



21st Century Vanadium: Raw Material Security, spiking prices and impact on ESS

Benchmark Minerals World Tour September 2018

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COMMENT

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COMPETENT PERSON REFERENCES

Competent Person Statement – Mineral Resource Estimation

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Competent Person Statement – Metallurgical Results

The information in this statement that relates to Metallurgical Results is based on information compiled by independent consulting metallurgist Brian McNab (CP. B.Sc Extractive Metallurgy), Mr McNab is a Member of The Australasian Institute of Mining and Metallurgy. Brian McNab is employed by Wood Mining and Metals. Mr McNab has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which is undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr McNab consents to the inclusion in the report of the matters based on the information made available to him, in the form and context in which it appears.

The information is extracted from the report entitled "Significant vanadium resource upgrade at Gabanintha" released to ASX on 5 September 2017 and is available on the company website at www.australianvanadium.com.au.

The company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of estimates of Mineral Resource or Ore Reserves, that all material assumptions and technical parameters underpinning the estimates in the relevant market announcement continue to apply and have not materially changed. The company confirms that the form and context in which the competent person's findings are presented has not been materially modified from the original market announcement.

FORWARD LOOKING STATEMENTS

This announcement may contain certain "forward-looking statements" which may not have been based solely on historical facts, but rather may be based on the Company's current expectations about future events and results. Where the Company expresses or implies an expectation or belief as to future events or results, such expectation or belief is expressed in good faith and believed to have a reasonable basis. However, forward looking statements are subject to risks, uncertainties, assumptions and other factors which could cause actual results to differ materially from future results expressed, projected or implied by such forward-looking statements. Such risks include, but are not limited to Resource risk, metal price volatility, currency fluctuations, increased production costs and variances in ore grade or recovery rates from those assumed in mining plans, as well as political and operational risks in the countries and states in which we sell our product to, and government regulation and judicial outcomes. For more detailed discussion of such risks and other factors, see the Company's Annual Reports, as well as the Companies other filings. Readers should not place undue reliance on forward looking information. The Company does not undertake any obligation to release publicly any revisions to any "forward looking statement" to reflect events or circumstances after the date of this announcement, or to reflect the occurrence of unanticipated events, except as may be required under applicable securities laws.

AVL Gabanintha on Pathway to Vanadium Production

Company

- Listed on Australian Stock Exchange since 2007 (ASX:AVL)
- AVL has strongest technical team of all prospective new vanadium prospects globally

Vanadium Markets

- Vanadium price on long term uptrend as traditional steel markets actively seek new sources of long term supply
- Company focused on new V_2O_5 production to support Ferrovandium, VCN and vanadium battery markets

Project

- Bushveld-like vanadium magnetite deposit
- Globally significant project with large, high-grade Resources over 11km
- Metallurgical recovery and concentrate grade comparable to other global operating mines
- Process design and PFS underway as Company prepares to fast-track project development



Corporate Snapshot

Key Statistics (as at 12-9-18)

Ordinary shares on issue	1,621m
Listed Options (ex at 2c exp Dec 2018) AVLO	378.8m
Share price	AUD \$0.044
Market capitalisation (undiluted)	A\$70m (Cash ~A\$5m)
Shareholders	6,409

Substantial Shareholders

Substantial Shareholders	% holding
J P Morgan Nominees	3.54 %
Citicorp	2.22%
Management	7 %

Board of Directors

Board of Directors	Title
Vincent Algar Bsc (Hons) Geol, MAusImm	Managing Director
Leslie Ingraham	Executive Director
Brenton Lewis MBSc, BBSc (Hons)	Non Executive Chairman
Daniel Harris BSc Chem Eng	Non Executive Director

