30 July 2014

SYRAH RESOURCES

# VANADIUM SCOPING STUDY FINALISED

## Highlights:

- **Vanadium Scoping Study encompassing an approximate 5,000 tonne per annum scenario has been submitted by Chalieco, the international engineering arm of Chinalco**
- **Metallurgical testwork has successfully produced a 99.9% $V_2O_5$ powder. Syrah previously reported a 98.5% $V_2O_5$ concentrate**
- **Ability to produce a high purity powder strongly differentiates Balama when compared to most vanadium deposits outside China**
  - **Positions Syrah as supplier to the high growth vanadium redox battery storage market**
  - **Global energy storage market is forecast to be US$114 billion by 2017 with vanadium redox batteries (VRBs) expected to account for 34% or approximately US$38 billion (Lux Research)**
- **The Scoping Study assumes that 3,804 tonnes of min. 98% $V_2O_5$ powder or flake (for steel alloys) and 1,245 tonnes of 99.9% $V_2O_5$ powder (for VRBs) will be produced annually over a 20 year period**
- **Robust financial metrics projected including:**
  - **capex of only US$80 million**
  - **annual total sales of US$125 million**
  - **annual total opex (including royalties) of US$45 million**
  - **projected annual EBITDA and EBITDA margin of US$85 million and 68%, respectively**
  - **post tax NPV (10% discount rate) of US$330 million**
  - **internal rate of return of 59%**
  - **payback period of 3.4 years after completion of construction**
- **Incremental, low risk potential development strategy leveraging planned graphite plant, site infrastructure and logistics**
  - **vanadium production expected to commence following completion of ramp up and established graphite production**
- **Resources exist to increase this projected production profile by several times and Syrah has received interest for more than its planned projected production from Asian and European vanadium traders and users. Accordingly, Syrah intends to investigate the scope for increased vanadium production in the future**

| ASX Code | SYR |
|---|---|

### Current Corporate Structure

**Ordinary Shares**

| | |
|---|---|
| Issued Shares: | 163,005,614 |

**Options**

| | |
|---|---|
| Exercisable at $0.26: | 1,989,467 |
| Exercisable at $2.21: | 50,000 |
| Exercisable at $2.90: | 250,000 |
| Exercisable at $3.87: | 1,000,000 |
| Exercisable at $5.50: | 500,000 |

**Major Shareholders**

| | |
|---|---|
| Directors | 22.28% |
| Citicorp Nom PL | 12.68% |
| HSBC Custody Nom Aus Ltd | 7.06% |
| Copper Strike Ltd | 6.77% |
| National Nom Ltd | 6.28% |
| Gasmere PL | 4.00% |

### Board of Directors

Mr Tom Eadie
*Non-Executive Chairman*

Mr Paul Kehoe
*Managing Director*

Mr Tolga Kumova
*Executive Director*

Mr Rhett Brans
*Non-Executive Director*

Mr José Manuel Caldeira
*Non-Executive Director*

Ms Melanie Leydin
*Company Secretary*

### Key Project

Balama Graphite and Vanadium Project (Mozambique) Balama is the largest and one of the highest grade flake graphite and vanadium projects globally.

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# Introduction

Syrah Resources (ASX:SYR) is very pleased to announce the results of the finalised Vanadium Scoping Study for its 100% owned Balama Graphite and Vanadium Project in north Mozambique.

## BACKGROUND

The Balama Graphite and Vanadium Project has an exceptional Inferred Resource containing 1.15Bt at 10.2% total graphitic carbon (TGC) and 0.23% $V_2O_5$ (refer ASX announcement on 27 May 2013). This makes the Balama contained vanadium resource almost four times larger than Rhovan in South Africa (majority owned by Glencore) which is currently the world's largest operating vanadium deposit (Source: Glencore annual report).

## OVERVIEW OF THE BALAMA DEPOSIT

Balama comprises a series of hills consisting of graphitic schist which rise up to 250 metres from the surrounding plains. The outcropping strike extent of the graphite is in excess of 7 km. The outcropping width of the graphite and vanadium mineralisation is up to 2 km.

