

# Mulga Rock uranium project

## Uneconomic and unlikely

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*A stagnant commodity price, improbable market scenarios and excess global supply options raise credibility issues with Vimy Resources 'Definitive Feasibility Study' for the Mulga Rock uranium project.*

Report commissioned by the Australian Conservation Foundation (ACF) and the Conservation Council of Western Australia (CCWA)

**Dr Cameron K. Murray**  
**2018**

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# Summary

Vimy Resources claims its “Definitive Feasibility Study” (DFS) shows that the Mulga Rock uranium deposit east of Kalgoorlie is financially viable and ready to begin mining in the near future.

The DFS relies on heroic assumptions about prices, unfounded optimism about a booming nuclear industry and a scenario where Vimy has no low-cost competitors. In reality, many low-cost competitor mines have recently decreased production or delayed investment in response to low uranium price and could resume production in response to possible future price increases before this project is close to being viable.

Regulatory risks are also downplayed or ignored in the DFS. The mine still requires a number of remaining approvals and the DFS fails to reflect the miner’s financial obligations to contribute to Western Australia’s Mine Rehabilitation Fund or the likelihood that the WA Government may require a significant mine closure bond.

Assumptions about exchanges rates and establishment costs in the DFS are made with little regard to the macroeconomic realities of Australia. If commodity markets boom and raise the uranium price to USD\$60/lb, so will the exchange rate and the capital costs of mining construction, undermining profitability. The last time uranium prices met the DFS forecast the exchange rate was USD\$0.85 and mining capital costs were increasing at 7% per year.

The project risk is profound. A more complete scenario analysis that expands the scope of the Mulga Rock DFS shows that under plausible assumptions about exchanges rates (USD\$0.75-0.80 range) and uranium prices (USD\$20-40 range) the mine is unprofitable. Applying the recent ten-year average price (USD\$40) and exchange rate (USD\$0.85) the NPV of the project is nearly negative half a billion dollars.

NPV at 8% discount rate (AUD \$ million)		Exchange rate (USD/AUD)				
		0.70	0.75	0.80	0.85	0.90
Uranium price (\$USD/lb)	20	-972	-1,022	-1,066	-1,104	-1,139
	30	-596	-671	-737	-795	-847
	40	-221	-321	-409	-486	-555
	50	155	29	-80	-177	-263
	60	530	380	248	132	29

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# Background

Despite the global uranium price sitting at multi-decade lows, with little growth in global uranium demand on the horizon, Vimy Resources continues to advance their Mulga Rock uranium mine proposal in Western Australia (WA). Their Definitive Feasibility Study (DFS) estimates the project has an NPV of \$530 million at an 8% discount rate and a 25% IRR in the base case scenario.<sup>1</sup>

This report takes a critical look at the economic and financial assumptions in the DFS that are required to make this project appear financially viable.

Progress on the project is described in the DFS as follows.

The Mulga Rock Project lies approximately 290km by road east-northeast of the regional mining city of Kalgoorlie-Boulder in the Shire of Menzies. The MRP comprises two granted Mining Leases (M39/1104 and M39/1105) and associated Miscellaneous Leases covering critical infrastructure.

The MRP is the largest advanced uranium project in Australia with an Ore Reserve of 22.7Mt at 845ppm U<sub>3</sub>O<sub>8</sub> for 42.3Mlb U<sub>3</sub>O<sub>8</sub>. The Ore Reserve is a subset of the Mineral Resource which stands at 71.2Mt at 570ppm U<sub>3</sub>O<sub>8</sub> for a contained 90.1Mlb U<sub>3</sub>O<sub>8</sub> at a cut-off of 150ppm U<sub>3</sub>O<sub>8</sub>.

