



Technology Metals Australia (TMT AU, \$0.365, market cap \$75.6m)

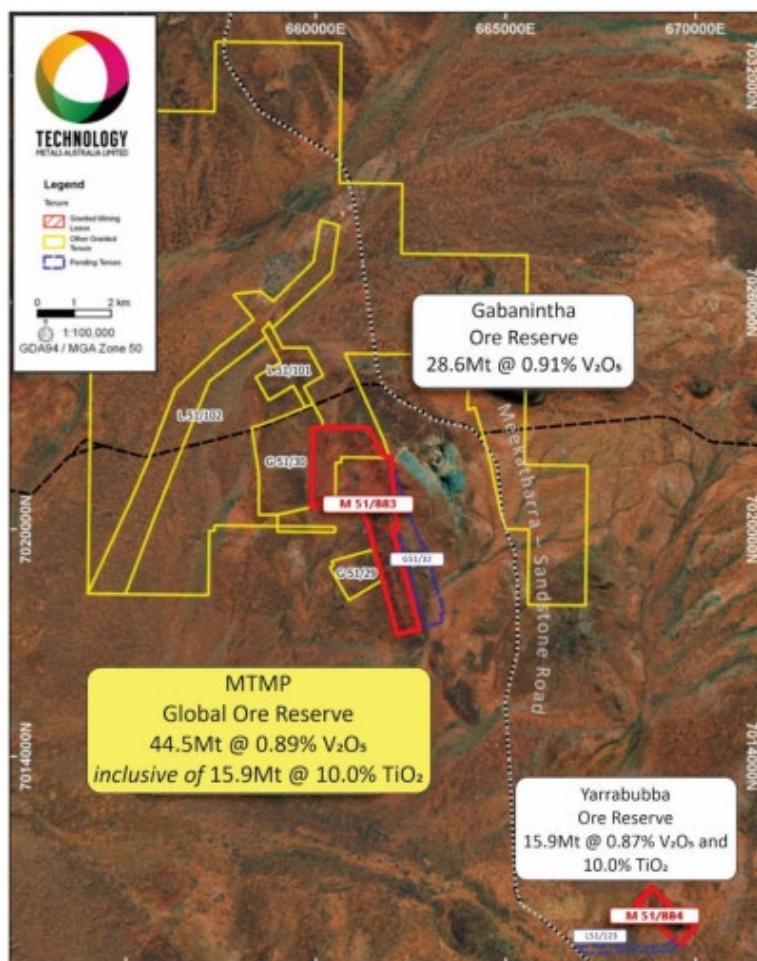
Reserves statement reveals encouraging economics for an emerging Tier 1 vanadium project, assisted with an ilmenite by-product

- TMT has recently announced the results of the integration of the high-grade Yarrabubba satellite deposit into the nearby Gabanintha vanadium project. The combined project has been named the Murchison Technology Metals Project (MTMP) which now comprises the Gabanintha and Yarrabubba deposits.
- The 100%-owned MTMP is located some 45km south of Meekatharra, in WA's Murchison region. Total resources are 146.2Mt averaging 0.8% V₂O₅. Within this resource are higher grade sections, some 61Mt at 1.1% V₂O₅ in the northern Gabanintha deposit and 19Mt also at 1.1% within the Yarrabubba deposit.
- The Yarrabubba deposit offers not only relatively high vanadium in concentrate grades but also the opportunity to produce an ilmenite concentrate for sale to global pigment producers, enhancing cashflows in the early years and therefore the economics of the MTMP.
- TMT's Measured and Indicated resource of 50.2Mt at a grade of 0.9% V₂O₅ has translated to an Ore Reserve totalling 45mt at 0.89% V₂O₅. Within this is the ilmenite reserve, confined to the Yarrabubba deposit with 15.9Mt at 10.03% TiO₂. With the proposed ca. 2Mtpa mill throughput this results in a 25-year mine life, a good advance on the earlier DFS based on the northern Gabanintha orebody alone. Annual production is forecast to be around 12.5ktpa V₂O₅ flake and around 100ktpa of ilmenite (from the Yarrabubba orebody) to be sold into the global pigment feedstock market.
- Completion of the MTMP reserve has allowed us to get a sense of the project's economics, though it must be stressed that these estimates are based on limited disclosure by TMT, sufficient for release of the new reserve statement. The release of a combined reserve for MTMP is important, but is far from the final BFS, which is due late 2022/early 2023.
- From the pre-BFS estimates released by TMT project costs, both capex and opex, appear to have risen significantly since the initial Gabanintha DFS (+33% and +28% respectively). Despite these increases, endemic within the mining industry globally, we see that the integrated reserve for Gabanintha can still offer attractive capital intensity with lowest cost quartile production costs.
- At our assumed long term V₂O₅ price of US\$12/lb, US\$260/t for ilmenite by-product and AUDUSD of 70c, we derive an unfunded post tax NPV₈ of A\$974m and an IRR of 23%.
- Strongly leveraged to the current slowdown in Chinese construction activity, V₂O₅ prices are in the doldrums. We believe prices will need to move up significantly in order to incentivise new primary production to fuel strong growth for the novel Vanadium Redox Flow Battery industry.

