

# Australian Vanadium Ltd

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Mines and Money Presentation

September 2020 | ASX: AVL



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## 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 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 "Total Vanadium Resource at The Australian Vanadium Project Rises to 208 Million Tonnes" released to ASX on 4<sup>th</sup> March 2020 and is available on the Company's 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.

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# Corporate Overview

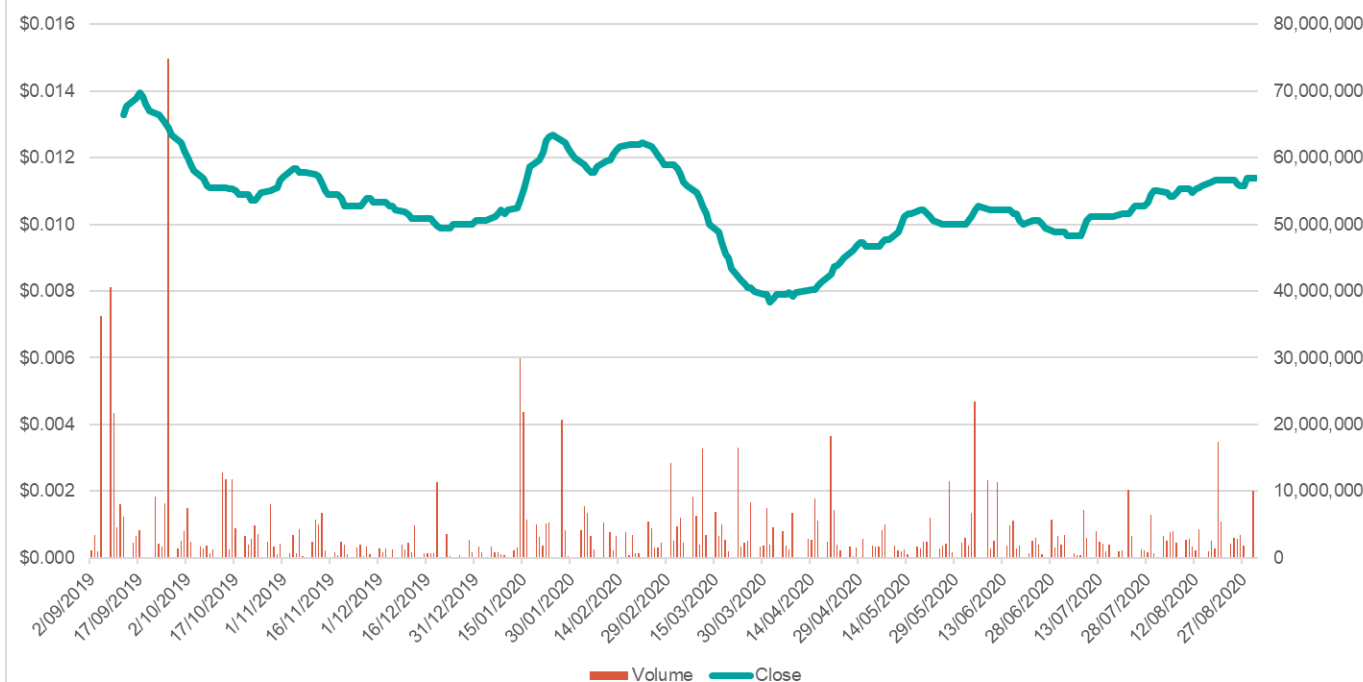
## Australian Vanadium Limited

- Australian Vanadium Limited (ASX: AVL) is an emerging vanadium producer
- Focused on developing **The Australian Vanadium Project** at Gabanintha in Western Australia
- Mining Lease granted
- Strong technical and commercial team
- High quality deposit
- Focus to deliver through all vanadium price cycles
- Moving directly from completed PFS to BFS
- Federal Major Project Status
- Western Australian Lead Agency Status
- Vanadium is recognised as a critical and battery mineral by the Australian Government
- Subsidiary VSUN Energy promotes **vanadium redox flow batteries** for renewable energy storage

## Key Statistics (31/8/20)

Ordinary Shares on Issue	2.55b	Market Cap (undiluted)	A\$33.4m
Share Price	A\$0.013	Cash	~A\$4.8
Average Daily Traded Volume	4,235,919	Shareholders	6,698

AVL Share Price History (31/8/2020)



# Overview

## High quality vanadium deposit

- Vanadium titanium magnetite (VTM) with massive high-grade zone 87.9Mt at 1.06% V<sub>2</sub>O<sub>5</sub>

## Feasibility study status

- Feasibility studies proceeding direct to bankable level to ensure financing success
- Detailed pilot on 30t sample nearing completion. Crucial to de-risk for success
- Granted Mining Lease

## Focus on innovation

- \$1.1m CRC-P grant for vanadium research centred on high purity products and process
- Innovations developed to reduce Opex and Capex (eg processing plant location, Fe co-product)

## Unique points of difference

- Experienced vanadium team; unique mineral resource and metallurgical characteristics; proven processing path

## Government support

- Federal Major Project Status and State Lead Agency, strong global focus on battery and critical mineral projects

## Energy storage market

- Proven capability to produce high-purity V<sub>2</sub>O<sub>5</sub> suitable for vanadium redox flow batteries (VRFB) and production of electrolyte
- Dedicated subsidiary focused on growing the Australian VRFB energy storage market



“AVL is developing one of the highest-grade vanadium projects underway in the world. Our aim is to become a low-cost producer, able to withstand long-term commodity price cycles.”

