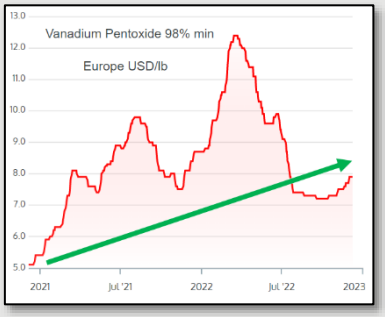


	Price ($)	Mkt Cap ($M)
Audalia	A$0.01	A$7.6
Aura Energy	A$0.25	A$130.5
Australian V.	A$0.03	A$103.8
Blue Sky	$0.10	$21.6
Bushveld	£0.05	£61.8
Critical Minerals	A$0.19	A$8.4
Currie Rose	$0.02	$3.5
Energy Fuels	$7.85	$1,237.4
EVRAZ	£0.81	£1,181.5
Flinders Mines	A$0.38	A$64.2
Glencore	£5.33	£67,614.9
Golden Deeps	A$0.01	A$11.6
Gossan	$0.05	$3.0
Horizon Minerals	A$0.06	A$38.6
Ironveld	£0.003	£8.5
King River	A$0.01	A$18.6
Largo	$6.75	$432.0
Neometals	A$0.89	A$489.2
NextSource	$2.78	$347.7
Pegasus Resources	$0.03	$3.4
Richmond Van.	A$0.28	A$62.1
Strategic Res.	$0.35	$15.7
Surefire Resources	A$0.01	A$22.1
Syrah Res.	A$2.29	A$1,535.6
Technology Met.	A$0.35	A$73.4
TNG	A$0.08	A$112.5
Vanadian Energy	$0.02	$0.8
Vanadium Res.	A$0.06	A$27.1
Vanadiumcorp	$0.11	$5.2
Venus Metals	A$0.13	A$24.0
Voyager Metals	$0.11	$9.8
Western U. & V.	$1.14	$49.7
Westwater Res.	US$0.84	US$40.4

Sources: Vanadiumprice.com; S&P Capital IQ

Chris Thompson, CFA, MBA, P.Eng.
Director of Equity Research
eResearch Corp.

Note: All figures are in Canadian dollars unless otherwise noted.

Vanadium: Powering the Renewable Energy Revolution

Your Guide to Understanding and Investing in Vanadium Companies

Vanadium is an important element due to its lightweight, steel-strengthening alloying abilities, non-corrosive properties, and various industrial and non-industrial applications. However, vanadium is rarely found in its metallic form in nature, but it is found in 65 different minerals.

The majority of the vanadium produced today is consumed by the steel industry as an alloying agent for lighter-weight, high-strength steel.

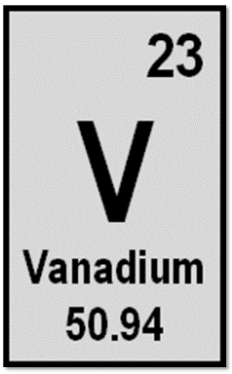
However, vanadium's use in the energy storage industry is expected to dramatically rise as a result of the increased deployment of renewable energy projects that are estimated to grow global renewable electricity capacity by 50%-60% over the next four years; the projects often require high-capacity batteries to store energy due to the inconsistency of power being produced.

REPORT HIGHLIGHTS:

- **Shift to Renewable Energy Could Trigger a Surge in Demand**
  - The use of vanadium in renewable energy storage solutions, such as Vanadium Redox Flow Batteries (VRFB), is an efficient and cost-effective alternative to existing lithium-ion (Li-ion)-based batteries.
  - Currently, it is estimated that the VRFB market only accounts for 3%-5% of vanadium production but the continued shift to renewable energy solutions could trigger a surge in vanadium demand and account for 20% of vanadium consumption by 2030.
- **Demand Across Various Applications Continues to Grow**
  - The majority of all vanadium produced is used as an alloying agent for strengthening steel. Vanadium producers have recently benefited from an increase in infrastructure spending.
  - However, the demand for vanadium also continues to increase with other applications, including in the aerospace industry and the production of vanadium redox batteries.
- **Potential Supply Deficit as Early as 2025**
  - Various supply-demand forecasts have vanadium in a supply deficit starting around 2025. Without additional supply to meet the demand, the price of vanadium could remain above historical averages.
- **Domestic Sources Needed to Secure Supply Chains**
  - Over 66% of vanadium production comes from China, while China and Russia together account for over 83% of world mine production.
  - With recent geopolitical and supply chain issues, Australian, European, and North American industries need to secure a domestic supply chain for critical minerals, including vanadium.

CONTENTS:

Vanadium Overview



Vanadium is a chemical element with the symbol V and atomic number 23. It is a hard, silvery, non-magnetic, ductile metal that is resistant to corrosion against acids and alkalis due to the presence of an outer protective film.

Vanadium is the 22nd most abundant element in the earth and accounts for approximately 0.014% of its continental crust. It is not found in its metallic form in nature but can be found in approximately 65 different minerals, including magnetite (iron oxide), carnotite, patronite, vanadinite, and some iron ores. It also can be found in phosphate rock and fossil fuels such as crude oil, coal, and tar sands.

Vanadium has a wide range of applications including use in iron and steel production, in Vanadium Redox Flow Batteries (VRFBs), and as a chemical catalyst. The majority of all the vanadium produced today is used as an alloy to strengthen steel but the demand growth could come from an increase in the production of vanadium redox batteries. Demand for vanadium continues to increase even though the vanadium supply remains relatively flat.

