



# Australian Vanadium Limited

*Corporate Presentation*

November 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.

# Project Overview



Awarded Major Project Status  
in September 2019

Bushveld-type VTM deposit  
amenable to conventional  
processing

Completed PFS with strong  
fundamentals through all  
price cycles

High-grade Resource of  
96.7Mt at 1% V<sub>2</sub>O<sub>5</sub> Reserve of  
18Mt at 1.05% V<sub>2</sub>O<sub>5</sub>

Expert team with extensive  
vanadium & corporate  
experience

PFS opex of US\$4.15/lb V<sub>2</sub>O<sub>5</sub>  
with potential to be the  
world's lowest cost  
vanadium producer

High-purity (99.4%) V<sub>2</sub>O<sub>5</sub>  
flake and powder product –  
for steel, chemical & battery  
markets

22.5Mlbs (10,100t) V<sub>2</sub>O<sub>5</sub>  
production per annum –  
equal to 6.8% current global  
production

Initial mine life 17+ years,  
with 65.9Mt at 0.97% of  
Inferred Resources for  
extension

Processing Plant Relocation  
study underway – potential  
reduced capex and gas price

# Corporate Snapshot



## Key Statistics (30/09/19)

Ordinary shares on issue	2.55b
Share price	A\$0.012
Average Daily Traded Volume	5,418,291
Market cap (undiluted)	A\$28m
Cash	~A\$8.1m
Shareholders	6,770
Enterprise value	A\$19.9m

## AVL's Top Shareholders

J P Morgan Nominees Australia Pty Ltd	2.94%
HSBC Custody Nominees (Australia) Ltd	2.50%
Southland Snipe Superannuation Fund	2.41%
Citicorp Nominees Pty Ltd	2.30%

# Experienced Team



## **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.



# The Australian Vanadium Project – Developments

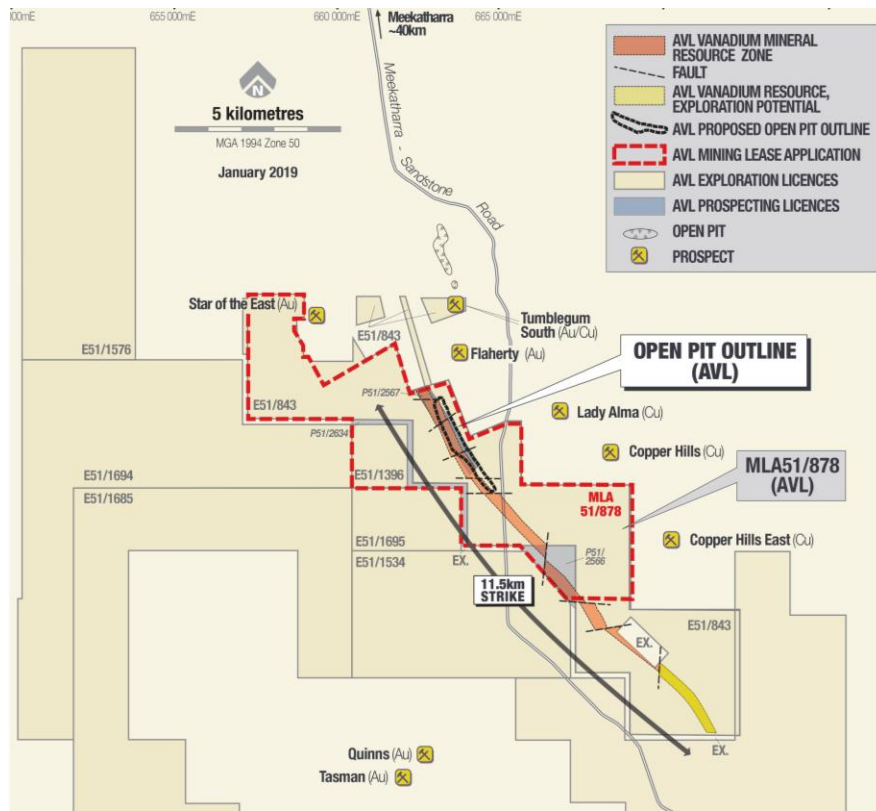
## Recent Announcements 2019

---

29 Oct	Geraldton Processing Plant Land Option Agreement
25 Oct	Drilling Program Completed
24 Sept	R&D Refund
23 Sept	Successful SPP and Placement
9 Sept	Calcine By-Product
6 Sept	Major Project Status
30 Aug	Metso Selected for Pilot Roast Work
9 Aug	Pilot Study Update
18 Jul	Drilling Results Support DFS
25 Jun	Key Project Water Supply Opportunity
28 May	Benchscale Testwork Results (99.4% V <sub>2</sub> O <sub>5</sub> )



# Project Location



- WA Ranked 2<sup>nd</sup> best mining investment location globally.
- Located in an active mining region – close to road, rail, port, natural gas.
- 11.5km of known mineralisation under 100% AVL control.
- 18Mt at 1.04% V<sub>2</sub>O<sub>5</sub> in Reserve, 55.3Mt at 0.97% V<sub>2</sub>O<sub>5</sub> Inferred Resource available to extend life.

# Resource Table & Ore Reserve

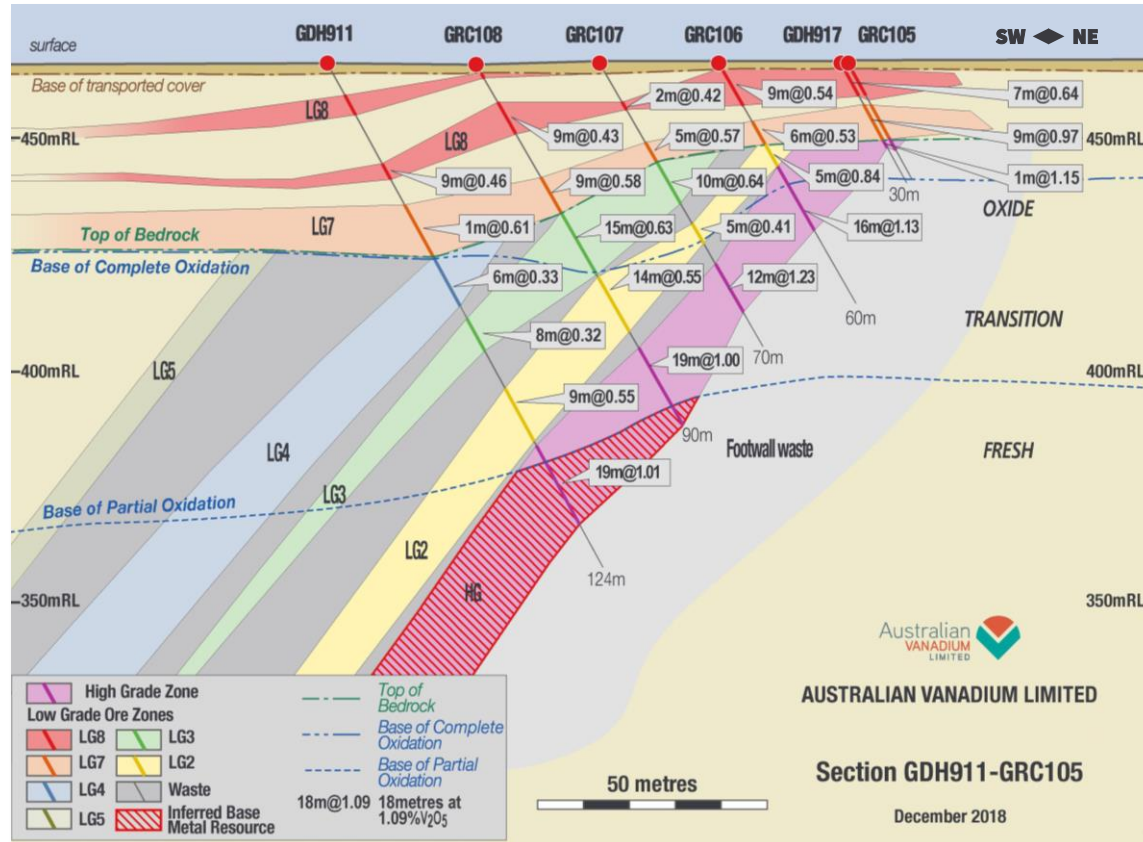
Material	JORC Resource Class	Million Tonnes	V <sub>2</sub> O <sub>5</sub> %	Fe%	TiO <sub>2</sub> %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	LOI%
High Grade	Measured	10.2	1.11	42.7	12.6	10.2	8.0	3.9
	Indicated	12.1	1.05	43.8	11.9	10.6	7.6	3.5
	Inferred	74.5	0.97	42.1	11.2	11.6	7.6	3.4
	<b>Subtotal – 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).

