



Australian  
VANADIUM  
LIMITED

# Australian Vanadium Limited

Corporate Presentation

July 2019 | 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.

## **Competent Person References**

**Competent Person Statement – Mineral Resource Estimation** The information in this presentation 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 and Mr Davis are members 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 presentation of the matters based on their information in the form and context in which they appear.

**Competent Person Statement – Ore Reserves** The scientific and technical information in this presentation that relates to Ore Reserve estimates for the Project is based on information compiled by Mr Roselt Croeser, an independent consultant to AVL. Mr Croeser is a member of the Australasian Institute of Mining and Metallurgy. Mr Croeser has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being 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 Croeser consents to the inclusion in the presentation of the matters related to the ore reserve estimate in the form and context in which it appears.

**Competent Person Statement – Metallurgical Results** The information in this presentation 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. Mr 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 presentation 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 announcement entitled “Gabanintha Pre-Feasibility Study and Maiden Ore Reserve” released to ASX on 19 December 2018 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 Resources 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 Company's 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.

# Executive Summary



The Australian Vanadium Project is a high-grade Vanadium Titanium Magnetite (VTM) deposit located in the Murchison Province approximately 43kms south of the mining town Meekatharra in Western Australia. It is one of the highest-grade vanadium projects currently being developed in the world.

## *Factors Differentiating AVL and The Australian Vanadium Project*

Bushveld-type VTM deposit with high-grade Resources and Reserves amenable to conventional processing.

A completed PFS showing strong fundamentals through all price cycles. Large scale pilot testing and DFS underway.

High-grade Resource with 96.7Mt at 1%  $V_2O_5$  and Reserve of 18Mt at 1.05%  $V_2O_5$ .

Expert team with extensive vanadium and corporate experience.

PFS opex of US\$4.15/lb  $V_2O_5$  with potential to be the world's lowest cost vanadium producer.

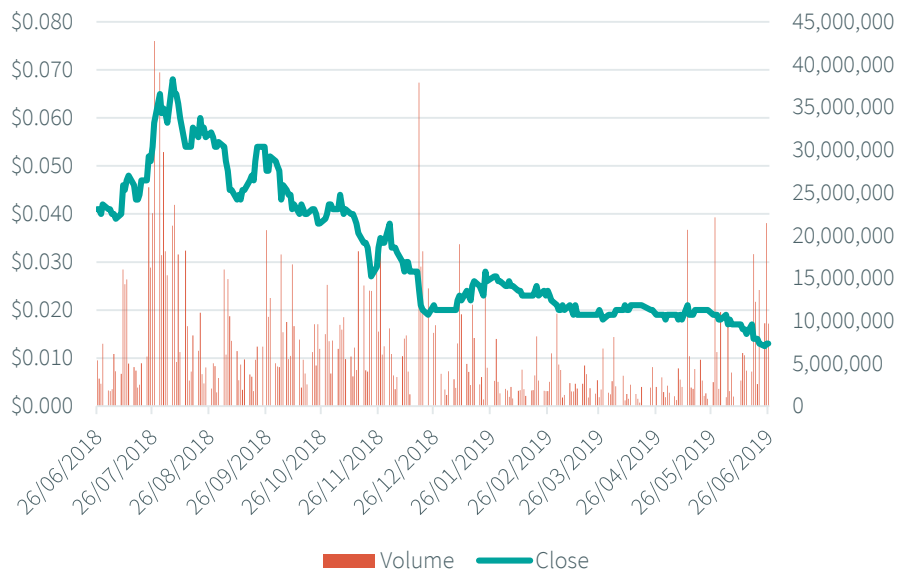
High-purity (99.4%)  $V_2O_5$  flake and powder product – for steel, chemical and battery markets.

Initial mine life of 17+ years, with 74.5Mt at 0.97% of inferred Resources available to extend project.

# Corporate Snapshot



## AVL Share Price History



## Key Statistics (26/06/19)

Ordinary shares on issue	1.97b
Share price	A\$0.013
Market cap (undiluted)	A\$26m
Cash	~A\$4.4m
Shareholders	6,667
Enterprise value	A\$22m

## AVL's Top Shareholders

J P Morgan Nominees Australia Pty Ltd	3.50%
HSBC Custody Nominees (Australia) Ltd	2.19%
Citicorp Nominees Pty Ltd	2.19%
Mr Peter James Muir	1.46%

# AVL's Team of Experts



**Vincent Algar**  
*Managing Director*

Geologist with over 25 years' experience in the mining industry spanning underground and open cut mining operations, greenfields exploration, project development and mining services. Significant experience in the management of publicly listed companies.



**Daniel Harris**  
*Technical Director*

Over 40 years of global vanadium experience including processing and operation. Recent roles include interim CEO and Managing Director at Atlas Iron; Chief Executive & Operating Officer at Atlantic; Vice President & Head of Vanadium Assets at Evraz Group; and Managing Director at Vametco Alloys.



**Todd Richardson**  
*Chief Operating Officer*

Over 20 years' experience in the vanadium sector and an expert in vanadium process design, commissioning and operations. Extensive background in operations, management and technical services both in the USA and Australia, in all phases of plant operation.

# Vanadium Market Overview



## Vanadium Production and Consumption

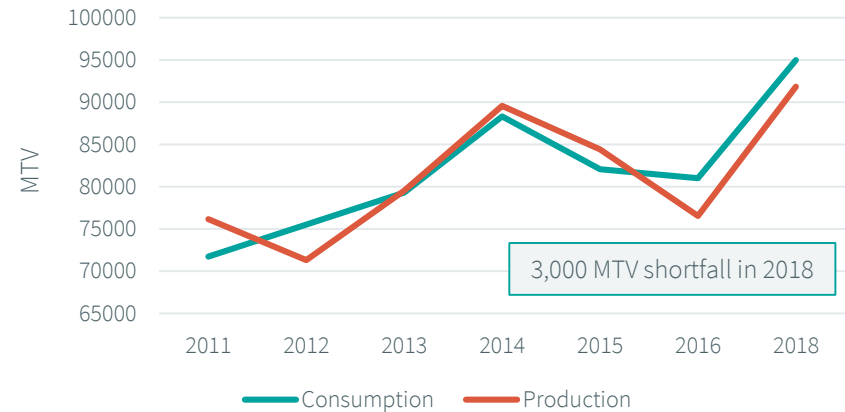
**90%** of vanadium consumption occurs in the steel industry