Final Ministerial Approval was granted by the State of Western Australia under s.45(5)(b) of the Environmental Protection Act 1986 (EP Act) in December 2016. The Australian Federal Government granted final approval under s.133 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) in March 2017. This completes all the Ministerial approvals for the development of the project.<sup>2</sup>

In terms of the required government approvals, the existence of the current conditional project approvals is far from the end of the assessment process. A number of further approvals and permits are required including water licences, mining licences and export licences. There is also the potential need for an Indigenous Land Use Agreement, or approvals under the Aboriginal Heritage Act. All of these approvals processes will occur in a political climate that has turned against uranium mining and prompted the Western Australian government to impose a moratorium on new

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<sup>1</sup> Vimy Resources. (2018). *Definitive Feasibility Study — Mulga Rock project*.  
<https://vimyresources.com.au/2018-dfs-summary/>

<sup>2</sup> Ibid. p5.

uranium mines (with the Mulga Rock project being exempt from the moratorium— at least until its five-year ministerial approval expires in 2022).<sup>3</sup>

Even more than this, the financial constraints facing the development of the Mulga Rock project are significant. The global resources boom of the late 2000's that triggered the investment to date has receded, leaving many mining proposals in limbo. The analysis in this report show why financiers are likely to be, or at least should be, hesitant to back this high-risk project based on its published DFS.

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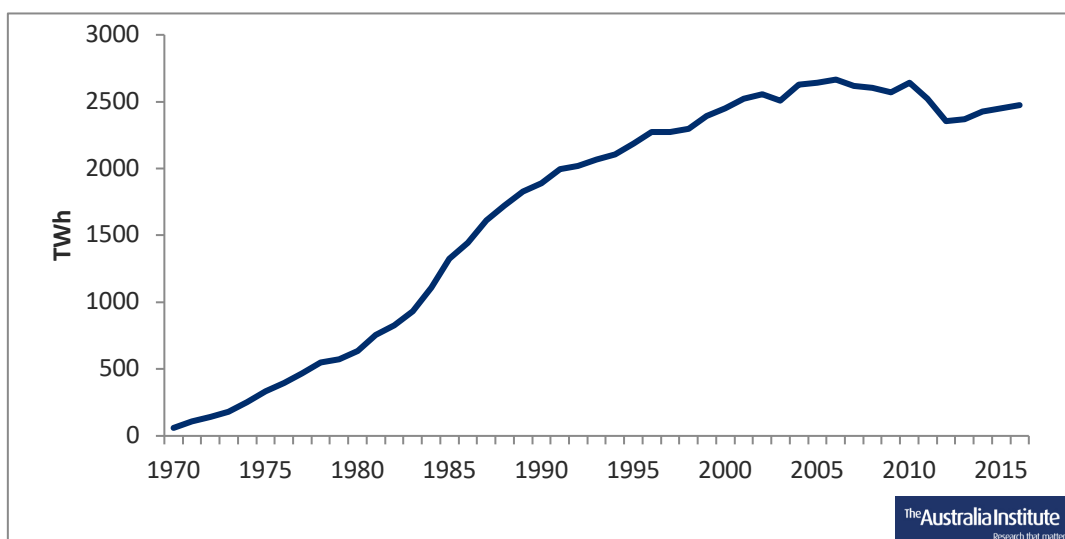
<sup>3</sup> Strutt, J. (2017). *Uranium miners given five-year deadline as WA Premier says he hopes they don't go ahead*. ABC News. 21 June 2017. <http://www.abc.net.au/news/2017-06-21/wa-uranium-miners-given-deadline-to-get-mines-up-and-running/8639070>

# Economic limitations

The DFS rests on a number of assumptions that are not based on consensus forecasts and are extremely optimistic. These range from assessments of global nuclear power trends and competition in uranium mining, to more locally-specific assumptions about prices, costs and exchange rates.

## GLOBAL NUCLEAR TRENDS

In terms of broad trends, the nuclear power industry has diminished in importance within the electricity sector, generating around 10% of electricity globally in 2016, compared to 18% at its peak in 1996.<sup>4</sup> The total number of operating reactors peaked at 438 in 2002<sup>5</sup> while the total electricity output from nuclear peaked in 2006, as Figure 1 shows.



