



ASX: KNL  
FSE: FMK

*BUILDING A SUSTAINABLE ECO-FRIENDLY GLOBAL GRAPHITE BUSINESS*

## **EcoGraff** Kwinana Development

Presentation at Beer & Co Conference, Melbourne – 6<sup>th</sup> Nov 2019

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Information in this presentation that relates to Mineral Resources is based on information compiled by Mr David Williams, a Competent Person, who is a Member of the Australasian Institute of Mining and Metallurgy. David Williams is employed by CSA Global Pty Ltd, an independent consulting company and has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking 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”. David Williams consents to the inclusion in this presentation of the matters based on his information in the form and context in which it appears.

Information in this presentation that relates to Ore Reserves has been compiled by Mr Steve O’Grady, who is a Member of the Australasian Institute of Mining and Metallurgy. Steve O’Grady is a full time employee of Intermine Engineering and produced the Mining Reserve estimate based on data and geological information supplied by Mr Williams. Mr O’Grady has sufficient experience which is relevant to the estimation, assessment, evaluation and economic extraction of the Ore Reserve that he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the “Australasian Code for Reporting of Exploration Results, Minerals Resources and Ore Reserves”. Steve O’Grady consents to the inclusion in this presentation of the matters based on his information in the form and context in which it appears.



# VERTICALLY INTEGRATED BUSINESSES FOR MANUFACTURE OF BATTERY GRAPHITE FOR THE LITHIUM-ION MARKET



<b>Manufacturing of battery (spherical) graphite for lithium-ion batteries</b>	<b>Scalable mining projects for long term supply of graphite products</b>
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Australia / Asia / Europe	Epanko Graphite Project Debt Financing Advanced
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**Total pre-tax NPV<sub>10</sub> US\$546m and EBITDA US\$121.5m**  
*(geared, nominal terms)*

Shares on issue	Key holders	Financial
Listed 293m F-diluted 295m	Mitsubishi UFJ Group 12.5% JP Morgan Nominees 11.8% Board 10%	Cash (1 Oct) – \$1.4m Share Price – 7c Mkt Cap - A\$20.5m

## *Strong mix of graphite expertise, commercial and project development*

- Kibaran Chairman Robert Pett, Managing Director Andrew Spinks and Project Director Grant Pierce OAM established Tanzania's Golden Pride Mine which was the recipient of the President's Award in Tanzania for environmental excellence
- German-based non-executive director Christoph Frey (ProGraphite) is a globally recognised graphite expert.
- Howard Rae, CFO has over 20 years' experience in project financing
- Listed on the Australian and German (Frankfurt) stock exchanges



# BATTERY MARKET OPPORTUNITY: ELECTRIC VEHICLES

Global expansion of electric vehicle markets reliant on battery graphite and natural graphite feedstock