Facts About Vanadium

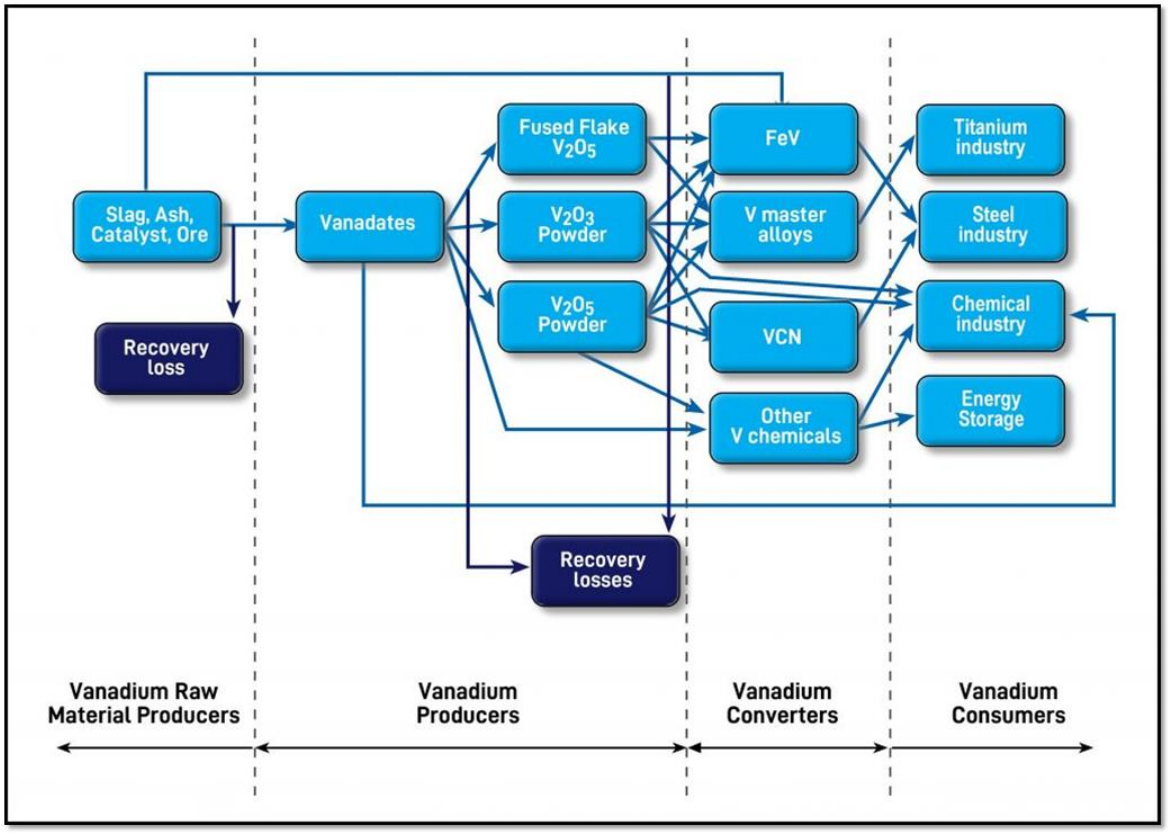
- Vanadium was originally discovered in 1801 by a professor in Mexico City who named it erythronium and was rediscovered in 1830 by a Swedish chemist who named it after a Norse goddess (Vanadis).
- In February 2018, the U.S. government declared vanadium as one of the 35 minerals deemed to be critical to the economy and national security under Executive Order 13817 for its use in manufacturing steel alloys. The U.S. is currently a net importer of this element.
- Vanadium is also on Canada's list of critical minerals as part of the Canadian Minerals and Metals Plan (CMMP), is one of twenty minerals on the European Union's list of "Critical Raw Materials", and is on the Australian Government's list of 26 commodities deemed to be "critical minerals".
- It is primarily used in the manufacturing of high-strength steel products with a wide range of applications including reinforcing bars in construction, armour plating, axles and crankshafts for motor vehicles, components for jet engines, and tool steel. In 2021, 94% of reported vanadium consumption in the U.S. was for metallurgical use, primarily as an alloying agent in iron and steel production.
- Vanadium is also in alloys used in nuclear engineering and superconductors, and is also used in the production of ceramics, electronics, fertilizers, and textile dyes.
- As a chemical catalyst, vanadium is used in the making of sulfuric acid and the desulfurization of sour gas and oil. More recently, attention has focused on the development of energy cells such as VRFBs.
- The first significant industrial application of vanadium was in 1905, when vanadium-enriched steel was used in the Ford Model T to make it stronger and lighter.
- More than 85% of vanadium is recovered from magnetite and titano-magnetite ores, either as the primary product or more commonly as a byproduct from iron processed for steel production.
- It can also be recovered as a secondary product from fly ash, petroleum residues, alumina slag, and the recycling of spent catalysts used in crude oil refining.

Figure 1: Vanadium Dendritic Crystals

Source: Smart-elements.com

Figure 2 provides an overview of the vanadium industry supply chain and identifies the various raw material and intermediate product producers as well as the main consumer groups.

Figure 2: Vanadium Industry Supply Chain



Source: TTP Squared, Inc.

Vanadium Demand

Vanadium demand is projected to rise in the future primarily due to:

1. **Commitments to Greener Economies:** The use of vanadium in renewable energy storage solutions, such as VRFBs, is a cost-effective alternative to existing Lithium-ion (Li-ion) based batteries. Currently, it is estimated that the VRFB market only accounts for 3%-5% of vanadium production but the continued shift to renewable energy solutions could trigger a surge in vanadium demand and account for 20% of vanadium consumption by 2030;
2. **Infrastructure Projects:** An increase in its usage in steel-making to improve steel quality by countries such as China and Japan, and billion-dollar infrastructure projects in various countries;
3. **Industry Shifts:** The automobile industry will increase the use of vanadium in alloys in manufacturing automobile parts to reduce their weight to help improve fuel efficiency.

According to a 2022 report by **Global Industry Analysts**, the 2020 global market for vanadium was estimated at US$39 billion and is projected to grow by a compound annual growth rate (CAGR) of 7.4% to reach US$64.2 Billion by 2027.

Vanadium use as an alloy in iron and steel production is projected to grow at a CAGR of 7.7% and reach US$33.6 billion by 2027 with applications in the energy storage segment growing at a CAGR of 8.2% during the seven years.

In the U.S., demand was estimated at US$10.6 billion in 2020, with China's demand estimated at US$6.5 billion but growing at a CAGR of 10.8%.

Vanadium as a Battery Metal

A redox flow battery (RFB) is an electrochemical energy storage device that converts chemical energy into electrical energy. An RFB differs from other conventional rechargeable batteries in that the energy storage occurs in a liquid media and the charging and discharging processes can occur within a single cell.

