

5 December 2017

ASX Announcement

## Kibaran to build pilot plant for producing battery-grade graphite following outstanding results of feasibility study

### Study shows downstream processing plant will be low-cost and environmentally friendly while generating strong financial returns

**Kibaran Resources Limited** (“Kibaran” or the “Company”) (ASX: KNL), is pleased to announce the successful completion of the feasibility study on downstream processing of graphite from its Epanko Graphite Project in Tanzania. The study found that production of battery-grade graphite using Kibaran’s proprietary purification technology would be low-cost and environmentally friendly. In light of these findings, Kibaran has decided to establish a pilot plant in Germany which will be expanded to commercial scale production for the supply of premium battery graphite to customers in Europe and Asia.

#### HIGHLIGHTS

- The feasibility study was based on production of 20,000 tonnes per year of spherical graphite, four times the rate originally planned.
- Decision to increase the production rate in the study was based on strong customer feedback on Kibaran’s eco-friendly processing route and the anticipated 300%-400% growth in demand from the battery sector from 2020.
- Assessment of product samples met specifications at leading battery anode manufacturers for markets in Japan, Korea, China, Germany and the United States.
- Development of proprietary non-hydrofluoric acid purification technology delivers environmentally-superior battery products at a highly competitive cost.
- Steps taken to protect intellectual property associated with the study.
- The study found:
  - Initial investment would be US\$66m
  - Pre-tax NPV<sub>10</sub> of US\$145m
  - IRR of 34.3%
  - Annual EBITDA of US\$30.5m (A\$42m)
- Feasibility study led by GR Engineering with participation of ProGraphite GmbH.
- Initial expenditure requirements for pilot plant will be funded through available working capital with boost from R&D cash rebate.

**Kibaran Managing Director Andrew Spinks commented:** “The results of the feasibility study have exceeded our expectations and I thank GR Engineering and ProGraphite for their dedication and commitment to complete this program over the course of 2017. Kibaran is now positioned to commercialise its battery graphite processing plans, commencing with a downstream processing pilot plant early next year and I look forward to updating our shareholders as we progress with this exciting addition to our graphite business.”

## INTRODUCTION

In early 2017 the Company commenced a feasibility study into the production of battery grade graphite to target increasing demand for lithium-ion batteries from the automobile and renewable energy sectors. The feasibility program was led by GR Engineering and involved extensive testing undertaken by ProGraphite, an international study of new industry developments and the participation of leading laboratories and potential customers. The objective was to identify a non-hydrofluoric acid processing technology to address the demand by lithium-ion battery manufacturers for a more environmentally friendly graphite product and at the same time, meet the stringent quality standards required for anode manufacture.

This was successful with the Company able to identify and refine a breakthrough in purification technology capable of producing premium quality battery product at a cost competitive with less environmentally acceptable production techniques adopted by the majority of existing anode material manufacturers.