AVL Share Price History

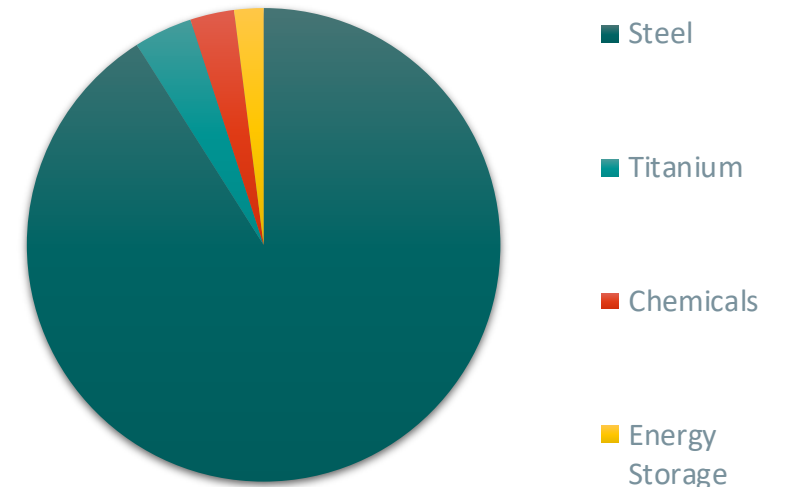


Vanadium Markets

Vanadium Markets - Steel

Despite reduced rate of steel production, demand for vanadium continues to grow. Steel remains the price driver for vanadium.

- Steel is the primary market (92% of vanadium consumption)
- Key metric is Chinese rebar consumption
- Vanadium used to micro-alloy finished steel products
- Addition of 0.2% vanadium increases steel strength up to 100% and reduces weight up to 30%
- Demand for use in rebar continues to increase at 6% annually (TTP Squared)
- New standards for Chinese rebar require increased vanadium use, doubling to rest-of-world standards
- Risk of substitution minimal due to unique micro-alloy effects
- New markets in steel will increase demand such as:
 - Materials for automotive, aviation and aerospace
 - Power lines and power pylons
 - High-strength steel structures

