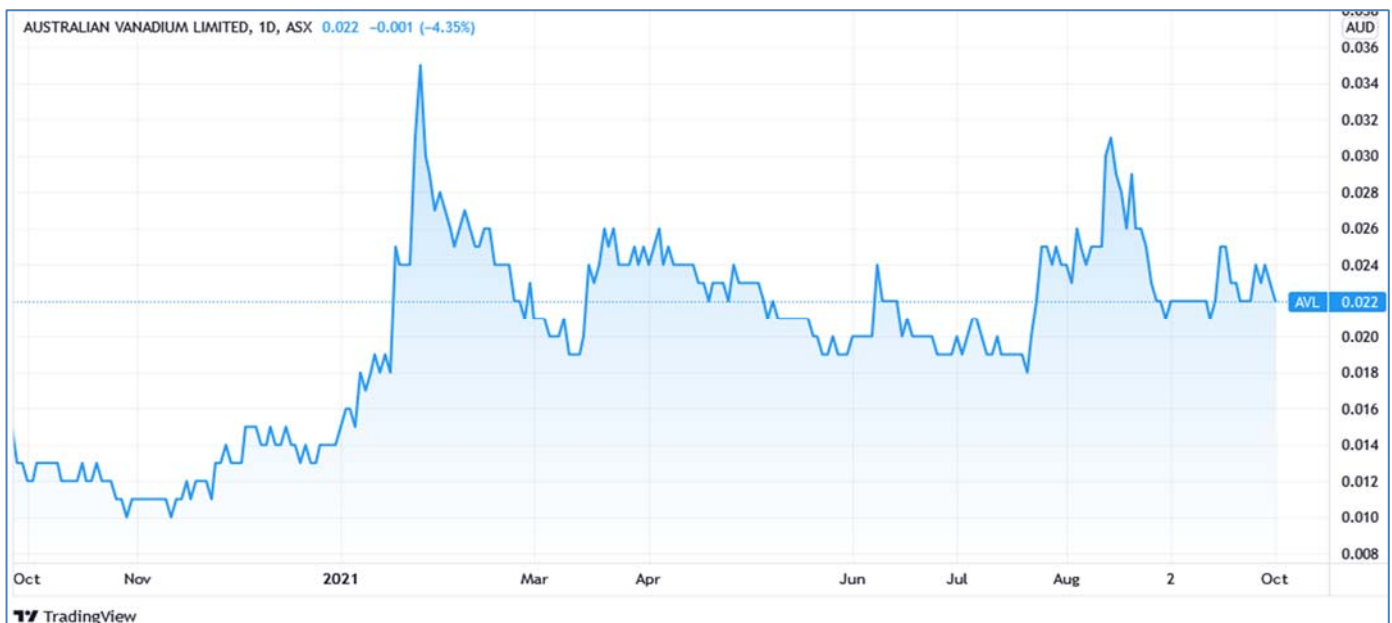


Friday 1<sup>st</sup> October, 2021

### Portfolio Stock Developments

**Australian Vanadium** - (ASX: AVL, Share Price: \$0.022, Market Cap: \$78m, coverage initiated @ \$0.014 in Aug 2017 – *current gain of 57%*)



### Key Catalyst

***Engineering group Primero appointed to undertake Early Contractor Involvement for the building of AVL's vanadium electrolyte manufacturing plant, which is stage 1 of the plant build process.***

We introduced AVL to our coverage universe during August 2017, based on its potential as an emerging vanadium producer through the planned development of its 100%-owned namesake project in the Murchison Province of Western Australia. The Australian Vanadium Project covers an area of 260 sq km and is one of world's highest-grade vanadium projects currently under development. The project has been awarded Major Project Status by the Australian Federal Government, as well as Lead Agency Status by the Western Australian Government, in recognition of its strategic importance as a critical and battery metal project. An updated Pre-feasibility Study (PFS) has reinforced the project's robust economics, with a revised layout and location, updated process design and an enhanced Ore Reserve. It has set AVL up for completion of a BFS that's focused on vanadium pentoxide production for steel and battery industries.

## Latest Activity

### **Vanadium Projects Update**

AVL has provided an update with respect to progress at its proposed vanadium electrolyte manufacturing plant in Western Australia, which forms part of the company's plan of becoming a fully-integrated vanadium company.

#### Overview

AVL has taken a first major step with respect to production status, with the appointment of Western Australian engineering group, Primero, for first stage of AVL's vanadium electrolyte manufacturing plant build. The AVL facility will be the first full-scale vanadium electrolyte manufacturing plant in Australia.

