Disruptive Process Technology
Delivering a Sustainable Energy Future
Vanadium coproduct from the Chinese steel boom helped create the business case for the vanadium battery gigafactory, and home of the world’s first gigabattery, in Dalian, China. Low-cost vanadium is the key to sustainable, energy-storage technologies.
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Magnetite is the primary source of vanadium. Current methods recover just 1% and dispose of all iron and titanium value in the calcine waste.
VanadiumCorp is developing a disruptive process technology that will change the way steel, iron, vanadium and titanium is made. This high efficiency electrochemical innovation has the potential to recover vanadium as a free by-product, as well as titania and pure iron - with a negligible carbon footprint.

Conventional steel and vanadium production methods have not changed in over 60 years. They are expensive, inefficient and damaging to the environment – emitting over two tons of carbon for every ton of product.

The energy-storage industry will also be revolutionized with this innovative process – enabling renewable energy storage systems with sustainable battery materials. Steel and iron production will also change dramatically by providing a green alternative to polluting smelting and roasting methods. Clean steel and alloys made in an environmentally-friendly way will provide the foundation to a cleaner, more sustainable future.

Sustainable energy is now possible, and commercialization of this technological innovation is VanadiumCorp’s commitment.

Adriaan Bakker
President, CEO
VanadiumCorp Resource Inc.
The World Needs Vanadium More Than Ever

The US geological society recently categorized vanadium as a critical metal with many irreplaceable uses.

Steel and Alloys
Vanadium has the highest strength-to-weight ratio of any metal on earth. It is irreplaceable in many products and applications – from rebar to space travel. Current production methods are unable to meet the growing demand.

High Purity Applications
Vanadium’s unique chemical properties allow a myriad of high tech applications including supercomputing, robotics, nanotechnology, window coating, pigments and aerospace super alloys.
Energy Storage
Vanadium can conduct electricity without generating heat, making it irreplaceable in energy storage systems. Vanadium batteries last up to two lifetimes and are considered the most sustainable form of energy storage on the market today.

By using the same metal, there is no cross-contamination of battery materials

Cycle life is theoretically unlimited

Can maintain ready state for long periods

Can be charged and discharged at same time

Extremely scalable

Can rapidly release large amounts of electricity

Vanadium electrolyte is reusable, recyclable, and has a battery lifespan of 25+ years.

Non-flammable / Extremely safe

In fact, close to 80% of the battery is vanadium electrolyte that can be reused indefinitely. A stable, low-cost and reliable supply of high-purity vanadium is the key to the widespread use of energy storage systems, and broader use of renewable energy.
Vanadium energy storage requires high purity compounds, which makes up only 2% of all vanadium output. A direct consequence of this limited supply is the cost.

Vanadium pentoxide production is tailored to meet the needs of the steel industry, and vanadium producers are not financially motivated to develop processes for optimized, low-cost production of electrolytes necessary for vanadium redox flow batteries (VRFB).

To obtain the vanadium pentoxide required for the steel industry, expensive extraction processes are used, including roasting, smelting, leaching and solvent-extraction operations. As a result, the cost of the vanadium electrolyte for VRFBs is much higher than necessary.
Economics of Battery Dependent on Stable Supply

With vanadium electrolyte representing more than 40% of the capital cost of VRFBs, the economics of vanadium batteries are dictated by a privately-traded commodity with no dedicated production. The result is significant, and often dramatic, price volatility.

With the inefficient production methods of today, only a small fraction of supply meets the high-purity, low-impurity requirements of vanadium redox flow batteries.

Since 2011, the global inventory of vanadium has been decreasing every year, with consumption far outstripping production - particularly over the past few years.
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.
Magnetite: The Ultimate Source of Vanadium

Most available vanadium is contained in thousands of massive magnetite resources, and only a few are in production. VanadiumCorp owns 100% of two of the foremost, undeveloped primary vanadium-rich magnetite resources hosted in iron and titanium.