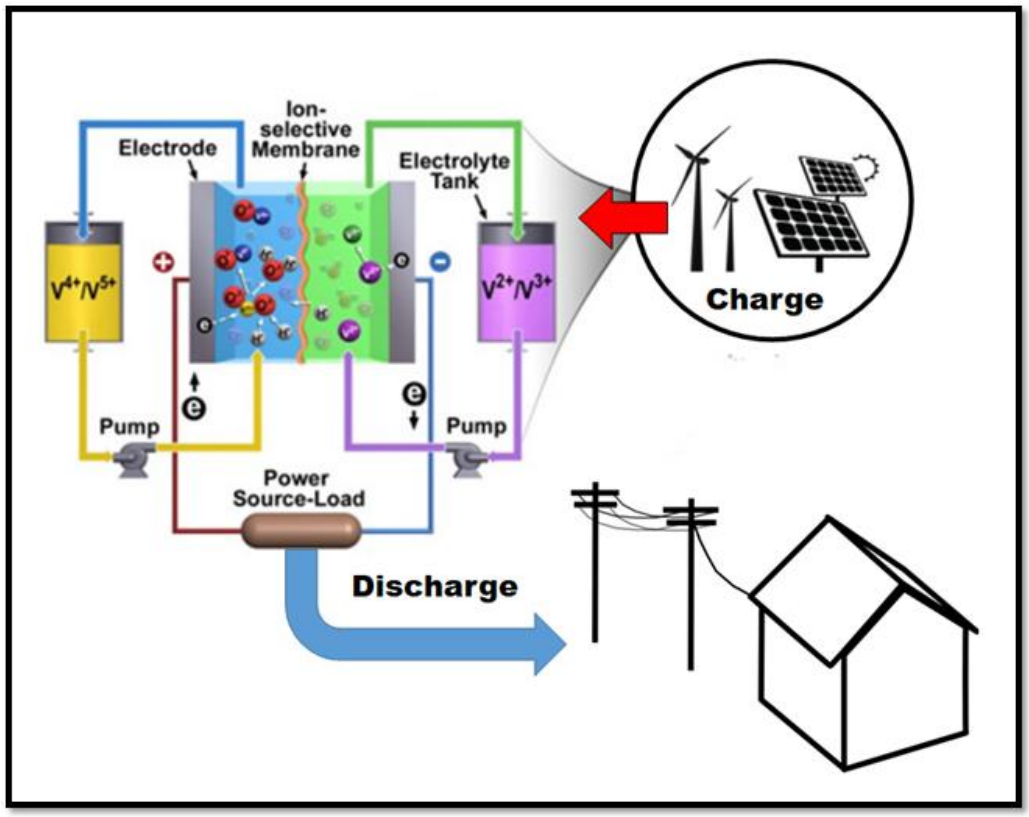
The vanadium redox flow battery (VRFB), also known as the vanadium redox battery (VRB), is a type of RFB that uses vanadium ions as the charge carriers and has two separate tanks in which one tank contains the positive electrolyte and the second tank contains the negative electrolyte.

VRFBs offer unique advantages over Li-ion batteries for energy storage, including:

- Significantly longer cycle lifetimes and performance result in a lower overall energy storage cost:
    - Each round of full recharge and full discharge is called a battery life cycle. A battery's cycle lifetime is the number of battery life cycles that a battery can complete before losing performance.
    - A VRFB has between 15,000-20,000 battery cycles as opposed to 2,000-3,000 cycles for a comparable Li-ion battery. The longer battery lifetime results in a lower overall energy storage cost.
    - In addition, the VRFB has the ability for repeated battery life cycles without a drastic drop in performance.
- Scalability – can be used for small to large energy storage projects:
    - The energy storage battery can be scaled appropriately to meet the project's specific energy requirements, from a few hundred megawatts (MW) of power and watt-hours (Wh) of storage to multi-MW and megawatt-hours (MWh) systems.

- Reusability:
  - Nearly 100% of the liquid electrolyte used in a VRFB can be recovered and reused in another battery with minimal processing, resulting in a lower environmental impact.
- Safety:
  - Flow batteries do not contain toxic materials and, because the battery's electrolyte is in an aqueous form, it makes the technology inherently nonflammable and safe, so it does not pose the same explosion or fire risks when compared to lead-acid or Li-ion batteries.

Figure 3: Vanadium Redox Flow Battery



Source: U.S. Department of Energy; eResearch Corp.

Currently, Li-ion technology dominates the storage market with over 86% share of the total utility-scale storage market as opposed to a 3% share for VRFB. Because VRFBs have lower energy and power density (a lower round-trip efficiency of 70%-85% as opposed to 90%-95% for Li-ion batteries), they must be physically larger and heavier with respect to comparable Li-ion systems. This limits their use to long-duration energy storage applications. Li-ion technology's versatility in grid-scale and distributed energy storage applications combined with a drastic drop in its capital cost over the past two decades also explains its ubiquity.

The deployment of green power solutions, such as solar panels or wind turbines, is expected to be a major demand driver for VRFBs due to the variable supply that often requires energy storage to balance supply with demand.

A recent VRFB deployment project includes an 800 MWh energy storage system deployment project in Dalian, China, the largest of its kind, was connected to the grid in late-May 2022 and is a result of a

business partnership between **Dalian Rongke Power Co.** (www.rongkepower.com) and the **National Energy Administration of China**.

Other projects include the Pangea Storage Project by **Pangea Energy** (www.pangeastorageproject.com), which plans to invest $200 million to establish a 200 MWh battery in southern Australia, and a 15 MW/60 MWh grid-scale VRFB-deployment project in Hokkaido, Japan by **Sumitomo Electric Industries (TSE:5802)** in an effort to incorporate large-scale renewable energies such as wind and solar into the electric grid.

VRFB Demand

According to a 2022 report by **Global Industry Analysts**, the global VRFB market was estimated at US$284.5 million in 2022, with a projected CAGR of 20.9% until 2027 to reach US$734.9 million. In 2022, the VRFB market in the U.S. was estimated at US$51.9 million.

Figure 4: Electrolyte Tanks for a 3 MW/12 MWh VRFB

Source: VRB Energy

Electricity Demand Could Drive VRFB Demand as Global Renewable Electricity Generation Increases Exponentially

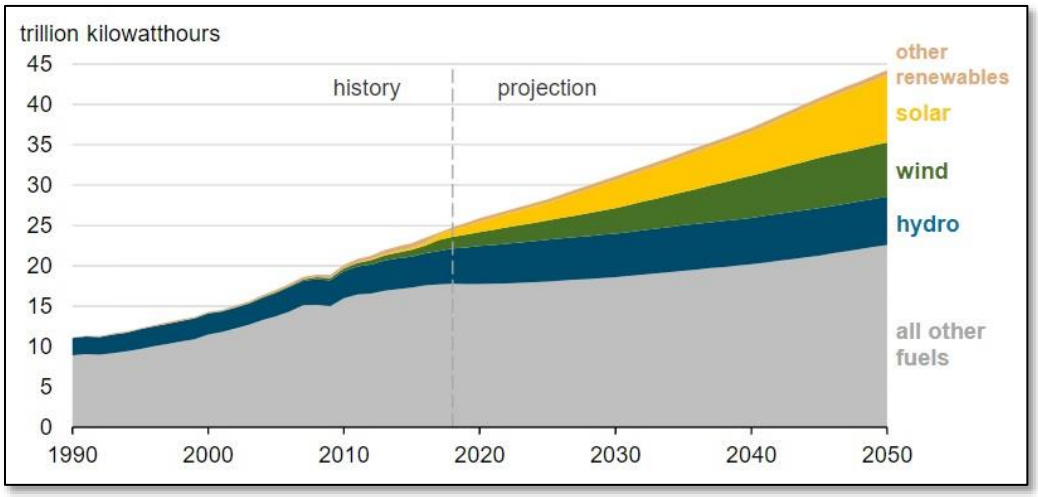
According to the **U.S. Energy Information Administration (EIA)**, global electricity demand could almost double to 45 trillion kilowatt hours by 2050, up from approximately 25 kilowatt hours in 2020. The **EIA** estimates that renewable energy will increase to 49% of global electricity generation by 2050, with solar energy's share of the generation growing the fastest (Figure 5).