**4%** of vanadium consumption occurs in the titanium industry

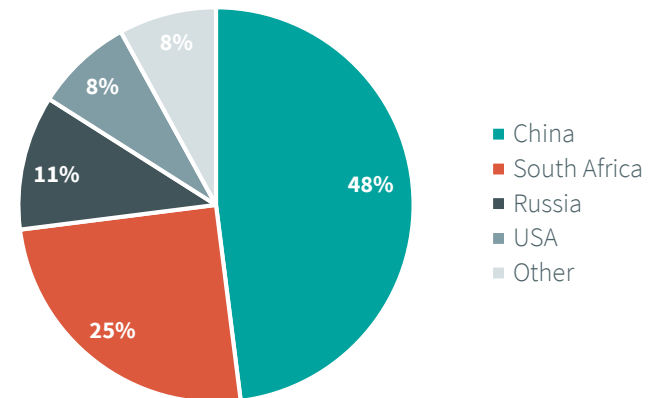
**4%** of vanadium consumption occurs in the chemical and catalyst industries

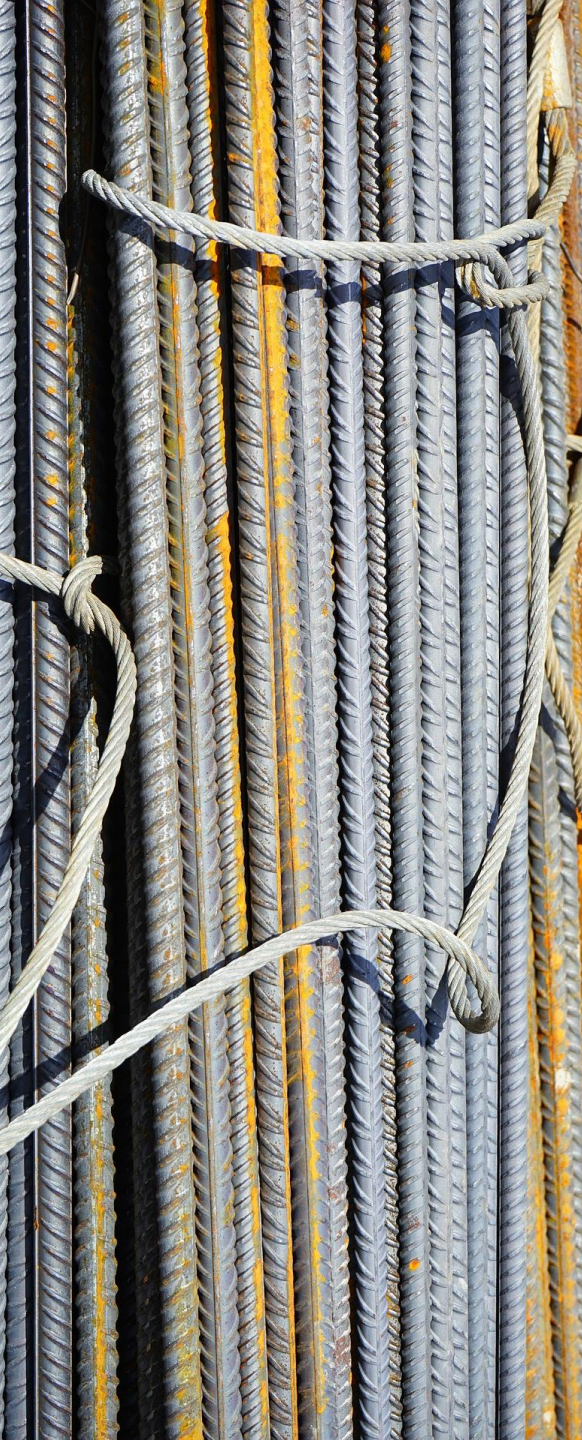
**2%** of vanadium consumption occurs in energy storage applications

**Global Vanadium Production vs Consumption**



**Vanadium Production by Country**





# Steel Market

## *Primary Market for Vanadium*

- Steel remains vanadium's primary market and price driver
- Chinese rebar consumption a key metric
  - New standards require increased vanadium use in grade 3 and above
- Unique microalloy effects reduce the risk of substitution
- Current deficit in supply is projected to remain
- New applications of vanadium in steel further increase demand
  - Automotive, aviation and aerospace; powerlines and power pylons; high-strength structures

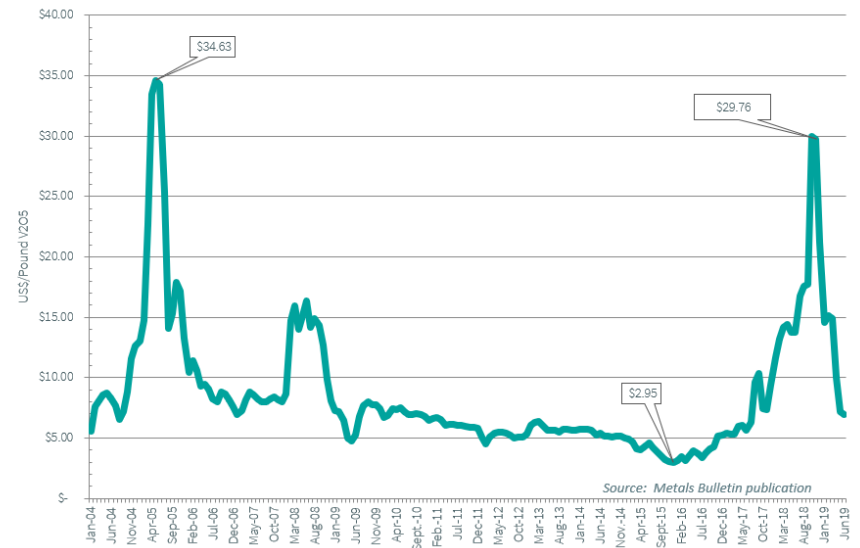
# Steel Market

## Primary Market for Vanadium

- Historically, vanadium has experienced long periods of low prices, followed by periods of high prices
- Lowest quartile producers best positioned to survive downturns and benefit from high-price periods
- Only 3 primary vanadium mines operating outside China, accounting for 14% of global vanadium production
- Recent drop in price due to niobium substitution and delayed implementation of new microalloy standards in China
- Overall reduction in steel market growth
- Price stabilising at market supply/demand balance