Managing Director  
Vincent Algar

## 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. Currently Director of US Vanadium LLC.



**Todd Richardson** | Chief Operating Officer  
Over 20 years of 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.

**Leslie Ingraham** | Executive Director  
Has been in private business for over 26 years and has worked successfully as a consultant for private companies and public companies listed on the ASX. Core competencies are in corporate advisory, investor relations, capital raising, prospecting and exploration, building long lasting relationships with high end investors in Australia and overseas.

**Brenton Lewis** | Chairman  
A senior academic having spent the past 20 years in the tertiary education sector. Has held management positions including Head of Department and Head of Post Graduate Studies and chaired Boards of management in both academia and community organisations.

## Vanadium Markets



### 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.

Vanadium electrolyte in **vanadium redox flow batteries (VRFBs)**

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



### Additional: Ti and Chemical

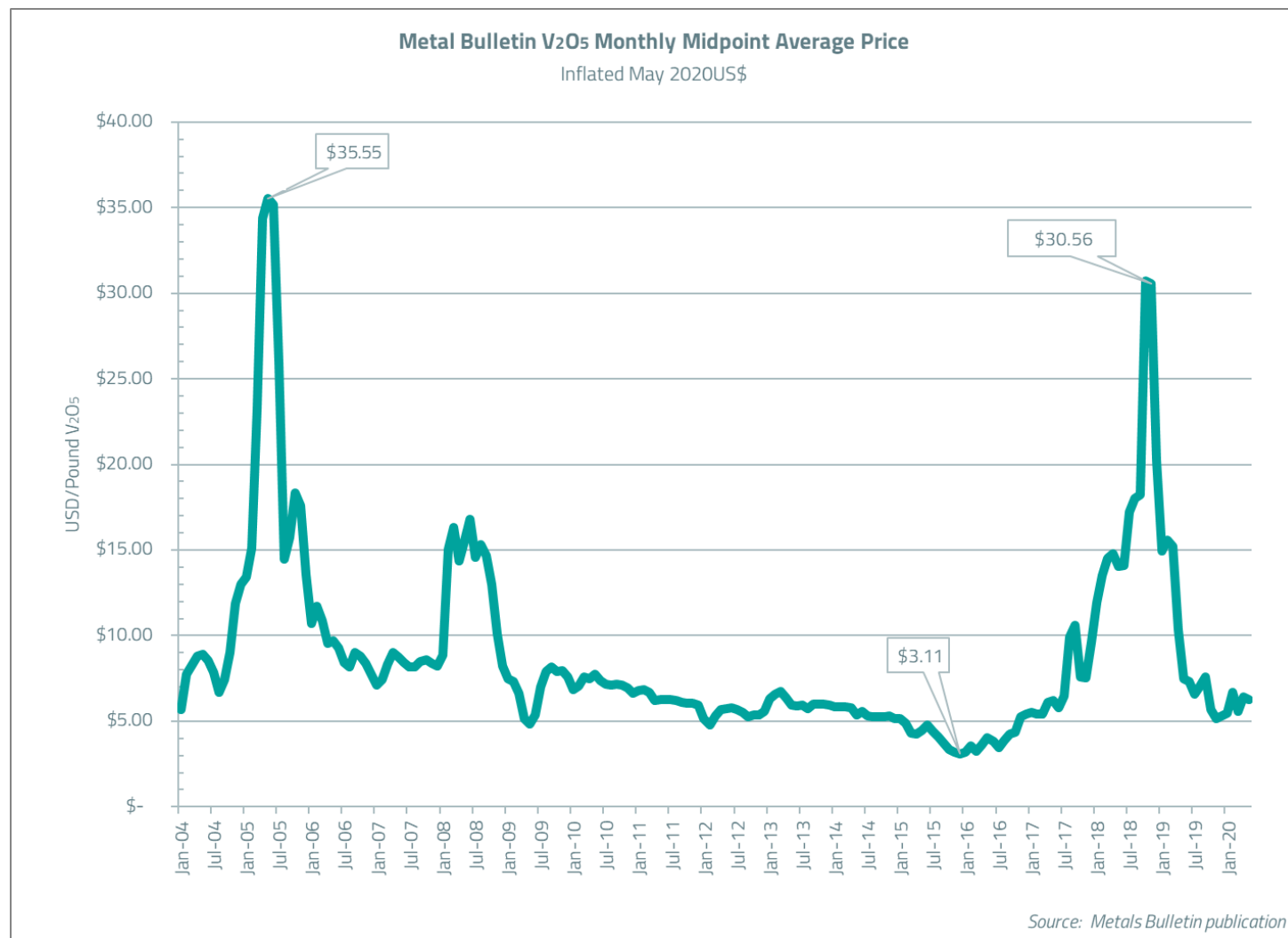
4% of vanadium consumption each, with significant potential for growth (super alloys, 3D printing, etc).

