AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

# EcoGraf Limited (ASX: EGR)

July 2021

INDEPENDENT
INVESTMENT RESEARCH

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INDEPENDENT INVESTMENT RESEARCH

# EcoGraf Limited (ASX: EGR)

## Comprehensive Update - July 2021

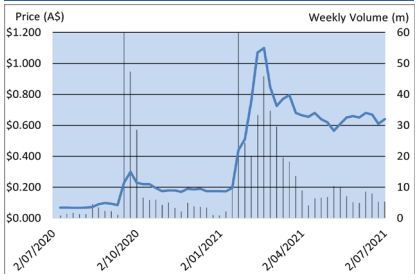
**Note**: This report is based on information provided by the Company as of July 7, 2021.

| Investment Profile | |
|---|---|
| Share Price as at 6 July 2021 | A$0.585 |
| Unrisked base case NAV - conceptual funding scenario | A$1.35/share |
| Issued Capital: | |
| Ordinary Shares | 449.8 m |
| Listed Options | 0.0 m |
| Unlisted Options | 0.0 m |
| Performance Rights | 7.95 m |
| Fully Diluted | 457.8 m |
| Market Capitalisation | A$263.2 m |
| 12 month L/H | A$1.10/$0.03 |
| Cash Position | |
| Cash as at 31/03/2021 | A$52.42 m |

| Board and Management |
|---|
| Mr Robert Pett: Non-Executive Chairman |
| Andrew Spinks: Managing Director |
| John Conidi: Non-Executive Director |
| Howard Rae: Executive Director - Finance |
| Michael Chan - Executive Manager - Product Development |
| Shaun O'Neill - Executive Manager - Project Development |
| David Cairns: Technical Consultant |
| Marshall Hestelow - Corporate Consultant |
| Nassor Said - Director - TanzGraphite |

| Major Shareholders | |
|---|---|
| J P Morgan Nominees | 23.7% |
| First Sentient Investors | 8.6% |
| Allianz Asset Management | 5.1% |
| Paradice Investment Management | 5.1% |
| Board and Management | 7.5% |
| Top 20 | 56.2% |

**Share Price Performance**




The investment opinion in this report is current as at the date of publication. Investors and advisers should be aware that over time the circumstances of the issuer and/or product may change which may affect our investment opinion.

## READY FOR DEVELOPMENT

Driven by the expected growth in the uptake of electric vehicles, a number of forecasters see Li-ion battery capacity demand rising ~6 fold from current levels to 2,000 GWh by 2030, and by ~15 fold to over 5,000 GWh by 2040. Naturally this will see a concurrent rise in the demand for the main battery materials, including graphite (anode), and various metals for the cathode.

One of the key anode ingredients is spherical graphite ("SpG"), which forms around 50% of the anode, along with synthetic graphite and silicon - SpG usage intensity is ~0.5 kg/kWh, or 30 kg per 60 kWh vehicle - on a larger scale this equates to 500 kg/GWh.

Currently, 100% of uncoated SpG (the pre-cursor to the coated SpG as used in batteries) is produced in China, using the environmentally unfriendly hydroflouric ("HF") acid purification process. However several factors are now in play to diversify this production, including geopolitical, the growing demand and a wish for diversification of supply by end users, and the wish for ethically sourced, traceable "clean green" materials, with the latter now being legislated in the EU. Legislators and investors are now placing greater emphasis on adherence to Environmental, Social and Corporate Governance ("ESG") factors.

EcoGraf Limited ("EcoGraf" or "the Company") is ideally placed to take advantage of this, and is well down the path to the implementation of a vertically integrated graphite business supplying markets outside of China. The main plank of the Company's strategy is the development of a 20,000 tpa uncoated SpG facility in "Battery Alley", the Kwinana-Rockingham Industrial Area ("KRIA") just south of Perth in Western Australia - this will be the first such plant outside of China - the Company is also investigating the potential for similar plants in Europe.

EcoGraf has developed the proprietary EcoGraf™ purification process that will allow the treatment of relatively low value 94% TGC, 150 µm flake graphite to produce high value SpG. The process is relatively benign, using only mild reagents, without the problems of HF or thermal purification processes. The process has been rigorously tested using various feedstocks to pilot scale, with product qualification demonstrating the suitability for battery use.

Equity funds are in place to develop the initial 5,000 tpa, US$22.9 million plant, with negotiations well underway with Export Finance Australia and others for the US$35 m debt portion of the expected US$49.2 million required for expansion to 20,000 tpa. The Company is looking to commence construction by the end of CY2021. Modelling by the Company has indicated a pre-tax nominal equity $NPV_8$ of US$448 million.

The suitability of the EcoGraf™ process to upgrade waste graphite (including SpG production waste and the recycling of anode material from lithium-ion batteries) has also been demonstrated, with this potentially being a lucrative business. EcoGraf has entered into a partnership with South Korean battery recycler SungEel HiTech Co ("SungEel") to develop modular recycling units.

The main upstream asset is the 100% owned Epanko Graphite Project ("Epanko") in Tanzania, which is fully permitted and has binding offtake agreements thus far with German and Japanese customers for ~44,000 tpa of the planned 60,000 tpa of proposed high-quality graphite concentrate production, with an estimated pre-tax equity $NPV_8$ of US$211 million, with an estimated up-front capital cost of US$88.9 million.

The Company is advancing debt funding negotiations with the German KfW-IPEX-Bank and Tanzanian Government for the US$60 million facility required to advance Epanko.

The recently appointed President of Tanzania, Her Excellency Samia Suluhu Hassan is initiating positive industry and legislative changes to attract foreign investment back into the country, following issues over the past few years, including the poorly received 2017 changes to the Mining Law.

Material improvements to the situation have been made, as demonstrated by the awarding of a Special Mining Lease ("SML") to ASX listed OreCorp Limited (ASX: ORR, "OreCorp").

## VALUATION

**We have an unrisked, after tax NAV valuation for EGR of A$752 million, or A$1.35/share. This uses a conceptual funding scenario, is based on a DCF valuation of the Kwinana EcoGraf™ facility and Epanko, and assumes EGR keeps 100% of the projects. However such scenarios may change, and thus this NAV valuation should be treated as conceptual. There is also upside, particularly with the development of additional EcoGraf™ facilities.**

# SWOT ANALYSIS

## Strengths

- **Close to development ready:** Both the proposed Kwinana EcoGraf SpG facility and Epanko mine are close to development; the first stage of the Kwinana facility is funded, with debt financing well advanced for the 2nd stage at Kwinana and the development of the Epanko mine.
- **Robust BFS and technically de-risked:** Both projects have returned robust development studies (that have gone through a number of iterations) - in particular the review process and meeting the IFC and World Bank requirements have resulted in a robust BFS for Epanko and the technical de-risking of the Project.
- **Environmentally friendly EcoGraf™ process:** Given that the majority of current SpG purification is carried out using HF treatment, the EcoGraf process presents an ethical, clean alternative that should gain wide appeal to end users which includes the major automobile and energy storage markets, and which meets increasingly stringent ESG guidelines.
- **Robust, high quality Resource:** Epanko has a high quality and robust Resource, with the graphite suitable for most applications and hence readily marketable.
- **Forecast strong graphite outlook:** Most commentators are seeing a strong outlook for graphite for the foreseeable future, with this to be largely driven by the strong forecast for growth in the electric vehicle market.
- **Strong offtake partners:** The Company has sales and offtake agreements for both flake and SpG with German and Japanese parties, with customers within Europe and Asia looking to diversify sources of supply away from China. The tie in with German partners also means EcoGraf will be ideally placed to provide SpG to planned German gigafactories.
- **Close to infrastructure:** The planned EcoGraf™ facility is in a well developed heavy industrial area, with all that entails with respect to infrastructure and services. Epanko has ready access to transport infrastructure (both road and rail) connecting it to the port at Dar es Salaam; in addition planned upgrades to the Tanzanian electricity grid should result in Epanko being supplied by grid power after a few years of operation.
- **Experienced board and management:** Company personnel have experience in the mining and resources sector, including Tanzania and graphite, and also have a significant shareholding in EcoGraf, thus aligning their interests with other shareholders.

## Weaknesses

- **Tanzania:** Given issues with the Mining Law and ex-President Magufuli over the past few years, being located in Tanzania may be seen as a weakness by some. However, on the other hand these now have been largely sorted out, with finalisation of the new laws, the Minerals Commission being formed and MLs being granted. Also, due to the recent passing of President Magufuli, Tanzania has seen the elevation of ex-Vice President Hassan to President, with her actions to date indicating that she wishes to lead a more investor-friendly Government.

## Opportunities

- **Downstream expansion and diversification:** The nature of the EcoGraf™ process will allow ready expansion in response to changing markets, with the ability for plants to be located to suit customers; in addition there may be the potential to move into even higher value downstream processing, including the production of coated spherical graphite.
- **Upstream expansion:** The potential to increase Resources at Epanko provides the opportunity to expand graphite concentrate production, with this also potentially being provided at Merelani-Arusha.
- **Other acquisitions:** Should production eventuate, cash generated could then be used for further acquisitions to grow the Company.

## Threats

- **Commodity prices and demand:** Change in commodity prices will affect both any decision to go ahead and the ongoing viability of an operation; our view is that this is largely mitigated with regards to Epanko and EcoGraf™, given the strong forecast demand for graphite, the offtake agreements that are in place and the wish for non-Chinese end users to diversify away from Chinese sourced products. In addition the planned gigafactories in Asia, the US and Europe should see increasing demand for ethically sourced product.

- **Equities markets:** Although reasonably strong at the moment, the resources sector can turn on a dime, with the riskier junior end being the first to feel any downturn. The main effect that any downturn in the short term will have on EcoGraf would be to affect the price at which project equity is raised at and hence the amount of dilution. The ability to raise equity can also flow on to the ability to raise debt.
- **Development funding**: This is the final hurdle before commencement of development at Epanko and Kwinana, however given the work completed with the various financiers to date our view is that this is now largely mitigated.
- **Execution and start-up:** There are commonly issues with project start-ups, however Epanko is somewhat mitigated from this by virtue of using standard operational methods. Successful pilot scale testing for the EcoGraf™ process will also somewhat mitigate that business unit from this risk, although there may be the need for product qualification from the upscaled processing.
- **Sovereign:** As events of recent years have shown, there is sovereign risk in Tanzania, however things have now largely settled down with the adoption of the new Mining Act and Regulations, as well as the change of President.

# OVERVIEW

## STRATEGY AND PROJECT OVERVIEW

- EcoGraf's[1] strategy is to develop a vertically integrated graphite production business targeting traditional markets and the rapidly growing uncoated spherical graphite battery markets in Europe, North-East Asia and the US (Figure 1).
- This strategy has involved the setting up of two main wholly owned business units, TanzGraphite, which is involved in the development of upstream mining operations in Tanzania, and EcoGraf, which will operate the downstream purified SpG business to supply the battery anode markets - additional downstream value add opportunities that may be considered in the future include the production of the higher value coated spherical graphite.
- The initial EcoGraf™ facility is planned for "Battery Alley", located within the KRIA south of Perth in Western Australia - the KRIA hosts several industries required to develop a lithium-ion battery market, with the Company securing a 6.7 ha site for the planned SpG facility.
- One point of concern for anode and battery producers is the current concentration of uncoated SpG production in China - given current geopolitical factors, and the forecast rapid growth in the uptake of EVs, battery producers are looking for diversity in supply, and it is likely that EcoGraf's planned Kwinana facility will be the first of its type outside of China.

