent.

	ASX	Price A\$ps	MCap A\$M	Cash A\$M	Debt A\$M	EV A\$M
Brownfield Re-starts						
Paladin Energy	PDN	1.32	3,939.7	95.0	127.8	3,972.5
Boss Energy	BOE	5.35	2,186.3	226.7	0.0	1,767.2
Lotus Res.	LOT	0.33	571.1	12.4	0.0	558.7
Peninsula En.	PEN	0.13	263.1	17.9	0.0	197.4
Greenfield projects						
Deep Yellow	DYL	1.47	1,124.1	25.2	0.0	1,098.9
Bannerman En.	BMN	3.53	539.5	35.2	0.0	504.4
Alligator Energy	AGE	0.07	262.6	36.6	0.0	226.0
Aura Energy	AEE	0.27	159.7	9.7	0.0	150.0
Berkely Energia	BKY	0.32	142.7	75.0	0.0	67.7
Toro Energy	TOE	0.47	55.9	15.4	0.0	40.5
Explorers						
Elevate Uranium	EL8	0.58	177.4	15.7	0.0	161.6
Devex Res.	DEV	0.30	130.2	21.8	0.0	108.4
Cauldron Energy	CXU	0.05	59.3	1.3	0.0	58.0
92 Energy	92E	0.51	54.4	5.0	0.0	49.4
Marmota Limited	MEU	0.05	49.8	3.1	0.0	46.6
Global Ur. Enrich	GUE	0.13	27.6	1.2	0.0	26.4
Energy Metals	EME	0.16	32.5	13.2	0.0	19.3
GTI Energy	GTR	0.01	20.5	2.1	0.0	18.4
Eclipse Metals	EPM	0.01	14.4	0.9	0.0	13.5
Haranga Res.	HAR	0.17	15.2	2.0	0.0	13.3
Valor Resources	VAL	0.00	12.7	2.0	0.0	10.7
Terra Uranium	T92	0.19	10.5	0.8	0.0	9.8
Basin Energy	BSN	0.17	13.7	6.5	0.0	7.2
Adavale Res.	ADD	0.01	7.4	2.4	1.2	6.2
Thor Energy	THR	0.03	4.8	1.0	0.0	3.9
Moab Minerals	MOM	0.01	5.0	2.8	0.0	2.2

At market close on 14 Feb 2024, debt and cash as at 31 Dec 2023, plus post quarter raisings

Favoured stocks in the sector:

- Given liquidity and scale, BOE and PDN have captured investor demand to-date. At the smaller end, we like LOT for its meaningful scale, comparative value (below 1/6 the EV/lb production of BOE and PDN), and its status as an emerging brownfield developer.
- Within greenfield developers we prefer the scale potential of BMN, trading below DYL in terms of EV/lb of production.
- Within explorers, we like the Athabasca Basin (92E, GUE), Australia's Alligator River Region (DEV) and potential producers in the US (GUE) given strong US support, and Namibia (EL8) as an established supplier.

Uranium spot price is strong in nominal terms...

The uranium spot price is strong (Figure 1). While it has not breached record nominal pricing it is historically high on a nominal basis, with current spot of US\$102.75/lb. CY23 saw the commodity spot price increase by 88% from US\$48.63/lb at the start of the year to US\$91.50/lb, with the spot price currently at its highest level since 2007.

Figure 1: U₃O₈ spot price over the last year



Source: Trading Economics

...but the bear market was long and brutal

The uranium market was in a bear market for 11 years, from 2007 to 2018, with the spot price falling from US\$137/lb to below US\$20/lb. This included the impact of the Fukushima accident in 2011.

The current bull market is arguably six years old, and has included extended periods of grinding consolidation at or near price lows (Figure 2).