AVL has partnered with U.S. Vanadium LLC to utilise proven electrolyte manufacturing technology, which will simplify the design, construction, and start-up phases. The project will be capable of producing up to 33 MWh of VRFB energy storage annually. The facility will support the anticipated rapid growth of the long-duration, renewable energy powered VRFB market in Australia.

AVL was recently awarded an Australian Government grant of \$3.69M to co-fund its commercial vanadium electrolyte plant development. Vanadium electrolyte is the key component of vanadium redox flow batteries (VRFBs). which are used to store and redeploy renewable energy.

#### Details

The appointment of prominent engineering group Primero, (a subsidiary of NRW Holdings), to undertake the Early Contractor Involvement (ECI) for the building of AVL's vanadium electrolyte manufacturing plant, is effectively stage 1 of the vanadium electrolyte manufacturing plant build process. The next step, stage 2, will involve engineering, procurement, and construction (EPC).

The ECI stage will incorporate analysis of the U.S. Vanadium LLC<sup>1</sup> plant design, including alignment with Australian standards, design layouts and EPC contract preparation. Primero will also work with AVL to review potential locations for the plant.

The vanadium electrolyte plant will initially be able to produce enough electrolyte per annum to fill VRFBs that can store up to 33MWh of energy. For comparison purposes, a single Tesla Powerwall stores 13.5 kWh of energy, with the electrolyte plant producing the equivalent energy storage capacity of 2,444 Powerwalls per year.

#### Technical Significance

While AVL is continuing work on its world-class namesake vanadium resource project in Western Australia, which is now at the BFS stage, the company has continued to explore opportunities to fully-integrate its business by moving downstream into battery production opportunities. AVL's renewable

energy and battery supply subsidiary, VSUN Energy, is a key part of its vertical integration strategy for the VRFB market.

The contract award to Primero represents the next step in AVL’s strategy of becoming a fully-integrated vanadium company, reinforcing AVL’s goal of developing downstream processing capability in Western Australia. Importantly too, Primero have a proven track record of delivering battery minerals projects internationally

At present, AVL is aware of at least 20 commercial global manufacturers of VRFBs – and the delivery of its own high-purity electrolyte production capability will provide a critical link in the supply chain for VRFBs. The steel market currently consumes most of the world’s vanadium production. VRFBs are anticipated to grow rapidly and this new demand is expected reach 25,000 tonnes of vanadium and account for over 15% of global vanadium consumption by 2025.