**Figure 1: EcoGraf project location map**


Source: EcoGraf

- One of the aims of EcoGraf™ is to produce an ethically sourced traceable and environmentally friendly product that will gain wide market appeal (and for which some markets are looking to demand in the future); as such a proprietary non-hydroflouric acid (HF) purification process has been developed and successfully tested at a pilot scale - this is significantly cleaner than the environmentally unfriendly HF processing (that provides close to 100% of Chinese production) and cheaper than thermal processing, which requires significant energy - this should also bolster EcoGraf's ESG credentials, with ESG factors becoming significantly more important to investors.
- The EcoGraf™ process has successfully treated feedstock from Epanko and from several 3rd party sources to produce +99.95% C battery anode grade SpG (which meets battery producers' specifications), with the target feed being relatively low cost -100 mesh, lower grade (94%) flake.
- Having the flexibility to successfully process a range of feedstocks is important, and also means that the EcoGraf™ facility can operate independently of any future mining and concentrating operations at the Company's proposed Epanko graphite mine.
- It is planned to ramp up the EcoGraf™ business to the production of 20,000 tpa of SpG over the next few years (and potentially up to 40,000 tpa after that based on forecast demand), with initial commercial production of 5,000 tpa - different locations, including Tanzania, Asia and Europe have been considered for the plant(s), with these having the

1 Throughout the document "EcoGraf" refers to the Company, and "EcoGraf™" refers to the treatment process.

flexibility to be sited close to customers - recent work has led to the decision to site any second plant in Europe.

- Global demand for batteries has been forecast to grow ~6 fold from current levels to 2,000 GWh by 2030, and by ~15 fold to over 5,000 GWh by 2040, with this made up of significant growth outside of China - given that ~0.5 kg of SpG is required for each kWh (~500 t per GWh), the 2030 forecast will require some 1.0 Mt of SpG, with 57%, or ~570,000 t of this demand outside of China.
- Even if these forecasts are optimistic, there is still significant scope for EcoGraf to enter the market, and grow from the initially planned 20,000 tpa.
- As an example of recent growth, global production of light electric vehicles increased from ~2.25 million units in 2019 to 3.24 million in 2020, with~90% of this growth outside of China, and hence in the markets that EcoGraf is targeting - this is notwithstanding the effects of COVID in 2020.
- Another aspect that EcoGraf has successfully tested is using the EcoGraf™ process on treating manufacturing waste and the recycling of anode material from discarded batteries - this is a potentially valuable business partly given that the EU is legislating battery recycling targets, and there is a move towards a circular economy.
- SpG production commonly results in ~50% of the feedstock reporting as waste fines - this material is usually sold into the low value recarburiser market, however the production of high purity material from this through the EcoGraf™ process leaves open the opportunity for this to be used in higher value applications and the development of new technologies, and should also potentially improve the already potentially robust economics of any SpG facility.
- The ability to treat (and hence recycle) the anode waste from discarded batteries will be a vital consideration in the future, with battery disposal potentially being a significant issue with the expected uptake of EVs.
- As such, the Company has entered into an agreement with SungEel, a major South Korean battery recycling group - the planned business is complimentary to both companies, given that SungEel largely recycles cathode material, and EcoGraf plans to recycle anode material.
- The Company's upstream activities are currently focussed on finalising the debt financing of the proposed 60,000 tpa high quality Epanko Graphite Project in south-central Tanzania (Figure 1). This has the Resource upside to allow for significant production increases if need be and has the flake quality and mix to suit most applications.
- Other projects include the brownfields Merelani-Arusha Graphite Project in northern Tanzania, however this will not be discussed further.

## ENVIRONMENT, SOCIAL AND CORPORATE GOVERNANCE

- ESG factors are becoming more universal, with several governments now mandating them as well as potential investors looking at a target Company's ESG credentials before any investment is made.
- As an example, the European Union ("EU") has in place regulations regarding battery manufacture to promote sustainability, including:
  - Responsible, sustainable and ethical sourcing of raw materials,
  - Declaration of carbon footprint of all batteries,
  - Traceability of raw materials, with this to meet OECD guidelines; and,
  - Recycling and establishing a circular economy.
- EcoGraf's activities are being developed to respect and adhere to these regulations and guidelines, and, as well the industry it is in, being the battery and recycling industries, should have positive ramifications for the Company's ESG credentials.
- Having strong ESG credentials should make a company more attractive to a wider investor base, and thus make it easier to secure funding with all other things being equal.

## TANZANIA

- Given the well publicised 2017 changes in the Mining Law, disputes with major mining companies and the reported governing style of the recently deceased President John Magufuli, foreign investors became wary about investing in Tanzania.

- A key aim of President Magufuli's successor, Her Excellency Samia Suluhu Hassan, is to regain the trust of foreign investors, and hence attract foreign investment back into Tanzania; as such reforms are being undertaken to this end - prior to the poorly received 2017 reforms, Tanzania was seen as a relatively attractive mining destination.
- A recent positive event in the mining industry was the previously mentioned Cabinet approval for the awarding of an SML to OreCorp for the Nyanzaga Project.

### FINANCIAL POSITION

- As of March 31, 2020, the Company had A$52.42 million in cash and no debt.
- In Q1, 2021, the Company raised A$54.6 million through a placement at A$0.60/share, with funds to be partly used for the development of Stage 1 of the planned EcoGraf™ facility in Kwinana - this means that the 5,000 tpa Phase 1 is now fully funded.

### CAPITAL STRUCTURE

- The Company has 449.8 million ordinary shares and 7.95 million Performance Rights on issue - the largest shareholder is J P Morgan Nominees, with 23.7% (on behalf of several investors) with First Sentier Asset Management (formerly Colonial First State), holding 8.6%; the Board and Management hold 7.5% of the Company.
- Other significant institutional investors include Allianz Asset Management and Paradice, both with 5.2%.
- The company is also listed on the US over the counter OTCQX market (ECGFF.NQO), and the Frankfurt Stock Exchange (FMK.F).

## ECOGRAF™ DOWNSTREAM PROCESSING - ECOGRAF 100%

### INTRODUCTION

- As previously stated, EcoGraf's overall strategy is to become a significant player in the downstream graphite market, with initial plans to produce ethically sourced uncoated spherical graphite using environmentally friendly processing, and then potentially to produce higher value coated battery anode material as these markets develop.
- The Company's plans have strong Federal and State Government support, including, amongst others, being awarded Major Project Status ("MPS") by the Federal Government, and Lead Agency status by the State Government.
- Also on the Federal side, the Company is well advanced in debt finance negotiations for Stage 2 of the plant through Export Finance Australia.
- The plan is to construct a modular plant, with an initial capacity of ~5,000 tpa of SpG and ramping up to ~20,000 tpa by year 3, with a similar production of fines produced from the milling process - estimated capex for this facility includes:
  - Initial production of 5,000 tpa to be developed in 2022, with an estimated capital cost of US$22.8 million, fully funded from the recent A$54.6 million placement; and,
  - Full scale production of 20,000 tpa to be developed in 2023/2024, with an estimated incremental capital cost of US$49.2 million, and to be partly funded by a US$35 million debt facility currently being negotiated with Export Finance Australia.
- The downstream strategy was launched in 2015, with considerable progress made since then, with this including successfully developing the EcoGraf™ purification process, successfully producing"in-spec" SpG, and now moving close to the development of the first plant in Western Australia.
- Key milestones over the last twelve months include:
  - Memorandum of Understanding ("MoU") executed with German based TECHNOGRAFIT GmbH ("TECHNOGRAFIT"), for the supply of pre-qualified graphite concentrate feedstock for the planned Kwinana facility - this will ramp up to 40,000 tpa from 2023, and apply for an initial five year term with a five year option (April 8, 2020) - these volumes allow for the 50% wastage in producing SpG,
  - Qualification following an 18 month process by two potential European industrial customers of high purity fines produced from the EcoGraf™ treatment of low value fines generated in the milling and spheroidisation of graphite feedstock (May 12, 2020),
  - Confirmation of superior battery electrochemical performance of SpG produced from different feedstocks (including Epanko) selected for the EcoGraf™ processing (July 1 and August 12, 2020),

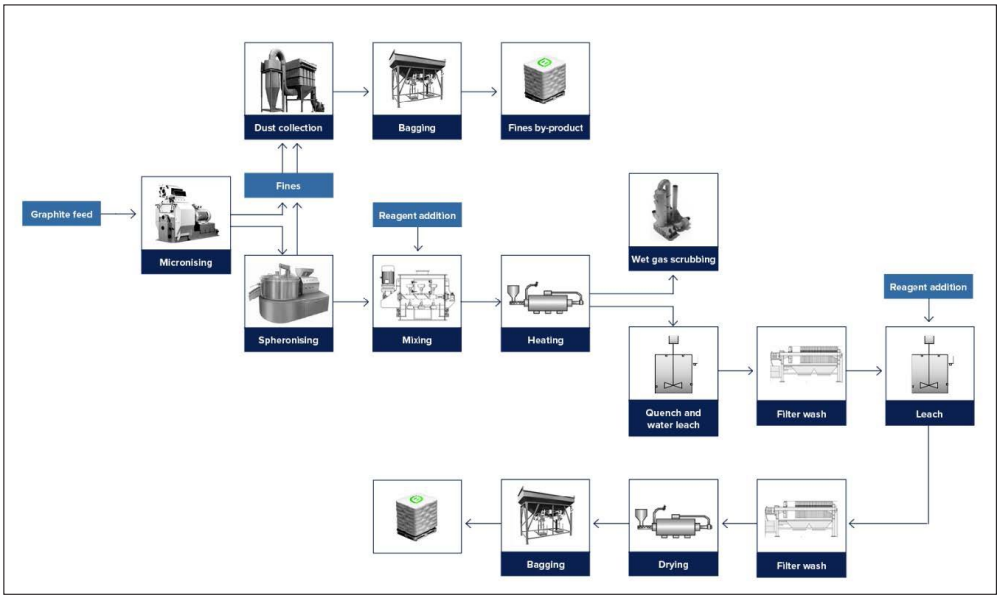
- Non-binding term sheet executed with thyssenkrupp Materials Trading for the offtake of 50% of the planned SpG and fines production from the planned facility, ramping up from 2,310 tonnes of each in Year 1 to 10,020 tonnes of each in Year 3 (June 4, 2020),
- Execution of an agreement with the Western Australian Land Authority ("DevelopmentWA") over a 6.7 ha industrial site in the KRIA (September 28, 2020),
- Completion of a Development Report, which includes updates to the previously released Feasibility Study (discussed below, November 5, 2020),
- Progress in securing the debt facility with Export Finance Australia (January 25, 2020); and,
- Commencement of detailed engineering design by GR Engineering (February 8, 2021).

- Given the modular nature of the plant, there will be the potential to further increase production (at a reasonable incremental cost) down the track depending upon markets, with the Company also having the flexibility to site new plants to be near customers.
- EcoGraf is now also advanced on site selection for a proposed 20,000 tpa facility in Europe, with five sites being shortlisted; the Company will also consider options regarding the siting of additional facilities dependent upon markets and customers.