## BATTERY RAW MATERIAL COMPOSITION

47%

GRAPHITE

16%

COBALT

16%

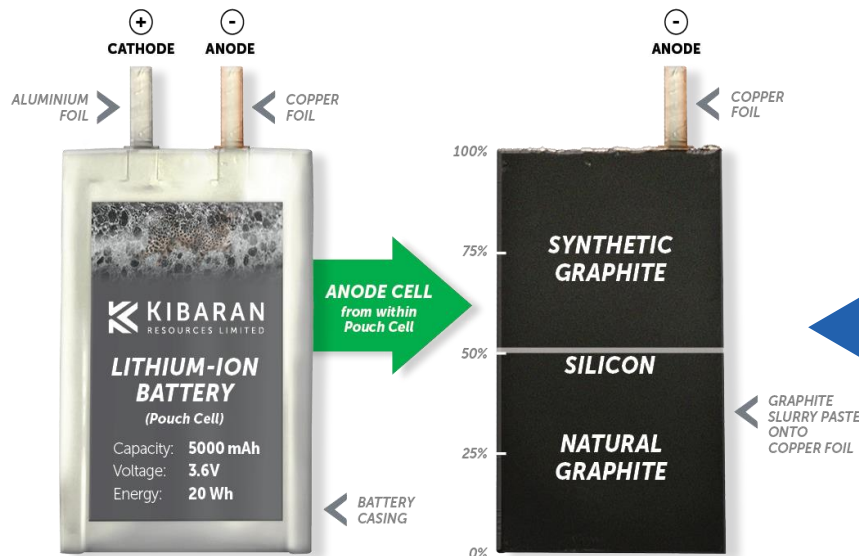
NICKEL

7%

LITHIUM

14%

MANGANESE



27kg

Natural (Spherical) Graphite per EV

- 54kg of natural graphite feedstock is required to manufacture 27kg of natural (spherical) graphite
- Natural (spherical) graphite used in battery anode is currently only sourced from China

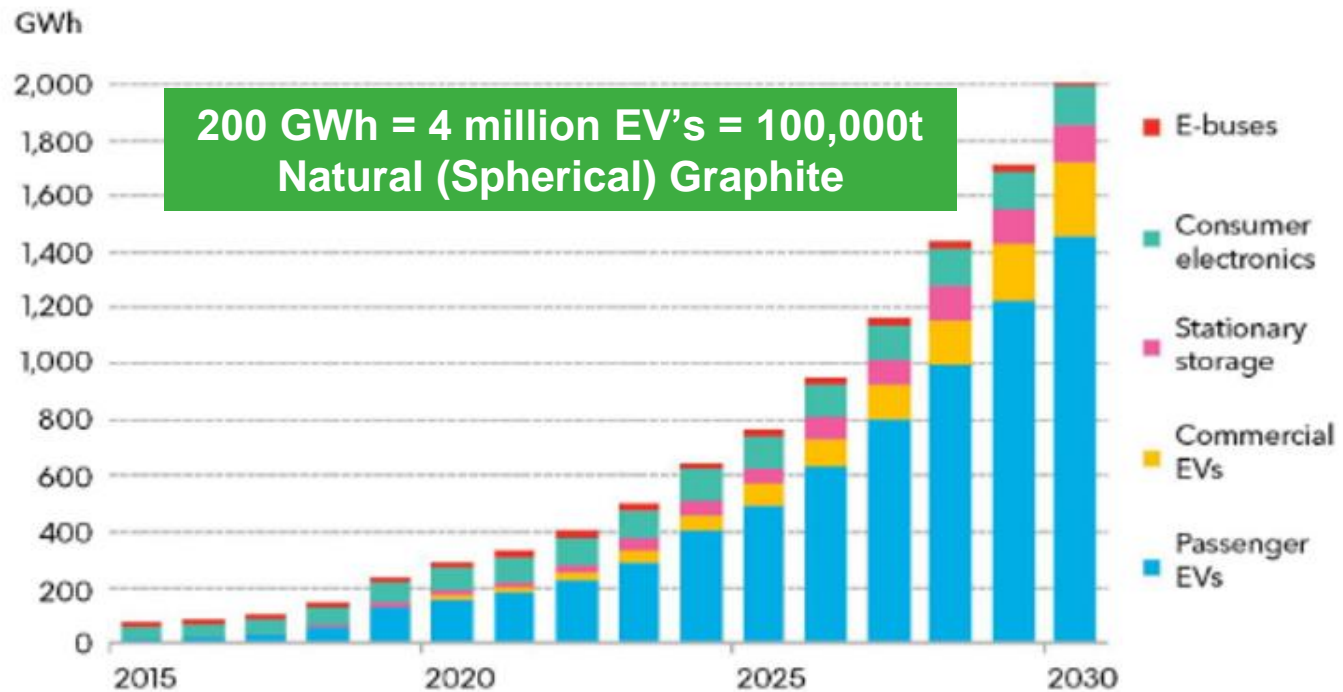


Battery graphite is manufactured from natural flake graphite into a 99.95% high purity product suitable for anode manufacturing



# BATTERY GRAPHITE DEMAND

Global expansion of electric vehicle markets forecast to drive a 700% increase in annual natural spherical graphite demand by 2025 Roskill



Source: BloombergNEF, Avicenne

Bloomberg New Energy 2019 reported that on current plans, total battery cell production capacity will exceed 1,000 GWh by 2025.



