

ASX ANNOUNCEMENT

16<sup>TH</sup> SEPTEMBER 2020

# RESIDENTIAL VANADIUM FLOW BATTERY DEVELOPMENT AND VANADIUM OFFTAKE MOU

*AVL signs collaboration agreement for product development, vanadium pentoxide and electrolyte supply with Chinese residential vanadium redox flow battery producer*

## KEY POINTS

- **Memorandum of Understanding (MOU) signed with Chinese vanadium redox flow battery (VRFB) manufacturer Gui Zhou Collect Energy Century Science and Technology Co Ltd, trading as CEC VRFB Co. Ltd (CEC), based in Guizhou province.**
- **MOU provides a framework for one or more binding agreements:**
  - **Offtake agreement for vanadium pentoxide supply for CEC VRFBs installed in Australia and internationally;**
  - **Electrolyte production within Australia for use in CEC VRFBs;**
  - **Product development of CEC's residential VRFB for the Australian market;**
  - **12-month exclusivity over sales of CEC's residential VRFBs in Australia.**
- **Australia's first grid-connect ready 5kW/30kWh residential VRFB ordered from CEC, due to be delivered to the Port of Fremantle in late October 2020.**

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Australian Vanadium Limited (ASX: AVL, "the Company" or "AVL") has signed an MOU with Gui Zhou Collect Energy Century Science and Technology Co Ltd, trading as CEC VRFB Co. Ltd (CEC). CEC is a Chinese technology enterprise devoted to energy storage through vanadium redox flow battery (VRFB) technology research and development and industrialisation, based in Qiandongnan, Guizhou Province, China.

The MOU sets the parameters for discussions to progress to one or more binding formal agreements.

The subjects contemplated are:

- The supply of vanadium pentoxide from the planned Australian Vanadium Project at Gabanintha (the Project) for CEC's VRFB installations in Australia and internationally, with an initial sum of 2,000 tonnes of V<sub>2</sub>O<sub>5</sub> per annum as the basis for finalising a binding offtake agreement;

- The supply of vanadium electrolyte for CEC's Australian installations;
- Product development of CEC's residential VRFB for the Australian market; and
- Exclusive sales of CEC's residential VRFBs into the Australian market by VSUN Energy for an initial 12 month period, with the option to renew.
- The term of the MOU is 24 months from 14<sup>th</sup> September 2020.

To facilitate the development of CEC's residential VRFB, VSUN Energy has ordered a 5kW/30kWh system which is due to arrive at the Port of Fremantle, Western Australia in late October 2020. In a first for Australia, the battery comes with an inverter approved by the Clean Energy Council for grid connection.

This means that the CEC VRFB will be able to store energy to use for self-consumption or to enable the export of domestically generated renewable energy when connected to an existing or new solar system. The first VRFB from CEC will be installed at a property in Perth, where testing and feedback for future product development will occur. The companies are aiming to refine a market-ready residential and small business VRFB for the Australian energy storage market, for release in 2021. In return for product and market development assistance, the MOU includes the intent for VSUN Energy to have an exclusive right of sale over the product(s) in Australia for an initial period of 12 months, with the option to renew.

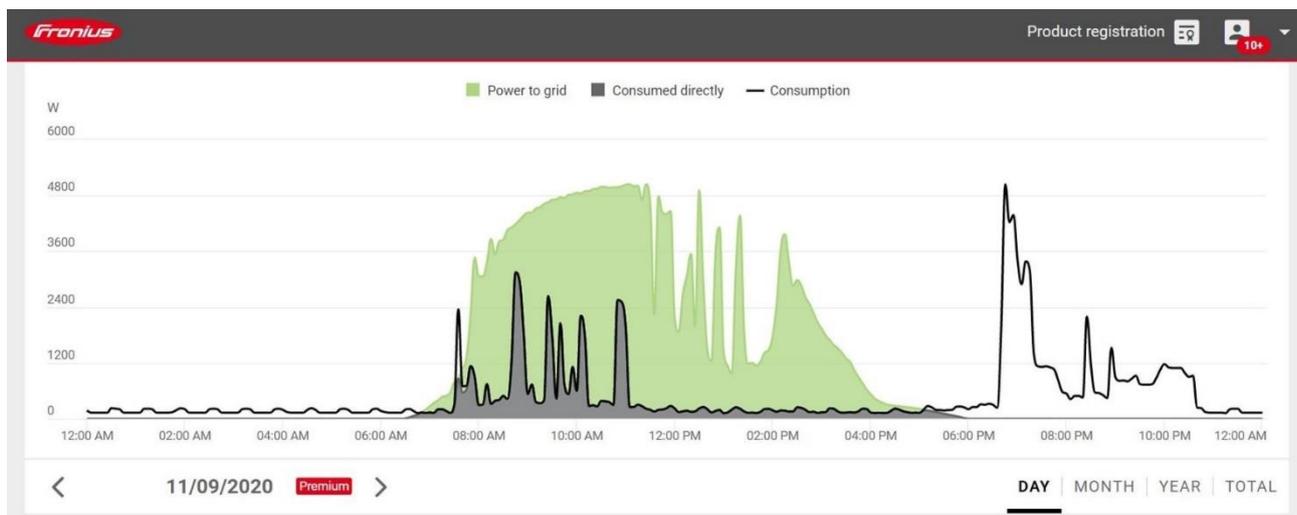
The arrival of a grid-connect ready VRFB in Western Australia is well timed, with the Western Australian Government's recent announcement of a new residential programme for solar buyback. WA residents will be able to sign up to the Distributed Energy Buyback Scheme (DEBS) programme, which allows households to export to the grid at the higher rate of 10c per kWh during the late afternoon and evening.

