

Mulga still does not rock

Analysis of “refreshed Definitive Feasibility Study” for the Mulga Rock uranium mine

A new study of the Mulga Rock project still relies on optimistic price and exchange rate forecasts. Details of claimed cost reductions have not been published, but costs still appear high relative to international competitors.

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Summary

The Mulga Rock project is a proposed uranium mine northeast of Kalgoorlie, WA. The project's proponent, Vimy Resources, has recently published a "Refresh" of its 2018 "Definitive Feasibility Study (DFS)". The DFS Refresh estimates a net present value for the Mulga Rock project of A\$560 million.

Mulga Rock is Vimy's main asset. In contrast to the DFS Refresh's valuation, the market capitalisation of Vimy is just A\$25 million. Like most uranium miners and nuclear energy companies, Vimy has seen a decline in its share price of 98% over the last decade. The fundamental reasons for this market-wide decline are the poor economics of nuclear energy, which is reliant on government subsidy and a track record of running overbudget. Nuclear energy is being undercut by cheap renewable generation, which nuclear reactors are unable to complement due to their inability to respond peaks and troughs in daily electricity market conditions.

Vimy's company reports make clear that it needs to raise capital to continue as a going concern.

The DFS Refresh assumes a very high uranium price (US\$55/lb) over the 15 year life of the project. This price has not been achieved since 2013, and aside from the resource boom period between 2007 and 2013, uranium prices have never reached the levels assumed in the DFS Refresh.

Forecasters have predicted a surge in uranium prices for the last decade, but it has not occurred. In one analyst's words, the uranium price has "made fools and liars of many in recent years, including ourselves." Futures markets expect an increase in the uranium price to US\$38/lb to 2025, well below Vimy's assumed price. The DFS Refresh also assumes an AUD/USD exchange rate of 0.65, optimistic considering prevailing rates over the last decade and futures markets focused around 0.71.

On the cost side, it is important to note that the DFS Refresh document discussed here is a 15 page ASX announcement by Vimy, not the actual Refresh report, which we understand is not publicly available. Even on the numbers available, the DFS Refresh shows that the project is at the higher cost end of world producers, in either the third or fourth quartile of the cost curve.

The DFS Refresh document claims capital costs have been revised down by 20% due to the purchase of "fit-for-purpose mining equipment" from an external contractor that no experience in uranium mining listed on its website. The contractor would then operate this equipment "on a cost-plus basis". Buying second-hand equipment from a contractor

reduces upfront capital costs, but is likely to increase expenditure in the later years of the project, perhaps explaining the DFS Refresh placing an emphasis on costs over the first five years of the project.

In these first five years the DFS Refresh estimates an 8% decrease in operating costs, while the life of the project would see only a “nominal” increase in operating costs. This is surprising as such an arrangement would usually involve higher annual operating costs, in return for the benefits of lower upfront capital costs.

The “all-in sustaining cost” for the first five years of the project is estimated at US\$28.10. However, the life of mine break-even cost is stated as being US\$36.64/lb, while a chart suggests the project reaches a zero NPV at US\$38.50/lb. None of these estimates appear to consider the costs of closure and rehabilitation, which are significant for uranium mines. For example, Rio Tinto/Energy Resources Australia’s Ranger mine in the Northern Territory currently has a provision for rehabilitation of A\$744 million.

The Mulga Rock DFS refresh should be seen in the context of economic literature on project assessment. Such assessments are routinely found to include strategic misrepresentation, optimism bias and other flaws. Historical studies of mining projects show average capital cost overruns of between 40% to 60% more than what assessment documents estimate, while much larger blowouts are common, particularly in marginal projects such as Mulga Rock.

Introduction

The Mulga Rock project is a proposed uranium mine northeast of Kalgoorlie, WA. The project is owned by Vimy Resources, a small ASX-listed company previously known as Energy and Minerals Australia. The company has been developing the Mulga Rock proposal for a number of years. In January 2018 Vimy released a 'Definite Feasibility Study' (Original DFS) that estimated a net present value (NPV) of A\$530 million for the project. The Australia Institute reviewed the Original DFS, finding that it:

- relied on an unrealistic future uranium price of US\$60/pound (The highest uranium price since then has been US\$34/pound);
- relied on booming demand for uranium, an expectation at odds with the balance of new reactors and shutdowns and the trend towards low-cost renewables taking up a larger share of electricity markets, particularly as nuclear generation is slow to 'ramp up' or 'ramp down' generation in response to demand peaks or price troughs;
- assumed that Vimy had no low cost competitors, while in reality many low-cost competitors could respond to possible future price increases;
- did not 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.¹

We concluded that the Original DFS overstated the case for the project, which was likely to have an NPV below zero under most credible scenarios around price and exchange rate.

In August 2020 Vimy publicised a "refresh" of the Definitive Feasibility Study (DFS Refresh).² The new document claims that the Mulga Rock project's economics are in fact better than estimated in the Original DFS. The DFS Refresh claims that the Net Present Value (NPV) of the project has increased by 14% to US\$393 million or A\$560 million.³ The increase in NPV followed changes to the following assumptions in the Original DFS:

- The uranium price reduced from US\$60/lb to US\$55/pound.
- AUD/USD exchange rate improving from 0.70 to 0.65.
- Capital costs reduced by 20% and operating costs only 'nominally increased'.