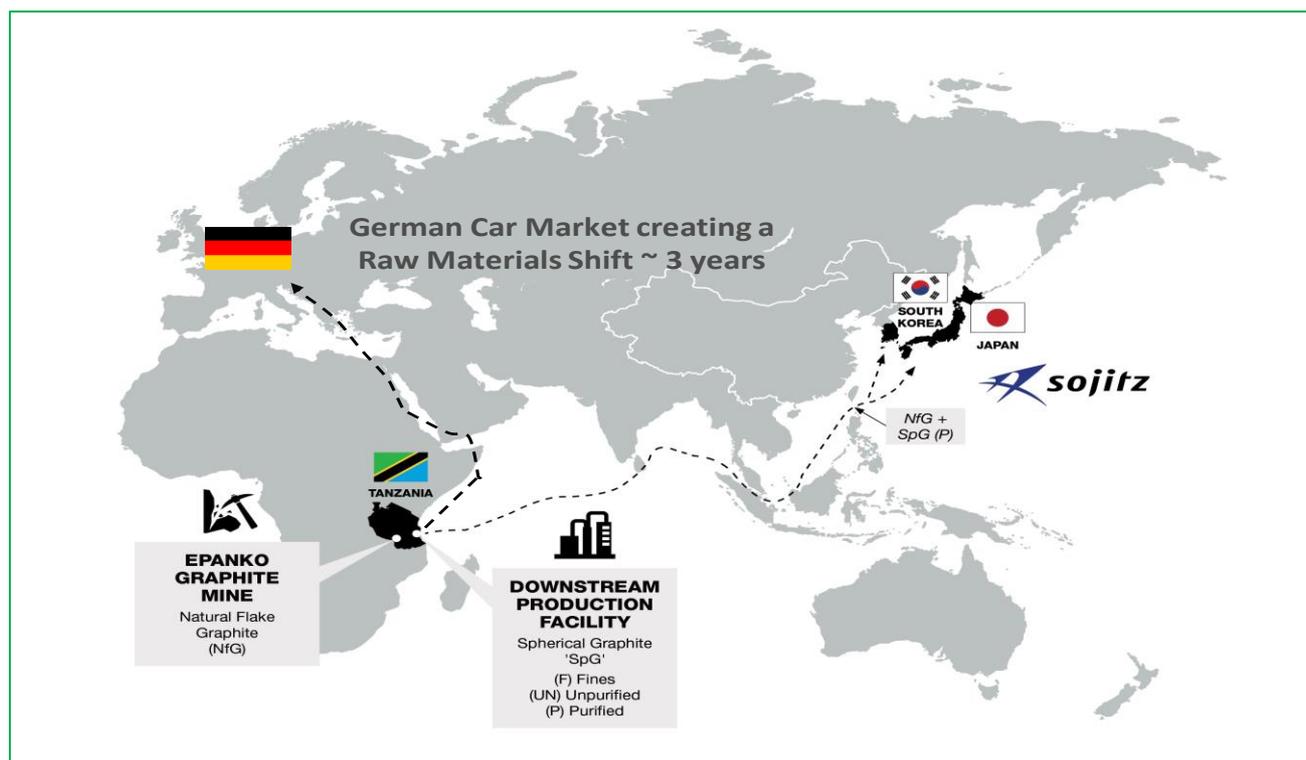
The success of the feasibility work and the development of the new processing technology provides Kibaran with an exciting opportunity to generate significant additional value for shareholders and as a result, the Company plans to accelerate the commercialisation of battery graphite production operations during 2018, focussing on the establishment of a modular pilot plant with an initial capability of producing 600tpa of unpurified battery-grade graphite by the end of 2018.

The pilot plant will then be used in the ramp-up of throughput rates to 20,000tpa.

Establishment of the new battery graphite manufacturing capacity is expected to provide the Company with a significant competitive advantage in a key growth market in the graphite supply chain. Together with the sale of graphite concentrate from Epanko, this will enable Kibaran to supply the full range of graphite products.

 <b>EPANKO GRAPHITE PROJECT</b> Natural Flake Graphite (NfG)	 <b>DOWNSTREAM PRODUCTION FACILITY</b> Spherical Graphite (SpG) (F) Fines (UN) Unpurified (P) Purified
<b>Production</b> : 60ktpa <b>NPV<sub>10</sub></b> : US\$211m <b>Annual EBITDA</b> : US\$44.5m	<b>Production</b> : 20ktpa <b>NPV<sub>10</sub></b> : US\$145m <b>Annual EBITDA</b> : US\$30.5m

*Refer ASX Announcement 21 June 2017 (downstream processing assumes an increase in output at Epanko).*



## BATTERY GRAPHITE PROCESSING AND PRODUCT TESTING

During the feasibility study two types of spherical graphite, SPG14.5 and SPG20, were produced for analysis under commercial production plant conditions. The natural flake graphite used was -195micron, produced from the flotation of Epanko graphite, also within a commercial production plant.