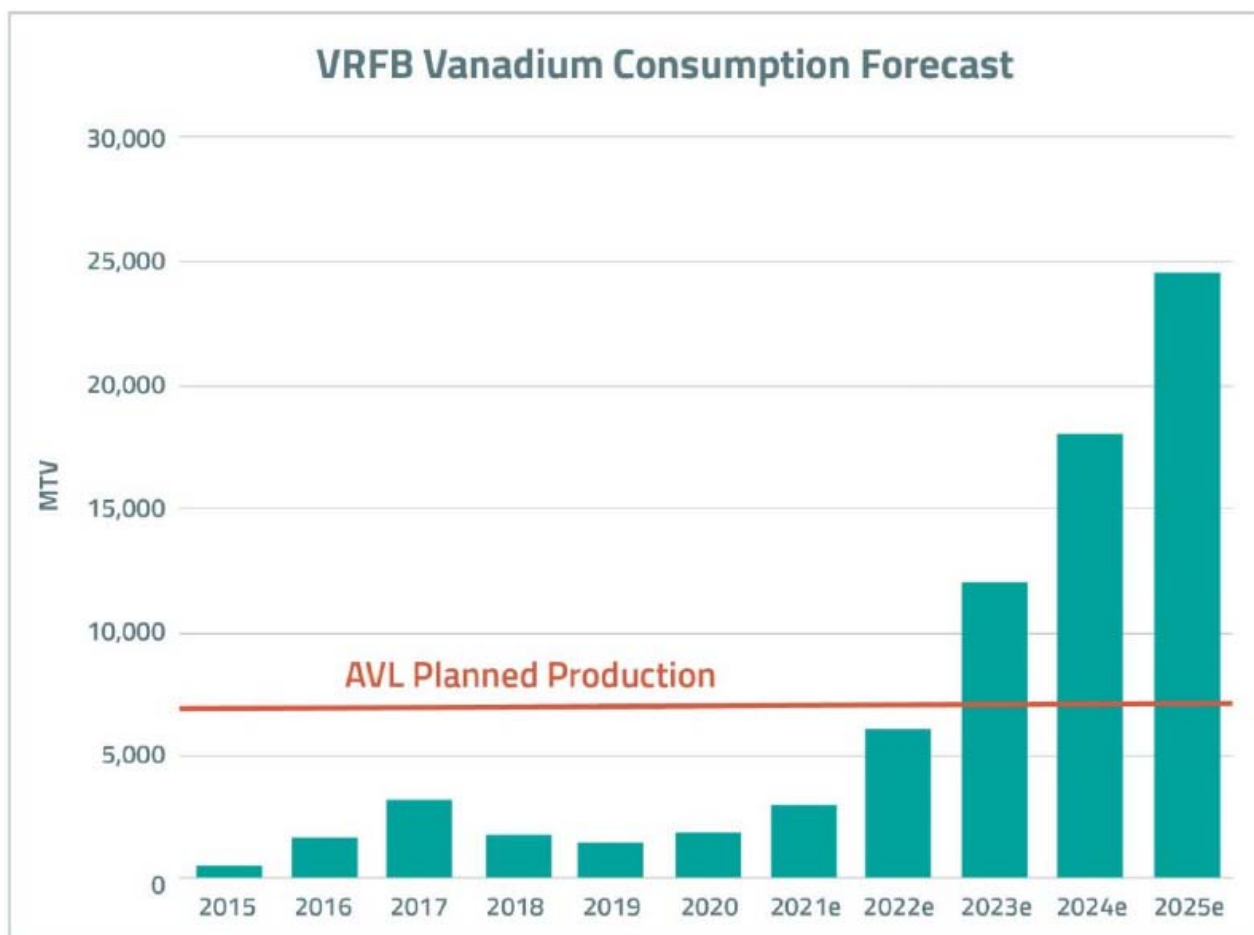


Figure 1: VRFB Global Vanadium Consumption Forecast

### What is Vanadium?

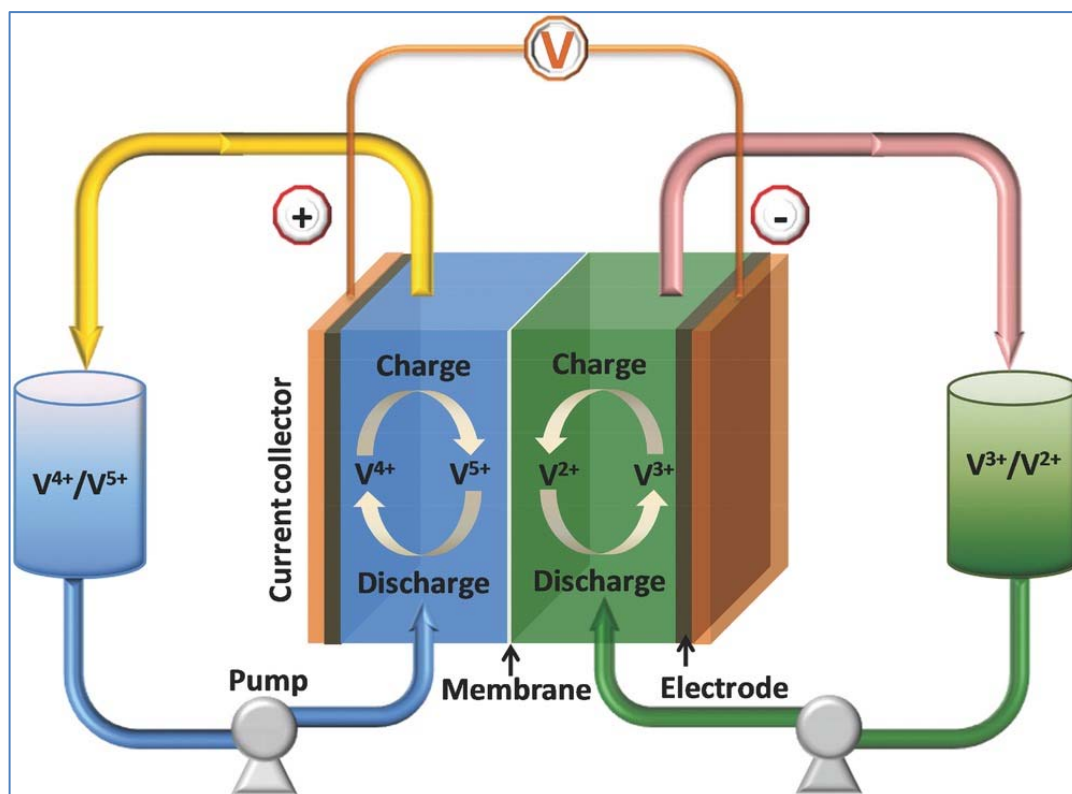
Vanadium is a medium-hard, steel-blue metal. Although a lesser-known metal, it is quite valuable in the manufacturing industry due to its malleable, ductile and corrosion-resistant qualities – and is increasingly utilised in battery storage. Around 80% of the vanadium produced is alloyed with iron to make a shock-

and corrosion-resistant steel additive called ferrovanadium, which contains between 1% and 6% vanadium.