Balama drilling commenced in early 2012 following a series of trench sampling programs. Although over 120 diamond drilling holes have been completed in total, with the deepest being 350 metres (which ended in mineralisation), this drilling only represents a limited portion of the outcropping Balama deposit. In addition, Syrah has also defined several high grade zones within this global resource using a 13% TGC cutoff. These high grade zones are shown below:

| Deposit | JORC Category | Tonnes (Mt) | TGC % | $V_2O_5$ % | Contained Graphite (Mt) | $V_2O_5$ (t) | TGC and $V_2O_5$ Correlation |
|---|---|---|---|---|---|---|---|
| Ativa (BW) | Measured | 23.4 | 20.2 | 0.38 | 4.7 | 88,223 | |
| | Inferred | 17.3 | 19.9 | 0.40 | 3.4 | 68,859 | |
| | Indicated | 11.0 | 19.7 | 0.39 | 2.2 | 43,066 | |
| Mualia (BW) | Inferred | 118.7 | 18.5 | 0.45 | 22.0 | 529,927 | |
| Balama East | Measured | 26.0 | 16.4 | 0.44 | 4.3 | 113,243 | |
| | Indicated | 28.4 | 15.9 | 0.45 | 4.5 | 127,684 | |
| | Inferred | 160.0 | 16.0 | 0.43 | 25.5 | 686,386 | |
| | | **384.6** | **17.3** | **0.43** | **66.6** | **1,657,388** | **0.77** |

**Table 1 – Balama high grade zones (within global resource) using a 13% TGC cutoff and down to a depth of 300m (refer ASX announcements dated 27 May 2013, 10 December 2013 and 25 March 2014)**

Block modelling of drill hole assays for Ativa, Balama East and Mualia has also shown a high correlation between increasing TGC% and increasing $V_2O_5$% as shown in Table 1 above. Based on Syrah's analysis, the correlation coefficient between vanadium grades of ≥0.3% $V_2O_5$ and a TGC% of ≥13%, is 0.77 (on average) to date.

Figure 1 illustrates this correlation for Balama West, with block models showing graphite and vanadium mineralisation at a 5% TGC and 0.10% $V_2O_5$ cutoff, respectively. Red coloured zones represent grades of ≥20% TGC and ≥0.50% $V_2O_5$, respectively. Syrah notes that graphite and vanadium mineralisation at Balama West extends beyond the drill zones modelled below.