### Growth in Global Consumption

- Total expected vanadium consumption in 2020 is **104,000 Mt** (V metal equivalent - MTV).
- Annual global consumption predicted to grow to **>135,000 MTV** by 2025.
- Demand for vanadium in batteries could grow to **25,000 MTV** by 2030.
- AVL's current projected production is **5,600 MTV** per annum\* (**10,200 t V<sub>2</sub>O<sub>5</sub>**).

\* See ASX announcement dated 19<sup>th</sup> December 2018 'Gabanintha Pre-Feasibility Study and Maiden Ore Reserve'

# Vanadium Price



## Long-Term Price

Long-term average price for commodity grade V<sub>2</sub>O<sub>5</sub> is \$8.86/lb (inflated to 2017 USD).

- High purity V<sub>2</sub>O<sub>5</sub> is typically sold at a premium to the commodity price.

## Prices Negotiated Privately

Vanadium doesn't trade on the open market - sellers and buyers negotiate prices privately for contracts and spot purchases.

- London Metal Bulletin Fastmarkets (Europe)
- Ryan's Notes (US) weekly spot prices

## Vanadium Market Analysis

- According to respected market expert Terry Perles, consumption of vanadium has started to rise above production globally
- Historically China has only once been a net importer of vanadium, in Q1 2004
- Growing consumption in China is having a huge impact on its export capability

# PFS Vanadium Project Metrics\*

**TOTAL RESOURCE**  
208 Mt  
@  
0.74% V<sub>2</sub>O<sub>5</sub>



**HIGH-GRADE ZONE**  
87.9 Mt  
@  
1.06% V<sub>2</sub>O<sub>5</sub>

**INITIAL MINE LIFE**  
17 years



**V<sub>2</sub>O<sub>5</sub> PRODUCTION**  
22.5 Mlbs  
per annum

**QUALITY RESOURCE**



**LOW OPEX AND CAPEX**



**LONG MINE LIFE**



**EFFICIENT PROCESS**

**OPEX**  
US\$4.15/lb  
V<sub>2</sub>O<sub>5</sub>



**CAPEX**  
US\$354M

**LOM AVERAGE RECOVERY**  
64.1% vanadium



**LOM GRADE CONCENTRATE**  
1.37% V<sub>2</sub>O<sub>5</sub>

\* See ASX announcement dated 19<sup>th</sup> December 2018 'Gabanintha Pre-Feasibility Study and Maiden Ore Reserve'



# Project Location



- **Global Tier 1 mining location**
- **Mining Lease granted**
- **Unique coastal vanadium processing of vanadium**
- **Access to globally competitive natural gas supply**