¹ Murray (2020) *Mulga Rock uranium project* <https://www.tai.org.au/content/mulga-rock-uranium-project>

² Vimy Resources (2020) *DFS Refresh significantly improves Mulga Rock Project Economics*, <https://www.asx.com.au/asxpdf/20200826/pdf/441xbs15dzpvcy.pdf>

³ AUD/USD exchange rate of 0.70.

This report reviews these key claims in the DFS Refresh and puts them in the wider context of investment and energy markets and economic literature on project assessment.

Mulga Rock in market context

Before reviewing the DFS Refresh claims in detail, it is useful to consider the stockmarket reaction to the release of the DFS Refresh document. Mulga Rock is Vimy's main asset and the company does not have any debt, meaning that the stockmarket value of Vimy provides investors' collective estimate of the value of Mulga Rock.⁴ This valuation has not changed significantly this year, including since the release of DFS Refresh, as shown in Figure 1 below:

Figure 1: Vimy Resources share price



Source: Market Index (2020) Vimy Resources Limited, <https://www.marketindex.com.au/asx/vmy>, accessed 15 October 2020.

Figure 1 shows that not only did the market not respond to the DFS Refresh in late 2020, but the five year share price decline of 80% suggests scepticism about the Mulga Rock project has increased. In contrast to the Original DFS and DFS Refresh estimates of NPV in the hundreds of millions, the stockmarket values Vimy Resources at only around \$25 million.⁵

It is important to note that Vimy is not alone in such large losses. Virtually all investments in uranium mining and nuclear power have made large losses over the last ten years, as shown in Table 1 below:

⁴ The Vimy website also lists uranium interests in the Northern Territory, but these appear to be at a very early stage of development.

⁵ Google Finance estimate viewed 4 November 2020.

Table 1: Uranium and nuclear power companies: share price change - last ten years

Company	Share price change - ten years to Sep 2020	Share price index change - ten years to Sep 2020
<i>Vimy Resources</i>	-98%	+32%
Paladin Energy (Aus)	-96%	+32%
ERA (Aus)	-97%	+32%
Toshiba Japan (Jap)	-34%	+151%
TEPCO (Jap)	-86%	+151%
Cameco (Can)	-52%	+31%

Source: Buckley (2020)⁶ Comparison indices are All Ordinaries (Australia), Nikkei (Japan), and TSX Composite Index (Canada)

These losses all stem from the same factors - nuclear industries are reliant on variable government support, projects are routinely overbudget, and renewable energy is undercutting the profitability of nuclear and fossil fuel power generation.

Consistent with its share price decline, since its inception, Vimy Resources has run down almost all the \$114 million in capital it has raised from shareholders by accumulating losses of \$107 million. Its shareholder capital at 30 June 2020 was only \$8 million. It had cash of \$7 million and owed \$4 million in deferred consideration. Vimy Resources directors noted in its most recent annual report that it depends on being able to raise capital and 'this creates a material uncertainty as to the ability of the Group to continue as a going concern'.⁷ Figure 2 below reproduces this section of the company's annual report:

Figure 2: Extract from Vimy annual report

The Group's ability to continue as a going concern, including meeting deferred consideration obligations and to advance its exploration and evaluation activities, depends on its ability to obtain additional funding through strategic partners, equity, debt, hybrid financing, joint ventures, production off-take arrangements, research and development claim or other means. This creates a material uncertainty as to the ability of the Group to continue as a going concern.

In considering these circumstances, the Directors have taken into account the Group's demonstrated past successes in raising equity and debt, and in the event that additional funding is not able to be obtained at the amounts and timeframes anticipated, the Directors would actively curtail both project and corporate expenditure to conserve cash resources.

Source: Vimy Resources (2020) *Annual Financial Report*, page 4.

Vimy has been successful in raising capital in the past but, as its directors note, there is no guarantee this will continue. The company's decline in the fortunes is due to the industry-wide issues mentioned above - decreasing cost of renewable energy; the poor economics of nuclear power and competition from low cost uranium producers. There are no major signs

⁶ Buckley (2020) *Global Energy Markets: A Technology Driven Disruption - Uranium and Nuclear Power*, <https://vimeo.com/465696360>

⁷ Vimy Resources (2020) *Annual Financial Report*, <https://www.vimyresources.com.au/investor-relations/annual-and-half-yearly-reports/general-news>