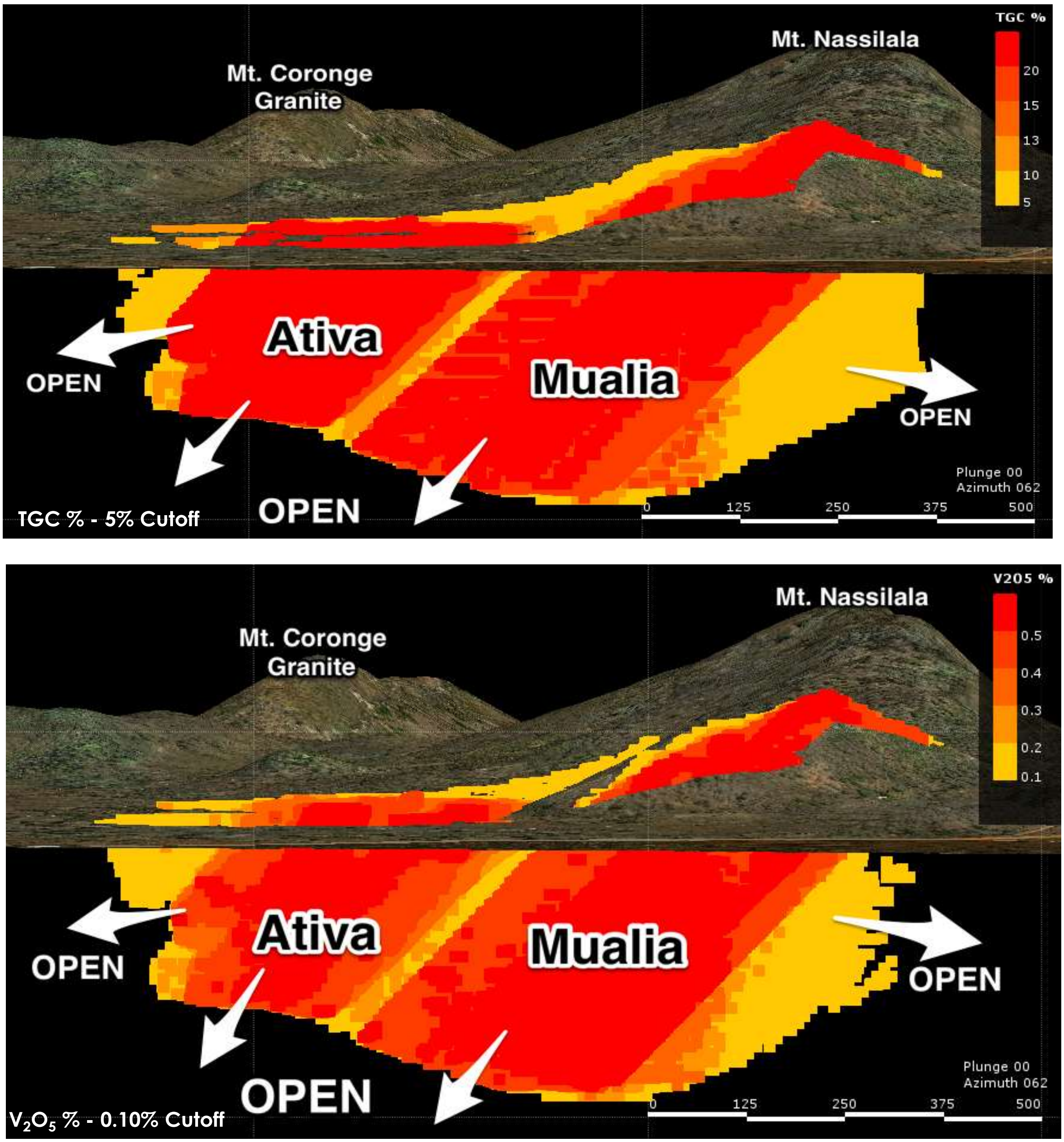


**Figure 1 – Block models showing graphite and vanadium mineralisation at Balama West using a 5% TGC and 0.10% $V_2O_5$ cutoff, respectively**

## VANADIUM METALLURGICAL TESTWORK

During April 2014, Syrah engaged Chalieco, the international engineering arm of the Chinalco Group, to complete the Vanadium Scoping Study. Chalieco was selected by Syrah based on its experience in undertaking the engineering work on eight vanadium projects in China with a similar ore assemblage to that of Balama (vanadium hosted in graphitic schists). In China, the vanadium is hosted in amorphous graphite (and not flake like Balama).

On 8 April 2014, Syrah announced that metallurgical testwork to date has shown that the vanadium reports to the tailings during the graphite flotation process. Assays on the graphite concentrate show that vanadium is below detection limits in the graphite concentrate.

Magnetic rich mineralisation (mainly magnetite and limonite) can be upgraded by 8-11 times to achieve a $V_2O_5$ grade of 4-5% by a WHIMS (Wet high Intensity Magnetic Separator). Non-magnetic mineralisation (mainly roscoelite) can be upgraded by 4-5 times to achieve a $V_2O_5$ grade of 2-2.5% by flotation. These two processes have been demonstrated to produce a combined concentrate grade of >3% $V_2O_5$. The Vanadium Scoping Study has conservatively assumed a combined concentrate grade of 2.5% $V_2O_5$.

Chemical processing of this initial vanadium concentrate had shown that a 98.5% purity vanadium pentoxide can be produced.

**Syrah is very pleased to announce that additional metallurgical testwork has now successfully produced a 99.9% high purity vanadium pentoxide by solvent extraction as shown in the Figure 2.**

The ability to produce a 99.9% concentrate is a significant differentiating factor for Balama when compared to the majority of vanadium projects outside of China, which are generally ferro-magnetite style deposits for which it may not be economic to upgrade to these levels. As a potential major supplier of high purity vanadium outside of China, Syrah is well positioned to take advantage of forecast future growth in vanadium battery manufacture (including VRBs). Potential applications for vanadium are described subsequently in this release, and in the accompanying presentation.


**Figure 2 – Balama >99% vanadium pentoxide from stage 2 processing**

The following figure shows the simplified flow sheet for the production of vanadium at Balama.