Vanadium's use in the energy storage industry is expected to rise dramatically as a result of the increased deployment of renewable energy projects that are estimated to grow global renewable electricity capacity by 50%-60% over the next four years as countries try and reach milestones to meet the **United Nations** Climate Action plan of Net Zero Emissions by 2050.

According to the **International Energy Agency (IEA)** (www.iea.org), global renewable electricity generation grew by over 8% in 2021 and accounted for almost 30% of global electricity generation.

Government policies and national renewable energy targets in various countries, including China, India, the European Union, and the U.S., prompted the construction of a record amount of renewable energy capacity in each year from 2020 to 2022.

Figure 5: World Net Electricity Generation (1990-2050)



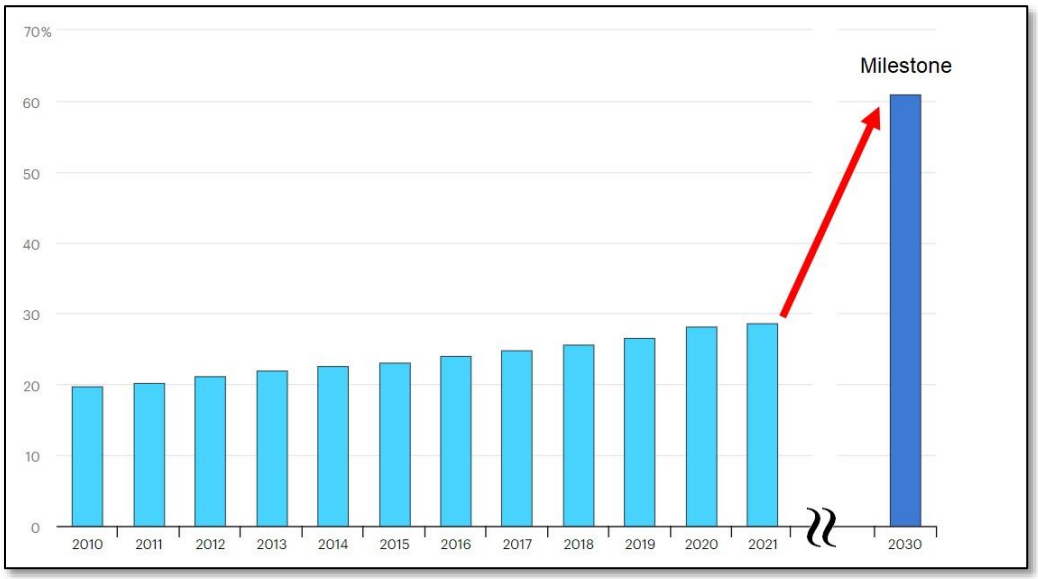
Source: EIA (2019)

However, the annual growth rate in renewable energy generation needs to increase to at least 12% per year to meet the Net Zero Emissions by 2050 target of 70% by 2030 (Figure 6). Electric power generation companies often require high-capacity batteries to store energy due to the inconsistency of power being produced from some renewable energy sources (e.g., solar and wind).

In 2020, the **World Bank** announced its new Climate Change Action Plan for 2021-2025 that reiterated its commitment to provide US$1 billion to finance investments in battery storage solutions to help developing and middle-income countries ramp up the use of renewable energy sources, primarily solar and wind power.

The **World Bank's** program aims to finance 17.5 gigawatt hours (GWh) of battery storage by 2025, more than doubling the 16 GWh currently installed worldwide and is expected to garner an additional US$4 billion in financing from public and private investments in the program.

Figure 6: Renewables Share of Power Generation in the Net Zero Scenario, 2010-2030



Source: IEA (2022); eResearch Corp. (annotations)

Other Uses for Vanadium

Steel Production

- Close to 75% of vanadium is produced as ferro-vanadium for high-strength low alloy (HSLA) steels used in construction and rebar.
- Adding a kilogram of vanadium to a tonne of steel can enhance its strength more than twofold.
- Vanadium is also incorporated in the production of tool steels (i.e., axles and crankshafts) to increase their resistance to corrosion, in tubes and pipes manufacturing, and in the automotive industry to make car components such as hoods, door panels, and piston rods.

Master Alloys

- When mixed with aluminum, vanadium strengthens and promotes thermal stability in titanium alloys, which makes it a critical component in the aviation sector to produce jet engines, airframes, and spacecraft. The alloys' high strength-to-weight ratio makes the components stronger and lighter, promoting fuel efficiency.
- Vanadiumlow neutron absorption abilities, along with its resistance to high thermal stress and radiation, also make it an excellent candidate material for manufacturing structural components for nuclear reactors.

Chemicals & Catalysts

- Vanadium compounds have applications in dye manufacturing, particularly in the production of aniline black, a cotton dye, and are also used as mordants, substances used to set dyes on fabrics.
- The compounds are also used in glass and ceramics production and as a catalyst in manufacturing sulfuric acid and can be combined with gallium to form superconductive magnets.

Health

- Vanadium is utilized in health supplements to treat, prevent, and manage health issues such as diabetes, high cholesterol, tuberculosis, and syphilis.
- Lithium-silver-vanadium oxide batteries are also used in pacemakers and other medical devices.

Vanadium Supply

World Resources

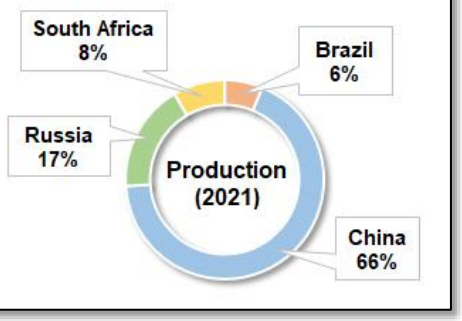
Vanadium is not found in its metallic form in nature but can be found in approximately 65 different minerals, including magnetite (iron oxide), carnotite, patronite, vanadinite, and some iron ores, often constituting less than 2% of the host rock.

It also can be found in phosphate rock and fossil fuels such as crude oil, coal, and tar sands.

Vanadium-bearing magnetite ores can be primarily processed using a roasting and leaching operation or as a byproduct of a smelting operation, which is then reduced to ferro-vanadium (FeV) or vanadium powder. For example, FeV is a byproduct of steel production.

