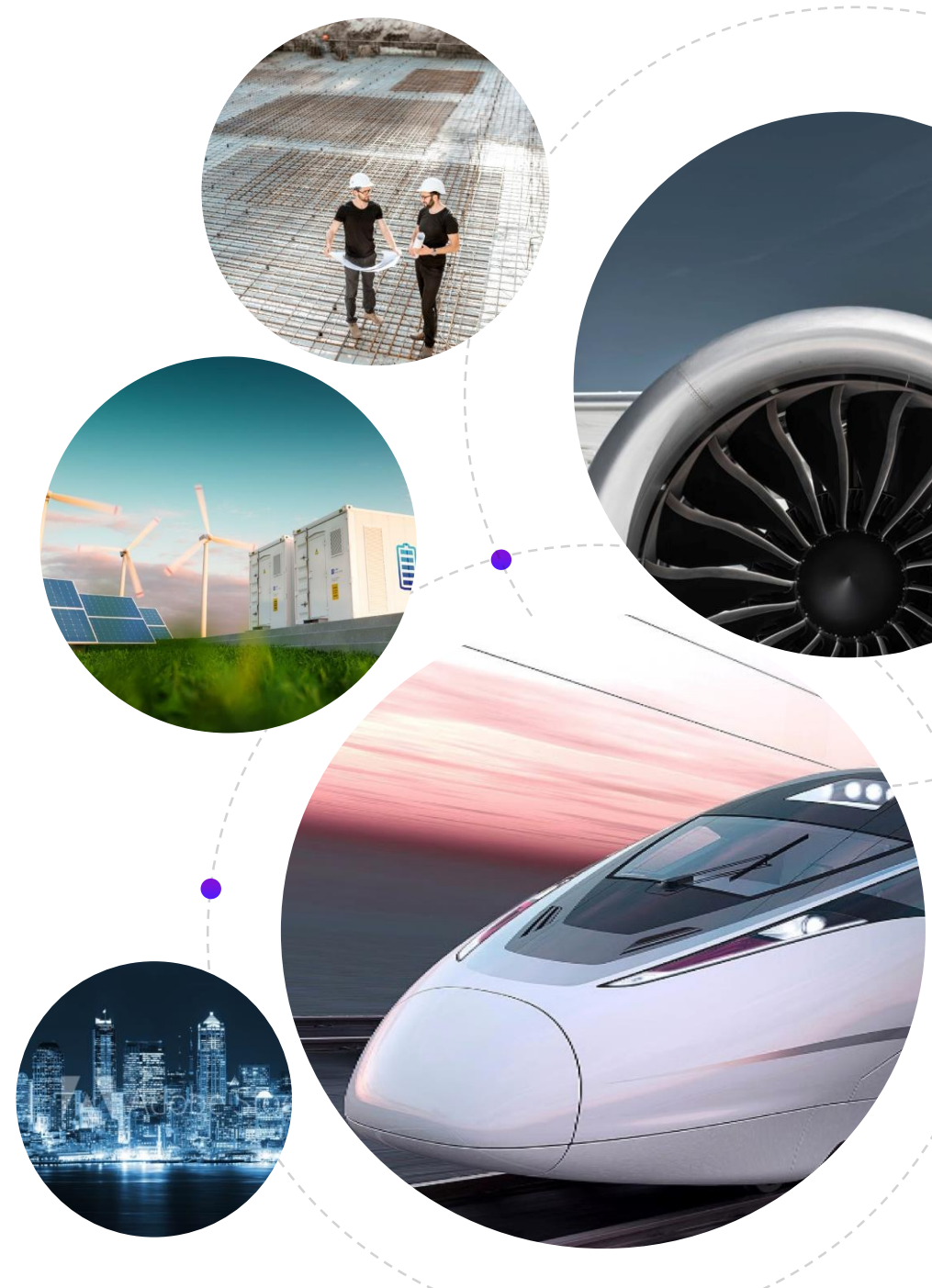




# QEM Limited Dual Commodity Opportunity

ASX: QEM

AGM PRESENTATION  
November 2020



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investment in QEM.

## **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") and the subsequent resource upgrade announcement ("Resource Upgrade") dated 14 October 2019. The Company confirms that it is not aware of any new information or data that materially affects the information included in the Prospectus and Resource Upgrade, 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 and Resource Upgrade continue to apply and have not materially changed.

## **Authorised for Release**

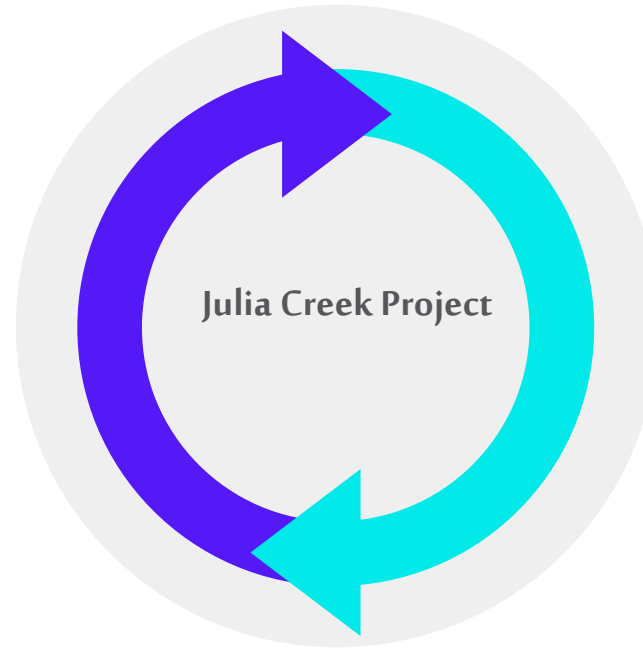
This announcement was authorised for release by Gavin Loyden, Managing Director