Figure 2: Uranium commodity bear and bull markets

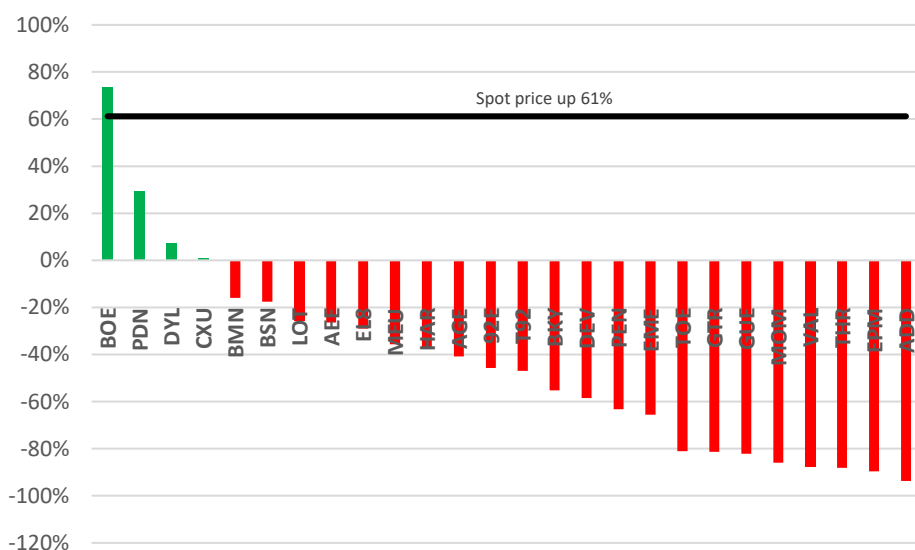


Source: Trading Economics, Petra Capital

Equities have a lot of catching up to do

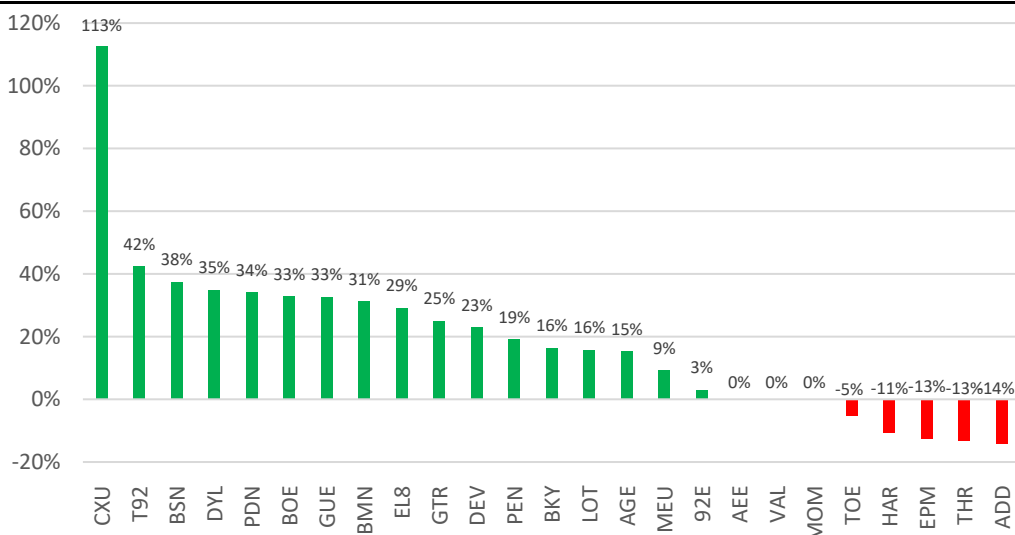
The uranium price rapidly accelerated throughout 2021 and early 2022, driving a sharp spike in the share price of uranium equities, where most stocks hit multi-year highs. Despite the current uranium price increase and strong underlying fundamentals, equity returns are well below their highs of 2021 or 2022, despite the spot price having increased by 61% since then (Figure 3). Only BOE has outperformed spot uranium since the Company’s 2021-2022 peak. We therefore see ASX uranium equities having a lot of catching up to do, even after the run they have had in CY24 to date (Figure 4).

Figure 3: Equity returns from peak in 2021-2022 highlight the catch-up required



Source: Iress, Petra Capital

Figure 4: 2024 YTD returns

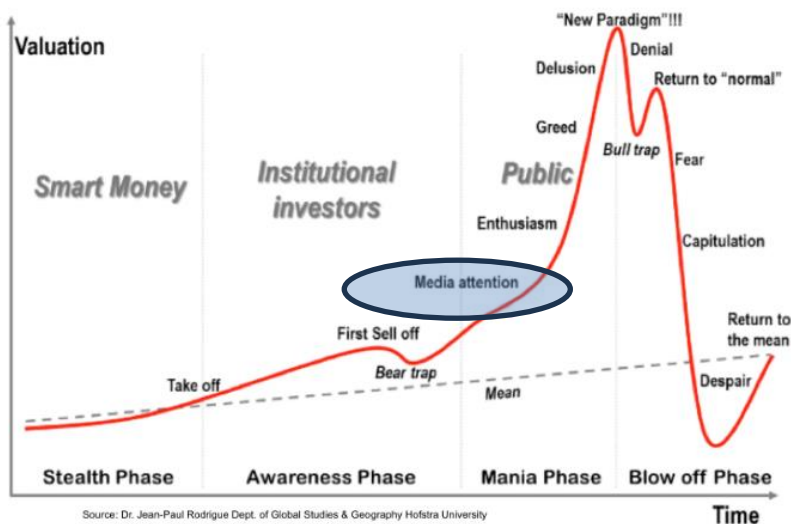


Source: Iress, Petra Capital

Cycle position

While the bull market is by no means young in terms of years, we contend that we are still relatively early in the classic market cycle, as shown in Figure 5. We are starting to see the uranium sector gain media exposure, and would place the sector in the “Media attention” phase, well advanced in terms of years, but relatively early in terms of potential returns. This year’s strong equity performance represents the start of a required equity catch-up to the performance of the underlying commodity.

Figure 5: Typical market cycle



Source: Dr. Jean-Paul Rodrigue Dept. of Global Studies & Geography Hofstra University

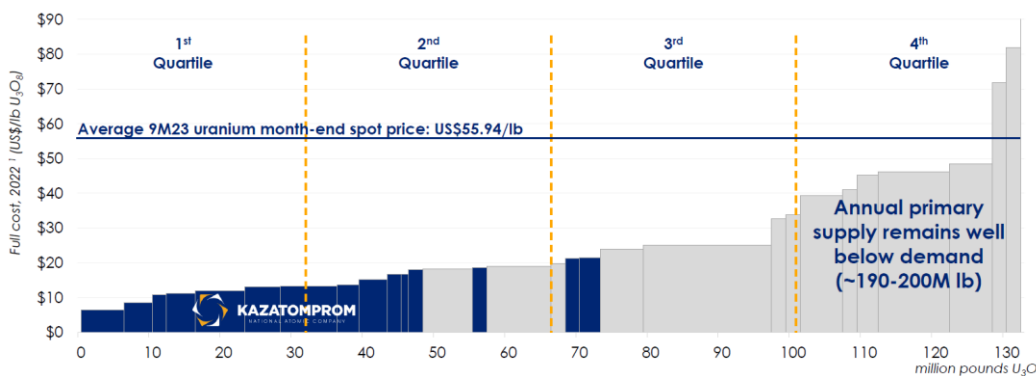
Source: Dr Jean-Paul Rodrigue via Medium.com, Petra Capital

Cost curve is not a near term anchor for spot prices

The uranium price is historically volatile. Nuclear fuel has no substitutes for end users and thrifting does not exist. Fuel cost is a small percentage of operating costs, and a large capital base is dependent upon securing fuel – demand is essentially price inelastic. As we recently saw in the coal market (Figure 7) and the UK/EU gas market (Figure 8), the industry cost curve (Figure 6) has no relevance if supply is scarce.

In the previous cycle, the uranium spot price was US\$72/lb at the start of 2007 and increased by 90.3%, to US\$137/lb by June of the same year. A repeat of this percentage gain would suggest a spot price of US\$174/lb this year.

Figure 6: Industry cost curve – just not relevant in an undersupplied market



Source: Kazatomprom

Figure 7: Thermal Coal Price History



Source: Trading Economics

Figure 8: UK Gas Price History



Source: Trading Economics

In the last uranium cycle, flooding of Cameco's 18Mlb pa Cigar Lake development brought into question the reliability of supply, but the market was not in deficit at any point in the cycle. Kazakhstan was emerging as a significant producer and circa 19.5Mlbs pa was available as secondary supply from the Megatonnes to Megawatts project ([Ready...set](#), see Figure 2).

