



Australian  
VANADIUM  
LIMITED

# The World's Next High Grade Vanadium Mine

Technology and Low Emission Minerals Conference  
November 2018 | ASX: AVL

## Disclaimer

The views expressed in this presentation contain information derived from publicly available sources that have not been independently verified.

No representation or warranty is made as to the accuracy, completeness or reliability of the information.



## COMMENT

It is common practice for a company to comment on and discuss its exploration in terms of target size and type. In addition surface sampling assays and drill sample results may also be discussed in the context of information describing the presence of anomalous metal content. The information relating to an Exploration Target should not be misunderstood or misconstrued as an estimate of Mineral Resources or Mineral Reserves. Hence the terms Resource(s) or Reserve(s) have not been used in this context. The potential quantity and grade is conceptual in nature, since there has been insufficient exploration to define a Mineral Resource. It is uncertain if further exploration will result in the determination of a Mineral Resource.

## COMPETENT PERSON REFERENCES

### Competent Person Statement — Exploration Results

The information in this report that relates to Exploration Results is based on and fairly represents information and supporting documentation prepared by Mr Brian Davis (Consultant with Geologica Pty Ltd). Mr Davis is a shareholder of AVL. Mr Davis is a member of the Australasian Institute of Mining and Metallurgy and has sufficient experience of relevance to the styles of mineralisation and types of deposits under consideration, and to the activities undertaken to qualify as Competent Persons as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Specifically, Mr Davis consents to the inclusion in this report of the matters based on his information in the form and context in which they appear.

### Competent Person Statement — Mineral Resource Estimation

The information in this report that relates to Mineral Resources is based on and fairly represents information compiled by Mr Lauritz Barnes, (Consultant with Trepanier Pty Ltd) and Mr Brian Davis (Consultant with Geologica Pty Ltd). Mr Davis is a shareholder of Australian Vanadium Limited. Mr Barnes is a member of the Australasian Institute of Mining and Metallurgy and Mr Davis is a member of the Australian Institute of Geoscientists and both have sufficient experience of relevance to the styles of mineralisation and types of deposits under consideration, and to the activities undertaken to qualify as Competent Persons as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Specifically, Mr Barnes is the Competent Person for the estimation and Mr Davis is the Competent Person for the database, geological model and site visits. Mr Barnes and Mr Davis consent to the inclusion in this report of the matters based on their information in the form and context in which they appear.

### 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](http://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 presentation 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.

## Cautionary Statements

The base case PFS results referred to in this presentation are based on a preliminary technical and economic study of the potential viability of developing an open pit mine and standalone vanadium plant to be constructed onsite at Australian Vanadium Limited's Gabanintha Vanadium Project. The study referred to in this announcement is based on low level technical and preliminary economic assessments and is insufficient to support estimation of ore reserves or to provide assurance of an economic development case at this stage, or to provide certainty that the conclusions of the study will be realised. The results should not be considered a profit forecast or production forecast. The production target referred to in this presentation is based on 43% Measured Resources, 20% Indicated Resources and 37% Inferred Resources for the life of mine. The mine plan comprises 100% of current global Measured resources, 96% of current global Indicated resources, and 11% of current global Inferred resources. The Company has concluded that it has reasonable grounds for disclosing a production target that includes a modest amount of Inferred material. However, there is a low level of geological confidence associated with Inferred Mineral Resources and there is no certainty that further exploration work will result in the determination of Measured or Indicated Mineral Resources or that the production target or the economic assessment will be realised.

The study is based on the material assumptions described elsewhere in the ASX announcement dated 26<sup>th</sup> September 2018 (table page 30-34). These include assumptions about availability of funding. While the Company considers all the material assumptions to be based on reasonable grounds, there is no certainty that they will prove to be correct or that the range of outcomes indicated by the study will be achieved. To achieve the potential mine development outcomes indicated in the study, additional funding will be required. Investors should note that there is no certainty that the Company will be able to raise funding when needed.

However, the Company has concluded that it has a reasonable basis for providing the forward-looking statements included in this presentation and believes it has "reasonable basis" to expect it will be able to fund the development of the AVL Gabanintha Vanadium Project.