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# Resource Summary

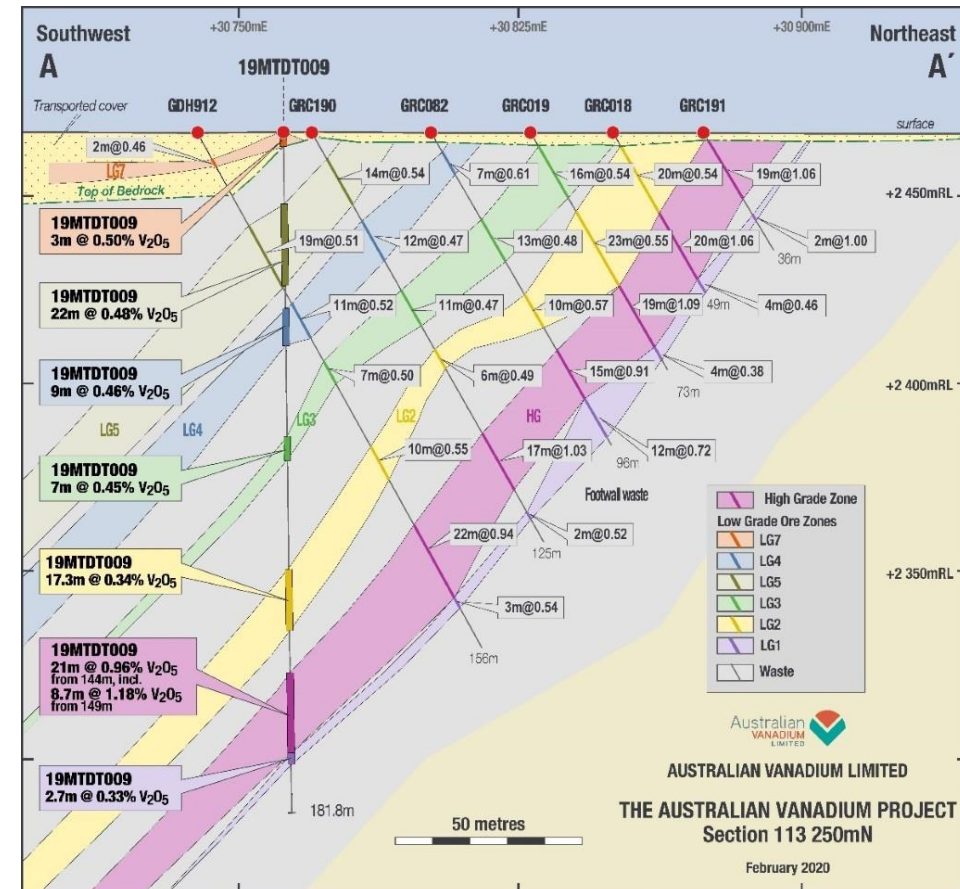
## The Australian Vanadium Project

- Located in Western Australia, approximately 43kms south of mining town Meekatharra.
- Consists of 11 tenements covering 260km<sup>2</sup> held 100% by AVL.
- Mining Lease granted
- High-grade, Bushveld-type VTM deposit drilled over 11km of AVL controlled strike with consistent geology.
- PFS initial mine life of 17 years, with significant ground for extension.

## Mineral Resource

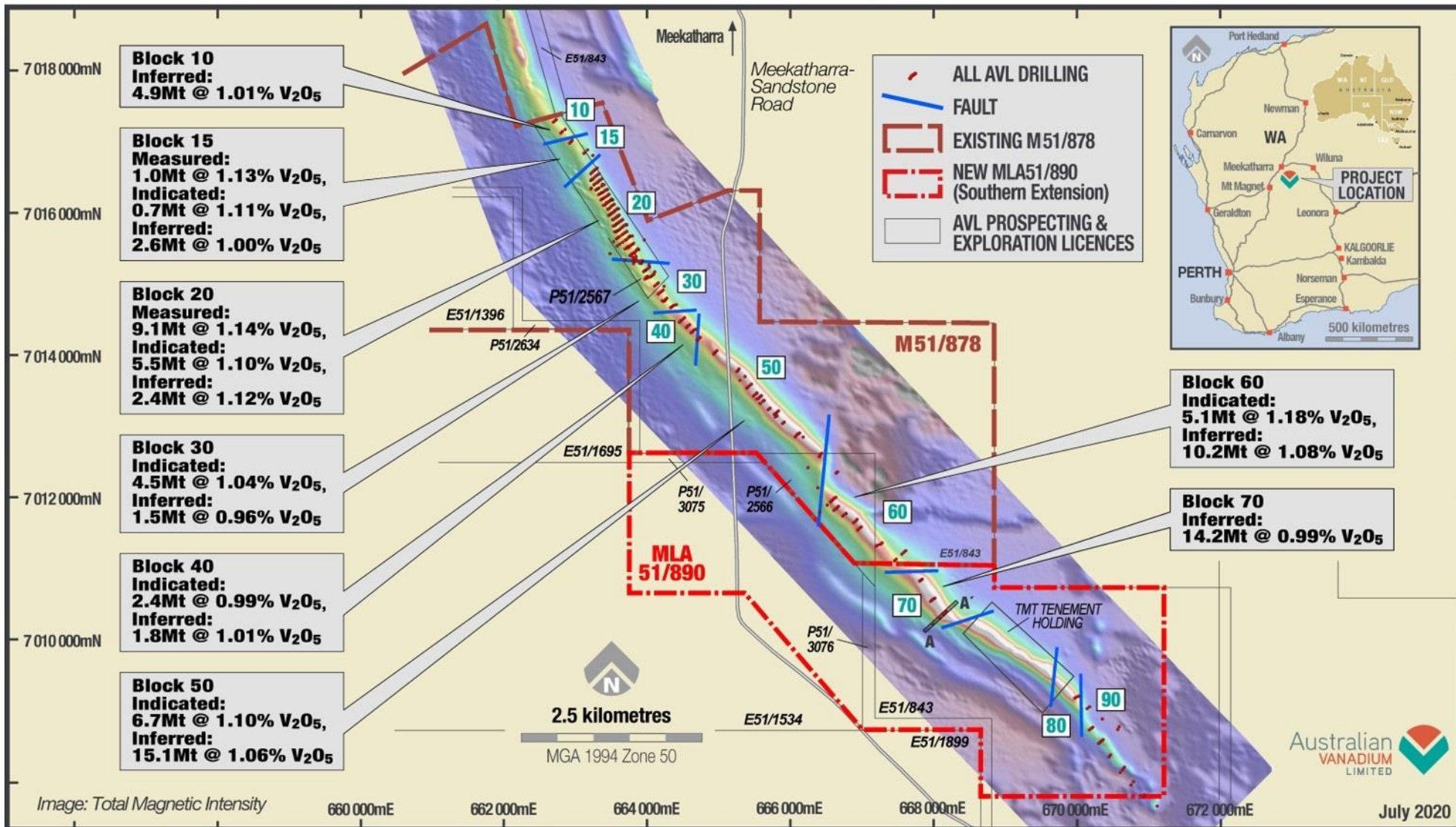
### Total Resource 208Mt 0.74% V<sub>2</sub>O<sub>5</sub>