This time around:

- there is already a primary supply deficit (production ~130Mlbs, demand ~190Mlbs)
- there was no real investment or exploration over the last 17 years
- secondary supply from the Megatonnes to Megawatts project no longer exists, and
- enrichers will be forced to overfeed (essentially requiring more U₃O₈ to deliver the same quantity of enriched fuel) rather than underfeeding (given the "loss" of Russian enrichment capacity - see [Long term pricing](#))

Uranium from a restarting McArthur River/Key Lake (TSX CCO) and Kazatomprom (LSE KAP) moving from 80% to 100% of its Subsoil Use Agreement, were seen as the easiest of "easy pounds", coming to the market. CCO failed to meet revised production guidance in 2023, whilst highlighting risks to its unchanged 2024 guidance. Together with KAP being unable to ramp up from 80% to 90% in 2024, this is bullish for the uranium price, despite the market's negative reaction to CCO retaining its 2024 guidance. Given difficulties in 2024 (originally guided to ramp-up from 80% to 90% - recently guided that production would remain flat), it seems unlikely KAP will be able to produce at 100% levels in 2025 (current guidance), while failure to meet revised guidance for 2023 call into question CCO's ability to meet its 2024 guidance.

That the world's two leading producers of uranium are struggling to reliably ramp up supply encapsulates the uranium thesis: demand is robust and growing, supply growth is insufficient and insufficiently reliable.

KAP's significant downgrading of 2024 production guidance may trigger increased utility concern, and lead to an increase in contracting.

New supply needs more than a price spike

The uranium deficit is not a result of a spike in demand. Simply, demand has gradually overwhelmed supply, and demand for enriched fuel means the end of underfeeding, turning secondary supply into secondary demand. When considering the underinvestment over the last 17 years and the increased timeframes and headwinds to bring new mine supply online (build/commissioning/regulatory risks etc), new supply will take many years to eventuate. In the short to medium term, the fix for high prices will not be high prices.

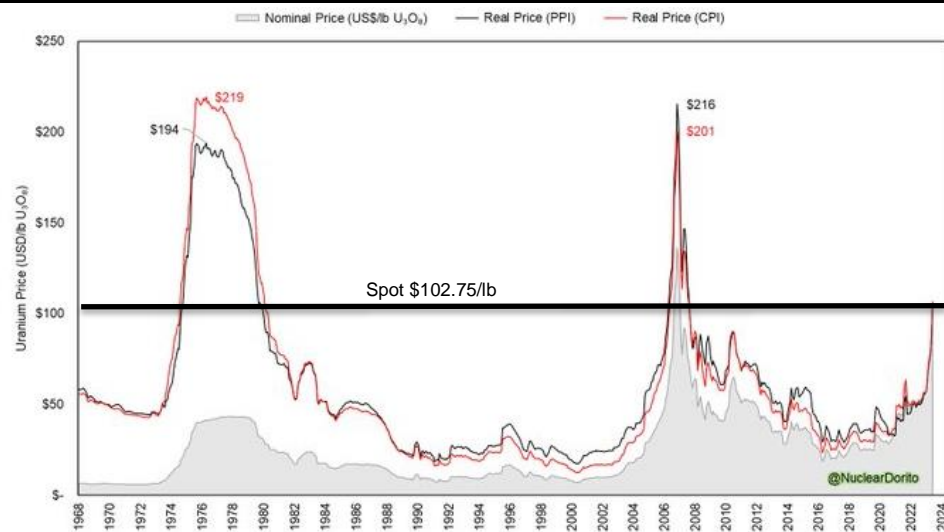
The industry needs to induce new production, not merely from the existing brownfield producers, but from greenfield producers as well. A short-lived price spike will do little to induce new greenfield supply. New projects need sustained higher prices above the high end of the cost curve to induce new supply.

In real terms the U₃O₈ price remains modest

In nominal terms, the uranium price of the mid-to late 1970s appears irrelevant in the context of the 2007 cycle pricing. However, on an inflation adjusted basis the pricing observed also peaked well above the US\$137/lb nominal peak of 2007. Figure 9 shows the nominal uranium price in grey, with inflation adjustments using both the US CPI index and the (likely more relevant) PPI for Metals and Metal Producers.

When viewed in real rather than nominal terms (Figure 9), the 1970's pricing environment was strong enough, and high prices were likely sustained long enough, to induce new greenfield supply – the “hard pounds” the uranium industry needs to bring online in this cycle. Despite appearances on a nominal basis, the 1970s provide a historical precedent for the price action now required.

Figure 9: Inflation adjusted U₃O₈ Spot Price



Source: Nuclear Dorito @NuclearDorito via Twitter, Petra Capital

Overview of ASX listed uranium producers

In the context of spot uranium returns of +88% in 2023, brownfield developers led gains within the ASX uranium sector in 2023, delivering a +37% return, versus a +27% for greenfield developers and a 4% loss for explorers.

Since the start of CY24, brownfield projects have still led returns on average (+25%), but explorers (+17%) have received increased investor attention with average returns bettering those of the greenfield developers (+15%), with all sectors outperforming U₃O₈ (+12%) year-to-date.

Brownfield developers

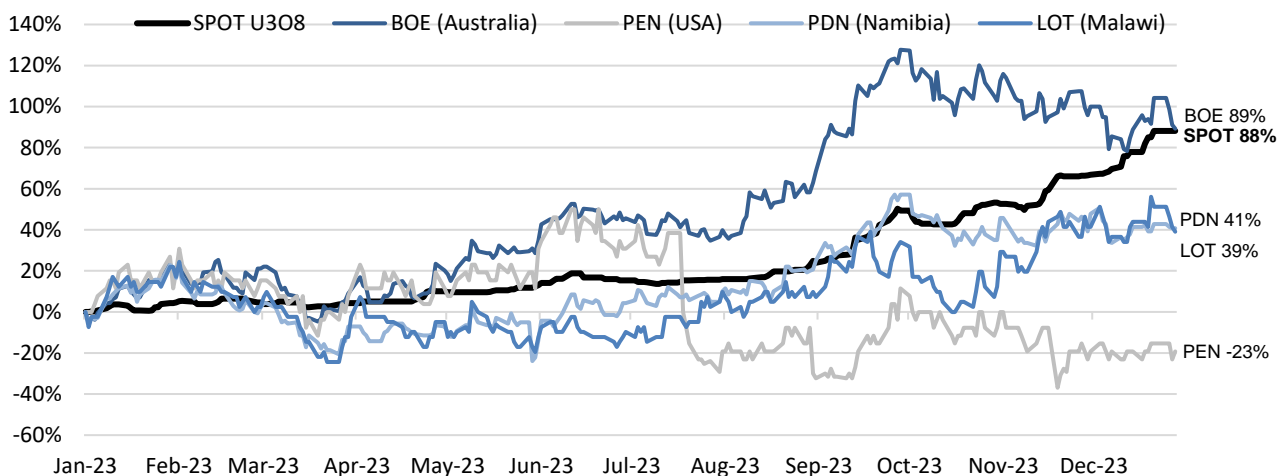
Brownfield developers led returns in 2023, outperforming greenfield developers and explorers, with investors focussed on large liquid names such as PDN and BOE.

