Black Rock Mining

Slow & steady will win out

Share Price: A$0.13

ASX: BKT
Sector: Materials
18 May 2023

Black Rock Mining (ASX:BKT) is developing the Mahenge graphite project in Tanzania. With a mineral resource estimate of 213mt, Mahenge is the world's fourth-largest JORC-compliant graphite resource. The project's Definitive Feasibility Study (DFS) outlines a compressed development schedule comprising four production modules with a total planned annual capacity of 350kt. This makes BKT potentially one of the largest graphite producers globally.

Financing is key, but is it forthcoming?

BKT is negotiating finance for Mahenge, aiming to seal a deal in the next few months. Last October's updated DFS estimates Module 1 needs US$182m will be needed for Module 1. It is targeting up to 50% debt via traditional project finance and for Module 1 construction to take 20 months. We think the long wait to finalise a deal has been why the share price has lagged in recent months, along with the significant capex updates in the October 2022 eDFS. We think it is inevitable that funding will be secured, given current graphite market dynamics. 2023 will be the year when the broader graphite market will enter a supply deficit. We also note that BKT's specific product fits right into the plans of shareholder and offtake partner POSCO.

Mahenge is still a compelling project

Mahenge remains a high-margin project with compelling economics – it has a 36% IRR and US$1.4bn NPV – and several positive traits compared to peers Syrah (ASX:SYR) and Evolution Energy Minerals (ASX:EV1), including lower costs (even with the upgraded capex forecasts), a higher value product, the existence of a by-product (meaning further revenues), lower counterparty risk and having all necessary licenses in place.

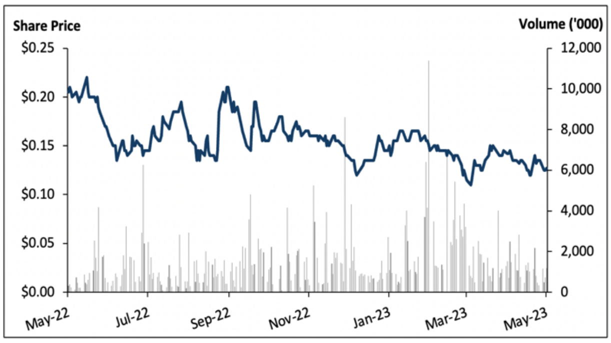
Valuation of A$0.62-0.83 per share

We update our valuation of BKT from last year's initiation report, accounting for the DFS updates. We value the company at A$0.62-$0.83 per share using the DCF approach assuming it enters production as per the eDFS. We think BKT can re-rate as it obtains project financing. A final deal is expected before the end of CY23 with a Term sheet expected during the current quarter. Thereafter, we believe BKT can create further value upon entering production, which it anticipates in early CY25. The key risks are outlined on page 12.

Market cap. (A$ m)	127.0
# shares outstanding (m)	977.3
# shares fully diluted (m)	1,041.2
Market cap ful. dil. (A$ m)	135.4
Free float	100.0%
12-months high/low (A$)	0.23 / 0.11
Avg. 12M daily volume ('1000)	3,390.0
Website	blackrockmining.com.au

Source: Company, Pitt Street Research

Share price (A$) and avg. daily volume (k, r.h.s.)



Source: Refinitiv Eikon, Pitt Street Research

Valuation metrics	
Fair valuation range (A$)	0.62–0.83
WACC	12.7%
Assumed terminal growth rate	1.0%

Estimates: Pitt Street Research

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Disclosure: Pitt Street Research directors own shares in BKT.

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Overview of the Mahenge graphite project

The Mahenge graphite project hosts a multigenerational resource with a total resource of 213mt @ 7.8% TGC, which makes it the second-largest reserve globally and the fourth-largest (JORC compliant) flake resource in the world.

The Tier 1 scale Mahenge Liandu graphite project is located in the Ulanga district in Tanzania. This project is a large, open-pit graphite mine with a unique combination of high-quality geology and world-class geography.