## ECOGRAF™ PROCESS

- The driver of the strategy has been the development of the proprietary EcoGraf™ treatment process - this involves a non-HF purification process, which has been successfully tested on Epanko graphite and several other 3rd party graphite samples from various regions, including Europe, Asia, the Americas and Africa.
- This is a relatively low cost and "green" process, with the following benefits over commonly used purification methods:
  - It doesn't have the safety concerns or environmental impacts of the HF processing route, as widely used in China; and,
  - It doesn't have the very high energy costs associated with thermal purification - in this process the graphite is heated to over 2,500° C to "boil" off the impurities, taking advantage of carbon having the highest melting/boiling point of any of the elements.
- The flowsheet is shown in Figure 2, with key stages including:
  - Micronising to 10µm - 20µm,
  - Spheronising,
  - Reagent addition and mixing,
  - Heating,
  - Two stages of leaching and filter washing,
  - Drying; and,
  - Bagging.

**Figure 2: EcoGraf™ process**




Source: EcoGraf

- Over 100 samples using all feedstocks have been produced from the pilot scale production in Germany, and have consistently produced +99.95% C SpG.

- This material has been used to produce "in-spec" battery anode material, with the quality and suitability for use in battery anodes confirmed by a range of battery manufacturers, thus highlighting the potential for the global application of EcoGraf™.
- In addition to the flexibility in the feedstock selection, the process is also flexible in allowing specifications, including particle size, to be changed to meet specific customer requirements.
- One key point is that the planned processing route uses "off the shelf" equipment, including the key mechanical shaping (micronising and spheronising) and purification equipment, thus mitigating some of the upsize risk.

## FEASIBILITY STUDY AND UPDATES

- A positive Feasibility Study for a 20,000 tpa facility was completed in late 2017, with this updated in April 2019 following optimisation work, and again through the production of a Development Report as released to the market on November 6, 2020.
- The initial study was based on a plant located in Tanzania, the first update within the Asia-Pacific area, and with the 2020 iteration using the KRIA site.
- The Feasibility Study completed in 2017 considered a 20 year operation (including a three year ramp up) to produce 20,000 tpa of purified SpG, with the positive results leading to the decision to undertake the pilot scale processing undertaken in Germany - the results of this and the two updates are presented in Table 1.
- The operating cost includes the cost of the graphite feed, which also relies on the yield to SpG - we (and the Company) have used a yield of 50%; graphite feed costs will also depend upon whether they are "transfer" priced from the Company's upstream operation or bought at market prices.
- It is difficult to independently comment on the quantum of these costs, however our analysis indicates that they are broadly in line with those presented in publicly released studies for similar development projects.

**Table 1: EcoGraf development study results**

| EcoGraf development study results | | | | |
|---|---|---|---|---|
| **Item** | **2017 Study** | **2019 Update** | **2020 Update** | **Notes** |
| Stage 1 Pre-Production Capital | US$66.00 m | US$19.98 m | US$22.80 m | No breakup of capex for 2017 case, however will ramp up from 5,000 to 20,000 tpa |
| Stage 2 Expansion Capital | N/A | US$44.37 m | US$49.20 m | |
| Total Capital | US$66.00 m | US$64.35 m | US$72.00 m | |
| Stage 1 SpG Production | 20,000 tpa | 5,000 tpa | 5,000 tpa | |
| Stage 1 Fines Production | 20,000 tpa | 5,000 tpa | 5,000 tpa | |
| Stage 2 SpG Production | N/A | 20,000 tpa | 20,000 tpa | |
| Stage 2 Fines Production | N/A | 20,000 tpa | 20,000 tpa | |
| Cash operating cost/tonne SpG (inc feedstock) | Not disclosed | US$1,998/t | US$2,000/t | |
| Battery Graphite Pricing | US$3,250/t | US$3,575/t | US$3,250/t | |
| Fines Pricing | US$700/t | US$675/t | US$700/t | |
| EBITDA (20,000 tpa) | US$30.50 m | US$42.00 m | US$30.62 m | |
| NPV Pre-Tax (note different valuation approaches, and project locations) | US$145 m | US$194 m | US$448 m | 2017, 2019 - Real NPV, DR of 10%, project value<br>2020 - Nominal NPV, DR of 8%, equity value |
| IRR Pre-Tax | 34.3% | 49.8% | 42.4% | |

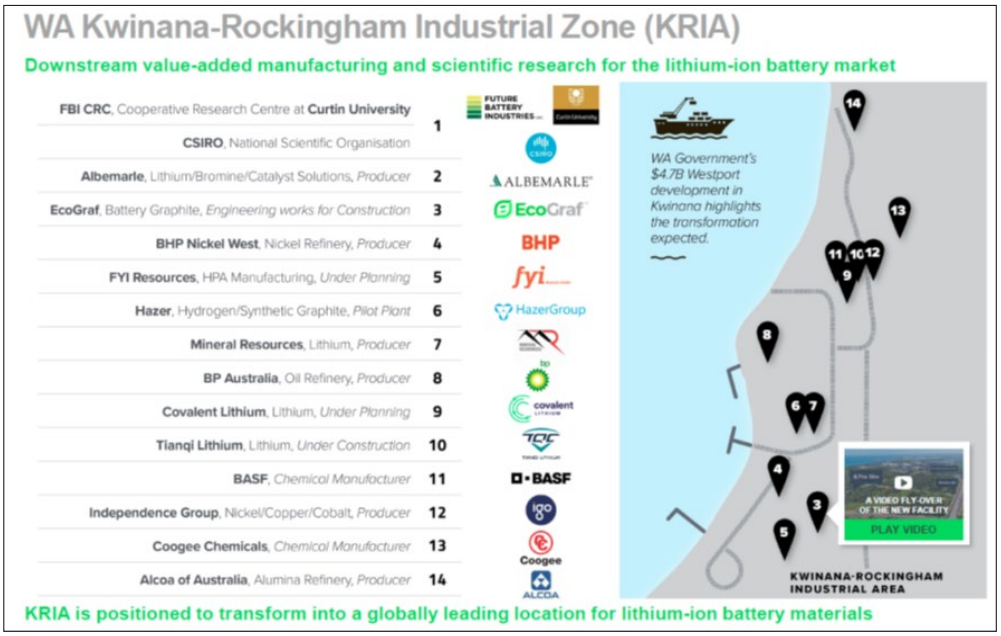
Source: EcoGraf

## "BATTERY ALLEY"

- The Battery Alley site secured by EcoGraf has ready access to all services, including utilities and transport, and is located only ~30 km south of Perth - the 6.7 ha site will allow for significant future expansion - the currently planned 20,000 tpa facility covers ~2 ha.
- As shown in Figures 3 and 4, the KRIA, which is part of the Western Trade Coast, is host to several facilities either operating, or planned, for the production of battery minerals, with Western Australian mines producing the critical battery cathode materials, including nickel, manganese, lithium, cobalt and aluminium.

- This makes Western Australia a logical place to initially produce anode and cathode materials, and then develop battery gigafactories - the Western Australian Government has the *Future Battery Industry Strategy* in place.

**Figure 3: KRIA map and industry**




Source: EcoGraf

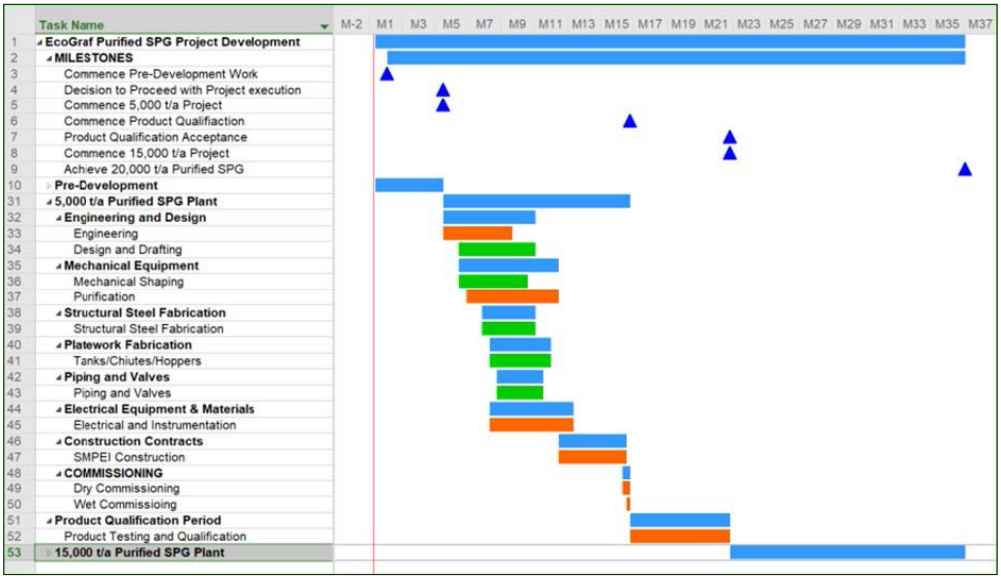
**Figure 4: KRIA map and aerial view**


Source: EcoGraf

## DEVELOPMENT TIMELINE

- The estimated development timeline is presented in Figure 5 - the Company plans to be in a position to commence construction of Phase 1 of the Kwinana facility by the end of 2021, with GR Engineering Services ("GRES") having commenced pre-construction works for the detailed engineering design for the 20,000 tpa facility.

**Figure 5: EcoGraf facility development timeline**

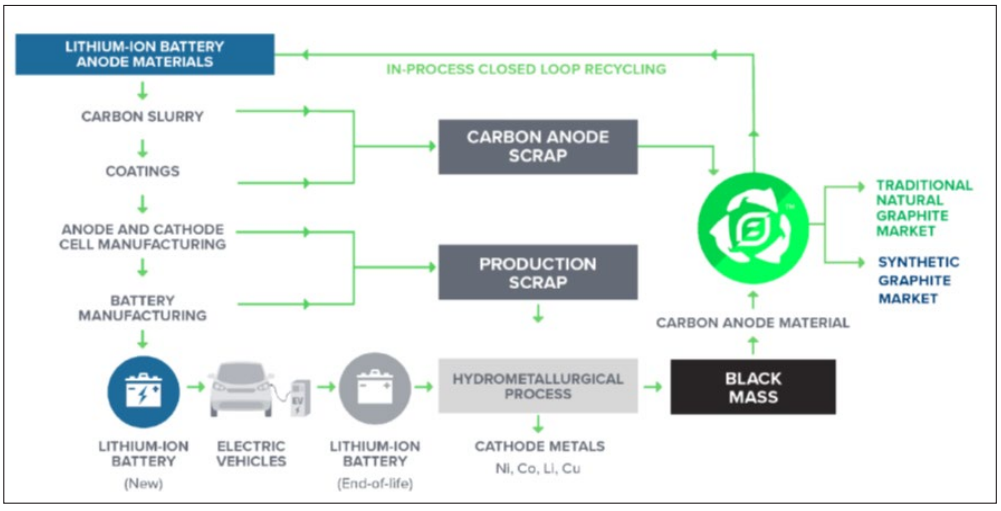



Source: EcoGraf

## BATTERY RECYCLING

- Using the EcoGraf™ process to treat waste material is a natural extension of its application, with the Company looking at two aspects (Figure 6):
  - The processing of low quality waste from anode material manufacture to produce a high purity product for use in specialist applications; and,
  - The recycling of anodes from discarded batteries - the recycling produces "black mass" as shown in Figure 5.
- Success in this aspect of the Company's overall strategy should also significantly add to EcoGraf's ESG credentials.

