Australian VANADIUM LIMITED

Upstream, Midstream, and Downstream: Unlocking an Australian VFB Supply Chain

40th Anniversary Flow Battery Symposium

October 2024

ASX:**AVL**

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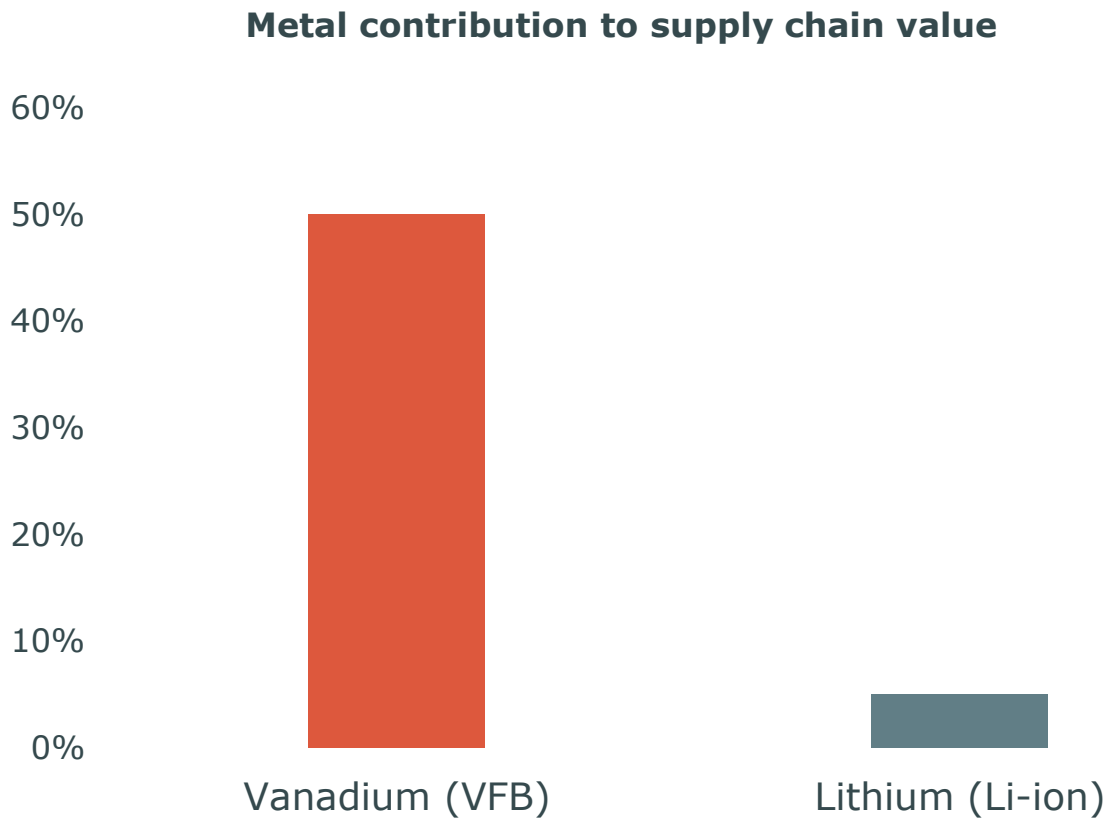
A renewables-based energy transition requires both electricity generation AND matched energy storage

- There is enormous effort and spend on electricity generation – **too little on energy storage despite ambitious decarbonisation targets from State and Federal Governments**
- Vanadium flow batteries provide a **proven, economic solution** for utility scale energy storage
- The value of vanadium in a flow battery provides AVL with an **unparalleled opportunity for value creation**