To achieve the range of outcomes indicated in this presentation, funding in the order of US\$360 million will likely be required. Investors should note that there is no certainty that Australian Vanadium Limited will be able to raise the amount of funding required or when it will be needed. It is also possible that such funding may only be available on terms that dilute or otherwise affect the value of the Company's existing shares. It is also possible that Australian Vanadium Limited could pursue other strategies to provide alternative funding options. Given the uncertainties involved, investors should not make any investment decisions based solely on the results presented in this presentation.

*See ASX Announcement 'Gabanintha Presents Robust Base Case for PFS' dated 26<sup>th</sup> September 2018*

## Expert Vanadium Team

### Vanadium expertise separates AVL from other explorers

At Australian Vanadium Ltd our management is committed to fast-track this significant global resource. Our team brings together experts in geoscience, mining, chemical engineering, marketing and corporate governance and has an extensive vanadium network and knowledge.



**Vincent Algar**  
Managing Director



**Daniel Harris**  
Technical Director



**Todd Richardson**  
Technical Manager

## Gabanintha Project

Globally significant vanadium resource

175.5Mt at 0.77%  $V_2O_5$

Massive high-grade zone

93.6Mt at 1%  $V_2O_5$

PFS base case ( $\pm 35\%$ )

Capex US\$360m

Opex US\$4.28/lb

Feed 900,000 tonnes p/a

Mag Con 1.39%

$V_2O_5$  10,100 tonnes p/a

Mine life 17 years

At US\$20/lb the project has an NPV of

# US\$2.37 billion

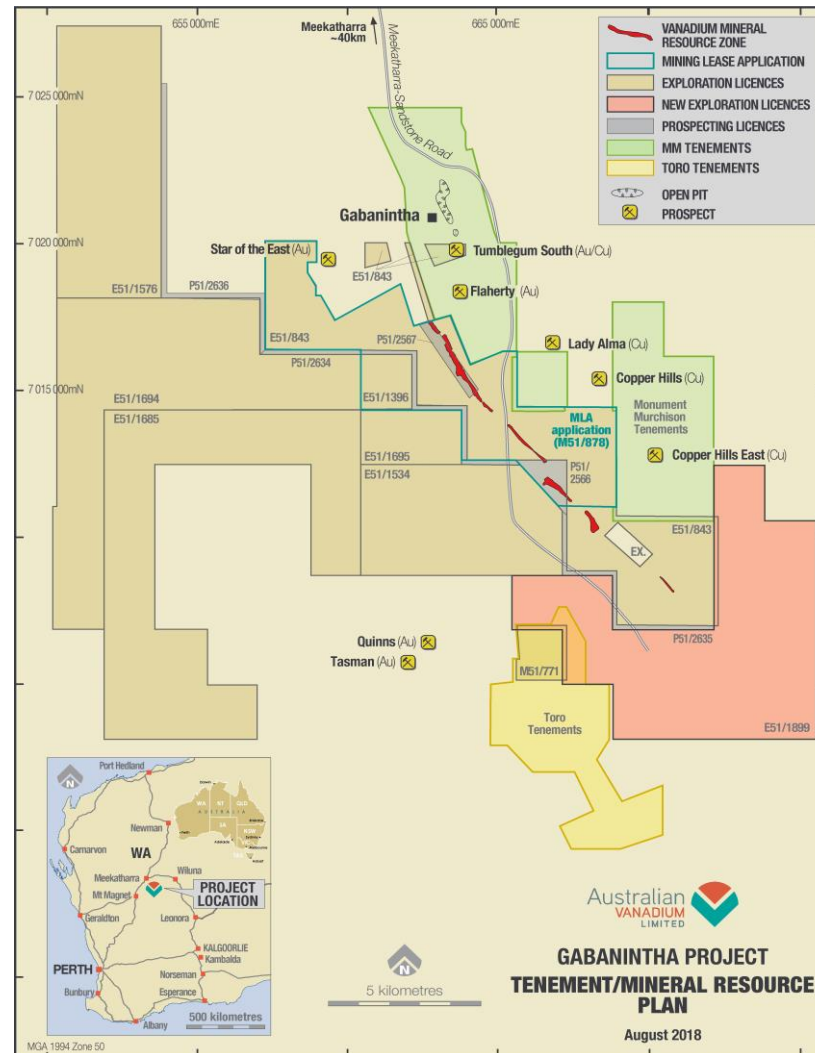




# Gabanintha Project

Vanadium deposit  
drilled over 11km of  
AVL controlled strike

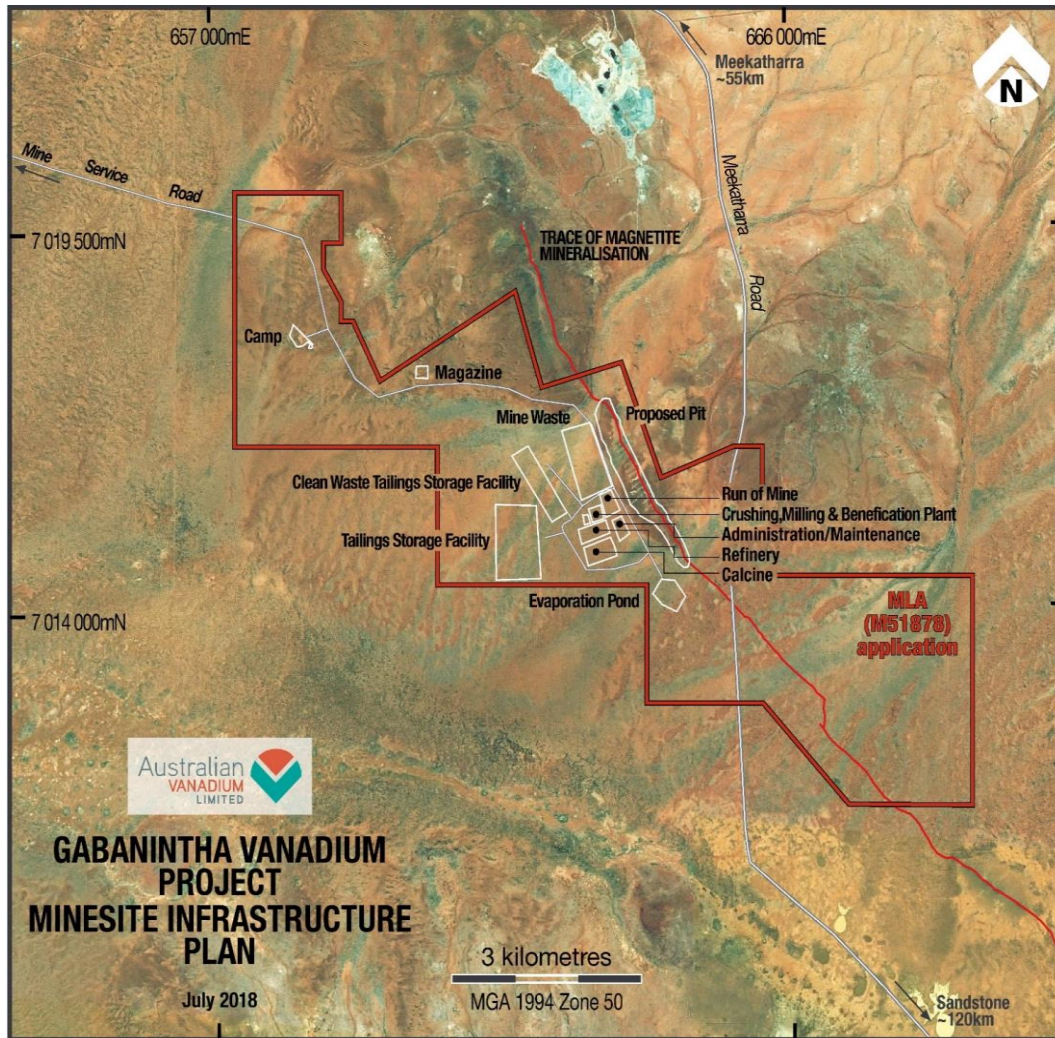
AVL holds significant  
ground position for  
project development



