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A Green Future with VanadiumCorp

“2020 marks the 13th year of vanadium resource development for VanadiumCorp and a maiden resource statement is anticipated in Q4 that may rival grade, size and metallurgy only found in the Bushveld Complex in South Africa. Our objective is to harness the potential of our exceptional vanadium resources into the fast-emerging vanadium redox flow battery “VRFB” market. VRFB technology is 100% green when the contained vanadium is produced sustainably. The green recovery technology and strategic vanadium resources of VanadiumCorp may enable a new era of clean energy storage.”

Adriaan Bakker
President / Chief Executive Officer
Our Company - VanadiumCorp is a mining and technology company focused on developing its wholly-owned strategic vanadium-titanium-iron resource base and green process technology in the geopolitically stable and safe mining-friendly province of Quebec, Canada. VanadiumCorp is a Tier 1 issuer on the TSX Venture Exchange trading under the stock symbol “VRB”

Our Vision - A world without pollution from metal production, energy storage, or renewable technologies.

Our Mission - To develop our exceptional mineral resources and process technology to produce vanadium with all by-products (titanium, iron, and silica).

Our Values - We are committed to creating long-term relationships with the communities in which we operate as well as with our stakeholders, creating shared value for them and us, and operating with a focus on human rights. Our approach to sustainability reflects our commitment to operate ethically, transparently, and is implemented throughout the company, and is reflected in our governance and policies.
Company Overview

Capitalization Structure – TSX- Venture “VRB”
Share Issued/Outstanding: 288,551,120
Market Capitalization: $18,756,000.00 CDN
Warrants: 21,108,699
Options: 21,108,699
Cash Position: $ 995,146.00 CDN
As of financials filed  June 29, 2020

Stock Exchange Listings
- TSX Venture – Ticker Symbol: "VRB"
- OTC Markets: - Ticker Symbol: ‘APAFF”
- Frankfurt Exchange : Ticker Symbol “NWN”

Major Shareholders
Roger Shook – 12.35%
Management -- 3.5%

Investment Proposition – Circumventing the Metallurgical Market

Vanadium Resources - Battery Materials
Primary vanadium hosted in massive magnetite in Quebec, Canada for the long term.
Vision to build an all-electric magnetite mine with local transformation of V, Ti and Fe.

Processing Technology - Green Recovery
Eco-friendly alternative to recover vanadium with all by-products.
Vertical integration goal to reducing the cost and carbon footprint of vanadium batteries.

Energy Storage - Infinite Re-use in Energy Storage
Global alliances to facilitate increased use of vanadium in VRFBs.
Vision to become a lead supplier of advanced materials to fuel the emerging VRFB market.

Corporate Structure

VanadiumCorp
Resource Inc.

V-Ti-Fe
Resource Base
100%

Process Technology
50%

VanadiumCorp
GmbH
100%
Experienced Team

Board of Directors

Adriaan Bakker – Chief Executive Officer / President
Stephen Pearce – Chief Financial Officer
Gilles Y. Champagne – Chief Technical Officer
John Hewlett – Director
Sokhie Puar – Director

Advisory Board & Technical Team

Dr. Maria Skyllas-Kazacos - Professor Emeritus, Inventor of the VRFB
Terry Perles - Vanadium market and commodity advisor
Denis Bouchard - Manager, Strategic Project Development
James (Jim) A. McLeod - Explorationist & Cree First Nations Advisor
Paul Sorbara - M.Sc., P.Geo. & Advisor
Peter Maclean - Financial Advisor & Consultant

Strategic Partners, Consultants and Clients

Mining

CSA Global – Mineral resource estimate [Website Link]
Table jamésienne de Concertation Minière – Mining project and regional advisory [Website Link]
InnovExplo – Drill program and testing management [Website Link]
Miikan Drilling Ltd – Contracted drilling company [Website Link]
SGS – Drill core testing and metallurgy [Website Link]
EnviroCree Ltd. – First Nations community advisory and environmental consulting [Website Link]

Process Technology

Electrochem Technologies & Materials Inc. – Technology Joint Owner and Developer, R&D and trial production and testing of global feedstocks [Website Link]

Energy Storage

Delectrik Systems Pvt Ltd – Partnership to improve/optimize VRFB stack power and alliance to market VRFB products [Website Link]
Cenelest (Fraunhofer ICT & UNSW) – Testing and integration of higher energy density electrolyte [Website Link]
The Challenge

Pollutive and inefficient recovery restricting vanadium supply.