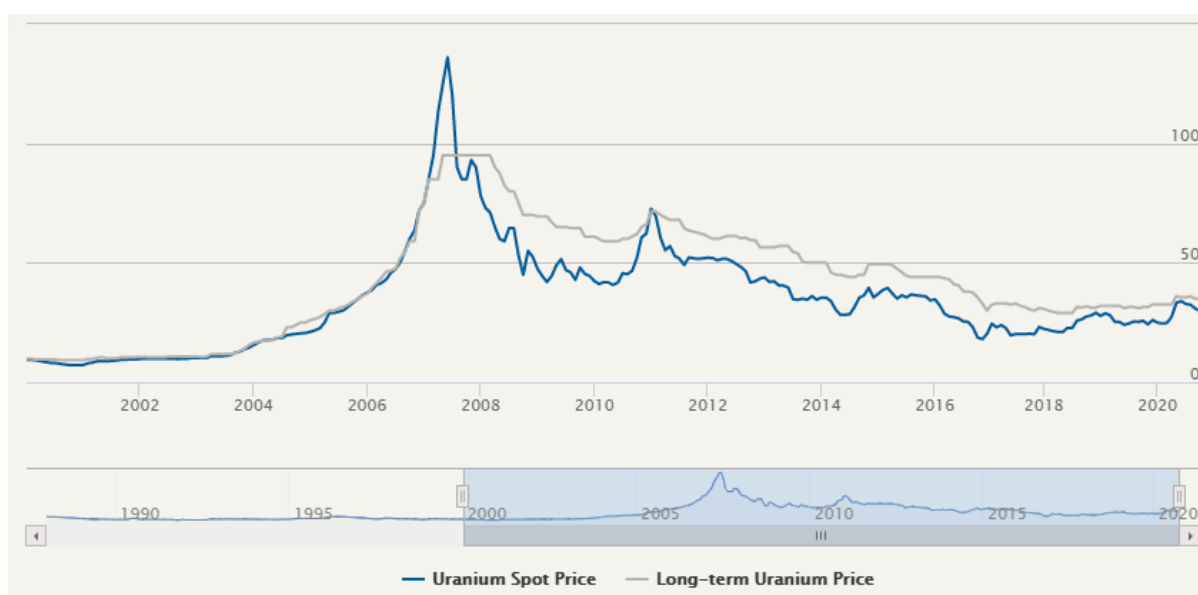
that these issues will change, suggesting that a market decision not to further fund Vimy and its Mulga Rock project may be drawing near.

DFS Refresh: Uranium Price

‘The yellow mineral has made fools and liars of many in recent years, including ourselves.’⁸

The Original DFS assumed a price of US\$60/lb of uranium (U3O8), an assumption we called ‘heroic’. The DFS Refresh assumption of US\$55/lb of U3O8 is still heroic in our view. As shown in Figure 3 below, the last time long term contract price reached \$55/lb was seven years ago:

Figure 2: Uranium price: last 25 years (US\$/lb of U3O8)



Source: Cameco (2020) *Uranium price*, <https://www.cameco.com/invest/markets/uranium-price>

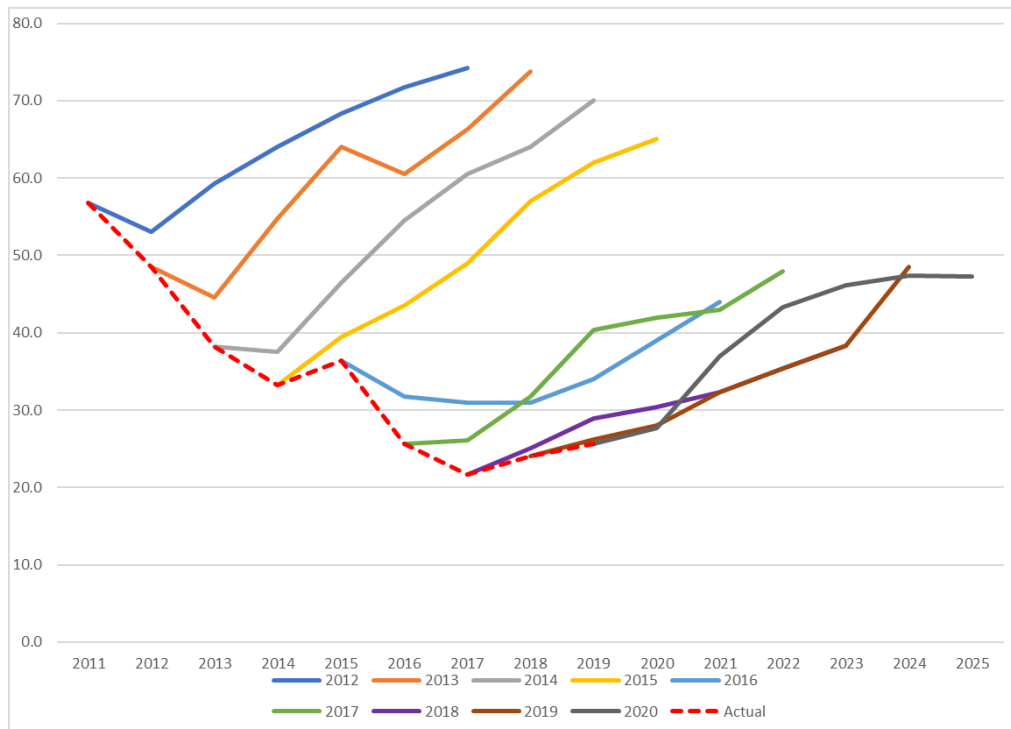
Figure 3 shows that aside from the resource boom period between 2007 and 2013, uranium prices have never reached the levels assumed in the DFS Refresh. In the Original DFS, Vimy devoted seven pages to analysing the future uranium market before forecasting a price of US\$60/lb. The actual spot price since then has barely risen above US\$30/lb.

Forecasters have been optimistic about a significant uranium price rise for many years but it simply has not happened. Figure 4 below shows the Australian Government’s Department of Industry, Science, Energy and Resources uranium price forecasts for the last nine years.

⁸ Eccleston (2016) *Uranium – Waiting for Godot or Forging Ahead?* <https://investorintel.com/sectors/uranium-energy/uranium-energy-intel/uranium-waiting-godot-forging-ahead/>

The actual spot price realised each year has been below that forecast *for every single year since 2012*.