Our Quebec-based resources are easily accessed at surface and ideally suited to supply vanadium-based energy storage technologies. VanadiumCorp’s Quebec-based magnetite resources are situated near roads, the CN railway, 161KV power, water and a local airport. The projects are both supported by an experienced workforce, a mining-friendly community and the local Cree First Nations communities.

VanadiumCorp-Electrochem Process Technology is the key to unlocking magnetite resources. It represents the world’s first environmentally sustainable, high yield, low-cost process for producing high-purity vanadium. In addition, this innovative process technology will help unlock a new, strategic supply of critical metals needed globally, including titanium and iron.
Turning Industry Challenges and Bottlenecks into Opportunity

Conventional Processes for Producing Vanadium Are Unsustainable

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 VanadiumCorp-Electrochem Process Technology 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 titania byproduct, high quality and competitive iron co-product and silica.
Breakthrough Innovation: VanadiumCorp-Electrochem’s Process Technology

Revolutionizing Vanadium, Titanium, and Iron Recovery and Processing

VanadiumCorp partnered with Electrochem Technologies & Materials Inc., to develop a ground breaking electrochemical process technology that has potential to revolutionize energy storage, steel making, iron production, titanium industries, and a wide variety of vanadium-dependent applications.

The VanadiumCorp-Electrochem Process Technology is electrochemical and does not involve any carbon-based pyrometallurgy. Power consumption is estimated at about half of either smelting or roasting. The technology is 100% sustainable, and easily scalable.

This disruptive technology, invented and operating in Montreal, Quebec, Canada, completely changes the method that vanadium, steel, iron and titanium is made and can also be retrofit to existing operations. The new method maximizes the recovery of vanadium, iron and titanium from virtually any vanadium-bearing supply. The process relies on the exothermic nature of materials to dissolve 95%+ in solution by creating a self-sustaining reaction.
New Supply Possibilities with VanadiumCorp’s Green Processing Technology

MINING APPLICATIONS
Three metals recovered, highest yields, low energy, and no greenhouse gases

Steel Production
No greenhouse gases

Mine Revitalization
Magnetite and hematite

Economic Gamechanger
1000s of magnetite and hematite resources become available
RECOVERY FROM WASTE
Reusable vanadium battery materials, iron, titanium and more

Calcine
60 years of high-grade iron, titanium and vanadium waste can now be recovered

Steel Slags
Byproduct from steel production full of vanadium, titanium and iron

Oil & Coal Residues
High grade vanadium recoverable currently disposed in landfills and contaminating water tables
The energy of tomorrow will be radically different from the past. Innovation will prove essential to meeting the world’s growing energy needs sustainably.

VanadiumCorp and Electrochem current mandate is to validate the innovative technology on a commercial scale and explore opportunities to license the technology to select mining operations globally.

VanadiumCorp owns 100% of two of the most coveted, undeveloped primary vanadium-rich magnetite resources hosted in rich iron and titanium. The company’s innovative process technology will unlock the resources maximum value.

With the global inventory of vanadium decreasing rapidly, high-purity vanadium is becoming increasingly rare for new applications. With most supply coming from China, South Africa and Russia, the prospect North American production is very attractive.

Vanadium electrolyte is the key to energy storage and the widespread deployment of renewable energy. Extracting and processing vanadium cost-effectively has remained elusive — until now.

A vertically integrated, sustainable energy supply chain is within reach with VanadiumCorp’s 2018 commercial demonstration objective.
Aside from vanadium’s incredible strengthening abilities, the metal also acts as a battery material that is 100% reusable.

The first wide-scale use of vanadium in industry was in 1905, when Henry Ford realised that the Model T could be stronger and lighter if he used vanadium-enriched steel.

Today, vanadium promises to be a major player in the green energy storage revolution.

The VanadiumCorp-Electrochem patent pending process technology is the world’s first low carbon, high yield, cost-effective process for unlocking a new, strategic supply of critical metals needed globally. Our Lac Doré Project in Chibougamau, Quebec is one of the world’s premier, undeveloped vanadium resources.