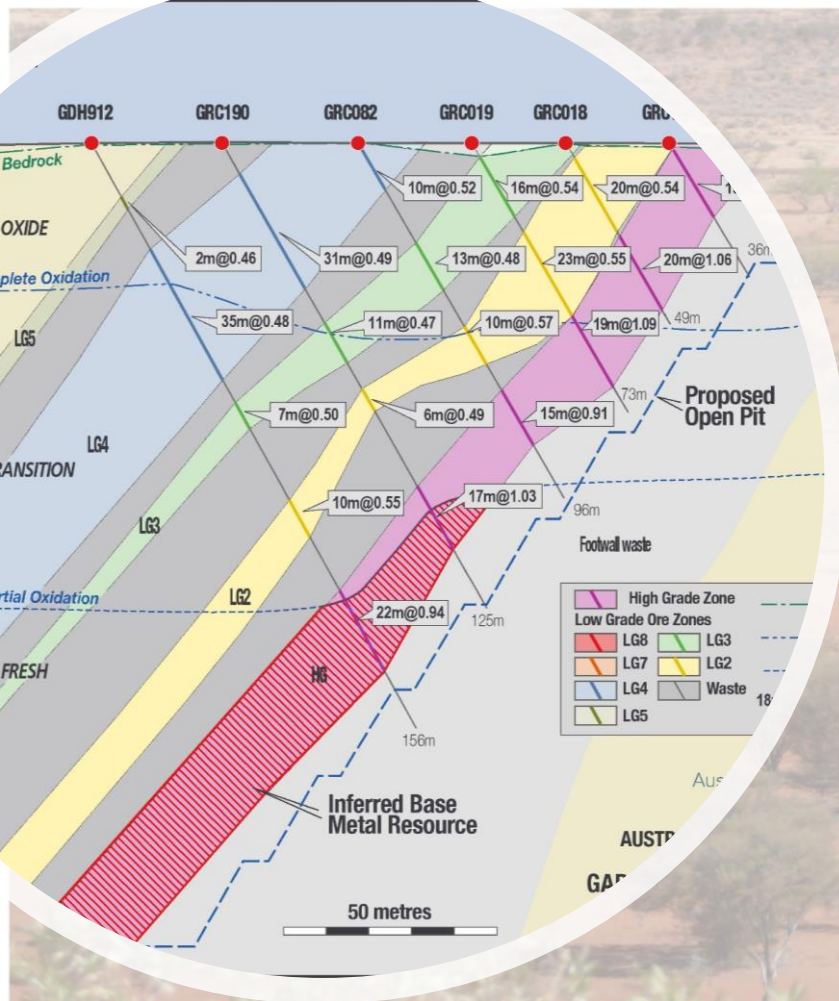


# Gabanintha Project

## Planned Infrastructure







- Consistent geology over 11km of AVL controlled strike
- Magmatic layered intrusion
- Bushveld Complex analogue
- Massive magnetite averaging 15-20m in true thickness