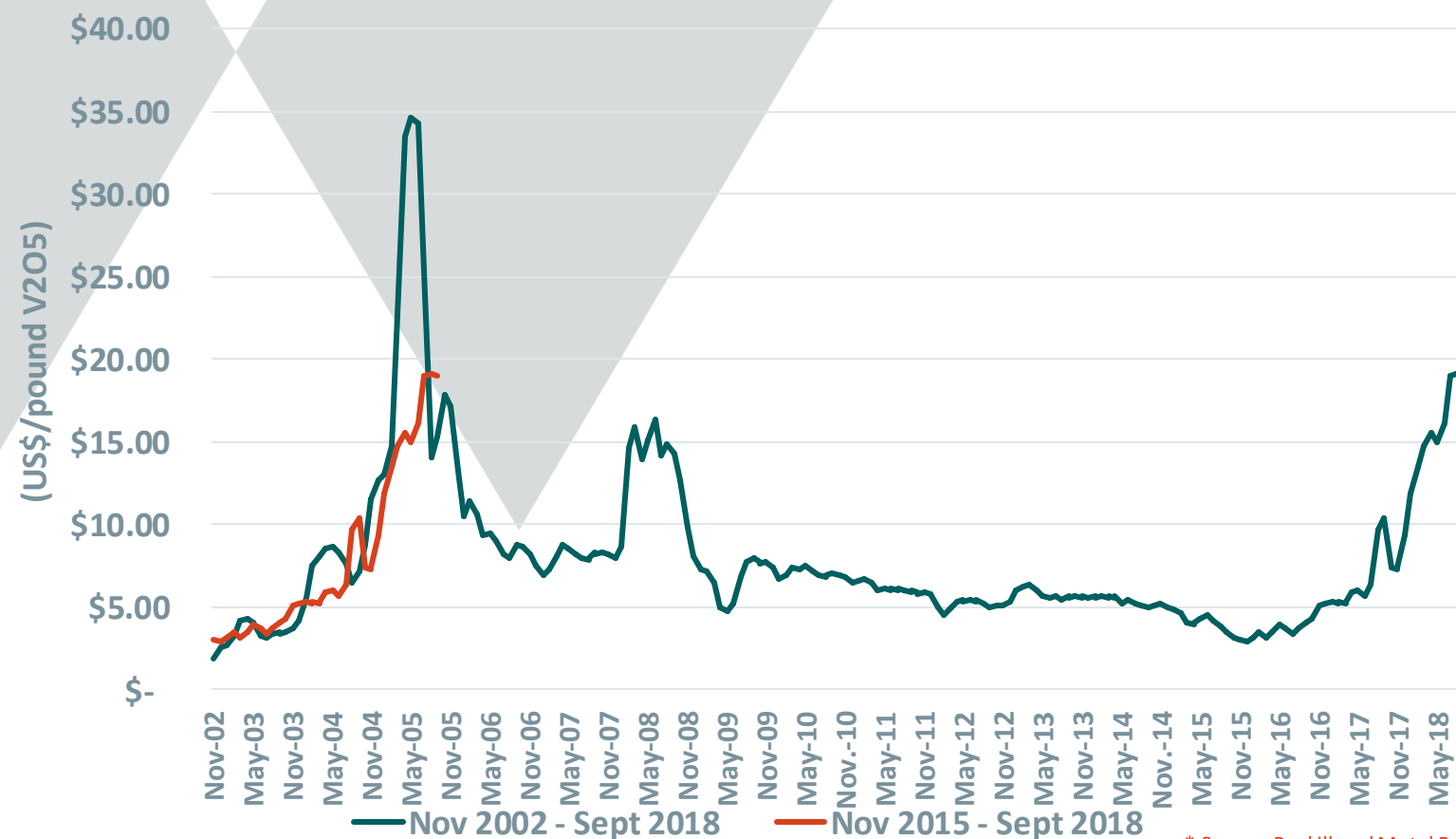


Vanadium Markets - Steel

Global inventory levels are decreasing as evidenced by rising prices over the past three years.