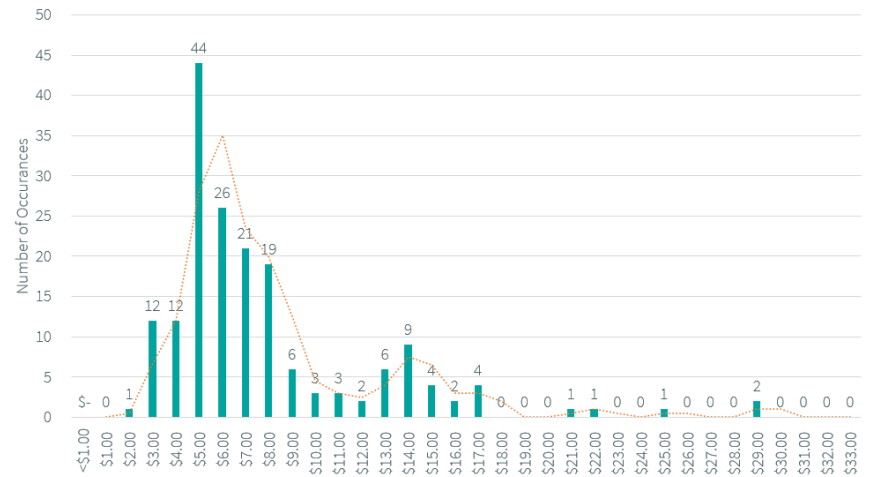
**Metal Bulletin V<sub>2</sub>O<sub>5</sub> Monthly Midpoint Average Price**

Inflated to November 2017 US\$



**V<sub>2</sub>O<sub>5</sub> Distribution Chart  
Jan 2004 - Jun 2019**

Inflated to Nov 2017 US\$





# Energy Storage Market

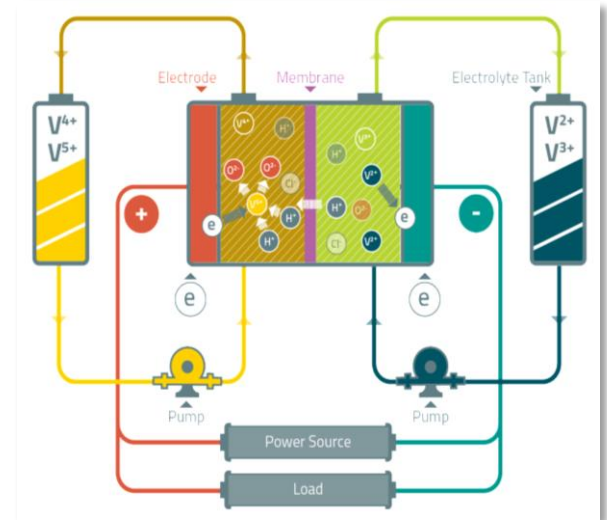
## Emerging Market for Vanadium

### What is a VRFB?

- A redox flow battery is made up of two tanks filled with electrolyte fluid – the electrolyte acts as cathode and anode and tank size determines battery capacity
- In a *vanadium* redox flow battery (VRFB), the fluid used is vanadium electrolyte
- VRFBs are easy to scale, non-flammable, suitable for grid and off-grid use, can discharge 100% without damage, and the vanadium electrolyte can be reused indefinitely

### The VRFB Market

- Rising prices have led to innovations and new entrants
  - Advancements utilising welded stack technology; leasing of electrolyte; changing power-to-energy ratio to compete with lithium; VRFBs providing dispatchable energy at solar farms; government incentive programs
- VSUN Energy, AVL's 100% owned subsidiary, is focused on growing the VRFB market



# Energy Storage Market

## Emerging Large Consumption Markets for Vanadium in Energy Storage

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

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

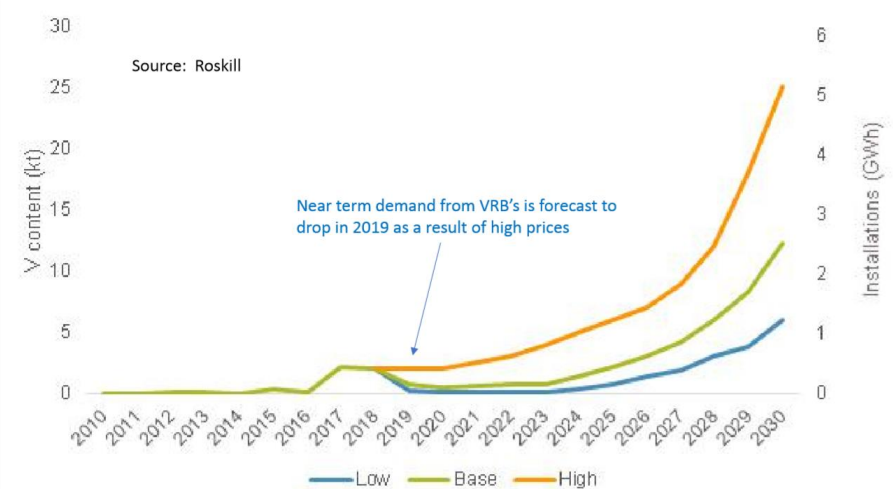
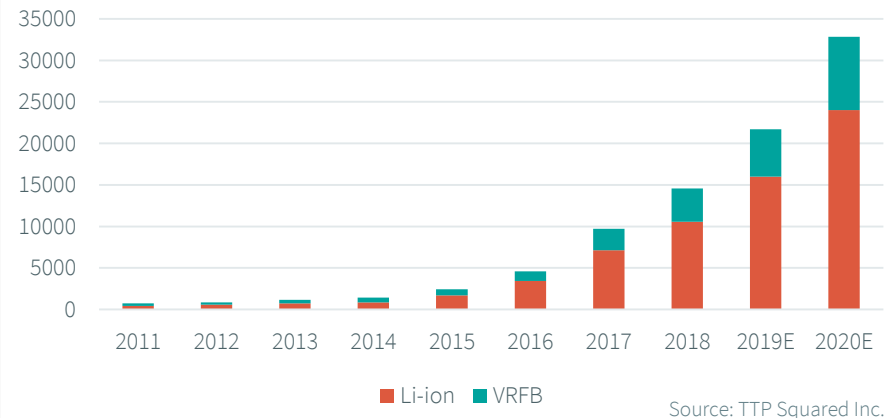
**11GWh** Projected global stationary energy storage needed per year