Australian  
VANADIUM  
LIMITED

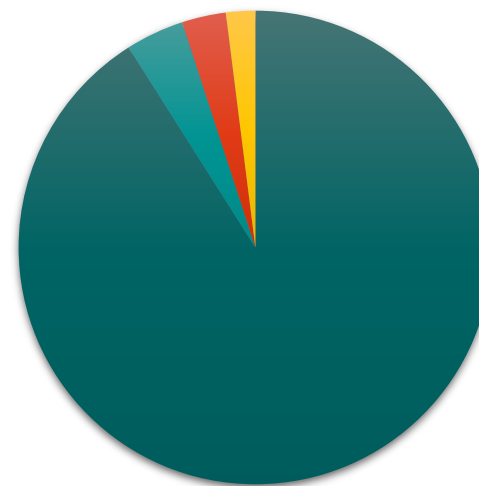
# Vanadium Markets

Steel

# Vanadium Markets - Steel

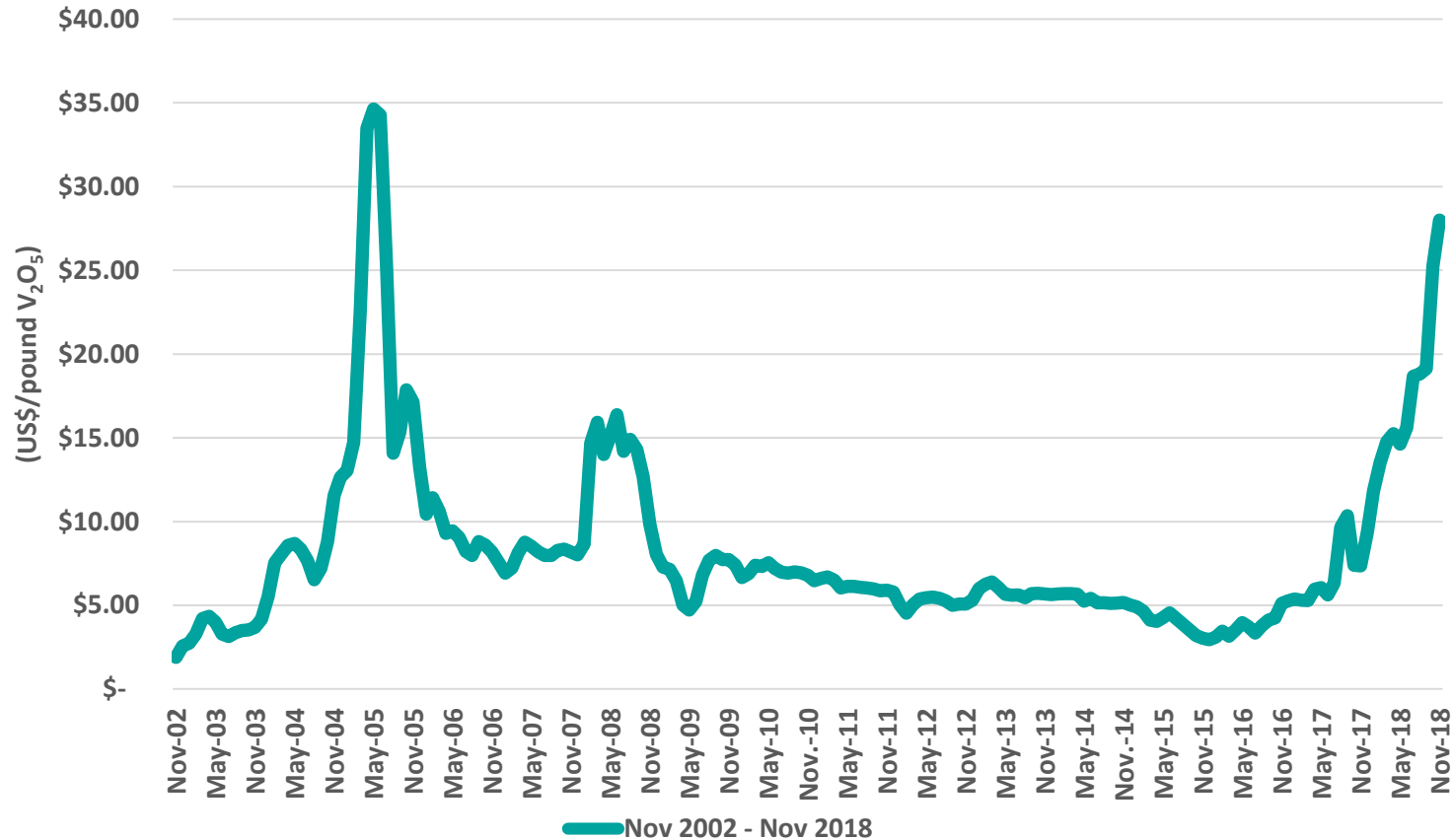
Steel remains the price driver and primary market for vanadium (92% of vanadium consumption)

- Key metric is Chinese rebar consumption
- New standards for Chinese rebar require increased vanadium use, doubling to rest-of-world standards (implemented today)
- 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