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>



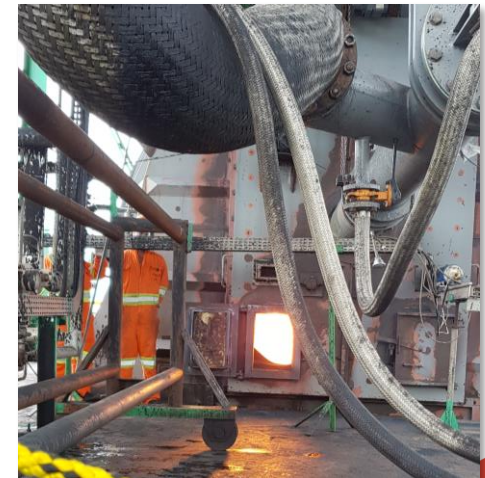
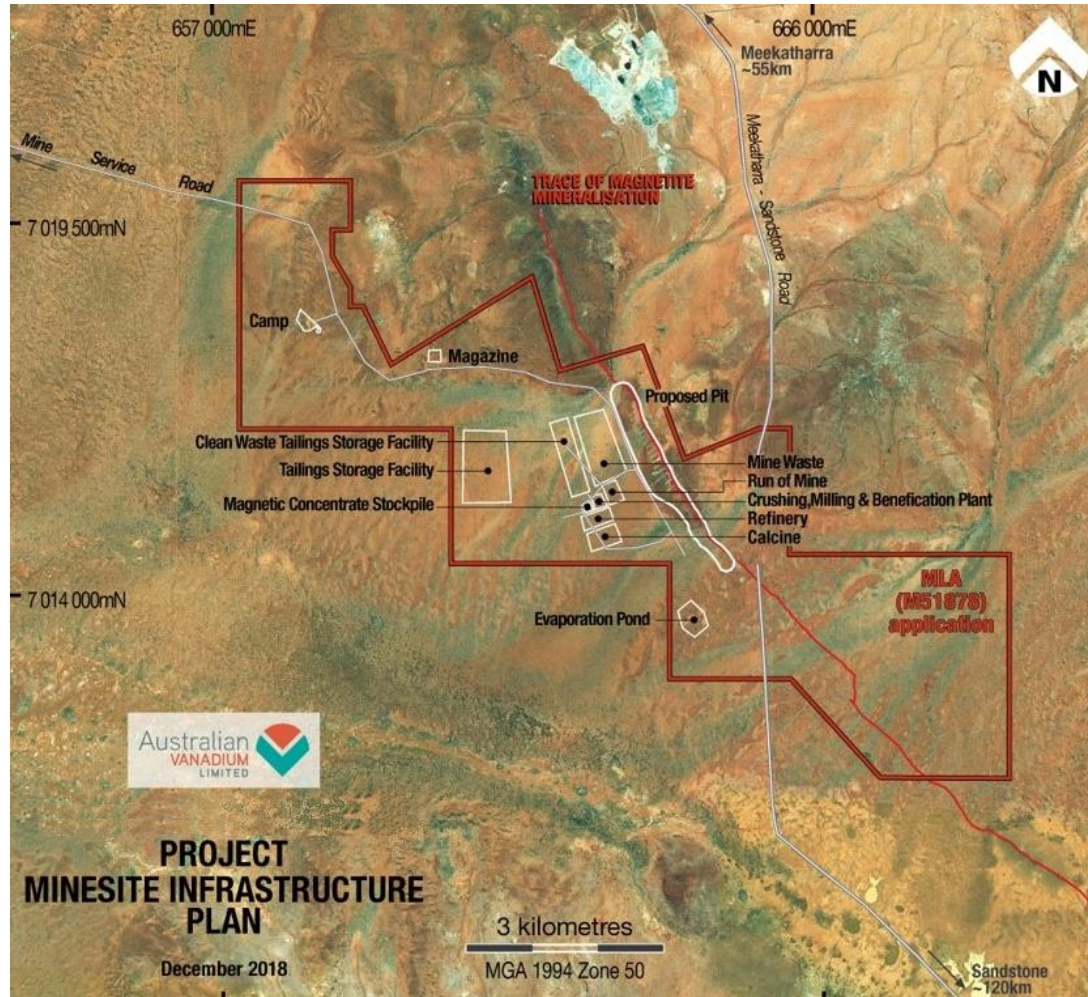
# Project Geology



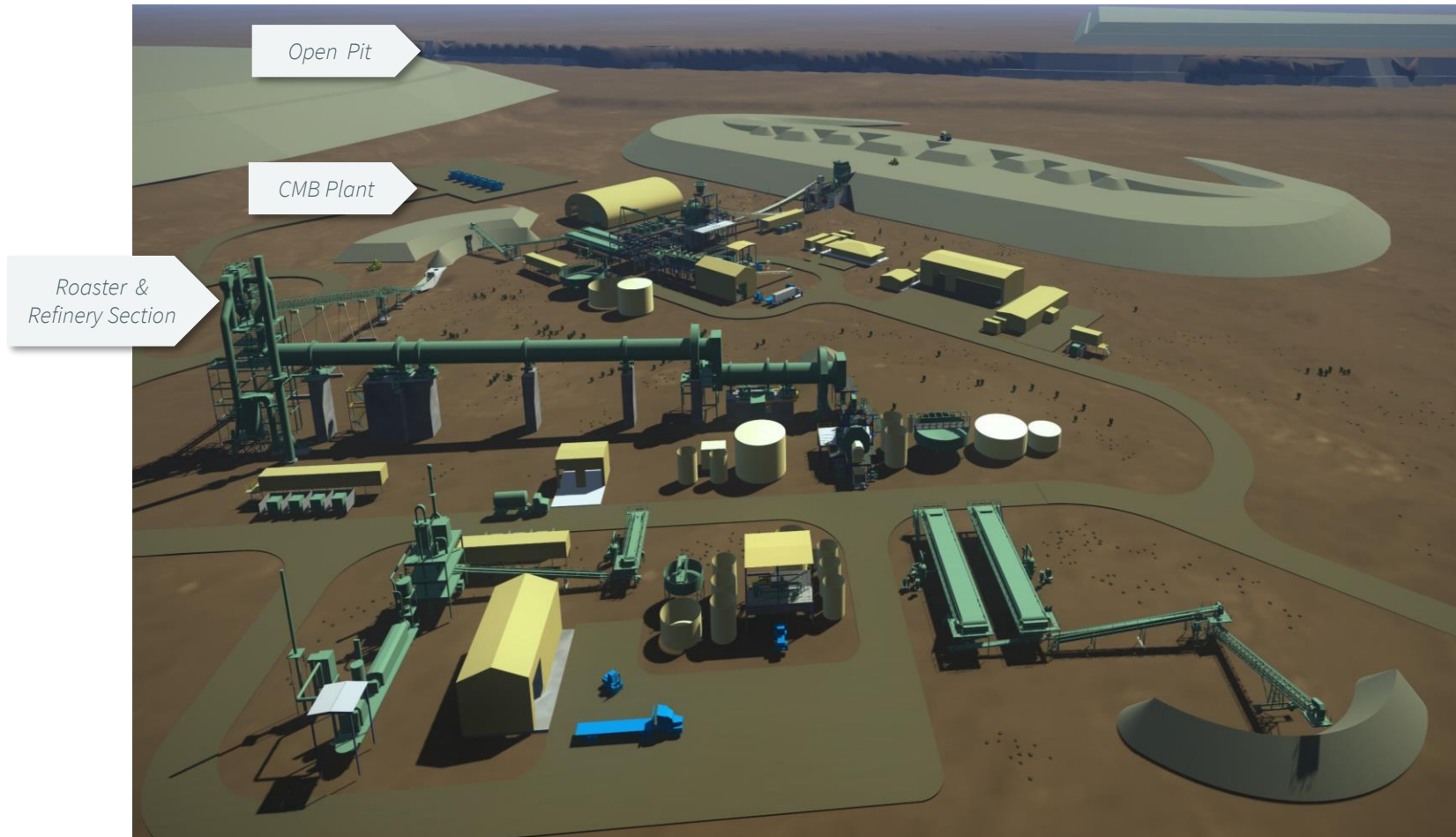
- Bushveld-type VTM deposit with significant ground position for project development and highly consistent geology over strike.
- Massive magnetite, averaging 15-20 metres in true thickness.



# Planned Infrastructure



# Model of Proposed Plant



# PFS Financial Model

## $V_2O_5$ Product Pricing Scenarios November 2018

		Preferred Case:	
<b>Year 1-5</b>	\$8.67/lb $V_2O_5$	\$13/lb $V_2O_5$	\$13/lb $V_2O_5$
<b>Year 6-17</b>	\$8.67/lb $V_2O_5$	\$8.67/lb $V_2O_5$	\$13/lb $V_2O_5$
<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 used 0.72, USD:AUD is currently 0.69.

Post tax NPV<sub>8%</sub> in US\$8.67 price case increases from \$125M to \$160M at US\$0.69.

All figures pre-PFS process improvements announced in 2019.

# Major Project Status

## Major Project Status Awarded

- The Australian Vanadium Project was awarded **Major Project Status** by the Federal Government in September 2019.
- Award enables AVL to access **streamlined assistance** with Australian Government approvals.

## Recognition of Significance

The award is formal recognition of the Project's **national significance** due to:

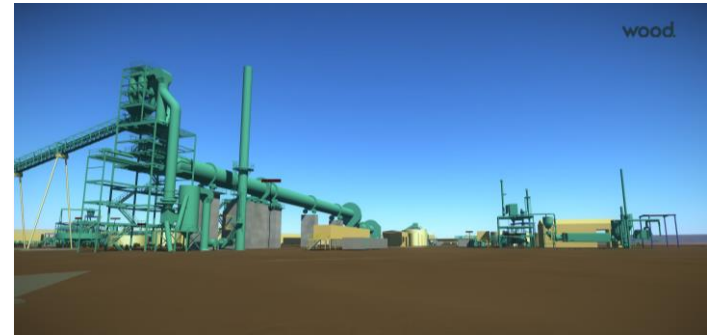
- **Economic growth** of the Australian vanadium market (steel, energy storage).
- **Economic growth** for the Mid-West region through direct and indirect jobs.
- Vanadium being on the **critical minerals list** for Australia and the US.