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

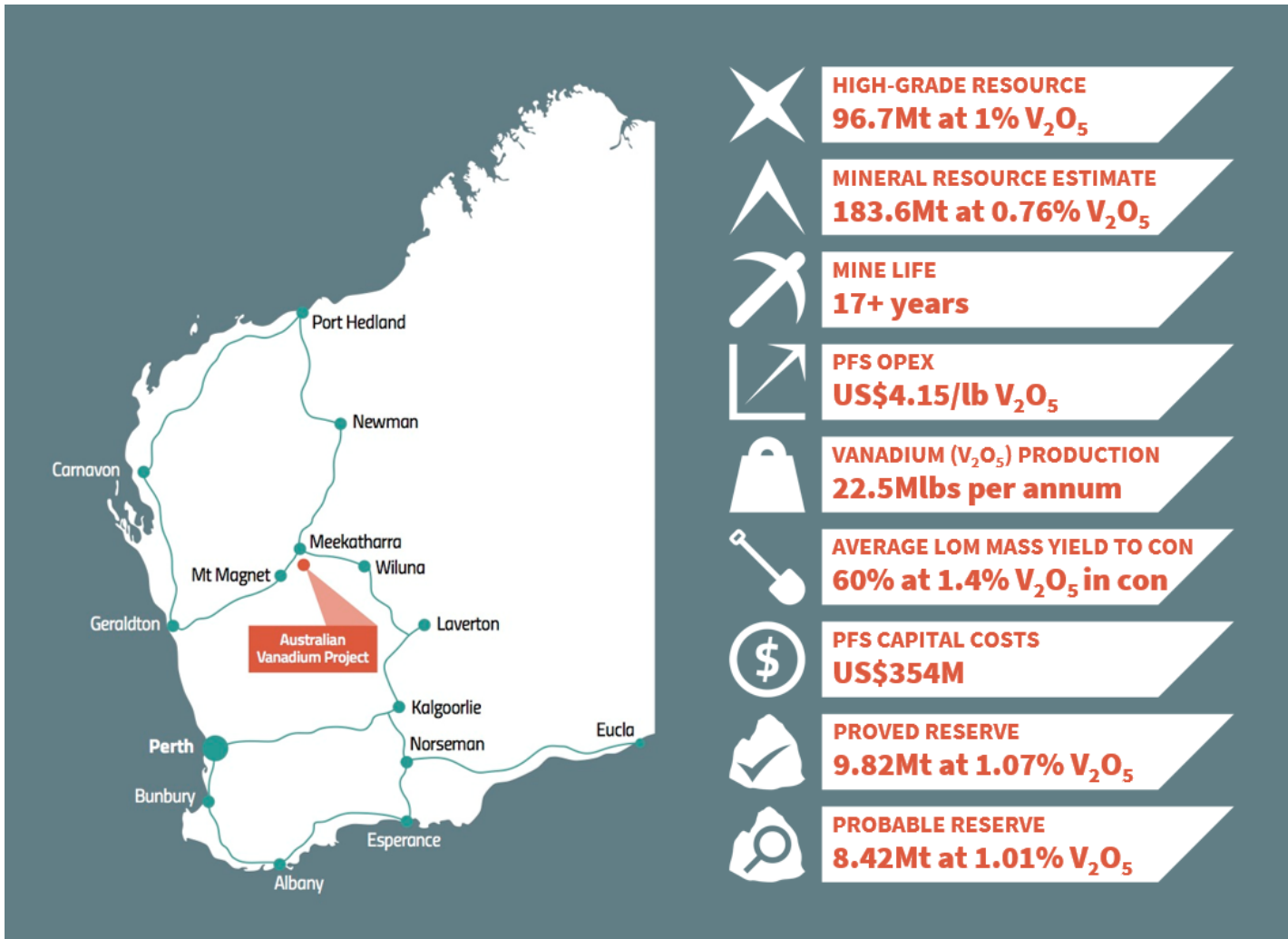
**10kt**  $V_2O_5$  needed to supply VRFB demand per year

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

### Vanadium Consumption in Energy Storage (Li-ion and VRFB)



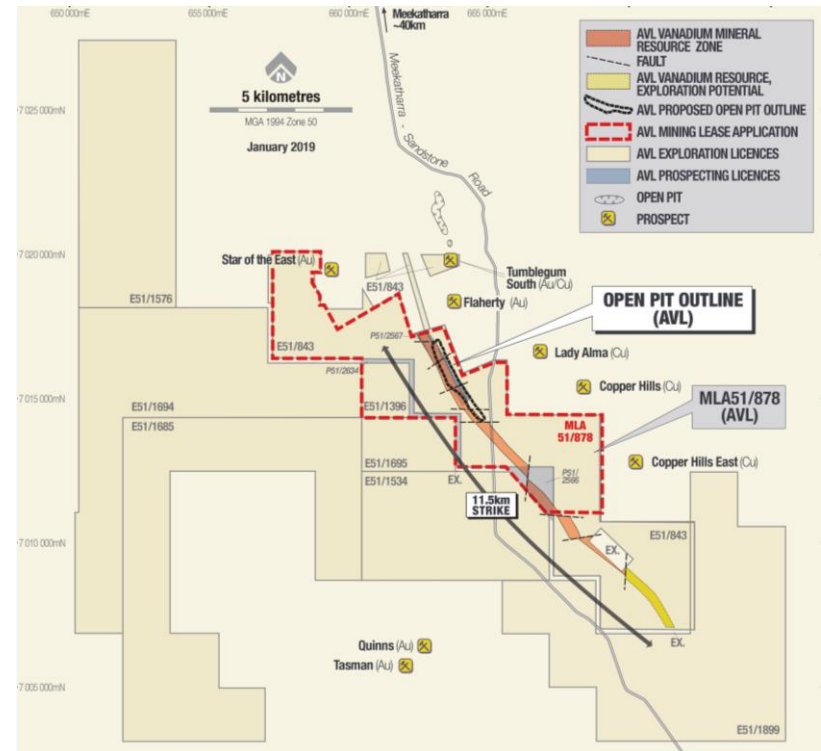
# The Australian Vanadium Project



# Project Location

Project in active mining region, close to road, rail, port and natural gas

WA ranked 2<sup>nd</sup> best mining investment location globally



11.5km of known mineralisation under 100% AVL control

18Mt at 1.04%  $V_2O_5$  in Reserve, 74.5Mt at 0.97%  $V_2O_5$  Inferred Resource to extend project