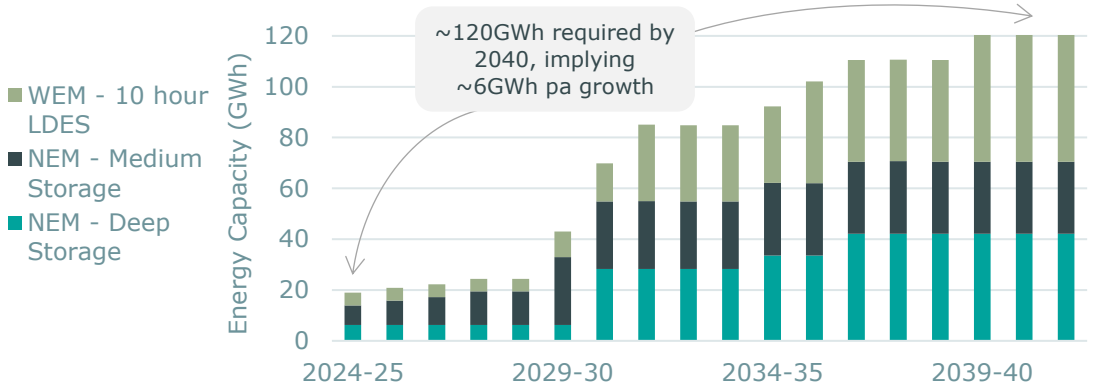


Indicative only. Based on installed capex of total battery deployment
Source: FBICRC Li-ion battery cathode manufacturing in Australia: A Scene Setting Project and AVL analysis

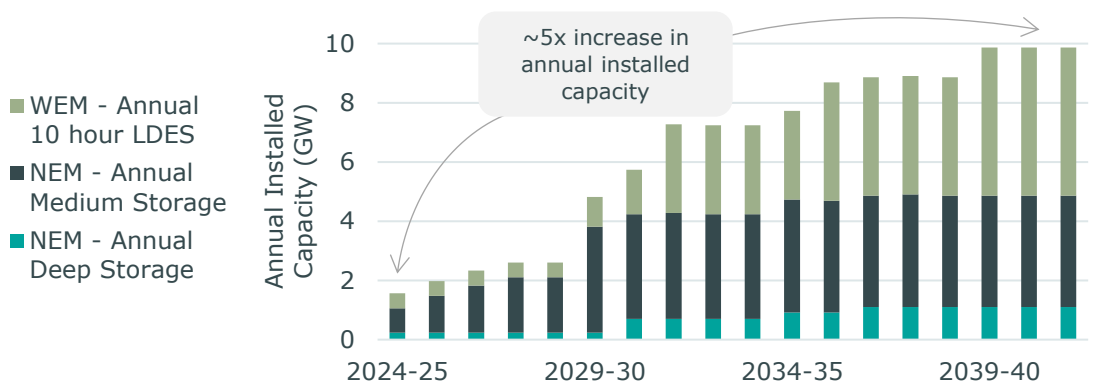
Long duration storage – an unprecedented opportunity

A critical shortage of Medium and Long Duration BESS storage in the Australian market between 2025 and 2035 is looming, as legacy coal plants are slated to be shutdown.

1 Medium/Long-Duration Energy Storage Capacity Requirements in GWh *(excluding AEMO planned pumped hydro capacity)*[2]



2 Medium/Long-Duration Energy Storage Installed Capacity in GW *(excluding AEMO planned pumped hydro capacity)*[2]



3 Implications

- Medium/Long duration storage capacity is forecast to **grow to 120GWh** by 2040, growing at an unprecedented **6 GWh pa for the next ~25 years**.
- **AEMO's implied average duration** for the 120GWh medium / long duration energy storage (excluding pumped hydro) is ~**11 hours**[3]
- **VFBs** are expected to be one of the most credible/proven solutions to meet this demand (120GWh excludes planned pumped hydro).

Why Critical Shortage of Medium/Long-Duration Storage in Australia?

- Australia plans to **retire over 20GW of coal assets by mid 2030**, replacing them with ~80% intermittent renewable sources (VRE).
- **Intermittent renewables lack power stability**, making energy storage a necessity for the implementation of VRE.
- Vanadium flow battery and alternative medium / long duration storage technology **supply chains need to ramp-up significantly** to meet demand.
- **AEMO is relying on pumped hydro to supply 400GWh** of medium / long duration storage demand, **if this slips it amplifies demand for VFBs/Other.**

1. Australian Energy Market Operator (AEMO) 2024, 2024 Draft Integrated System Plan, AEMO
2. Excludes energy requirements for the Northern Territory and WA's Pilbara region.
3. Chart #1 divided by chart #2, implies average storage requirement of 11 hours.