**Figure 6: Battery and scrap recycling schematic**

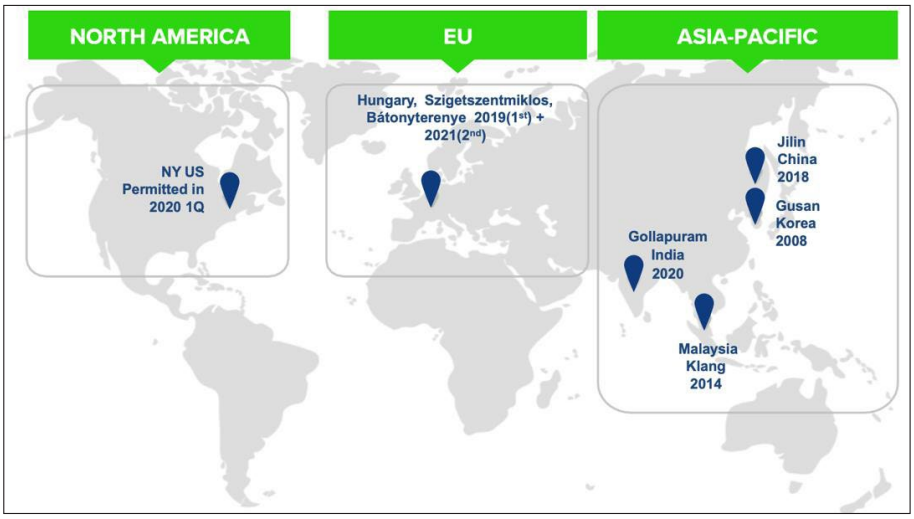



Source: EcoGraf

- As mentioned earlier the results of work undertaken by the Company have been very successful, highlighting the suitability of EcoGraf™ for these applications - in addition to the successful treatment of anode manufacture waste, more recent testwork (as announced on February 1, 2021) has produced material with a carbon purity of >99.95% TGC from "black mass", which results from the recycling of battery anodes.
- The Company will test the suitability of using the treated waste in new battery anodes, replacing at least in part the high cost synthetic graphite that currently makes up ~50% of anode material - this has at least two positive outcomes, firstly potentially lowering the cost of new batteries, and secondly cutting the carbon footprint of the EV manufacturing process, of which batteries currently make up ~40%.
- The potential of the process has been reinforced by the signing, and subsequent extension, of the MoU with SungEel, which currently concentrates on the recycling of cathode materials; SungEel currently processes ~24,000 tpa of battery materials, with

plans to ramp up to 56,000 tpa, of which ~22% is carbon anode material - facility locations are shown in Figure 7.

**Figure 7: SungEel global pre-treatment plants**




Source: EcoGraf

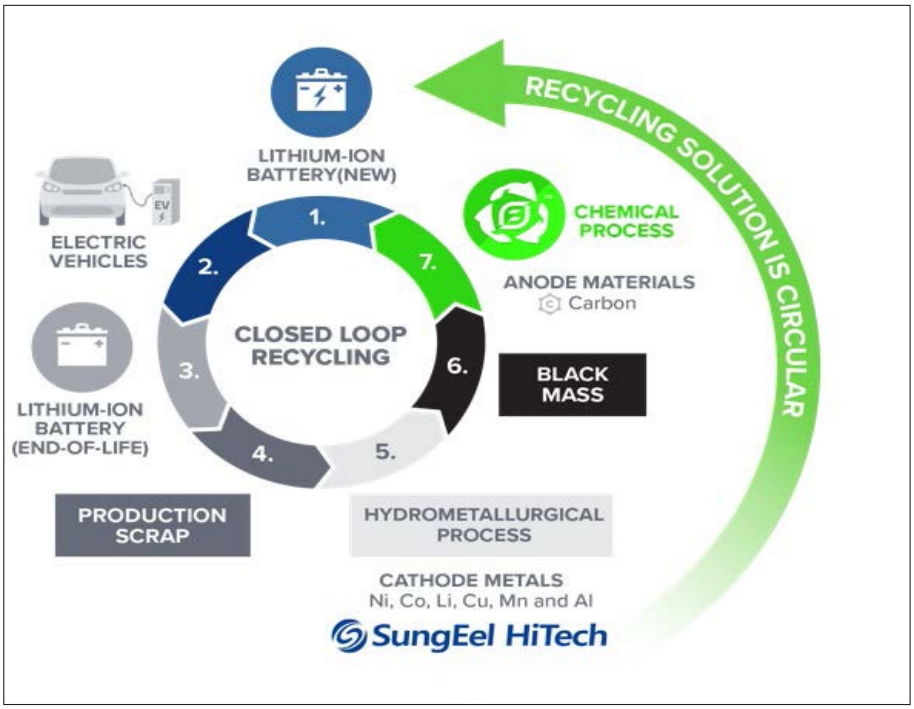
- This is complementary to EcoGraf, given that SungEel largely treats cathode waste, with EcoGraf planning to treat anode waste (Figure 8).

**Figure 8: Battery and scrap recycling synergies**


Source: EcoGraf

- One of the aims of the collaboration (which includes GRES), is to develop modular battery recycling facilities, that can also be tailored to the customers' specifications.
- The recycling strategy is partly driven by EU legislative requirements for the recovery of battery waste, with the ultimate aim to reach as close as possible to a "closed loop" manufacturing and recycling industry (Figure 9).

**Figure 9: Closed loop manufacturing and recycling schematic**



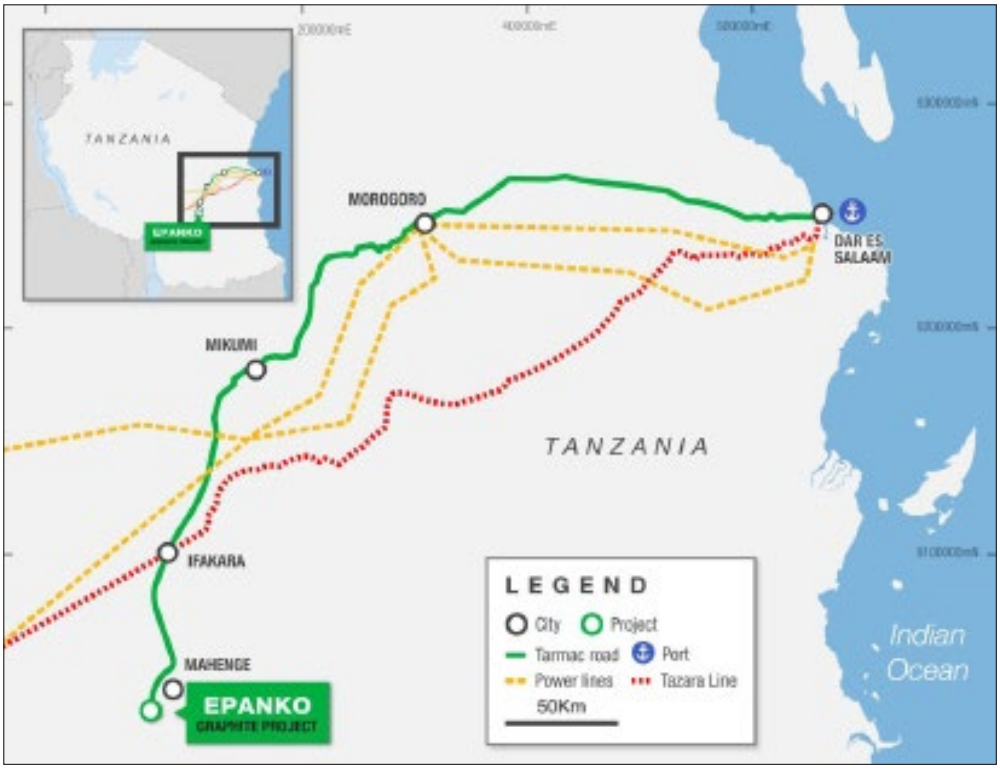

Source: EcoGraf

# EPANKO GRAPHITE PROJECT - ECOGRAF 100%

## LOCATION, INFRASTRUCTURE AND TENURE

- The Epanko Graphite Project is located approximately 470 km SW by road from Dar-es-Salaam in southern Tanzania, and approximately 130 km south of the "Tanzara" railway at Ifakara (Figure 10) - the Project is held and operated through TanzGraphite, a 100% owned subsidiary of EcoGraf.

**Figure 10: Epanko location and infrastructure**




Source: EcoGraf

- Access from Dar es Salaam is by 340 km of tarred road to Ifakara, and then 130 km of compacted laterite road to site; transport infrastructure improvements over recent years have included the construction of a bridge over the Kilombero River near Ifakara, which replaced a vehicular ferry.
- The main Tanzanian electricity supply passes through Ifakara (Figure 10); it is expected that an upgraded substation in Ifakara will result in the Project being able to be connected to the Ifakara substation via a dedicated 33kV powerline.
- The project comprises one granted Mining Lease (ML 548/2015, 9.62 km$^2$) and seven granted Prospecting Licences ("PL", 80.47 km$^2$), all held by TanzGraphite.
- The Mining Lease was originally granted in 2015 for a term of 10 years; as announced to the market on September 9, 2018, the Company received a Letter of Guarantee from the Government of Tanzania for the renewal of the Mining Lease for a further 10 years from expiry in 2025 until 2035 - this is important in that it aligns the term of the Mining Lease with that of the proposed senior debt facilities.
- The original issue of the Mining Lease required the grant of all required environmental permits.

## WORK BY ECOGRAF

- Since acquiring the Project, EcoGraf has carried out significant work, largely concentrated on development studies for Epanko, with activities including drilling, metallurgy, engineering and other programmes associated with the relevant studies; community and stakeholder consultation and engagement has also been a critical part of activities, including the development of a Resettlement Action Plan ("RAP") and compensation schedules.
- The Company is also well advanced on offtake and financing, with ~44,000 tpa of the proposed 60,000 tpa concentrate output being subject to offtake agreements.

## Local Community

- One of the key aspects of advancing the Project is the resettlement and compensation for the local community which comprises six hamlets (~300 families) that will be affected by the proposed operation.
- The Company has also put in place a long term, US$7.5 million community investment package, which includes the RAP, upgraded infrastructure and community facilities, new housing and assistance with the establishment of micro-enterprises amongst family groups, with plans meeting the requirements of the Equator Principles.
- The Company expects to directly employ up to 250 locals during construction, and up to 200 during operations; however the economic benefits flowing from the direct employment will have an expected 10x to 15x multiplier affect within the local communities.

## Resources and Reserves

- The latest JORC 2012 compliant Mineral Resource Estimate ("MRE", Table 2) for Epanko was completed in March 2017 - this increased Resources from 23.3 Mt @ 9.4% TGC (as reported in June 2015) to 30.7 Mt @ 9.9% TGS, a 40% increase in contained graphite.
- Reserves (Table 3) were updated in June 2017 as part of the updated BFS; the previous Reserve, completed as part of the 2015 BFS, was 10.9 Mt @ 8.6% TGC.