## Major investment underway in battery manufacturing for Electric Vehicles



Source: Reuters, Bloomberg New Energy and Benchmark Minerals

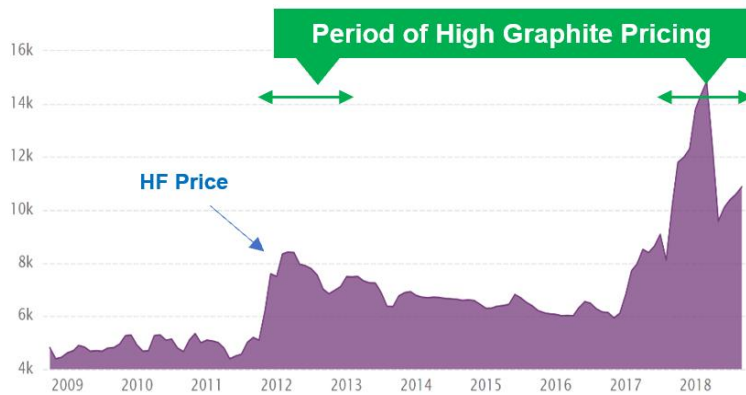
- ❑ Currently all German EV's are reliant on Asian battery anode cells
- ❑ German Government announced support for 3 new battery alliances
  - 1 billion euros to preserve the automotive value chain in Germany and Europe
  - Finance minister stated, *"Germany and Europe need to develop and build competitive, innovative and environmentally sustainable battery cells."*
- ❑ Raw materials shift into Europe expected from 2023

# EcoGraf ECO-FRIENDLY AND COST COMPETITIVE ALTERNATIVE TO CHINESE SUPPLY



- All battery graphite is presently produced in China using hydrofluoric (HF) acid to achieve 99.95%C with Hubei and Shandong the largest producing areas and increasingly subject to environmental regulation
- HF is a major contributor to the cost of Chinese battery graphite production in both input cost and management of fluorine enriched waste residues
- EcoGraf non-HF method is both cost competitive and eco-friendly compared to Chinese supply

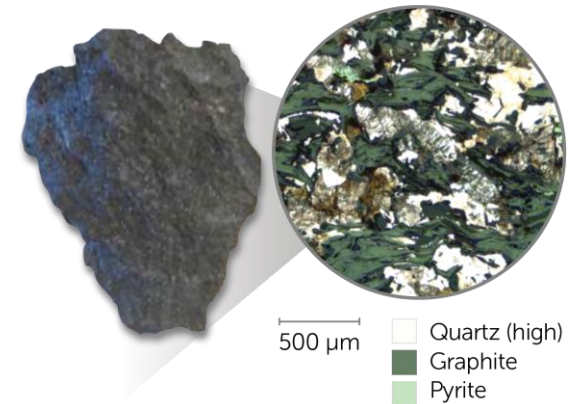
Source: Industrial Minerals



China HF Price (RMB)

*Chinese graphite ore with high quartz (silica) content of 40% (SiO<sub>2</sub>).*

*HF is the only acid that will digest high silica remaining in the graphite concentrates.*



# **EcoGraf** BATTERY GRAPHITE BUSINESS SUMMARY

## MANUFACTURE OF BATTERY GRAPHITE – KWINANA, WA

**Business Description** Production of spherical graphite in Western Australia using a new eco-friendly process to sell directly to lithium-ion battery manufacturers  
Initially supplying existing Asia markets, thereafter expanding to meet new European growth