Metal Bulletin V2O5 Monthly Midpoint Average Price

inflated to Sept 2018 US\$

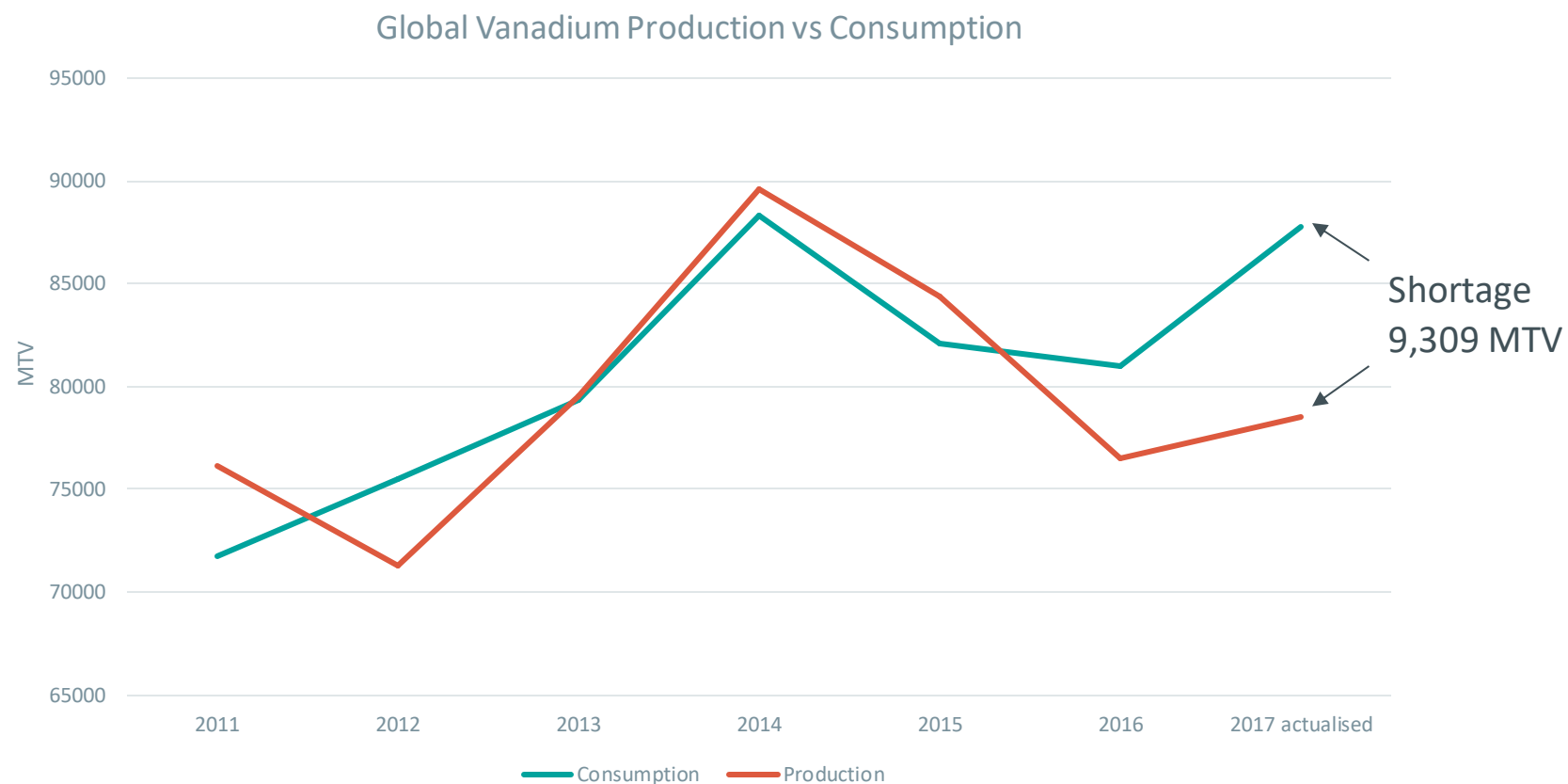


* Source Roskill and Metal Bulletin

- Ferrovandium prices in China have risen to about \$80 per kilogram and to about \$81 per kilogram in Europe
- Vanadium pentoxide prices have risen to \$19.0/lb* in China and as high as \$19.0/lb in Europe
- Vanadium prices close to ten times higher than 2016*
- Supply remains under pressure globally
- Vanadium electrolyte demand increasing
- New Rebar standard in place October 18
- Environmental shutdowns of slag plants ongoing
- Slag imports to China were banned from Jan 1st 2018

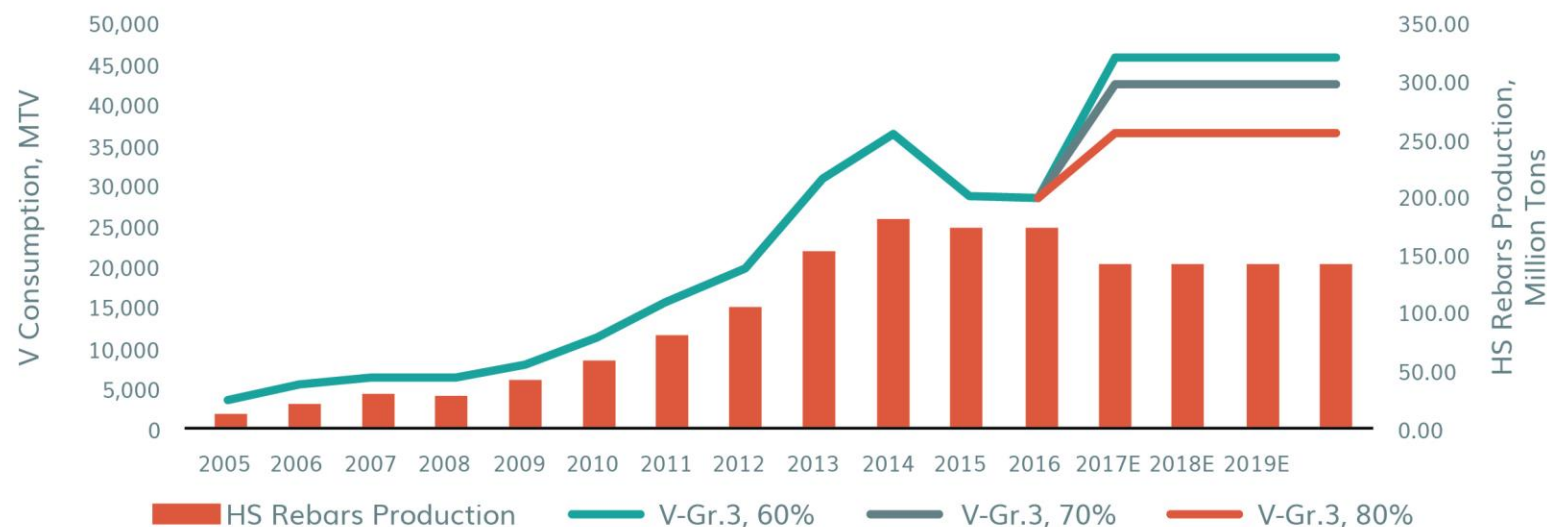
Vanadium Markets - Overview

In 2017 (based on three quarter actual results annualized), vanadium consumption exceeded production by more than 9,000 MTV, or over 10% of the market.