# Dual Commodity Champion



## Vanadium

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



## Right Project

Julia Creek in North Queensland allows production of both Vanadium (a Critical Mineral) and high quality transportation fuels



## Oil & 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.

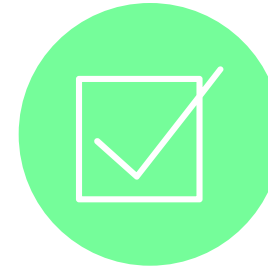
# Corporate Overview



QEM Limited (ASX:QEM) is developing the Julia Creek Vanadium and Oil Shale Project



Targeting Dual commodities of transport fuels and vanadium pentoxide



Vanadium defined as Critical Mineral by Australian and US Governments



Transport fuels to support Australian resilience in post COVID economy



Globally significant JORC (2012) Indicated +Inferred Resource  
2,760 Mt @ 0.30% V2O5



783MMBL's of oil in the 3C category



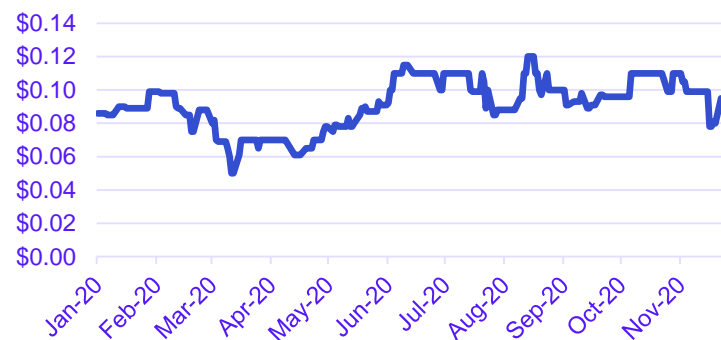
Team that delivers

# Capital Structure



## Clean Capital Structure and Shareholder Alignment

**QEM Share Price in 2020**



ASX Symbol: QEM	
Shares on Issue	100 million
Market Cap (26 November 2020)	\$9.5m
Share Price (26 November 2020)	\$0.095
Cash (as at 30 September 2020)	\$2.24m

Major Shareholders	
Directors	49.48%



### Enterprise value of \$7m

Provides significant leverage to development strategy success.



### Director Support

2.4m shares purchased by Directors on market over last 12 months



### Alignment

Management alignment with public shareholders.

# Right Project **At the right time**



## Significant Project

- Regionally and nationally significant project in North Queensland
- Dual commodity deposit
- Globally significant JORC (2012) Indicated +Inferred Resource **2,760 Mt @ 0.30% V<sub>2</sub>O<sub>5</sub>** making it one of the world's largest vanadium resources
- The Project also contains **783MMBBIs** of Oil in the 3C category
- On-site green hydrogen production envisioned



## Management that Delivers

- Team includes highly successful and experienced mining professionals, with proven track record of mine development globally
- Directors with “skin in the game”



## Growth Focused

- Development of the resource through exploration, evaluation and development
- Offers investors exposure to increasing value as the project progresses towards development



## Processing Route Studies Underway

- Recent favourable test work is showing strong progress towards finalising innovative processing route
- Potential to add significant shareholder value as increasingly efficient and cost effective solutions are confirmed



## Excellent location

- Project located within the **North West Minerals Province (NWMP)**- a priority mineral develop area in NW Queensland



## In Demand Commodities

- Vanadium Pentoxide for energy storage market
- Transport fuels to enhance national resilience