- Status/Achievements**
- ✓ New eco-friendly process developed and trade marked EcoGraf
  - ✓ Feasibility study to produce Battery Spherical Graphite completed GR Engineering in December 2017
  - ✓ 2 years of Pilot testwork completed in Germany to produce commercial product
    - ✓ Process optimisation completed
    - ✓ Engineering design completed
    - ✓ Optimised flowsheet derisks process
    - ✓ Engineering design and costing completed for Kwinana, Western Australia and Asia
  - ✓ Global patent pending over unique eco-friendly purification processing technology
  - ✓ EcoGraf product fully tested and endorsed as meeting stringent operating specifications
  - ✓ Agreement in place for supply of suitable feedstock based on successful testwork
  - ✓ Over 80 product samples distributed to battery anode manufacturers in South Korea, Japan, China, North America and Germany
  - ✓ Debt and equity financing discussions underway
  - ✓ Offtake support underpins project financing

**Production Scale** Staged production facility at Kwinana to commence at 5,000tpa, quickly expanding to 20,000tpa

Manufacturing Facility Economics	CAPITAL		FINANCIAL RETURNS FOR 20,000TPA			
	5,000tpa	15,000tpa	NPV <sub>10</sub>	EBITDA	IRR	Payback
<b>Kwinana, WA</b>	US\$22.8m	US\$49.2m	US\$141m	US\$35m	37.0%	~4yrs





# EcoGraf MANUFACTURING PROCESS

Process flowsheet and planned scale-up de-risked through process optimisation, engineering, off the shelf equipment, extensive product qualification and endorsement of customers for eco-friendly products.

Agreements in place to secure feedstock



- 100 mesh @ 94-95%C natural flake graphite

Produced through crushing, grinding and flotation, with agreements in place to secure supply

Off the shelf equipment in use in China



**Mechanical grinding and shaping**

Micronising and spheronising using standard milling equipment

- ✓ 50% fines bi-product for sales into various markets
- ✓ Ability to purify fines for sales into higher value market

International patent pending for chemical purification process



**Multi-stage chemical purification, washing and filtration process (eliminates HF and is non toxic)**

EcoGraf

- ✓ Eco-friendly
- ✓ Cost effective
- ✓ Lowest cost quartile
- ✓ Supply diversity



**Purified battery (spherical) graphite for sale into lithium-ion battery market**



# EcoGraf DEVELOPMENT HISTORY

*Over 3 years of intensive testwork and process design to develop a new eco-friendly chemical process that provides a cost competitive alternative to existing Chinese supplies*

- Testwork performed in Australia and Germany conducting >100 trials using a systematic, scientific method to optimise the purification process with R&D support from Australian Government
- Evaluation of all leading micronising and spheronising equipment, resulting in improved yields at 45-55%
- Extensive product testing by potential partners and customers in Asia and Europe confirms attractiveness of EcoGraf SPG products as a high quality and cost effective alternative to existing Chinese supply
- EcoGraf effectiveness demonstrated through successful application to 10 existing sources of natural flake graphite from Europe, Africa, Asia and the America's
- EcoGraf process suitable for purification of fines bi-products, providing options to generate additional revenues from high purity fine graphite products
- Engineering and feasibility work on Kwinana location



# EcoGraf PRODUCT QUALIFICATION

Over 80 graphite product samples, including various grades of spherical graphite, tested successfully by battery anode manufacturers in South Korea and Japan



- ✓ Battery graphite samples (SpG14.5, 15 and 20) tested by battery anode manufacturers
- ✓ Testing confirms EcoGraf product meets all battery anode manufacturers' specifications

## PRODUCT SAMPLE SPECIFICATION (SPG15)

Particle Size			Carbon	%	99.98			
d10	micron	10.3	<b>Impurities</b>					
d50	micron	15						
d90	micron	22.1						
<b>Tap density</b>						Al	ppm	2.7
<b>Surface Area (SSA)</b>						Ca	ppm	4.6
kg/l			0.98	Fe	ppm	5.5		
m <sup>2</sup> /g			7.4	Mg	ppm	0.5		
			S	ppm	5			
			Si	ppm	15.4			
			Zr	ppm	0.5			