The Mahenge graphite project hosts a multigenerational resource with a total resource of 213mt @7.8% TGC, which makes it the second-largest reserve globally and the fourth-largest (JORC compliant) flake resource in the world. Currently, the Mahenge project has the largest measured graphite mineral resource globally (Figures 1 and 2). The project will deliver 350kt per annum of 98.5% Loss on Ignition (LOI) premium graphite flake concentrate over a mine life of 26 years, after which the current defined deposits will be depleted.

Figure 1: Mahenge's JORC-compliant mineral resource estimate and ore reserve*

Ore Reserves	Tonnes (mt)	Grade (% TGC)	Contained Graphite (mt)
Proven	-	-	-
Probable	70.5	8.5	6
Total Ore Reserves	**70.5**	**8.5**	**6**
Mineral Resources			
Measured	31.8	8.6	2.7
Indicated	84.6	7.8	6.6
Total M&I	**116.4**	**8.0**	**9.3**
Inferred	96.7	7.4	7.2
Total Measured, Indicated & Inferred	**213.1**	**7.8**	**16.6**

**Resource and ore reserve estimates as released to ASX on 3 February 2022*
Source: Company

Figure 2: The Mineral resource estimate and ore reserve by prospects in the mining area

Prospect	Category	Tonnes (mt)	TGC (%)	Contained TGC (mt)
Ulanzi	Measured	19.6	8.8	1.7
	Indicated	46.2	8.2	3.8
	Inferred	48.7	7.8	3.8
	Sub-Total	**114.5**	**8.1**	**9.3**
Cascades	Measured	12.1	8.3	1.0
	Indicated	20.8	8.3	1.7
	Inferred	27.3	7.9	2.2
	Sub-Total	**60.2**	**8.1**	**4.9**
Epanko	Measured			
	Indicated	17.6	6.4	1.1
	Inferred	20.8	5.9	1.2
	Sub-Total	**38.4**	**6.1**	**2.4**
Combined	**Measured**	**31.8**	**8.6**	**2.7**
	Indicated	**84.6**	**7.8**	**6.6**
	Inferred	**96.7**	**7.4**	**7.2**
	TOTAL	**213.1**	**7.8**	**16.6**

Source: Company

As per the enhanced DFS, the Mahenge project is expected to deliver an after-tax NPV of US$1.16bn, IRR of 44.8%, AISC margin of 63.1% and a payback period of 3.8 years.

The project has compelling economics (Figure 3) with construction underwritten by binding offtake agreements. The most notable offtake deal was with South Korean steel manufacturer POSCO which has signed a term sheet for product prepayment commitments for US$10m and offtake for 100% of planned fines production under module 1 of the Mahenge project. POSCO is also a 13% shareholder in the company.

The excellent forecasted economics translate to a strong profitability outlook for BKT. As per the enhanced DFS, the Mahenge project is expected to deliver an after-tax NPV of US$1.16bn, IRR of 44.8%, AISC margin of 63.1% and payback period of 3.8 years.

Figure 3: The Mahenge project's key financial metrics

Financial Parameter	Unit	LOM
Net Present Value $ 10% Nominal – Post Tax & Ungeared after 16% free carry	US$M	1,376
Internal Rate of Return – Post Tax & Ungeared after 16% free carry	%	36
Project Life	Years	27.5
Operating Life	Years	26
Assumed Graphite Price^	US$/t	1,731
Initial Development Capital Costs	US$M	182
C1 Cost: Real (including withholding tax)	US$/t	466
All-in Sustaining Cost over first 10 years	US$/t	518
Stable State EBITDA (after year 5)	US$M, real	364