**Figure 1: Total global nuclear energy output<sup>6</sup>**

While there has been a recent increase in the new nuclear plant construction starts, particularly in China, the balance of new reactors and shutdowns is expected to be

<sup>4</sup> World Bank. (2018). *Electricity production from nuclear sources (% of total)*. <https://data.worldbank.org/indicator/EG.ELC.NUCL.ZS?view=chart>

<sup>5</sup> Schneider, M. et. al. (2017). *The World Nuclear Industry Status Report 2017*. <https://www.worldnuclearreport.org/IMG/pdf/20170912wnisr2017-en-lr.pdf>

<sup>6</sup> World Nuclear Association. (2017). *World Nuclear Performance Report 2017*. <http://www.world-nuclear.org/getmedia/b392d1cd-f7d2-4d54-9355-9a65f71a3419/world-nuclear-performance-report-2017.pdf.aspx>

negative over the next decade as much of the global reactor fleet is approaching the end of design life and licensing. Furthermore, as low-cost renewables take up a larger share of electricity markets, inflexible energy sources like nuclear will struggle to compete as they that cannot 'ramp up' production during peak times to capture higher prices. This is a core part of the economic story behind announced closures of some US nuclear plants.<sup>7</sup>

The driver of the global uranium market in which the Mulga Rock project would operate is nuclear power, but the trends in this industry are not positive.

## COMPETITION ISSUES

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The DFS seems to contradict itself on the issue of competition from other uranium mines. To justify its high-cost mine proposal, with an 'all-in sustaining capital cost' per pound of USD\$30, it explains the subtleties of the uranium market being primarily long-term contracts and not closely tracking the spot price.

...most uranium miners are shielded by a portfolio of long-term contracts written at a time of historically high uranium prices. But over the next few years, many of these contracts come to an end and so the industry is entering a period of re-adjustment as the disconnect between utilities and the uranium miners begins to play out.<sup>8</sup>

Yet this re-adjustment is towards lower-priced long-term contracts. The DFS itself goes on to say that the currently low uranium prices have led some low-cost established miners, like the McArthur River Mine in Canada, owned by Cameco, to suspend operations.<sup>9</sup> But this trend is global. Closer to home, Cameco's two proposed uranium mines in Western Australia have recently been shelved in the face of low demand,

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<sup>7</sup> Lovins, A. (2016). *Closing Diablo Canyon Nuclear Plant Will Save Money And Carbon*. Forbes. <https://www.forbes.com/sites/amorylovins/2016/06/22/close-a-nuclear-plant-save-money-and-carbon-improve-the-grid-says-pge/#58b8437c5093>

<sup>8</sup> Vimy Resources. (2018). p98.

<sup>9</sup> These Cameco mines are now suspended indefinitely. Business Insider. (2018). *Cameco reports second quarter results and its decision to suspend production at McArthur River and Key Lake for an indeterminate duration*. 25 July 2018. <https://markets.businessinsider.com/news/stocks/cameco-reports-second-quarter-results-and-its-decision-to-suspend-production-at-mcarthur-river-and-key-lake-for-an-indeterminate-duration-1027400877>



incurring a \$238 million write-down on these assets.<sup>10</sup> Other global uranium miners in Kazakhstan, Namibia and elsewhere have also reduced output.<sup>11</sup>

All of these existing low-cost mines which have temporarily reduced output, and a number of low-cost proposed mines, would be able to (and plan to) respond to any higher commodity price by increasing output again at a lower cost than Mulga Rock. The DFS seems to assume the opposite— that the reduced output of these mines removes them as potential future competitors.

Additionally, the global commodity price boom at the start of the century, of which uranium was a part, triggered extensive exploration and new mine planning and establishment. This has increased the number of potential new low-cost competitors in the global uranium market, a factor also ignored in the Mulga Rock DFS.