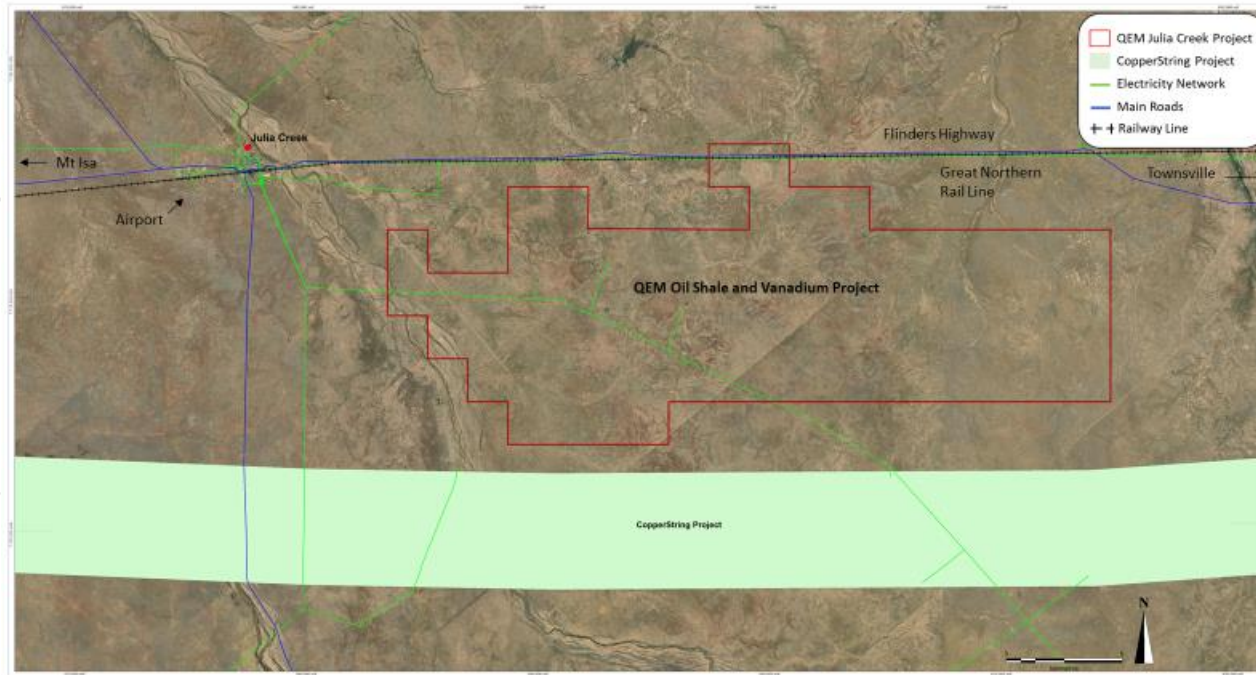


# Location Infrastructure

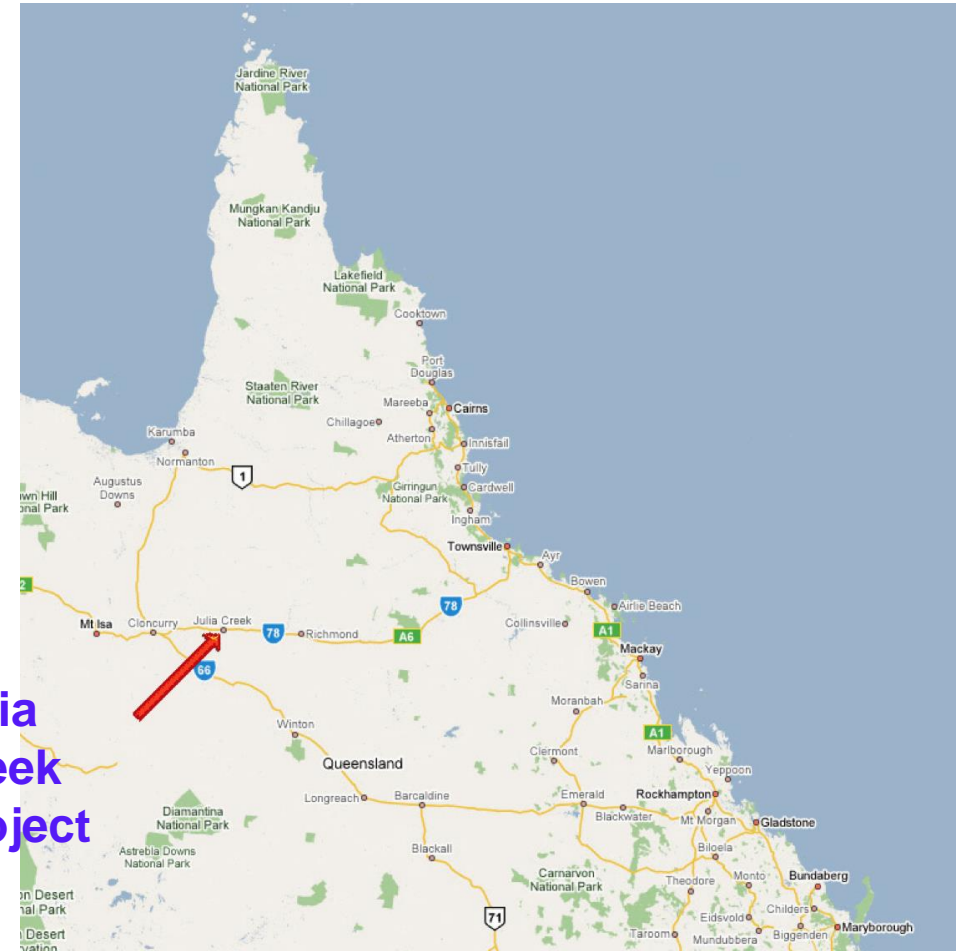


Wholly-owned Exploration Tenements Covering 249.6km<sup>2</sup> in the Julia Creek Area, North Western Queensland

- Project located within the **North West Minerals Province (NWMP)**- a priority mineral develop area in NW Queensland
- Project sits inside the newly defined Eastern Resource Corridor
- Access to all necessary infrastructure and services, including road and rail direct to the Port of Townsville 600km to the east. Mt. Isa 230km to the west.
- Proposed Copper String 2.0 project corridor to the south of project.