However, with the exception of BOE (+89%), all brownfield developers underperformed the spot price in 2023 (+88%), with the brownfield developer return of +37% dragged down by PEN's underperformance (Figure 10).

BOE led Brownfield returns (slightly outperforming spot) with a 2023 return of 89%. Both BOE and PDN are now captured in both the Small Ordinaries index and the ASX200, delivering them both a certain weight of passive investment.



Figure 10: Brownfield developer and spot movements in 2023



Source: Iress, Petra Capital

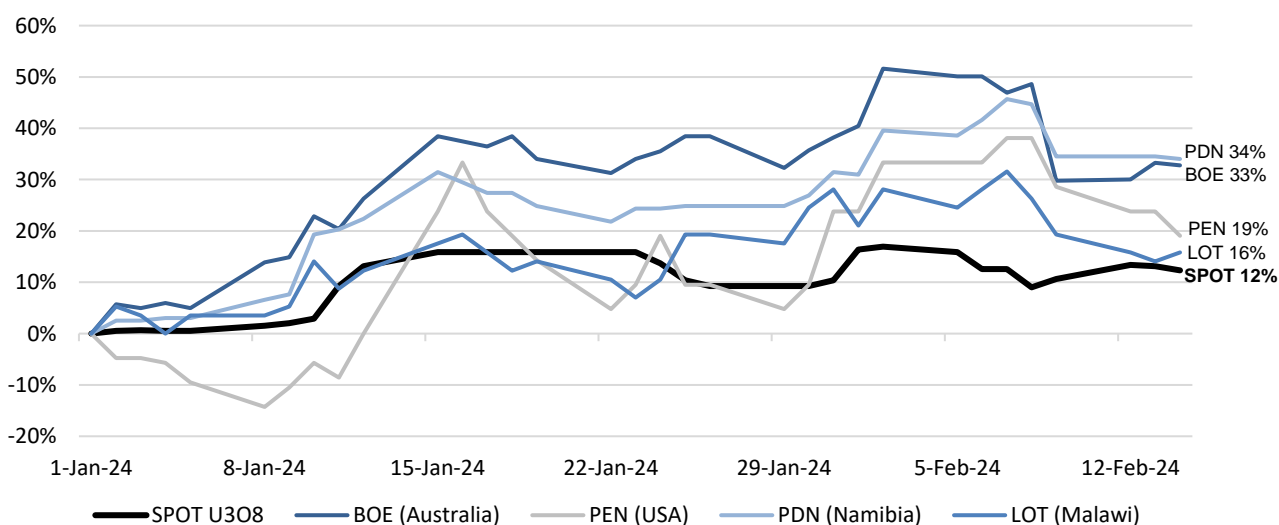
Since the start of 2024, all brownfield developers have outperformed the spot price (Figure 11) reflecting increasing investor interest in the sector. As Figure 3 shows, with the exception of BOE, there remains significant catching up to be done to match the performance of the underlying commodity.

BOE is now in production at Honeymoon and has acquired a 30% interest in enCore Energy's (TSXV EU) Alta Mesa ISR project in Texas, USA which is targeting production in 2024.

The next producer to come online is PDN's restart of Langer Heinrich which is over 93% complete.

LOT is targeting FID for its Kayelekera project in Malawi by mid-year – with a likely 15-month construction period to follow. Following a setback late in 2023, PEN's Lance ISR project is now expected to commence late in 2024.

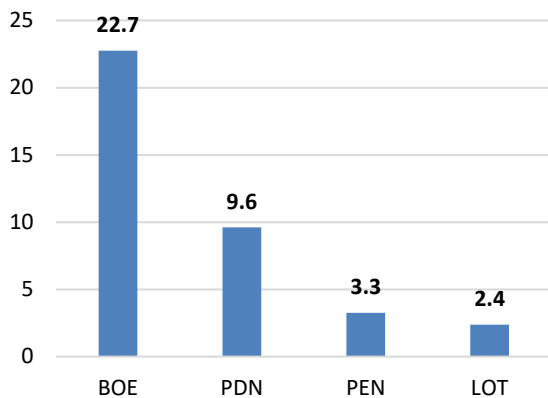
Figure 11: Brownfield developer and spot movements in 2024



Source: Iress, Petra Capital

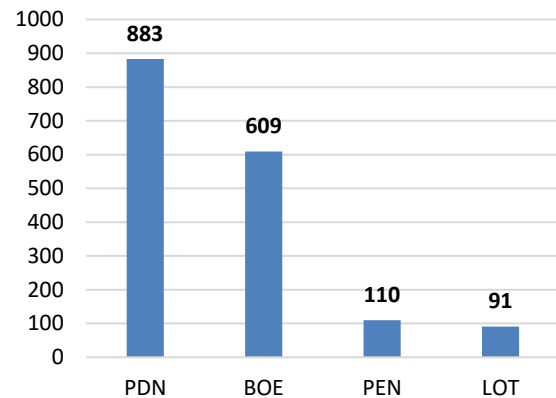
Given BOE's strong share price performance since late 2023, it now scans as expensive in terms of EV/lb of global Resource (Figure 12, all Resources, not merely the Resource attributable to a project). Exploration success around Honeymoon (71.6Mlbs) could quickly change this.

Figure 12: EV/lb global Resource (A\$m/Mlb)



Source: Company reports, Petra Capital

Figure 13: EV/lb peak production (A\$m/Mlb)



Source: Company Reports, Petra Capital

PDN's Langer Heinrich project (96Mlbs @ 415ppm) is responsible for just 22% of the Company's attributable Resource base, with 128Mlbs @860ppm in Canada (Michelin) and various Australian deposits contributing a further 190Mlbs @ 635ppm. Despite this, only Langer Heinrich contributes to current production expectations, making PDN appear expensive on a production basis (Figure 13).