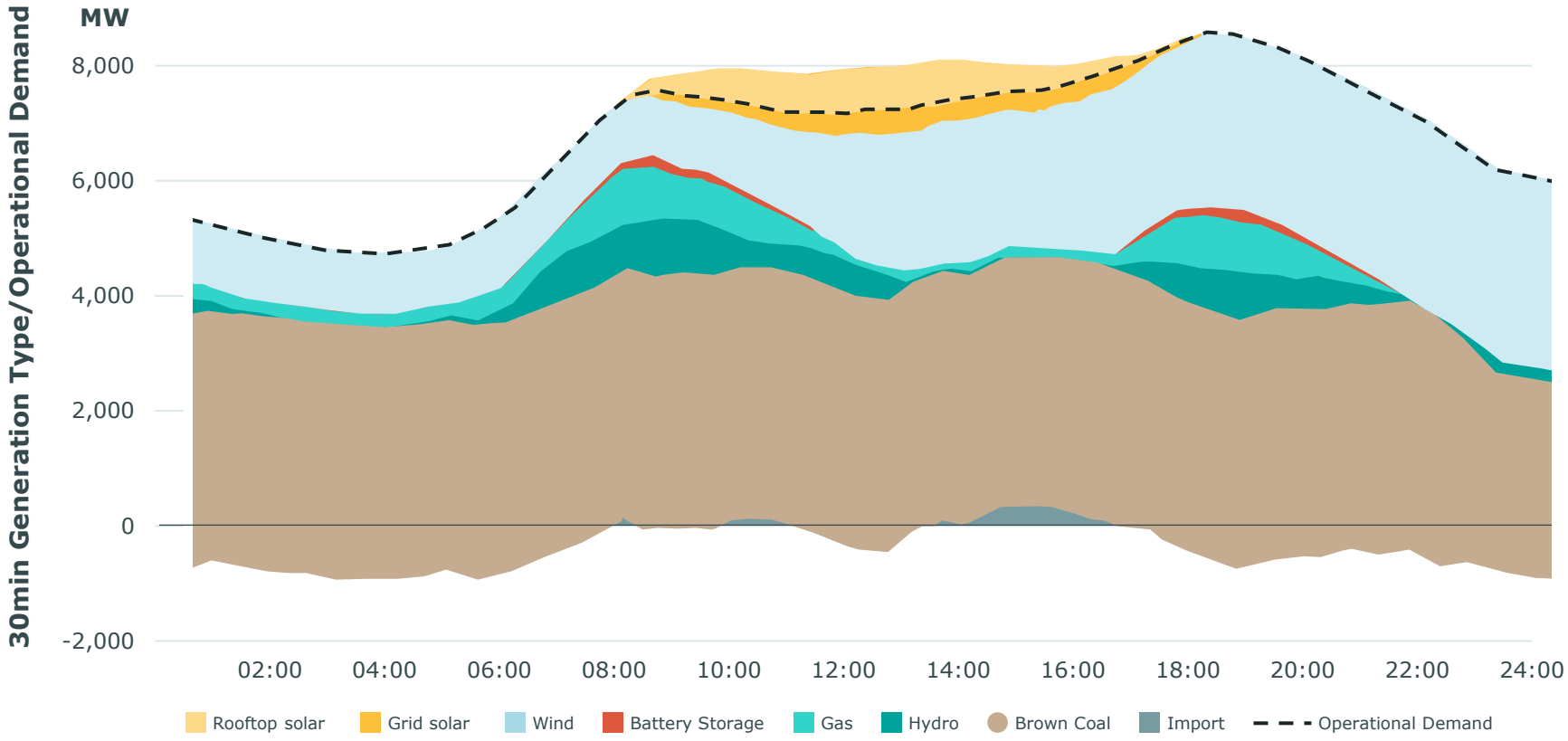
Victoria case study – grid scale storage required

Victoria recently set a new peak power demand record of 8.6GW

Brown coal and wind provided the majority of supply

Victoria needs long duration energy storage to **reduce the reliance of the grid on brown coal** and **achieve emission reduction targets**