Julia  
Creek  
Project



# Julia Creek Project Update



Opportunity for a World-Class Vanadium & Oil Shale Mine



## Key Facts

- Dual commodity deposit – shallow oil bearing shale that is also mineralised with vanadium
- QEM confident will be able to extract both oil and vanadium, for dual revenue contribution to project economics
- Close to all infrastructure and services including road, rail, water, telecommunications and fibre optic cable



## Significant Resource Upgrade

- **October 2019** Resource Upgrade of total JORC Inferred resource by **62% to 2,760** million tonnes
- JORC Indicated area of 220Mt
- Average content V<sub>2</sub>O<sub>5</sub> @ 0.30%
- Oil component- **783MM Barrels** 3C Contingency with up to 88l/t



## 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.**
- Detailed process studies and bench scale testing currently underway for extraction of both hydrocarbons and vanadium.
- Extraction methods being investigated are safe, sustainable and environmentally friendly.
- Above ground processing envisioned at Julia Creek.





# Latest Developments Test Work

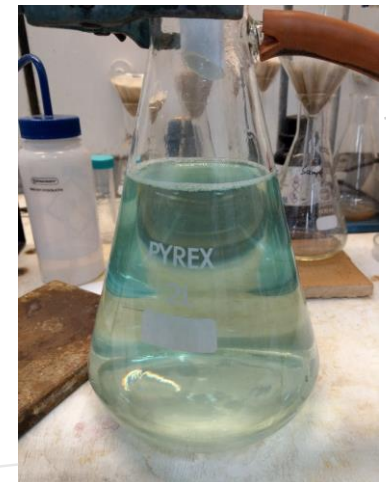


## Solvent assisted extraction shows promising results

- On 21 July QEM announced results from extraction test work, utilising hydrogen donor solvent to aid extraction of kerogen from oil shales
- Test results from the Julia Creek resource confirm **oil yields up to 181 kg per tonne**, which is **218%** on those reported under Modified Fischer Assay (MFA)
- Oil yields consistently over **175%** of Modified Fischer Assay oil yield for a range of varying test conditions
- The increase in oil yields is made possible with the addition of a solvent, which would be derived directly from the oil stream produced from the Julia Creek resource and therefore be exceptionally cost effective
- Potential for raw oil be upgraded through on-site hydrogenation to produce transport fuels (diesel)
- On 11 August, QEM announced test work results for vanadium extraction rates within the shale portions of the Julia Creek resource. Initial results show **90%** yield available through acid extraction.

## Continuing test program with HRL Laboratories

- Complete optimisation test work for vanadium extraction, building on the knowledge from the work to date including;
- Optimisation of acid leach testing, for temperature and capacity
- Alkaline leaching tests underway
- Potential for cement by-product
- Economic assessment and engineering studies to follow



# The Team



Led by a team of highly successful and experienced 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).



**Gavin Loyden**  
*Managing Director*

- Company Founder, identified, acquired and began developing Julia Creek
- Responsible for early capitalisation, and oversaw initial exploration program and scoping study for QEM