Allocating the average greenfield EV/lb of A\$4.30/lb to the Australian and Canadian Resources, leaves an EV of A\$2,607m associated with PDN's Langer Heinrich project. This suggests an EV/project Resource lb of A\$27/lb, 23% above BOE at A\$23/lb.

PDN's 100% owned Michelin deposit in Canada is one of the largest undeveloped deposits in continental North America, with a Resource of 128Mlbs @ 860ppm (well above Langer Heinrich's 415ppm). It deserves a greenfield developer's rating (EV A\$4.30/lb) rather than the average Australian explorer's rating (EV A\$1.18/lb) in our view.

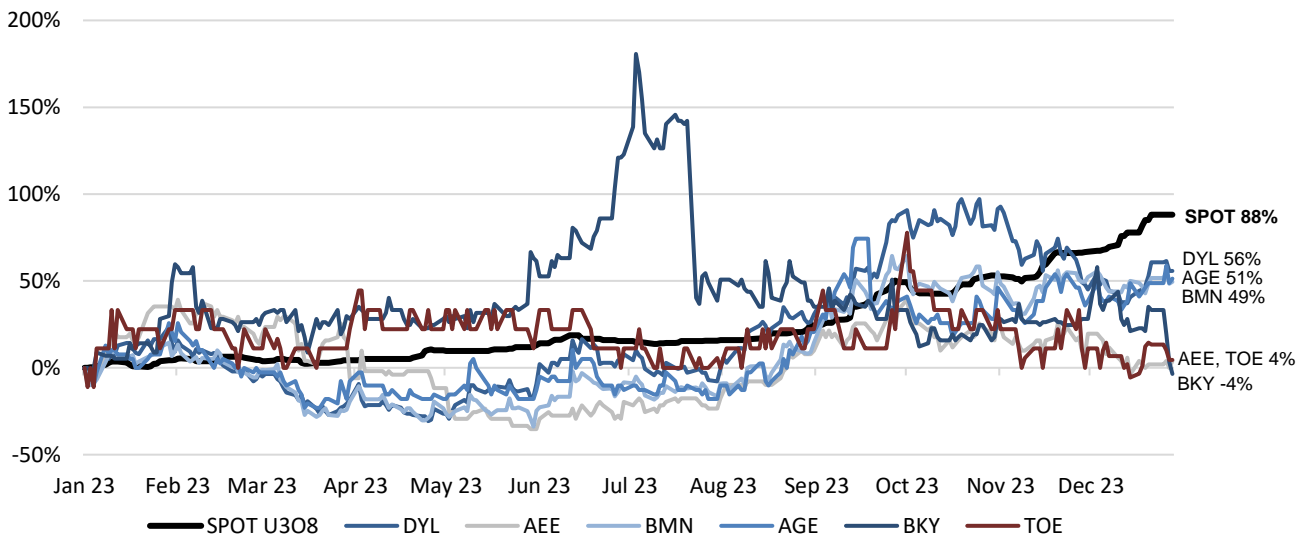
The much lower EV/Mlbs of production rating of A\$91/Mlb (i.e., less than one sixth) attributed to LOT demonstrates the value to be captured as the Kayalekera project progresses towards FID, and equity dilution fears recede. Following the successful acquisition of A-Cap Resources and its Letlhakane project, LOT now has a very significant Resource base, and with two projects, a potential production life well beyond a decade.



Greenfield developers

Greenfield developers underperformed spot in 2023 (Figure 14), with market attention focussed on well-known brownfield plays such as PDN and BOE. BKY's mid-year share price spike coincided with optimism associated with a general election in Spain that could have seen a relaxation of prohibitive regulator policies; however, this did not eventuate.

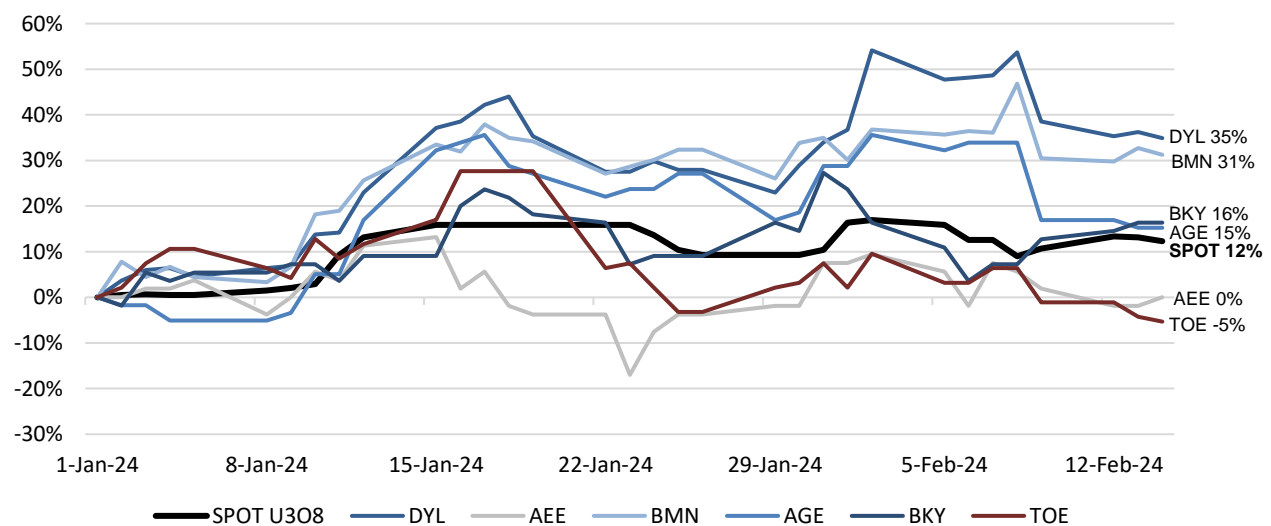
Figure 14: Greenfield developer and spot movements in 2023



Source: Iress, Petra Capital

2024 has seen investor's willing to take on more risk and greenfield developers have started to outperform spot, particularly those with name recognition, such as DYL and BMN (Figure 15).