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MTMP Summary (TMT 100%)

- The Murchison Technology Metals Project (MTMP) is an open-pit vanadium pentoxide (V_2O_5) project with ilmenite by-product credits situated 45km south of Meekatharra in Western Australia. The project is targeting production of 12.5ktpa (27.5mlbspa) of vanadium over a 25-year mine life.
- The project is based upon an Ore Reserve of 44.5Mt grading 0.89% V_2O_5 , which straddles 2 distinct but similar deposits: the Gabanintha deposit (28.6Mt @ 0.91% V_2O_5) and Yarrabubba (15.9Mt @ 0.87% V_2O_5) which is located some 15km to the south of Gabanintha. The Yarrabubba deposit is differentiated from the main Gabanintha orebody in that it contains a significant proportion of recoverable ilmenite.
- This represents a high conversion of Measured and Indicated resources of around 91%. Total resources for the project amount to 146.2Mt at 0.8% V_2O_5 of which around two third remains in the Inferred category, presumably towards the base and hanging wall of the deposit.



Source: TMT release, August 2022

- Key to the MTMP is the ability to magnetically separate the vanadium-bearing magnetite then separate and concentrate the vanadium using conventional salt roast technology.
- Importantly, test work by the likely kiln supplier FLSmidth confirms the suitability of Yarrabubba ore to be processed through a Gabanintha-design vanadium processing plant. High vanadium recoveries (up to 96%) were delivered from batch kiln roast – leach test work on a representative Yarrabubba composite. This work shows the ability to achieve very rapid conversion and very good physical flow behaviour, highlighting scope for enhanced operating parameters.

- The process plant is planned to be established at the northern Gabanintha tenement, with Yarrabubba ore to be transported by road-train to the process plant via the existing Meekatharra-Sandstone road infrastructure with ~8km of additional haul road construction.
- The recent Integration Study & Ore Reserve update estimated pre-production capex of A\$604m and average LOM EBITDA of A\$182m. While detailed cost estimates have not yet been disclosed we estimate the project has an average AISC of ~A\$8.53/lb V₂O₅ (~US\$5.97/lb) after ilmenite by-product credits which contribute ~A\$0.74/lb.
- In our valuation model we have incorporated 10.5Mt of Inferred Resource material (located at the base and hanging wall of the pit) into our mining inventory. Within the TMT valuation reported in the recent reserve update, this material was reported as waste. Moving this into ore drops the strip ratio from around 6:1 to 4.6:1.
- Economic analysis of the project completed by TMT as part of the Integration Study derived a pre-tax NPV (at an 8% discount rate) of A\$942m and IRR of 23%, predicated on prices of US\$10.50/lb V₂O₅, US\$260/t ilmenite concentrate and AUDUSD of 0.70. We estimate that on a post-tax basis using TMT's assumptions the project NPV₈ would be ~A\$560m.
- Subsequent discussions with management suggest that the cost inputs to the interim economic model are conservative. The exercise was not designed to present an optimum economic outcome for the project. That will await completion of the BFS which is due late 2022 or early 2023. The opportunities to reduce costs and enhance returns include:
 - Upgrading Inferred resources to Indicated to allow conversion to reserves and thereby increasing the mine life while reducing the strip ratio.
 - Scheduling of ore and waste movement. We estimate that mining makes up over 40% of the total project cost, so small unit savings will be important.
 - Earlier scheduling of the higher-grade ore at Yarrabubba.
 - Staging of capex.
- We have modelled the MTMP (summary below) with information in the public domain and can largely replicate the NPV₈ presented by TMT. In coming to our estimate, we have undertaken the following adjustments and commodity price assumptions:
 - We have included the 10.5Mt of Inferred Resources into the mining inventory and have removed this volume from waste. The strip drops from 6:1 to under 5:1.
 - As discussed below, we have adopted a long term V₂O₅ price of US\$12/lb (\$10.50/lb assumed by TMT), ilmenite price of US\$260/t (FOB) and AUDUSD of 0.70 (the latter two in line with TMTs own forecasts).
- Together our post tax NPV₈ amounts to A\$974m with an IRR of 23.4%.