# Land Option Agreement

## Vanadium Processing Plant Location

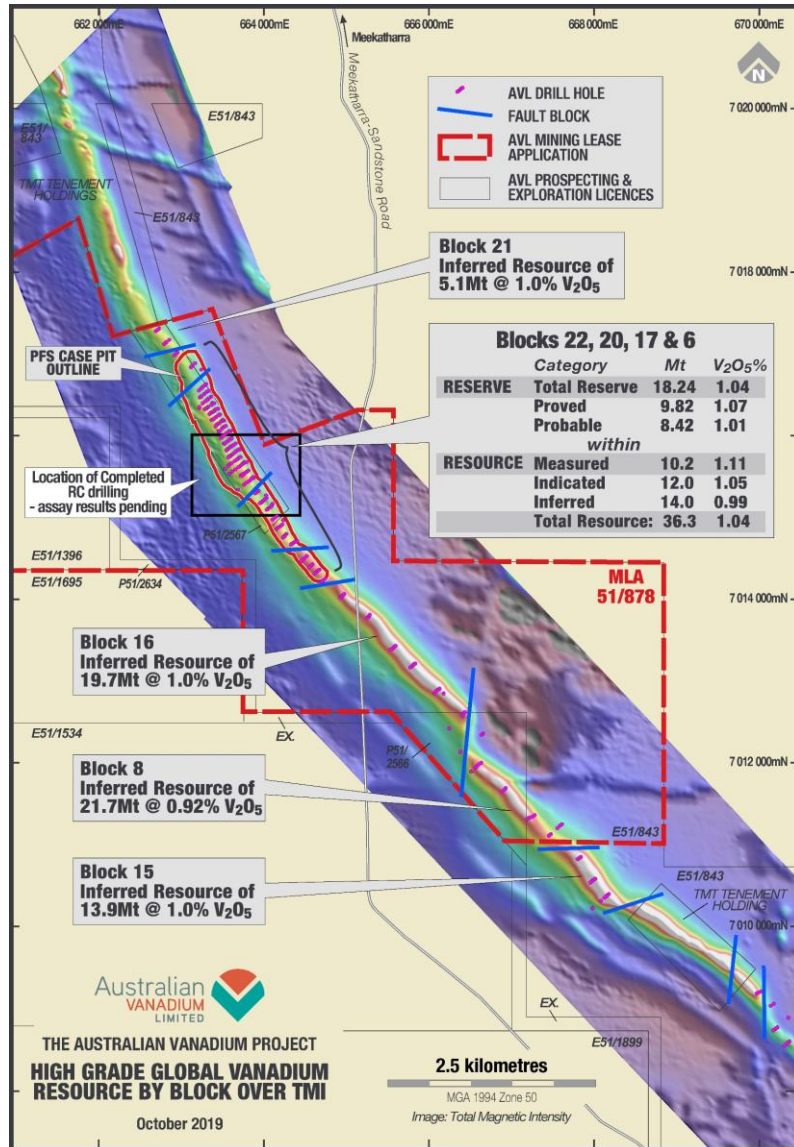
- AVL has identified a potential location east of Geraldton, as a possible site for its vanadium processing plant.



## Benefits of Geraldton Location

- Proximity to gas pipeline infrastructure and associated low domestic WA gas prices.
- Available local workforce.
- Existing road, rail, water and gas infrastructure.
- Reduced capex at Meekatharra minesite.
- Increased potential to sell valuable iron ore by product via Port of Geraldton.
- Strong Federal, State and local Government support.

# Resource Extension



## Drilling to Extend Project Life

- Conversion of Resources to Reserves on 55.3Mt of High-Grade ore zone.
- Completed Phase 1 program comprised 13 RC holes for 1,224 metres.
- Mineral Resource update to follow receipt of assays.
- Further drill programs in advanced planning stage, targeting southern blocks to convert current Inferred Resources to Indicated Resources.



# Testwork Update

## *Pilot Scale Testwork*

### **Pilot Scale Testing is Crucial**

Testwork at scale is a key differentiator of successful projects, allowing potential problems to be identified and remedied before commitment to full-scale construction.

- AVL is following a bankable due-diligence level approach to project de-risking and delivery.

### **AVL's Pilot Scale Testwork Progress**

Pilot scale metallurgical testing on 30 tonnes is currently underway as part of AVL's DFS.

- Once testing has been completed, DFS engineering and Front-End Engineering Design (FEED) will commence.





*AVL's Standard V<sub>2</sub>O<sub>5</sub> Product  
and Magnetic Concentrate*



# Process Improvement

## *Benchscale Testwork*

### High-Purity Product

High-purity 99.4% vanadium pentoxide (V<sub>2</sub>O<sub>5</sub>) produced from pre-pilot testwork – expected to be AVL's standard mine product.

- Provides greater value per unit of ore processed than anticipated in PFS.
- For steel, chemical and battery markets.

### Roast-Leach Process Innovation

Extraction rate significantly improved through roast-leach process innovation – vanadium yield in refining increased by 6% to 94%.

- Provides greater value per unit of ore processed than anticipated in PFS.

# Pilot Roast Work

## Metso Selected For Pilot Roast Work

Metso was chosen because of its world-renowned expertise in Grate Kiln (GK) processing solutions.

- Tests have shown a substantial increase in vanadium extraction – 95.4% vs standard rotary kiln 85-88%.

## Concentrate Pellet Evaluation

Testing of pelletising and GK use is underway.

- Extraction rate significantly improved through roast-leach process innovation – yield increased to 94%.
- Reduction of gas consumption.
- Significant reduction of dust loading.
- Opportunity to leach pellets intact, enabling calcine iron ore by-product to be more saleable.



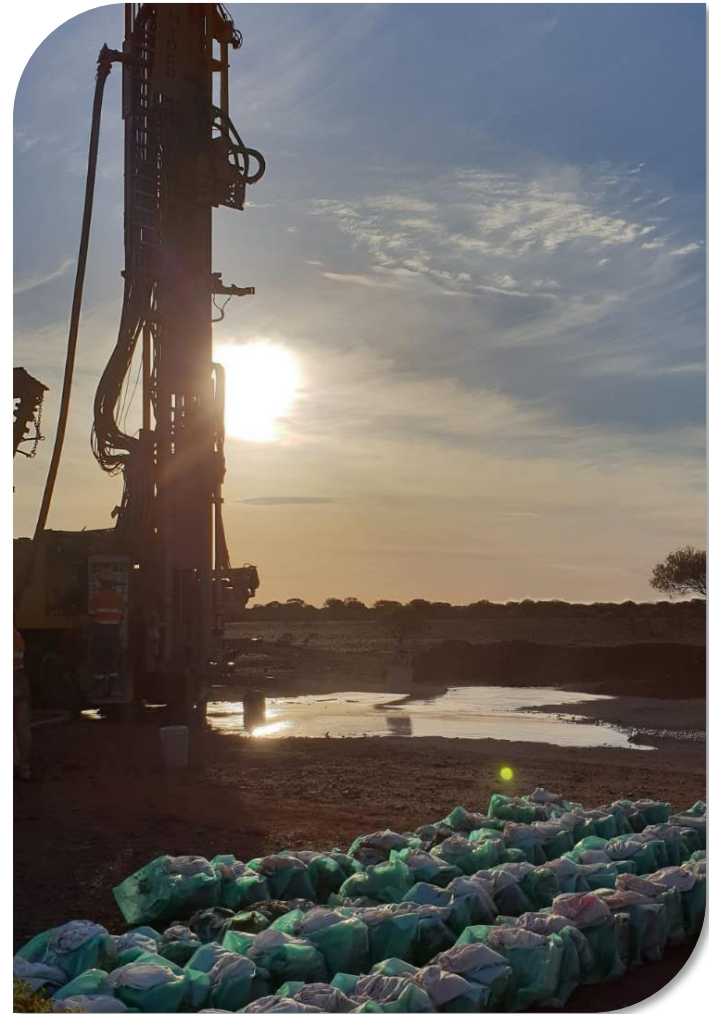
*Vanadium-Rich Iron Concentrate Pellets*

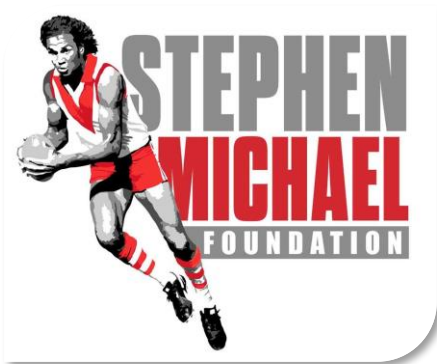


# Calcine By-Product

## Calcine By-Product Opportunity

- Testwork being undertaken to establish whether calcine can be upgraded from a lower-grade concentrate (<55% Fe) to a higher-grade product (>62% Fe), which could generate significant additional revenue over the life of the Project.
- Current process will produce significant quantity of iron calcine per annum.
- By-product sales of iron ore can increase revenue and reduce the need for material storage.
- Research to increase iron grade from 54% to 66% is underway.
- Opportunities to blend with other high Al-Si ores, which attract pricing penalties from steel makers.



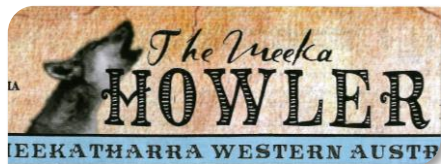


# Social Responsibility

## The Meekatharra Community

AVL sponsors the Stephen Michael Foundation.

- Engaging kids with school; improving lives through sport. Subsidiary VSUN Energy sponsors The Meeka Howler.



## Carbon Footprint Analysis

Project analysis of emissions across the supply chain.

- Offset and emission reduction plan; cost assessment with immediate and future abatement schemes.
- Understanding lifecycle emissions in the steel industry in conjunction with Vanitec.



**VANITEC**  
TRANSFORMING POSSIBILITIES

## Reducing Emissions

Potential strategies to reduce emissions.

- Solar plus VRFBs; non-traditional fuel for haulage.
- Process improvements such as pelletising can significantly reduce gas and particulate emissions.

# Carbon Footprint

## Regulatory Context

- Legislation requires monitoring and reporting of emissions.
- The Western Australian Government's Greenhouse Gas (GHG) Emissions Policy for Major Projects aims to ensure that new proposals make an appropriate contribution to the State's aspiration of net zero GHG emissions by 2050.



## Our Approach

- AVL is committed to minimising GHG emissions.
- Largest contributors to emissions expected to be direct fuel use in the roasting kiln, electrical power for the concentrator and processing plant, and use of dump trucks.
- Opportunities to reduce emissions are being investigated, including:
  - Use of hybrid renewable and vanadium redox flow battery electricity plant;
  - Innovations to reduce energy requirements through roasting;
  - Haul route design and equipment selection to minimise truck fuel use,
  - Electric Vehicle and Hydrogen fuel technological advances.
- AVL will demonstrate commitment to proactively minimise emissions through a GHG management plan (currently in development).