Vanadium-steel alloys are used to make extremely tough tools such as axles, armour plates, car gears, springs, cutting tools, piston rods and crankshafts. Vanadium alloys are also used to make nuclear reactors because of their low-neutron-absorbing properties. In fact, the first widespread industrial use for vanadium was in the steel framework of the Model T Ford, which allowed for a lighter weight frame that was also of greater tensile strength.

When mixed with aluminium and titanium, vanadium can create a very strong alloy that is used for special applications, such as dental implants and jet engines.

In Vanadium Redox Flow Batteries (VRFBs), vanadium is used to create a reliable, safe and stable solution for the storage of renewable energy.



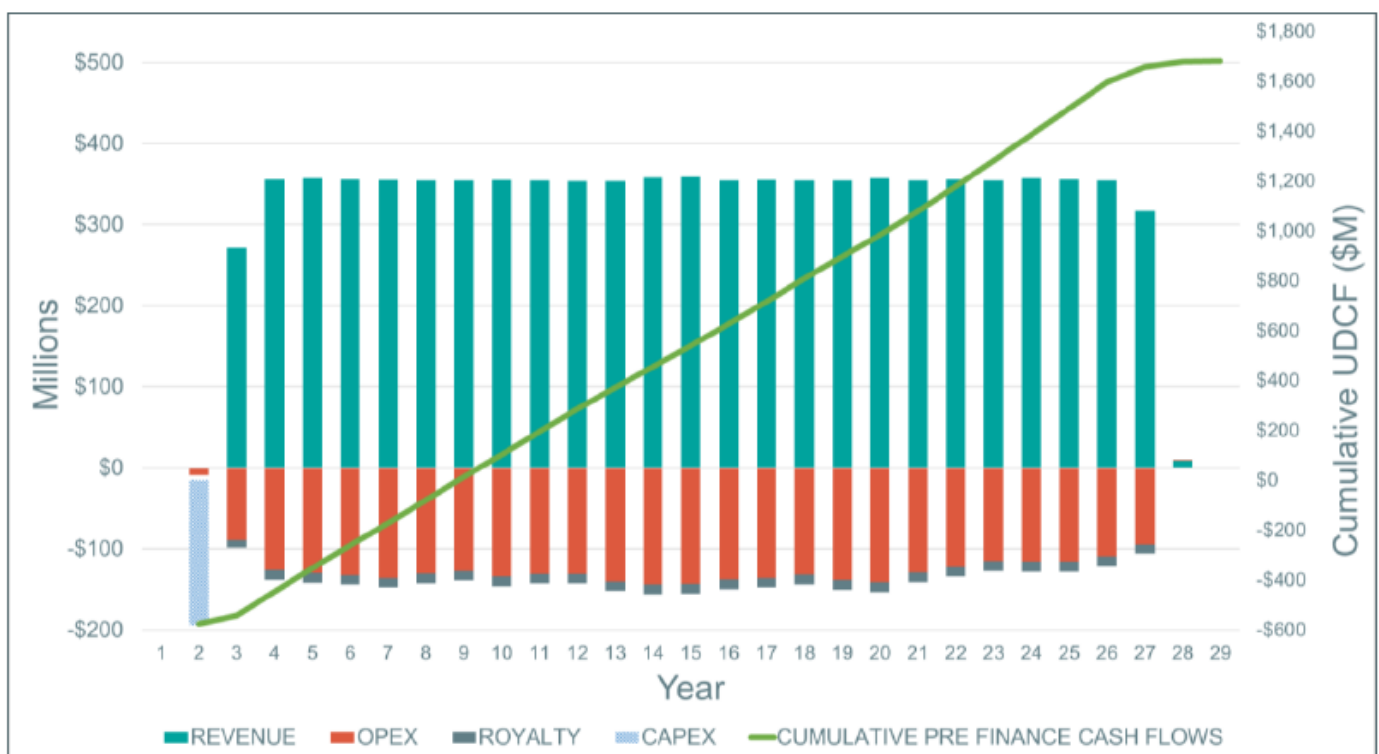
**Figure 2:** Workings of a Vanadium Redox Flow Battery

## Projects Overview

AVL is pursuing two avenues, mining and manufacturing, as part of its vision of vertically integrating its business. The idea is to move away from Australia's traditional role of simply extracting and exporting raw minerals, to instead creating products from those materials onshore, which typically generates far higher profit margins. AVL plans to supply vanadium pentoxide ( $V_2O_5$ ) from its Australian Vanadium Project to manufacture vanadium electrolyte, which will then be supplied to VRFB projects in Australia and in the Asia Pacific Region.