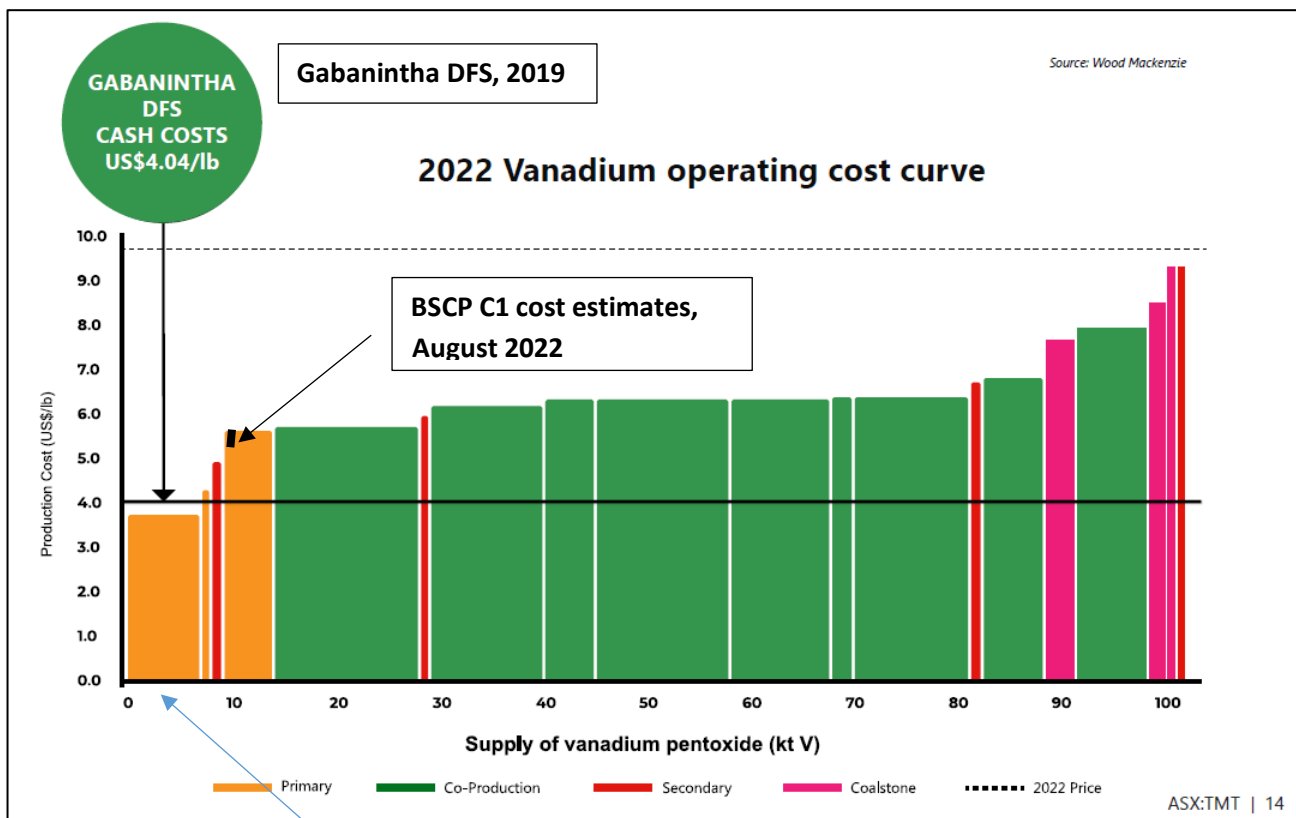
MURCHISON TECHNOLOGY METALS PROJECT	Units	FY25	FY26	FY27	FY28	FY29	FY30
Plant Feed (kt)	kt	1,600	2,400	2,300	2,300	2,200	2,250
Head Grade (% V2O5)	% V2O5	0.89%	0.78%	0.82%	0.82%	0.85%	0.83%
Mag Con Grade (% V2O5)	% V2O5	1.40%	1.23%	1.28%	1.28%	1.34%	1.31%
Kiln-AMV Recovery (% V2O5)	% V2O5	80%	80%	80%	80%	80%	80%
V2O5 Flake Production	kt	9.5	12.5	12.5	12.5	12.5	12.5
V2O5 Flake Production	mlbs	20.9	27.6	27.6	27.6	27.6	27.6
Ilmenite Production	kt	120	160	120	40	10	70
AISC (including BPC's)	US\$/lb	6.58	6.18	6.39	6.79	6.90	6.44
AISC (excluding BPC's)	US\$/lb	8.07	7.69	7.52	7.16	7.00	7.10
NPV (post tax)	A\$m	974					
IRR (post tax)	%	23%					