**Table 2: Epanko JORC-2012 complaint MRE >8% TGC**

| Epanko JORC-2012 complaint MRE | | | |
|---|---|---|---|
| **JORC Classification** | **Tonnage (Mt)** | **Grade (% TGC)** | **Contained Graphite (Kt)** |
| Measured | 7.5 | 9.8 | 739 |
| Indicated | 12.8 | 10 | 1,280 |
| Inferred | 10.4 | 9.9 | 1,031 |
| Total | 30.7 | 9.9 | 3,050 |

Source: EcoGraf

**Table 3: Epanko JORC 2012 compliant Ore Reserves >5% TGC**

| Epanko JORC 2012 compliant Ore Reserves | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Classification** | **Proven** | | | **Probable** | | | **Total** | | |
| | **Tonnes (Mt)** | **% TGC** | **Cont (Kt)** | **Tonnes (Mt)** | **% TGC** | **Cont (Kt)** | **Tonnes (Mt)** | **% TGC** | **Cont (Kt)** |
| Oxide | 4.2 | 8.48 | 356 | 3 | 7.54 | 227 | 7.2 | 8.09 | 583 |
| Transitional | 0.5 | 7.99 | 43 | 0.6 | 8.96 | 55 | 1.1 | 8.51 | 97 |
| Fresh | 1 | 8.36 | 85 | 2.3 | 8.95 | 206 | 3.3 | 8.77 | 291 |
| **Total** | **5.7** | **8.41** | **483** | **5.9** | **8.23** | **488** | **11.7** | **8.32** | **971** |

Source: EcoGraf

- The Resource presented above is based on an 8% TGC cutoff; decreasing the cutoff to 5% TGC results in an MRE of 113.3 Mt @ 7.2% TGC, for 8.1 Mt of contained graphite, again providing significant upside.

## Previous Development Studies

- The initial development study was a Scoping Study completed in July 2013, based on the initial MRE of 14.9 Mt @ 10.5% TGC; this study was updated following a Resource upgrade to 22.7 Mt @ 9.8% TGC, with the results announced in August 2014.
- Given the positive results, it was decided to progress directly to a BFS (with GR Engineering Services overseeing the study), with this being completed in July 2015; this followed the granting of the environmental certificate and the initial 10 year Mining Lease.
- As part of the financing process, SRK were appointed by the potential debt financiers to complete an Independent Expert's Review ("IER") on the 2015 BFS, with this work being completed in August 2017.
- This resulted in several recommendations, with a comprehensive work programme, including technical, social and marketing aspects, being competed over the 12 months leading up to the release of the updated BFS in June 2017.
- The updated BFS also incorporated an expanded concentrate production of 60,000 tpa, up from the 40,000 tpa as presented in the 2015 BFS.

## 2017 Updated BFS

### Introduction and Summary

- The updated BFS is based on a 720,000 tpa RoM operation, producing 60,000 tpa of graphite concentrate - key inputs and outcomes are presented in Table 4, and compared with the results of the original BFS - as shown in Table 4, this resulted in a pre-tax $NPV_{10}$ of US$211 million, with an IRR of 38.9%.
- Estimated capital and operating costs are presented in Table 5, and incorporates outcomes resulting from the IER.
- Given that these were subject to the financiers due diligence process they should be considered as reasonable, and possibly even conservative; the capital intensity of US$1,480/annual tonne is significantly higher than the production weighted average of US$927/tonne for studies released by peers, and also higher than those with similar planned throughputs.
- The opex of US$500/tonne FOB is ~10% higher than the production weighted average of US$445/tonne for peers at the time of the study, however we note that the other studies that we have compared EcoGraf's figures to have not been through the independent debt financing review process.

**Table 4: Epanko updated BFS parameters and outcomes**

| Epanko updated BFS parameters and outcomes | | | |
|---|---|---|---|
| **Input** | **Unit** | **Jun-17** | **Jul-15** |
| Development period | (months) | 19 | 18 |
| Mine life | (years) | 18 | 25 |
| Average annual throughput | (t) | 695,000 | 434,000 |
| Plant nameplate capacity | (tpa) | 720,000 | 450,000 |
| Strip ratio | (waste to ore) | 0.4:1 | 1:01 |
| Average feed grade | (% TGC) | 8.3 | 8.6 |
| Graphite recovery | (%) | 94.7 | 93.3 |
| Average product carbon grade | (%) | 96 | 96 |
| Graphite production | (Kt) | 60,000 | 40,000 |
| Average product price | (US/t FOB) | 1,181 | 1,446 |
| Average product price | (US/t CIF Europe) | 1,213 | - |
| Mining cost | (US$/t processed) | 7.93 | 9.83 |
| Processing cost | (US$/t processed) | 19.61 | 23.25 |
| General & Administration cost | (US$/t processed) | 4.75 | 6.23 |
| Transport and port charges | (US$/t sold) | 107 | 102 |
| C1 FOB cost | (US$/t sold) | 500 | 570 |
| All In Sustaining Cost | (US$/t sold) | 572 | 622 |
| Pre-production capital cost | (US$m) | 88.9 | 77.5 |
| **Output** | **Unit** | **Jun-17** | **Jul-15** |
| Pre-tax $NPV_{10}$ | (US$m) | 211 | 197 |
| Pre-tax IRR | (%) | 38.9 | 41.2 |
| Payback period post construction | (years) | 3.4 | 2.7 |

Source: EcoGraf

**Table 5: Epanko updated BFS capital and operating costs**

| Epanko updated BFS capital and operating costs | | |
|---|---|---|
| **Capital Costs ($US million)** | | |
| **Area** | **Jun-17, 60 ktpa** | **Jul-15, 40 ktpa** |
| Mining | 0.7 | 2.4 |
| Process Plant | 48.8 | 45.1 |
| Infrastructure | 13.2 | 10.9 |
| EPC | 11.5 | 11 |
| Contingency | 7.1 | 6.2 |
| Owners Cost | 7.6 | 1.9 |
| Total | 88.9 | 77.5 |
| **Operating Costs (US$/tonne concentrate FOB Dar es Salaam)** | | |
| **Area** | **Jun-17, 60 ktpa** | **Jul-15, 40 ktpa** |
| Mining | 96 | 117 |
| Processing | 239 | 277 |
| Transport & Port Charges | 107 | 102 |
| General & Administration | 58 | 74 |
| C1 cost FOB Dar es Salaam | 500 | 570 |
| Royalties | 39 | 43 |
| Other sustaining costs (includes sustaining capital - US$15/t, off site corporate - US$10/t and rehabilitation - US$8/t | 33 | 9 |
| All in sustaining cost | 572 | 622 |

Source: EcoGraf

### Mining

- Mining will be conventional drill and blast using contract miners; the location of the pits over hills, and the broad nature of mineralisation result in a very low strip ratio of 0.4: 1.
- The strip ratio is very low, with the Company stating that waste rock will largely be used in tailings dam lifts and infrastructure.

### Metallurgy and Processing

- A key aspect of the proposed graphite operations is metallurgy, and being able to meet the customers' specifications; to that end the Company has liaised closely with the offtake partners and carried out comprehensive metallurgical test work, with plans to produce four size fractions with an average grade of >96% TGC.
- This will enable the product to be sold into existing markets; in addition graphite from Epanko has been shown to be suitable for use in Li-ion battery anodes.
- Work has highlighted high quality mineralisation, with high TGC contents (particularly in the fresh mineralisation, where grades of +99% TGC have been achieved from the standard processing route) and the relatively high proportion of large and jumbo flake.
- The Company, as part of a Feasibility Study for the EcoGraf™ plant, produced purified spherical graphite from -195 micron Epanko flake - this material was extensively evaluated by a number of leading battery anode manufacturers.
- Metallurgical test work also included a 200 tonne bulk sample for production testing for the lithium-ion battery market; this sample also reconciled 24% above the predicted block model Reserve grade.
- The planned processing is a standard crush, mill and float route.

### Tailings and Waste

- The planned TSF is a valley fill facility - the capacity will be sufficient for the entire LoM, with ~660,000 tonnes of tailings being generated annually at full production.

### Infrastructure

- Plans are to ultimately connect to the national electricity grid, with a powerline link (which is included in the capital costs) needing to be constructed - it is expected that this could take 12 to 18 months to plan, design and construct.

- Until such time as the operation is connected to the grid, the estimated installed power of 2.8 MW and peak draw of 2.4 MW will be generated using on-site diesel generation; these will be retained on site for backup power generation following connection to the grid.
- It is planned to source process water from pit dewatering, the TSF and a two well borefield; the water infrastructure includes a wat`er storage dam.
- The Project will include an accommodation camp.

**Concentrate Transport**

- The concentrate will be bagged and containerised on site, and then trucked 470 km to Dar es Salaam for shipment to markets - there may be the opportunity to truck product to Ifakara, and then load onto rail for the final transport to Dar es Salaam.
- The port at Dar es Salaam has an estimated capacity of 1 Mtpa container cargo, 3.1 Mtpa general cargo and 6 Mtpa liquid bulk cargo served by seven deep water berths.

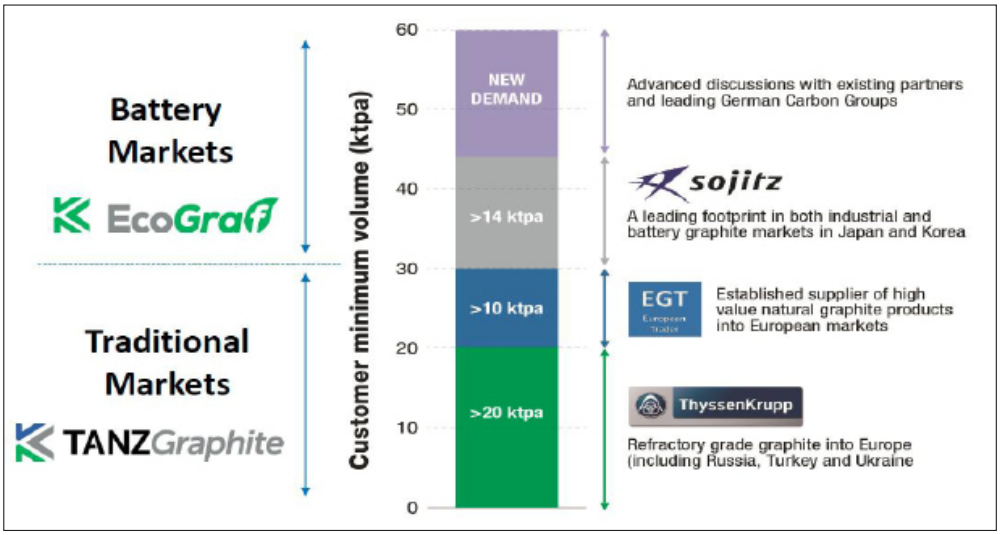
**Workforce**

- It is planned to use local labour (both skilled and unskilled) wherever possible, however there may be the need for some expatriate personnel for specialised jobs.
- The Company estimates that the Project will provide 250 local jobs during the construction phase and 200 jobs during operations.

## OFFTAKE AGREEMENTS

- The Company has offtake agreements in place for 44,000 tpa of product, with these shown diagrammatically in Figure 11.
- This includes two main components - offtake for 30,000 tpa into traditional markets (thyssenkrupp and EGT), and 14,000 thus far committed into the battery markets.
- The thyssenkrupp agreement is initially for 10 years with a five year option, and is targeted at the sale of 20,000 tpa of refractory grade flake graphite into Europe, Turkey, Russia, Ukraine and Korea - this agreement was finalised in August 2015, and has the capacity to supply 30% of the German refractory market.
- The binding agreement with a major European graphite trader ("EGT") was signed in late 2013, and is for 10,000 tpa over a 5 + 5 year term - the identity of this party is confidential.
- A binding exclusivity agreement with Sojitz, a major Japanese group, was finalised in August 2016, and gives EcoGraf exclusive rights to supply Sojitz with 14,000 tpa of Tanzanian graphite products for distribution into Asian markets including Japan, Korea and Taiwan for an initial five year period.
- Part of this supply may now include value added purified spherical graphite, which is planned to be produced by EcoGraf's EcoGraf™ subsidiary.