Figure 7: World Mine Production & Reserves (US Ton)

	Mine production (metric tons)		Reserves (metric tons)
	2020	2021	2021
United States	17	—	45,000
Australia	—	—	6,000,000
Brazil	6,620	6,700	120,000
China	70,000	73,000	9,500,000
Russia	19,500	19,000	5,000,000
South Africa	8,580	9,100	3,500,000
World total (rounded)	105,000	110,000	24,000,000



Source: USGS Mineral Commodity Summaries (2022) - Vanadium

The vanadium ore market consists of vanadium ores and concentrates containing various concentrations of vanadium. Vanadium is primarily sold as vanadium pentoxide (V_2O_5) and less commonly as vanadium trioxide (V_2O_3) for non-steel applications.

The most common vanadium concentrate is FeV, a combination of iron (Fe) and vanadium, at various percentages of vanadium ranging from 40% (FeV40) to 80% (FeV80); FeV80 is the most common FeV alloy.

According to a market report by the **Business Research Company** in May 2022, the global vanadium ore market grew to US$2.69 billion in 2022 from US$2.53 billion in 2021 at a CAGR of 6.2% and is expected to reach US$3.28 billion in 2026 at a four-year CAGR of 5.0%.

In the **United States Geological Survey (USGS)** Mineral Commodity Summary for vanadium in 2021, China was the world's top producer, accounting for more than 66% of the global supply, with Russia and South Africa being the distant second- and third-largest producers of vanadium at 17% and 8%, respectively.

In 2021, China had the largest vanadium reserves ahead of Australia, Russia, and South Africa. Currently, there are no operating vanadium mines in Australia, the U.S., or Europe.

However, byproduct vanadium production in the U.S. occurred at **Energy Fuels' (TSX:EFR)** White Mesa mill in Utah. As of November 2022, **Energy Fuels** had produced 1.9 million pounds of high-purity (over 99.7%) V_2O_5 from tailings and sold approximately 575,000 lbs at an average price of $13.44/lb.

Vanadium Mines

Many mines in the world are currently mining vanadium, but China, Russia, South Africa, and Brazil mined 98% of the vanadium production in 2021.

1) China:

With a total vanadium mining output amounting to over 66% of the global supply in 2021, China far outpaced other vanadium-producing countries. China's Vanadium Titano Magnetite Mining Company, one of the largest producers of vanadium in China, currently operates the Baicao and Xiushuihe mines in the Sichuan province of China.

2) Russia:

Russia supplies approximately 17% of the world's vanadium supply. **Evraz PLC (LSE:EVR)**, a UK-incorporated multinational steel manufacturing and mining company, in which billionaire Roman Abramovich is one of the largest investors, is the largest Russian vanadium producer with facilities in Russia, the Czech Republic, and the U.S. **Evraz** produces FeV from slag, a by-product of steel production.

3) South Africa:

South Africa is the third-largest producer of vanadium in the world with a large quantity of vanadium-rich magnetite ore bodies. It provides around 8% of the metal's global supply. **Bushveld Minerals (AIM:BMN)** and **Glencore PLC (LSE:GLEN)** presently provide most of the current vanadium supply in South Africa.

4) Brazil:

Brazil is the fourth-largest vanadium producer in the world at approximately 6% of the world's supply. The Maracas Menchen vanadium mine, located in Brazil, is one of the world's highest-grade vanadium deposits and the only vanadium mine in Latin America. Operating since 2014, the open-pit mine is owned and operated by **Largo Inc. (TSX:LGO)**, a Canadian vanadium producer and supplier. The mine has a 2017 Reserve of 60.36 million tonnes at 0.79% V_2O_5.

Figure 8: Largo's Maracas Menchen Mine in Bahia State, Brazil

Source: Largo Resources Ltd.

Mining Companies

Since vanadium is not publicly traded, it is difficult to invest in physical vanadium. Instead, investors interested in the vanadium industry can gain exposure to the market through mining companies focusing on vanadium exploration, development, or mining. In Figure 9, we list some mining companies with vanadium projects.

Figure 9: Select Companies Producing, Developing, and Exploring for Vanadium

COMPANY NAME	TICKER	PRICE	MKT CAP (M)	CASH (M)	EV (M)	EBITDA (M)	EV/ EBITDA	LOCATION
Producers								
Bushveld Minerals	AIM: BMN	£0.05	£61.8	£7.0	£152.0	£21.7	7.0	South Africa
Energy Fuels	TSX: EFR	$7.85	$1,237.4	$88.7	$1,121.1	-$35.5		Utah, U.S.
EVRAZ plc	LSE: EVR	£0.81	£1,181.5	£849.0	£3,223.5	£5,526.0	0.6	Russia
Glencore plc	LSE: GLEN	£5.33	£67,614.9	£2,882.0	£88,258.6	£26,654.0	3.3	South Africa
Largo	TSX: LGO	$6.75	$432.0	$62.7	$382.2	$41.4	9.2	Brazil
Average							***5.0***	
Median							***3.3***	
Feasibility / Pre-Feasibility Stage								
Aura Energy	ASX: AEE	A$0.25	A$130.5	A$10.0	A$120.8	-A$3.1		Mauritania
Australian Vanadium	ASX: AVL	A$0.03	A$103.8	A$26.4	A$77.4	-A$4.9		Australia
Horizon Minerals	ASX: HRZ	A$0.06	A$38.6	A$5.4	A$33.3	-A$8.6		Australia
Ironveld Plc	AIM: IRON	£0.00	£8.5	£0.0	£11.7	-£0.8		South Africa
King River	ASX: KRR	A$0.01	A$18.6	A$2.9	A$15.8	-A$2.1		Australia
Richmond Vanadium Tech. Ltd.	ASX: RVT	A$0.28	A$62.1	A$1.1	A$61.1	-A$0.5		Australia
Technology Metals	ASX: TMT	A$0.35	A$73.4	A$18.6	A$54.8	-A$2.5		Australia
TNG Limited	ASX: TNG	A$0.08	A$112.5	A$14.6	A$97.9	-A$4.4		Australia
Average					***A$60.3***			
Median					***A$58.0***			
PEA / Scoping Study Stage								
Audalia Resources	ASX: ACP	A$0.01	A$7.6	A$0.2	A$12.1	-A$0.3		Australia
Blue Sky Uranium	TSXV: BSK	$0.10	$21.6	$1.0	$20.6	$0.0		Argentina
Neometals	ASX: NMT	A$0.89	A$489.2	A$62.4	A$427.2	-A$19.6		Australia
Strategic Resources	TSXV: SR	$0.35	$15.7	$0.2	$15.5	$0.0		Finland
Surefire Resources	ASX: SRN	A$0.01	A$22.1	A$5.1	A$17.1	-A$2.4		Australia
Voyager Metals	TSXV: VONE	$0.11	$9.8	$0.6	$14.6	-$2.1		Quebec, Canada
Average					***$78.0***			
Median					***$15.6***			
Resource Stage (NI 43-101 / JORC)								
Currie Rose Resources	TSXV: CUI	$0.02	$3.5	$0.3	$3.2	$0.8		Australia
Critical Minerals	ASX: CMG	A$0.19	A$8.4	A$0.0	A$3.8	A$0.0		Australia
Flinders Mines	ASX: FMS	A$0.38	A$64.2	A$2.6	A$62.8	-A$2.1		Australia
Golden Deeps	ASX: GED	A$0.01	A$11.6	A$8.0	A$3.2	A$0.0		Namibia
NextSource Materials	TSX: NEXT	$2.78	$347.7	$4.6	$342.0	-$3.1		Madagascar
Syrah Resources	ASX: SYR	A$2.29	A$1,535.6	A$168.6	A$1,419.2	-A$35.8		Mozambique
Vanadium Resources	ASX: VR8	A$0.06	A$27.1	A$2.9	A$24.4	-A$1.3		South Africa
Vanadiumcorp	TSXV: VRB	$0.11	$5.2	$0.0	$5.6	-$1.0		Quebec, Canada
Venus Metals	ASX: VMC	A$0.13	A$24.0	A$6.5	A$22.1	-A$6.5		Australia
Western Uranium & Vanadium	CNSX: WUC	$1.14	$49.7	$10.5	$35.3	$0.1		Colorado & Utah, U.S.
Average					***$179.1***			
Median					***$21.3***			
Resource Definition Stage								
Gossan Resources	TSXV: GSS	$0.05	$3.0	$0.4	$2.6	$0.0		Manitoba, Canada
Pegasus Resources	TSXV: PEGA	$0.03	$3.4	$0.1	$3.4	-$1.1		Utah, U.S.
Vanadian Energy	TSXV: VEC.H	$0.02	$0.8	$0.0	$1.1	$0.0		Manitoba, Canada
Westwater Resources	NYSEAM: WWR	$0.84	US$40.4	US$100.3	-US$59.8	-US$11.8		Alabama, U.S.