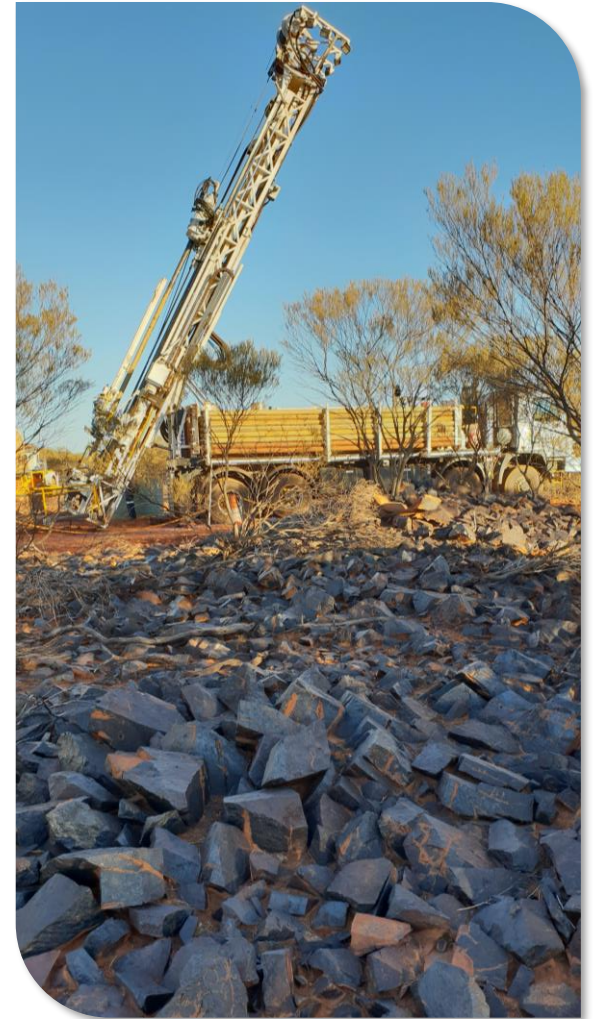
# Permitting Progress

## Finalised

- Water impact assessment ✓
- Flora and fauna field assessments ✓
- Heritage access agreements ✓
- Stygofauna/troglofauna sampling ✓
- Mining licence application ✓
- Major Project Status (Federal) ✓

## Progressing

- Mining agreement and licence grant
- Environmental approval application
- Major project status (State)





# Project Summary

## Completed

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



# Project Summary

## Ongoing

- Large scale pilot testing & DFS
- Environmental impact studies and heritage review
- Mining agreement & mining licence approval
- Native Title
- Financing – partnership agreements and MOUs
- Offtake agreements
- NAIF key infrastructure funding application
- Capex and opex optimisation of base case through option study reviews
- Conversion of Resources to Reserves to increase project life

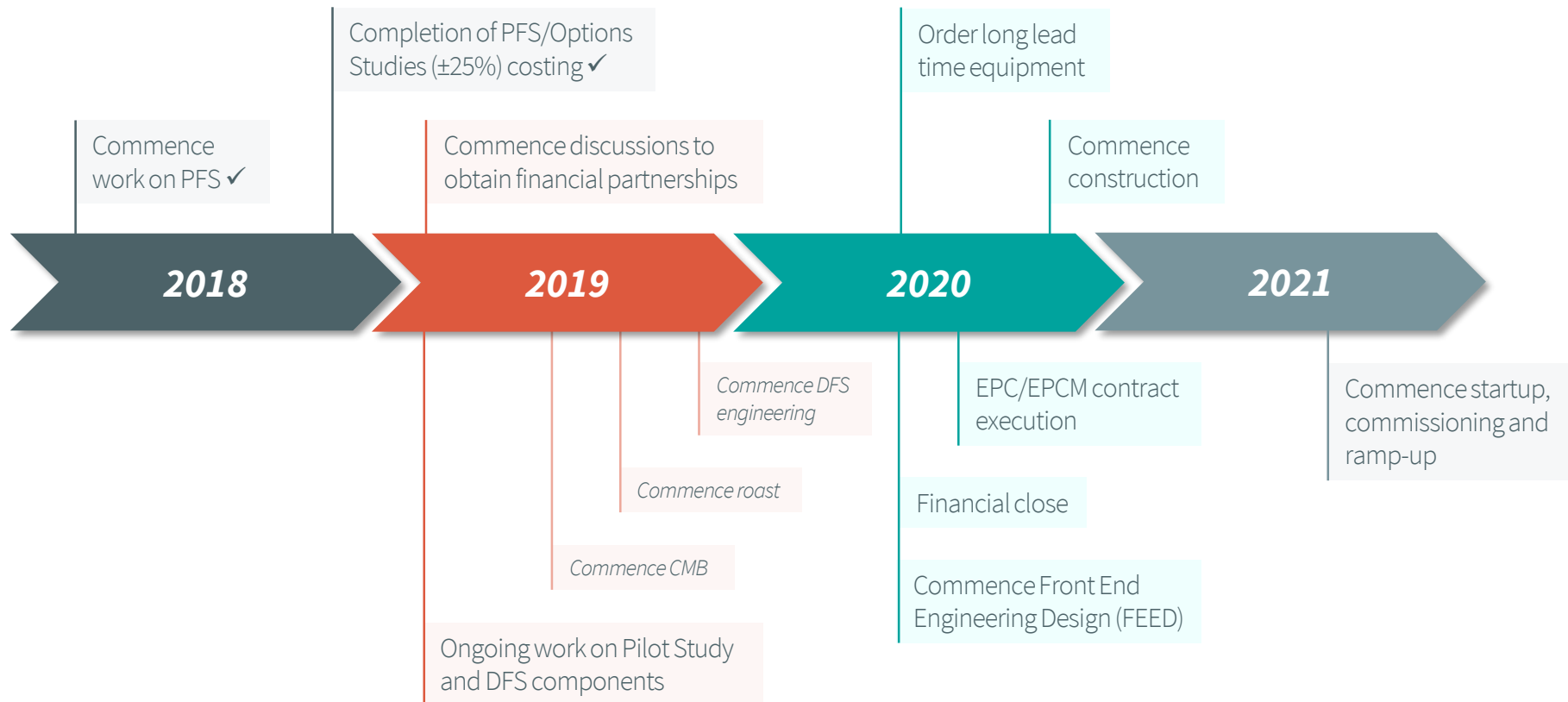
## Planned

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



# The Path Forward

## The Australian Vanadium Project



# Vanadium Market Overview



## Primary: Steel

Accounts for 90% of current global vanadium consumption.



## Emerging: Energy Storage

Accounts for 2% of current global vanadium consumption, with significant potential for growth.



## Additional: Ti and Chemical

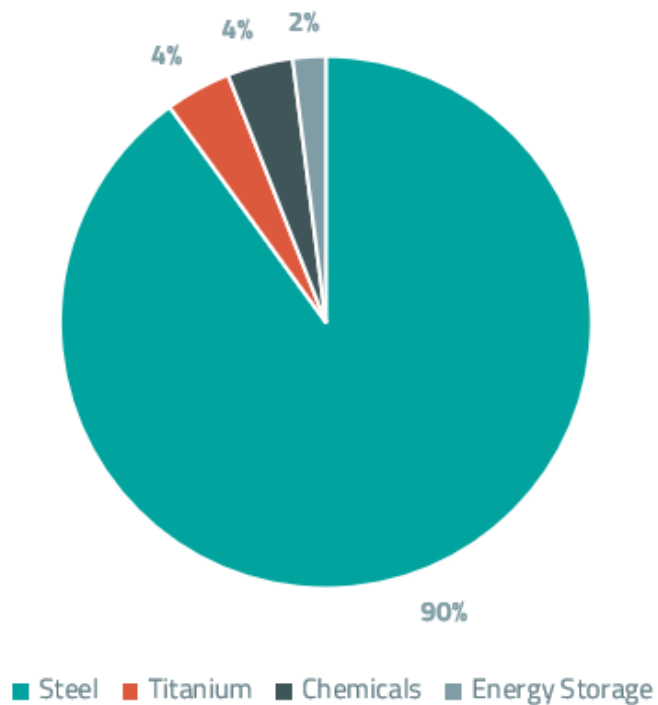
4% of vanadium consumption each, with significant potential for growth (super alloys, 3D printing, etc.).

Vanadium electrolyte functions as cathode and anode in vanadium redox flow batteries (VRFBs)

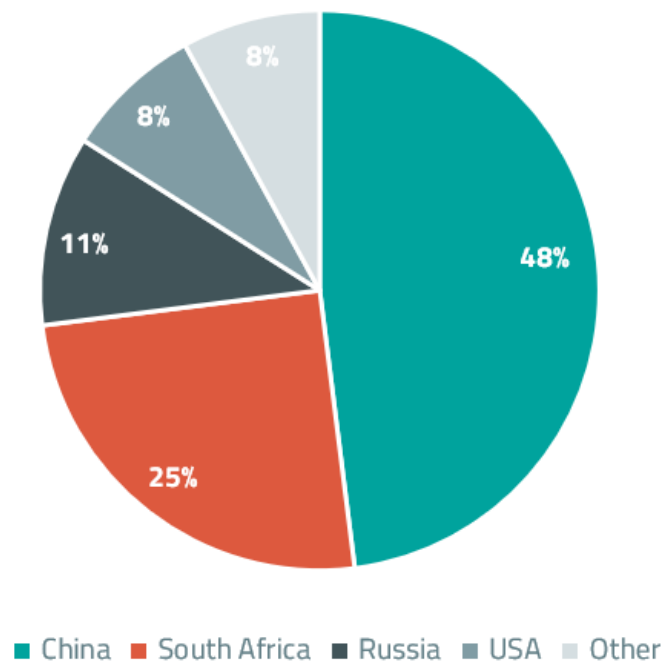
Vanadium can be used in the cathode of Li-ion batteries.

