Vanadium Batteries
Proven energy storage technology requiring a primary supply solution
(Non-cyclical)

High Purity Vanadium
Strong domestic market opportunity as foreign supply chain halted in 2016
(Open Market)

$V_2O_5$ Flake for Steel
Market flexibility when steel market drives demand & price
(Cyclical Market)
Zero carbon future

Primary VE supply

Vanadium Redox Flow Battery “VRFB”
Corporate Overview

**Primary project**
- Tier I vanadium asset: Lac Dore Vanadium Project
- Concentrate grade above global production average (1.08% V₂O₅)
- NI 43-101 resource: 621,214,000LB V₂O₅ in magnetite concentrate
- High purity, low impurity VE @ 99.9% V₂O₅ achieved in 2002 SGS pilot plant

**Strategic advantages**
- Exclusive North American market – Best jurisdiction (Quebec, Canada)
- Size, grade, quality, access & infrastructure
- Unrivalled VE, & high purity V supply metrics
- Potential to disrupt VRB technology market
- 100% owned – VE offtake ready

**People**
- Experienced & invested management
- Industry leading V & VE technical team
- Strong shareholder representation (+80%)
- Community and government support

**Alliances and consultants**

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*TSX-V: “VRB”*
Adriaan Bakker  
**President & Chief Executive Officer**  
14 years experience in mineral resource development and battery materials in the public and private sectors. Project acquisition/management/finance, marketing and M&A

Stephen Pearce  
**Chief Financial Officer & Corporate Secretary**  
Law degree from the University of British Columbia and an Honors Bachelors Degree in economics from York University with an emphasis on corporate finance. Mine management, current corporate and securities law focus

Paul Sorbara  
**M.Sc., P. Geo & Director**  
Designation of Professional Geologist received in 1991 from the Association of Professional Engineers and Geoscientists in British Columbia and in 1985

John Hewlett  
**Director**  
Strategic investor in the resource market for over 30 years  
Project management and development
Primary project technical highlights

Size, grade, & unrivalled quality

- NI 43-101 vanadium resource
- 99.1Mt @ 0.43% V₂O₅ inferred
- 621,214,000 million lbs *1.08% V₂O₅
- P2 Zone – Up to *2% V₂O₅
- 95% recovery from concentrate
- Spans 45km²
- Open at depth and along strike
- Favorable metallurgy
- 2002 SGS Pilot plant achieved 99.9% V₂O₅ Vanadium Electrolyte

Location

- Mining friendly Quebec, Canada
- 30 minute drive from established mining town
- Adjacent to mine permitted project (non NI 43-101, ½ wide extension of VanadiumCorp)
- Available highway, road, CN railway, 161KV power, water, cellular & workforce

*In magnetite concentrate
Sustainable vision and objectives

**Green Project**
- Low cost Quebec hydropower, commitment to maximize electrification

**Green power**
- Canadian renewable & VRFB deployment

**Green processing**
- Objective: VanadiumCorp Gigafactory

**Green Battery Material**
- Infinite use- vanadium is 100% reusable

**Green Technology - VRFB**
- No emissions, heat or risk of fire, 25yr+ life and 100% reusable battery material

**Green Mandate**
- Canadian & global governments, VanadiumCorp carbon zero goal
Chibougamau Region

James (Jim) A. MacLeod – Regional and Cree First Nations advisor

President of J.A. MacLeod Exploration and EnviroCree Ltd and regarded as a leading mining exploration technologist. Founder of the Mistissini Geological Resources Centre and former Mistissini chief of police. Jim works closely with aboriginal communities as a consultant on projects and training in mining exploration.
Infrastructure

Road access and mining town
35km south-west of Chibougamau, Québec, Highway 167 access

Power (161 kV)
Proposed substation approved (Blackrock)
(1.5 km South of Lac Dore)

Railway
25 km to CN Rail head,
rail spur approved for Blackrock

Saguenay Rail & private port
Construction and port upgrade in 2015
(Blackrock)
Rich history of Lac Dore Project

9 Resource estimates & extensive metallurgical testing

East Deposit 54 Drill holes

Former Quebec government project

2002 Pilot plant achieved 99.9% Vanadium Battery Electrolyte
The Lac Dore preliminary economic assessment (PEA) is nearing completion and will highlight the following:

- Processing of vanadium battery electrolyte (VE)
- Production model comparisons
- NPV, CAPEX, Mine life and IRR estimates
- Economics of producing high purity vanadium products
- Market pricing for VE, high purity vanadium products, V2O5 Flake
- Market report for high purity vanadium
- Employment potential
Primary vanadium production

- **Vanadium recovery**: is comprised of beneficiation from magnetite, sodium salt roasting, water leaching and solution treatment process.

