

vsunenergy

**MARCH 2023** 

Paydirt Battery Minerals Conference

### ASX CHAPTER 5 COMPLIANCE AND CAUTIONARY AND FORWARD-LOOKING STATEMENTS

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#### ASX Listing Rules 5.19 and 5.23

#### **ASX Listing Rule 5.19**

The information in this Presentation relating to production targets, or forecast financial information derived from a production target, is extracted from the announcement titled "Bankable Feasibility Study for the Australian Vanadium Project" released to the ASX on 6 April 2022 which is available on the Company's website www.australianvanadium.com.au.

The Company confirms that all material assumptions underpinning the production target, or the forecast financial information derived from a production target, in the original market announcement continue to apply and have not materially changed.

#### **ASX Listing Rule 5.23**

The information in this Presentation relating to exploration results and mineral resource and ore reserve estimates for the Australian Vanadium Project is extracted from the announcement titled "Bankable Feasibility Study for the Australian Vanadium Project" released to the ASX on 6 April 2022 which is available on the Company's website 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 that all material assumptions and technical parameters underpinning the estimates in the original 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 have not been materially modified from the original market announcement.

#### **Forward Looking Statements**

This Presentation may contain certain forward-looking statements with respect to matters including but not limited to the financial condition, results of operations and business of AVL and certain of the plans and objectives of AVL with respect to these items. These forward-looking statements are not historical facts but rather are based on AVL's current expectations, estimates and projections about the industry in which AVL operates and its beliefs and assumptions.

Words such as "anticipates," "considers," "expects," "intends," "plans," "believes," "seeks," "estimates", "guidance" and similar expressions are intended to identify forward looking statements and should be considered an at-risk statement. Such statements are subject to certain risks and uncertainties, particularly those risks or uncertainties inherent in the industry in which AVL operates.

These statements are not guarantees of future performance and are subject to known and unknown risks, uncertainties, and other factors, some of which are beyond the control of AVL, are difficult to predict and could cause actual results to differ materially from those expressed or forecasted in the 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.

AVL cautions shareholders and prospective shareholders not to place undue reliance on these forward-looking statements, which relate only to events as of the date on which the statements are made.

#### ASX:AVL

# Why Vanadium? Industrial, critical, and (battery metal)<sup>2</sup>

#### **Steel Alloy: Growth Market**

#### **Industrial Metal**

- Increased use of vanadium alloyed steels is a force multiplier in reducing carbon footprint
- 20 years of continuous demand growth, set to accelerate as higher specific V use continues to increase

#### **Quality of Life: Growth Market**

#### **Critical Metal**

- Vanadium contributes to sustaining and improving our quality of life. It is used extensively in aerospace, defence and chemical catalysts
- Over 75% of global vanadium supply currently sourced from China, Russia, and South Africa
- There is a case to diversify supply chains toward stable, ESG credentialled jurisdictions



#### **Energy Storage: Growth Market**

#### **Battery Metal (Horizon 1 VRFBs)**

- Vanadium redox flow batteries (VRFBs) are a mature and proven technology ideally positioned to meet demand for long duration storage.
- 2% of V market historically, expected to be >10% in 2023
- More VRFB capacity has been commissioned in the last 12 months than the entire prior 40 year history of VRFB technology combined

#### **Innovation: Future Upside**

#### **Battery Metal (Horizon 2 Lithium-ion)**

- Multiple advanced pre-commercialisation technologies showing significant economic and technical merits of vanadium use in lithium-ion cathodes and anodes
- Potential to improve Li-ion batteries including energy density, charge rate, cycling, and safety
- Vanadium use in solid state lithium metal batteries is another exciting application for vanadium under research

### AUSTRALIAN VANADIUM LIMITED Vanadium – consensus on demand growth

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Vanadium demand to **double by 2032**, with more than 90% of this growth from Vanadium Redox Flow Batteries (VRFBs).



VRFBs will **fundamentally restructure** the vanadium supply chain.



Massive growth in batteries will **stress supply**.

'Assuming even modest growth in vanadium consumption in energy storage applications, the industry will be **challenged to meet surging demand** in the coming decade.' **TTP Squared** 

### *e*Research

Currently, it is estimated that the VRFB market only accounts for 3%-5% of vanadium production but the continued shift to renewable energy solutions could trigger a surge in vanadium demand and account for **20% of vanadium consumption by 2030**.