Source: S&P Capital IQ; eResearch Corp.

Company Spotlight – Currie Rose Resources Inc. (TSXV:CUI)

Company Description:

Currie Rose Resources is a mining exploration and development company focused on its 100%-owned North Queensland Vanadium Project (NQVP) located within the mining-friendly vanadium hub in central Queensland, Australia. The project has a well-developed infrastructure with a local, skilled workforce, power service, and rail, road, and port access.

The NQVP hosts the Cambridge deposit with an NI 43-101 compliant resource of 61.33 Mt at 0.34% V_2O_5 in the Indicated category and an Inferred Resource of 144.87 Mt at 0.33% V_2O_5 as well as an estimated MoO_3 grade of 239.7 parts-per-million (ppm). The Indicated resource can be part of a Preliminary Economic Assessment (PEA) study. The Cambridge resource is open for expansion to the north and the project hosts multiple other drill-ready targets.

Currie Rose is run by a well-seasoned management team, with Mike Griffiths, CEO and President, having 40 years of experience in the industry, and also has a strong shareholder base.

Website: www.currierose.com

Investment Thesis:

Currie Rose is an advanced-stage exploration company with a district-scale vanadium and molybdenum project that contains an existing resource in a mining-friendly jurisdiction with an experienced management team and is advancing the project toward a PEA.

Currently, **Currie Rose** is trading with an Enterprise Value (EV) that is well below the Average and Median EVs for other vanadium companies in the Resource Stage of development (see Figure 9).

The project contains an oxide resource within sediments that can be mined with a low strip ratio and the preliminary metallurgy work that was completed in 2018 shows the vanadium ore is suitable for pre-concentration and acid leaching. Concentrate production will have reduced energy requirements and lower Capital Expenditure (Capex).

In addition, the Queensland Government is supplying an initial A$10 million grant to support the development of a common user pilot processing plant to domestically process vanadium ore at the nearby city of Townsville on the northeastern coast of Queensland.

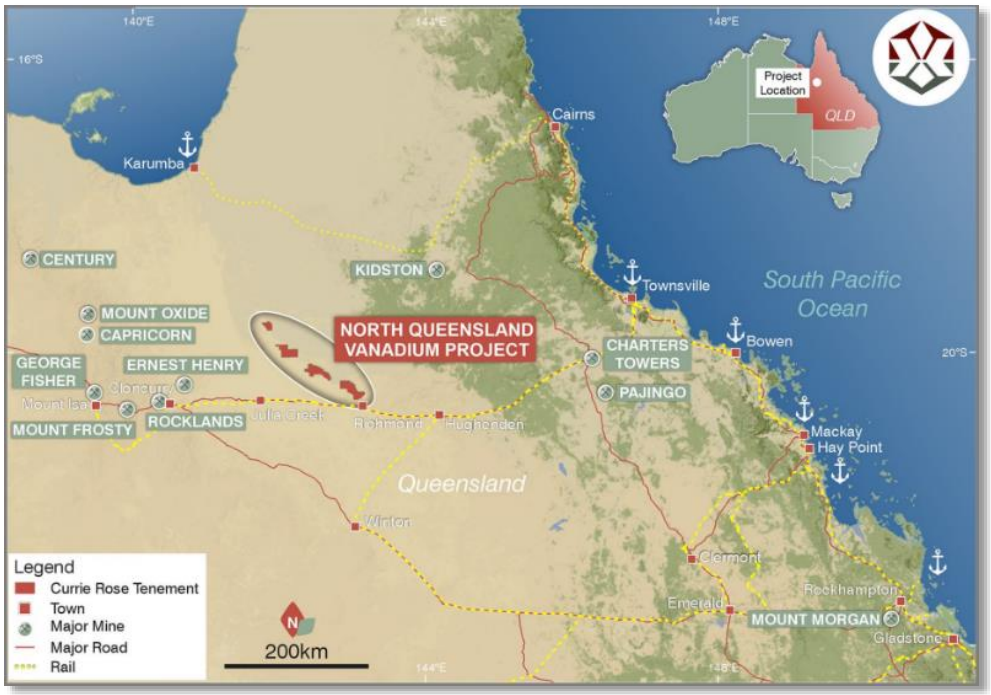
The processing plant will be part of a plan to "make Queensland a leading producer and exporter of new-economy minerals and the home of new industries" and is targeted for opening by the end of 2023.

Property Summary: North Queensland Vanadium Project (NQVP)

In October 2021, **Currie Rose** entered into a purchase agreement with **Liontown Resources Limited (ASX:LTR)** and **CGM Vanadium Pty Ltd.**, a subsidiary of **Chalice Mining Limited (ASX:CHN)**, to acquire a 100% ownership of the seven exploration permits that comprise the NQVP.