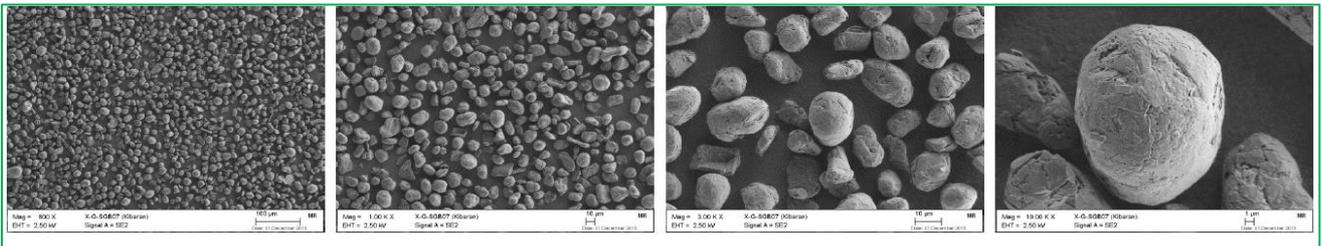
These SPG14.5 and SPG20 products were then evaluated extensively by leading battery anode manufacturers within Asia, all of whom confirmed that the Company's battery graphite satisfies their specification and performance requirements for potential future supply arrangements. The results and feedback provided by these organisations has been universally positive, with particular interest in the Company's new proprietary non-hydrofluoric acid purification process.

### Kibaran SPG14.5 and SPG20 Product Specifications

Grade	SPG14.5	SPG20
Carbon Content	99.98%	99.98%
Ash	0.02%	0.02%
Moisture	0.10%	0.10%
d10	9.8 micron	12.1 micron
d50	14.8 micron	19.0 micron
d90	22.3 micron	29.2 micron
SSA	7.8 m <sup>2</sup> /g	6.5 m <sup>2</sup> /g
Tap Density	0.95 g/ml	0.96 g/ml

The Epanko battery graphite was also tested to benchmark its performance against a commercially available product used in anode production, to assess its performance as an uncoated spherical graphite.

### Preparation of spherical graphite

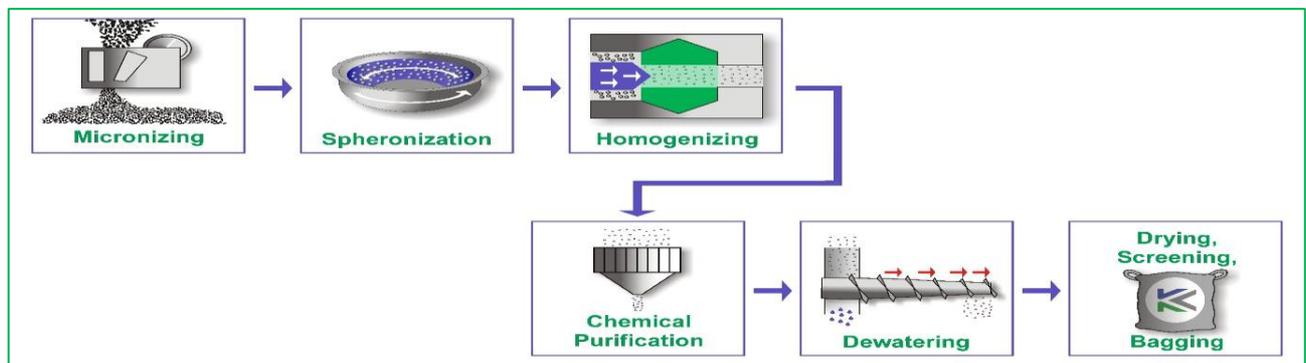


A lithium-ion battery anode was then produced using the SPG14.5 product in a leading German research institute as shown in the following diagram.



The feasibility study demonstrated that electrochemical testing and benchmarking of lithium-ion battery anode cells using the SPG14.5 Epanko anode slurry performed comparably to the standard commercially available anode material, with the results exceeding initial expectations and resulting in requests from major Asian-based anode manufacturers for additional Epanko product samples in order to undertake additional trial testing and analysis. Discussions with these parties have commenced in relation to potential agreements to supply battery graphite, which will form the basis for the planned expansion of the pilot plant during 2018.

Production of battery graphite typically involves a six-stage process, commencing with medium grade fine natural flake graphite feedstock and applying a combination of mechanical and chemical processes to create a very high purity fine graphite material for the coating of lithium-ion battery anodes. A simplified flowsheet comprises of the following steps:



The critical chemical purification stages can involve extensive processing applications and is the focus of the Company’s proprietary technology developed during the feasibility study. Optimisation testwork recently completed confirms the positive results of Kibaran’s new non-hydrofluoric acid purification process and as a result, steps have been taken through the Company’s legal advisors to protect the intellectual property associated with this development.