# Vanadium Production

## Vanadium Production by Market



## Vanadium Production by Country



# Production vs Consumption

Production/consumption  
in balance in late 2018.

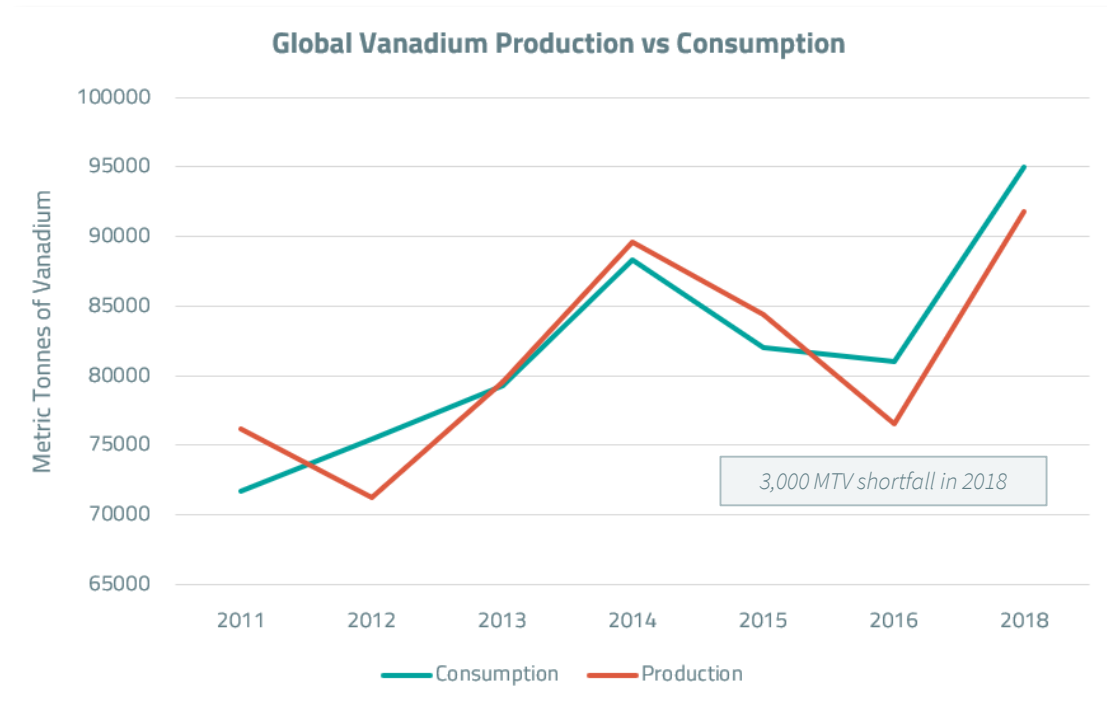
Chinese production  
capacity at limits.

14% of world production  
from 3 primary mines  
(Brazil, South Africa).

60% from Chinese slag  
production.

Market remains at risk  
from supply shocks.

New market demand a  
swing factor.





# Steel Market

## Primary Market

Steel is the primary market and price driver of vanadium – accounting for 90% of global consumption.

## Chinese Rebar

Chinese rebar consumption is a key metric – new standards require increased vanadium content.

## Risk of Substitution

Unique microalloy effects of vanadium reduce the risk of substitution.

## Vanadium Supply Deficit

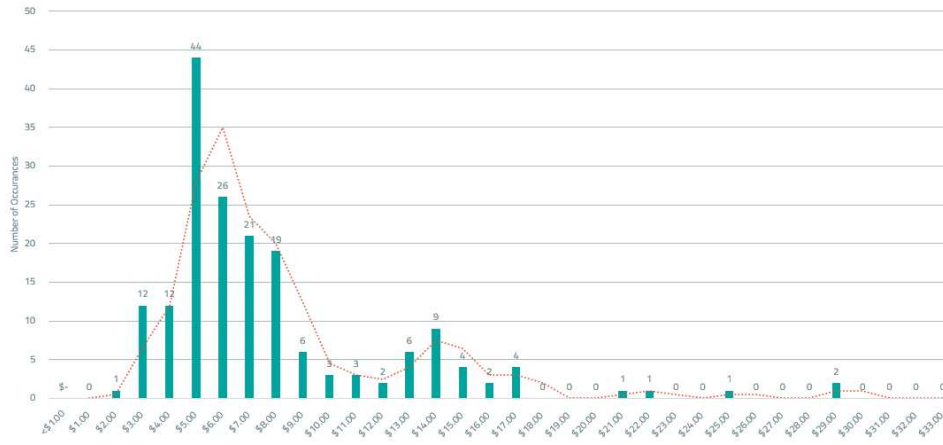
Current supply deficit that exists within all markets is projected to remain.

## Factors Increasing Demand

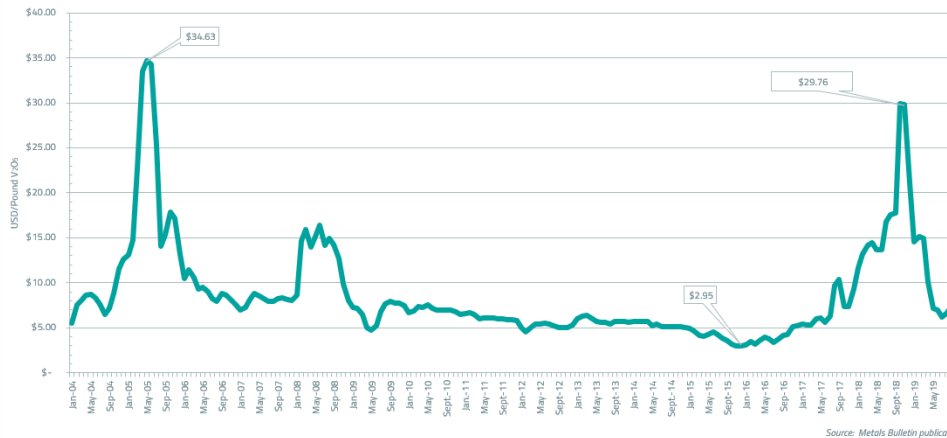
The development of new applications of vanadium in steel further increases demand – automotive, aviation and aerospace; powerlines and power pylons; high-strength structures.

# Steel Market

VzOs Distribution Chart - Jan 2004 to August 2019  
Inflated to Nov. 2019 USD



Metal Bulletin VzOs Monthly Midpoint Average Price  
Inflated to August 2019 US\$

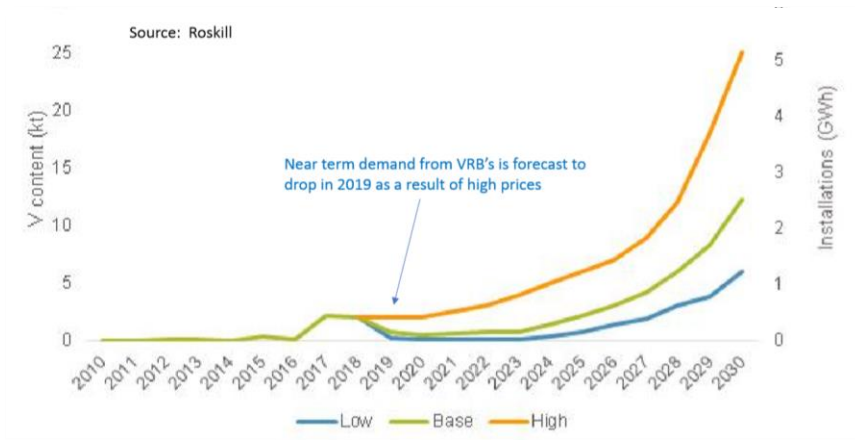


Vanadium has historically experienced long periods of low prices, followed by periods of high prices – lowest quartile producers are best positioned to survive and benefit.

Recent price drop was due to niobium substitution and delayed implementation of new standards in China, reduction in steel market growth.

Price has now risen and is stabilising at market supply/demand balance. Expected to be between US\$8-12 for the foreseeable future.

# Energy Storage Market



## Emerging Market

Energy storage is an emerging market for vanadium, accounting for around 2% of global vanadium consumption with significant growth potential.

## Vanadium in Batteries

Vanadium electrolyte is used in vanadium redox flow batteries (VRFBs), and vanadium can also be used as the cathode material in Li-ion batteries.

## Hybrid Systems

Hybrid systems that use VRFBs alongside Li-ion batteries are already being used – these systems combine the best of both technologies.



# Vanadium Redox Flow Batteries

## Redox Flow Batteries

- 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 **vanadium electrolyte** is used, which contains **145g of high-purity  $V_2O_5$**  per litre.



## New Market Entrants

Rising prices have led to innovations and new entrants, for example:

- Welded stack technology;
- Electrolyte leasing;
- Changing power-to-energy ratio;
- Dispatchable energy at solar farms;
- Government incentives;
- 1GWh of new vanadium energy storage needing ~10,000 tonnes of high-purity  $V_2O_5$ .





# VRFB Characteristics

An **energy battery**, able to store large amounts of energy for later use



The VRFB is **non-flammable**, making it safer than other batteries on the market.

It's **easy to scale**, just add modules or introduce larger electrolyte tanks.



Can charge and discharge **simultaneously**, with **100% depth of discharge**.

Lifespan of over 20 years with **no degradation of capacity** over time.



The vanadium electrolyte in a VRFB can be **reused indefinitely**.



# VSUN Energy

## About VSUN Energy

VSUN Energy is AVL's fully owned subsidiary, launched in 2016 to grow the VRFB market in Australia. Its first VRFB installation was at a native tree nursery in Busselton, WA.

## VRFB Sale – Meredith Dairy

- 80kW/320kWh vanadium redox flow battery to be installed at a dairy farm in Meredith, Victoria.
- System will provide a minimum of **four hours of stored renewable energy**, allowing the client to increase onsite renewable generation and consumption.