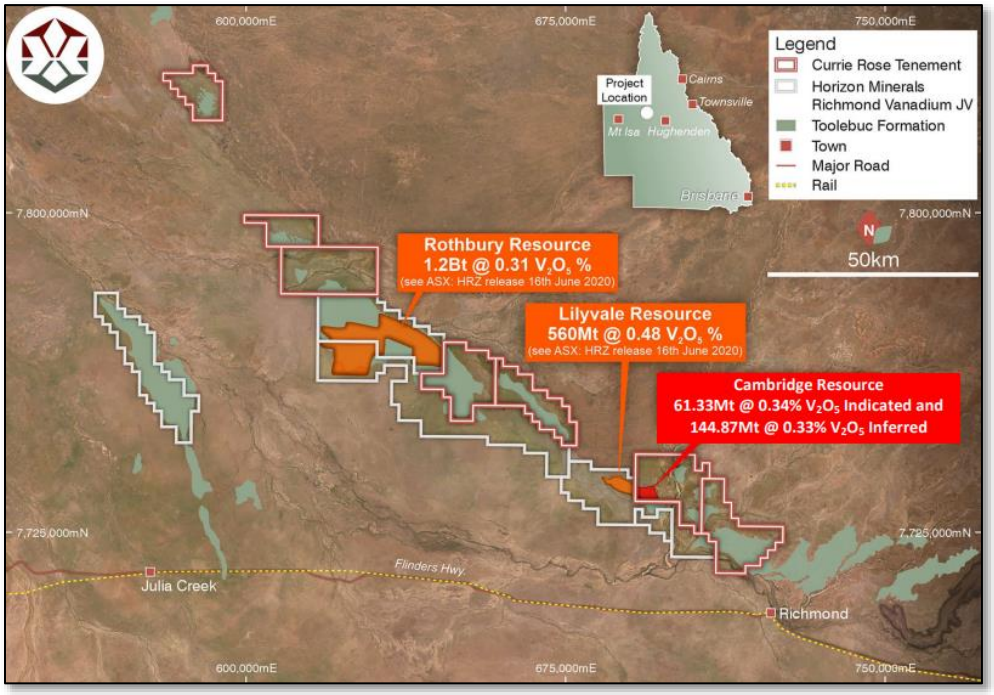
The NQVP is located midway between Mt. Isa and the Port of Townsville and serviced by the town of Richmond. The NQVP comprises seven partially contiguous to non-contiguous Exploration Permits for Minerals (EPM) covering 1,246 km^2 in Queensland, Australia, within the Julia Creek - Richmond Vanadium Hub. The project is on private land.

Figure 10: North Queensland Vanadium Project (NQVP) in North-Eastern Australia



Source: Company Presentation (2022)

Figure 11: Cambridge Resource Location – On Trend with Rothbury and Lilyvale Resources



Source: Company Presentation (2022)

The NQVP contains the Cambridge Resource (NI 43-101) resource and advanced prospects.

- **Cambridge Resource (NI 43-101 compliant):**
  - **Indicated:** 61.33 Mt at 0.34% V_2O_5;
  - **Inferred:** 144.87 Mt at 0.33% V_2O_5;
  - **Molybdenum:** 239.7 ppm MoO_3 (average grade).

Figure 12: NI 43-101 Resource (2022)

Category	Tonnes (Mt)	V_2O_5 (%)	MoO_3 (ppm)
Inferred	144.87	0.33	241.9
Indicated	61.33	0.34	234.6
0.25% Vanadium Cut-Off Grade			

Source: Company Presentation (2022)

- The NQVP is on trend with regional projects including the Richmond-Julia Creek Vanadium Project, owned by **Richmond Vanadium Technology Limited (ASX:RVT)**, comprising the Lilyvale and Rothbury Vanadium Oxide deposits and containing a combined 1,838 Mt at 0.36% V_2O_5 (Figure 11). The Lilyvale deposit is in the Feasibility stage.
- **Advanced Prospects:**
  - **Flinders River Prospect:** Acquired in 2022 and historical drilling identified an area of extensive vanadium mineralization that is open to the east.
  - **Runnymede Prospect:** Acquired in 2022 and historical drilling defined the presence of shallow vanadium mineralization over a 3.5 km by 3.5 km area.
  - **Silver Hills Prospect:** High-priority drill targets have been identified based on the historic drilling results and surface sampling.

Capital Structure

As of December 14, 2022	(M)
Shares Issued & Outstanding	174.50
Warrants ($0.05-$0.10; Jan-Aug 2024)	66.34
Options ($0.075-$0.125; Feb 2024-May 2026)	9.39
Fully Diluted	**250.23**

Source: From the Company

Short-term Catalysts

1. Deliver the next phase of the metallurgical test work required for the PEA.
2. Initiate the environmental test work required for the PEA.
3. Initiate drilling programs to get the appropriate samples for geotechnical and metallurgical test work, water testing, and exploring new advanced projects, including Flinders River and Runnymede.
4. Develop a plan for processing the resource.
5. Update the Cambridge Resource with infill drilling.
6. Complete the PEA.

Vanadium Pricing

Vanadium presents a myriad of real-world applications in the field of construction, the automotive industry, transportation, and more recently, the energy sector; however, the steel sector continues to drive most of the demand.

Going forward, the vanadium price trend is expected to be majorly influenced by growth in the steel sector and the aerospace sector, and the demand for vanadium-based energy storage solutions.

As previously mentioned, vanadium is primarily sold as vanadium pentoxide (V_2O_5) or as a ferro-vanadium alloy with FeV80 being the most common.

Vanadium is not currently traded on any commodity exchange such as the London Metal Exchange ("LME"). Prices are determined in private negotiations between buyers and sellers, however, various companies track pricing as proprietary information for subscribers, such as **Fastmarkets**, owned by **Euromoney Institutional Investor PLC (LSE:ERM)**.

The long-term price history of vanadium has been highly volatile and prices have ranged from as low as US$16/kg V (US$4/lb V_2O_5) to more than US$120/kg V (more than US$30/lb V_2O_5).