Initial testing has confirmed that battery graphite products produced using this new purification technology meet the specifications required by leading battery anode manufacturers and the elimination of hydrofluoric acid (which is currently used extensively by battery graphite producers) has attracted strong interest from a range of potential customers.

Following feedback during a visit to Japan, Korea and China in September, Kibaran upgraded its battery graphite demand forecasts and increased the planned production rate of battery graphite four-fold to reach 20,000tpa over the next three years as Japanese and Korean demand growth alone is now expected to be 300-400% by 2020, reaching approximately 120,000 tonnes per annum by 2025.

Based on these discussions with prospective customers, the Company is targeting future battery graphite production sufficient to supply 30% of this ex-China demand. Domestic demand from within China is expected to double over the next twelve months and will be a further catalyst for global demand and price growth. Kibaran believes that its non-hydrofluoric acid production process will be a key future requirement of anode material and lithium-ion battery producers and it is well positioned to secure agreements to enable the commercial production of battery graphite to ramp-up efficiently.

## FINANCIAL ANALYSIS

The battery graphite feasibility study presents a robust and compelling investment case, both as an initial standalone operation and also via the proposed vertical integration of Epanko and Kibaran’s other Tanzanian graphite projects into the lithium-ion battery supply chain. A detailed financial model has been developed as part of the feasibility study sensitivity analysis, demonstrating a highly attractive return on investment.

Key metrics, assuming a 60% gearing rate and 20 year operation are as follows:

Battery Graphite	Battery Graphite Pricing <sup>1</sup>	Pre-production Capital	Pre-tax NPV <sub>10</sub>	IRR	Annual EBITDA
20,000tpa	US\$3,250/t	US\$66m	US\$145m	34.3%	US\$30.5m

1. 2018 terms.

The battery graphite investment has a pay-back period of approximately 3 years and capital and operating costs adopted in the feasibility study were prepared on the basis of independent quotations and then subject to peer review by ProGraphite GmbH. Major operating expenditures are power and reagents, with the potential for future savings from the use of renewable energy supplies and process improvements that optimise chemical usage efficiencies.

Prices for battery graphite products have increased significantly during 2017, with recent pricing for standard grade graphite increasing from US\$2,300/tonne to US\$3,500/tonne. The Company has adopted a conservative long-term pricing model that is based on discussions with anode and battery manufacturers in Asia and an assessment of various global forecasts for energy, electric battery and electric vehicle growth rates over the next 10-20 years.

The outlook for battery graphite demand is very positive and further price increases are expected to be supported by a number of key developments:

- Chinese battery anode manufacturers doubling installed capacity in 2018.
- A restriction in supply due to increasing environmental pressure on both natural flake and battery graphite producers in China.
- Limited availability of high quality battery grade graphite to satisfy customer requirements for increasingly stringent product specifications.
- Increased pressure to reduce the use of existing hydrofluoric acid purification processes due to both Government and customer environmental concerns as more provinces within China adopt bans on the use of this widely used, but highly toxic acid in current graphite purification processes.

No allowance in the financial projections for such expected price increases has been made, nor for the benefit of Government investment and export incentives that are intended to promote value-added manufacturing processes and investment in renewable energy battery technologies. These programs will be a key focus during the pilot plant program.

### **NEW BATTERY GRAPHITE MANUFACTURING FACILITY**

The Company has developed a seamless two stage commercialisation strategy to meet market demand as follows:

- **Phase 1**

Establishment of a pilot plant in Germany in early 2018 for the purposes of conducting further testwork on product qualities, refining the new non-hydrofluoric acid purification technology and completing customer pre-qualification processes. The pilot plant will allow expansion of production rates to 600tpa to enable initial commercial sales of unpurified battery (spherical) graphite.

- **Phase 2**

Construction of a full commercial scale operation in 2019, commencing with the production and sale of up to 5,000tpa and ramping-up over several years to reach a battery graphite production rate of 20,000tpa. It is expected that the expansion of the pilot plant and the commencement of construction of full scale facilities would be undertaken in parallel to meet the forecast demand growth from customers in Asia and Europe.

Completion of the feasibility study is an important milestone in Kibaran's transition towards becoming a developer and operator of vertically integrated graphite operations and the Company expects to be able to provide further details on its 2018 battery graphite commercialisation plans in coming weeks.

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