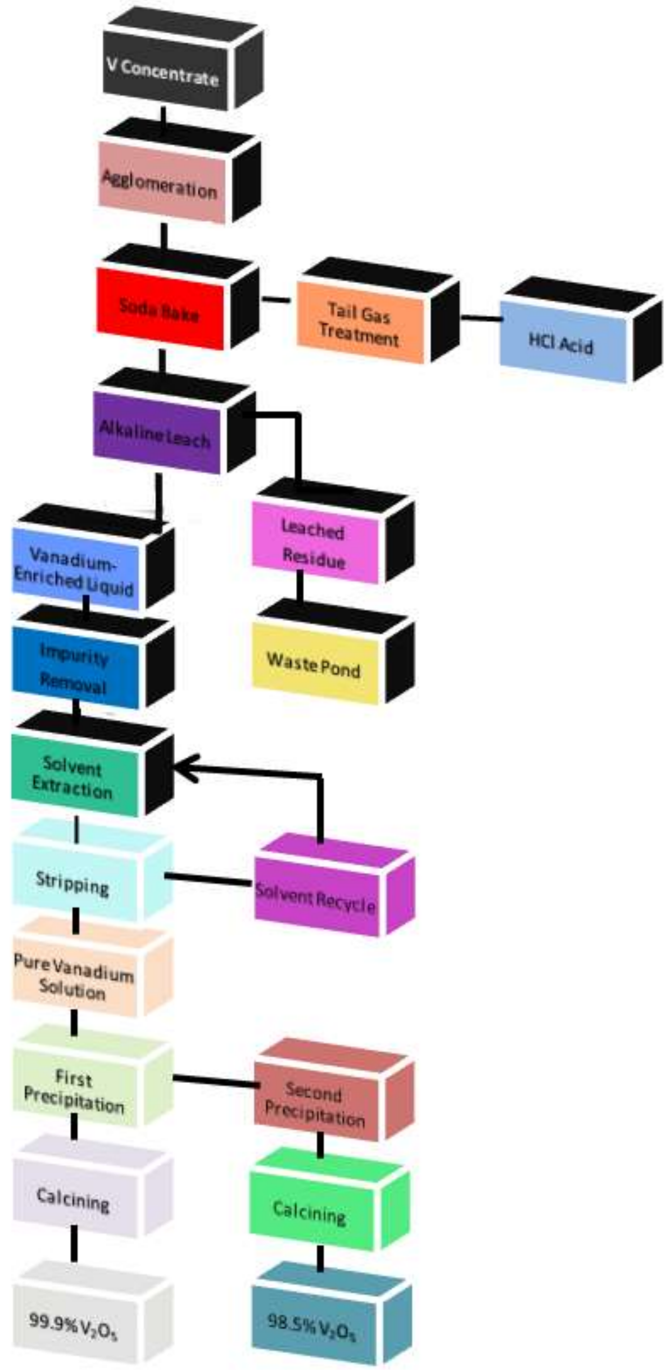


**Figure 3 – Simplified vanadium flow sheet**

## VANADIUM SCOPING STUDY

The key results of the finalised Vanadium Scoping Study under an approximate 5,000 tonne per annum scenario are summarized in the following table:

| Operational metrics | Unit | |
|---|---|---|
| Life of mine [1] | years | 20 |
| Concentrate throughput (2.5% $V_2O_5$) [2] | tpa | 255,000 |
| Recovery | | |
| Min. 98% $V_2O_5$ | % | 58.5 |
| 99.9% $V_2O_5$ | % | 19.5 |
| Product | | |
| Min. 98% $V_2O_5$ | tpa | 3,804 |
| 99.9% $V_2O_5$ | tpa | 1,245 |
| Total | tpa | 5,049 |
| By-product | | |
| HCl acid (33% concentration) | tpa | 105,300 |

| Financial metrics | Unit | |
|---|---|---|
| Capex | US$ m | 80 |
| Price assumptions | | |
| Min. 98% $V_2O_5$ | US$/t (FOB) | 12,000 |
| 99.9% $V_2O_5$ | US$/t (FOB) | 50,000 |
| HCl acid (33% concentration) [3] | US$/t (FOB) | 175 |
| Unit operating costs (Min. 98% & 99.9% $V_2O_5$) | US$/t product | 7,200 |
| Total costs (Min. 98% & 99.9% $V_2O_5$) | US$/t product | 8,250 |
| **Post-tax NPV (10% discount rate)** | **US$ m** | 330 |
| **Internal rate of return (IRR)** | **%** | 59 |
| **Payback period** | **years** | 3.4 |

Note 1: Although there are sufficient resources to support a mine life exceeding 20 years, for the purposes of the scoping study a mine life of 20 years was used as the NPV impact will be immaterial beyond this period

Note 2: Based on a 300-day production schedule and a head grade of >0.40% $V_2O_5$ over life of mine.