While the DFS makes some reference to the global cost curve—the quantity of global uranium produced at different costs—they do not consider the potential entry of new projects at a similar stage as their own, such as NextGen Energy’s Rook I project at their Arrow deposit in the Athabasca Basin in Saskatchewan, Canada.

The cost curve in Figure 2 is from the DFS, showing estimated production of a number of established mines at different unit costs. Figure 3 is the cost curve estimated by NextGen Energy’s Arrow mine, where they include their own potential production at a cost below the existing Canadian mines. NextGen Energy’s proposed Arrow mine could produce 27.6 M lbs per year in its first five years (nine times the output of Mulga Rock) at an operating cost per lb of USD\$4.42/lb<sup>12</sup> compared to Mulga Rock’s USD\$25.11/lb.

Whether NextGen’s mine goes ahead also depends on favourable market conditions and government regulations. However, the striking comparison is the different assessments of competition in these two mine proposals. NextGen’s feasibility study does not consider mines producing at a price above USD\$50/lb to be a likely competitor, while the Mulga Rock DFS does not consider the potential new entry of low cost miners, nor the expansion of production from suspended mines, that would radically shift the global cost curve to the right and make their project unviable.

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<sup>10</sup> Weber, D. (2017). *Uranium mines 'not priority' in WA following profit downgrade, environmentalists claim*. ABC News. 11 Feb 2017. <http://www.abc.net.au/news/2017-02-11/wa-uranium-mines-not-priority-environmentalists-claim/8262280>

<sup>11</sup> WNN. (2017). *Kazakhstan to cut uranium production*. 4 December 2017. <http://www.world-nuclear-news.org/UF-Kazakhstan-to-cut-uranium-production-0412177.html> and

Xin, Z. (2018). *Nuclear giant ramps up mining of uranium in Namibia*. China Daily. 24 Jan 2018. <http://www.chinadaily.com.cn/a/201801/24/WS5a67f705a3106e7dcc136424.html>

<sup>12</sup> NexGen. (2018). *Arrow Project Summary*. <http://www.nexgenenergy.ca/projects/arrow/>

