

# QEM Limited Innovative Energy Solutions

ASX: QEM

INVESTOR PRESENTATION October 2019



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QEM

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# Competent Persons and Qualified Estimator Statements

The information in this announcement that relates to exploration results, mineral resource and contingent resource estimates for the Company's Julia Creek Project was first reported by the Company in its IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus"), released to the ASX on 17 October 2018. The Company confirms that it is not aware of any new information or data that materially affects the information included in the Prospectus, and in the case of estimates of Mineral Resources and Contingent Resources, that all material assumptions and technical parameters underpinning the estimates in the Prospectus continue to apply and have not materially changed.

# **Innovative Energy Solutions**





# **Transport Fuels**

QEM aims to provide innovative and environmentally friendly solutions that are important to our energy future. The Company seeks to assist with the current fuel security issue facing Australia, by producing liquid fuels for the domestic market.



## Hydrogen

QEM sees hydrogen as an important part of Australia's energy mix into the future and is investigating ways of transitioning to hydrogen production.



### Vanadium Pentoxide

QEM also aims to become a leading supplier of high quality vanadium pentoxide to both the nascent energy storage sector and the Australian steel industry.

# **Key Figures**



# over **2.7**Bt

V2O5 @ Ave 0.30%

### 783 MMbl @ Ave 53L/t

JORC Inferred resource making it **one of the largest vanadium deposits in the world** 

# Up to **0.74%**

### V2O5 In High Grade Intercepts

High grade intercepts up to 0.74% V2O5. **Up to 88.9 L/t oil content** 

# Up to **3**X

### **Beneficiation Upgrade**

Beneficiation: Studies show up to 3x upgrade available.

# **Investment Highlights**



### **Unique World Class Resource**

- Unique world class resource with the potential to deliver innovative energy solutions, through the production of energy fuels and vanadium pentoxide
- Globally significant JORC (2012) Inferred Resource
  2,760 Mt @ 0.30% V<sub>2</sub>O<sub>5</sub> making it the world's largest vanadium resource
- High-grade intercepts up to 0.74% V205
- The Project also contains 783MMBBls of Oil in the 3C category with oil content up to 88l/t

### **Management that Delivers**

• Team includes highly successful and experienced mining professionals, with proven track record of mine development globally

### **Growth Focused**

- Development of the resource through exploration, evaluation and development
- Offers investors exposure to advantageous byproduct in the form of oil



### Simple and Clean Structure

- New ASX listed entity, with a clean capital structure and low overheads
- Simple capital structure
- Compares favourably with other listed Vanadium companies

### **Global Vanadium Deficit**

- Supply squeeze: global vanadium consumption expected to exceed supply by ~2,198t in 2019.
- Focus offers leverage to rising vanadium prices and new applications in energy storage

# **Globally Significant Resource**



**QEM's Julia Creek Vanadium Resource is one of the Largest on the ASX** 

Company	ASX Code	Project Name	Location	Resource Mt	V205 %	Resource Type	V205 MT
King River Resources	KRR	Speewah Project	Wyndam Port, North West WA	4,712 Mt	0.30%	Measured, Indicated, Inferred	14.14 Mt
QEM Limited	QEM	Julia Creek Project	North West QLD, Australia	2,760 Mt	0.30%	Indicated and Inferred	8.28 Mt
Horizon Minerals	HRZ	Richmond Project	Richmond / Julia Creek, QLD	2,579 Mt	0.32%	Inferred	8.25 Mt
TNG Limited	TNG	Mount Peake Project	Arunta, NT	160 Mt	0.28%	Measured, Indicated, Inferred	4.48 Mt
Neometals	NMT	Barrambie Project	Barrambie, WA	280 Mt	0.45%	Indicated and Inferred	1.26 Mt
Australian Vanadium	AVL	Australian Vanadium Project	Murchison Province, WA	184 Mt	0.76%	Measured, Indicated, Inferred	1.39 Mt