- **Beneficiation**: magnetite is crushed and milled to the required particle size. Magnetic separation is utilized to separate iron from the crushed rock.

- **Sodium salt roasting**: the water insoluble vanadium is converted to water-soluble form. In the next operation, vanadium is dissolved from the mineral by leaching in water.

- **Vanadium bearing solution** is then treated to yield vanadium product. Solution treating methods differ from case to case and are generally tailored to product type and quality.

Source: Largo Resources Inc.
*Conventional Timeline for global vanadium projects

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<tr>
<th>Phase I</th>
<th>Year 1</th>
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<td><strong>Production</strong></td>
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*Average development timeline for primary vanadium mines currently in operation globally. Not a current timeline for VanadiumCorp*
Project Development Milestones

**1980-2007** Incorporation and mining exploration

**2002** Canadian Government (SOQUEM) completes Lac Dore feasibility study and pilot plant for battery electrolyte

**2007-2011** Acquisition of vanadium projects

**2013** Management replaced by proxy

**2014** Lac Dore database acquired (+$25M Historic work)

**2015** Lac Dore NI 43-101 resource statement (without further diamond drilling)

**2015-2016** Strategic battery partners secured

**2016** Preliminary Economic Assessment pending
SCHMID Energy Systems have several installations of the VRB in operation and is committed to the research and development of the EverFlow® energy storage solution. All components including the cell and stack production are 100% made by SCHMID and are manufactured and assembled in Freudenstadt in the Black Forest. With more than 50 years of experience in the manufacture of wet chemical systems SCHMID has the necessary competence and experience for the production of EverFlow® storage solutions.
VanadiumCorp is a partner of VEPP. VEPP is an independent consortium of developers collaborating to establish low cost vanadium electrolyte (VE) solutions

**Current initiatives and mandates**

- Impurity assessment – Source specific – 1st initiative underway [More info...]
- Impurity assessment – Technology specific
- VE standardization and classification as a commodity (ie Generation I, II & III)
- VE process development from various sources
- VE pilot plant design & “Gigafactory” model
- EV charging, diesel replacement, remote power, UPS, load leveling & microgrid
- R&D for emerging battery technologies
  - Fe-V
  - Li-V-PO
  - Li-V
  - Vanadium-Air
  - Li-V-Graphene
  - Mini flow VRB

Energy storage partners for sustainable future

www.vepp.org
Vanadium is referred to as the "the electric metal" for its bright future in energy storage and green technology

The National Research Council in Canada is completing a vanadium market study with the objective of presenting a business case for Canadian primary vanadium production. Subsequent potential projects considered include:

- **Vanadium Electrolyte Research & Development (Project specific & Industry)**
- **Vanadium Electrolyte Beneficitation Process for Lac Dore Project**
Strategic resource & exclusive North American market

2002 Pilot Plant Production

SGS Lakefield, Lakefield Ontario, 99.99% VE utilized by Sumitomo

Best Jurisdiction
Quebec, Canada

World class high purity
Vanadium resource

Quality  Positive metallurgy

Low impurity profile
Required by VRFB technology

SGS VE Process Flowsheet
Competitive Advantages

- V2O5, VE & High Purity
- Low Impurity
- Uncommitted Supply
- Low cost target
- Expandable Resource
- Exclusive North American Supply
- 100% Reusable
- High Quality
Vanadium electrolyte technical team

**Terry Perles - Vanadium sales & marketing**
The world’s leading vanadium authority and former VP global sales for Stratcor & EVRAZ. Through his managed company’s, TTP Squared Inc. and MoTiV Metals LLC, he handles global sales and marketing for the leading producers of vanadium, molybdenum & titanium worldwide.

**Dr. Maria Skyllas–Kazacos - Professor Emeritus, scientific advisor**
Inventor of the Vanadium Redox Battery (VRB,VFB,VRFB) technology now commercialized in China, Japan, Europe, Korea and North America. Dr. Maria is currently pioneering Generation 2 VRB and Vanadium Oxygen Redox Fuel Cell technology at the University of New South Wales, Sydney, Australia.

**Dr. Ron Molnar – Vanadium electrolyte process specialist**
35 years experience in hydrometallurgical bench and pilot plant testing. He is a solvent-extraction specialist. Dr. Molnar is a life member and fellow of CIM. He has designed, built and operated over 60 pilot plant circuits (including Lac Dore) extracting a wise range of metallic elements. Dr. Molnar is an author and a consultant within the field of solvent extraction and ion exchange process testing and development.
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Tier I Issuer listed on the Toronto Stock Exchange: Stock Symbol “VRB”

Shares issued: 206.8 Million

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