Source: Company
^ based on Expert consensus pricing

Why Mahenge is a superior project

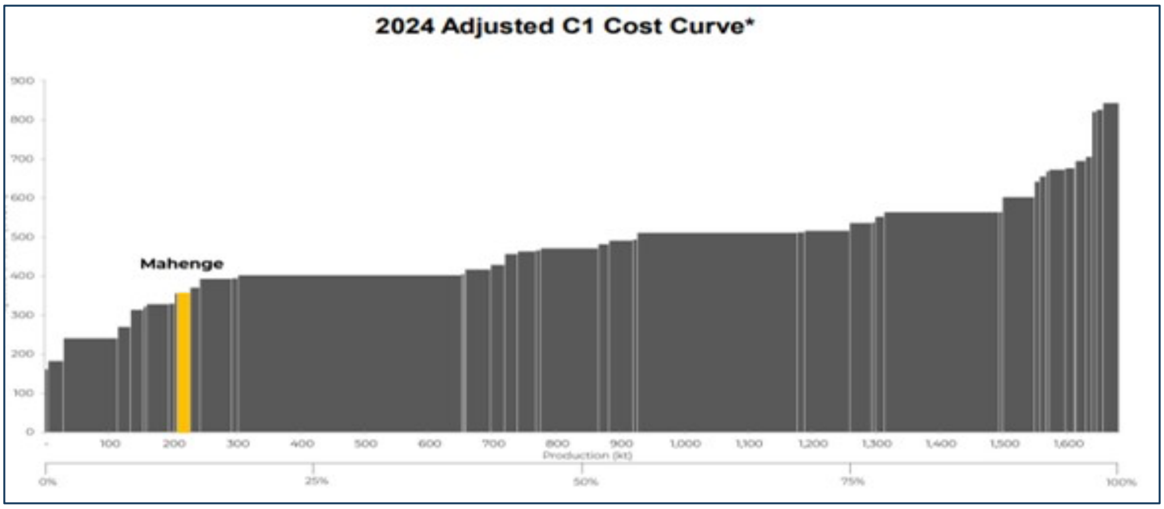
BKT has several advantages over its peers, particularly Syrah Resources (ASX:SYR) which has the operational Balama project in Mozambique and Evolution Energy Minerals (ASX:EV1) which is trying to get the Chilalo project in Tanzania into production.

Syrah Resources – Investors may observe that Syrah is already in production and might say it is better positioned than BKT just because of that fact. But the irony is that it does not have any confirmed offtake agreements, just a conditional agreement that is subject to Syrah achieving final qualification by no later than the end of May CY24 – albeit an agreement with Tesla. The graphite anode material has to be qualified with a would-be client and this has not happened. In other words, although Telsa is interested, it is uncertain if the final product is suitable for their needs. SYR assumed 'build it and they will come'. In the case of BKT, POSCO knows it is suitable for their needs, having qualified the graphite and signed a term sheet in 2021. BKT meanwhile has ~80% of its Module 1 production under offtake/production, only building Mahenge when knowing for sure that customers will come. Addressing Syrah's persistent operational problems in 2018, these have impacted shareholder value too. The issues were a result of going straight into production from the PFS stage without doing a DFS, thereby not allowing for sufficient engineering due diligence.

We would note four further points. First, BKT will have power costs less than ~33% of Syrah's at US8c/kWh compared to US25-30c/kWh for Syrah[1]. This represents a cost benefit of US$150/t of the final product. The reason for this is that BKT plans for 70% of its grid power to be from hydro, with the balance from gas while Syrah has 70% of its power from diesel gensets. Second, BKT has a higher value/tonne product mix. Syrah's product split is 90% fines (small flake) and 10% large flake with a current basket price of US$799/t but BKT's final product will be 60%-70% large flake with a current basket price of $1,162/t. Third, BKT's by-product generates an additional US$363/t whereas SYR's by-product will not be sold, being not as valuable to customers. Fourth, it is inevitable that pricing in the final offtake deal, will be determined by short-term market conditions.

Evolution Energy Minerals – Even if investors would disagree that SYR and BKT are comparable given they are at different stages and different jurisdictions, this is not the case with Evolution Energy Minerals. We see five ways in which BKT is superior to EV1. First, BKT's NPV of US$1.38bn is over 300% higher than EV1's at US$338m. The second is lower power costs with EV1 at US22c/KWh, planning to use diesel and gas generation in conjunction with some solar power. This compares to BKT's US8c/kWh, using 60-70% hydro with the balance gas. The third is the C1 cash costs (cash costs excluding royalties and sustaining capex) which is US$773 per tonne for EV1 and US$466 per tonne for BKT. This places BKT in the 1st quartile and EV1 in the 4th quartile among upcoming graphite projects (as per Figure 4). This means Mahenge will be higher margin and more robust throughout market cycles. The fourth is that BKT has lower counterparty risk, a critical factor for lenders. 100% of EV1's offtake is to China while at least 32% will be to POSCO. And finally, BKT is more advanced from a licensing perspective. Under Tanzanian law, any project with a capex of >US$100m needs a Special Mining License (SML) as opposed to a standard Mining License (ML). BKT has an SML while EV1 does not. We would also make the observation that BKT has a superior risk/reward due to superior project scale.