- Very few vanadium resources meet the criteria required to produce vanadium for high purity applications.
- Vanadium has historically been produced, consumed and controlled by global steel interests.
- Producing vanadium has not changed in 60 years. Conventional smelting and roasting is inefficient, pollutive and must evolve to meet the emerging Vanadium Redox Flow Battery (VRFB) markets.
- World bank forecasts 500X growth in battery metal demand for energy storage systems by 2050 which will put existing supply chain under severe stress.
- Increased awareness of pollutive vanadium and steel production methods has slowed development of new supply.
The Solution

Green recovery unlocking strategic vanadium resources.

Strategic Supply

- Our 100% owned North American resource base is located in the geopolitically stable and safe jurisdiction of Québec, Canada.
- Commercializing and licensing VEPT will unlock global supply.

Process Technology

- VanadiumCorp-Electrochem Process Technology (VEPT) represents an eco-friendly and cost-efficient process alternative that recovers vanadium with all by-products.

Vanadium Batteries

- Vanadium electrolyte is reusable and the main component of the VRFB technology.
- VanadiumCorp's subsidiary in Germany, VanadiumCorp GmbH is facilitating increased use of vanadium in VRFBs.

Environmental Benefit

- Opportunity to reduce the world's carbon footprint by producing vanadium, sustainably, for perpetual use in 100% green VRFBs.
Clean Energy Resource Base

VanadiumCorp owns 100% of two of the foremost undeveloped primary vanadium-rich magnetite resources.
Magnetite
The Ultimate Source of Vanadium

Vanadium is plentiful in the earth’s crust, however, most of this green critical metal is trapped in thousands of massive magnetite resources and there are very few operating primary vanadium producers.

Magnetite is the leading (primary) source of vanadium. Current primary methods recover just 1% as vanadium from magnetite and dispose of all iron and titanium value in the calcine waste.
Vanadium Resource Base
Lac Doré & Iron-T

What sets us apart:

✓ Grade - Vanadium resources in Quebec, Canada. Massive, semi-massive and disseminated magnetite with metal grades rivalling primary vanadium mines in Bushveld, South Africa

✓ Size - Vertically oriented, and open at 200m+ depth and 2km strike

✓ Quality – Exceptional metallurgy and low impurities facilitate high recovery

✓ Access - At surface mineralization and low strip ratio

✓ Infrastructure - Situated near roads, the CN railway, 161KV power, water, local airport and an experienced workforce

✓ Vanadium battery integration verified – Pilot production of high purity vanadium electrolyte at SGS Lakefield was successfully commissioned by Sumitomo in vanadium redox flow batteries

✓ 100% owned – Uncommitted Supply

✓ Location – Both projects are supported by local communities and Cree First Nations, in the Eeyou Istchee James Bay Territory of mining friendly Québec, Canada
Strategic Supply

Vanadium, Iron & Titanium in Québec, Canada

Our Lac Doré Project in Chibougamau, Québec is one of the world’s premier, undeveloped vanadium resources.


Development - Objective to advance key vanadium mining assets through integration of green process technology targeting the lowest cost vanadium for energy storage.
Clean Energy Process
Efficient and green recovery of vanadium, titanium, and iron.
Conventional Recovery Methods

Conventional steel and vanadium production methods have not changed in over half a century. The vanadium industry is constrained by expensive and inefficient recovery methods, that damage the environment, emitting close to two tonnes of carbon for every tonne of product.

The Current Situation:
- The extraction of vanadium usually neglects the recovery of iron, titanium and silica
- Huge calcine stockpiles are generated without further processing
- Requires overseas sourcing of chemicals and raw materials (coal, electrodes, ammonia)
- Significant water and energy consumptions
- Large carbon footprint
- Requirement to build an integrated smelter
- Unreliable profitability has led to the closure of several vanadium producers worldwide
Breakthrough Innovation “VEPT”

The VanadiumCorp-Electrochem Process Technology (“VEPT”) is the most efficient, low carbon, high yield, process for unlocking a new strategic supply of critical metals needed globally.

Conventional pyrometallurgical processes for producing vanadium utilize either direct soda-ash roasting of the magnetite, followed by water leaching, or the arc smelting and slagging of the magnetite followed by soda-ash roasting of the vanadium-rich slag.

Smelting or roasting is capital intensive with high operating costs, technical risks and significant emissions of greenhouse gases, that pose serious environmental issues. The long-term economics of smelting and roasting are unattractive, and the environmental impact too costly.