- Combined Measured and Indicated Resource 35.2Mt at 1.11% V<sub>2</sub>O<sub>5</sub>.
- Massive high-grade zone 87.9Mt at 1.06% V<sub>2</sub>O<sub>5</sub> comprising 10.1Mt at 1.14% V<sub>2</sub>O<sub>5</sub> Measured, 25.1Mt at 1.10% V<sub>2</sub>O<sub>5</sub> Indicated and 52.7Mt at 1.04% V<sub>2</sub>O<sub>5</sub> Inferred Resource.
- Total low-grade zones Resource 120.4Mt at 0.51% V<sub>2</sub>O<sub>5</sub>. (see *Mineral Resource table*).



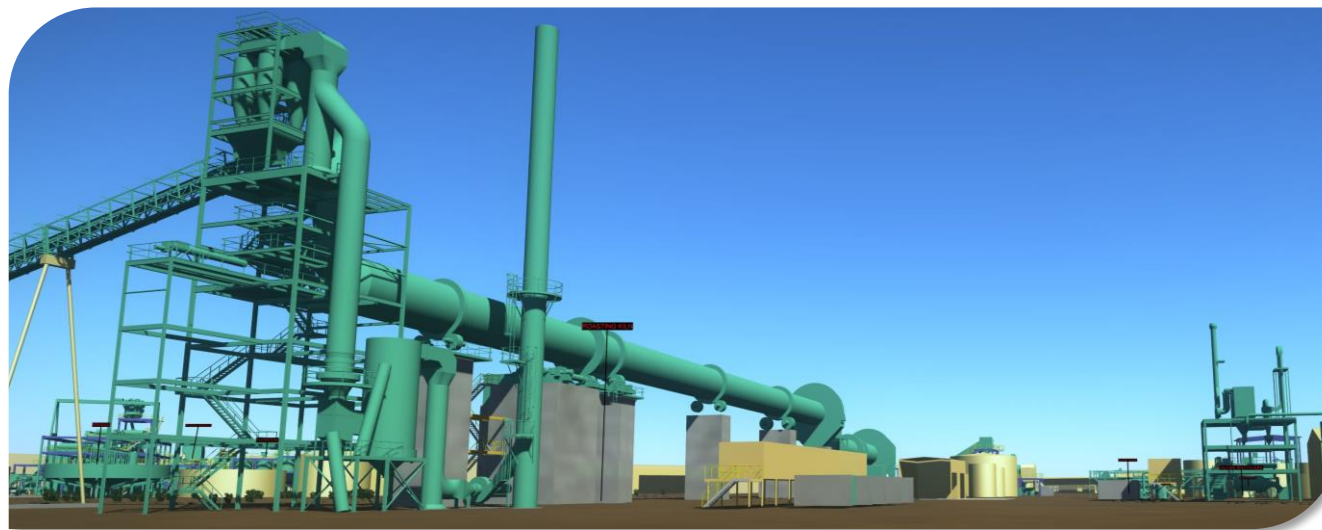
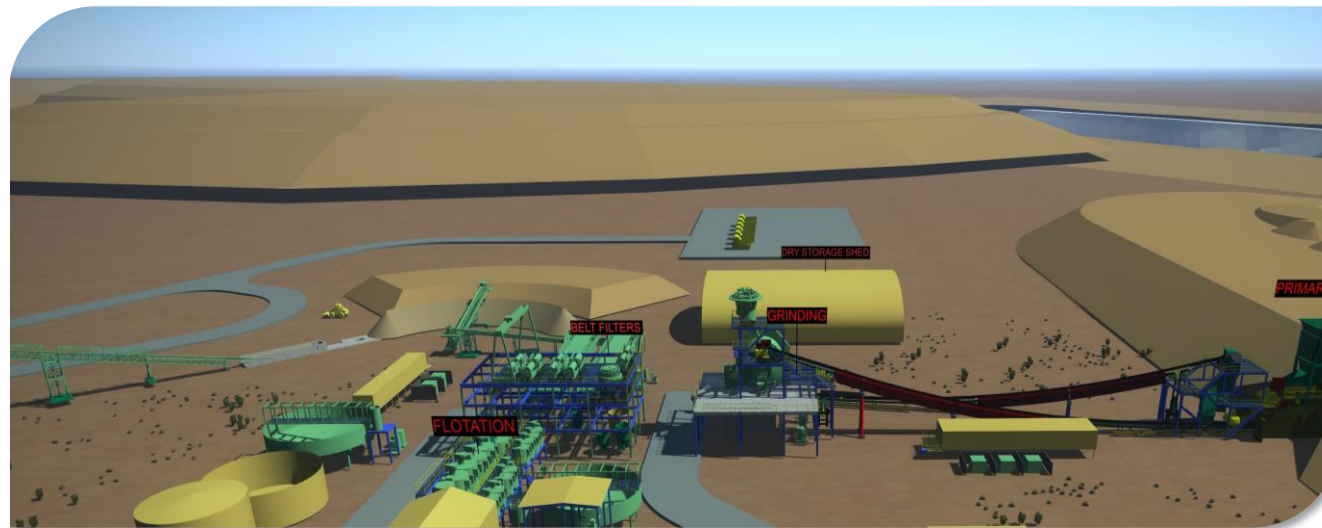
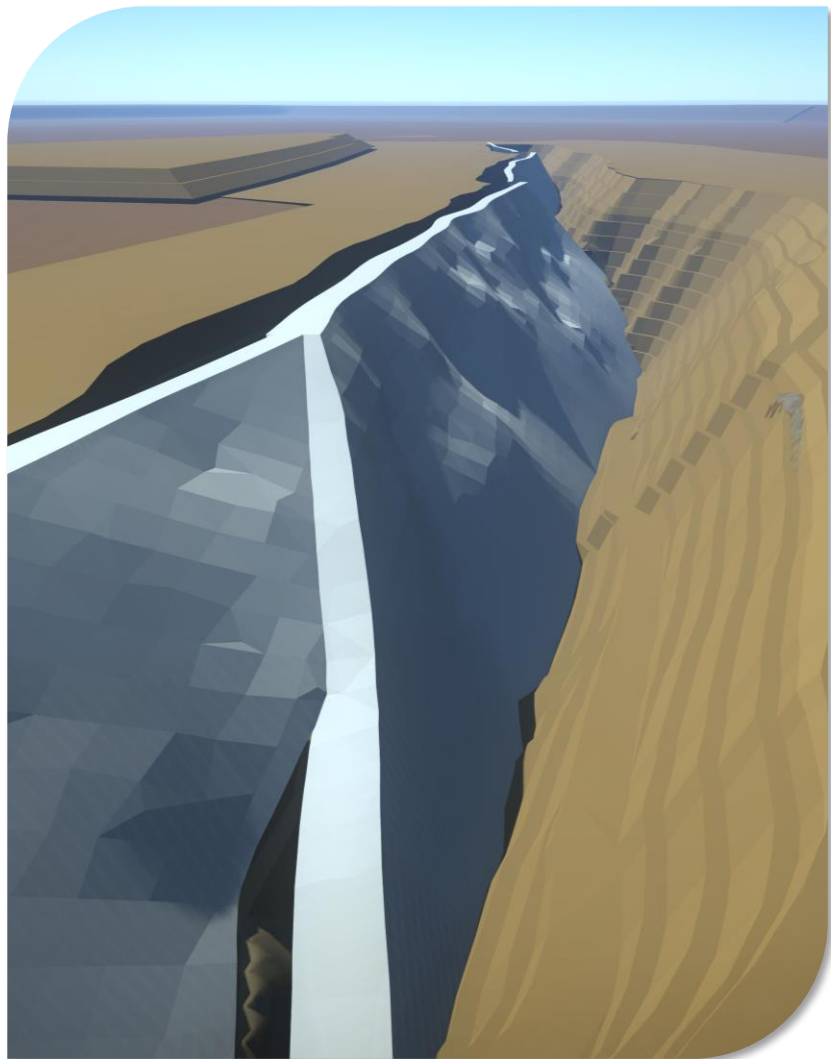
*The massive high-grade zone is the current focus of economic evaluation.*