**Figure 11: Offtake partners and structure**




Source: EcoGraf

## FINANCING

- The Company is well advanced in financing negotiations with KfW-IPEX-Bank (Germany) and various Tanzanian Government ministries - these have resulted in a debt structure that complies with the banking requirements of the new Tanzanian mining legislation, and will need to be approved by the Tanzanian Government.
- Progress in financing however had been held up due to the introduction of the new mining legislation and regulations.
- The proposed debt funding is for an amount of up to US$60 million; part of this will also involve securing an Untied Loan Guarantee from the Federal Government of Germany - the Company has received "in-principal" eligibility for cover.
- Financing activities have included completion of the IER as part of the financiers due diligence, and the incorporation of the recommendations from the review in the updated BFS; the social plans (including the RAP) were also requirements of the debt financiers.

## VALUATION

- Our valuation is in two parts - an overall unfunded technical valuation of the assets, and a per share after tax net asset value ("NAV"), using conceptual funding arrangements and assumed equity raising prices - a per share valuation should be based on a share structure diluted for future equity raises.
- In both, we have used the inputs as provided by the company - there are no real equivalent figures, especially for the Western Australian facility, that we can base an alternative on; however figures for Epanko appear to be reasonable.
- As an alternative we have also included a valuation based on EBITDA multiples - this is presented in Table 10.
- In both projects we have assumed that the Company does not bring in an equity partner - this results in a 100% ownership for the EcoGraf™ operation; at Epanko we have allowed for a Tanzanian Government 16% free carried interest ("FCI") following repayment of project debt.
- However we note that these are conceptual scenarios, and thus the outcomes need to be treated as such.
- Our funded valuation is sum of the parts, and includes:
  - A risked, funded post tax DCF valuation for EcoGraf™,
  - A risked, funded, post tax DCF valuation for TanzGraphite,
  - A DCF valuation for Head Office costs (outside of those accounted for in the Epanko modelling),
  - Nominal valuation for Merelani-Arusha; and,
  - Current cash, adjusted for that used in funding of Stage 1 of the EcoGraf™ facility.
- Table 7 presents the unrisked and unfunded technical valuation for the various business segments ; the Company valuation is presented in Table 6, with DCF valuations using a real discount rate of 8%, and an AUD:USD exchange rate of 0.75;
- The per share valuation is based on a share structure diluted for equity raisings at A$1.00/share for both Epanko and EcoGraf, with our modelling resulting in the issue of 108 million shares.

**Table 6: EcoGraf unrisked, unfunded technical valuation**

| EcoGraf unrisked, unfunded technical valuation | | |
|---|---|---|
| **Item** | **Total** | **Notes** |
| EcoGraf | A$337 m | $NPV_8$ |
| Epanko | A$343 m | $NPV_8$ |
| Other Properties | A$15 m | Nominal |
| Head Office | -A$9 m | $NPV_8$ |
| Cash | A$56 m | Est |
| **Total** | **A$743 m** | |

Source: IIR analysis

**Table 7: EcoGraf company valuation**

| EcoGraf company valuation | | |
|---|---|---|
| **Item** | **Value** | **Notes** |
| Ecograf - after tax, funded | A$342 m | 8% DR, Company assumptions |
| Add back Capex | A$96 m | Adds back value of plant etc |
| Less Debt | -A$39 m | |
| EcoGraf equity value | A$399 m | |
| Epanko - after tax, funded | A$272 m | 8% DR, Company assumptions |
| Add back Capex | A$119 m | Adds back value of plant etc |
| Less debt | -A$53 m | |
| Epanko equity value | A$338 m | |
| Total Project Equity Value | A$737 m | |
| Other Properties | A$15 m | Nominal |
| Head Office | -A$19 m | |
| Cash | A$19 m | After equity for Ecograf S1 |
| EcoGraf Unrisked NAV | A$752 m | |
| | | |
| New Equity Required - EcoGraf | A$46 m | Assume P1 fully funded |
| New Equity Required - Epanko | A$62 m | |
| Total Equity Required | A$108 m | |
| Equity Price | A$1.00 | |
| New Shares Issued | 107.97 m | |
| Current Shares on Issue | 449.6 m | |
| Diluted Shares | 557.6 m | |
| **Unrisked NAV per Share** | **$1.35** | |

Source: IIR analysis. * Cash is balance after funding Phase 1 of the EcoGraf™ facility

**Table 8: Sensitivity to discount rate used**

| Sensitivity to discount rate used | | | | |
|---|---|---|---|---|
| | **EcoGraf Technical** | **Epanko Technical** | **EGR Funded Post Tax NAV** | **EGR Funded NAV ps** |
| 5% | A$632 m | A$491 m | A$1,011 m | A$1.813 |
| 6% | A$535 m | A$435 m | A$908 m | A$1.629 |
| 7% | A$456 m | A$386 m | A$823 m | A$1.476 |
| 8% | A$392 m | A$343 m | A$752 m | A$1.348 |
| 9% | A$339 m | A$306 m | A$692 m | A$1.241 |
| 10% | A$295 m | A$272 m | A$641 m | A$1.149 |

Source: IIR analysis

- We have allowed for additional Australian head office costs of U$1,400,000 pa; this is above the allowance in the DCF model for Epanko as sourced from the BFS.
- Note that the "cash" figure is not actual cash at the bank - we have subtracted the EcoGraf™ Phase 1 funding requirements, which are included in the EcoGraf™ DCF model.
- We have included additional funding requirements for working capital (25% of annual operating costs for all business segments) and finance fees (6%) in the funding required, with this resulting in:
  - EcoGraf Phase 1 - US$26.8 million required, 100% equity, already in place,
  - EcoGraf Phase 2 - US$64.9 million required - 60% debt, 40% equity for upfront capex of US$49.2 million, 100% equity for working capital and fees of US$15.7 million; and,
  - Epanko - US$100 million required - 60% debt, 40% equity for upfront capex of US$88.9 million, 100% equity for working capital and fees of US$11.1 million.
- In the DCF modelling we have largely used costs as publicly released by the Company and as discussed in the relevant sections above; published costs have been verified against standard cost curves, with our view being that the costs used by the Company are reasonable given the IER review.

- Table 9 presents a risked per share sensitivity analysis for EcoGraf, with the changes in prices and costs (to which the projects are most sensitive) being applied to both Epanko and EcoGraf - graphite price changes also apply to the feedstock for the SpG plant.

**Table 9: EcoGraf unrisked per share sensitivity**

| EcoGraf unrisked per share sensitivity | | | | | | |
|---|---|---|---|---|---|---|
| | | Change in Site Operating Costs | | | | |
| | $0.47 | -20% | -10% | 0% | 10% | 20% |
| Change in Product Price | 20% | $1.85 | $1.78 | $1.72 | $1.66 | $1.60 |
| | 10% | $1.66 | $1.60 | $1.54 | $1.47 | $1.41 |
| | 0% | $1.47 | $1.41 | $1.35 | $1.29 | $1.23 |
| | -10% | $1.28 | $1.22 | $1.16 | $1.10 | $1.04 |
| | -20% | $1.09 | $1.03 | $0.97 | $0.91 | $0.85 |

Source: IIR analysis

- An alternative way of valuing companies is by using multiples, including EV/EBITDA multiples as presented in Table 10. This is more applicable to industrial/manufacturing operations (e.g. the EcoGraf™ plant), rather than an operation with diminishing resources such as a mine (e.g. Epanko), although they can be used in the latter, albeit with a lower multiple.
- We have included two scenarios in Table 10 - firstly, valuing both operations on a multiple basis, and secondly using the DCF derived NAV for Epanko and the EBITDA multiple for the EcoGraf™ facility.
- This also includes the unrisked per share value, based on the structure diluted for our financing scenario.
- In 2020 global EV/EBITDA multiples have been in the order of 15 x for specialty chemicals and 10 x for mining operations; the figures for 2018 were 10 x and 6 x respectively.

**Table 10: Unrisked EBITDA multiple valuations**

| EcoGraf unrisked, unfunded technical valuation | | | | |
|---|---|---|---|---|
| **Business** | **Max EBITDA** | **8 x** | **10 x** | **12 x** |
| EcoGraf - Multiple | A$46.76 m | A$374 m | A$468 m | A$561 m |
| Epanko - Multiple | A$56.73 m | A$454 m | A$567 m | A$681 m |
| Total | A$103.49 m | A$828 m | A$1,035 m | A$1,242 m |
| **Total/Share** | **A$0.19** | **A$1.49** | **A$1.86** | **A$2.23** |
| Epanko - DCF | - | $337.66 | $337.66 | $337.66 |
| Total - Ecograf Multiple, Epanko - DCF | | $711.74 | $805.26 | $898.78 |
| **Total/Share** | **-** | **$1.28** | **$1.44** | **$1.61** |

Source: IIR analysis

## BOARD AND MANAGEMENT

- **Mr Robert Pett – BA (Hons), MA (Econ), FAICD, Minerals Economist - Independent Non-Executive Director and Chairman:** Robert Pett is a minerals economist with over 30 years' experience working in exploration and mining. During this time, he has worked internationally in the resources sector at senior levels both in Australia and Africa. He has been involved with listed companies at all levels, from grass-roots exploration through to mine development, production and financing of more than ten mining projects globally including East and West Africa and the construction of the Golden Pride Gold Mine in Tanzania.

  He was founding Chairman of Resolute Mining Limited (gold mines and exploration Africa and Australia), Sapphire Mines Limited (gemstone mining and exploration), Reliance Mining Limited (nickel mining Kambalda), Senex Energy Limited (petroleum production and exploration) and director of several other mining and exploration companies operating in Africa, Asia and Australia in gold, base metals, petroleum and uranium.

  Robert has also had an active involvement in education and community activities including over 10 years' service to Murdoch University Western Australia as Senator and Chairman of their Resources (Finance) Committee.

- **Mr Andrew Spinks – B.App.Sc, MAusIMM - Managing Director:** Andrew Spinks has over 25 years' professional experience in Australia, Asia and Africa on a range of commodities including speciality and industrial minerals.

  Andrew has worked in a range of diverse roles across exploration through to successful project developments, and has held a number of board positions on both ASX and TSX.V listed companies.

  Andrew was co-founder of TanzGraphite Pty Ltd and has been Managing Director of EcoGraf since its acquisition.

- **Mr John Conidi - BBus, FCPA – Non-Executive Director:** John Conidi is a Certified Practicing Accountant. He has over 20 years' experience developing, acquiring and managing businesses in the technology and healthcare sectors. In his roles as Managing Director of Capitol Health Limited, Mr Conidi's role drove its sustained expansion, increasing its market capitalisation.

  John has extensive interests in the graphite sector. He is an experienced investor specialising in technology and resources and is the Chairman of 333D Limited that with EcoGraf, jointly owns 3D Graphtech Industries Pty Ltd.

- **Mr Howard Rae – B.Com (UWA) Finance & Marketing, CA - Executive Director - Finance:** Howard Rae is a Chartered Accountant with over 20 years' experience in acquiring, developing, financing and operating a range of businesses in Australia, Canada, Asia, Africa and Europe.

  His career includes Chief Financial Officer roles with a number of successful ASX listed companies active internationally in the precious and base metals, steel-making materials and industrial minerals sectors, together with Directorships of several unlisted and not-for-profit organisations.

  During this time, he's been responsible for new business development, joint ventures, structuring and negotiating corporate, project and infrastructure funding transactions, sales and marketing, risk management and implementing business improvement programs.