Figure 4: Mahenge is in the 1st quartile among graphite producers (existing and upcoming)



Source: Company, Benchmark Mineral Intelligence

[1] Company estimates based on data from RefWin, Asian Metals and ICC Sino

Why BKT is well positioned

BKT is well positioned, given its high exposure to the high-margin large graphite flake market.

BKT is well positioned in the graphite market generally, not just because of the expanding demand for graphite, but also given its high exposure to the high-margin large graphite flake market. The large-flake market is high-margin given the high-priced end markets for large-flake graphite – including aviation, lithium-ion batteries, refractories and flame retardants. By 2023, lithium-ion batteries are expected to become the dominant end-use for graphite.

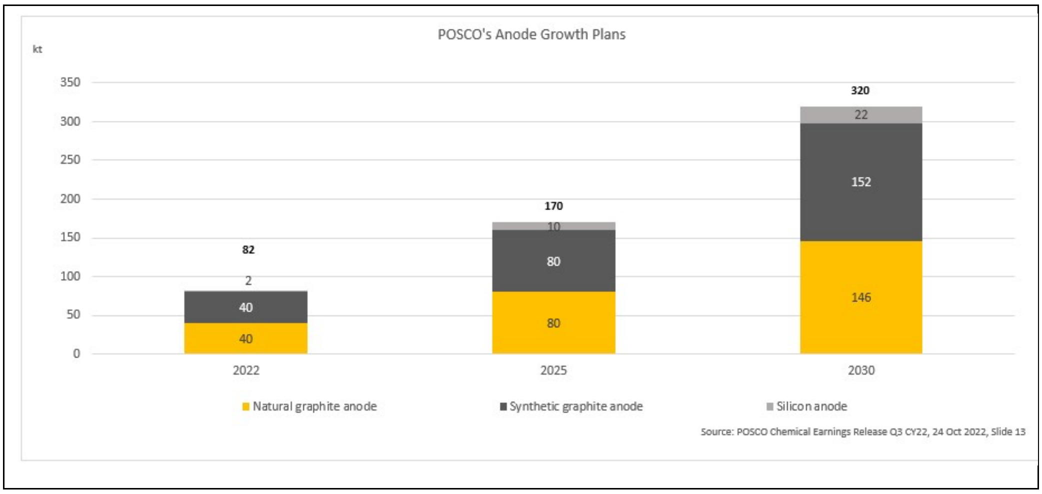
The Mahenge graphite mine's mineral resource has industry-leading high-grade purity resulting from low deleterious elements and favourable metallurgy, a good distribution of large flake sizes, and low strip ratios. The company can achieve a 99%+ TGC concentrate purity with a conventional floatation processing at a commercial scale. Additionally, the project offers cleanest graphite concentrates globally, which reduces energy consumption levels.

POSCO needs BKT

Why would a company with an ~A$35bn market cap like POSCO partner with a pre-production company like BKT when it could have easily partnered with an existing producer? Why did it become a shareholder of the company and spend several months qualifying the product? Because BKT's product will meet its needs in a way existing producers will not.