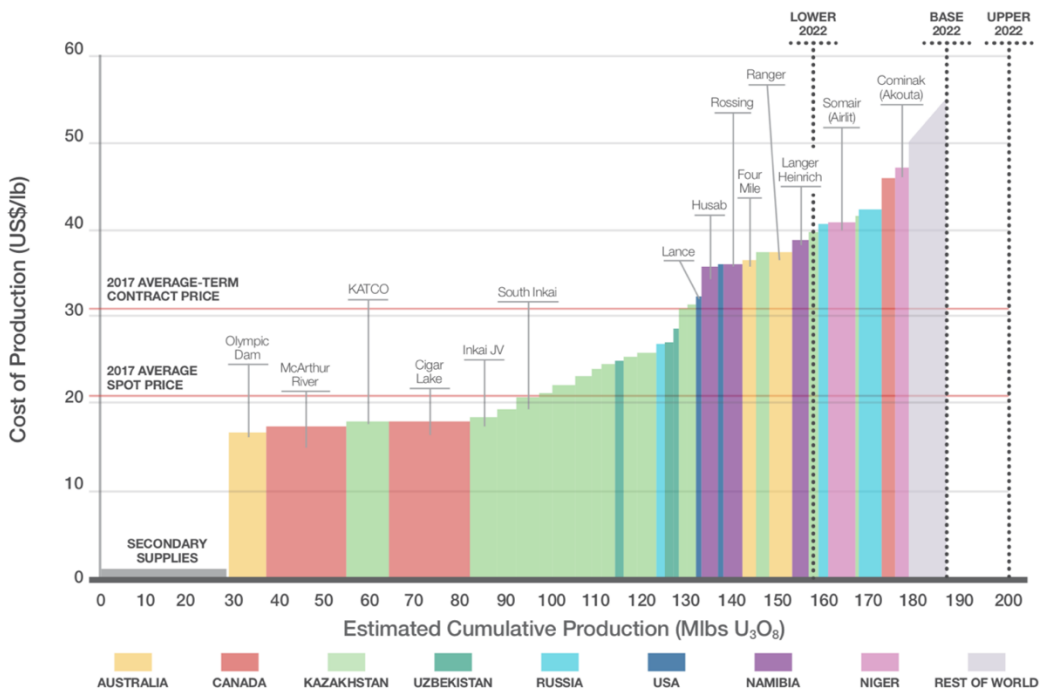


Figure 13.1: Estimated 2017 'All-In Sustaining Cost' of Global Uranium Production - showing Vimy's Demand Cases (Lower, Base, Upper)  
 Source: Company Data + Analysts' Views + Vimy Calculations, US Energy Information Administration | 2016 U Marketing Annual Report

Figure 2: Vimy's Mulga Rock DFS global cost curve assessment

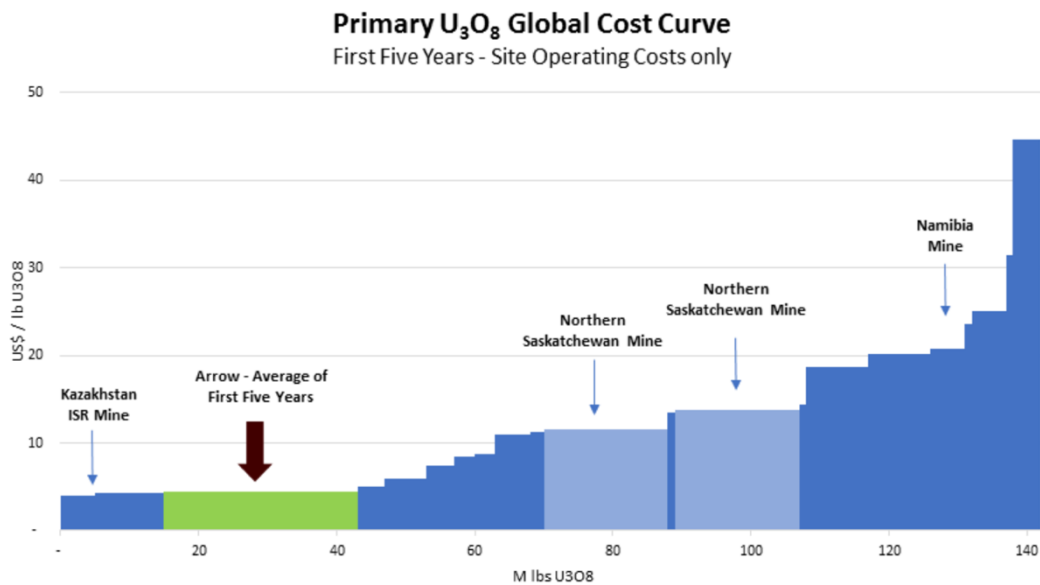
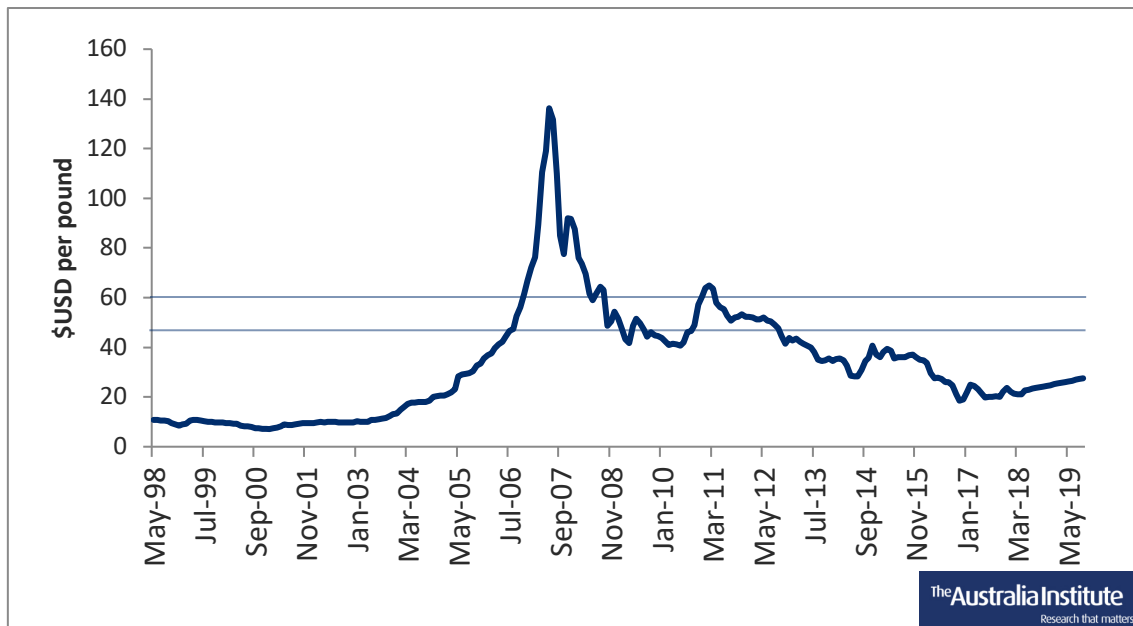