Figure 3: Uranium price forecasts and actual price (US\$/lb of U3O8)



Source: Department of Industry, Science, Energy and Resources, Resources and Energy Quarterly, various March issues since 2012.

Figure 3 shows that even the long-term uranium optimists in the Federal Department of Industry now forecast uranium prices to plateau at below \$50/lb, below the DFS Refresh forecast price of US\$55/lb. While long-term contracts and spot prices may differ, the message from Figures 2 and 3 is clear – be wary of optimistic uranium price forecasts and any project that depends on one.

An illustrative example of this message came in March 2016 from commodity price forecaster, Hallgarten & Company. Despite offering a glum assessment of the uranium market, the company’s analyst went on to forecast a uranium price increase.

The yellow mineral has made fools and liars of many in recent years, including ourselves. That said, every dog has its day and some of the things that weighed on the uranium price (most notably the Japanese plant shutdown) are retreating as issues. At the risk of being made to look foolish again, we think the tide has turned for Uranium and would not be surprised to see it close to \$40 per lb by year end and break through \$50 per lb by the end of next year.⁹

⁹ Eccleston (2016)

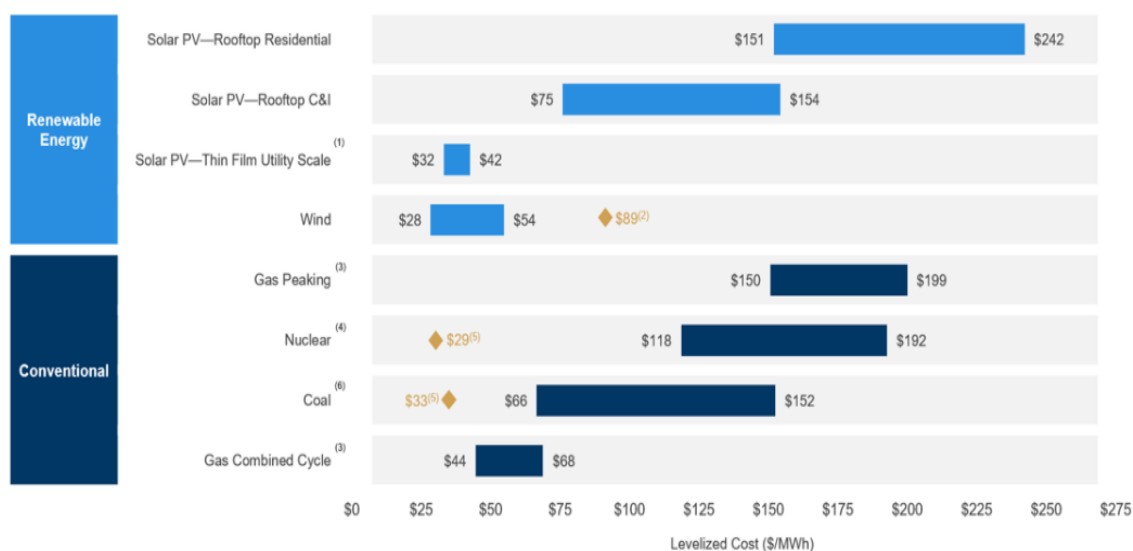
Unfortunately Hallgarten & Company simply looked foolish again. The uranium spot price has not risen above US\$34/lb since.

Some explanation may lie on the demand side for uranium, with perennial forecasts of increased demand that do not eventuate. One reason for this is that the financial viability of nuclear power is dubious.

The financial case for nuclear power has been challenged since well before the advent of cheap renewable energy. The German economic research institute, DIW Berlin, reviewed the development of 674 nuclear power plants built since 1951, finding that none of the plants was built using ‘private capital under competitive conditions’. Instead, most plants have been built while heavily subsidised by governments, and often motivated by military purposes. DIW Berlin calculated that the average 1000MW nuclear power plant would generate a negative NPV of minus 4.8 billion euros (A\$6.9 billion) and even in the best case the NPV is minus 1.5 billion euros (A\$2.1 billion).¹⁰

The poor economics of nuclear energy are likely to deteriorate further as cheap renewable energy undercuts the profitability of nuclear generation. The US investment bank, Lazard, annually releases its respected *Levelized Cost of Energy Analysis*.¹¹ In its latest issue Lazard notes that new solar, wind and battery power are now cheaper than new, and sometimes existing, nuclear and fossil fuel power generation, as shown in Figure 5 below:

Figure 4: Levelized cost of energy



¹⁰ DIW Berlin (2019) *High-Priced and Dangerous: Nuclear Power Is Not an Option for the Climate-Friendly Energy Mix*,

https://www.diw.de/de/diw_01.c.670590.de/publikationen/weekly_reports/high_priced_and_dangerous_nuclear_power_is_not_an_option_for_the_climate_friendly_energy_mix.html