## VRFB Sale – Priest Bros.

- Solar and a 20kW/80kWh VRFB energy storage system to an orchard in Pakenham, Victoria.
- System will provide a minimum of **four hours of stored renewable energy**, allowing the client to increase onsite renewable generation and consumption.

# Global VRFB Update

**Vanadium Redox Flow Battery (VRFB)**  
technology is increasingly being tested or deployed across the globe

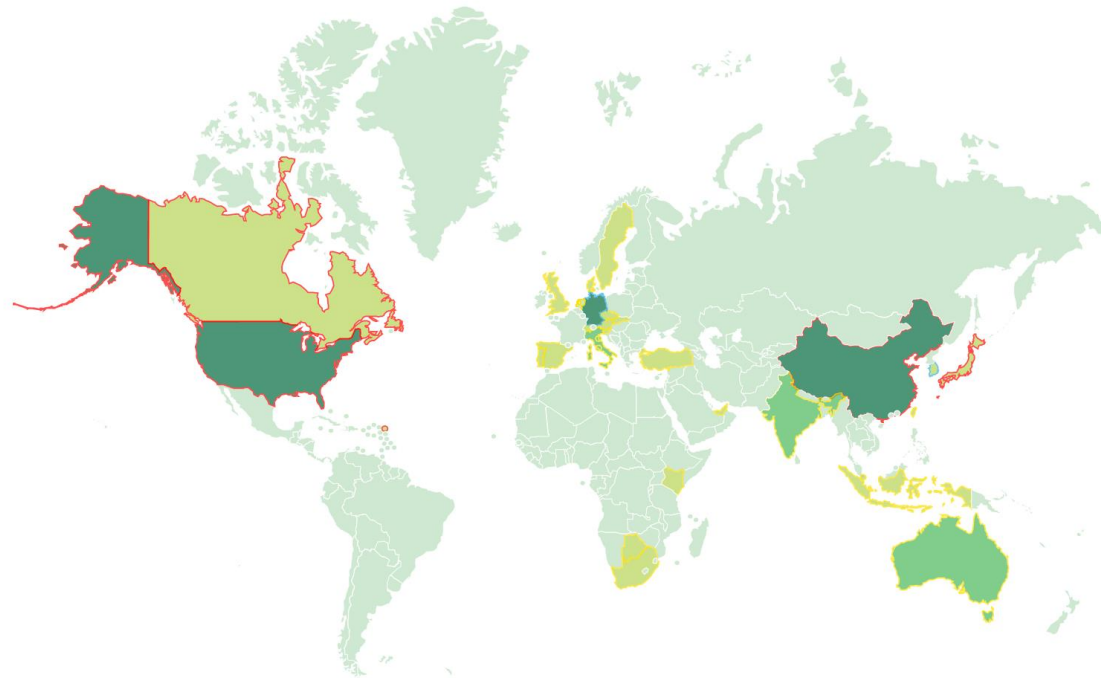


**Number of VRFBs**

● 1 - 5 VRFBs    ● 6 - 10 VRFBs    ● > 11 VRFBs

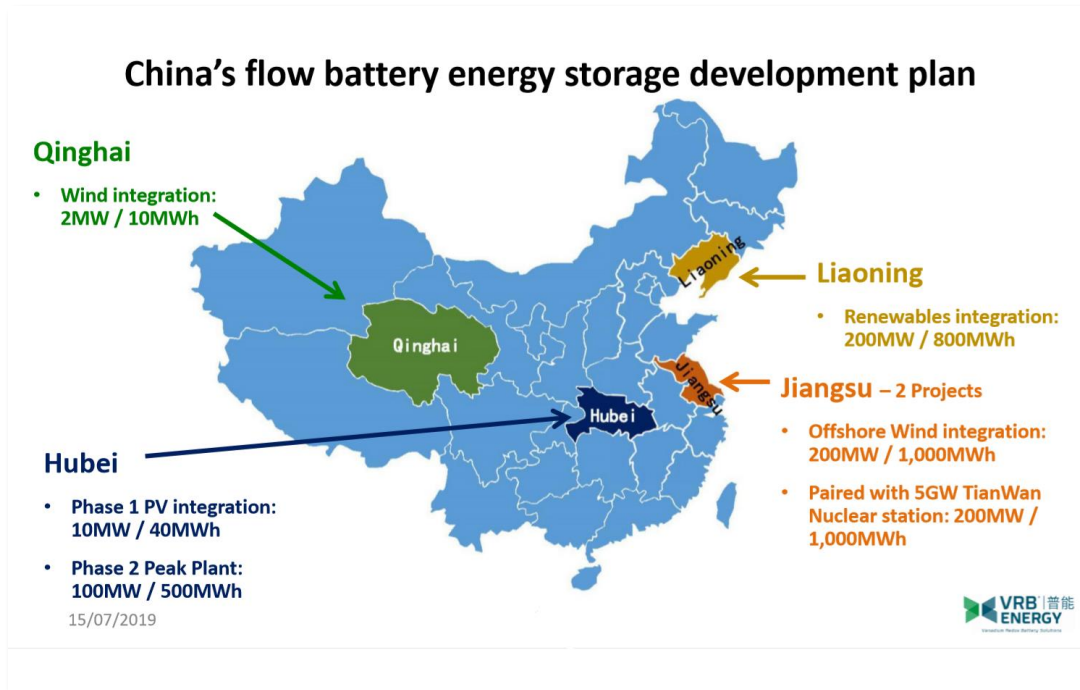
**Size of VRFBs in Kilowatts**

● 1 - 1000 kW    ● 1001 - 2000 kW    ● > 2000 kW



Country	VRFBs	kW	kWh
Australia	7	945	4,629.90
Barbuda	1	3,000	12,000.00
Botswana	1	112	560.00
Canada	3	2,500	10,000.00
China	17	15,825	48,005.00
Czech Rep.	3	47	209.90
Denmark	3	40	260.00
Germany	15	1,530	86,190.00
India	4	155	740.15
Indonesia	2	400	500.00
Italy	5	631	2,610.00
Japan	5	2,330	7,481.00
Netherlands	1	10	80.00
Portugal	5	5	60.00
Singapore	1	250	2,000.00
Slovenia	1	10	45.00
South Africa	2	745	2,950.00
South Korea	5	1,250	4,900.00
Spain	4	220	800.00
Sweden	1	800	1,800.00
Switzerland	2	210	460.00
U. Kingdom	5	805	5,180.00
USA	17	7,418	33,173.70
Austria	1	14	84.00
Kenya	1	140	84.00
Slovakia	2	107	640.00
UAE	1	10	40.00
Taiwan	1	125	750.00
Turkey	1	10	40.00

# VRFB Installations in China

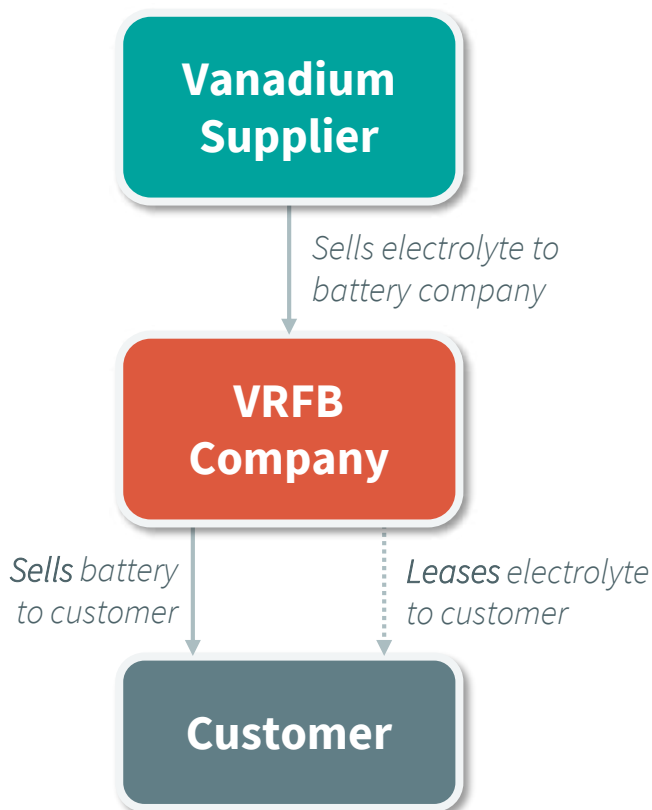


A new 5MW/20MWh vanadium redox flow battery project was announced at the vanadium and titanium conference in China, Sept 2019.

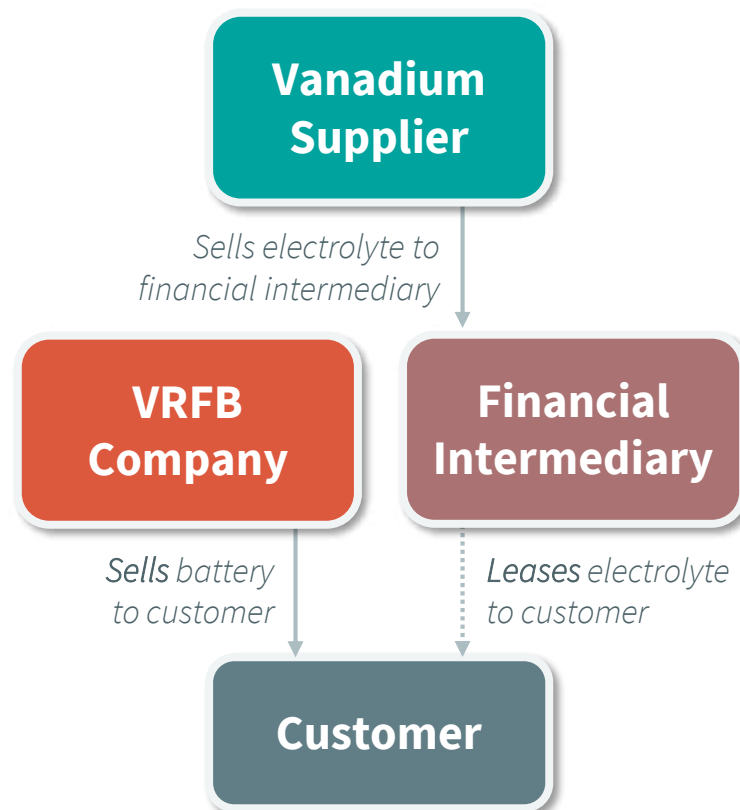
China committed to significant new VRFB installations in the near future. Map shows equivalent to 4 years production from The Australian Vanadium Project.

