Vanadium in Queensland: An Insight into the Julia Creek Project with QEM's Managing Director

Over the last 12 months, critical minerals have moved to the forefront of discussions about Queensland and Australia's economic futures. Critical minerals will play a hugely productive and positive role in national defence, transport, technological innovation, and most importantly, domestic infrastructure across Australia. When it comes to these resources, we really do live up to our name as 'The Lucky Country'. Australia is home to some of the richest and most abundant recoverable critical mineral deposits on the planet. Our country has critical mineral deposits stretching from Perth to Byron Bay, and the Great Ocean Road to the north-most points of Cape York. Once mined, our Cobalt, lithium, tungsten, manganese and rare earth elements are used in smartphones, televisions, aerospace automotives, and lithium-ion batteries for vehicles and energy grids, as well as the manufacturing of magnetic, high-strength alloys, computers and light bulbs.

One that many have not heard of, or know relatively little about, is vanadium. The overwhelming majority of vanadium produced is used to manufacture strong, specialised steel alloys. It is particularly valuable as it is highly malleable, ductile and resistant to corrosion. Australia has the second largest vanadium reserves at 7.4 million megatons (MT). Much of these reserves lie in Queensland, and as a result, mining and processing vanadium is a key part of meeting the state's renewable goals.

There is currently one vanadium mining lease granted in Queensland's Northwest Minerals Province. QEM's Julia Creek Project covers nearly 250 square-km, and holds 2,850MT, making it one of the single largest Vanadium deposits in the world today. QEM's Managing Director, Gavin Loyden, is an expert on vanadium, its use and its benefit to Queensland, and was kind enough to answer a series of questions developed by IAQ.

Q What is involved in the Julia Creek Vanadium & Oil Shale Project, and what is its scope?

> *Multi-commodity project which primarily focuses on the critical mineral vanadium, with the added benefit of producing transport fuel for regional consumption. Regionally important for fuel supply – Globally important for V*

Q The primary benefits of the Julia Creek project seem to be two-fold: (1) vanadium will help with Queensland and Australia's renewable transition, and (2) given the increasing global demand for it, vanadium development, investment and extraction will help establish Queensland as a critical mineral powerhouse in the coming decades. Can you please elaborate on these two primary benefits from QEM's perspective?

1) *Vanadium is increasingly being used globally in Vanadium Redox Flow Batteries (VRB) systems. VRBs are used primarily to support power grids by managing load fluctuations and increasing for off-grid applications, where they are capable of storing energy for long periods and that energy can then be discharged on demand. These are large static batteries described as Long Duration Energy Storage (LDES) systems, which are scalable and well suited to Australian conditions, but vanadium also has a primary function in steel strengthening and is used in the steel for wind turbine towers themselves.*

2) *Australia holds approximately 31% of global vanadium resources, which are as yet untapped. Queensland holds about half of that resource. The Queensland Government is very proactive in assisting with the development of the industry in the State, as they realise that this commodity is unique when it comes to energy storage, as only vanadium is required to build a battery. VRB does not require any other metals such as cobalt or nickel as inputs to the manufacture of these systems, therefore it is a pit-product opportunity.*

Q IAQ's Catalysing Infrastructure Transformation Taskforce (CIT) aims to develop solutions to the challenges of society from an infrastructure perspective, and our Regional Infrastructure Taskforce (RIT) is particularly focused on regional infrastructure opportunities and challenges. The Julia Creek Project is an area of interest for both CIT and RIT, as mining is the foremost driver of Queensland's regional economies, while vanadium offers unique infrastructure-based solutions to contemporary societal challenges. What societal challenges do you see vanadium and critical minerals contributing to, and how will the QEM Julia Creek project benefit communities in regional Queensland (i.e. jobs for locals)?

The Julia Creek Project is a long-life asset, with over 30 years of resources available in the first defined pit area, with the potential to mine for 100 years in the same location. This length of project provides a level of certainty to communities. It will provide long-term and permanent opportunities across a wide range of employment options.

In addition, QEM has designed a large-scale renewables project which has attracted strong interest from developers. The location at Julia Creek is extremely attractive to global renewable energy project developers due to the announcement in March this year by the Queensland Premier that the Queensland Government will deliver the 1,100 km CopperString 2.0 Project (CopperString) as part of Queensland's "SuperGrid". Relevantly, the Julia Creek Project is located directly adjacent to the path of the electricity transmission line in the North West Minerals Province in North-Western Queensland, so a renewable energy developer at Julia Creek can effectively 'plug-in' their solar and wind farm to the SuperGrid and access the NEM.

Q The use of vanadium in redox-flow batteries has put the critical mineral front and centre in the renewable energy discussion. Why will vanadium, and its use in redox-flow batteries, be so critical to Queensland's renewable energy-grid transition?

The Queensland Government owns the power network, including distribution and generation and it has shown ambition to transition to renewable energy by mid-century. To achieve this goal, the State will require a great deal of energy storage, up to 24 GWh or according to the Queensland Resources Minister, up to 7000 new grid-scale batteries, and flow batteries provide the best solution for this scale of LDES. These are systems that can be built in Queensland using Queensland vanadium and are unique in that sense. These batteries were invented in Australia and are proven technology with over 30 years of development behind them

Q How do redox-flow batteries compare with their lithium counterparts when it comes to performance and environmental impact, and how will this affect infrastructure stakeholders?

The main advantages of VRB over Li-ion batteries for the grid are that they are safe, reliable, cycle for 100,000 times without degradation and are fully recyclable.

They do not have issues with thermal runaway as they are two tanks of fluid so they can't catch fire as Li-Ion batteries are prone to do, as they did in the Genex fire recently, and they are almost endlessly cyclable. They can also discharge and recharge at the same time; 100% up and down, making them exceptional for load levelling in the grid. They have a life cycle of up to 30 years. The electrolyte that stores the energy doesn't degrade and can be used over and over in new VRB systems or even recycled back into steel and alloy markets.