Figure 15: Greenfield developer and spot movements in 2024



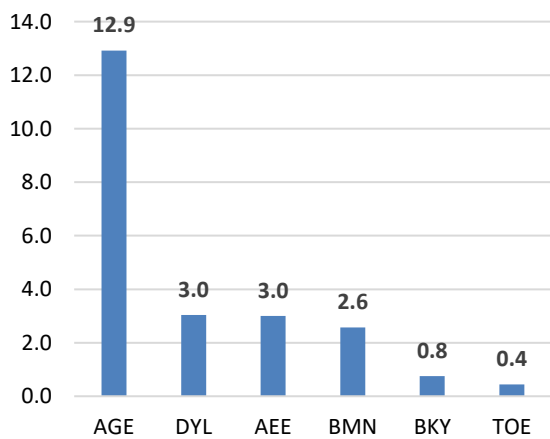
Source: Iress, Petra Capital

DYL has John Borshoff as MD/CEO, providing name recognition on the ASX and unique experience associated with bringing two uranium assets into production in the last cycle with PDN. Following the addition of the Alligator River project as a result of the acquisition of Vimy Resources in 2022, we would like to see DYL consolidate the Alligator River region, giving DYL exposure to similar high-grade Resource potential as found in Canada’s Athabasca Basin whilst leveraging Mr Borshoff’s name recognition within Australia. When compared with fellow Namibian developer BMN, DYL scans relatively expensively, both on an EV/lb of Resource and EV/Mlb of peak production. Given its comparative value, and the extensively studied nature of the project, we prefer BMN with its ETANGO-8 project also in Namibia (Figure 16 & Figure 17). DYL is also in the Small Ordinaries (with PDN and BOE) and passive investing may drive returns regardless of comparative value.

Given the success of BOE, we like AGE with its Australian Samphire project a potentially meaningful replication of BOE’s Honeymoon ISR project. A significant drilling program should resolve the currently small project Resource, while Alligator River tenements in Australia’s Northern Territory NT offer high-grade potential over the longer term.

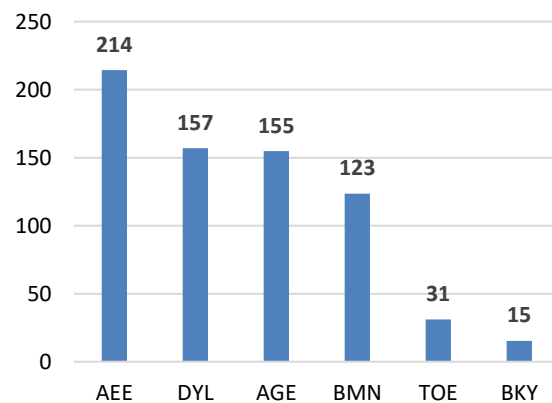
While Mauritania is not an existing uranium supplier, AEE’s (ASX AEE) Tiris project is well advanced (FEED imminent) with potential for Resource extensions (extensional drilling has commenced) and increased initial production targets.

Figure 16: EV/lb global Resource (A\$m/Mlb)



Source: Company reports, Petra Capital

Figure 17: EV/lb peak production (A\$m/Mlb)



Source: Company Reports, Petra Capital

Explorers

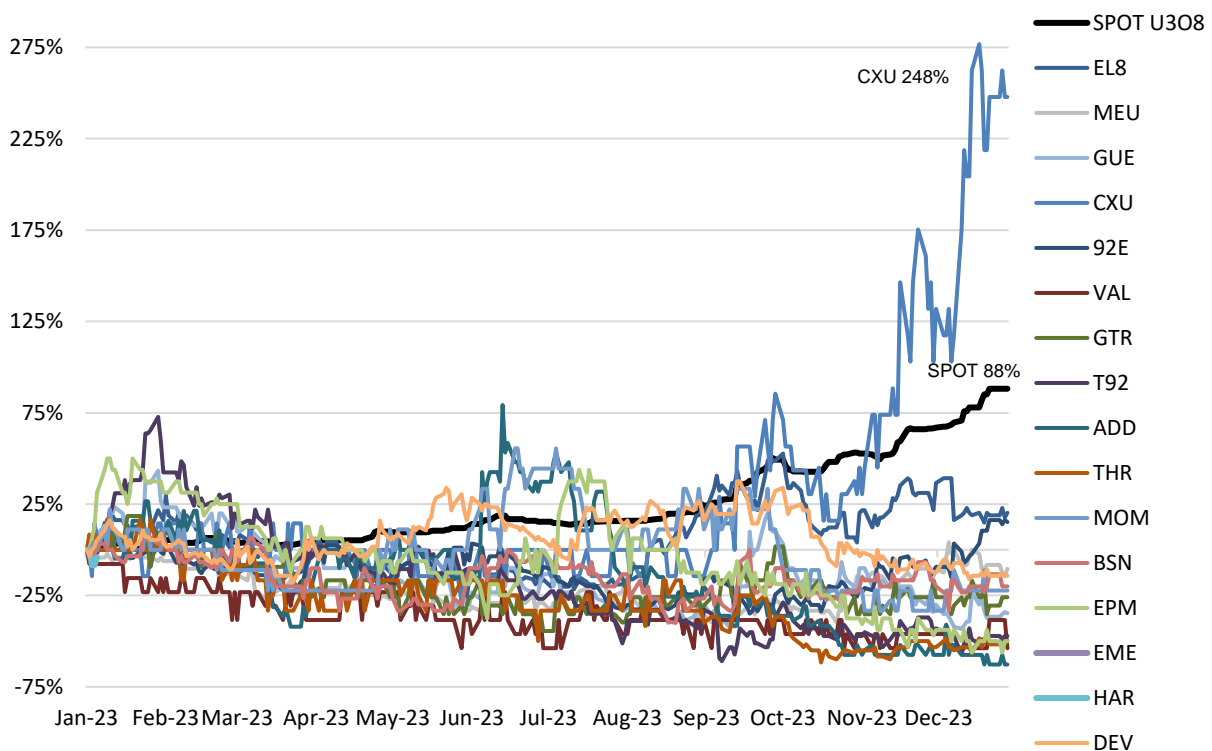
As a starting point, the following jurisdictions offer favourable attributes, including prospective geology and a uranium-friendly regulatory environment:

- **Canada’s Athabasca Basin** – this region offers potential for super high-grade discoveries, with Resource grade measured in % rather than ppm. Nexgen Energy’s (TSX NXE) Arrow deposit (Rook project) sees over 60% of the Measured and Indicated Resource with a grade of circa 17% (170,000ppm); compare this to PDN’s Langer Heinrich project in Namibia with a Resource grade of 0.0448% (448ppm).
- **Namibia** – despite generally low grades, Namibia is the third largest supplier of uranium (11% in 2022), with a well proven development framework and path to market.
- **USA** – The USA depends heavily on nuclear energy, but as of 2022 imported 95% of its uranium requirements, with most potential assets either permanently shuttered or still on care and maintenance. The US government has identified this as a key vulnerability and is actively supporting new US production.
- **Australia’s Alligator River region** in the Northern Territory. Like the Athabasca Basin in Canada, this region offers the potential for extremely high grades – the historic Nabarlek mine produced 24Mlbs at 1.84% (18,400ppm).

CXU was the clear outlier amongst explorers, being the sole explorer to outperform spot in 2023 (Figure 18). Its Yanfrey Project (including the Bennet Well deposit) is based in WA which has a moratorium on uranium developments. Parle Investments became a substantial holder in early November with an 11.6% interest, increasing to 15.5% by the end of the month and this appears to have driven outperformance.

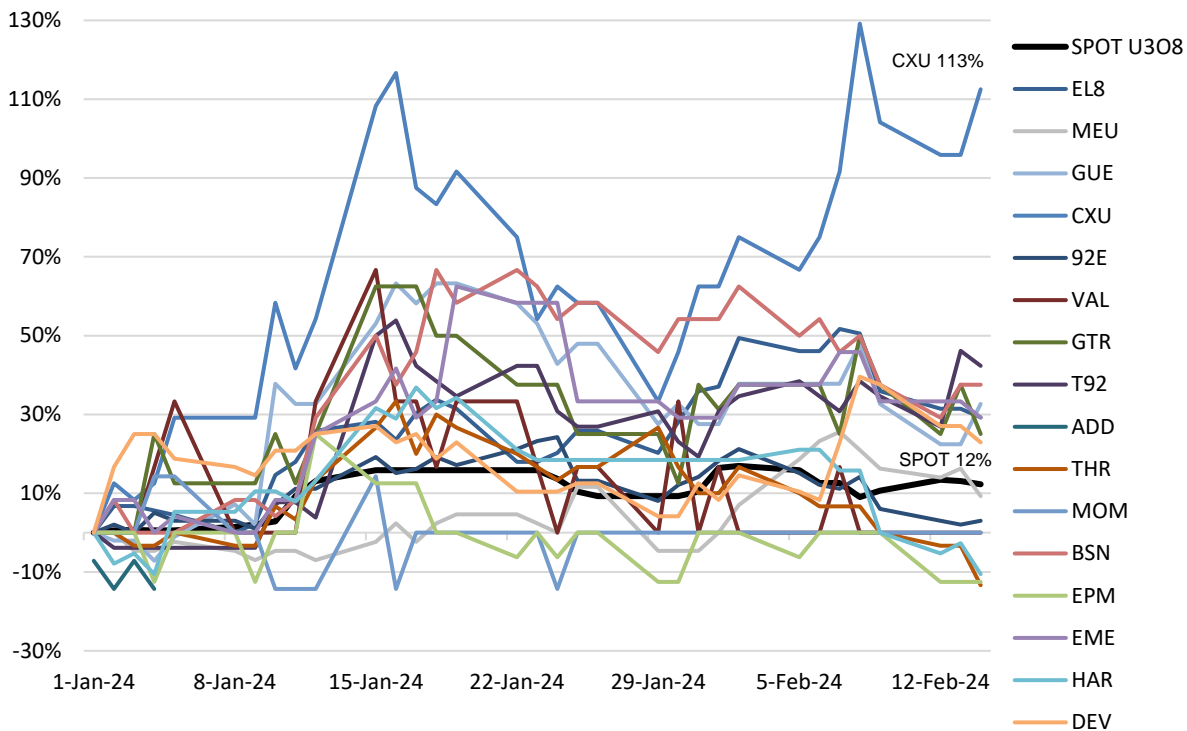
All other ASX listed explorers underperformed spot in 2023. In general, in 2024 explorers have tended to outperform spot, with MEU, EPM, HAR, THR, ADD, VAL and 92E the exceptions (Figure 19).

Figure 18: Explorer and spot movements in 2023



Source: Iress, Petra Capital

Figure 19: Explorer and spot movements in 2024



Source: Iress, Petra Capital

Explorers can generally be split between those with an existing Resource, and those that remain pre-Resource.

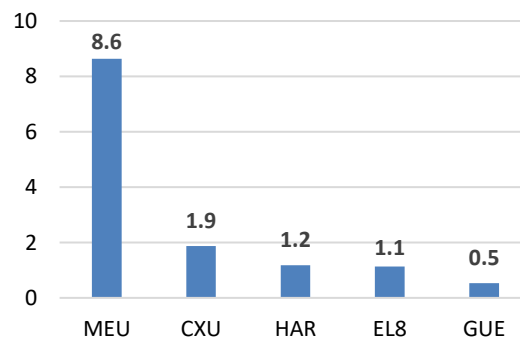
Explorers with a Resource

Despite its low Resource grade (prior to upgrading) we like the scale and location of EL8’s Namibian projects, with Namibia the third largest global supplier of uranium (11% market share in 2022), with a well-established development pathway and export infrastructure.

With the US being the leading consumer of uranium but with negligible domestic production, a focus on new US supply makes sense. Of US focussed explorers, we like GUE with a large 50Mlb Resource with upside potential in Colorado, USA, as well as blue-sky exploration potential in Canada’s Athabasca Basin.

We note the high valuation attributed to MEU likely reflects value given to the Company’s 300koz gold Resource (Figure 20).