# Leasing Vanadium Electrolyte

## Direct Leasing Model



## Indirect Leasing Model





# Contact Us

***Australian Vanadium Limited | ASX: AVL***

+61 (08) 9321 5594

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

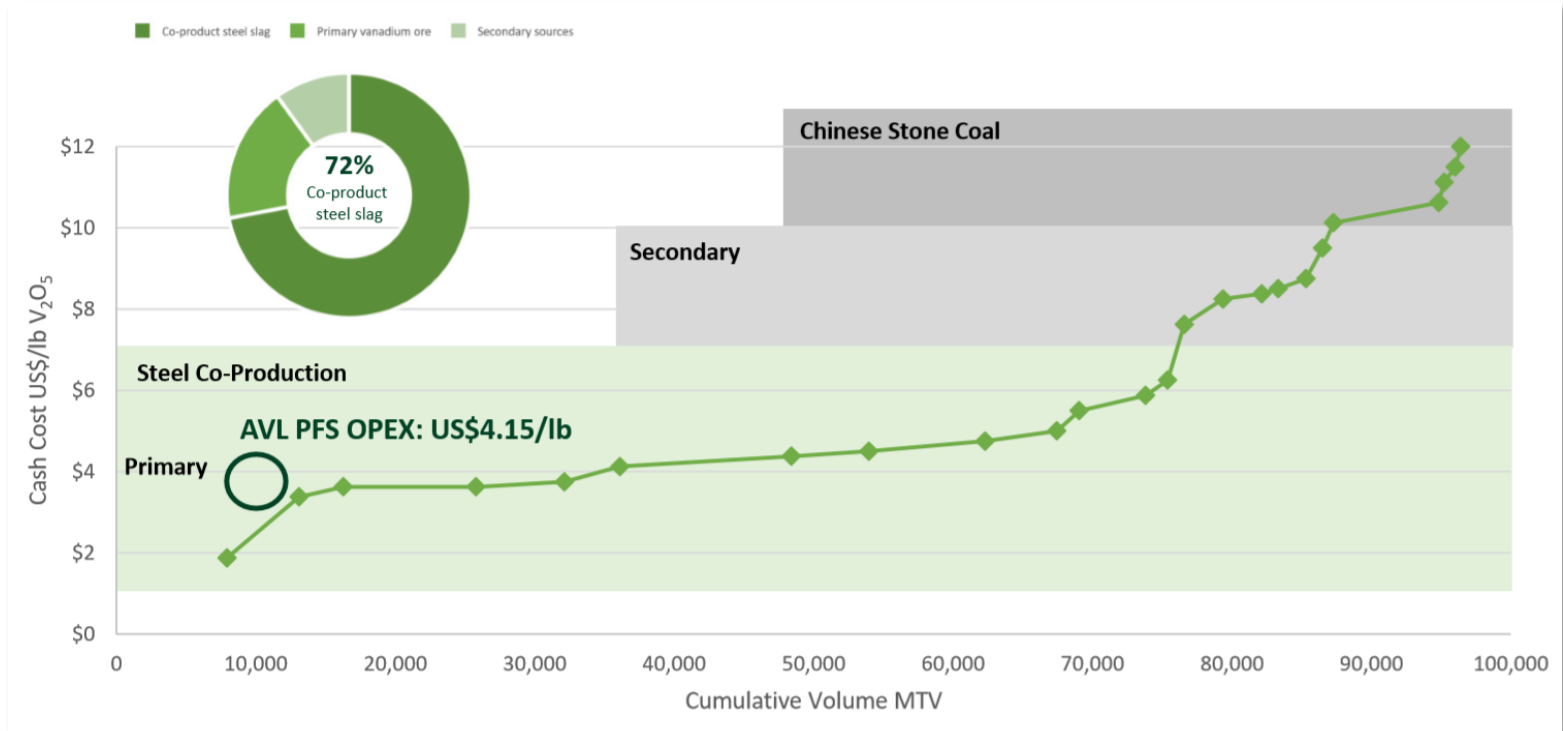
Level 1, 85 Havelock Street  
West Perth, Western Australia 6005

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

# Resources by Fault Block

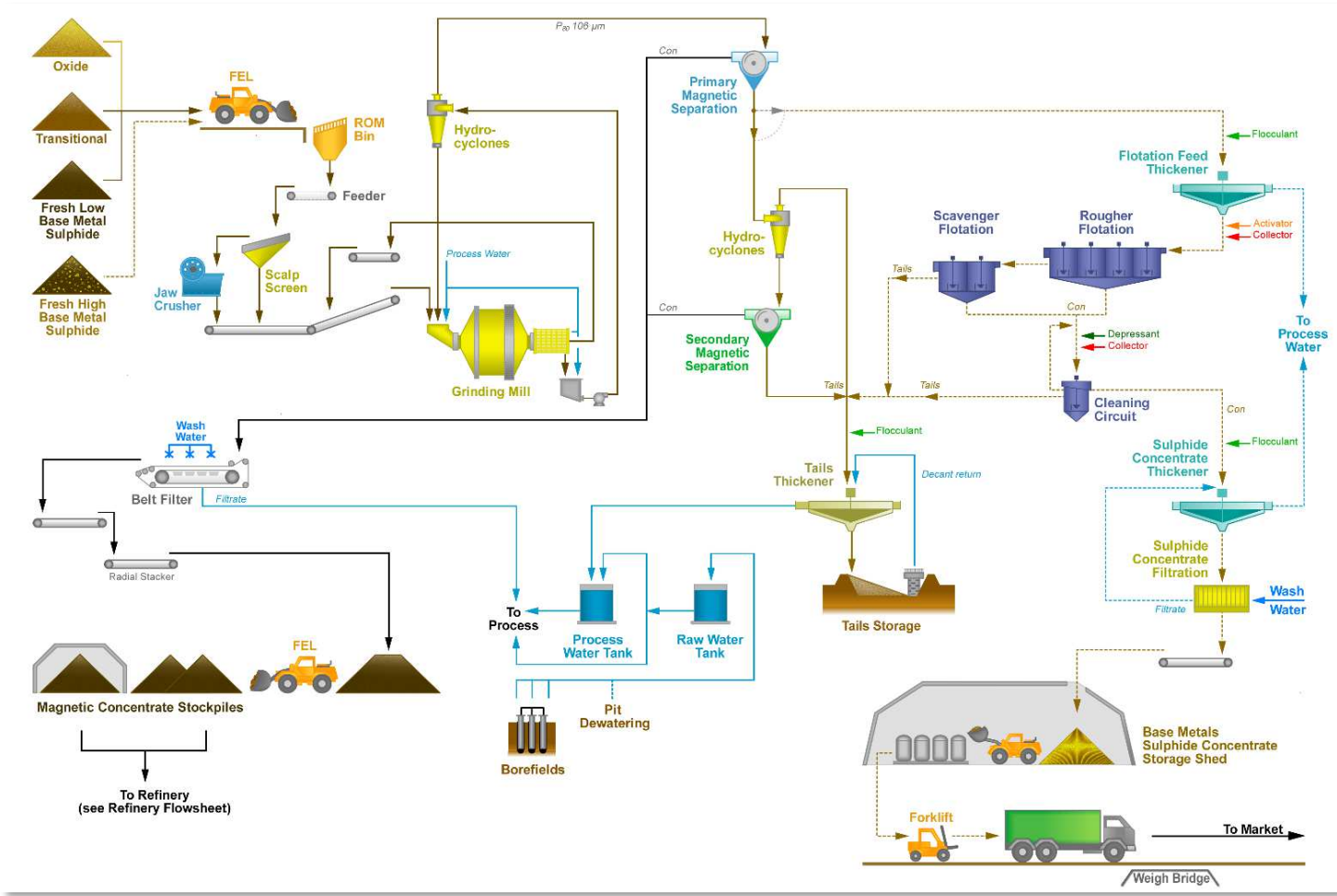
Block	Area	Category	Current Resource Tonnage	Current Resource Grades					
Block #			Mt	V <sub>2</sub> O <sub>5</sub> %	Fe %	TiO <sub>2</sub> %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	LOI %
21		Inferred	5.1	1.00	41.7	11.4	12.3	7.8	3.9
22	In pit extents	Measured	1.0	1.10	41.7	12.5	10.4	9.3	4.9
22		Indicated	0.7	1.09	40.8	12.6	11.4	9.6	5.2
22		Inferred	2.6	1.02	40.0	12.9	12.1	10.4	5.7
20	In pit extents	Measured	9.2	1.11	42.9	12.7	10.2	7.9	3.8
20		Indicated	5.9	1.09	44.4	12.1	9.7	7.2	3.1
20		Inferred	4.7	1.08	43.4	12.0	10.6	7.7	3.4
17	In pit extents	Indicated	5.5	1.01	43.6	11.5	11.4	7.8	3.7
17		Inferred	1.5	0.95	42.7	10.9	12.7	7.9	3.8
6	In pit extents	Inferred	5.2	0.91	40.1	10.4	14.7	8.4	3.3
<b>Subtotal Pit</b>	<b>Within PFS pit extents</b>		<b>36.3</b>	<b>1.04</b>	<b>42.6</b>	<b>11.9</b>	<b>11.3</b>	<b>8.1</b>	<b>3.7</b>
16		Inferred	19.7	1.00	42.5	11.0	11.3	7.2	2.3
8		Inferred	22	0.92	40.5	11.0	12.7	8.4	3.8
15		Inferred	13.9	1.00	45.1	11.3	9.1	6.3	3.7
<b>Subtotal</b>	<b>Outside pit extents</b>		<b>60.4</b>	<b>0.97</b>	<b>42.29</b>	<b>11.11</b>	<b>11.37</b>	<b>7.45</b>	<b>3.29</b>
<b>Sum</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>