2018 Chinese demand increased 40% and Rest of World demand to exceed 100,000 tonnes by 2020

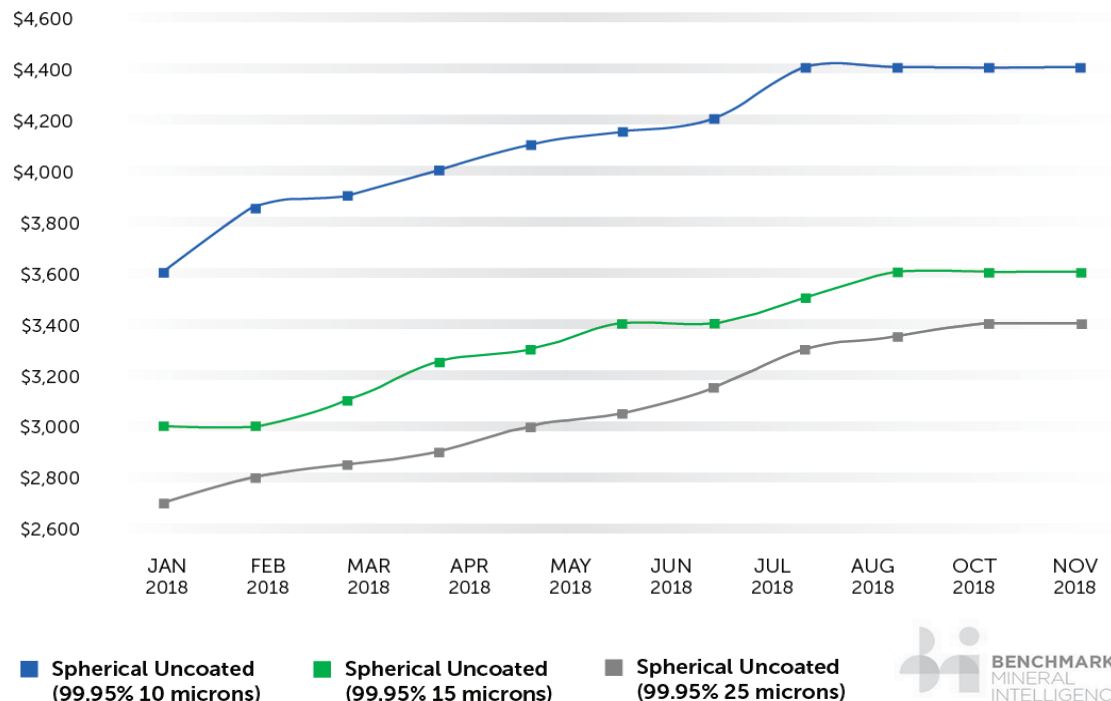
## Latest News:

- Prices increased 20% during 2018 for Spherical Graphite (SPG)
- Benchmark Minerals has reported SPG exports from China up 16% from Jan-July 19, with coated SPG up over 200%

## Further price increases:

- Restriction in Chinese supply due to increasing environmental pressure with fluorine residues
- Limited availability of high-quality battery grade graphite to satisfy customer requirement

GRAPHITE PRICES (USD/Tonne) : JAN 2018 - NOV 2018



*Graphite feedstock will be procured and processed at the Kwinana facility and exported to lithium-ion battery manufacturers in Asia, Europe and the US*

- Awarded “Lead Agency Support’ and in process of being offered a 6.7ha industrial site within Kwinana Industrial Area (KIA)
- Pre-development activities, including engineering, permitting and environmental approvals commenced
- Final Investment Decision (FID) in the first half of 2020



## Key Benefits

- Geographic risk - Australia’s reputation as a reliable supplier of high-quality industrial products
- Location/Infrastructure - KIA emerging as a global hub for value added processing of battery materials
- Logistics - KIA has direct port access
- Ethical transparency in raw material production supply chains
- Protection of intellectual property rights for additional downstream processing activities