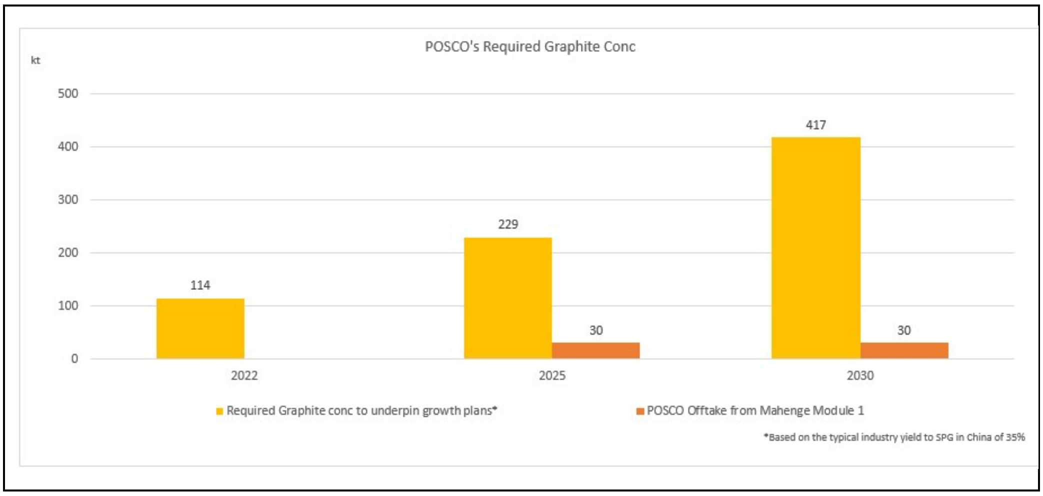
As Figures 5 depicts, POSCO will in 2025 require double the amount of synthetic graphite anode than just 3 years prior. By 2030, it will require nearly 4 times more than in 2030.

Figure 5: POSCO needs more anode



Source: Company, Pitt Street Research

Figure 6: POSCO needs more graphite



Source: Company, Pitt Street Research

The irony is that, as Figure 6 depicts, POSCO's offtake for Module 1 barely satisfies POSCO's requirements. However, beggars cannot be choosers and POSCO has been willing to secure whatever it could.

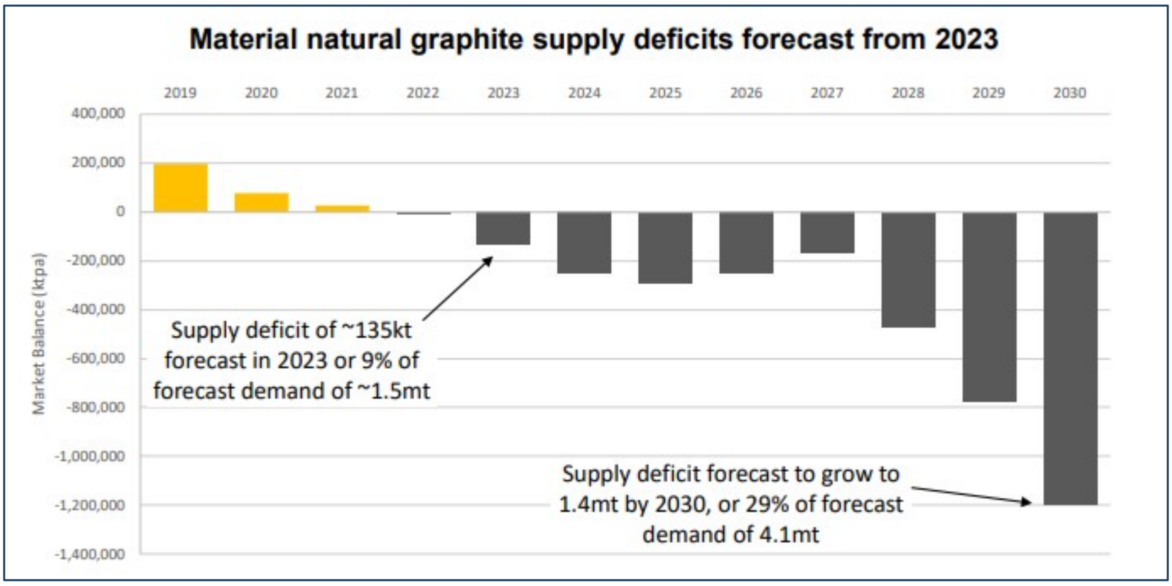
A graphite supply deficit is emerging

Graphite is an important mineral in the world and plays a key role in the path towards decarbonisation.