The VEPT addresses these key issues and allows the full recovery of vanadium to produce vanadium electrolyte (VE) or vanadium chemicals, as well as the concurrent production of titanium byproduct, high quality and competitive iron co-product and silica.
Cost-Effective And Green Recovery of Vanadium Is The Key To The Advancement Of Vanadium Batteries

Our revolutionary VanadiumCorp-Electrochem Process Technology (VEPT) is a cost-effective and Green Method (VEPT) that recovers all metal values and facilitates mass commercialization of VRFBs.

The Pollutive (Primary) Method recovers only vanadium, produces significant waste and greenhouse gases and does not facilitate VRFB commercialization.

Green Method ("VEPT")

Pollutive Method ("PRIMARY")

Economics Reliant on a single commodity

Vanadium Pentoxide

Natural Gas

Calcination

Ammonium Metavanadate

Precipitation

Ammonia

Water Leaching

Sodium Metavanadate

WASTE Titanium

WASTE Iron

Water

Soda Ash and Coal

Soda Ash Roasting

High Carbon

Low Carbon

RECOVERED Titanium

RECOVERED Silica

RECOVERED Iron

RECOVERED Sulphuric Acid

Vanadium Recovered

Vanadium Products

Vanadium Electrolyte

Profitability is ensured because all the metal values are monetized

Steam

Suspension

Separation

Pregnant Solution

Reduction & Crystallization

Magnetite Concentrate

Vanadium Feedstock

Slags
Residues
Calcine
Hematite

Magnetite Concentrate

Created 9/27/2023 by VanadiumCorp and Electrochem
Partnership with Electrochem
Joint Strategy and Development

On January 2018, VanadiumCorp signed a partnership agreement with Electrochem Technologies & Materials Inc. The partnership expands on successful collaboration that began in 2016, with the objective of commercial demonstration.

Key Successes to Date:
• Construction of custom-built reactor pilot with 300 kg/month nameplate capacity
• National patent protection in key global jurisdictions and international PCT published
• Trial production of VanadiumCorp magnetite and vanadium feedstocks including waste residues from global companies

Core Objectives:
• License technology globally and demonstrate commercially
• Upgrade process option for mining projects with VEPT
• Produce eco-friendly and cost-effective vanadium electrolyte for VRFBs
Clean Energy Storage

Vanadium is the main component of 100% green vanadium redox flow battery technology “VRFB”.
XRG Vanadium Redox Flow Battery

XRG is the brand of VanadiumCorp GmbH (Germany), a wholly-owned subsidiary of VanadiumCorp Resource Inc. Vanadium is the main component (both cathode and anode) of the VRFB and VanadiumCorp has the security of supply in strategic mineral resources and proprietary green and efficient recovery technology. Through strategic alliances, VanadiumCorp is participating in advancements pertaining to VRFB architecture and electrolyte chemistries. This strategy is aimed at facilitating commercialization of proven VRFB technology, which is the fastest growing application for vanadium today.

One of two VRFB units delivered to Ecosource NV, Cordeel Group, Belgium
Collaboration With the Best Teams

**Delectrik Systems Pvt Ltd** – Partnership to improve/optimise VRFB stack power and alliance to market VRFB products

**Cenelest (Fraunhofer ICT & UNSW)** – Testing and integration of higher energy density electrolyte

**National Research Council Canadian (NRC)** – Assessment of Vanadium Electrolyte for Vanadium Redox Flow Batteries
About Vanadium

The element, the history and the world’s increasing demand.
What is Vanadium?

Vanadium is a grey, soft and ductile high-value metal with several unique characteristics that position it strongly in the steel, alloys and chemicals sectors. The metal also acts as a battery material that is 100% reusable.

More than 80% of vanadium is recovered from magnetite and titano-magnetite ores, either as the primary product or more commonly as a co-product with iron processed for steel production. It can also be recovered as a secondary product from fly ash, petroleum residues, alumina slag, and from the recycling of spent catalysts used in some crude oil refining.

Today, Vanadium is the most utilized “green” alloy, with the highest strength to weight ratio.
History of Vanadium

Vanadium was officially discovered by the Swedish scientist Sefstrom in 1831. He named it after Vanadis the “Swedish Goddess of Beauty and Fertility” because of the attractive brilliant colors of the chemical compounds in which it was first found. It was well named for it has provided many discoveries for scientists and technologists who, for over 150 years, have developed and continue to develop new materials for the benefit of humanity.