# Resource Table

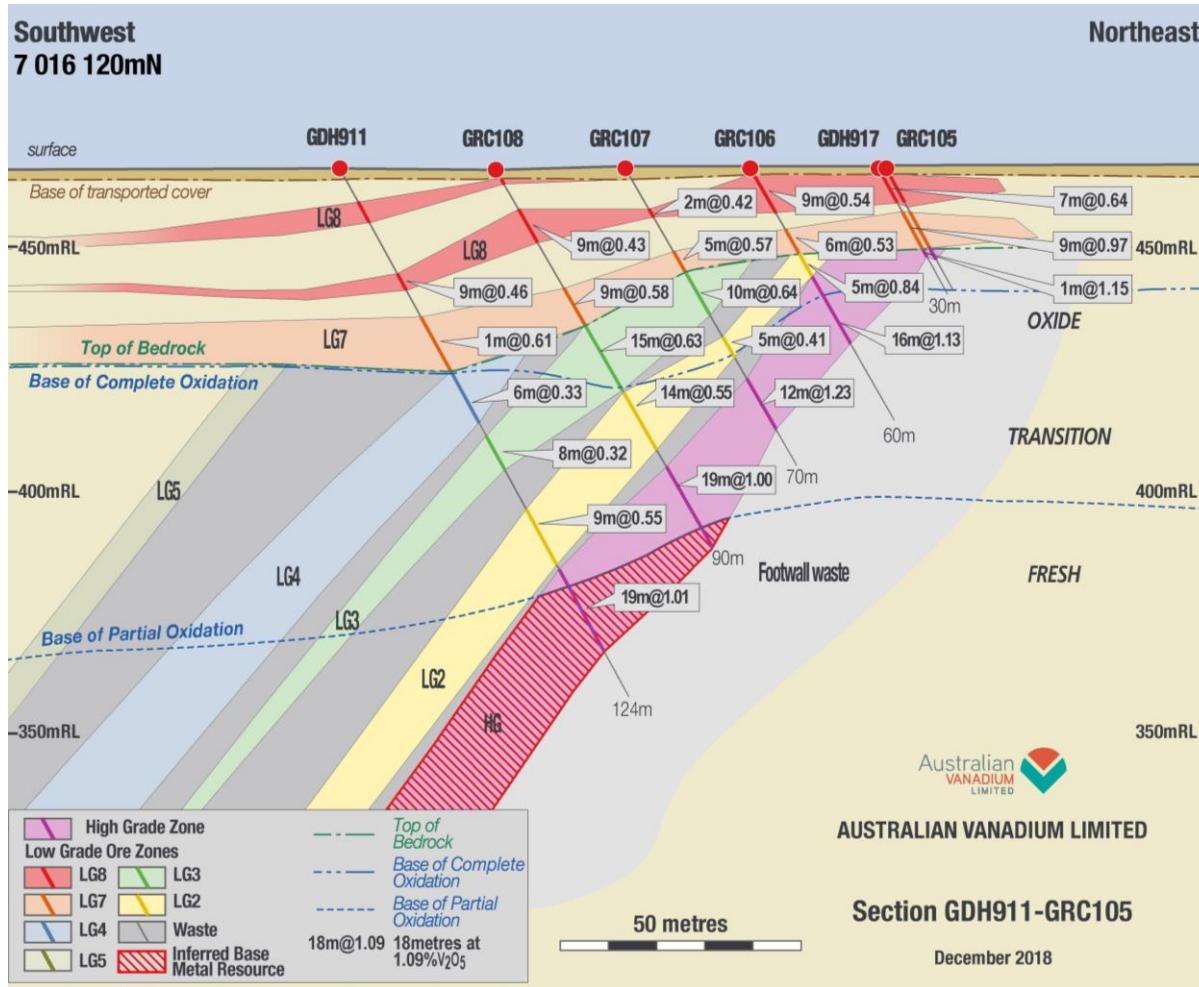
Material	JORC Resource Class	Million Tonnes	V <sub>2</sub> O <sub>5</sub> %	Fe%	TiO <sub>2</sub> %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	LOI%
High Grade	Measured	10.2	1.11	42.7	12.6	10.2	8.0	3.9
	Indicated	12.1	1.05	43.8	11.9	10.6	7.6	3.5
	Inferred	74.5	0.97	42.1	11.2	11.6	7.6	3.4
	<b>Subtotal – High Grade</b>	<b>96.7</b>	<b>1.00</b>	<b>42.4</b>	<b>11.4</b>	<b>11.3</b>	<b>7.7</b>	<b>3.5</b>
Low Grade	Indicated	28.6	0.5	24.6	6.9	27.5	17.9	8.6
	Inferred	53.9	0.49	25.3	6.7	27.5	16.4	7.3
	<b>Subtotal – Low Grade</b>	<b>82.5</b>	<b>0.49</b>	<b>25.1</b>	<b>6.8</b>	<b>27.5</b>	<b>16.9</b>	<b>7.7</b>
Transported	Inferred	4.4	0.65	28.2	7.2	24.7	16.7	8.5
	<b>Subtotal – Transported</b>	<b>4.4</b>	<b>0.65</b>	<b>28.2</b>	<b>7.2</b>	<b>24.7</b>	<b>16.7</b>	<b>8.5</b>
TOTAL	<b>Measured</b>	<b>10.2</b>	<b>1.11</b>	<b>42.7</b>	<b>12.6</b>	<b>10.2</b>	<b>8.0</b>	<b>3.9</b>
	<b>Indicated</b>	<b>40.7</b>	<b>0.66</b>	<b>30.3</b>	<b>8.3</b>	<b>22.5</b>	<b>14.8</b>	<b>7.1</b>
	<b>Inferred</b>	<b>132.7</b>	<b>0.77</b>	<b>34.8</b>	<b>9.2</b>	<b>18.5</b>	<b>11.5</b>	<b>5.1</b>
	<b>TOTAL</b>	<b>183.6</b>	<b>0.76</b>	<b>34.3</b>	<b>9.2</b>	<b>18.9</b>	<b>12.1</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 cut-off 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).

# Ore Reserve

Reserve classification	t	V <sub>2</sub> O <sub>5</sub> %	Co ppm	Ni ppm	Cu ppm	S %	SiO <sub>2</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	V <sub>2</sub> O <sub>5</sub> produced t
Proved	9,820,000	1.07	172	571	230	0.06	9.47	58.7	65,000
Probable	8,420,000	1.01	175	628	212	0.08	10.07	59.5	56,000
<b>Total</b>	<b>18,240,000</b>	<b>1.04</b>	<b>173</b>	<b>597</b>	<b>222</b>	<b>0.07</b>	<b>9.75</b>	<b>59.1</b>	<b>121,000</b>