Source: TMT/BSCP estimates

Positioning on the cost curve

Positioning of mining projects on cost curves is of critical importance in our view. A cost structure which allows companies to position their assets within the bottom third of the curve will allow them to survive the inevitable cyclical dip in commodity prices.

As shown on the accompany curve (from Wood Mackenzie, quoted by TMT) even if MTMP's costs lie in a US\$5-5.50/lb range (after ilmenite credits), the project should still sit within the lowest cash cost quartile. It must be stressed that (1) these are our estimates and (2) TMT is still 'sharpening the pencil' to obtain the best outcome for the BFS. Our LOM C1 cash cost for MTMP is US\$5.10/lb V₂O₅, excluding a 5% WA government royalty (to allow peer group comparisons).

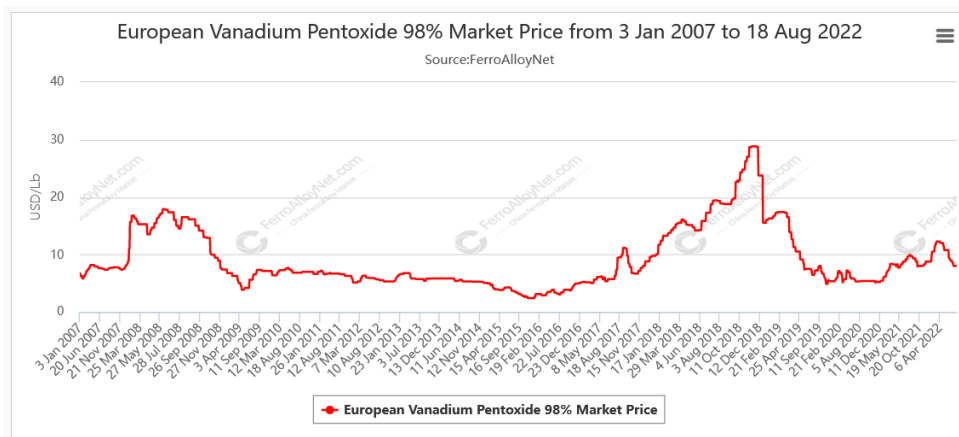


Source: TMT presentation, July 2022

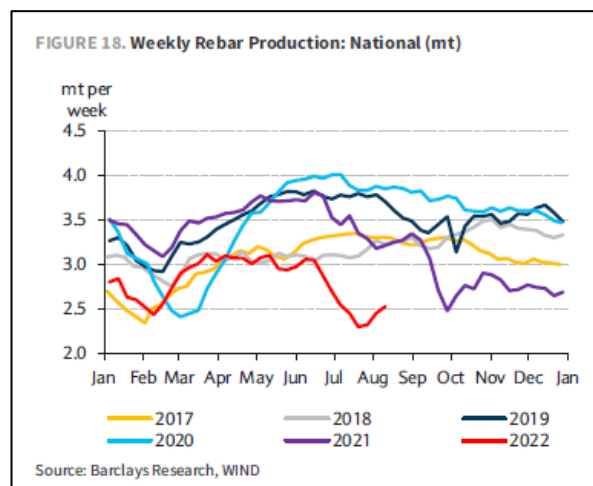
A point we would make regarding this cost curve (expressed on an 'ex royalties' basis) is to note the positioning of the lowest cost primary producer, the Maracas Menchen mine of Largo Inc, which produces around 12ktpa V₂O₅. In its recent quarterly, the company is now guiding to C1 costs (ex-royalties) of US\$4.10-4.50/lb for 2022, up around 5% from projections earlier in the year. Cash costs in 2021 were US\$3.37/lb. This highlights recent inflationary effects accentuated by declining grades at Largo's mine. We would therefore use caution in using published cost curve information from this poorly understood industry.