- **Mr Michael Chan - B.Sc (Hons) in Minerals Engineering, C Eng (London) - Executive Manager – Product Development:** Michael Chan has a degree in Minerals Engineering (University of Birmingham, England) and is a Chartered Engineer (London) with 35 years' experience in senior operations, project development and commercial roles for multi-national and ASX- listed companies across Africa, Asia and the United States.

  Mr Chan has 8 years of graphite/spherical graphite/battery anode material project experience, 15 years extensive rare earth project experience as well as 13 years of titanium dioxide commercial development project experience.

  During his time, he's been responsible for the major test work programs, process flow sheet development, pilot processing and graphite product development, core technical marketing, process flow sheet design, establishing pilot scale facilities, developing full scale commercial plants and driving much of the detailed downstream test work in collaboration with end-users.

- **Mr Shaun O'Neill - Executive Manager - Project Development:** Shaun is a Perth based qualified metallurgist and has 23 years' industry experience in operations, project management and commissioning across a broad range of commodities, including battery and critical minerals.

  During his career Shaun has been involved in a number of battery mineral developments, with both construction and operational experience in the Kwinana-Rockingham Industrial Area, where he was the Project Manager for Tianqi Lithium's lithium hydroxide processing plant and also worked at the BHP Billiton Nickel West Refinery.

  Prior roles include working for BHP Billiton commissioning the $3.5 billion Worsley-Alumina expansion and the $3.4 billion Rathensthorpe Nickel Project.

- **Mr David Cairns – BSc (Geol.) MSc (Env Sci) MAusIMM - Technical Consultant:** David Cairns is a highly respected and qualified geologist with more than 40 years experience in exploration, development and mining.

  Mr Cairns' expertise lies in the evaluation and management of projects. He has been responsible for managing multidisciplinary teams on studies that led to the successful development of seven mineral projects in Australia and Africa.

He is experienced with a vast range of mineral commodities which includes graphite, nickel, cobalt, copper, chromite, gold, bauxite, uranium, rare earths, vanadium, iron ore and sapphires in a wide range of locations including Australia, China, Laos, Africa and North and South America.

Mr Cairns is a recognised industry leader who has served as Board director on a number of successful ASX listed exploration and mining companies that have produced gold, nickel and sapphires.

**Marshall Hestelow - B.Bus (Accounting), CPA - Corporate Consultant:** Marshall Hestelow is an accountant with over 30 years' experience in senior management roles within ASX listed mining companies, that are active both in Australia and internationally.

He has considerable experience in a broad range of financial, management, project development and administrative activities. During his time with EcoGraf he has assisted with project financial modelling, ASX and financial compliance and associated administrative activities.

**Nassor Said - B.Com (Accounting), MBA (Finance) - Director - TanzGraphite:** Nassor Said has over 12 years' experience in the exploration and mining industry across a range of commodities, including industrial minerals and rare earth elements.

Mr Said's career includes Chief Accountant and Finance Manager roles with a number of resource companies operating in Tanzania and he has substantial experience in project development, environmental and social planning, community engagement and government relations.

# BACKGROUND – THE BATTERY SECTOR

## Introduction and Battery Types

- The expected takeup of EVs, including plug-in electric vehicles ("PEV") and hybrid electric vehicles (PHEV) over coming years will drive the demand for the so called "battery materials".
- These materials include five main groups:
  - The anode materials, dominantly graphite, but with new technologies including silicon and silicon composites,
  - The cathode materials, including lithium, nickel, manganese, cobalt and aluminium,
  - The separators, which to date have largely been polymers, but with higher capacity (and hence hotter) batteries now being used, include materials such as high purity alumina ("HPA"),
  - The current collectors, which include copper and aluminium; and,
  - The lithium electrolyte solution.
- Graphite by far and away makes up the largest component of a lithium ion battery, comprising between 40% and 50% of the "active" components of a battery.
- The graphite anode includes two types, generally split 50:50 - SpG and synthetic graphite.
- Table 11 presents the approximate material intensities for a range of common battery types, including nickel cobalt aluminium ("NCA"), as favoured by Tesla, and two types of nickel manganese cobalt, as commonly used in other EVs - there are several other cathode types not listed here, but these are less common.
- The two types of NMC (nickel, manganese, cobalt) batteries reflect two cathode metal mixes, with the numbers representing the proportions of the different metals in the cathode - users are tending towards the 8:1:1 mix given a higher energy storage capacity, and a lower cost, given lower cobalt content.
- The figures are approximate - NMC 1:1:1 batteries have a capacity of ~0.9 kWh/anode kg, with the NMC 8:1:1 units having a capacity of ~ 1.2 kWh/anode kg.
- Note that the figures are in kg/kWh - a usual light electric passenger vehicle will have a battery in the order of 50 kWh to 80 kWh.
- What is significant is that the intensity of graphite remains largely the same with changing cathode chemistries; also, given the wastage in spherical graphite production, approximately double the amount of flake graphite (which is preferred as synthetic graphite is relatively expensive) is required to produce the anode material as presented below.

**Table 11: Material intensity - kg/kWh**

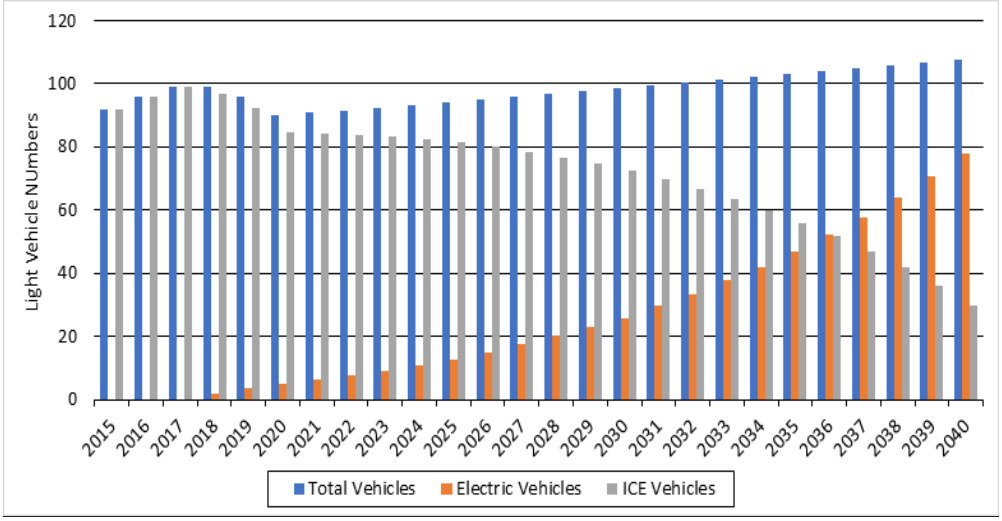
| Material intensity - kg/kWh | | | |
|---|---|---|---|
| **Material** | **NCA** | **NMC 1:1:1** | **NMC 8:1:1** |
| **Graphite Anode Total** | **~1** | **~1** | **~1** |
| Inc SpG | 0.5 | 0.5 | 0.5 |
| **Cathode Metals** | **0.84** | **1.0** | **1.0** |
| Nickel | 0.7 | 0.33 | 0.8 |
| Manganese | - | 0.33 | 0.1 |
| Cobalt | 0.12 | 0.33 | 0.1 |
| Aluminium | 0.02 | - | - |
| **LCE** | **0.12** | **0.13** | **0.11** |
| Example | Tesla | Samsung, LG Chem | |

Source: IIR analysis

## Forecast Demand

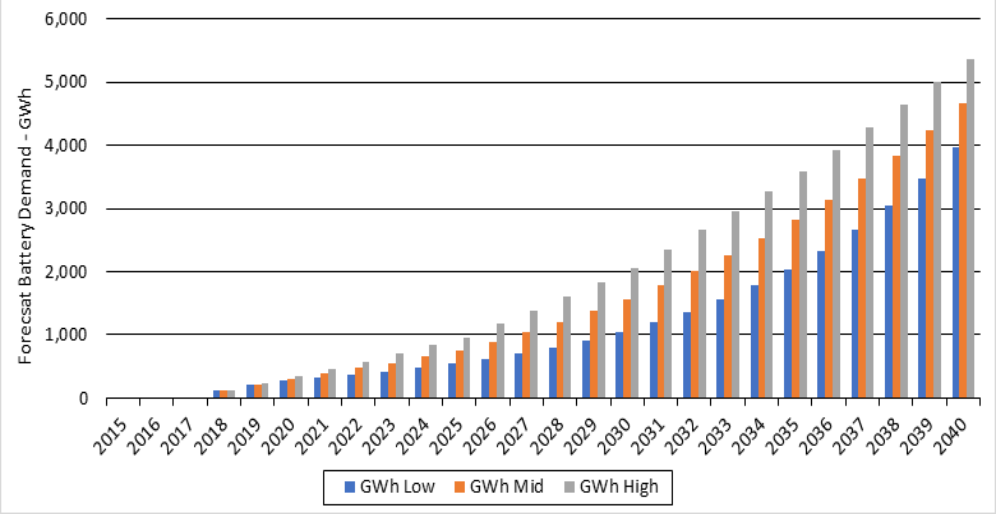
- We will concentrate here on the EV markets, which, under current forecasts, will provide the bulk of increased demand for battery materials in coming years, although traditional markets for the materials will continue to grow, albeit at a slower rate.
- The traditional graphite markets are also pertinent to EcoGraf, given the offtake agreements in place for Epanko which include non-battery applications - these markets are expected to grow at ~3% CAGR over coming years, in line with past performance.
- As a guide to the numbers used, a gigawatt hour ("GWh") equals one million kilowatt hours ("kWh"), or in the order of 12,500 to 20,000 light electric vehicles, based on batteries with capacities of between 80 kWh and 50 kWh.
- Figure 12 presents our analysis of the growth in light and commercial vehicle markets, with this being adapted from a number of publicly available documents, including company presentations - source data suppliers include Mackenzie, Benchmark Mineral Intelligence and Deloitte amongst others.
- All forecast that EVs will have an average total vehicle market share of ~30% by 2030, with forecasts indicating that this could reach somewhere between 60% and 80% by 2040, with this significantly driven by Government legislation and agreements, with some examples of regulations shown in Figure 15.
- Pre-COVID forecasts indicated total vehicle sales of ~110 and 120 million in 2030, however COVID, according to the OICA, reduced sales by some 13% in 2020 over 2019 - we have adjusted our figures accordingly, hence the dip in Figure 12.
- The base case figures as used in Figure 20 show an increase from 2.34 million vehicles in 2020 to close to 80 million in 2040, a CAGR of ~19%, with a range of 18% to 20%.
- Figures 13 and 14 show respectively the expected growth in battery capacity and requirements for SpG using the base case - in these we have used an average battery size of 60 kWh and an estimated requirement of 500 tonnes/GWh of SpG (which will require ~double that figure of flake graphite).
- Note these latter two figures are more prone to variation than the forecast for the number of units, particularly when forecasting out past 2030 - these will depend on changes in battery size (they may get larger as costs come down and technology changes), and developments in new technologies, for example the development of silicon and silicon-graphite anodes.