Sources: Stockhead, TTP Squared, Project Blue, eResearch, Wood Mackenzie

# Industrial metal and battery metal demand growth



### **VRFB:** Technical merit









Vanadium electrolyte can be **reused indefinitely** or recycled for use in

steel market

Long duration

Easy to scale power and energy separately Lifespan over 20 years with little to no degradation in performance over time Non-flammable making it one of the safest and most stable battery chemistries

Multiple daily cycles, with **100% depth of discharge** available

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### VRFB: Financial merit

Example cost comparison for VRFB vs Lithium-ion 3MW / 24MWh (8 hour) system over 20-year lifespan



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#### ASX:AVL

### AUSTRALIAN VANADIUM LIMITED Vanadium in lithium-ion (Energy Storage, Growth Horizon 2)

- Vanadium is an ideal candidate for use in lithium-ion batteries due to unique properties and scalability
- Vanadium known for decades to improve lithium-ion performance, but earlier use impacted cycle life.
- Multiple promising technologies (eg Dimien-cathode, Tyfastanode) claim to overcome past challenges
- Opportunity to substantially reduce the cost of lithium-ion cathodes, improve energy density, charge times, cycling, safety
- Vanadium is also considered an important ingredient in lithium metal batteries (eg Pure Lithium)





Sources – 'V Market Data', TTP Squared, Inc, https://www.mckinsey.com/industries/automotive-andassembly/our-insights/battery-2030-resilient-sustainable-andcircular, Company websites, Interview with Joe Lowry 26/2/23

#### ASX:AVL

# Why AVL?

**Vertical Integration** 

**Ethically Sourced** 

Distinctive ability to produce an ethical, low

carbon product

Industry leading product quality, LoM

True "Pit to Battery" integration optionality



**Track Record** 

Track record in raising capital and securing significant

#### **Asset & Scalability**

- 25+ years mine life, competitive C1 OPEX
- Hub Processing Configuration: built for scalability
- Scalable Infrastructure: gas and logistics
- Scalable Feed: proximal to 1B tonnes similar ore types
- Premium mining & processing jurisdiction: Western
   Australia

#### **Green Lights**

- A recent, comprehensive BFS, advanced approvals status
- Strong relationships: \$49M MMI-C Federal Government Grant (Multiple Grants, Major Project Status), Critical Minerals Office Austrade; State Government (Lead Agency Status)
- One of the most advanced undeveloped vanadium projects in the world
- Positioned with early mover advantage and supplier of choice status in the battery market.

#### **Collective Expertise**

- Technical team in place from inception of asset development strategy
- Commodity experience in board, executive, and technical teams

#### **Quality of Board and AVL Team**

- A future-proofed board with the right skillsets to finance, build, and operate the project and grow a globally relevant company in this commodity
- A team that can deliver with proven technical and commercial track record in vanadium, project development, operations

### A TEAM THAT CAN DELIVER International vanadium expertise Track record in project execution and operations





Experienced Chair with extensive executive career in resources. energy,

and investment

banking.

**Cliff Lawrenson Non-Executive** Director



**Vincent Algar** Managing Director



management

of publicly

companies.

listed

**Daniel Harris** Non-executive Director

Board

#### Over 40 years of vanadium experience including executive leadership of global vanadium

operations.

companies, and

Miriam Stanborough **Non-Executive** Director

Over 20 years of experience in mineral processing. research. operations, technology &

Peter Watson innovation. Non-Executive Roles with Director Monadelphous, Iluka, Alcoa and WMC.



senior technical. project and management roles, executive experience running ASXlisted companies.

40 years of

experience in



Mineral sector experience spans vanadium and lithium project development and operations.

Graham Arvidson **Chief Executive** Officer



Todd **Richardson Chief Operating** Officer



Over 20 years of experience in the vanadium sector and an expert in vanadium

process design. **Louis Mostert** commissioning **Chief Legal and** and operations. **Commercial Officer** 



experience in contracting and corporate advisory. mergers and acquisitions.



**Liesl Strachan Chief Financial** Officer







### Australian Vanadium Project BFS – Robust Project Metrics



RESOURCE

**Total Resource 239Mt @ 0.73% V<sub>2</sub>O<sub>5</sub>** High-grade 95.6Mt @ 1.07 V<sub>2</sub>O<sub>5</sub>

Ore Reserve **30.9Mt @ 1.09 V<sub>2</sub>O<sub>5</sub>** Proved 10.5Mt @1.11% V<sub>2</sub>O<sub>5</sub> Probable 20.4Mt @V<sub>2</sub>O<sub>5</sub>