# Resource Total Magnetic Intensity





# Pit, Beneficiation and Processing Plant





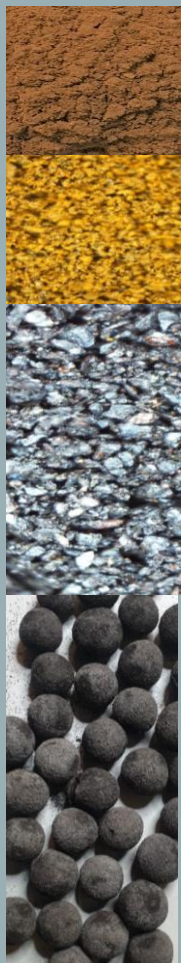
# AVL's Innovative Approach

## CMB – Crushing Milling & Beneficiation

- Extensive pilot study work completed on 20t of representative drill core
- Unique high vanadium yield achieved from massive magnetite zone:
  - Life of Mine 76% vanadium recovery, at a grade of 1.37%  $V_2O_5$  and 1.68%  $SiO_2$
  - First five-year ore blend 69% vanadium recovery at 1.39%  $V_2O_5$  and 1.83%  $SiO_2$
- High vanadium recovery and low silica content represent unique value opportunities for AVL in ongoing economic studies
- Achieved high vanadium recovery and low silica which are key to efficient downstream vanadium processing