Figure 3: NextGen Arrow's global uranium cost curve assessment<sup>13</sup>

Mulga Rock uranium project: Uneconomic and unlikely

## PRICE ASSUMPTIONS

Even the more optimistic forecasts are for uranium prices to, at best, incrementally increase in the coming decade. Figure 4 shows the historical uranium price along with recent forecasts. Notice that the price assumption used in the Mulga Rock DFS of USD\$60/lb has only been realised for three of the past 20 years, and is more than double the Department of Industry, Innovation and Science price forecasts for 2019, which are just USD\$29/lb.



**Figure 4: Historical global uranium prices and forecast<sup>14</sup>**

Indeed, even the breakeven price of USD\$45/lb is extremely optimistic, being close to NextGen's more conservative base case price forecast of USD\$50/lb in their own Arrow mine feasibility study.

<sup>13</sup> NextGen. (2017). *Maiden Preliminary Economic Assessment*.

[http://www.nexgenenergy.ca/\\_resources/presentations/NXE-PEA-Presentation\\_July\\_IcFINAL.pdf](http://www.nexgenenergy.ca/_resources/presentations/NXE-PEA-Presentation_July_IcFINAL.pdf)

<sup>14</sup> IMF. (2018). *Historical U3O8 spot price data*.

<http://www.imf.org/external/np/res/commod/index.aspx>

Forecasts adopted from

DIIS. (2017). *Resources and Energy Quarterly*. Department of Industry, Innovation and Science.

[https://industry.gov.au/Office-of-the-Chief-](https://industry.gov.au/Office-of-the-Chief-Economist/Publications/ResourcesandEnergyQuarterlyJune2017/documents/Resources-and-Energy-Quarterly-June-2017-Uranium.pdf)

[Economist/Publications/ResourcesandEnergyQuarterlyJune2017/documents/Resources-and-Energy-Quarterly-June-2017-Uranium.pdf](https://industry.gov.au/Office-of-the-Chief-Economist/Publications/ResourcesandEnergyQuarterlyJune2017/documents/Resources-and-Energy-Quarterly-June-2017-Uranium.pdf)

## COST ASSUMPTIONS

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The DFS does not account for any specific rehabilitation costs or any financial assurances that the Western Australian government would require. Instead, the DFS simply claims that its progressive strip-mining method with backfill will

...result in 'real-time rehabilitation' leading to a smaller environmental footprint and significant savings in waste movement and end of mine life rehabilitation liability.