**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)

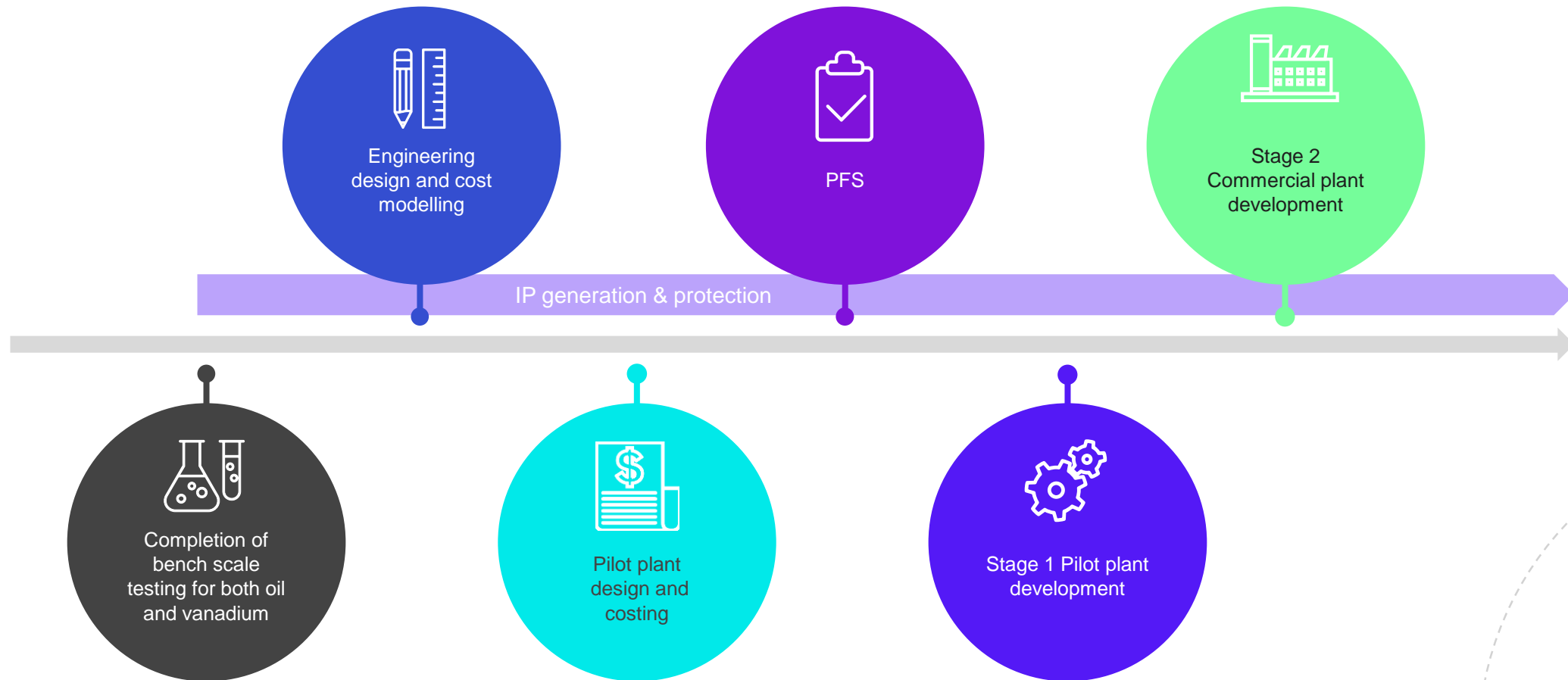


**David Fitch**  
*Non-Executive Director*

- 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.

# Development Strategy

Moving towards PFS in 2020/21



# Supportive Policy Environment



## Development of Northern Australia and Resource Corridors Government Priority

- Post COVID-19 recovery in Australia will prioritise project development at both State (Queensland) and Federal levels
- Northern Australia Infrastructure Fund (NAIF) extended through to 2026 with over \$3 billion still to invest in quality projects essential to developing the North
- \$10 million expansion of the Government's Exploring for the Future program-focussed on new economy minerals
- QEM's Julia Creek Project \$100m Resources Community Infrastructure Fund established by QLD Government



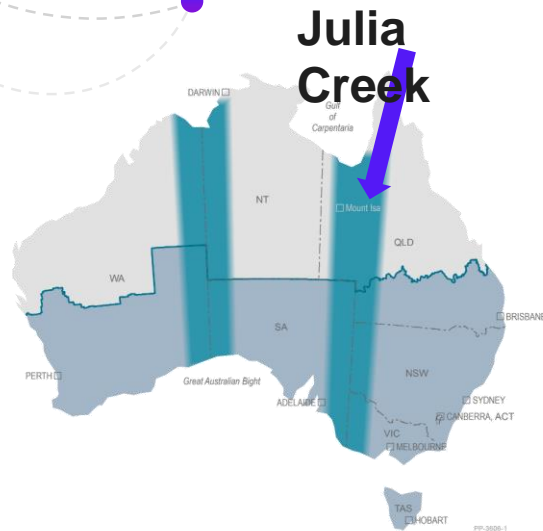
## Vanadium is a new energy mineral – strategic significance as a Critical Mineral

- Along with lithium and rare earths, vanadium is a 'strategic metal' when building a new energy economy
- New economy minerals supported by Federal and Queensland governments
- Vanadium on the 'Critical Minerals List' for priority development and investment
- Vanadium is the key element in Vanadium Redox Flow Batteries (VRFB)



## Greater Fuel Resilience Needed

- Domestic sources of fuel are few, and local stocks are very low, particularly diesel.
- Julia Creek has the potential to contribute to local transport fuel supply needs for Agri, Mining & Defence



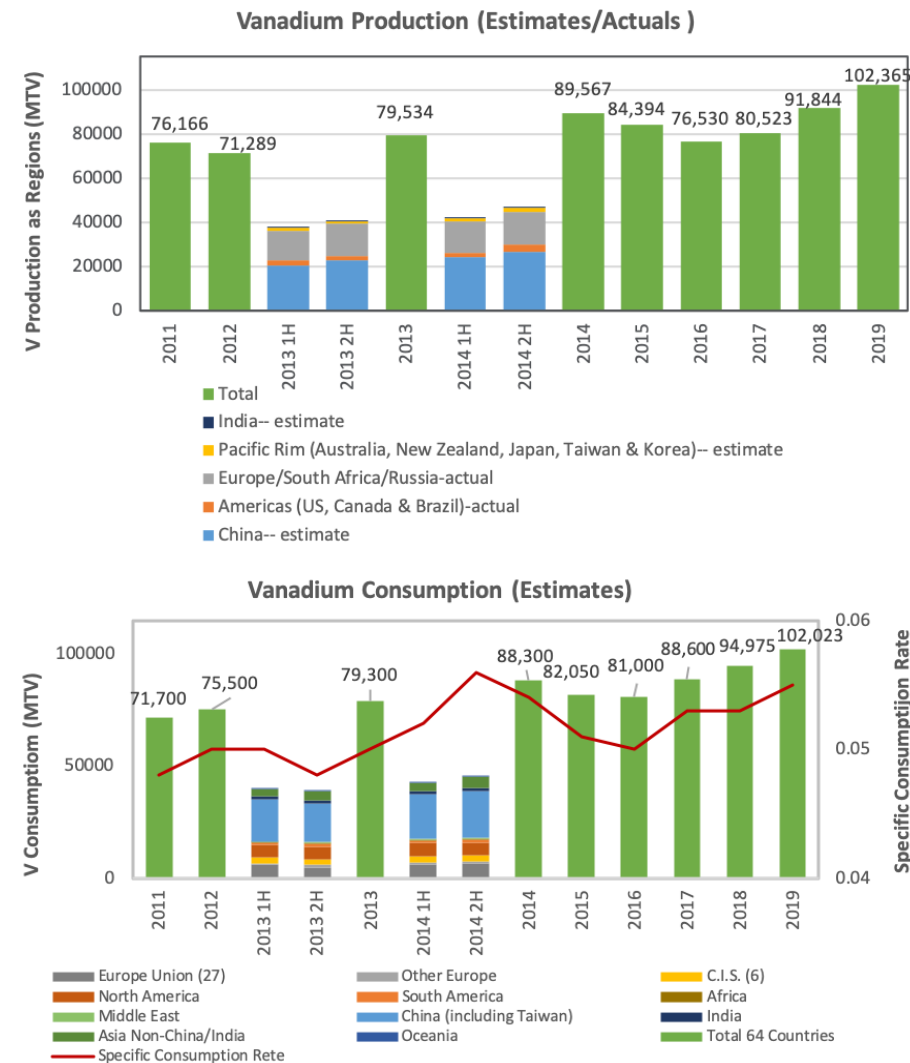
### Federal Government Resource Corridors