- Steel
- Titanium
- Chemicals
- Energy Storage

## Metal Bulletin V<sub>2</sub>O<sub>5</sub> Monthly Midpoint Average Price inflated to current US\$







Australian  
VANADIUM  
LIMITED



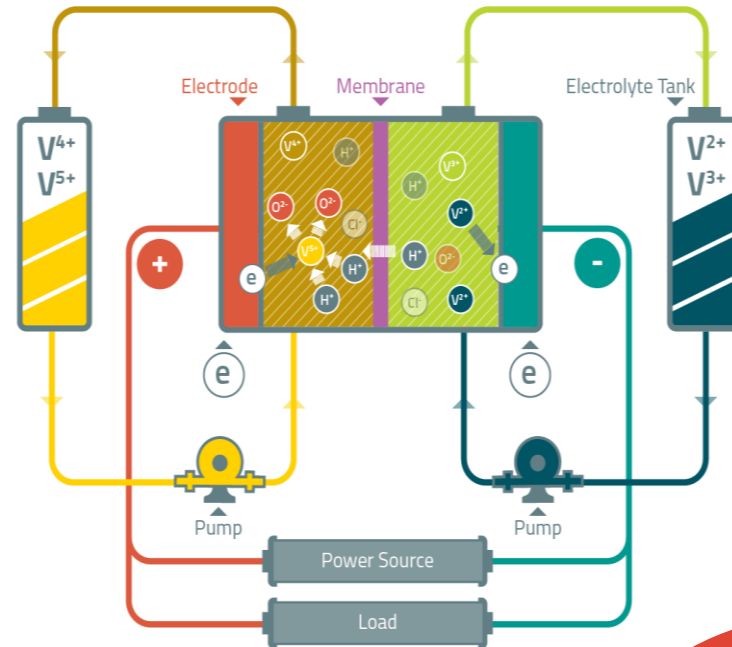
# Vanadium Markets

Energy Storage

# Vanadium Markets – Energy Storage

## Unique characteristics of Vanadium Redox Flow Batteries (VRFBs)

- 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, V2O5 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)



# VRFB Manufacturers





# 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*



## Vanadium Market Future

### Vanadium supply currently in deficit

---

- Current global producers can increase their supply to provide up to half of the supply deficit
- Increased demand from VRFB and tightened environmental controls in China mean a change from the previous cycle - new supply is required
- Deposits with high in-situ grade combined with high concentrate grade will have the best chance of success
- Utilising proven methodology on magnetite hosted vanadium deposits

# Gabanintha Investment Summary

Globally significant vanadium resource with a team of experts experienced in the extraction of vanadium using convention processing of vanadium magnetites

- 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
- High quality asset and team best able to deliver in price cycle

ASX: AVL Mkt Cap \$65.6M

AVL Share Price History







Australian  
**VANADIUM**  
LIMITED

## Contact Us

+61 (08) 9321 5594

[info@australianvanadium.com.au](mailto:info@australianvanadium.com.au)

Level 1, 85 Havelock Street

West Perth, Western Australian 6005

[australianvanadium.com.au](http://australianvanadium.com.au)

---

Australian Vanadium Limited | ASX: AVL

# Resource Table

Material	JORC Resource Class	Million Tonnes	V <sub>2</sub> O <sub>5</sub> %	Fe%	TiO <sub>2</sub> %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	LOI%
High Grade	Measured	10.1	1.1	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
	<b>Sub Total High Grade</b>	<b>93.6</b>	<b>1.00</b>	<b>42.50</b>	<b>11.4</b>	<b>11.30</b>	<b>7.6</b>	<b>3.50</b>
Low Grade	Indicated	19.1	0.5	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
	<b>Sub Total Low Grade</b>	<b>77.5</b>	<b>0.50</b>	<b>25.10</b>	<b>6.8</b>	<b>27.50</b>	<b>16.9</b>	<b>7.70</b>
Transported	Inferred	4.3	0.7	28.1	7.2	24.7	16.7	8.5
	<b>Sub Total Transported</b>	<b>4.3</b>	<b>0.65</b>	<b>28.10</b>	<b>7.2</b>	<b>24.70</b>	<b>16.7</b>	<b>8.50</b>
Total	Measured	10.1	1.1	42.7	12.6	10.3	8.0	4.0
	Indicated	24.0	0.63	27.9	8.0	24.2	16.0	7.7
	Inferred	141.4	0.77	35.0	9.2	18.5	11.5	5.2
	<b>Total</b>	<b>175.5</b>	<b>0.77</b>	<b>34.5</b>	<b>9.3</b>	<b>18.8</b>	<b>11.9</b>	<b>5.5</b>