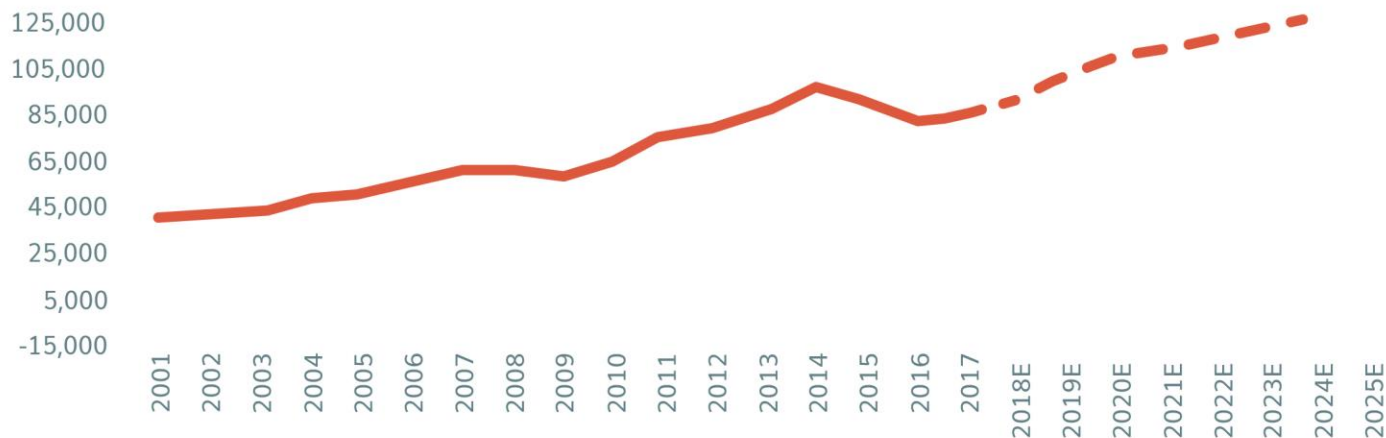
* Source Roskill and Metal Bulletin

Vanadium Consumption in Chinese Rebar



Vanadium Consumption Forecast

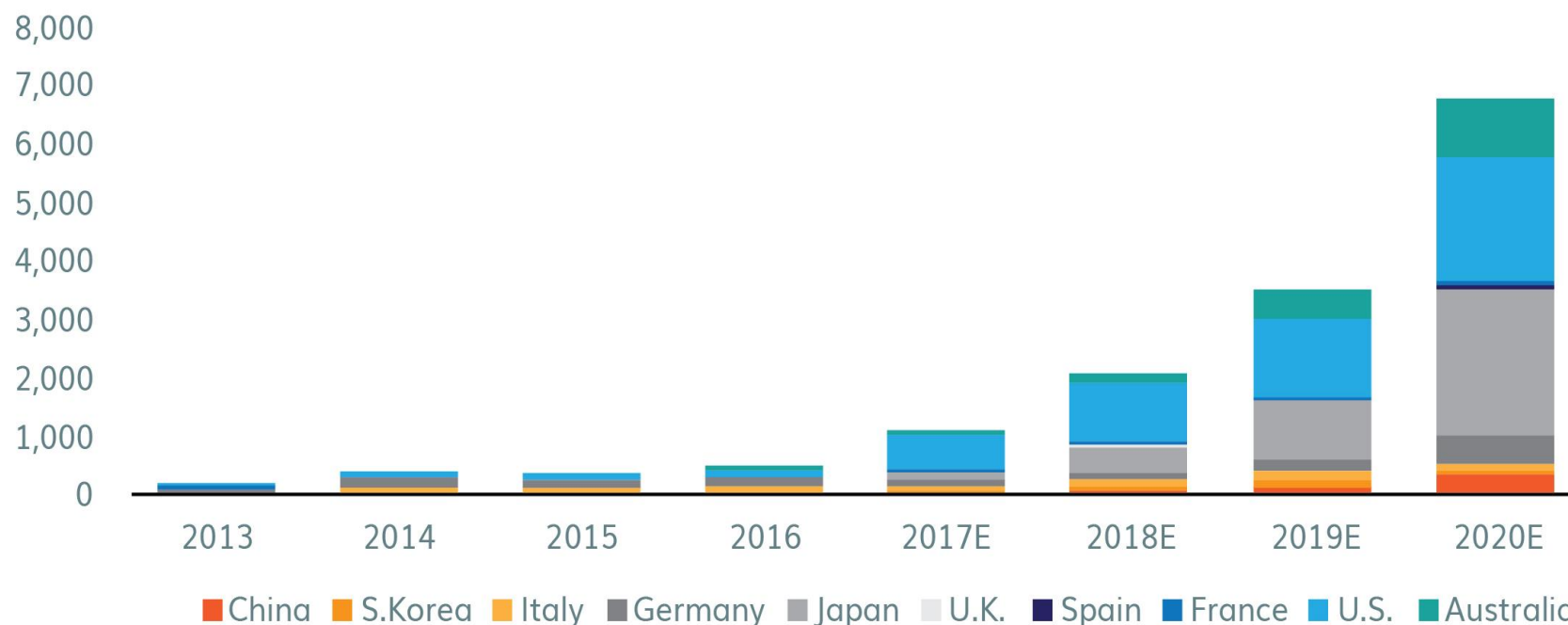
(Metric Tons V per Year)