# Project Geology



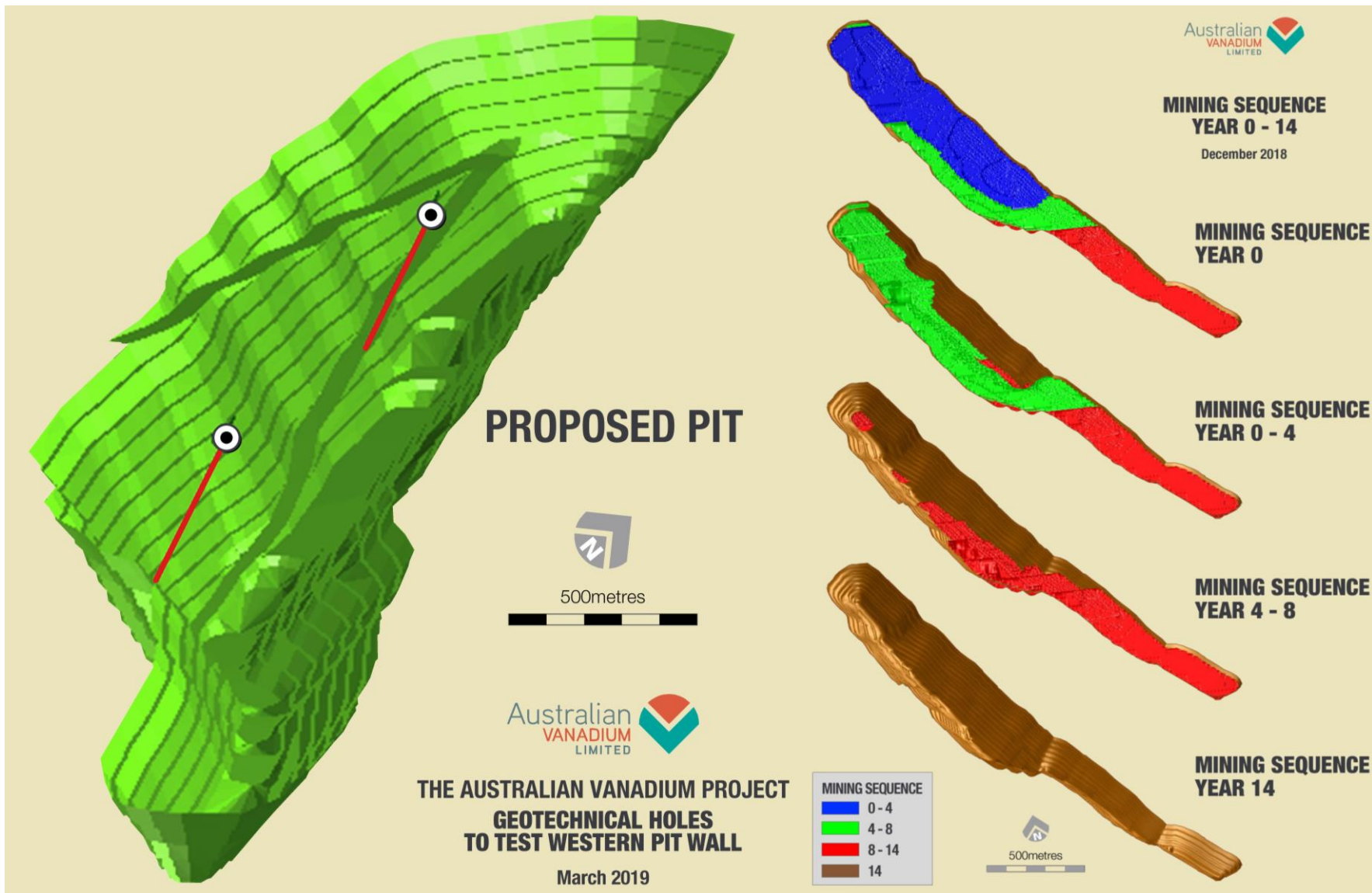
Bushveld-type VTM deposit

Drilled over 11.5km of AVL controlled strike

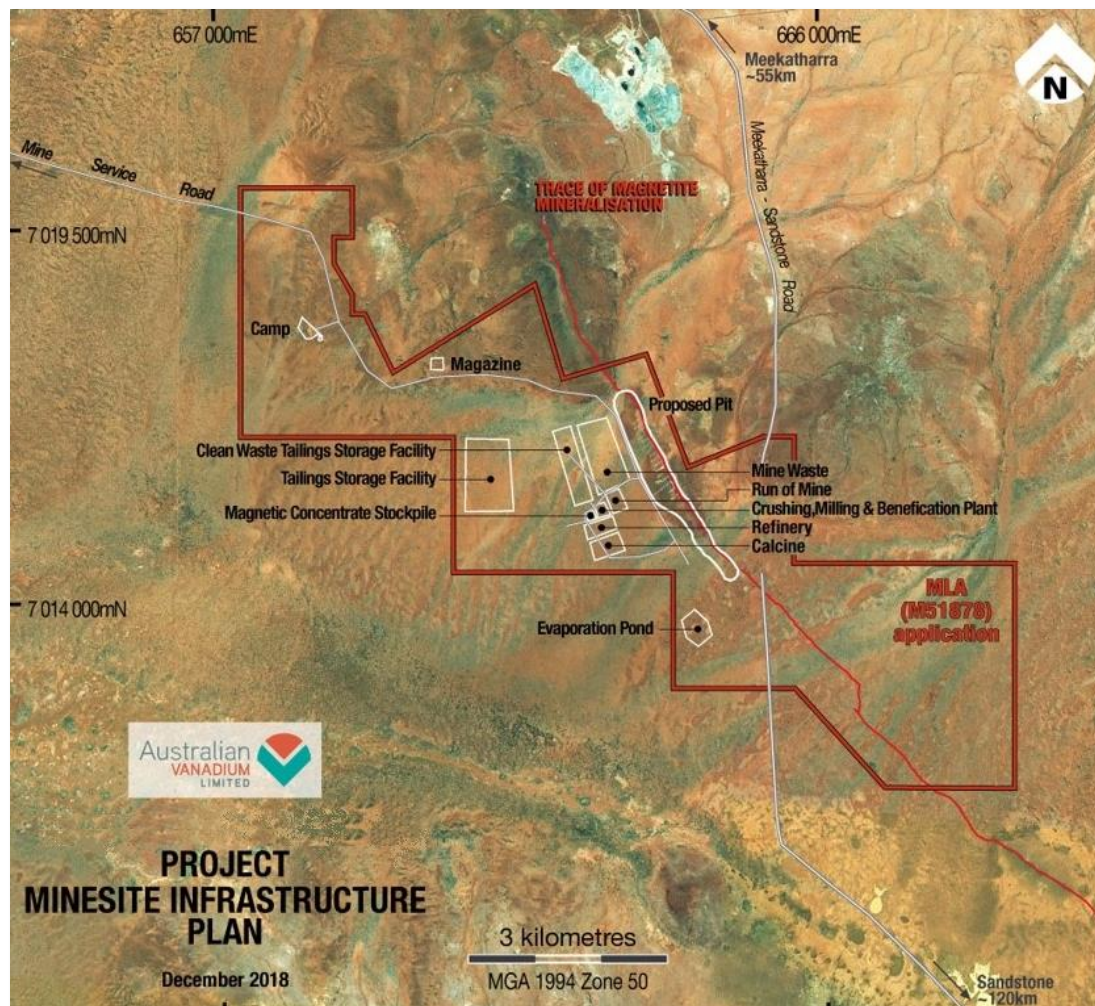
Significant ground position for project development