Note 3: The scoping study assumes that HCl acid can be sold. Syrah has conducted preliminary market research and is satisfied that there is likely to be sufficient local and/or regional demand for this product

**Table 2 – Key operational and financial metrics of the Vanadium Scoping Study**

**CAUTIONARY STATEMENT**

The Vanadium Scoping Study results and production targets reflected in this announcement are based on Measured and Indicated Resources. Although Syrah is confident that these will be converted into Proven and Probable reserves in due course, until such time, the results of the Vanadium Scoping Study should be considered as preliminary in nature. The stated production target is based on Syrah's current expectations of future results or events and should not be solely relied upon by investors when making investment decisions. Further evaluation work and appropriate studies are required to establish sufficient confidence that this target will be met. Further, Syrah cautions that there is no certainty that the forecast financial information derived from production targets will be realised.

Currently, it is envisaged that the development of the Vanadium Project will occur as a second stage incremental development following completion of ramp up and established graphite production, and leveraging proposed graphite plant, site infrastructure and transport logistics.

As demonstrated by the scoping study, the metrics of the Balama Vanadium deposit are extremely competitive when benchmarked against other known major vanadium projects currently in advance stages of development or being considered for development as shown in Table 3.

| Metric | Unit | Syrah Resources | Largo Resources | TNG Limited | American Vanadium |
|---|---|---|---|---|---|
| **Project** | | Balama | Maracas | Mount Peake | Gibellini |
| **Location** | | Mozambique | Brazil | NT, Australia | Nevada, USA |
| **Ownership** | **%** | 100 | 100 | 100 | 100 |
| **Life of mine** | **years** | 20 | 29 | 20 | Unavailable |
| **Strip ratio** | | 0.11 : 1 | 6.27 : 1 | 0.95 : 1 | 0.22 : 1 |
| **Concentrate throughput** | **$V_2O_5$ %** | 2.5 | 3.4 | 1.0 to 1.5 | Unavailable |
| **Production** | **tpa** | 3,804 $V_2O_5$ (Min. 98%) | 6,376 $V_2O_5$ | 11,000 $V_2O_5$ (99%) | 5,171 $V_2O_5$ |
| | **tpa** | 1,245 $V_2O_5$ (99.9%) | 4,899 FeV | 290,000 $TiO_2$ | |
| | **tpa** | | | 900,000 $Fe_2O_3$ (99.9%) | |
| **Price assumption** | **US$/kg** | 12.0 $V_2O_5$ (Min. 98%) | 14.0 $V_2O_5$ | 20.3 $V_2O_5$ (99%) | 24.1 $V_2O_5$ |
| | **US$/kg** | 50.0 $V_2O_5$ (99.9%) | 28.0 FeV | 0.4 $TiO_2$ (55%) | |
| | **US$/kg** | | | 0.2 $Fe_2O_3$ (99.9%) | |
| **Total costs** | **US$/kg** | 8.3 $V_2O_5$ (Min. 98% & 99.9%) | 7.0 $V_2O_5$ | 75.5 $V_2O_5$, $TiO_2$ & $Fe_2O_3$ | 9.0 $V_2O_5$ |
| | **US$/kg** | | 15.6 FeV | | |
| **Total capex** | **US$ m** | 80.0 | 235.0 | 563.0 | 95.5 |
| **Discount rate** | **%** | 10.0 | 8.0 | 8.0 | 7.0 |
| **NPV** | **US$ m** | 330.0 Post tax | 554.0 Post tax | 2,600 Pre or post-tax not specified | 170.1 Pre or post-tax not specified |
| **IRR** | **%** | 59.2 Post tax | 26.3 Post tax | 38.0 Pre-tax | 43.0 Pre or post-tax not specified |
| **Payback period** | **years** | 3.4 | Unavailable | Potentially 4 | 2.4 |

**Table 3 – Comparison of known global vanadium development projects**
**(Source: Company presentations and announcements)**

On an industry level, total incremental costs of US$8,250 per tonne or US$8.25 per kg projected by the Vanadium Scoping Study to extract vanadium from graphite tailings also compares favourably to the average industry cash costs of co-product slag and primary vanadium producers of approximately US$12.50 per kg and US$14.00 per kg, respectively (refer Figure 4).