*Julia Creek located in key corridor*

# Vanadium Market



- The global vanadium market is expected to grow by 28.31 thousand tons during 2020-2024. (Source: Technavio Global Vanadium Market Report 2020-2024)
- Demand for vanadium is expected to grow steadily in the future as a result of updated construction policy guidelines, which adjusted with Chinese domestic rebar standards to promote higher product strength in 2018.
- The impact of COVID-19 has increased China's stimulus spending on infrastructure, resulting in China being a net importer of vanadium for the first time since 2004.
- Chinese domestic market tightened due to increased consumption in steel
- 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)
- $V_2O_5$  price for 98% flake US\$7.10/lb; Europe US\$5.20/lb as of 25/11/2020
- Long term average price for commodity grade  $V_2O_5$  is \$8.86/lb USD (inflated to 2017 \$USD)
- High grade  $V_2O_5$  sold at a premium to commodity price
- Vanadium electrolyte for use in VRB in short supply worldwide





# Fuel Resilience

## COVID-19 demonstrates supply chain risks

- 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 April 2020 said this would amount to 30 days of petrol for automobiles, 20 days of diesel and 20 days of aviation fuel. (Courier Mail 5/07/2020)
- 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. Australia has not had 90 days supply since 2012.
- 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 and 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, with the aim of determining a potential method to produce liquid fuels from the Julia Creek resource, with the potential flexibility to also support hydrogen production.



# Peer Comparisons



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

Company	ASX Code	Project Name	Location	Total Resource	V <sub>2</sub> O <sub>5</sub> %	Total V <sub>2</sub> O <sub>5</sub> Mt (Measured)	V <sub>2</sub> O <sub>5</sub> % (Measured)	Total V <sub>2</sub> O <sub>5</sub> Mt (Indicated)	V <sub>2</sub> O <sub>5</sub> % (Indicated)	Total V <sub>2</sub> O <sub>5</sub> Mt (Inferred)	V <sub>2</sub> O <sub>5</sub> % (Inferred)
King River Copper	KRC	Speewah Project	Wyndam Port, North West North West WA	4,712 Mt	0.30%	322 Mt	0.32%	1,054 Mt	0.33%	3,335 Mt	0.29%
<b>QEM Limited</b>	<b>QEM</b>	<b>Julia Creek Project</b>	<b>North West QLD, Australia</b>	<b>2,760 Mt</b>	<b>0.30%</b>	<b>N/A</b>	<b>N/A</b>	<b>220 Mt</b>	<b>0.29%</b>	<b>2,540 Mt</b>	<b>0.31%</b>
Horizon Minerals	HRZ	Richmond Vanadium Project	Richmond / Julia Creek, QLD	1,838 Mt	0.36%	N/A	N/A	430 Mt	0.50%	1408 Mt	0.33%
Vanadium Resources	VN8	SPD Project	South Africa	662 Mt	0.78%	92 Mt	0.77%	284 Mt	0.78%	285 Mt	0.77%
Neometals	NMT	Barrambie Project	Barrambie, WA	280 Mt	0.44%	N/A	N/A	187 Mt	0.46%	93 Mt	0.40%
Australian Vanadium	AVL	Australian Vanadium Project	Murchison Province, WA Province, WA	208 Mt	0.74%	10.1 Mt	1.14%	70 Mt	0.72%	128 Mt	0.73%



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

King River Copper: <https://www.asx.com.au/asxpdf/20190401/pdf/443ysh379b4xy3.pdf>  
 Horizon Minerals: <https://www.asx.com.au/asxpdf/20200616/pdf/44jp422n1x1m0r.pdf>  
 Vanadium Resources: <https://www.asx.com.au/asxpdf/20200429/pdf/44hbr074305tkn.pdf>  
 Neometals: <https://www.asx.com.au/asxpdf/20190522/pdf/4458j3kk0nlpxq.pdf>  
 Australian Vanadium: <https://www.asx.com.au/asxpdf/20200305/pdf/44fs1hgil0mm5s.pdf>