Highly consistent geology over strike

Massive magnetite, averaging 15-20m in true thickness

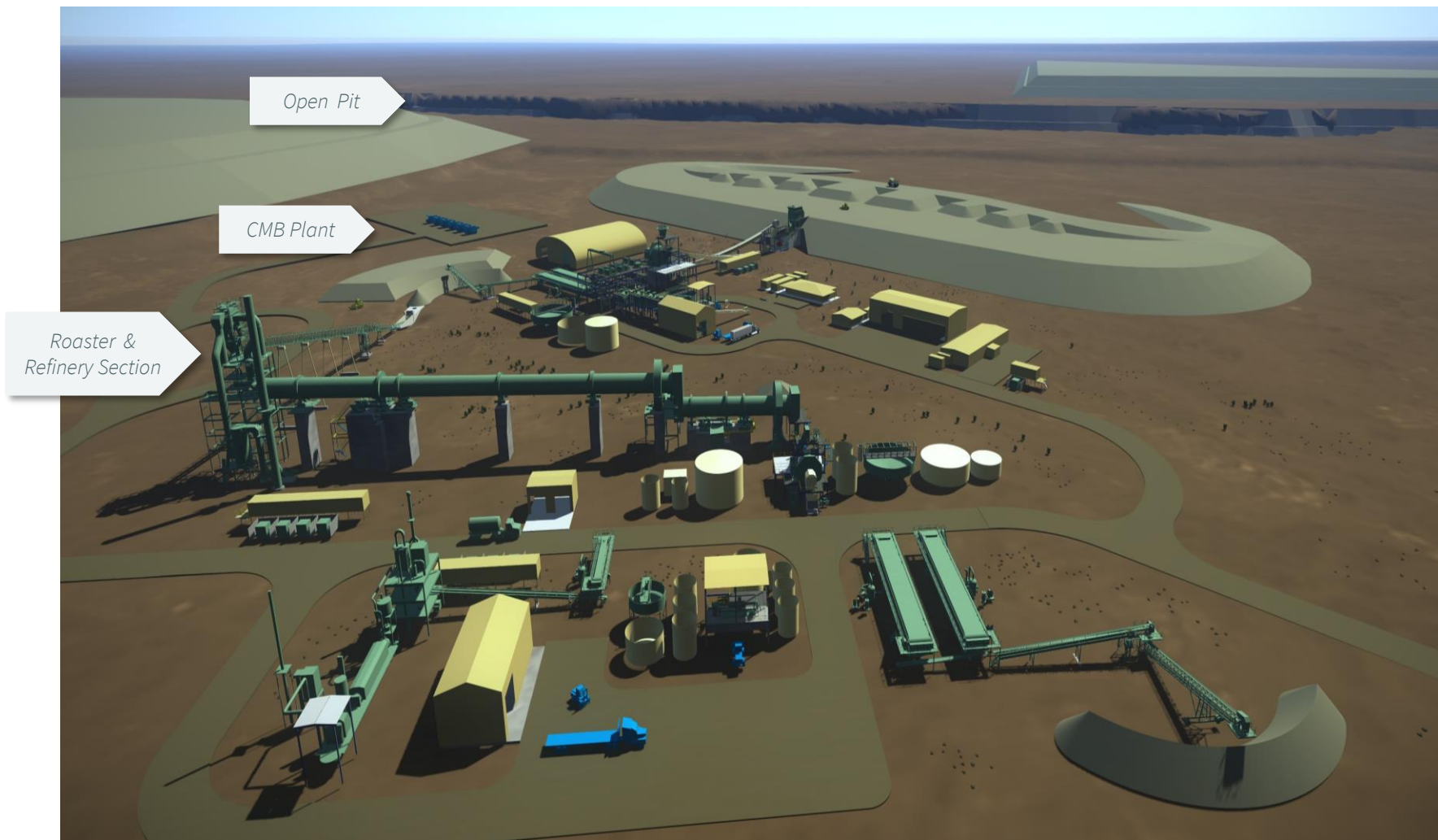


# Planned Infrastructure





# Model of Proposed Plant



# PFS Financial Model

## *V<sub>2</sub>O<sub>5</sub> Product Pricing Scenarios*

<b>Year 1–5</b>	\$8.67/lb V <sub>2</sub> O <sub>5</sub>	\$13/lb V <sub>2</sub> O <sub>5</sub>	\$13/lb V <sub>2</sub> O <sub>5</sub>
<b>Year 6–17</b>	\$8.67/lb V <sub>2</sub> O <sub>5</sub>	\$8.67/lb V <sub>2</sub> O <sub>5</sub>	\$13/lb V <sub>2</sub> O <sub>5</sub>
<b>Pre-tax NPV<sub>8%</sub></b>	\$230M	\$444M	\$912M
<b>Post-tax NPV<sub>8%</sub></b>	\$125M	\$280M	\$616M
<b>IRR</b>	12.4%	19.7%	27.2%
<b>Pre-tax UDCF</b>	\$1,232M	\$1,634M	\$3,166M
<b>Post-tax UDCF</b>	\$867M	\$1,148M	\$2,221M

- Project highest sensitivity is to vanadium price and USD:AUD exchange rate
- USD:AUD in PFS uses 0.72, currently 0.69
- Post tax NPV<sub>8%</sub> in US\$8.67 price case increases from \$125M to \$160M

# Benchscale Testwork

## Key Findings

### High-Purity Product

- High-purity 99.4% Vanadium Pentoxide ( $V_2O_5$ ) produced from pre-pilot testwork
  - Expected to be AVL's standard product
  - Better value per unit of ore processed than anticipated in PFS
  - For steel, chemical and battery markets

### Extraction Rate Improvement

- Extraction rate significantly improved through roach-leach process innovation
  - Vanadium yield in refining increased by 6% to 94%
  - Better value per unit of ore processed than anticipated in PFS



AVL's Standard  $V_2O_5$  Product



AVL's Magnetic Concentrate



# Pilot Scale Testwork

*AVL's Definitive Feasibility Study is Underway*

## Pilot Scale Testing is Crucial

- Testwork at scale is a key differentiator of *successful* projects
  - At-scale testing of circuit allows potential problems to be identified and remedied before commitment to full-scale construction
  - Experience supports view that problems discovered in the full-scale project will be more expensive to fix and may cause the entire project to fail
  - AVL following bankable due-diligence level approach to project de-risking and delivery

## Testwork Progress

- Pilot scale metallurgical testing on 30 tonnes is currently underway
- Once testing has been completed, DFS engineering and Front-End Engineering Design (FEED) will commence