# EcoGraf KWINANA PLANT LOCATION

*Ideally situated for transport of product to and from Fremantle Container Terminal and direct access to reagent suppliers, infrastructure services and highly skilled labour*



Source: Landcorp



FUTURE BATTERIES INDUSTRIES



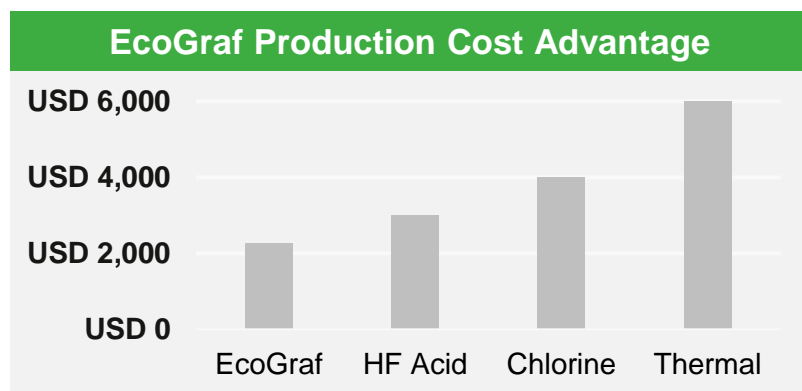
AVAILABLE LAND

Proposed EcoGraf Kwinana Plant Location



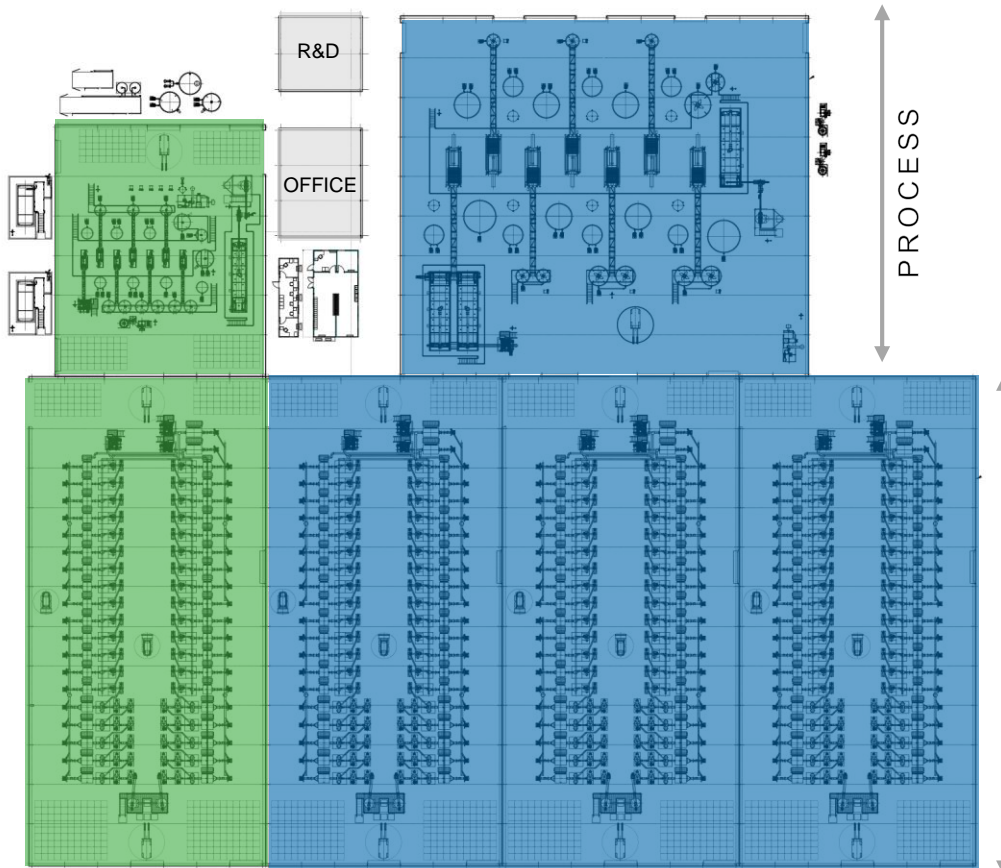
# EcoGraf KWINANA CAPITAL AND OPERATING COSTS