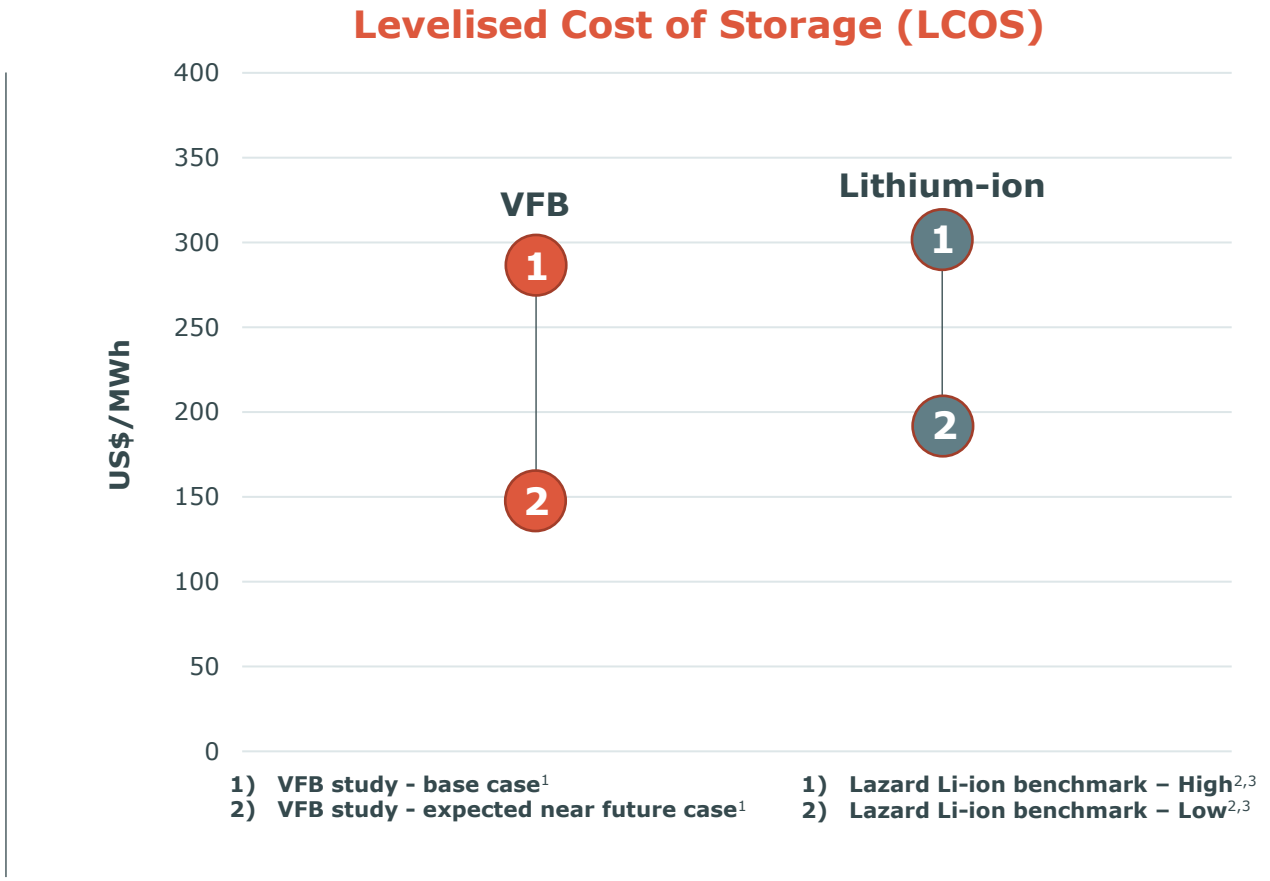
Winter operational demand – Victoria 15 July 2024



Source: AEMO

Levelised Cost of Storage

Large scale vanadium flow batteries are projected to have a lower LCOS than the current benchmark utility-scale lithium batteries, driven by their **30+ year life** and residual value (recycle value of the electrolyte).