However, the Mining Rehabilitation Fund Act 2012 and associated regulations requires all mines to pay into the Western Australian government's Mine Rehabilitation Fund (MRF) based on estimated of disturbed area.<sup>15</sup> The DFS makes no mention of this funding obligation, which ranges from \$18,000 to \$50,000 per hectare of ground disturbance. There is still a requirement for a Mine Closure Plan to be submitted for assessment at which point the state Minister for Mines has the option to require the deposit of a mine closure bond of up to 100% of the estimated costs of mine closure and rehabilitation. For the Western Australian government, the financial risk of this project means that in the event of its financial failure, the rehabilitation obligation would fall on the state government. The history of closed uranium mines in Australia and internationally is one of grossly underestimated rehabilitation costs.<sup>16</sup>

Further, the Mulga Rocks project is located in a remote area with only limited established mining nearby, meaning many of cost estimates for the mine's required infrastructure investments are perhaps more uncertain than they appear. The contingency allowed for in the DFS for capital costs is just 8.5%.

To put this in perspective, during the previous Australian mining boom from 2006 to 2012, when uranium prices last reached USD\$60/lb, wages in the mining sector grew at over 6% per year and capital costs grew by over 7% per year.<sup>17</sup> The 8.5% cost

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<sup>15</sup> Department of Mines, Energy, Industry and Safety. (2018). *What is the MRF?* Government of Western Australia. <http://www.dmp.wa.gov.au/Environment/What-is-the-MRF-19522.aspx>

<sup>16</sup> Crothers, J. (2014). *\$200m sought to rehabilitate former Rum Jungle uranium mine*. ABC News. 31 October 2014. <http://www.abc.net.au/news/2014-10-31/mines-department-seeking-200m-to-fix-former-rum-jungle-mine/5858764>

<sup>17</sup> Kent, C. (2013). *Reflections on China and Mining Investment in Australia*. Reserve Bank of Australia. <https://www.rba.gov.au/speeches/2013/sp-ag-150213.html> and ABS. (2018). *5206.0- National Accounts. Implicit Price Deflator- New engineering construction. Table 5*. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5206.0Main+Features1Mar%202018?OpenDocument>

contingency in the DFS is therefore only enough to cover the cost increases of a 15-month delay, assuming no other contingency costs associated with its remote location.

## MACROECONOMIC REALITIES

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There is a macroeconomic trade-off that occurs between the uranium price and the value of the AUD which seems to have been ignored in the Mulga Rock DFS. If the ambitious price assumption of USD\$60/lb of uranium is met it will likely be accompanied by a higher AUD, as the Australian dollar tracks commodity prices closely. During the 2006-08 period when the uranium price was over USD\$60/lb the exchange rate averaged USD\$0.87, far higher than the DFS base case scenario. This relationship would undermine any profits from a higher uranium price point.

If this high uranium price occurred, it would likely be in a scenario where other minerals and energy commodities have also increased in price. Under this scenario, new mining investments across the country would respond to high commodity prices by ramping up their investments, increasing competition for workers and mining wages, as occurred during the 2006 to 2012 mining boom when wages in the sector grew by 6% per year, and capital costs grew by over 7% per year.<sup>18</sup>

In sum, the macroeconomics of mining in Australia mean that if the favourable conditions to establish a USD\$60/lb the uranium price are met, the other DFS assumptions about mining costs and exchange rates certainly will not be.

## SENSITIVITY TO PRICES AND EXCHANGE RATES

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The reality is that the Mulga Rock DFS describes a high-risk venture and overplays its financial case based on an extremely optimistic base-case scenario that verges on implausible.