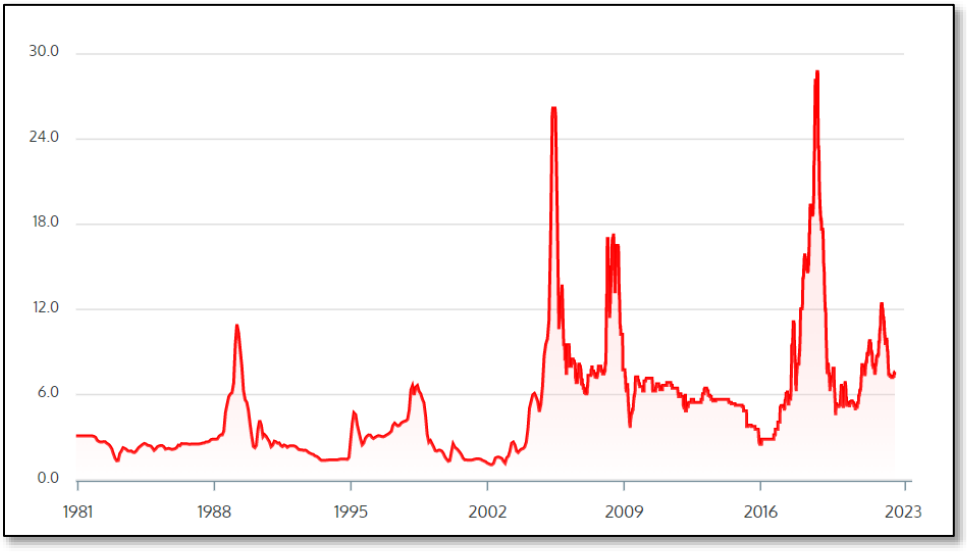
The prices for common sources of vanadium, ferro-vanadium, and vanadium pentoxide (V_2O_5) have shown major price volatility since the 1980s with the highest spike observed in 2018 as a result of the introduction of new high-strength rebar standards in China, which mandated a higher amount of vanadium in Chinese rebar products.

Ferro-vanadium peaked at more than US$120 per kilogram at the end of 2018 but then plunged as steelmakers partially substituted it with alternatives, such as niobium and titanium.

Various supply-demand forecasts have vanadium in a supply deficit starting around 2025. Without additional supply to meet the demand, the price of vanadium could remain above historical averages.

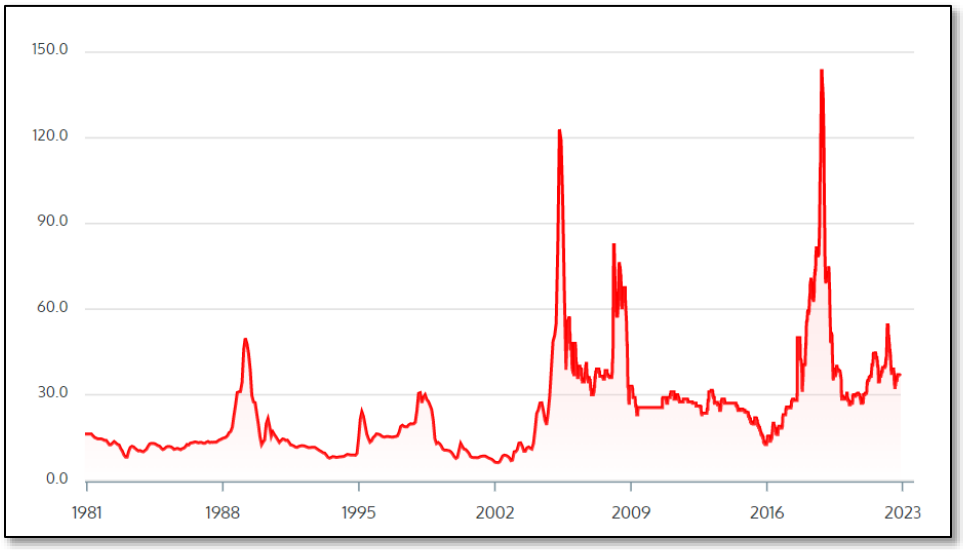
As of October 2022, the Vanadium V_2O_5 price was US$7.30/lb or US$16,060/Mt.

Figure 13: Vanadium Pentoxide (V_2O_5) 98% (Europe) (USD/lb) (1981-2022)



Source: Vanadiumprice.com

Figure 14: Ferro-Vanadium 80% (China) (USD/kg) (1981-2022)



Source: Vanadiumprice.com

Appendix A: eResearch Disclosure

*e*Research Corporation

***e*Research** was established in 2000 as Canada's first equity issuer-sponsored research organization. As a primary source for professional investment research, our Subscribers benefit by having written research on a variety of public companies, using fundamental analysis. We complement our corporate research coverage with a diversified selection of informative, insightful, and thought-provoking research publications from a wide variety of investment professionals. We provide our professional investment research and analysis directly to our extensive subscriber network of discerning investors, and electronically through our website (www.eresearch.com) and other channels, including social media, news releases, and video.

NOTE: *e*Research company reports are available FREE on our website: www.eresearch.com

***e*Research Intellectual Property:** No representations, express or implied, are made by *e*Research as to the accuracy, completeness, or correctness of the comments made in the report. This report is not an offer to sell or a solicitation to buy any security of the Company. Neither *e*Research nor any person employed by *e*Research accepts any liability whatsoever for any direct or indirect loss resulting from any use of its report or the information it contains. This report may not be reproduced, distributed, or published without the express permission of *e*Research.

Analyst Accreditation

***e*Research Analyst on this Report:** Chris Thompson CFA, MBA, P.Eng.

Analyst Affirmation: I, Chris Thompson, hereby state that, at the time of issuance of this research report, I do not own common shares, share options, or share warrants of any company mentioned in this report.

*e*Research Disclosure Statement

*e*Research is engaged solely in the provision of equity research to the investment community. *e*Research provides published research and analysis to its Subscribers on its website (www.eresearch.com), and the general investing public through its extensive electronic distribution network and through newswire agencies. With regards to the distribution of its research material, *e*Research makes all reasonable efforts to provide its publications, via e-mail, simultaneously to all of its Subscribers.

*e*Research does not manage money or trade with the general public, provides full disclosure of all fee arrangements, and adheres to the strict application of its Best Practices Guidelines.

*e*Research accepts fees from the companies it researches (the "Covered Companies"), and from financial institutions or other third parties. The purpose of this policy is to defray the cost of researching small and medium capitalization stocks which otherwise receive little or no research coverage.

Grove Corporate Services and Currie Rose Resources paid *e*Research a fee to have it conduct research and publish this report.

To ensure complete independence and editorial control over its research, *e*Research follows certain business practices and compliance procedures. Management of the Covered Companies is sent copies, in draft form before publication to ensure our facts are correct, that we have not misrepresented anything, and have not included any non-public, confidential information. At no time is management entitled to comment on issues of judgment, including Analyst opinions, viewpoints, or recommendations. All research reports must be approved, before publication, by *e*Research's Director of Research, who is a Chartered Financial Analyst (CFA).

All Analysts are required to sign a contract with *e*Research before engagement and agree to adhere at all times to the CFA Institute Code of Ethics and Standards of Professional Conduct. *e*Research Analysts are compensated on a per-report, per-company basis and not based on his/her recommendations. Analysts are not allowed to accept any fees or other considerations from the companies they cover for *e*Research. Analysts are allowed to trade in the shares, warrants, convertible securities, or options of companies they cover for *e*Research only under strict, specified conditions, which are no less onerous than the guidelines postulated by IIROC. Similarly, *e*Research, its officers, and directors are allowed to trade in shares, warrants, convertible securities, or options of any of the Covered Companies under identical restrictions.