Drilling at QEM's Flagship Julia Creek Project - May 2019

# **Capital Structure**



### **Clean Capital Structure and Shareholder Alignment**

ASX Symbol: QEM					
Shares on Issue	100 million				
Market Cap (11 October 2019)	\$9.7m				
Share Price (11 October 2019)	\$0.097				
Cash (as at 30 June 2019)	\$3.928m				

Major Shareholders					
Directors	26.50%				
Greenwich Global Pty Ltd	19.70%				
SkipTrak Pty Ltd	4.49%				



# The Team



## Led by a team of highly successfully and experience mining professionals, with proven track record of mine development



**John Foley** *Chairman* 

 Extensive experience as current Chairman of; Precious Metal Resources Limited (ASX: PMR), Citigold Corporation Limited (ASX: CTO) and Carbon Credit Corporation (C3).



**Daniel Harris** *Non-Executive Director* 

- Accomplished mining executive with 37+ years in all aspects of the resources sector, particularly in vanadium.
- Current independent Director Australian Vanadium (ASX:AVL), also former CEO & COO positions with Atlantic (ASX: ATI), Former Director of Atlas Iron (ASX: AGO)



**David Fitch** *Executive Director* 

- Experienced in strategic planning, commercial negotiations and business operations.
- Formerly the COO and major shareholder of the Fitch group,
- Director of BioCentral Laboratories.
- Largest shareholder of QEM.



Scott Drelincourt General Manager & Geologist

- A qualified geologist with over 14 years' experience in all facets of the resource and mining industry
- Significant experience in prospect generation, greenfield and brownfield exploration, mining development and mining operations.

# Julia Creek Project



**Opportunity for a World-Class Vanadium & Oil Shale Mine** 

# **Key Facts**

- Julia Creek Project comprises 4 exploration permits EPM25662, EPM25681, EPM26429 & EPM27057
- Advanced exploration stage and drilling demonstrates ore depth from 37m to 104m
- Close to all infrastructure and services including road, rail, water, gas, telecommunications and fibre optic cable

# Resource

- October 2019 Resource Upgrade of total JORC Inferred resource by 62% to 2,760 million tonnes
- V2O5 @ 0.30% and oil content 53/t.
- Scoping study completed in July 2016 (vanadium resource only)
- Oil component- 783MM Barrels 3C Contingency

# Method

- Deposit is shallow with favorable strip ratios as low as 2:1
- Given the resources are near surface **QEM intends to pursue development of a standard open cut method.**
- Preliminary V2O5 extraction studies showed up to 3x V2O5 content increase through simple beneficiation.
- Detailed process studies are currently underway in the USA and Australia for extraction of both hydrocarbons and vanadium.
- Extraction methods being investigated are safe and environmentally friendly.



# **Project Infrastructure**



### Queensland Government is spending millions to make mining more accessible



• A new plan, announced June 2019, included \$80m towards reducing freight charges on the Mount Isa Line and \$30m towards building a new container terminal at the Port of Townsville.



# Julia Creek Resource Overview



### **Table 1: Summary of JORC Mineral Resource Estimate**

Note:

1. The estimate uses a minimum cutoff of  $0.2\%~V_2O_5$  for the oil shale units, and minimum cut-off of  $0.15\%~V_2O_5$  for the Coquina units.

**QEM** 

2. The total resource tonnage reported is rounded to reflect the relative uncertainty in the estimate categories and component horizons may not sum correctly.

#### Table 2: Summary of SPE-PRMS Oil Resource

Total								
Strat.Unit	Mass (Mt)	Average Thickness (m)	Oil Yield (L/tonne)	MMBarrels (insitu-PIIP)	MMBarrels 3C			
CQL	1,701	5.93	44	446	401			
OSU	544	2.01	72	231	208			
OSL	518	1.97	63	193	174			
TOTAL	2,760		53	870	783			

#### Note:

1. The total resource tonnage reported is rounded to reflect the relative uncertainty in the estimate and component horizons may not sum correctly.