**Note:** Mineral Resource estimate by domain and resource classification using a nominal 0.4% V<sub>2</sub>O<sub>5</sub> wireframed cutoff for low grade and nominal 0.7% V<sub>2</sub>O<sub>5</sub> wireframed cut-off for high grade (total numbers may not add up due to rounding)

## Comment

It is common practice for a company to comment on and discuss its exploration in terms of target size and type. In addition surface sampling assays and drill sample results may also be discussed in the context of information describing the presence of anomalous metal content. The information relating to an Exploration Target should not be misunderstood or misconstrued as an estimate of Mineral Resources or Mineral Reserves. Hence the terms Resource (s) or Reserve(s) have not been used in this context. The potential quantity and grade is conceptual in nature, since there has been insufficient exploration to define a Mineral Resource. It is uncertain if further exploration will result in the determination of a Mineral Resource.

## Competent Person Statement — Mineral Resource Estimation

The information in this report that relates to Mineral Resources is based on and fairly represents information compiled by Mr Lauritz Barnes, (Consultant with Trepanier Pty Ltd) and Mr Brian Davis (Consultant with Geologica Pty Ltd). Mr Davis is a shareholder of Australian Vanadium Limited. Mr Barnes is a member of the Australasian Institute of Mining and Metallurgy and Mr Davis is a member of the Australian Institute of Geoscientists and have sufficient experience of relevance to the styles of mineralisation and types of deposits under consideration, and to the activities undertaken to qualify as Competent Persons as defined in the 2012 Edition of the Joint Ore Reserves Committee (JORC) Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Specifically, Mr Barnes is the Competent Person for the estimation and Mr Davis is the Competent Person for the database, geological model and site visits.

Mr Barnes and Mr Davis consent to the inclusion in this report of the matters based on their information in the form and context in which they appear.

# Production Information

NPV and IRR are reported at various  $V_2O_5$  pricing assumptions

Price US\$/lb $V_2O_5$	Year 1-5	\$8/lb	\$13/lb	\$13/lb	\$20/lb
	Year 6-17	\$8/lb	\$8/lb	\$13/lb	\$20/lb
NPV <sub>8%</sub>	US\$M	191	575	1099	2370
IRR	%	0.145	0.336	0.395	0.698
Opex	US\$/lb	4.28	4.28	4.28	4.28
Opex ( $V_2O_5$ Equiv) <sup>1</sup>	US\$/lb	4.13	4.13	4.13	4.13
UDCF	US\$M	705	1193	2386	4739

- A vanadium pentoxide ( $V_2O_5$ ) refinery at the Gabanintha site with an annual production rate of approximately 22.5 million pounds of  $V_2O_5$  per annum (10,100tpa) with an initial mine life of 17 years based on existing Measured, Indicated and a portion of the Inferred Mineral Resources.
- Open pit mining and beneficiation operation producing an estimated 900,000t of magnetic concentrate at planned grade of 1.39%  $V_2O_5$  and a low 1.5%  $SiO_2$  content.
- Average mass yield from the concentrator is estimated at 62.1% for the life of mine. This is exceptionally high versus other current operating vanadium operations, allowing for a compact and effective crushing and milling operation.
- A base metals circuit will extract an estimated 1500 tpa sulphide concentrate containing Cobalt, Nickel, and Copper. The project viability is not dependant on the mining and sale of base metals contained in the schedule.
- Base metal sales account for less than 2% of estimated overall gross revenues for the life of the project.
- Operating expenses are currently estimated at US\$4.13/lb  $V_2O_5$  equivalent ( $\pm 35\%$ ), assuring a low-cost operation that will be healthy throughout the vanadium business cycles.
- Initial indicative capital costs of US\$362M ( $\pm 35\%$ ).
- The current project scenario utilises 43% Measured resources, 20% Indicated resources, and 37% Inferred resources. The inferred resources are not a determining factor for project viability. See table 4, figure 4, table 5, and table 6 below.
- Bryah Resources Limited holds the rights to nickel, copper and gold recovered from any production, however AVL will benefit from this development in processing due to its 14% holding in Bryah (ASX: BYH).
- $V_2O_5$  equivalent pricing is determined by subtracting average base metal credits from average operating expenses through the life of mine.