> 25+ years mine life



STRONG FINANCIAL OUTCOMES

Pre-Tax NPV<sub>7.5</sub>

IRR
20.6%

EBITDA Annual Average

EBITDA Project

NPAT Project

Note: Information within this slide as detailed in ASX Announcement "Bankable Feasibility Study for Australian Vanadium Project" dated 6th April 2022. All material assumptions underpinning the production target and forecast financial information derived from a production target continue to apply and have not materially changed Note: MTV = metric tonnes vanadium

OPEX, CAPEX, ուՈ PRODUCTS C1 OPEX US\$4.43/lb V<sub>2</sub>O<sub>5</sub> **PRE-PRODUCTION** CAPEX US\$435M ANNUAL V PRODUCTION 11,200t V<sub>2</sub>O<sub>5</sub> (6,270 MTV) LoM V<sub>2</sub>O<sub>5</sub> Grade 99.5% **FeTi Coproduct** 

900,000tpa

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# Supply curve – AVL Project well positioned

"The cash cost of the last incremental units required to satiate demand in 2022 is above US\$12.00/Ib V<sub>2</sub>O<sub>5</sub>" – TTP Squared



#### 2022 V2O5 Cash Cost Curve

Source: TTP Squared, inc.

<sup>1</sup>See ASX Announcement "Bankable Feasibility Study for Australian Vanadium Project" dated 6<sup>th</sup> April 2022. All material assumptions underpinning continue to apply and have not materially changed.

## Historical pricing – AVL Project well positioned



"Long term inflated  $V_2O_5$  historical prices are in the range of US\$9.00-\$12.00/lb  $V_2O_5$ " – TTP Squared



V2O5 Real Price Distribution Chart, Jan. 2004-Nov. 2022, Inflated to Aug 2022 US\$

<sup>1</sup>See ASX Announcement "Bankable Feasibility Study for Australian Vanadium Project" dated 6<sup>th</sup> April 2022. All material assumptions underpinning continue to apply and have not materially changed.



# Project Delivery Path



ASX:AVL

ASX:AVL

# Funding model



### ESG IN ACTION Strong ESG Focus

#### **Renewable energy strategy**

- Ability to produce ethical, low carbon vanadium product, expecting to be 50% lower carbon intensity per unit of vanadium than existing co-production vanadium producers<sup>1</sup>
- Use of solar and/or wind generation
- Use of VRFBs for energy storage
- Collaboration with ATCO for use of green hydrogen into the natural gas supply at the processing plant through ATCO collaboration
- Exploring use of electric or green hydrogen fuelled vehicles onsite and for haulage



### **Community relationships**

- Workforce participation opportunities for Yugunga-Nya traditional owners
- Regional Engagement Manager based in Geraldton
- Sponsorship of awards and scholarships at Central Regional TAFE
- Mullewa community sponsorship
- Stephen Michael Foundation and Shooting Stars sponsorship





#### Governance

- Developing ESG reporting structure aligned to the developing ISSB framework through application of SASB, TCFD, and GRI reporting structures
- Experienced and competent Board of Directors
- Long term engagement with Environmental Protection Agency
- Organisational culture



### Vertical Integration

## Pit to Battery

Vertical integration optionality can give AVL the ability to produce the world's highest quality vanadium products tailored to our customers' needs from steel (low purity requirements) through to speciality chemicals (ultra high purity).

In addition to production, AVL will seek to participate economically in the vanadium value chain through partnerships and joint ventures



# **VSUN Energy: Current Projects Overview**



VSUN Energy is a 100% owned subsidiary of ASX-listed Australian Vanadium Limited (ASX: AVL)

### **Current Projects**

- Water Corporation successful completion of trial of a 5kW/30kWh vanadium redox flow battery (VRFB) to power a chlorinator.
- IGO (ASX: IGO) installation of an 80kW/300kWh VRFB standalone power system (SPS) to provide power to a bore pump at the Nova Nickel Operation (pictured right, currently being tested in Perth).
- **Priest Bros Orchard**, Victoria installation of a 20kW/80kWh VRFB.
- Consultancy work for major mining clients underway
- Tender applications underway
- Well positioned to position in a significant future pipeline



### Vanadium Electrolyte Project Update

- 33MWh per annum electrolyte plant under development
- AVL to be an early mover in electrolyte manufacture in Australia
- Location secured in Perth, Western Australia
- Detailed design complete
- Long lead equipment ordered
- Utilises proven US Vanadium technology



### **VUS** VANADIUM



VANADIUM ELECTROLYTE MANUFACTURE



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U.S. Vanadium LLC electrolyte plant in Arkansas, US



# In Summary Why Vanadium, and why AVL?





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