# Julia Creek Oil Yield



**Cross Section the Julia Creek Oil Deposit.** 



*Source: Measured Group* The estimation methodology used is deterministic. The estimation is based on grids constructed for unit structure, thickness and oil grade parameters

# **Petroteq Testwork**



Successful preliminary Stage 2 test results for oil extraction and recovery

- On 17 July 2019, QEM announced successful results using Petroteq Energy Inc's technology, from Stage 2 test work carried out on the previous drill core sample.
- The test work undertaken by independent lab PRI Asphalt Technologies Inc, provided strong results, with total oil recovery up to 65% of the contained oil, from Julia Creek Project samples.
- With further optimisation by Petroteq, QEM is confident that recovery can be further increased.
- The residual material of approximately 20% of original mass (after oil recovery) was separated as a result of the Petroteq process, and this residual material contains the metals.
- The V205 is contained in the residual material only, as verified by PRI's laboratory analysis.
- These results warrant a bulk sample test in order to produce sufficient oil and V205 required to carry out API (petrology analysis) testing of the oil, and V205 extraction.
- The bulk sample testing will provide a result that is a better representation for the beneficiation of the V205.

# **Project Milestones**



### **Major Achievements for QEM to Date**

- Scoping Study for vanadium only completed
- · Initial financial modelling complete, showing strong potential for economic viability
- No Native Title
- Positive test results using supercritical water processing for hydrogen extraction from QEM's oil shale (ATSE Grant)
- JORC (2012) Resource Upgrade to 1,700Mt @ 0.34% V2O5
- Daniel Harris joins Board of QEM
  as Non-Executive Director
- ASX Listed Q4 2018
- Successful initial results for oil extraction completed in USA.



• MOU signed with Petroteq Energy Inc USA

# 2020 Strategy





# **Fuel Shortage**

### Running on Empty

- Australia is an island nation that depends heavily on imported fuel and our stockpile is critically low. The Government's Australian Petroleum Statistics published in November 2018 said this would amount to 21 days of petrol for automobiles, 18 days of diesel and 20 days of aviation fuel. (ABC News 23/01/2019)
- This is clearly in contravention of Australia's obligation as a member of the International Energy Agency (IEA) to hold at least 90 days of supply.
- A review of the transport energy policies of 75 countries globally reveals Australia is alone in its total reliance on "market forces" to ensure secure access to transport fuel — critical to the functioning of society and the economy. Australia is critically exposed to disruption in the supply of transport fuels Australia's combined dependency on crude and fuel imports for transport has grown from around 60% in 2000 to over 93% today.
- QEM considers this an opportunity. Advances in processing technologies of oil shale have been rapidly developing over the last few years and although the use of oil shale for energy goes back for generations, these advancements have now made processing oil from shale commercially viable and profitable.
- QEM is currently investigating a number of these environmentally friendly extraction technologies, which will allow the company to produce liquid fuels from the Julia Creek resource, initially and provide the flexibility to potentially move toward hydrogen production in the future.





**ENERGY STORAGE** STEEL MANUFACTURING **Applications Of Vanadium** 

AEROSPACE





# Uses of Vanadium

### Vanadium - The Future of Energy Storage

**Improves Tensile Strength** Most widely used alloy to strengthen steel and alloys

### Supports Fuel Efficiency

High strength to weight ratio makes vanadium a vital component in the automotive and aerospace industries

# Weather Resistance

Vanadium alloys are naturally durable to extreme temperature and corrosion

#### **Renewable Energy Storage**

Vanadium Redox Batteries are the preferred solution for large scale energy storage globally.