Outlook for Vanadium

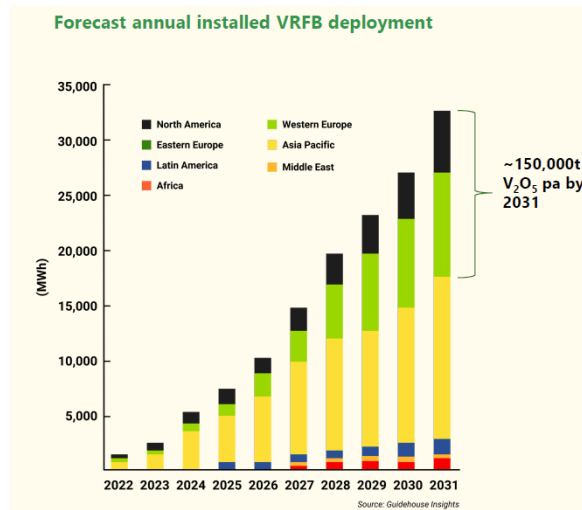
- The supply/demand outlook for vanadium was starting to look encouraging, with prices moving into a US\$10-12/lb V_2O_5 range earlier in the year (compared to a US\$5-7/lb range for much of 2019 and 2020. Consultants Roskill told us that “the vanadium market is set to tighten into 2022, driven by higher demand but also by tighter supply, as Chinese steel slag producers are running close to capacity. Outside of China, incremental supply will also be limited.”
- However, over the course of 2022, China moved into the doldrums, partly pandemic driven, partly due to the parlous state of the housing and construction sector. It is far from clear how this will pan out, but the impact has certainly taken the wind out of the commodity sector in general. V_2O_5 prices are currently trading around the US\$9/lb mark.



- Remember that the bulk of vanadium demand is currently as a strengthening alloy in various quality steels, but especially rebar. We don't need to be commodity analysts to work out why the vanadium price has been under pressure:

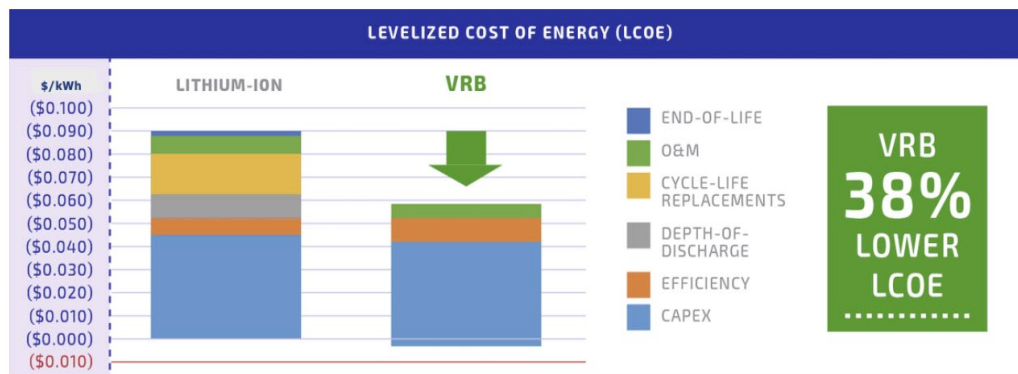


- It should also be noted that China produces around 62% of global vanadium, largely as a by-product from steel blast furnaces. Add to this some 16% from Russia and there is no wonder that the US has classified vanadium as a critical mineral. This is especially the case should demand profiles like the following come to fruition. See some of our earlier reports on TMT for a discussion of the technology of Vanadium Redox Flow Batteries (VRFB) and the outlook for this technology.



Source: TMT presentation, July 2022

- Should future vanadium demand be solely linked to an unpredictable Chinese construction industry we probably wouldn't be writing this report.
- We are firmly of the view that to efficiently decarbonise the globe, we will need multiple technologies for energy storage. Early indications are that VRFBs are one of the likely candidates.
- We are therefore of the view that V_2O_5 prices will need to be high enough to incentivise new production, and consider that US\$12/lb is the minimum price required to achieve that and satisfy a forecast supply/demand deficit. This is now our long term forecast for vanadium. In the complex world of vanadium it is, in our view, impossible to be more rigorous than this. As with lithium's performance where the pricing of all products, SC6 and downstream lithium salts continue to exceed even the most bullish commodity forecasters. We see every reason why vanadium pricing will follow a similar trend.
- A detailed understanding of the cost structure of various renewable+storage energy solutions is beyond the scope of this report (and probably of its author). However, we are attracted to information provided by VRFB manufacturer VRB Energy (a subsidiary of recently listed Ivanhoe Electric, IE:NYSE) which suggests that VRB's fully costed energy storage technology is significantly lower than an average energy/storage solution provided by lithium batteries.



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Appendix 1

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