# Julia Creek Resource Overview



Table 1: Summary of JORC Mineral Resource Estimate

Resource Class	Strat.Unit	Mass (Mt)	Average Thickness (m)	Total						
				Insitu Density (gm/cc)	V2O5 (wt%)	Cu (ppm)	Mo (ppm)	Ni (ppm)	Zn (ppm)	Al (ppm)
Indicated	CQLA	73	3.16	2.27	0.25	155	138	123	780	4752
	CQLB	67	2.97	2.24	0.28	182	168	142	890	5706
	OSU	40	1.94	2.08	0.33	223	153	191	1087	55317
	OSL	38	1.87	2.11	0.32	199	149	184	1015	55009
Inferred	CQLA	687	2.57	2.28	0.23	154	139	121	819	2854
	CQLB	874	3.33	2.15	0.38	220	221	201	1184	5323
	OSU	504	2.01	2.11	0.30	232	147	188	1148	62477
	OSL	481	1.98	2.13	0.29	212	134	171	1058	60316
<b>Total</b>		<b>2,760</b>		<b>2.18</b>	<b>0.30</b>	<b>201</b>	<b>166</b>	<b>170</b>	<b>1043</b>	<b>26100</b>

Note:

1. The estimate uses a minimum cut-off of 0.2% V<sub>2</sub>O<sub>5</sub> for the oil shale units, and minimum cut-off of 0.15% V<sub>2</sub>O<sub>5</sub> for the Coquina units.

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

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

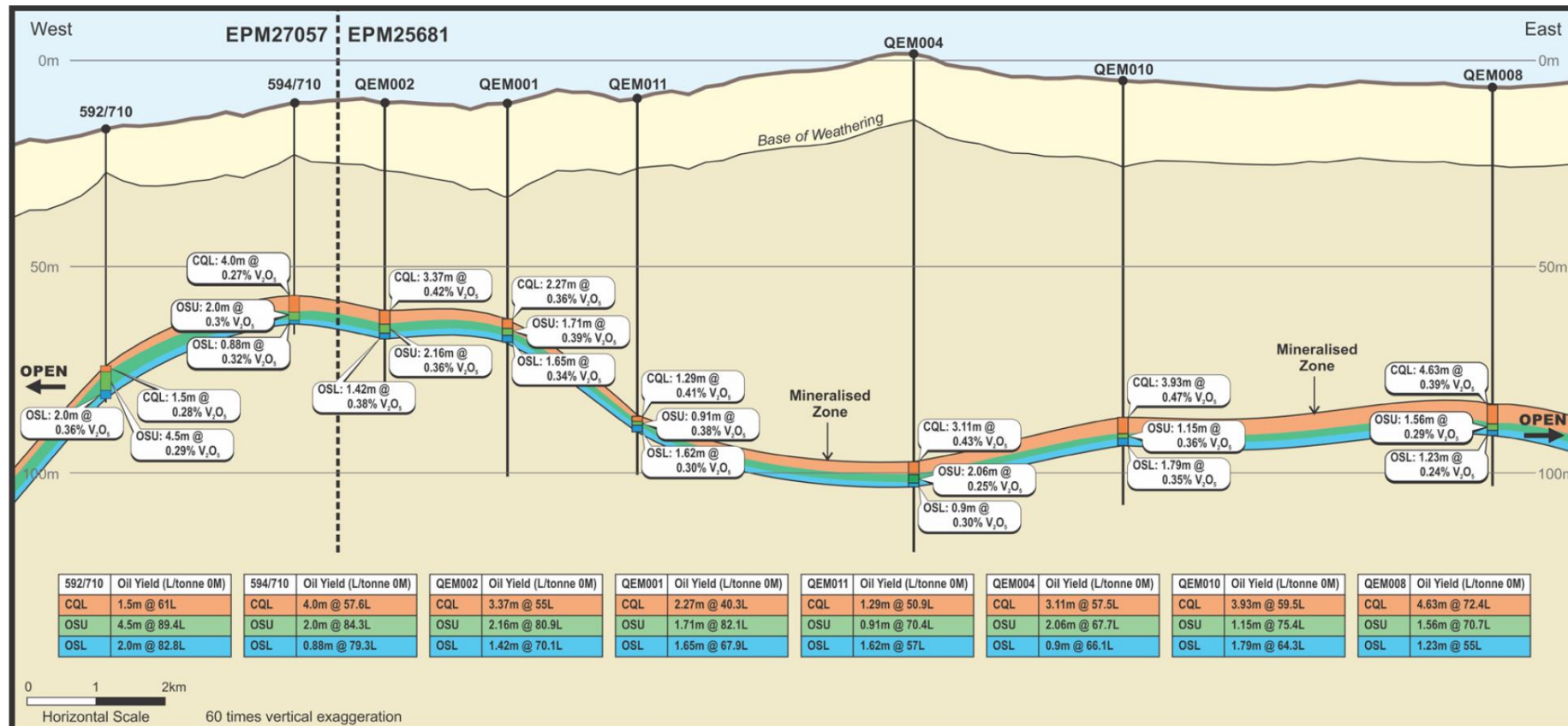
Note:

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



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# Appendix – Vanadium Market



# 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.



## Applications Of Vanadium



# 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, reducing the need for expensive gas peaker plants
- Long term cost advantage over competing battery technologies
- 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