Beyond the specific demand from POSCO, there is strong demand in the market generally. Graphite is an important mineral in the world and plays a key role in the path towards decarbonisation. This is common knowledge, but this has not been as manifest in the price of graphite as has been the case in lithium prices. We expect this to change as the lithium market enters a supply deficit that is expected to persist for the rest of this decade (Figure 7).

In 2023, a supply deficit of ~135kt is forecast, which is 9% of forecast demand. By 2030, the deficit is expected to grow to 1.4mt, or 29% of forecast demand in that year. This is due to supply constraints, triggered by two factors. First, that qualification requirements can add several years to the development of mines. And second, that project tends to be more difficult for graphite developers due to inability to hedge graphite as well as the dominance of China in downstream processing and higher capex. Given Mahenge's compelling project metrics, we think Mahenge can play its part in addressing the demand for graphite.

Figure 7: The graphite supply outlook



Source: Company, Benchmark Mineral Intelligence

Mahenge is poised to take off – now just needs funding

Mahenge has passed almost all the necessary steps to commence construction.

For the Mahenge project, it has passed almost all the necessary steps to commence construction. All all environmental approvals, mining licenses and RAP have been secured by BKT with a clear title to the project area in the enhanced DFS. Land and property values are being evaluated, and relocation of people and properties are being supported through RAP. BKT completed field activities in Tanzania and the RAP process for resettlement of affected persons affected by the project development with an acceptance rate of >98%, and 99% of participants willing to relocate voluntarily before arbitration. BKT has completed a pilot plant, a qualification process and subsequential off-take agreement with POSCO, plus it has signed a deal with the Tanzanian government for its 16% free-carried interest.

With all this done, the Mahenge project is at a critical juncture in the development cycle, just requiring funding.

The Funding Challenge

The immediate-term key to unlocking shareholder value is securing project financing.

The immediate-term key to unlocking shareholder value is securing project financing. We think investors have been concerned about this issue since the company's enhanced DFS in October last year that saw a significant increase in the amount of estimated capex than estimate in the original DFS in July 2019 (Figure 8).

Figure 8: Capex under the 2022 eDFS

Area	Stage 1 US$000	Stage 2 US$000	Stage 3 US$000	Stage 4 US$000	Total US$000	Change from 2019
Mining	11	-	-	-	11	8%
Ifakara	1	1	0.4	0.2	3	-33%
Infrastructure	29	8	12	20	59	-48%
Process Plant	70	64	68	59	261	148%
Site Support	1	1	1	1	4	74%
Indirects	6	9	9	9	32	0%
Owners Costs	42	7	7	7	64	95%
Contingency	22	18	20	17	76	97%
Total	**182**	**107**	**117**	**104**	**510**	**51**

Source: Company

Why the increase? The company has told shareholders this was driven by:

- Inflation in building materials, labour, energy and other consumables (32% of the increase).
- Project optimisation and debottlenecking enhancements to improve the flowsheet and to provide additional operational flexibility to de-risk the production of high-purity graphite concentrate (24%).
- An increase in the cost of relocation and resettlement to ensure the Company adheres to the highest global standards of ESG compliance and community stakeholder engagement (21%), and
- Additional contingency being added (16%).

There have been a handful of changes to the project including a move to contract mining (instead of owner operator), a 20-month construction period (previously 5-18 months), a more optimised project layout and flow sheet to incorporate lessons learned from the 500t pilot plant and an increase in throughput for Module 1 to 1.15mtpa during the first 5 years while mining oxide.

Mahenge is still a 1st quartile graphite project on the global cost curve.

However, in most other respects, the project is largely unchanged. And Mahenge is still a 1st quartile graphite project on the global cost curve. This is even ignoring the benefit of Mahenge's much higher purity concentrates than most of its peers. The eDFS reiterated the key project metrics including the US$1.4bn post-tax NPV (even taking into account the Tanzanian government's 16% free holding) and 36% IRR. Finally, we also note that there is industry desire for graphite outside of China given its long-term dominance in the graphite market. We are confident that the company can obtain funding for the project.