Managing Director Vincent Algar comments, *"VSUN Energy has seen a significant number of inbound enquiries for a grid connected, long duration residential VRFB to fill a space that is currently met by short life, short duration, less flexible and less safe energy storage solutions. Using solar energy at a time that suits the householder is the ideal application for VRFB energy storage."*

*"We look forward to developing this first residential VRFB in Australia with CEC and leveraging the future battery industry growth in Western Australia. Our goal to vertically integrate from mining vanadium, all the way through the value chain to onshore production of electrolyte and battery manufacturing in Australia, will allow AVL to benefit both commercially and ethically in helping the transition to a low carbon future and driving jobs growth in both the renewables and mining sectors."*

Points in favour of long duration VRFB for residential use include:

- The large capacity (30kWh) enables higher self-consumption during peak time, using self-generated energy from during the day and significantly increasing renewable energy penetration percentage.
- The large capacity also allows export of excess generation at higher DEBS rates, supporting the purpose of the scheme which is to “flatten the ‘duck’ curve”.
- Choice of timing of self-consumption or sale – having the ability to make the best economic decision for the householder (see Figure 1).



**Figure 1 Typical weekday household solar installation showing power exported to the grid**

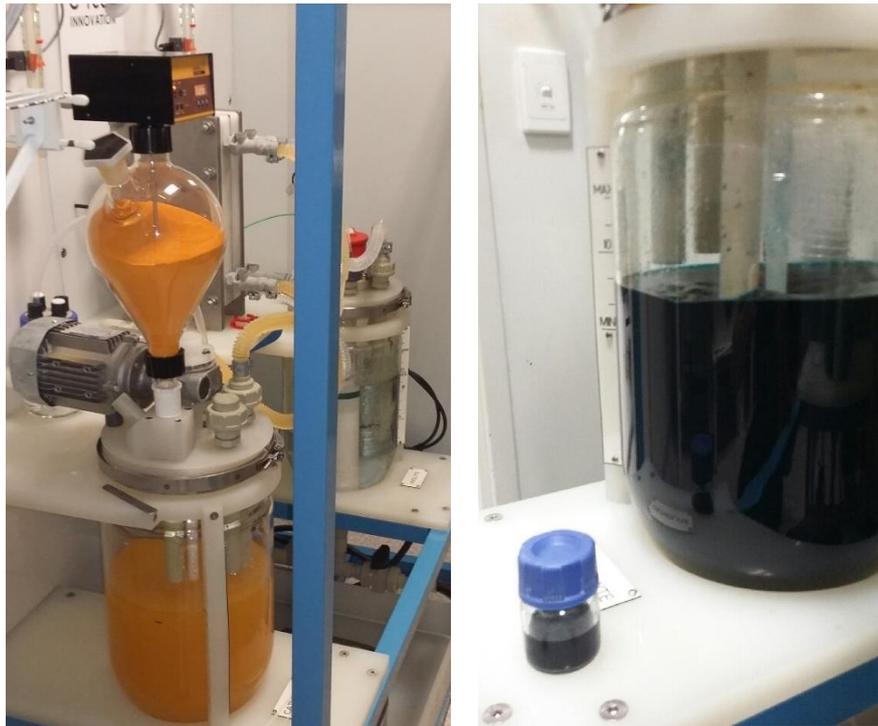
## Next Steps

On arrival in Fremantle the VRFB will be taken to a location near Perth for testing. VSUN Energy will provide feedback to CEC for any changes that need to be made to the product to enable it to operate optimally on Australian grids. It is anticipated that the finalised product will be available for sale to the public in early 2021.