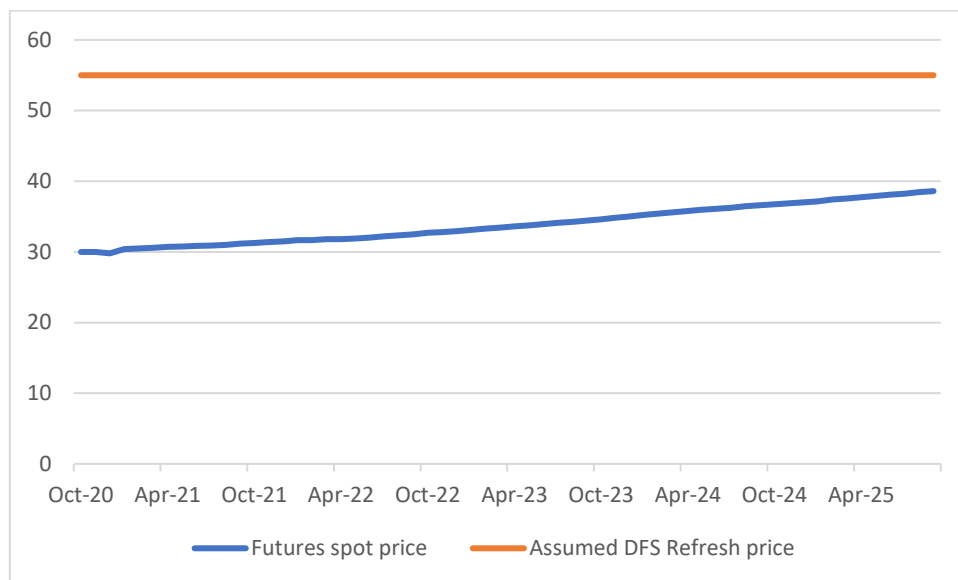
¹¹ Lazard (2019) *Levelized Cost of Energy Analysis (LCOE 13.0)*, <https://www.lazard.com/perspective/lcoe2019>

Source: Lazard (2019)

Figure 4 shows that levelized cost of energy for nuclear power ranges between US\$118 and US\$192 per megawatt hour. This is above the estimates for all other energy sources, with the exception of gas peaking and rooftop residential solar. Even these comparisons need to be qualified. Rooftop residential solar competes largely with retail prices rather than other wholesale generation. Gas peakers respond to peak electricity demand and price, generating relatively little electricity through their lives, meaning capital costs are spread over fewer megawatt hours of generation, increasing levelized cost. Nuclear generation is heavily challenged in markets with notable demand peaks and price troughs caused by intermittent renewable generation.

Futures markets are often considered the best predictor of future commodity prices.¹² Currently the forward market (Figure 5) predicts a gradual rise in the uranium price from currently US\$30/lb to US\$38/lb by 2025.

Figure 5: Uranium futures price and DFS Refresh assumed price (\$US/lb of U3O8)



Source: CME Group (2020) *UxC Uranium U3O8 Futures Quotes*, <https://www.cmegroup.com/trading/metals/other/uranium.html>, accessed 15 October 2020.

Figure 5 shows that the forward market forecast price rise to US\$38/lb is well below DFS Refresh assumed price of US\$55/lb. The DFS Refresh estimates the breakeven price of the project at \$36.64-\$38.50.¹³ On futures market prices, the Mulga Rock project would scarcely be viable even if it manages to produce at DFS Refresh's breakeven cost. The DFS

¹² Snowberg, Wolfers and Zitzewitz (2012) *Prediction Markets for Economic Forecasting*, <http://www.its.caltech.edu/~snowberg/papers/Snowberg%20Wolfers%20Zitzewitz%20economic%20forecasting.pdf>

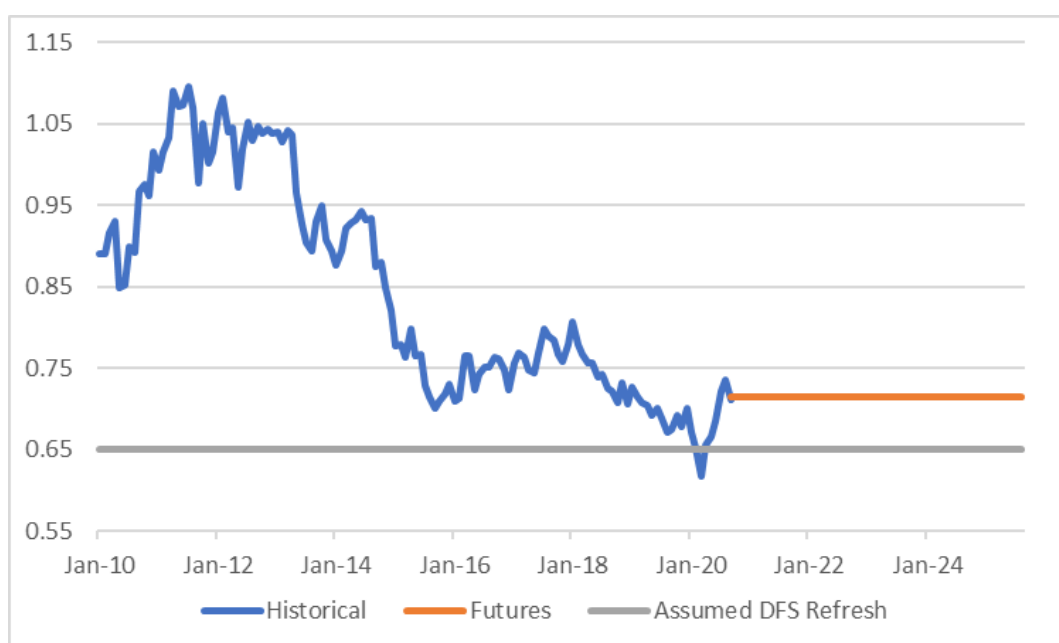
¹³ See *Cost and Competition* below.

