



**For immediate release**

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## **Launch of Bushveld Energy Limited**

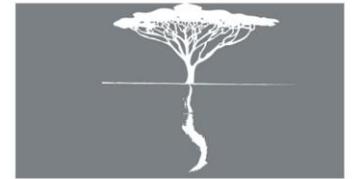
Bushveld Minerals Limited (AIM: BMN) is pleased to announce the establishment of Bushveld Energy Limited ("Bushveld Energy"), a new business focused on developing and promoting the role of vanadium in the growing global energy storage market through application in vanadium redox flow batteries (VRFBs).

### **Highlights:**

- Bushveld Energy is a 84% - owned subsidiary of Bushveld Minerals Limited
- Focused platform through which to support vanadium demand outlook via Vanadium Redox Flow Batteries ("VRFB")
- Energy Storage market opportunity at a tipping point and presents attractive commercial opportunity in its own right
- Vanadium redox flow batteries well placed to take significant share in the utility scale energy storage market
- Appointment of Bushveld Energy CEO designate, Mikhail Nikomarov, and dedicated management team with extensive energy (and specifically energy storage) experience
- Business model reliant on smart partnerships targeting scale opportunities for energy storage
- Objective to install several VRFB systems during 2016, build awareness of the VRFB proposition and, in the medium term, establish local assembly and manufacturing capacity, thus creating a captive market opportunity for Bushveld produced vanadium in the form of electrolyte.

Bushveld holds a significant high grade vanadium resource base through its Mokopane Vanadium Project in South Africa, which hosts 300 million tons of high grade low-cost primary vanadium magnetite resource. In addition, as announced on 6 November 2015, the Company acquired the Brits Vanadium Project which has a yet unquantified resource, but hosts the strike continuation of the vanadium ore body mined at Vametco Alloys' vanadium mine. In 2015, the Company articulated a strategy for its vanadium platform, which entails:

- a) Completing the vanadium project pre-feasibility Study ("PFS") followed by a Bankable Feasibility Study ("BFS") once a strategic partner has been identified
- b) Exploring opportunities to generate early cash flow by selling vanadium concentrate once the mining right has been finalised, while simultaneously targeting the development of fully integrated mining and vanadium processing operations
- c) Reducing the timeline and capital expenditure required to execute a fully integrated vanadium-producing operation by using existing under-utilised domestic processing capacity
- d) Supporting the development of additional vanadium demand beyond the steel sector through support for the energy storage applications of vanadium
- e) Consolidating primary vanadium resources across the Bushveld Complex.



**Bushveld Minerals**

**AIM: BMN**

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While the Company has clearly defined its vanadium platform as its priority and pursued its development accordingly, Bushveld's other commodity focused platforms remain important components of the Group's strategy and have made steady progress.

*Please see the separate RNS announcement released today, titled 'Corporate update', for further information on Bushveld's portfolio of commodity-focused platforms.*

Fortune Mojapelo, Bushveld Minerals' CEO commented:

*"We are pleased to launch Bushveld Energy today and are excited as much about its prospects as an energy storage platform as its potential impact on the vanadium market. Bushveld Energy is an important part of Bushveld Minerals' stated aim to build the most vertically integrated vanadium play in the world, leveraging its high quality low cost primary vanadium resources and an energy market environment ripe for utility scale energy storage solutions of the kind Bushveld Energy proposes.*

*Smart partnerships in a large market opportunity mean we do not have to develop all the competencies and capacity required across the entire value chain. In addition to broadening the capital sourcing opportunities for the group beyond the resource-biased capital pools Bushveld Minerals has hitherto relied on, Bushveld Energy presents arguably the deepest vertical integration to resonate with the beneficiation and local content manufacturing aspirations of the South African government. Furthermore, it offers a capital-light pathway to cash flows alongside the mining and brownfield processing platforms the Company is developing. We welcome the new Bushveld Energy management team and look forward to the development of a leading energy storage platform in Africa."*

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More information on Bushveld Energy can be found at [www.bushveldenergy.com](http://www.bushveldenergy.com)



## About Bushveld Energy

Bushveld Energy Limited is a Mauritian registered company in which Bushveld Minerals Limited owns 84 per cent of the issued share capital. Bushveld Energy has been established to promote energy storage applications of vanadium through vanadium redox flow batteries (VRFBs). Its vision is to become one of the largest energy storage providers in Africa by 2020, meeting the continent's demand for utility scale electrical energy storage by leveraging South Africa-mined and beneficiated vanadium. Bushveld Energy is 84% owned by Bushveld Minerals, with 16% shareholding held by Mikhail Nikomarov, Bushveld Energy's co-founder. (See below for his resume)

## Background rationale

90% of all vanadium produced globally is consumed in the steel sector where vanadium is used to add strength to steel. Notwithstanding the difficulties faced by the global commodities market, which the steel industry has not escaped, the Company believes that growing intensity of use of vanadium in steel will continue to support a relatively robust outlook for the vanadium demand, which together with a constrained supply outlook can be expected to support an improved vanadium price outlook.