## Vanadium Supply Agreements

AVL’s MOU with CEC covers the negotiation of a binding vanadium offtake agreement from the Project to CEC in China. Availability of high purity  $V_2O_5$  is constrained in China, particularly for VRFB applications, due to the country’s high demand on vanadium for micro-alloy steel manufacturing. CEC seeks to secure a high purity vanadium supply channel from AVL to support the growth of its Chinese VRFB business and to enable it to offer the product into the wider market. The agreement will consider a minimum of 2,000 tonnes  $V_2O_5$  per annum.

AVL has previously reported its capacity and understanding of vanadium electrolyte production<sup>1</sup> and is investigating a vanadium electrolyte production facility in conjunction with the development of the Project. AVL is planning to supply vanadium electrolyte directly into the CEC batteries sold in Australia. As part of the test process for the first residential VRFBs, AVL will look to manufacture and test electrolyte locally at its Perth based pilot electrolyte plant (see Figure 2), using vanadium sourced from the Project which is currently being refined in the pilot process in the United States.



**Figure 2 AVL's vanadium electrolyte pilot plant**

Prior to its own planned production, AVL plans to source 3<sup>rd</sup> party V<sub>2</sub>O<sub>5</sub> to locally manufacture electrolyte for battery use. Manufacturing vanadium electrolyte locally will help to drive down the cost of VRFBs due to reduced electrolyte transportation costs, as well as increase AVL's skill set in this area and further develop the Company's vertical integration strategy and the associated benefits of local job creation and content.

For further information, please contact:

**Vincent Algar, Managing Director +61 8 9321 5594**

*This announcement has been approved in accordance with the Company's published continuous disclosure policy and has been approved by the Board.*

<sup>1</sup> See ASX announcement dated 19<sup>th</sup> January 2017 'AVL Successfully Produces Vanadium Electrolyte from Pilot Plant'

## ABOUT AUSTRALIAN VANADIUM LIMITED

AVL is an Australian-owned resource company focused on production of high value vanadium products in Australia. AVL is seeking to offer investors a unique exposure to all aspects of the vanadium value chain – from resource through to steel and energy storage opportunities. AVL is advancing the development of its world-class Australian Vanadium Project and intends to produce a value-added vanadium product in Australia prior to sale to steel, battery and specialty chemical customers.

The Australian Vanadium Project is currently one of the highest-grade vanadium projects being advanced globally, with **208.2Mt at 0.74% vanadium pentoxide (V<sub>2</sub>O<sub>5</sub>)** and containing a **high-grade zone of 87.9Mt at 1.06% V<sub>2</sub>O<sub>5</sub>** reported in compliance with the JORC Code 2012 (see ASX announcement dated 4th March 2020 '*Total Vanadium Resource at The Australian Vanadium Project Rises to 208 Million Tonnes*').

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 have not been materially modified from the original market announcement.

AVL has developed a local production capability for ultra-high purity vanadium electrolyte, which forms a key component of vanadium redox flow batteries (VRFB). AVL, through its 100% owned subsidiary VSUN Energy Pty Ltd, is actively marketing the VRFB in Australia.

## ABOUT CEC

Gui Zhou Collect Energy Century Science and Technology Co Ltd is located in Meie Industrial Park, Congjiang County, Qiandongnan Prefecture, Guizhou Province. The company is a high and new technology enterprise devoted to energy storage vanadium battery technology research and development and industrialisation. It has advanced patented technology to produce high-performance perfluorinated ion membranes, vanadium battery batteries and vanadium electrolytes.

## APPENDIX 1

The Australian Vanadium Project – 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).

2020 Feb	Category	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 %
<b>HG</b>	Measured	10.1	1.14	43.9	13.0	9.2	7.5	3.7
	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</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>
<b>LG 2-5</b>	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</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>
<b>Trans 6-8</b>	Inferred	15.6	0.65	28.4	7.7	24.9	15.4	7.9
	<b>Subtotal</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>
<b>Total</b>	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>Subtotal</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>

## COMPETENT PERSON STATEMENT — MINERAL RESOURCE ESTIMATION

The information in this announcement 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 both members of the Australasian Institute of Mining and Metallurgy (AusIMM) and the Australian Institute of Geoscientists (AIG). 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 announcement of the matters based on their information in the form and context in which they appear.