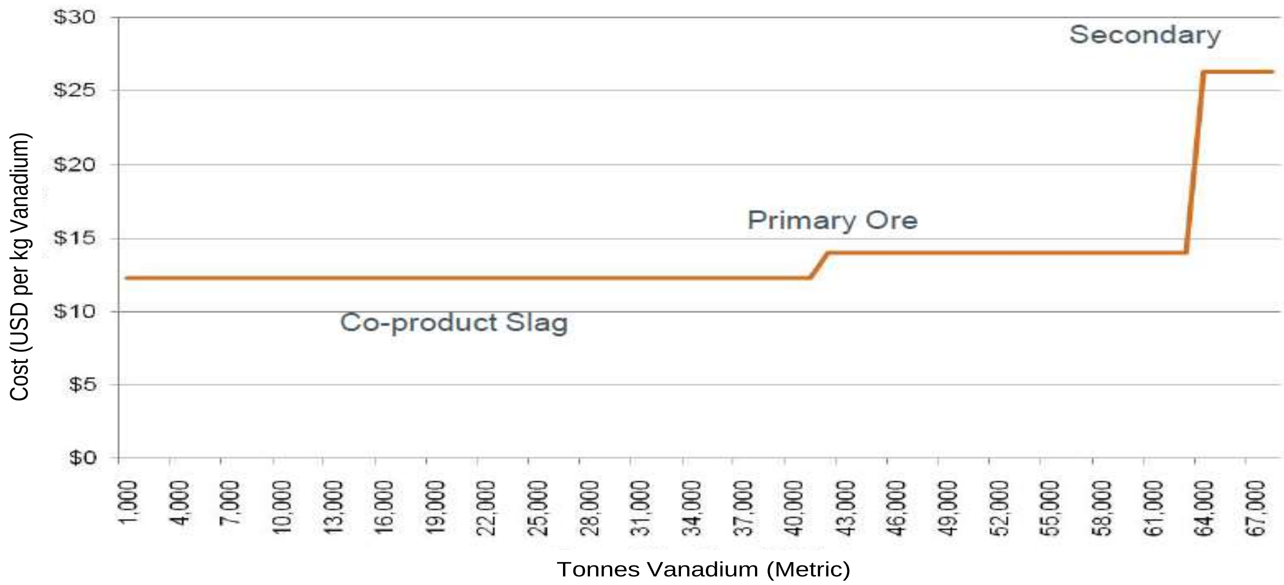


**Figure 4 – Average cash costs for co-product slag, primary ore and secondary vanadium producers in 2012 (Source: TTP Squared, Inc)**

## NEXT STEPS

As set out in this document, Syrah envisage the Vanadium Project will occur as a second stage development, following completion of ramp up and established production at the Balama graphite project. Key technical outputs from the Vanadium Scoping Study will considered in the context of the Balama Graphite Bankable Feasibility Study (currently underway) to ensure this integration can be achieved in a cost effective and technically robust manner.

## ABOUT VANADIUM

Vanadium is a soft silvery-grey element that is classified as a ductile transition metal. It has good resistance to corrosion and is stable against alkalis, sulfuric and hydrochloric acids. Vanadium compounds also have the ability to take on four oxidation states ($V^{2+}$, $V^{3+}$, $V^{4+}$ and $V^{5+}$). Metallic vanadium does not occur in nature, but vanadium compounds are found in about 65 minerals and in fossil fuel deposits. Syrah considers that the major markets for its projected vanadium production will be in steel alloys and vanadium redox batteries as discussed below.

In 2013, Roskill estimates that the vanadium market was approximately 136,000 tonnes of $V_2O_5$ equivalent. Syrah's proposed production of 5,049 tonnes of $V_2O_5$ only represents 3.7% of the total market. Accordingly, Syrah believes that there is ample opportunity for the Company to expand vanadium production in subsequent years and capture a greater market share. **In recent months, Syrah has received offtake interest for more than its proposed vanadium production from Asian and European vanadium traders and users.**

## APPLICATION OF VANADIUM IN STEEL ALLOYS

Vanadium is predominately used as an alloy called ferrovanadium which increases the tensile strength and hardness of steel as well as reducing its weight. This makes ferrovanadium one of the most cost-effective additives in the production of alloy steel.