Refresh documents make no explanation as to why their assumed prices are so far above the futures market shown in Figure 5.

DFS Refresh - Exchange Rate

The DFS Refresh assumes a more favourable AUD/USD exchange rate (\$0.65) than Original DFS (\$0.70). We noted that the Original DFS prediction was itself optimistic. The DFS Refresh assumption of A\$0.65 still looks optimistic considering that the AUD/USD exchange rates has been A\$0.70 or greater for much of the last ten years and futures markets forecast it to remain at around A\$0.71-\$0.72 for the next five years. As we noted earlier, economic research has found the futures market is the best forecast of future prices.

Figure 6: Actual and futures market AUD/USD exchange rate

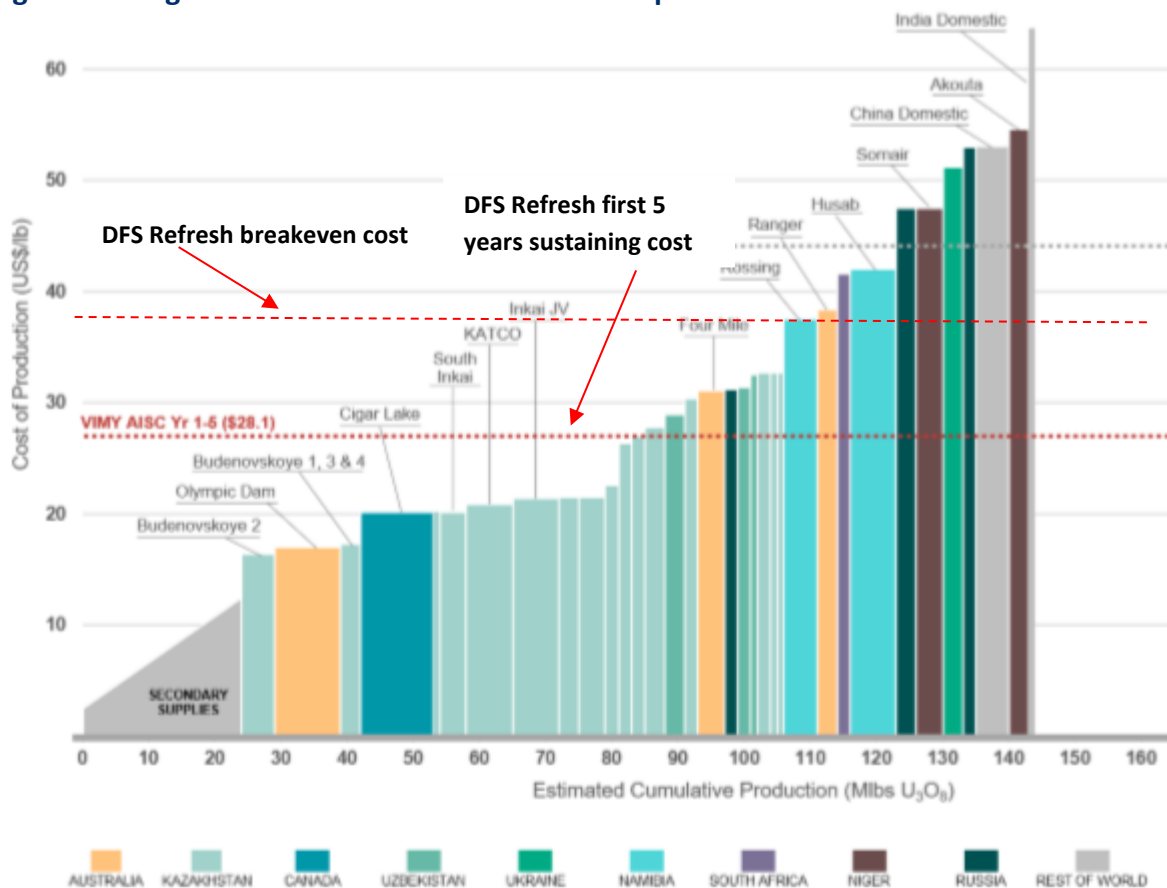


Source: Historical exchange rate price from Reserve Bank of Australia (2020) *Exchange rates monthly*, <https://www.rba.gov.au/statistics/historical-data.html>
Futures exchange rate from CME Group (2020) *Australian Dollar Futures Quotes*, <https://www.cmegroup.com/trading/fx/g10/australian-dollar.html>, accessed 15 October 2020.

Costs and competition

Our earlier critique of the Original DFS highlighted the existence of low cost producers internationally that keep downward pressure on uranium prices. These producers have not disappeared. As shown in Figure 8 below, more than half of the world’s existing uranium suppliers have lower costs of production than the lowest estimate from the DFS Refresh:

Figure 7: Mulga Rock in context of world uranium producers



Source: Vimy Resources (2020) p10.

Figure 7 comes from the DFS Refresh, comparing the DFS Refresh’s sustaining cost for the first five years of operation to the sustaining costs of international uranium mines. We have added a dotted line to highlight Mulga Rock’s overall breakeven price (discussed below), which as a greenfields project is relevant in comparison with existing mines. Considering either cost level, the Mulga rock project is at the higher cost end of world producers, in either the third or fourth quartile of the cost curve.