1. Poli et al. Techno-economic assessment of future vanadium flow batteries based on real device/market parameters, Applied Energy 2024.
2. Lazard. Levelized Cost of Energy, June 2024. Pages 20 and 41-42.
3. Lazard LCOS: 20-year project life; 400MWh; 90% DoD; 90% RTE; One cycle/day; 2.6% battery degradation p.a.; 350 days a year; USD/AUD 0.7, WACC 11.2%

AVL - Vertically integrated to generate value across the supply chain

	Upstream	Midstream	Downstream
	 **Vanadium Mining and Processing**	 **Electrolyte Manufacture**	 **Battery Installation and Maintenance**
Asset	Australian Vanadium Project	Electrolyte manufacturing facility	VSUN Energy
AVL advantage	High-grade project in Tier-1 jurisdiction	Established facility	Vertically integrated to deliver cost competitive VFB storage solutions
Status	Optimised Feasibility Study underway	Producing battery grade electrolyte	Establishing key partnerships to accelerate growth

UPSTREAM

The world class Australian Vanadium Project unlocks our vertically integrated strategy

- A world class asset located in Western Australia, a Tier-1 mining jurisdiction
- Simple open pit mining with standard magnetite concentrator process
- Proven processing technology that reduces project risk
- Optimised Feasibility Study (OFS) underway, aimed at creating project with superior economics
- Current focus on finalising remaining approvals, while securing offtake and funding

MIDSTREAM
Proven vanadium electrolyte manufacturing capacity

AVL built, owns and operates a manufacturing facility in Perth, Western Australia, capable of commercial vanadium electrolyte production

- 33MWh per annum energy storage equivalent of vanadium electrolyte production
- First production completed in 2024
- First use of AVL's vanadium electrolyte in an Invinity Energy Systems battery for WA utility Horizon Power
- Qualification of electrolyte well advanced with VFB industry leaders
- Ability to scale and replicate facility to meet growing demand
- Ability to process 3rd party vanadium oxides to supply high quality electrolyte prior to AVL oxide production

DOWNSTREAM
VSUN Energy – engaging with mining and utility customers

IGO Limited

Nova Nickel Operation (Western Australia)

Installation of a VFB to provide storage capacity to allow for carbon free electricity to be used 24/7 at the Nova Nickel operation, reducing their CO_2 emissions as part of IGO's broader net-zero strategy.

Status: Battery operational, standalone power system under final stages of commissioning

Horizon Power

Kununurra (Western Australia)

Horizon Power, a utility owned by the Western Australia government, purchased a vanadium flow battery (VFB) to be installed at Kununurra as part of a long-duration energy storage project.

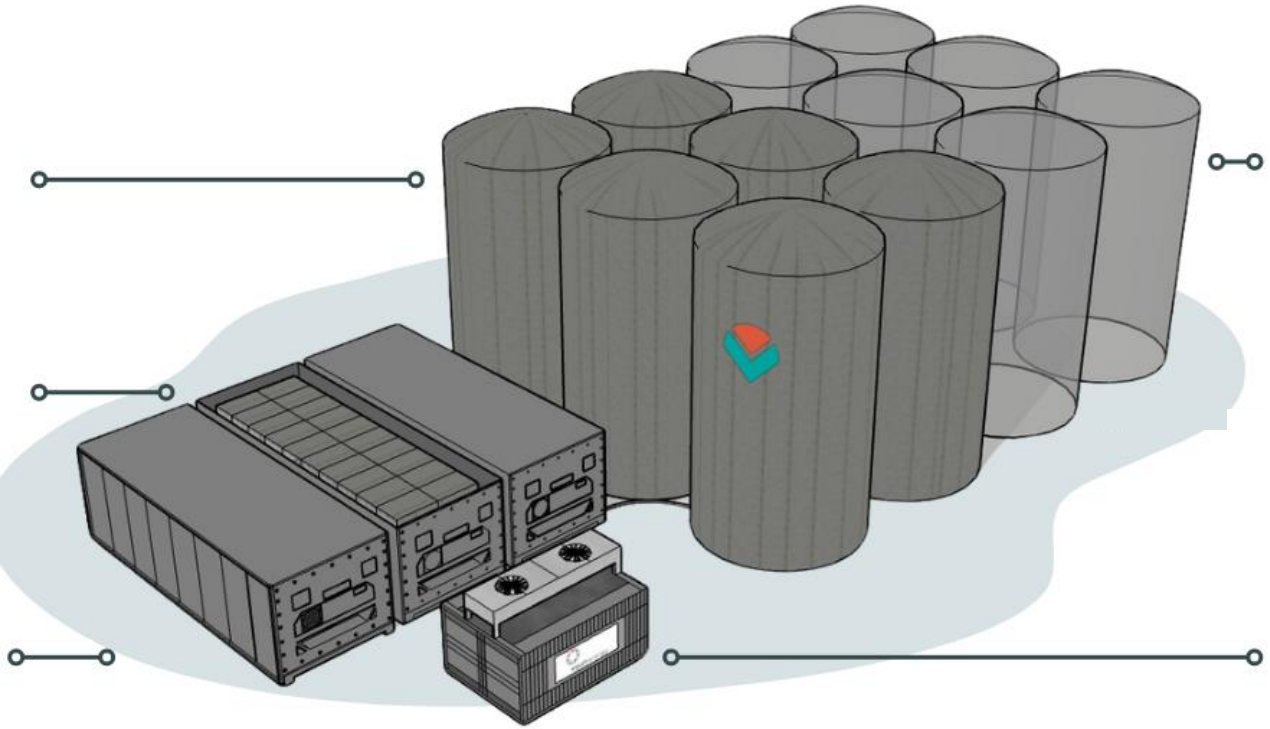
Status: Undergoing site acceptance testing and commissioning