	Phase 1	Phase 2
<b>CAPITAL</b>	<b>5,000TPA</b>	<b>15,000TPA Expansion</b>
Direct costs	\$18.6m	\$41.2m
EPC	\$2.7m	\$5.6m
Commissioning	\$0.2m	\$0.4m
Other	\$1.3m	\$2.0m
<b>Total</b>	<b>US\$22.8m</b>	<b>US\$49.2m</b>
<b>OPERATING</b>		<b>20,000tpa</b>
EBITDA pa		US\$35m
Production		5.5tph
<b>Total cost per SPG tonne</b>		<b>US\$2,275</b>



# EcoGraf PLANT LAYOUT

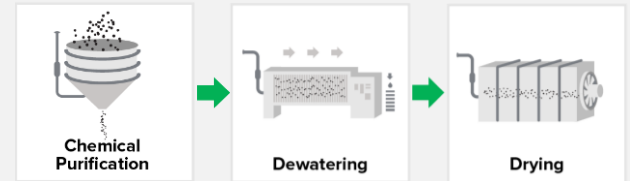
Staged expansion from 5,000tpa to 20,000tpa - flexibility with modular design



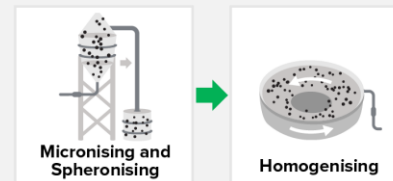
5 KTPA + 15 KTPA : TOTAL 20 KTPA



## Purification



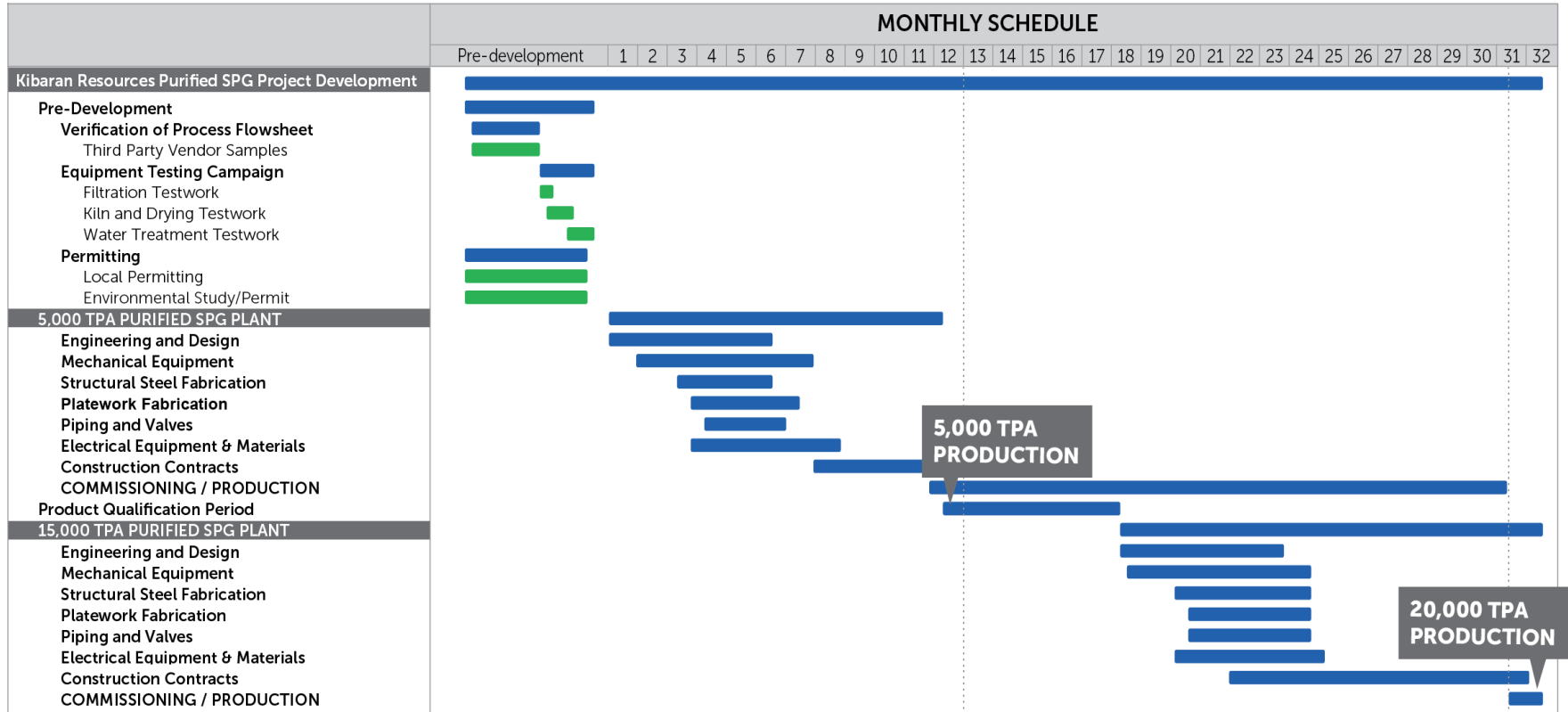
## Micronising and Spheronising





# EcoGraf DEVELOPMENT AND CONSTRUCTION

Short 11-month construction period to first production



## EPANKO GRAPHITE PROJECT

<b>Description</b>	Natural flake graphite project
<b>Location</b>	Epanko Valley, Mahenge, Ulanga District, Morogoro Region, Southern Tanzania
<b>Status – ready to construct</b>	<p>Bankable Feasibility Study completed June 2017                  Independent Engineer's Due Diligence via KfW and SRK completed August 2017                  Debt financing with German and Australian lenders</p> 
<b>Social and environmental planning</b>	<p>Completed to Equator Principles standards and achieved:</p> <ul style="list-style-type: none"> <li>• International Finance Corporation Performance Standards</li> <li>• World Bank Group Environmental, Health &amp; Safety Guidelines</li> </ul>