Yet, the growing energy storage market presents a step change opportunity for the vanadium demand outlook through the vanadium based utility scale Vanadium Redox Flow Battery (VRFB) technology. The energy storage market is expected to top US\$300 billion by 2030, according to various market forecast reports, with vanadium-based energy storage systems well placed to claim 15-25% share of this market on account of the several advantages that VRFBs enjoy over other energy storage battery systems, including:

- a) Long lifespan that allows the battery - to charge and discharge repeatedly over 20,000 times and a life of over 20 years. This lifespan ideally matches the lifespan of renewable energy generation technologies, such as solar photovoltaic (PV), and allows VRFBs to achieve the lowest costs of energy storage
- b) Capacity for 100% depth of discharge without performance degradation that allows for use of full energy rating of the battery system
- c) Safe chemistry that is water-based and neither flammable nor toxic, unlike alternative battery technologies
- d) Capacity to store large quantities of energy and scalable up to the MW-range
- e) Recyclability of the vanadium (and/or reusability of vanadium electrolyte) upon system decommissioning, making VRFB one of the most environmentally sustainable battery technologies
- f) Fast response times and compatibility with grid systems.

## Energy Storage at a tipping point

One of the main historical challenges in the electric power sector has been the difficulty and high cost of storing electricity. At the same time, the need for flexible, large scale storage has increased globally in the past 10 years, in part because solar and wind generation (whose supply can vary intermittently) has grown exponentially. This has led to numerous recent developments, including:

- Policy makers are writing energy storage into electricity plans globally. In March 2015, the European Commission published a report noting that by 2030, the "economic potential" of energy storage will be 400GW. In the USA, California has mandated its three utilities to install 1.3 gigawatts (GW) of storage capacity by 2020. In fact, annually installed energy storage capacity grew 40% from 2013 to 2014 in the USA and is expected to increase fourfold for 2015 to 200MW, according to GTM Research.
- Increased research and test site deployment has matured a number of nescient technologies. Tesla is building a gigawatt lithium ion battery factory to supply both its electric vehicles and residential customers of SolarCity. In South Africa, ACWA Power is building Concentrated Solar Plants (CSP) together with molten salt storage as part of its Renewable Energy Independent Power Producer Procurement Programme wins.
- Global projections for energy storage substantial. CitiGroup and the Boston Consulting Group agree that by 2030 the annual market for energy storage will range from \$300 to \$400 billion.
- The Vanadium Redox Flow battery (VRFB) today offers one of the most compelling technology options in commercial deployment. Although its need for more space and use of a liquid electrolyte make it a poor fit for



electronics and cars, its scalability, quick recharge rate and nearly unlimited ability to recharge without performance degradation make it extremely attractive in utility-scale applications. There are over 200 VRFB installations and several hundred more installations underway today, including some in South Africa.

### **The immediate opportunity for energy storage in Africa**

In many ways, the African market presents a more compelling business case than even the USA and Europe. In addition to grid support and integration of renewables into the electricity system, Africa's poor power grids create an opportunity to supply power either cheaper than diesel (when coupled with PV) or to "bring-round-the-clock" electricity to remote, unconnected locations (e.g. mines, rural villages).

Bushveld estimates the addressable market for utility scale energy storage in Africa to be 80-90 gigawatt hours (GWh), or \$20-30 billion. Key facts include:

- Electricity demand in Africa will grow at 4.5% p.a., with commercial and industrial customers making up 2/3 of total demand.
- Diesel generators in Africa produce around 16 terawatt hours (TWh) of electricity annually, costing \$5 billion for fuel alone (or over \$0.31/kWh on average), showing that Africans are willing and able to pay for electricity. Combining solar PV with a VRFB storage system can already yield lower unit costs than diesel, without taking into account further cost reductions expected in the coming 12-24 months.
- Energy experts estimate that South Africa needs 4GW and 24 GWh of energy storage capacity already, on top of the 1.3GW Ingula pumped storage project.

### **Bushveld's unique position to capture this opportunity**

Bushveld is well positioned to capture this opportunity in Africa because it can address the two greatest challenges to the mass adoption of VRFBs: security of vanadium supply and the cost of the batteries.

- Bushveld believes it has one of the lowest cost, highest quality vanadium deposits in the world and is at an advanced stage of finalising the pre-feasibility study on the project. Such vertical integration would allow Bushveld to guarantee supply of vanadium to manufacture the electrolyte and the entire battery system in South Africa. Bushveld is already working with key stakeholders (including potential funders) on electrolyte manufacturing and potential downstream VRFB manufacturing in South Africa.
- Since vanadium contributes 30-40% of the manufacturing cost of the battery (increasing with the size of the battery), this vertical integration also creates cost control. To capture the larger value pool from energy storage, Bushveld believes it is in a unique position to supply vanadium on a "cost plus" basis to accelerate adoption until economies of scale yield cost reduction in other VRFB components.