As shown in Figure 8, the DFS Refresh emphasises an estimated “all-in sustaining cost” for the first five years of the project of US\$28.10. However, the life of mine break-even cost is

stated as being US\$36.64/lb. Unusually, Figure 3 of the DFS Refresh shows that the project reaches a zero NPV at US\$38.50/lb, suggesting an alternate break-even cost. We note that neither breakeven price appears to include what is likely to be a substantial rehabilitation costs. Rehabilitation costs can be highly significant. ERA's rehabilitation provision for its Ranger uranium mine is currently A\$744 million.¹⁴

It is important to note that the DFS Refresh document discussed here is a 15 page ASX announcement by Vimy, not the actual Refresh report written by GR Engineering Services. We understand that the GR Engineering Services report is not publicly available, and the Refresh is not listed on GR Engineering Services website.¹⁵

The DFS Refresh document claims that GR Engineering Services have revised capital costs down by 20% from the Original DFS largely due to the purchase of "fit-for-purpose mining equipment" from an external contractor, who would then operate this equipment "on a cost-plus basis". Buying second-hand equipment from a contractor reduces upfront capital costs, but is likely to increase expenditure in the later years of the project, perhaps explaining the focus on costs over the first five years.

Despite outsourcing operations, Vimy says the increase in operating costs is only "nominal", preferring to focus on an estimated 8% decrease in operating costs in the first five years. This is surprising as such an arrangement would usually involve higher annual operating costs (particularly higher maintenance costs), in return for the benefits of lower upfront capital costs.

We note that the nominated company, Piantentini & Son, does not claim any experience in uranium mining on its website.¹⁶

¹⁴ ERA (2020) *Ranger Closure Plan: Executive Summary*, p34,
<https://www.energyres.com.au/sustainability/closureplan/>

¹⁵ GR Engineering Services (2020) *Uranium projects*, <https://www.gres.com.au/projects/default.aspx>

¹⁶ Piantentini & Son (2018) *Projects*, <https://www.piantentini.com.au/Base/Projects>

DFS Refresh in context of project assessment literature

“A mine is a hole in the ground. The discoverer of it is a natural liar. The hole in the ground and the liar combine and issue shares and trap fools.”¹⁷

Economics is not as scathing about the proponents of mining projects as the (possibly apocryphal) Mark Twain quotation, but there is an extensive literature on systemic biases in project assessment. The biases mean a project will rarely provide the benefits estimated in assessment documents and will often underestimate costs and risks. These biases are:

- Strategic misrepresentation – project promoters over-state benefits and under-state the costs in order to get a project approved;
- Over-optimism – proponents are, on average, naturally over-optimistic;
- Planning fallacy – humans often fail to imagine all the ways a project could go wrong;
- Principal-agent problem – the incentives faced by management are not necessarily to make profits. Often managers are incentivised to pursue growth or other goals rather than investors’ interests, and management often leave a company before the consequences of poor project selection and development are felt.

These biases have been highlighted by: economics Nobel Prize winner, Daniel Kahneman and colleague Amos Tversky; and the world’s most cited mega-project scholar, Bent Flyvbjerg.¹⁸ Flyvbjerg explains why project modelling should be treated sceptically:

Success in megaproject management is typically defined as projects being delivered on budget, on time, and with the promised benefits. If, as the evidence indicates, approximately one out of ten megaprojects is on budget, one out of ten is on schedule, and one out of ten delivers the promised benefits, then approximately **one in one thousand projects is a success**, defined as “on target” for all three. Even if the numbers were wrong by a factor of two—so that two, instead of one out of ten projects were on target for cost, schedule, and benefits, respectively - the success

¹⁷ Detroit Free Press 1881. A shorter version of this quote is often attributed to Mark Twain.
<https://quoteinvestigator.com/2015/07/19/gold-mine/>

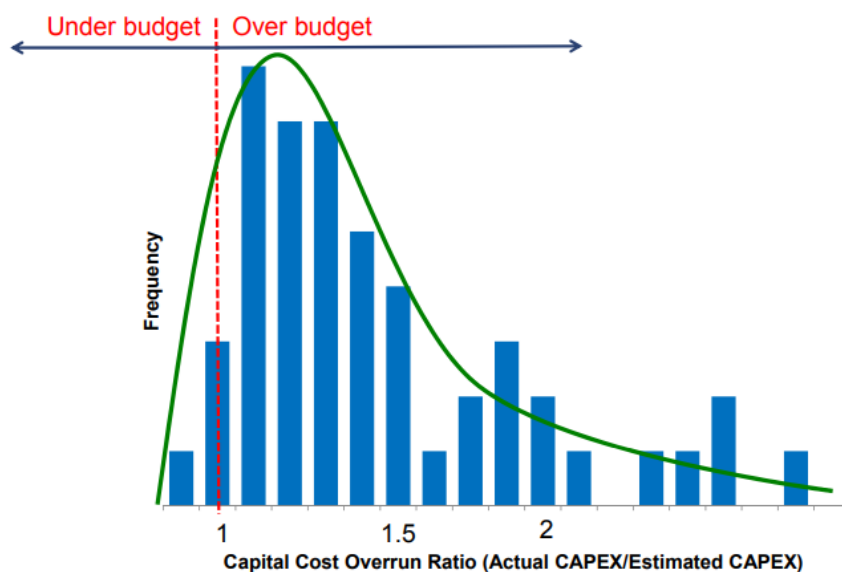
¹⁸ Kahneman & Tversky (1979) *Prospect theory: An analysis of decisions under risk*, *Econometrica*, 47, p 313–327; Kahneman & Tversky (1979) *Intuitive prediction: Biases and corrective procedures*, in Makridakis & Wheelwright (eds) *Studies in the Management Sciences: Forecasting*, vol 12. Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice*, *European Planning Studies* 16:3-21, p9
https://www.researchgate.net/publication/233258056_Curbing_Optimism_Bias_and_Strategic_Misrepresentation_in_Planning_Reference_Class_Forecasting_in_Practice