Cumulative Market Projection of Vanadium Consumption for Energy Storage

A New Player in Demand!

(Metric Tons V per Year)

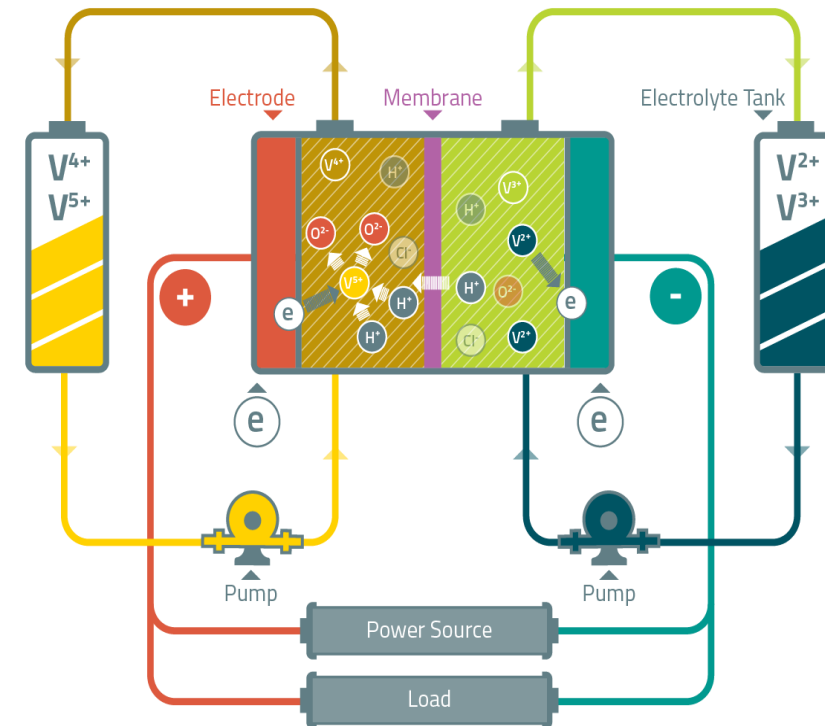


Source: Azure International

Vanadium Markets – Energy Storage

Unique characteristics of Vanadium Redox Flow Batteries (VRFBs)

- Flow battery technology is well established and at commercial deployment status
- VRFBs provide a way to store and re-supply renewable energy. Their very high capacity is ideal for large-scale energy storage applications, unlocking the full potential of renewables while maintaining grid security.
- VRFBs have unique advantages over other batteries:
 - Easily scaled into large MW scale solutions
 - Lifespan of 20 years with very high cycle life and no capacity loss over time
 - A key feature of using only one element in electrolyte, V_2O_5 which can be recycled
 - Immediate and rapid energy release
 - Non-flammable
 - Suitable for grid connection or off-grid use
 - Can discharge 100% with no damage
 - Improved safety and low replacement rate compared to Li-ion (lower lifetime LCOE)