Alloy steel is used across multiple industries such as the aerospace, automotive, construction and machinery industries. Generally, no more than 0.25% by weight is added to high carbon steel and between 1-5% is added to steel used in high speed tools.

Demand growth for vanadium in steel alloys is expected to be driven by new design codes implemented by China. These new design codes require Grade 2 reinforcing bars (rebar) which have no vanadium, to be phased out in favour of Grade 3 rebar which require about 0.35 kg vanadium per tonne of steel. An upgrade of rebar from Grade 2 to Grade 3 would require an additional 30,000 tonnes of vanadium per year. Syrah expects to supply 3,804 tonnes of its projected 98.5% purity $V_2O_5$ production into this market.

## APPLICATION OF VANADIUM IN BATTERIES

### VRB

The ability of vanadium compounds to take on four oxidation states (from 2+ to 5+) makes vanadium integral to the creation of the VRB which require high purity $V_2O_5$ of ≥ 99%. In addition, impurities such as nickel, cobalt or copper needs to be reduced to negligible levels in the $V_2O_5$.

VRBs are a type of flow battery which is an electrochemical battery in which one or both of the reactants (or reactant products) is stored in tanks external to the battery stack. The cell stack itself contains the electrode, which serve as reaction sites and current collectors. The following figure shows a simple schematic of a VRB.

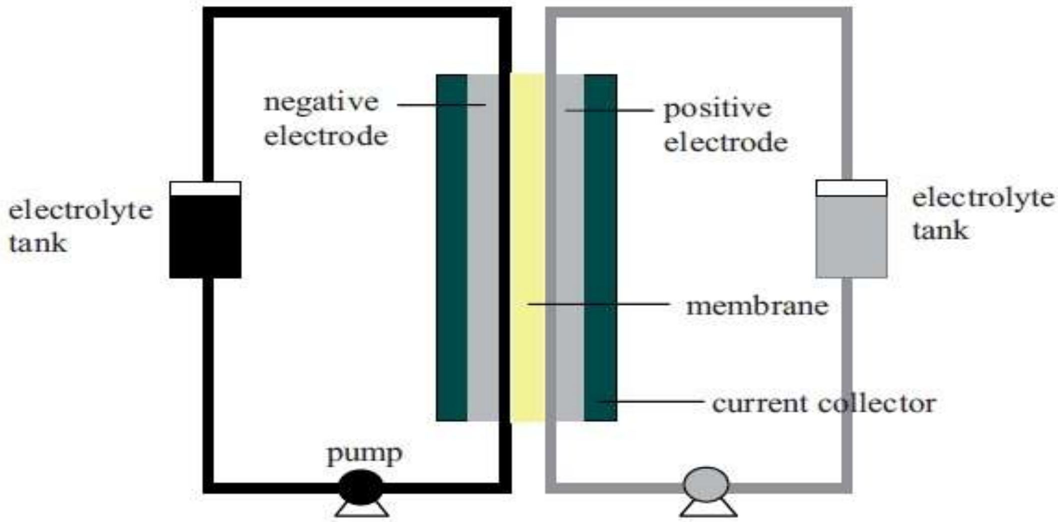


**Figure 5 – Schematic of a VRB (Source: Science Direct)**

VRBs have several key advantages over conventional batteries including easy scalability, long cycle life, rapid charge/discharge, operational stability and simplicity as well as lower maintenance costs.

Due to its relative mechanical complexity, space requirements and economies of scale, VRBs are most suited for use in the utility industry. VRBs can act as peak load support to allow infrastructure upgrade capital expenditures to be deferred. It can also facilitate the integration of alternative energy (e.g. wind, solar, etc.) into the grid by storing electricity generated and then discharging to match power supply and demand under varying weather conditions. All of this will contribute to increased grid stability.

The figure below shows VRB cell stacks which were installed in the Tomamae Wind Farm by Sumitomo in 2005. Sumitomo has extensive experience with VRB projects dating back to 1996.