Use of vanadium goes as far back as 3rd Century BC when super strength "Damascus steel" was first manufactured. The first wide-scale use of vanadium in industry was in 1905, when Henry Ford realized that the Model-T could be stronger and lighter if he used vanadium-enriched steel. The need for stronger, lighter-weight steel emerged with the need for higher safety.
The World Needs Vanadium More Than Ever

Steel

- About 85% is produced as ferrovanadium, a high strength low alloy additive (or HSLA), used in construction structure and rebar.
- Increases resistance to corrosion - used for tool steel (e.g. axles and crankshafts), for tubes and pipes manufacturing, and in the automotive industry to make components such as hoods, door panels and piston rods.

Master Alloys

- Mixed with aluminum, to strengthen and promote thermal stability in titanium alloy, largely utilized in the aviation sector to produce jet engines, airframes and spacecrafts, the high strength to weight ratio provides fuel efficiency.
- Also used in nuclear reactors because of the element’s low neutron absorption abilities and resistance to high temperature stress.

Chemicals & Catalysts

- Applications in dye manufacturing, in glass and ceramics production and as a catalyst in manufacturing sulfuric acid and can be combined with gallium to form superconductive magnets.
- Vanadium as a supplement for treating and preventing many health issues.

VRFBs

- Stores energy in liquid vanadium electrolyte (both the anolyte and catholyte) that never degrades. Hardware can be recycled and the vanadium electrolyte (up to 80% of the VRFB) can be reused indefinitely.
- Potential to revolutionize entire power grids and many new applications with sustainable energy storage.
Vanadium demand for energy storage exceeds the total market size

1 Gigawatt Hour = 10% of current global vanadium production

- The energy of tomorrow will be radically different from the past. Innovation will prove essential to meeting the world’s growing energy needs sustainably.

- Vanadium redox flow batteries “VRFBs” represent the most sustainable, mature technology available requiring enormous amounts of vanadium. The key to mass commercialization of green energy storage is sustainable supply of vanadium.

- Unlocking strategic vanadium supply can revolutionize power grids and dramatically reduce the world’s carbon footprint by combining sustainable production with infinite reuse of vanadium in energy storage.

- A vertically integrated, sustainable energy storage supply chain is within reach with VanadiumCorp’s strategic mining and technology assets.

Top Photo: 600,000 Litres of Vanadium Electrolyte at Fraunhofer ICT, Germany
Bottom Photo: Bolong/Rongke VRFB Gigafactory in Dalian, China
Energy storage allows for the capture of energy produced at one time for use at a later time and is the key to ensuring a carbon-neutral world.

According to the World Bank, production of battery metals will have to increase by nearly 500% by 2050 to meet the growing demand for clean energy technologies.

Vanadium is one of the top five minerals listed, showing to have a significant demand increase by 2050.

Over 3 billion tonnes of minerals and metals will be needed to deploy wind, solar and geothermal power, as well as the energy storage required to transition to a low-carbon economy.

Source: World Bank, 2019
How Does a Vanadium Redox Flow Battery Work?

The battery only uses vanadium electrolyte, and it takes advantage of the metal’s multiple oxidation states.

The electron differential between the two cells generates electric power.
<table>
<thead>
<tr>
<th></th>
<th>VANADIUM Redox Flow Batteries (VRFB)</th>
<th>LITHIUM Ion Batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cycles (lifespan)</td>
<td>Long life, &gt; 25 years at high deep of discharge (DOD)</td>
<td>Limited lifetime, decreases at high DOD</td>
</tr>
<tr>
<td>Suitable for grid scale storage &amp; load leveling</td>
<td>Suitable to all sizes</td>
<td>To medium size only due to cost per kWh</td>
</tr>
<tr>
<td>Compatible with renewable energy sources (solar, wind, hydropower)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Independent scaling of power and capacity</td>
<td>Yes, fully scalable</td>
<td>No, fixed ratio</td>
</tr>
<tr>
<td>Low environmental footprint</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Recyclability</td>
<td>100% recyclable</td>
<td>No (not largely implemented)</td>
</tr>
<tr>
<td>Non-hazardous/non-explosive</td>
<td>Yes (water based electrolyte)</td>
<td>No (organic electrolyte, risk of catching fire during thermal runaway)</td>
</tr>
<tr>
<td>Residual value</td>
<td>Yes (electrolyte keeps its full value)</td>
<td>No</td>
</tr>
</tbody>
</table>
Enabling Future Possibilities with Vanadium Redox Flow Batteries

- Marine
- Transportation
- EV Charging

- Communication
- Mining Operations
- Military

- Integration
- Microgrid
- Offgrid

- Smart Home
- Commercial
- Essential Services