**Figure 12: Forecast growth in different vehicle types**



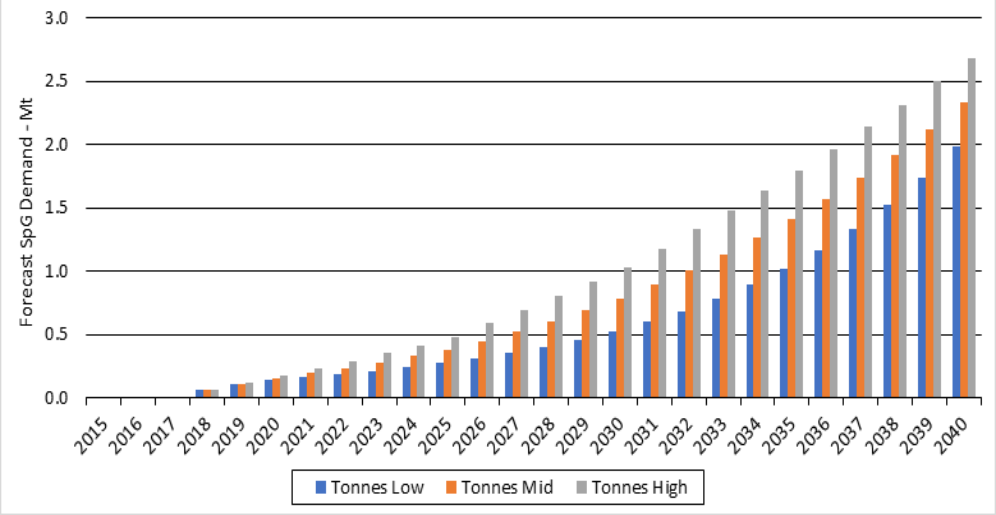

Source: Various, IIR anaylsis

**Figure 13: Forecast growth battery capacity**



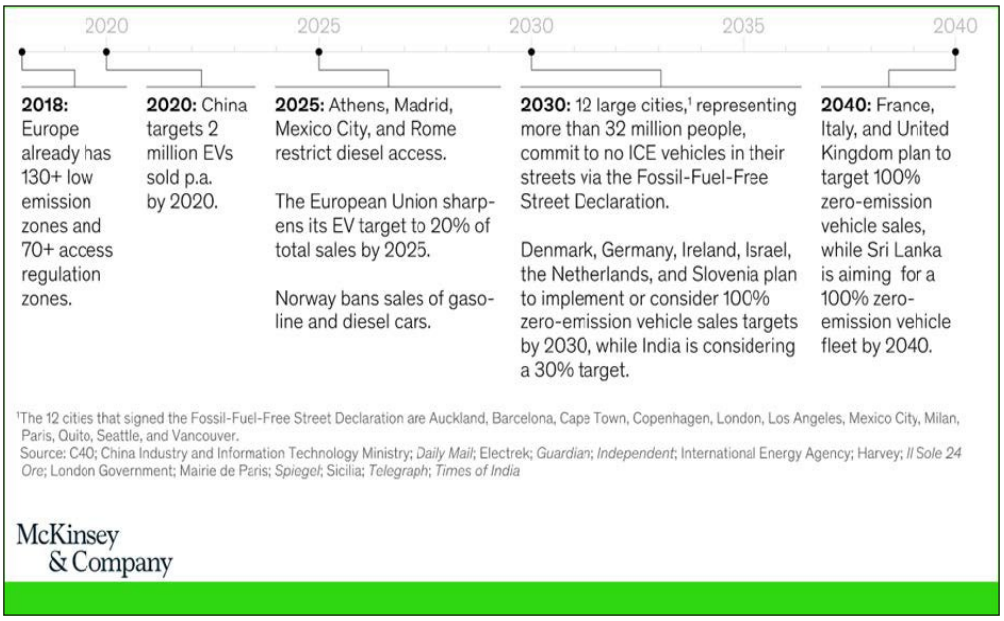

Source: Various, IIR anaylsis

**Figure 14: Forecast growth in SpG demand**




Source: Various, IIR anaylsis

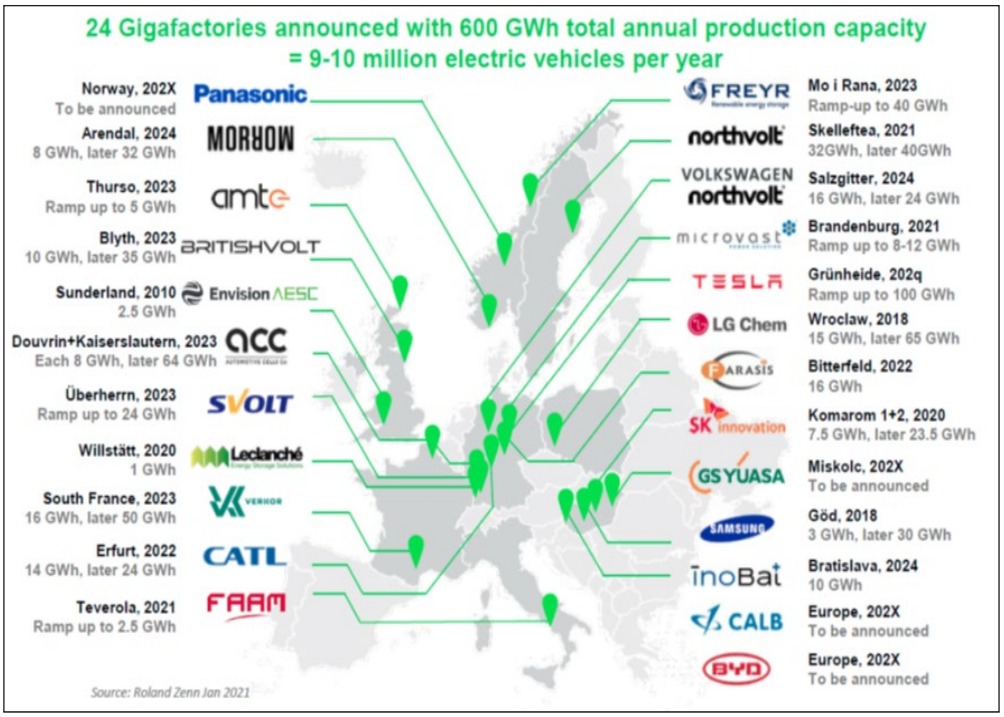
**Figure 15: Legislative timeline**




Source: EGR presentation

- Another factor to be considered is production split between regions - some forecasts have these at ~40% for China, 17% for Europe, 14% for the USA and 39% for the rest of the world by 2030.
- The expected growth in Europe is evidenced by the number and capacity of gigafactories planned, under construction or operating - this currently stands at 24 factories for a capacity of 600 GWh as shown in Figure 16.

**Figure 16: European gigafactories**

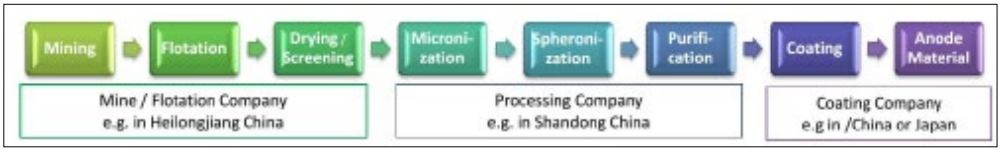



Source: EGR presentation

## Battery Anode Production

- Figure 17 presents a schematic of battery anode production, which involves micronisation, spheroidisation, purification and treatment of natural flake graphite.

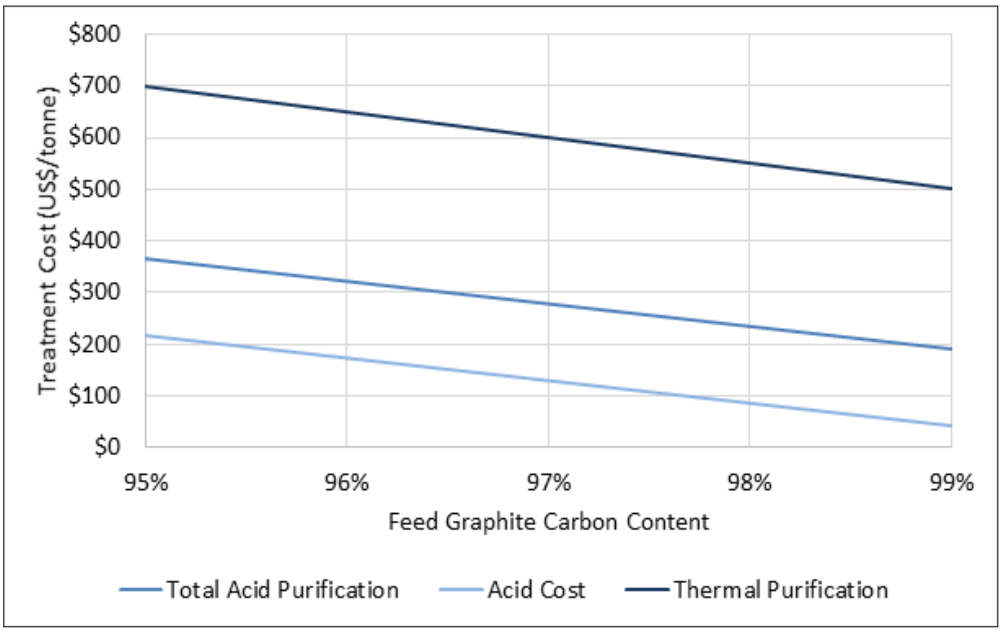
**Figure 17: Battery anode production schematic**




Source: EcoGraf

- The ideal feed is natural flake with a size of -100 mesh (-150 µm), and a grade of ~94% TGC.
- There is a trade off between flake size and grade, given the relative costs of micronising and purification; larger flake is commonly higher grade, and therefore will require less purification, however is more expensive to micronise, which is energy intensive.
- The initial stages include micronising (milling the flake down to ~10 µm to 20 µm, followed by spheroidisation to produces the un-purified spherical graphite.
- As part of the spheroidisation process, shavings of "fines" are produced, which can comprise up to 60% of the feed; these can be sintered/agglomerated into briquettes for the relatively low value recarburiser market, however as discussed earlier, the Company has successfully treated these with the EcoGraf process to produce a high purity, albeit fine product that may have future high value applications, and has been qualified by potential European customers.
- The next stage is purification, where the SpG is either thermally or chemically treated to remove contaminants and increase the purity to +99.95% C, which is required for battery anodes.
- Chemical purification has historically generally involved acid leaching, using a mixture of hydroflouric and hydrochloric acid; this is the main method currently used in China, however has the major drawback of using extremely hazardous reagents, and this is environmentally unfriendly - China is currently clamping down on the worst of the HF operations, which leaves the way open for alternative supply.
- The alternative route is thermal treatment, however is energy intensive and hence more expensive (Figure 18) but is less restrictive in terms of environmental regulations.

**Figure 18: Purification costs**




Source: Various

- As mentioned earlier, EcoGraf has developed the EcoGraf™ process, which is a chemical treatment process that doesn't use HF.
- Following purification, the SpG is heat treated and impregnated/coated to produce the final product - common coating materials include synthetic or amorphous graphite; the purpose of coating is to decrease the surface area of the SpG which increases the long term capacity of the battery.
- Pricing and estimated costs for each successive stage are presented below:

  - Purified SpG - priced at ~US$3,000/tonne - US$4,000/tonne - the key input costs are the feed graphite, with ~2 t to 2.5 t of feed required to produce 1 t of SpG and energy required for micronising; and,
  - Coated SpG - priced at ~US$7,500/tonne to US$10,000/tonne, with the inputs being the uncoated SPG, coating material and energy - anode material coated with amorphous graphite will tend to be cheaper than that coated with synthetic graphite.
- Following coating, the SpG is split into different in various sizes for different applications, including for example 15 µm for consumer electronics and vehicles and 23 µm for grid scale storage.

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