Given this risk, it is surprising that the financial sensitivity analysis undertaken in the DFS does not even cover ranges of future outcomes that include such sensible benchmarks as the ten-year average (2008-2018) of the global uranium price or the USD/AUD exchange rate.

To show how optimistic these scenarios are we can compare the DFS base case with the base case in the feasibility of the NextGen Rook I Arrow mine. The Canadian miners assume a lower USD\$50/lb uranium price in their base case, rather than the USD\$60/lb price in the Mulga Rock DFS. The Arrow mine base case has a USD\$0.80 exchange rate

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<sup>18</sup> Ibid.

(per CAD), which is around the five-year average, while the Mulga Rock DFS assumes a much more optimistic rate of USD\$0.70 (per AUD) when the five-year average is USD\$0.80.

To add some realism to the financial analysis of this project, a net present value (NPV) analysis replicating the DFS based on its disclosed information was undertaken, the results of which are contained in the sensitivity analysis in Table 1. The two main variables of interest are the uranium price and the exchange rate, which have large effects on the financial analysis. With relatively fixed costs, any change to the uranium price goes straight to the bottom line, and since costs are incurred primarily in AUD while revenues typically come from USD-priced contracts, the exchange rate too can be a simple profit squeeze.

**Table 1: Sensitivity analysis of Vimy's Mulga Rock DFS (and NextGen Arrow)**

NPV at 8% discount rate (AUD \$ million)		Exchange rate (USD/AUD)					Arrow scenarios
		0.70	0.75	0.80	0.85	0.90	(CAD \$ million)
Uranium price (\$USD/lb)	20	-972	-1,022	-1,066	-1,104	-1,139	-
	30	-596	-671	-737	-795	-847	1,500
	40	-221	-321	-409	-486	-555	2,490
	50	155	29	-80	-177	-263	3,490
	60	530	380	248	132	29	4,480

Table 1 can be understood as follows. Each row and column combination is a price and exchange rate scenario, with the bottom left cell (thick border) showing the DFS base case of a USD\$60/lb uranium price and a USD\$0.70 exchange rate, with an NPV of \$530 million at an 8% discount rate. The shading for each scenario/cell is green for a positive NPV and red for a negative NPV.

The cell that corresponds to the USD\$40/lb price and the USD\$0.85 exchange rate (thick border) is reflective of recent market conditions. The ten-year average exchange rate to July 2018 was USD\$0.86, while the uranium price since July 2008 has been around USD\$40/lb on average, which also includes the tail end of the previous boom period. The last extended period where the exchange rate was near the base case forecast of USD\$0.70 was from 1997-2003 when the global uranium price was just USD\$10/lb.

On the right column of Table 1 are the results of the NextGen Rook I project feasibility analysis under different price assumptions and their more conservative base-case

exchange rate assumption. This other uranium mine proposal is far more conservative in their financial assumptions than Mulga Rock, demonstrating the optimism in the Mulga Rock financial modelling.

The other set of bold and bordered cells in Table 1 represent a more conservative range of scenarios that are beyond the scenario analysis of the DFS. The reason why is clear to see—the project simply doesn't stack up except in the most extreme and implausible market scenarios.

In terms of costs, further sensitivity analysis shows that just a 10% increase in costs would generate a negative NPV in every scenario at a price less than USD\$60/lb, further highlighting the unfounded optimism in these financial assumptions.

# Conclusions

The Mulga Rock DFS is ambitious to the point of heroic. The projections for the future role of nuclear power are extremely optimistic and the economic analysis of the project's position in the global uranium marketplace seems contradictory. The price and exchange rate assumptions upon which the financial viability of the project hinge exceed even the most optimistic forecasts.

A more plausible NPV analysis would value the project somewhere in the range of negative \$321 million and negative \$1 billion. Given that other re-activated or new competitor mines can be brought into production at a faster rate or a lower cost under the same global market conditions, the Mulga Rock project is unlikely to succeed financially and poses a significant risk.