Vanadium in electrolyte – Market implications



V_2O_5 in H_2SO_4 at 1.6 molar **145g/l**

Amount of V_2O_5 used in 1MWh **9.89t**

Projected global annual energy storage per year **11GWh**

Estimated VRFB installs @ 10% **1GWh**

V_2O_5 per year needed to supply VRFB demand **10kt**

Current annual global production of V_2O_5 equivalent **140kt**



Vanadium in energy storage can have a significant effect on the market

Energy Storage Market Beckons in Australia

Can VRFBs be the ultimate grid energy storage solution for Australia?

- Rising power costs: VRFBs can reduce power bills by peak/off-peak shifting and demand management
- Australia has world's most extended networks - many fringe-of-grid and off-grid opportunities exist
- Battery storage strongly on political agenda: efforts to reduce power price rises and carbon dependency
- VRFB rollout can assist with Australian networks' primary goal – capital cost deferment
- Australian storage market expected to grow to 3000MWh by 2030 (CEC Report 2012)
- VSUN Energy, (AVL subsidiary), actively identifying multiple residential and commercial storage opportunities, ranging from 5kW of power with 15kWh of energy storage to 40MW of power with 160MWh of energy storage



Vanadium Redox Flow Battery Manufacturers



New Insights in State of Commercial VRFBs

Market signals appearing, driving revolution in VRFB suppliers



- Vanadium shortage and higher prices driving innovation in VRFBs
- Dramatic increase in number of VRFB manufacturers across all continents
- Higher V pricing resulting in “hardware” cost innovation
 - Modular smaller units emerging providing low production costs
 - Modularity offers size flexibility, serving more storage niches
- Megawatt scale implementations increasing - utility and commercial
- Innovation on finance “leasing” of vanadium – a unique, indestructable, reusable store of value in the VRFB
- Opportunities for 3rd party financial intermediaries to join market and lead to rapid increase in market space
- Changes driving new direct interest in new vanadium supply

Value Addition in V-electrolyte

Vanadium electrolyte production diversifies target market



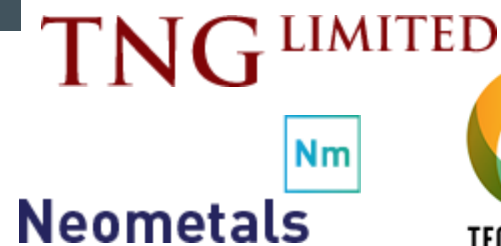
- Vanadium electrolyte is VRFB “fuel”
- A mild acid solution of V_2O_5 with all oxidation states balanced and available for electron transfer
- Requires high purity (99.5%+) V_2O_5
- High purity circuit planned for AVL’s processing plant to produce proportion of “battery ready” V_2O_5
- Final electrolyte can be produced in stand-alone plant or as part of mine process
- Offers unique opportunity to value-add at source location for low cost
- Local “supply” for imported battery units, or export product
- Electrolyte can be re-used, leading to developments in leasing structures
- AVL operates a pilot plant located in a lab at the University of Western Australia in Perth, commissioned in November 2016