<b>Production</b>	<p>Stage 1 is 60,000 tonnes per year of natural flake graphite                  Scalable development model enables rapid expansion to meet market demand</p>
<b>Construction cost</b>	Stage 1: US\$89 million
<b>Strong economic returns</b>	US\$44.5m pa EBITDA // 38.9% IRR // 3.5yr payback // US\$211m pre-tax NPV <sub>10</sub>
<b>Committed sales and offtake with major international customers</b>	<p>Thyssen Krupp (Germany) and Sojitz Corporation                  Offtake agreements in place for Stage 1</p>   

# BUILDING A SUSTAINABLE GLOBAL GRAPHITE BUSINESS

## DOWNSTREAM BUSINESS BATTERY GRAPHITE FACILITY



Spherical Graphite (SPG)  
(F) Fines  
(UN) Unpurified  
(P) Purified

	KWINANA	ASIA
Production	20ktpa	20ktpa
NPV <sub>10</sub>	US\$141m	US\$194m
EBITDA	US\$35m	US\$42m

- Strategic partnerships
- Offtake
- Financing



## UPSTREAM BUSINESS EPANKO GRAPHITE PROJECT



Natural  
Flake  
Graphite  
(NfG)

Production	60ktpa
NPV <sub>10</sub>	US\$211m
EBITDA	US\$44.5m

- Project financing



**Total pre-tax NPV<sub>10</sub> US\$546m/(A\$780m) and EBITDA US\$121.5m/(A\$174m)**  
*(geared, nominal terms)*





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**THANK YOU**