## Processing Plant

- Extraction rate significantly improved through roast-leach process innovation:
  - Pelletisation and Grate Kiln
  - 93.3% average extraction, an 8% relative improvement on the PFS basis
  - Provides greater value per unit of ore processed than anticipated in PFS
- High-purity 99.4% vanadium pentoxide ( $V_2O_5$ ) produced from pre-pilot testwork
  - CRC-P funding to develop 99.9% high-purity vanadium process and titanium recovery
  - Coastal processing offers unique iron co-product opportunities



# Innovative Project Layout

### Coastal Processing

BFS focused on processing plant near coast offering significant opportunities.

- Proximity to gas pipeline infrastructure and associated low domestic gas prices.
- Opportunity for lowest quartile Opex over life.
- Existing road, rail, water and gas infrastructure.
- Available local workforce.
- Reduced Capex and water use at Project minesite.
- Strong government support.



# Federal and State Government Support



## Australian Government

### Major Project Status

The Project has been awarded Major Project Status by the Federal Government in recognition of its national significance.

### CRC-P Grant for Vanadium Research

Federal grant awarded for improving vanadium processing efficiency:

- Development of an ultra-high-purity production path.
- Extraction of valuable by-products including critical minerals (eg titanium).
- Increasing recoveries from mine to mill.
- Reduction of mining and processing waste products.



## GOVERNMENT OF WESTERN AUSTRALIA

### Lead Agency Status

- The Project was awarded Lead Agency Status by the Western Australian State Government.
- The Lead Agency for the Project is the Department of Mines, Industry, Regulation and Safety with the support of the Department of Jobs, Tourism, Science and Innovation.
- Principal Advisor appointed to assist with advice on key approvals and co-ordination across government agencies.

**Vanadium is both a critical mineral and a battery mineral – sought after by Australia, US, UK, EU and other major industrial countries**



# Broader State Economic Impact Analysis

## Employment Opportunities

- During construction 500 jobs will be provided, 250 jobs at each of the two sites.
- Once construction is complete there will be approximately 240 jobs in total, 120 jobs at each site with a further headcount in the corporate office based in Perth.
- Using a mining industry standard job multiplier of 4, the estimated jobs for the entire project is about 3,000. *A job multiplier measures the amount of direct and indirect jobs created in the region as a result of the primary operation.*



## Mid-West region of Western Australia

### Geraldton

- With the processing plant located near to Geraldton, there will be significant economic impact on this area and the ability for the workforce to be located in a growing and vibrant town.

### Meekatharra

- AVL aims to ensure that the community of Meekatharra is offered job opportunities on site where appropriate.
- The company provides support for the town through volunteer work and expenditure into the businesses in town.
- During the exploration stage, AVL has been providing economic benefit to Meekatharra, with the company spending over \$350,000 on services from local businesses in the 2018/19 financial year.



# What makes AVL unique?



- Deposit size and strike length allowing for flexibility in mining and scheduling
- AVL's thorough understanding of the geo-metallurgical characteristics of its project resources, due to extensive and complete study work
- Low risk, high recovery flowsheet which has been fully piloted
- Location of processing plant closer to cheaper gas and local workforce near port and infrastructure reduces capital and environmental risk
- AVL team's extensive vanadium industry and processing, corporate experience
- VRFB market development through subsidiary VSUN Energy – a market maker

# Key Objectives for 2020

## **Offtake Agreements**

Offtake agreements with credible partners for final vanadium products

## **Finance**

Maintain strong financial position  
Qualification with financiers for Project equity and debt and/or Joint Venture partnerships

## **Environmental Approval**

Submission of environmental approval

## **Feasibility Studies**

Completion of engineering and BFS level costing

## ✓ **Social Licence to Operate**

Mining Lease granted  
Increase regional community engagement

## ✓ **Government Support**

Achieve Federal and State Government recognition and support

# Project Summary

## Completed

- Exploration success – large high quality VTM resource ✓
- Resource and Reserves for initial 17 year mine, significant potential for extension ✓
- Completed PFS showing strong fundamentals through all price cycles ✓
- CMB Pilot study (30t) ✓
- MOU with first significant party regarding finance, offtake of vanadium oxides ✓
- MOU with Westgold for life-of-mine water requirements ✓
- Increase Project Resource supporting longer minelife ✓
- Mining Lease granted ✓

## Ongoing Priorities

- Completion of large-scale downstream processing pilot program and definitive process flow diagrams
- Environmental impact studies, water and submission to EPA
- Mining approval
- Financing and resource bank engagement (partnerships, MOUs)
- Offtake agreements
- Mining schedule and financial model based on new Resource profile