Vanadium Supply Chain

Current global producers



Australian explorers

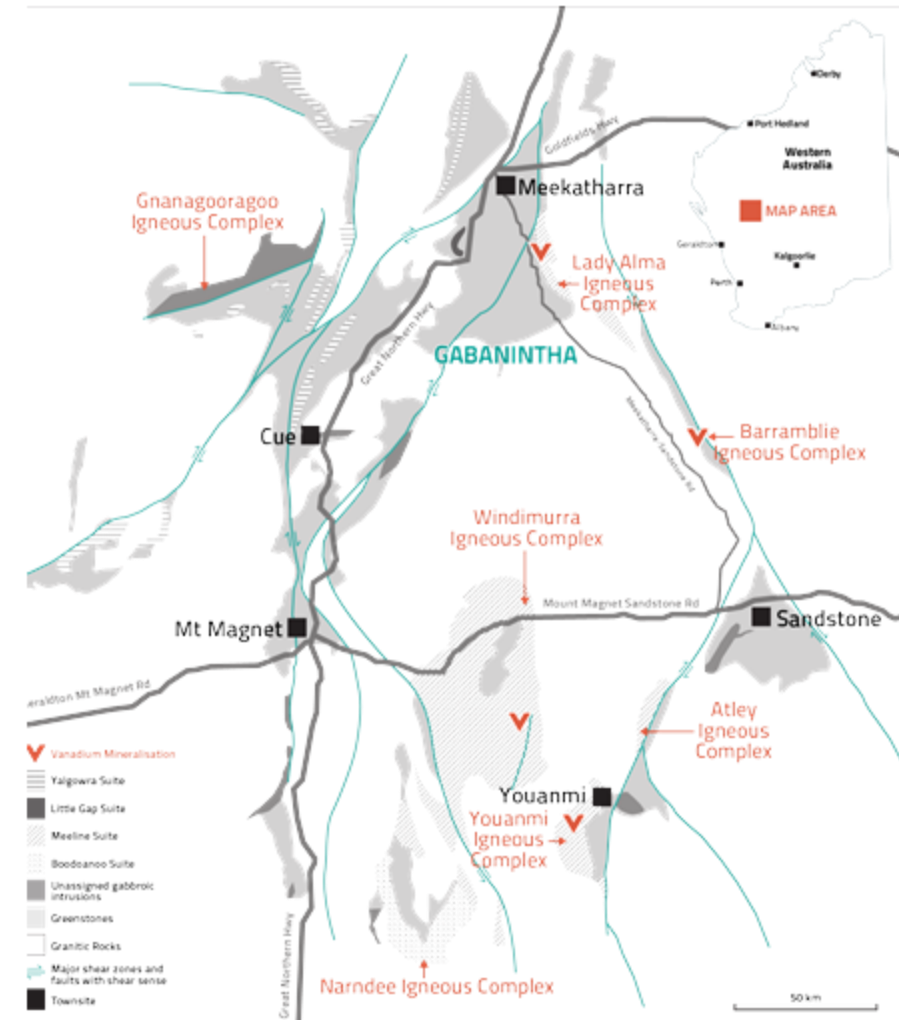


Project Highlights Gabanintha



AVL is a vanadium focused company

- Vanadium focused company listed on ASX since 2007
- Undertaking pre-feasibility study on magmatic titaniferous vanadium iron project at Gabanintha in Western Australia
- Significant project with high-grade Measured, Indicated and Inferred vanadium resources hosted in magnetite bearing rocks
- Energy subsidiary VSUN Energy actively developing Australian energy storage market
- AVL offers investors exposure to entire vanadium value chain
- Focus offers leverage to rising vanadium prices and new applications in energy storage





Globally Significant Project – PFS Nearing Completion

Gabanintha Vanadium Project
in Western Australia

Vincent Algar, Managing Director

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Western Australia 6005



Vanadium Resource

Resource Table

Material	JORC Resource Class	Million Tonnes	V ₂ O ₅ %	Fe%	TiO ₂ %	SiO ₂ %	Al ₂ O ₃ %	LOI%
High grade	Measured	10.1	1.11	42.7	12.6	10.3	8.0	4.0
	Indicated	4.9	1.09	43.3	12.1	10.5	7.8	3.7
	Inferred	78.6	0.98	42.4	11.2	11.4	7.6	3.4
Subtotal High Grade		93.6	1.00	42.5	11.4	11.3	7.6	3.5
Low grade	Indicated	19.1	0.51	23.9	7.0	27.8	18.1	8.7
	Inferred	58.5	0.49	25.5	6.7	27.5	16.5	7.4
Subtotal Low grade		77.5	0.50	25.1	6.8	27.5	16.9	7.7
Subtotal Measured	Measured	10.1	1.11	42.7	12.6	10.3	8.0	4.0
Subtotal Indicated	Indicated	24.0	0.63	27.9	8.0	24.2	16.0	7.7
Subtotal inferred	Inferred	141.4	0.77	35.0	9.2	18.5	11.5	5.2
TOTAL		175.5	0.77	34.5	9.3	18.8	11.9	5.5

Note: Mineral Resource estimate by domain and resource classification using a nominal 0.4% V₂O₅ wireframed cutoff for low grade and nominal 0.7% V₂O₅ wireframed cut-off for high grade (total numbers may not add up due to rounding)

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