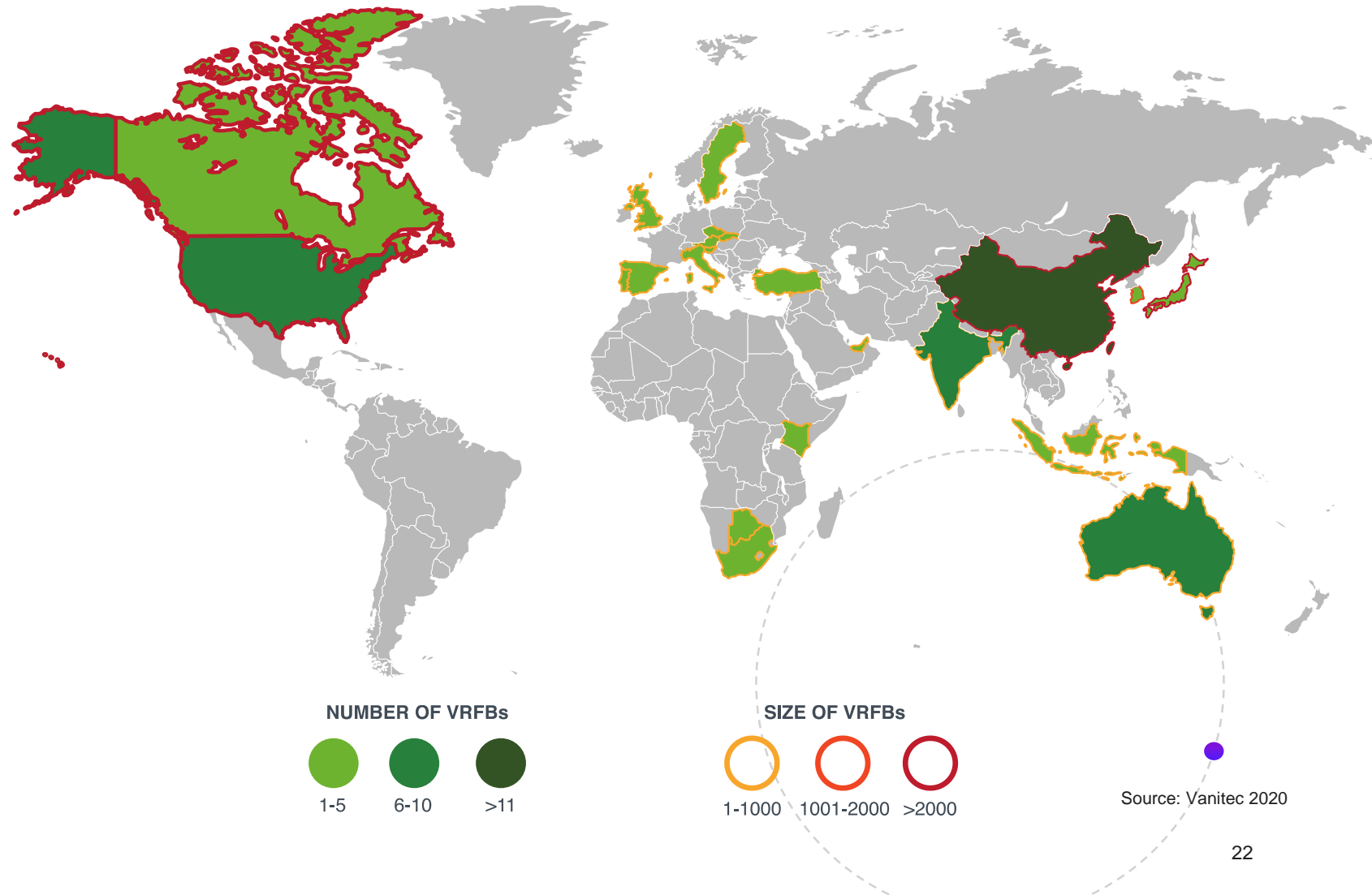


# 113 VRFB Installs Worldwide



39,664 kw of power, 209,800 kwh of energy

COUNTRY	VRFBs	kW	kWh
Australia	7	945	4629.90
Barbuda	1	3000	12000.00
Botswana	1	112	560.00
Canada	3	2500	10000.00
China	17	15825	48005.00
Czech Rep.	3	47	209.90
Denmark	3	40	260.00
Germany	15	1530	86190.00
India	4	155	740.15
Indonesia	2	400	500.00
Italy	5	631	2610.00
Japan	5	2330	7481.00
Netherlands	1	10	80.00
Portugal	5	5	60.00
Singapore	1	250	2000.00
Slovenia	1	10	45.00
South Africa	2	745	2950.00
South Korea	5	1250	4900.00
Spain	4	220	800.00
Sweden	1	800	1800.00
Switzerland	2	210	460.00
UK	5	805	5180.00
USA	17	7418	33173.70
Austria	1	14	84.00
Kenya	1	140	84.00
Slovakia	2	107	640.00
UAE	1	10	40.00





# Construction

## Stronger, safer buildings

- Vanadium plays an essential role as an alloy of steel to provide strength and is also added to increase fire resistance and increase tensile strength.
- 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 in the market today.
- Global crude steel production reached 1,869.9 million tonnes (Mt) for the year 2019, up by 3.4% compared to 2018. (Source: <https://www.worldsteel.org/media-centre/press-releases/2020/Global-crude-steel-output-increases-by-3.4--in-2019.html>)
- 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



- **Aerospace** - 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: <http://www.nextsourcematerials.com/vanadium/about-vanadium/> Mining Journal  
June 2018

- **Automotive** – Today, 45% of **vanadium** goes into **cars**, and it is estimated that 85% will be **used** in manufacturing **auto vehicles** by 2025. This will reduce the weight of cars, thereby increasing their fuel efficiency and be able to meet fuel economy standards. (Source: Vanadium Corp)
- 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)