# Vanadium Outlook



- Vanadium demand is conservatively forecasted to grow at a compound annual growth rate of 5.6%, reaching 133,000t in 2025(~202,000t V2O5 equivalent).
- 30% p.a. Increase in Vanadium Consumption expected, resulting from new regulatory changes in China.
   (Source: China Iron & Steel Research Institute (CISRI) & Metal Bulletin August 2018)
- Vanadium was added to the 'US Strategic Metals List' in 2018, illuminating the metals importance to that nations industry. (Source: ROBERT GOTTLIEBSEN: The Australian, March 5, 2018)
- Global crude steel production reached 1,808.6 million tonnes (Mt) for the year 2018, up by 4.6% compared to 2017. (Source: https://www.worldsteel.org/media-centre/press-releases/2019/Global-crude-steel-output-increases-by-4.6--in-2018.html
- Global deficit forecast to increase to ~28,500t V2O5 in 2021 and ~39,300t V2O5 in 2023

(Source: Merchant Research & Consulting).

 Automotive – 6.81% growth in vanadium use. By 2025-85% of all cars will contain vanadium alloys. (Source: Roskill 2017 report) China : US\$8.50/lb (0.00%) Oct 11, 2019 27.2 20.4 13.6 6.8 0.0 Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct



# **Renewable Energy Storage**



### **Building a Renewable Future**

### **Competitive Advantages:**

- Vanadium redox flow batteries (VRFB's) are the most efficient battery technology for utility scale renewable energy storage, including wind and solar
- Higher levels of safety & stability with proven, reliability, scalability & durability
- Load levelling function, removing the need for expensive gas peaker plants
- Long term cost advantage over competitors
- The global VRB market size was assessed at USD \$142.1 million in 2017 and is anticipated to expand at a CAGR of 59.7% over the forecast for the period from 2018 to 2022
- Currently <9% only of vanadium supply is used for VRFBs, with this figure set to grow significantly over the coming years

Source: https://www.energyandcapital.com/articles/the-best-thing-since-lithium/1531 Mining Journal June 2018



# Construction



### Stronger, safer buildings

- Vanadium plays an essential role in providing high strength, costeffective solutions in the steel industry
- Announced in February 2018, with implementation by the 1<sup>st</sup> of November 2018, China revised steel rebar standards to limit the use of inferior strength steels in its ever growing construction industry
- Due to these revised standards, global demand for vanadium is set to increase, with this development expected to add between 10,000t to 15,000t of vanadium demand, and signs of an increase in demand is already evident
- Vanadium demand is conservatively forecasted to grow at a compound annual growth rate of 5.6%, reaching 133,000t in 2025, and supply including all idle capacity and expansion of existing primary mines, predicted to grow at a CAGR of 3.7% to 111,000t in 2025.



# Aerospace & Automotive



### Vanadium and the future of transport

- Increased aircraft are required to service larger addressable air-travel market
- Both Boeing & Airbus both forecast annual global air traffic growth between 2016 and 2035 of nearly 5%. A titanium alloy containing 4% vanadium and 6% aluminium (Ti6Al4V) has been used extensively for blades, discs and casings of the compressors in many designs of the aero-engine gas turbine
- The development of new titanium alloys continues with the Vanadium component ranging from 8, 10 to 15%, which results in even higher strengths and the potential to make important contributions to weight reduction Source: <a href="http://www.nextsourcematerials.com/vanadium/about-vanadium/MiningJournalJune 2018">http://www.nextsourcematerials.com/vanadium/about-vanadium/MiningJournalJune 2018</a>
- Aerospace 70,000 new aircraft on order from Boeing and Airbus alone. (Source: The Australian, Friday, July 15 2016)
- By 2025, 85% of all cars will incorporate vanadium alloy to reduce weight
- Engine components such as crankshafts and connecting rods are highly stressed and must withstand many cycles. Vanadium micro-alloyed forging steels are widely used for these parts, as well as other applications in the chassis, drivetrain, suspension and valve springs. (source: Vanitec.org)

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