# Industry Cost Curve

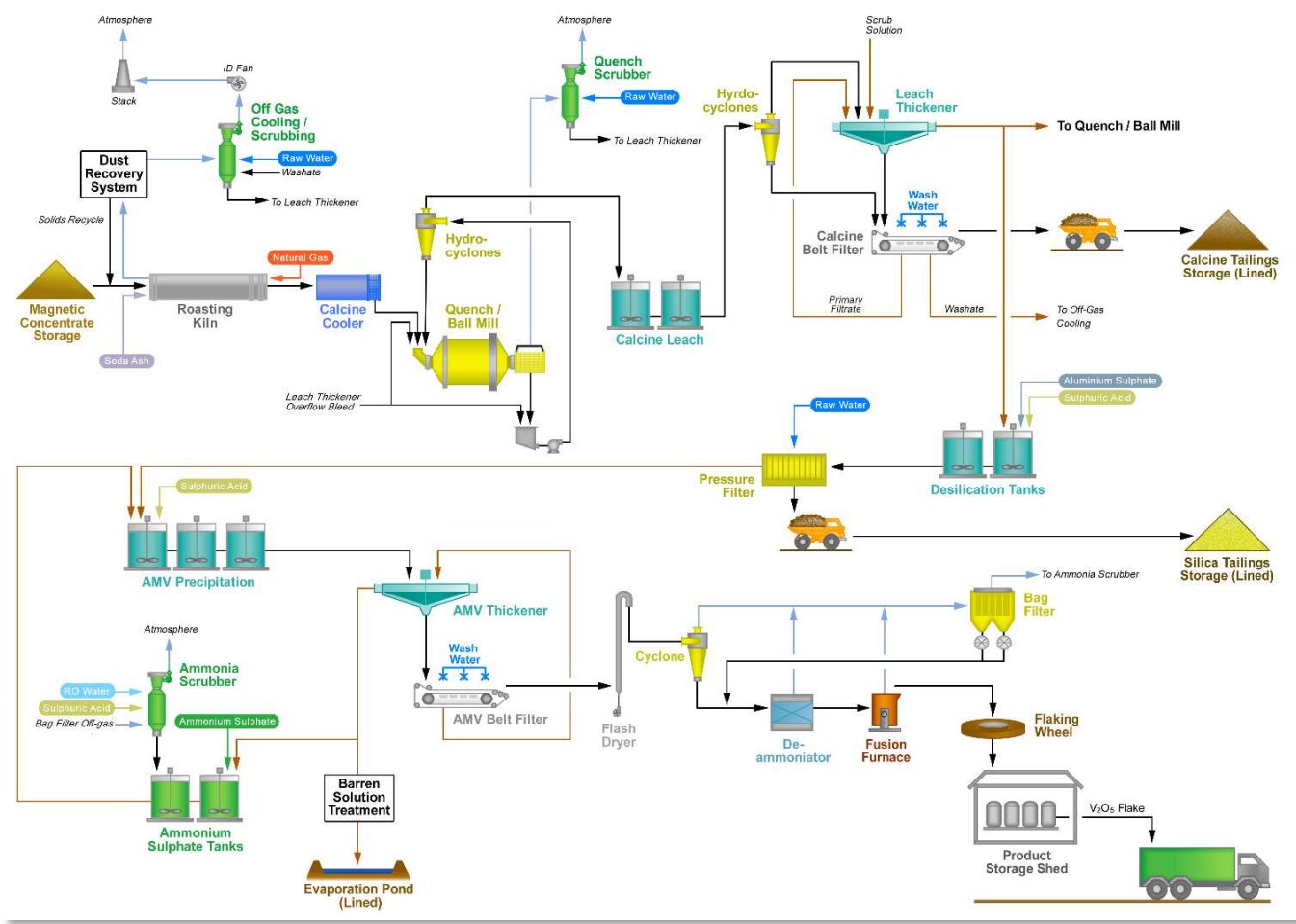




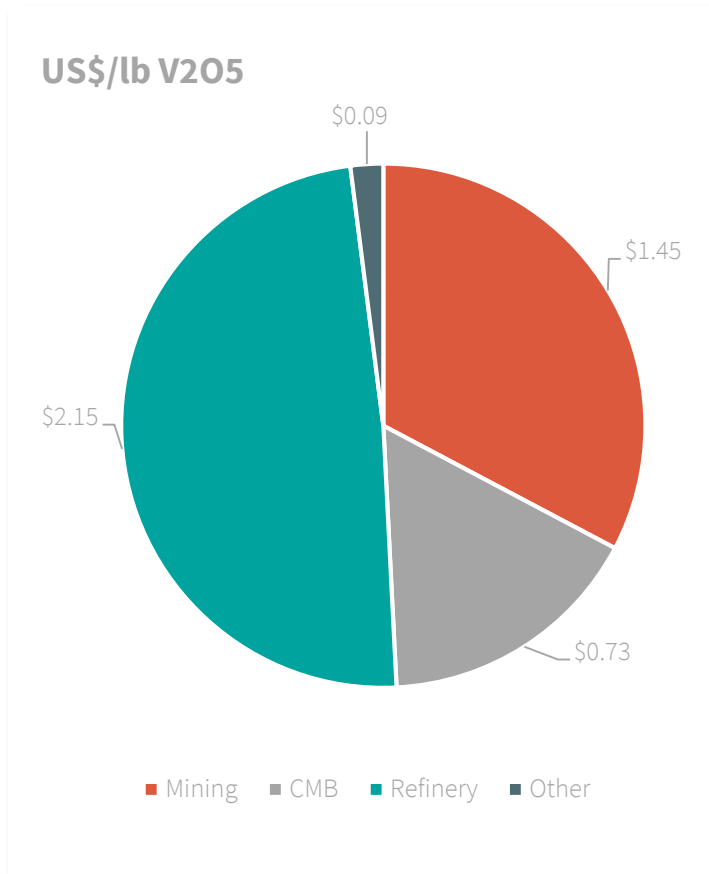
# Crushing, Milling & Beneficiation



# Refining: $V_2O_5$ Production



# Total PFS Opex Breakdown



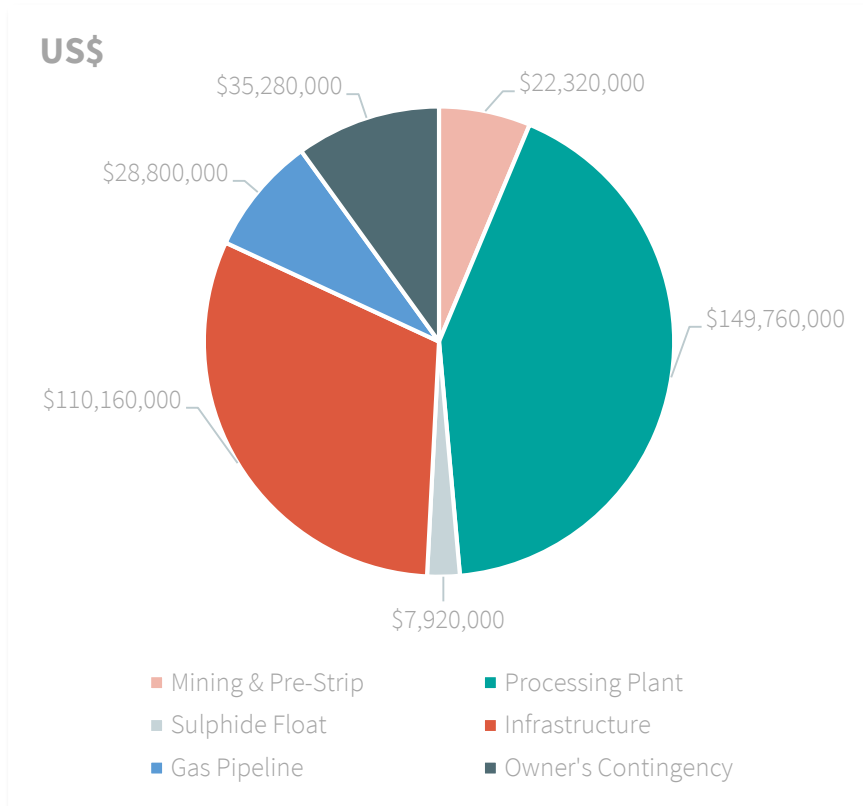
Total Opex	US\$/lb V <sub>2</sub> O <sub>5</sub>	\$/a
Mining *	\$1.37	\$31M
CMB*	\$0.71	\$16M
Refinery*	\$2.05	\$46M
Other*	\$0.10	\$2M
By-product credits*	-\$0.07	-\$2M
<b>Total</b>	<b>\$4.15</b>	<b>\$93M</b>

\* Identified opportunities to improve in DFS

## Optimisation Opportunities

1. Reduction of mining costs by lower pre-strip and haulage automation.
2. CMB circuit simplification.
3. New kiln (pellet) technology and lower gas consumption and cost.
4. Increase by-product credits by iron sale.

# Total Capex Breakdown



Total Capex	US\$	Comment
Processing Plant	\$149.76M	
Infrastructure	\$110.160M	
<b>Subtotal</b>	<b>\$259.92M</b>	
Mining & Pre-Strip*	\$22.32M	Improve in DFS
Gas Pipeline	\$28.8M	Own 50%
Sulphide Float	\$7.92M	Starts in Yr 3
Owner's Contingency	\$35.28M	
<b>Total</b>	<b>\$354.24M</b>	

## Optimisation Opportunities

1. Debt funding pipeline capital.
2. Reduction of oxide pre-strip.
3. Staging of refinery to 2 stages (50% each stage).



Australian  
**VANADIUM**  
LIMITED



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