# Social Responsibility

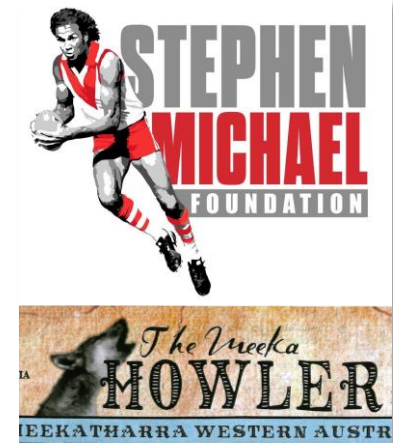
## Community Support and Environmental Protection

### Providing Benefits to the Meekatharra Community

- AVL sponsors the Stephen Michael Foundation
  - Helping to engage children in school; improving lives through sport
- Subsidiary VSUN Energy is sponsoring the *Meeka Howler* through ongoing advertising

### Carbon Footprint

- Full project analysis of emissions across the supply chain
  - Offset and emission reduction plan; cost assessment with immediate and future abatement schemes
- Potential strategies to reduce emissions
  - Use of solar plus VRFBs; non-traditional fuel sources for haulage
- Understanding lifecycle emissions in the steel industry (in conjunction with Vanitec)



# The Path Forward

## *The Australian Vanadium Project*

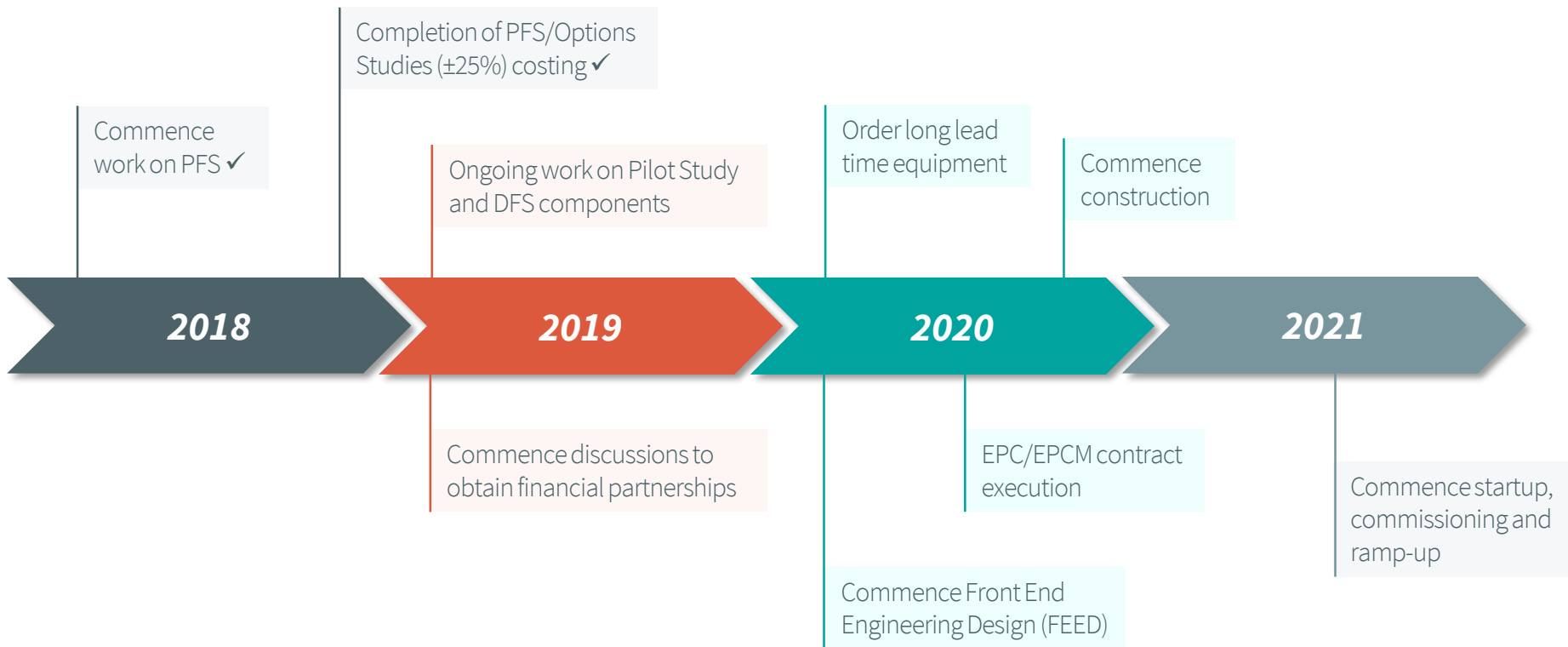


Dec 2018:	Completion of PFS, option studies, Mineral Reserve ✓
Jan 2019:	Commencement of pilot study sample collection (30t) ✓
Aug to Sept 2019:	Pilot study, environmental submission, heritage and mining licence approval
Aug to Dec 2019:	Financing – partnership selection, review, agreements and MOUs in place, NAIF loan application for key infrastructure
Dec 2019:	Definitive feasibility study completion
Apr 2020:	Detailed design engineering completion
Apr 2020:	Order long lead time equipment
Jun 2020:	EPC/EPCM contract execution
2020/2021:	Construction, startup, commissioning and ramp-up



# The Path Forward

## *The Australian Vanadium Project*



# Permitting

## *Finalised*

Water impact assessment ✓

Flora and fauna field assessments ✓

Heritage access agreements ✓

Stygofauna/troglofauna sampling ✓

Mining licence application ✓

## *In Progress*

Mining agreement and licence grant

Environmental approval application

Major project status (Federal and State)



# Project Summary



## Completed

- Exploration success – large high quality VTM resource defined
- Resources and Reserves for initial 17 year mine with significant extension potential
- Completed PFS showing strong fundamentals through all vanadium price cycles
- Heritage agreements
- Pilot study sample collection (30t)
- First MOU with Win-Win regarding project finance and offtake of vanadium oxides to China
- MOU with neighbour Westgold Resources for life-of-mine water requirements

## Ongoing

- Large scale pilot testing and DFS underway
- Environmental impact studies and heritage review
- Mining agreement
- Mining licence approval
- Financing – partnership agreements and MOUs
- Offtake agreements
- NAIF key infrastructure funding application
- Optimisation of capex and opex of base case through option study reviews

## Planned

- DFS completion
- Key funding partner selection and financial close
- Detailed design engineering completion
- Order long lead time equipment
- EPC/EPCM contract execution
- Construction, startup, commissioning and ramp-up



# Contact Us

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