- C1 operating cost of US\$3.66/lb V<sub>2</sub>O<sub>5</sub> competitive with world primary vanadium producers, includes iron titanium (FeTi) coproduct credit (down US\$0.49/lb V<sub>2</sub>O<sub>5</sub>).
- Project annual EBITDA average for 25 years up 31% to A\$144M.
- Plant and associated infrastructure capital cost of US\$253M.
- Total project capital cost up 13% to US\$399M (includes area and regional infrastructure, indirects, EPCM, growth and owner's costs).
- Ore Reserve increased by 76% to 32.1Mt at 1.05% V<sub>2</sub>O<sub>5</sub> (comprising of a Proved Reserve of 9.8Mt at 1.08% V<sub>2</sub>O<sub>5</sub> and a Probable Reserve of 22.4Mt at 1.04% V<sub>2</sub>O<sub>5</sub>).
- Increased anticipated mine life from 17 to 25 years, supporting a long-life, consistent ore feed operation on AVL's granted mining lease.
- Nominal vanadium production up 8% to 24.3 Mlbs V<sub>2</sub>O<sub>5</sub> annually.
- Forecast vanadium ore recovery to concentrate of 74.8% life of mine, supported by pilot testing.
- New innovative flowsheet for processing plant recovers 88% V<sub>2</sub>O<sub>5</sub> utilising tried-and-tested grate kiln technology.
- Separation of processing plant from minesite provides access to cheaper competitive natural gas near Geraldton, local workforce and FeTi coproduct sales opportunities for 900,000 dry tonnes per annum over the mine life.



**Figure 4:** AVL PFS 2020 annual free cash flows and costs (A\$ million) on pre-tax, pre-finance basis

The Australian Vanadium Project is based on a proposed open-cut mine and a crushing, milling and beneficiation plant (CMB) at Gabanintha. Concentrate will be transported to a vanadium processing plant

near Geraldton for final conversion to high-quality vanadium pentoxide - for sale or further conversion and use in steel and energy storage, catalyst, chemical and defence applications.



**Figure 5:** Australian Vanadium Project location

AVL is advancing the development of its world-class Australian Vanadium Project, which is currently one of the highest-grade vanadium projects being advanced globally - with 208.2Mt at 0.74% vanadium pentoxide ( $V_2O_5$ ), containing a high-grade zone of 87.9Mt at 1.06%  $V_2O_5$  with an Ore Reserve of 18.24Mt at 1.04%  $V_2O_5$  comprised of a Proved Reserve of 9.82Mt at 1.07%  $V_2O_5$  and a Probable Reserve of 8.42Mt at 1.01%  $V_2O_5$ , reported in compliance with the JORC Code 2012. The project consists of a high-grade V-Ti-Fe deposit located in the Murchison Province, 43km south of the mining town of Meekatharra in Western Australia and 740km northeast of Perth. The project consists of 11 tenements covering approximately 260 sq km and is held 100% by AVL.

The project will be unique among all global primary vanadium producers in having a coastal location for its final vanadium processing plant. The three primary vanadium mines currently in production globally (one in Brazil and two in South Africa), mine and process their ore to final vanadium product at one inland location. AVL has signed an option over land between Mullewa and the port city of Geraldton for the development of the processing facility.

## **Summary**

***The Australian Vanadium project is one of the highest-grade vanadium projects currently being developed in the world, and is forecast to generate significant cash flows due to its status as a low-cost, globally competitive operation, able to operate over a long mine life and under all market conditions. It is this project and the company's steady process of de-risking that has driven AVL's solid share price performance since our coverage initiation back in 2017.***

**Simultaneously, AVL is progressing an integrated business model, which is where the company's progress with respect to its proposed vanadium electrolyte manufacturing plant in Western Australia, represents an important development step.**

**The graphic below shows the performance of AVL (purple line, up 140%) compared to the S&P/ASX Small Ordinaries Resources Index (blue line, up 41%) over the past two years.**



**The company is well managed, with a methodical and measured approach to project development. At the same there is plenty of meaningful news-flow, with the market currently focused on the progress of the company's BFS. AVL remains firmly held within our coverage Portfolio.**

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