## Planned

- BFS 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



## Updated 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	1.14	43.9	13.0	9.2	7.5	3.9
	Indicated	25.1	1.10	45.4	12.5	8.5	6.5	2.9
	Inferred	52.7	1.04	44.6	11.9	9.4	6.9	3.3
	<b>Subtotal – High Grade</b>	<b>87.9</b>	<b>1.06</b>	<b>44.7</b>	<b>12.2</b>	<b>9.2</b>	<b>6.8</b>	<b>3.2</b>
Low Grade	Indicated	44.5	0.51	25.0	6.8	27.4	17.0	7.9
	Inferred	60.3	0.48	25.2	6.5	28.5	15.3	6.7
	<b>Subtotal – Low Grade</b>	<b>104.8</b>	<b>0.49</b>	<b>25.1</b>	<b>6.6</b>	<b>28.0</b>	<b>16.1</b>	<b>7.2</b>
Transported	Inferred	15.6	0.65	28.4	7.7	24.9	15.4	7.9
	<b>Subtotal – Transported</b>	<b>15.6</b>	<b>0.65</b>	<b>28.4</b>	<b>7.7</b>	<b>24.9</b>	<b>15.4</b>	<b>7.9</b>
Total	Measured	10.1	1.14	43.9	13.0	9.2	7.5	3.7
	Indicated	69.6	0.72	32.4	8.9	20.6	13.2	6.1
	Inferred	128.5	0.73	33.5	8.8	20.2	11.9	5.4
	<b>Total</b>	<b>208.2</b>	<b>0.74</b>	<b>33.6</b>	<b>9.0</b>	<b>19.8</b>	<b>12.1</b>	<b>5.6</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).



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# VSUN Energy



vsun energy



# VSUN Energy: A Renewable Energy Company



## About VSUN Energy

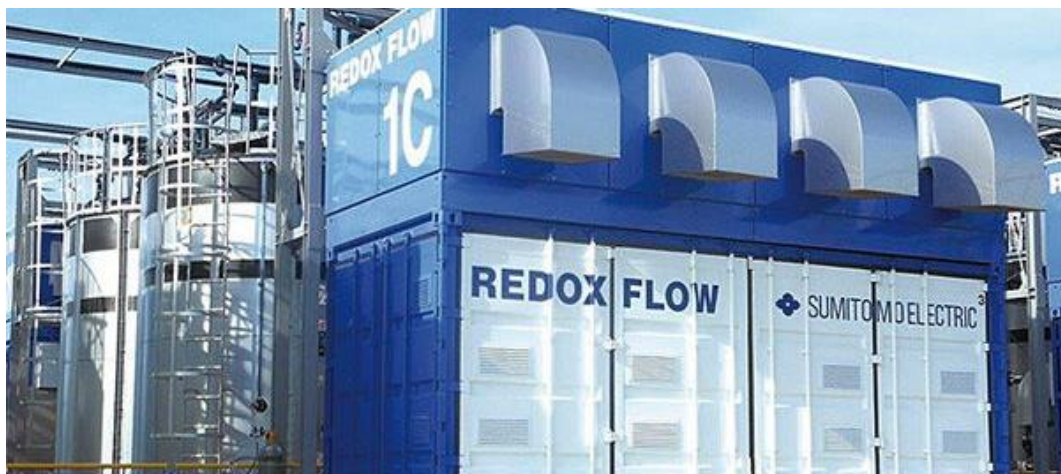
- VSUN Energy is a renewable energy company focused on sale of vanadium redox flow batteries (VRFBs) for energy storage.
- VSUN Energy is AVL's fully owned subsidiary, launched in 2016 to grow the VRFB market in Australia and increase the domestic vanadium market.
- Significant shift in global energy markets towards long duration +4 hours baseload – niche only able to be filled by large-scale grid-connected VRFBs.



## Recent Sales – Victoria Agribusiness

- 90kW/320kWh VRFB for a dairy in Meredith, Victoria.
- 20kW/80kWh VRFB plus solar energy storage system for an orchard in Pakenham, Victoria.
- Each system will provide a minimum of four hours of stored renewable energy, allowing the clients to increase onsite renewable generation and consumption.

# Energy Storage Business Opportunities



## Vanadium Electrolyte

Vanadium electrolyte (produced from high purity vanadium) in short supply

- Low levels of investment in refining  $V_2O_5$  and electrolyte production
- Investment needed in VRFB market development and electrolyte production increases

Vanadium leasing is a revenue generating opportunity

## Large Scale Installations

Large grid-scale VRFB implementations to assist with renewable energy penetration and carbon-based fuel reduction

- Energy, VRFB and vanadium electrolyte markets are expected to increase vanadium consumption globally
- 100MWh of energy storage uses 989t  $V_2O_5$ , with AVL's annual production estimated at 10,000t  $V_2O_5$  per annum





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# Contact AVL

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