rate would still be dismal, now eight in one thousand. This serves to illustrate what may be called **the “iron law of megaprojects”**: **Over budget, over time, over and over again. Best practice is an outlier, average practice a disaster** in this interesting and very costly area of management.¹⁹

More often than not the information that promoters and planners use to decide whether to invest in new projects is highly inaccurate and biased making plans and projects very risky.²⁰

While Flyvbjerg focuses on ‘megaprojects’, projects larger than Mulga Rock, the systemic biases towards over-statement of profits and understatement of costs and time to completion is widespread in the resources industry. In 2014, Christopher Haubrich, a mining analyst, gave a paper titled “Why Building a Mine on Budget is Rare: A Statistical Analysis”.²¹ Haubrich constructed a database of 50 mining projects and found that capital cost overruns are significant and persistent with average cost overruns of 20%–60% recorded since 1965. Many projects run over cost by much greater percentages – as shown in Figure 9 below:

Figure 9: Distribution of Capital Cost Overruns



Source: Haubrich (2014), p22.

¹⁹ Flyvbjerg (2014) *What you should know about megaprojects and why: An Overview*, p11, emphasis added, https://www.researchgate.net/publication/261411676_What_You_Should_Know_About_Megaprojects_and_Why_An_Overview/link/59fbaad60f7e9b9968bb03ff/download

²⁰ Flyvbjerg (2008) *Curbing Optimism Bias and Strategic Misrepresentation in Planning...*, p5, emphasis added.

²¹ Haubrich (2014) *Why Building a Mine on Budget is Rare: A Statistical Analysis*, 16 October 2014, http://www.canadian-german-mining.com/files/events/2014-10-16_CIM_MES_Rocks__Stocks/3_Chris_Haubrich_Why_Building_A_Mine_on_Budget_is_Rare_-_A_Statistical_Analysis.pdf

Figure 9 shows that only one of the mining projects in Haubrich's sample saw capital costs below what had been estimated, three came in on budget, and the vast majority saw cost overruns between 1.1 and 2 times what was estimated. Blowouts past double expected capital costs were not uncommon. Vimy's claim to have reduced its capital cost estimates should be viewed in this context.

Furthermore, Haubrich found that that marginal projects, like Mulga Rock, are likely to have larger cost overruns. Haubrich stated that this was because when projects are marginal, the incentive is to "sharpen your pencils" and reduce cost estimates in order to make the project numbers viable. Interestingly, Haubrich found no relationship between the cost of the project and cost overruns.

Global consulting firm EY found that mining projects run over-budget by an average of 62%, and that 50% of projects report delays. Only 31% of projects came in on budget. EY quoted media coverage of some projects with cost overruns:

A major copper and gold operation in Central Asia: The National Finance Minister had been quoted as saying: "No one understands why the project has gone US\$2b over budget."

A major iron ore project in Brazil: To date, the project has experienced an overrun from the initial estimate of approximately 690%. The chief executive officer of the company has gone on record to say that "they are working very hard" to ensure no more delays or cost overruns on the project.

A Brazilian megaproject: This project saw capital costs escalate from US\$3.6b in 2007 to US\$8.8b in 2013. Media sources have described this investment as one of this organization's "most significant failures of recent years."²²

It is against this background literature on project assessment that the DFS Refresh should be examined.

²² EY (2015) *Opportunities to enhance capital productivity: Mining and metals megaprojects*, [http://www.ey.com/Publication/vwLUAssets/EY-opportunities-to-enhance-capital-productivity/\\$FILE/EY-opportunities-to-enhance-capital-productivity.pdf](http://www.ey.com/Publication/vwLUAssets/EY-opportunities-to-enhance-capital-productivity/$FILE/EY-opportunities-to-enhance-capital-productivity.pdf)

Conclusion

In our view the Mulga Rock project is not economically or financially viable, is unlikely to deliver a net benefit to the WA community and presents potential environmental risks. It should not proceed.

Unfortunately, lack of net benefit to the community, or even shareholders, does not always prevent mines in Australia from going ahead. Projects like the Adani coal mine demonstrate that political connections can make apparently unviable projects proceed. This is particularly the case for nuclear industry projects that ultimately rely on politics and defence policy rather than conventional finance and economics.

The WA community should be aware of this context and the risks that it presents. There is potential for the project to proceed with government subsidy or speculative investment, but the marginal economics of the project could see corners cut on safety, environmental management and rehabilitation. Under such a scenario significant and continuing costs could be imposed on the WA community and environment.