### **Enter Bushveld Energy Limited**

Bushveld Energy's vision is to become one of the largest electricity storage providers in Africa by 2020, meeting the demand for utility scale energy storage in Africa by leveraging South Africa-mined and beneficiated vanadium. Africa's insufficient power infrastructure and rapidly growing electricity demand create a unique environment for immediate, mass-scale adoption of energy storage, especially in tandem with rising renewable energy generation adoption. Bushveld Energy estimates a potential opportunity of over \$20 billion for energy storage over the next five years from utilities, micro and mini-grid electrification and commercial and industrial consumers currently relying on diesel generation.

### **Bushveld Energy's business model**

Bushveld Energy's business model will feature separate entities responsible for the different steps in the value chain. Opportunities will be considered to establish a chemicals vehicle to manufacture the electrolyte to the specifications of the VRFB technology partner and other VRFB manufacturers where possible, as well as other vanadium-based chemicals. Bushveld Energy will in time look to manufacture and market the batteries. Partnerships are an important part of the Bushveld Energy business model and several partnerships are under discussion, including partnerships with



- VRFB technology providers.
- Solar PV and wind power project developers.

Key to unlocking the energy storage opportunity has been the growing global adoption of renewable energy generation, given even more impetus recently by undertakings by the global community to curb global warming and promote green energy solutions.

To date Bushveld Minerals has committed a modest amount of working capital to developing Bushveld Energy and will continue to do so. Individual developments will be subject to funding on a case-by-case basis either through Bushveld Minerals or alongside development partners.

### **Bushveld Energy's team**

Bushveld Energy has put together a core team and an advisory panel combining technical expertise, business acumen and beneficiation experience. In addition, the team understands that mass adoption in African electricity markets will not be driven by price and hardware sales but rather by business models that address customer pain points, such as cash flow, reliability of energy supply and total cost of ownership. The team combines:

- Executive-level experience in mining and power industry, including managing Eskom power stations and pumped storage schemes
- Over 7 years' senior strategy and policy experience in power sectors across Africa
- Over 15 years' experience in renewable generation and energy storage, including testing of utility scale battery applications
- Extensive geological and metallurgical development expertise through the Bushveld Minerals' team that is developing the Bushveld Vanadium project.

### **Mikhail Nikomarov, CEO-designate**

Mikhail spent over six years with global consulting group McKinsey & Company, advising national governments, utilities and multinational manufacturers on growth strategy and policy, and leading operational turnarounds in the power sector. He has worked on four continents and in eight African countries. Previously, he spent over four years in the US financial sector providing funding to mid-cap corporate clients. Published work by Mikhail covers national trade and competitiveness and, in 2015, he co-authored McKinsey's report on electricity in sub-Saharan Africa, "Brighter Africa: the growth potential of the sub-Saharan electricity sector." He holds an MBA from INSEAD, Economics Diploma from LSE and B.A. (History and Economics) from University of Massachusetts.

Mikhail is supported by Bushveld Minerals' team in South Africa and a team of power sector advisors including:

### **Ras Myburgh – Advisor**

Ras Myburgh is an Executive Director at Hindsight Financial and Commercial Solutions and brings vast experience in coal and iron mining and power generation. His previous roles include:

- CEO of Kumba Iron Ore LTD
- MD of Kumba Coal (now Exxaro Coal)
- Working at Eskom's Duvha and Matimba power stations and the Drakensberg Pumped Storage Scheme.



### **Pat Frampton – Advisor**

Pat is President of Patton Engineering and has significant experience in the energy sector including 13 years as consultant to Eskom's Renewables and Energy Storage Portfolio. He is an ongoing guest lecturer at University of Johannesburg on energy storage and renewables and has also co-authored numerous reports on energy storage and PV and wind generation.

### **Bushveld Energy's strategy**

Going forward, Bushveld Energy's strategic priorities will include:

- Launching initial VRFB installations across Africa, ranging in size from 5 kilowatts to over 1 megawatt
- Continuing to establish partnerships with renewable energy developers to develop and provide integrated generation and storage solutions
- Deepening strategic partnerships with technology partners
- Increasing the visibility of Bushveld Energy and VRFBs in South Africa and across the continent.

In the medium term, once sufficient critical mass of VRFB installations is attained, Bushveld Energy intends to establish South African electrolyte manufacturing capacity and later VRFB manufacturing capacity for the African market.

Finally Bushveld Energy will actively pursue financing opportunities, including joint ventures or strategic partnerships, to support the deployment of VRFBs in the market as well as the stated medium term objectives to develop VRFB assembly and manufacturing capacity.