**Figure 6 – VRB cell stacks at Tomamae Wind Farm (Source: J-Power)**

## MARKET FORECASTS FOR VRBs

According to the University of Tennessee, approximately 46 tonnes of $V_2O_5$ is required for 1 MW power capacity using VRBs for grid storage. **Lux Research forecast VRBs to account for 34% of the global large-scale storage battery market by 2017, which equates to approximately US$38 billion as shown in Figure 7.**

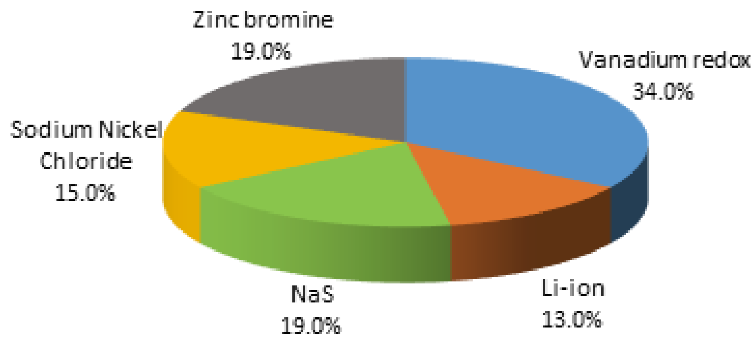


**Figure 7 – Forecast US$114 billion global large-scale storage battery market by 2017 (Source: Lux Research)**

The potential market potential for VRBs increases even more significantly if power networks adopt load-levelling worldwide. Currently, power generating facilities must have more capacity than the estimated peak daytime load. However, this creates a mismatch since the number of power users (and hence power consumption) is lower at night. If excess power generated at night can be stored, the actual power generating capacity during the day does not need to be as high as the peak daytime load.

If power networks worldwide were to adopt load-leveling, Credit Suisse Equity Research (Japan) estimates that storage capacity equal to about 20% of current electricity consumption would be required. Pumped hydroelectric storage already accounts to about 10% of consumption. Assuming that the remaining 10% of storage not currently provided by pumped storage is provided by batteries, a storage capacity of 1.8 TWh would be required.

Calculated in terms of current lead storage battery prices (US$225/kWh), this would constitute a massive market of approximately US$400 billion. The latent growth potential if this market takes off is therefore extremely significant. Industry analyst, Kema Inc. also forecast that the global market for energy storage over the next 10-20 years could be upwards of 300 gigawatts in size and US$200-US$600 billion in value.

Syrah expects to supply 1,245 tonnes of its projected 99.9% purity $V_2O_5$ production into the VRB market.

**Paul Kehoe**

Managing Director

Syrah Resources Ltd

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***About Syrah Resources***

*Syrah Resources (ASX code: SYR) is an Australian resource company with a diversified exploration portfolio located in southeast Africa. The Company is rapidly progressing its core Balama Graphite and Vanadium Project in Mozambique to production. Balama is a 106 km² granted prospecting licence located within the Cabo Delgado province in the district of Namuno in northern Mozambique. The project is approximately 265 km by road west of the port town of Pemba. Pemba Port is a deep-water container port, and the third largest in Mozambique. The Balama Project site is accessible by a sealed, main road, running directly from the airport and Pemba Port. The main road is located 1 km from the airport. Syrah's exploration portfolio also includes a strategic mineral sands portfolio in Tanzania, comprising eight tenement areas, some with high grade heavy mineral intersections, and the Nachingwea graphite project in Tanzania.*

**The information in this report as it relates to geology, geochemical, geophysical and exploration results was compiled by Mr Tom Eadie, FAusIMM, who is a Competent Person and Chairman of Syrah Resources Ltd. Mr Eadie has more than 20 years of experience in the activities being reported on and has sufficient expertise which is relevant to the style of mineralisation and type of deposit under consideration and to the activity undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Eadie consents to the inclusion of this information in the form and context in which it appears in this report.**

**The information in this report as it relates to mineral processing and metallurgical testing was compiled by Mr Michael T.N. Chan, MAusIMM, who is a Competent Person and General Manager of Project Development at Syrah Resources Ltd. Mr Chan has more than 20 years of experience in the activities being reported on and has sufficient expertise which is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Chan consents to the inclusion of this information in the form and context in which it appears in this report.**