DOWNSTREAM
VSUN Energy – Leveraging proven technology, EPC, and OEM partners to minimise technical risk

Vanadium electrolyte
Sourced from an AVL electrolyte manufacturing facility

Battery Technology
Utilise proven VFB technology from global suppliers

Project Management
VSUN Energy or third-party provider



Forward Planning
Ensuring additional units can be installed as required to allow capital efficient augmentation to longer duration

Power Conversion System (PCS)
Proven solutions from established manufacturers

Site Infrastructure
Utilise local specialist EPC partners

VSUN Energy - leveraging partners to accelerate deployment

Technology and Deployment

- Advanced discussions with VFB technology partners to secure strategic alliances with key manufacturers
- Progressing partnering opportunities with EPC/EPCM contractors to perform installation

VFB Funding

- 30+ year asset life delivers multiple funding opportunities
- Advancing government grant, asset infrastructure and JV partner funding models

Energy Offtake

- Advanced discussions with BESS energy offtake partners
- Ability to utilise brownfield sites with short transmission distances is attractive for energy offtake

Land Access

- Advanced discussions to secure land access with partners for long duration energy storage projects
- Competitive advantage in locations unsuitable for other technologies

Clear and focussed strategy will allow for rapid VSUN Energy deployment of VFBs to meet demand

Progressing our strategic initiatives

Delivered

- [x] BFS completed (pre-merger basis)
- [x] Mining Leases approved
- [x] Completion of large-scale process plant pilot programs
- [x] Australian Government grant agreement for up to $49 million executed
- [x] Mineral Resource Estimate update
- [x] Project development strategy update
- [x] Electrolyte production brought online

Next steps

AVL Project

- [ ] Publish integrated Optimised Feasibility Study (OFS)
- [ ] Progress approvals including EPA and Traditional Owner agreement
- [ ] Finalise permitting of proposed Tenindewa processing hub site
- [ ] Progress discussions with Government debt and export finance agencies
- [ ] Secure bankable vanadium offtake including option for project finance
- [ ] Deliver final investment decision

VSUN Energy

- [ ] Secure VFB technology partners
- [ ] Secure priority locations for VFB deployment
- [ ] Engage EPC/EPCM partners for battery deployment
- [ ] Progress funding discussions with potential strategic partners for rapid deployment of VSUN Energy strategy
- [ ] Secure energy offtake partners

Investment thesis

Growing vanadium fundamentals

Leveraged to energy market structural changes and increasing demand for long duration energy storage solutions

High metal content of VFBs

Underpinning the importance of upstream operations at the Australian Vanadium Project to secure supply of high-quality product

World-class Australian Vanadium Project

World-class asset located in Tier-1 mining jurisdiction with simple open pit mining and processing method

Ability to capture downstream value

VSUN Energy positioned to capture downstream value with a competitive advantage delivered through vertically integrated business

Delivering local content

Australian Vanadium Project and electrolyte manufacturing capability delivers a VFB that contains an unrivalled local content component

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