Figure 20: EV/lb global Resource (A\$m/Mlb)



Source: Iress, Petra Capital

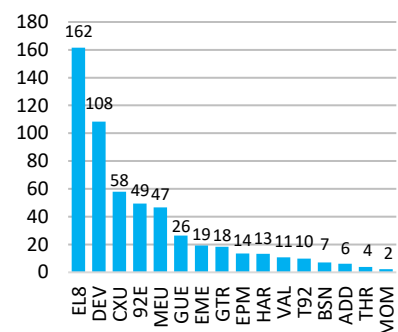
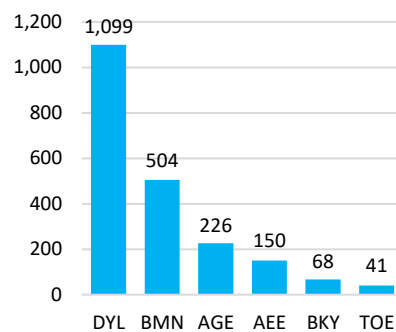
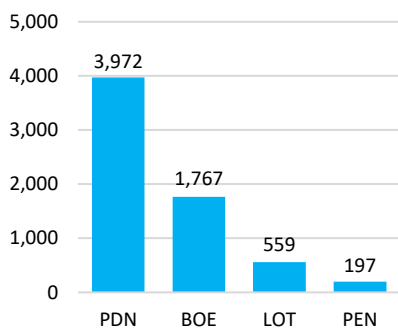
Explorers: pre-Resource

We like 92E, with a proposed three-way merger by CSE listed Atha Energy and Latitude Uranium, on foot (ASX 92E, CSE LAT, CSE SASK). The combined entity will include management which assembled the ground position that led to the Nexgen Energy’s (TSE NXE) Arrow discovery, and the Iso Energy (TSX ISO) Hurricane discovery. This new entity will retain a 10% free carried interest in various NXE and ISO exploration holdings, and post-merger will have significant cash (C\$65m), the leading ground position in both the Athabasca Basin and the Thelon Basin, together with a historic Resource in the Angilak deposit (43.3Mlbs @ 6,900ppm. Whilst likely to be TSX listed (SASK is currently CSE listed but has applied to list on the TSX), we see this new company being a leading equity performer in this cycle. Above the fundamental appeal of the exploration ground, 92E is trading well below the theoretical offer price of A\$0.64/sh, providing a ~25% arbitrage opportunity for ASX investors.

We like the exploration ground of DEV, which includes the historic high-grade Nabarlek mine, in the Northern Territory’s high-grade Alligator River region. DEV is well managed and is actively exploring highly prospective ground - the existence of the Nabarlek mine within its landholding re-enforcing the likelihood of establishing a commercial Resource.

ASX Uranium Sector Enterprise Values

Figure 21: ASX Brownfield EVs (A\$m) Figure 22: ASX Greenfield EVs (A\$m) Figure 23: ASX Explorer EVs (A\$m)



Source: IRESS, Company Reports, Petra Capital

Source: IRESS, Company Reports, Petra Capital

Source: IRESS, Company Reports, Petra Capital

Figure 24: ASX Listed Uranium Companies Overview

		EV A\$m	YTD %	1M %	Key asset/Location	Country
Enrichment technology						
SLX	Silex Systems	1,210.4*	18%	3%	Global Laser Enrichment Commercialisation Project (JV SLX 51% Cameco 49%)	Australia & USA
Brownfield Re-start Projects						
PDN	Paladin Energy	3,972.5	34%	10%	Langer Heinrich (75%)	Namibia
BOE	Boss Energy	1,767.2	33%	5%	Honeymoon, Alta Mesa (30%)	Australia, USA
LOT	Lotus Resources	558.7	16%	3%	Kayelekera (85%)	Malawi
PEN	Peninsula Energy	197.4	19%	19%	Lance	USA - Wyoming
Greenfield Project Developers						
DYL	Deep Yellow	1,098.9	35%	10%	Tumas (95%, DFS Feb-23), Mulga Rock	Namibia
BMN	Bannerman Energy	504.4	31%	4%	Etango-8 (95%, DFS Dec 2022)	Namibia
AGE	Alligator Energy	226.0	15%	-1%	Samphire Project, SA (Scoping Mar 2023)	Australia
AEE	Aura Energy	150.0	0%	-10%	Tiris (Enhanced DFS Mar 2023)	Mauritania
BKY	Berkely Energia	67.7	16%	7%	Salamanca (DFS 2016)	Spain
TOE	Toro Energy	40.5	-5%	-15%	Wiluna (Scoping Study/PEA 2014), WA	Australia (WA)
Explorers						
EL8	Elevate Uranium	161.6	29%	3%	Koppies, Erongo (Marenica, 75%)	Namibia
DEV	Devex Resources	108.4	23%	-2%	Nabarlek, Northern Territory	Australia
CXU	Cauldron Energy	58.0	113%	38%	Bennett Well (Yanfrey project), WA	Australia (WA)
92E	92 Energy	49.4	3%	-7%	Gemini (Athabasca Basin)	Canada
MEU	Marmota Ltd	46.6	9%	18%	Junction Dam, South Australia	Australia
GUE	Global Uranium Enrichmt	26.4	33%	0%	Tallahassee – Colorado & Athabasca Basin	USA & Canada
EME	Energy Metals	19.3	29%	3%	Biglryi JV (79%) & Ngalia Regional, NT	Australia
GTR	GTI Resources	18.4	25%	0%	Thor Projects, Wyoming	USA
EPM	Eclipse Metals	13.5	-13%	-30%	Northern Territory	Australia
HAR	Haranga Resources	13.3	-11%	-21%	Saraya Uranium Project	Senegal
VAL	Valor Resources	10.7	0%	-25%	Athabasca Basin	Canada
T92	Terra Uranium	9.8	42%	37%	Athabasca Basin	Canada
BSN	Basin Energy	7.2	38%	6%	Athabasca Basin	Canada
ADD	Adavale Resources	6.2	-14%	-40%	Lake Surprise, South Australia	Australia
THR	Thor Mining	3.9	-13%	-24%	Wedding Bell, Colorado	USA
MOM	Moab Minerals	2.2	0%	17%	Rex, Colorado	USA
ASX Uranium Sector		10,349				

Source: IRESS, Petra Capital, Prices as at COB 14 February 2024, * Cash and debt as at 30 June 2023



Petra Capital

Level 17, 14 Martin Place, Sydney NSW 2000 Office: +61 2 9239 9600
Level 5, 1 Collins Street, Melbourne VIC 3000 Office: +61 3 9123 3000

ABN 95 110 952 782
ACN 110 952 782
AFSL 317 944

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