Potential funding options

BKT intends to have a term sheet for debt finance in place during the June quarter of CY23.

BKT intends to have a term sheet for debt finance in place during the June quarter of CY23 and mandate debt lead arrangers thereafter. It plans for construction to commence in time to allow production to commence in the first half of CY25. It is targeting up to 50% debt via traditional project finance and our valuation has assumed a 50-50 split. We acknowledge, however, that this is highly dilutive approach and so the company may opt towards less dilutive options. This may include bringing in a partner at the project level or selling Life of Mine rights to fines for individual modules (or even the whole project).

Nonetheless, the company appears that it will be funding at least some portion of the capex with debt (even if not as high a portion as our models indicate), aiming for term sheets and to mandate debt lead arrangers in the next few months.

Are there any other milestones upcoming?

The clear value driver for BKT shares will be the securing of funding. But there are other milestones that it could drive shareholder value in the near-term, in particular milestones with POSCO. POSCO could upgrade its existing agreements to sign a full-form prepay agreement and/or an offtake agreement (in other words a deal for later Modules). We also see the potential for other offtake agreements that may come with project finance.

Valuation

We now value the company at A$0.62 per share in our base case and A$0.83 in our bull case.

We valued BKT at A$0.88 per share base case and A$1.14 per share optimistic case, in our initiation report last August. Taking into account increased capex requirements, as well as an increased WAAC due to changes in the metrics used in Pitt Street Research discount rate policy (as outlined below), **we now value the company at A$0.62 per share in our base case and A$0.83 per share in our bull case** (Figures 9-10).

We have valued BKT using the DCF approach and the key assumptions (including changes made leading to the reduction in our valuation from last year's report) are outlined below:

- **Ores extracted and production.** We incorporated the estimated production from all four stages mentioned in the enhanced DFS. We assumed that BKT would treat 95m tonnes of Mahenge ore in a four-stage approach over a LOM of 26 years (excluding development period). Graphite concentrate produced is computed based on an average feed grade of 8.12% and an average concentrate grade of 96.8% over the mine life.
- **Graphite concentrate price.** Our base case assumes an average graphite basket price of US$1,709/tonne, while our optimistic case assumes a 15% premium, US$1,965/t. Both use a conversion rate of A$1 = US$0.66 (or US$1=A$1.49) and are driven by an expected increase in demand from EVs.
- **Operating costs.** We adopted those used in the eDFS. We assume long-run operating costs (C1 cost) of US$466/t of ore produced. This includes mining costs (US$191/t), processing costs (US$143/t), and other logistics and administration costs. Further, we have considered a 4.3% royalty on gross revenue in-line with the company's expectations.

– **Capital costs.** Our model uses total project capital expenditure of US$510m which includes start-up capital cost of US$182m to be incurred before production begins on Module 1. The remaining amount will be spent over the next three years to initiate Modules 2–4 of the project. A sustaining annual capital cost of US$125/t produced has been considered for the LOM.
– **Funding.** As mentioned above, we have used a 50:50 debt-equity ratio to fund the start-up capital cost and that the funds are raised at the current share price - $0.15 per share. In time, we anticipate the company will be able to fund capex through free cash flows, although the assumptions significantly impact our valuation by more than doubling the current number of shares on issue. For this reason, it is plausible the company may seek a less dilutive approach for at least some of the financing.
– **Discount rate and terminal value growth rate.** We arrive at a WACC of 12.7% to discount our cash flows, reflecting: a 3.5% risk free rate of return (the level of the 10 year Australian government bond), a 7% equity premium, a 2% country premium and a beta of 1.5, deriving a 17.0% cost of equity. We assume an 8.4% after–tax cost of debt (derived from 12% pre-tax cost of debt and a 30% corporate tax rate). We have used free cash flow projections for the first 10 years from 2024, and thereafter, a 1.0% long-term growth rate to compute our terminal value.

As mentioned above, the two key differences between our base and optimistic cases are:

- **Average graphite prices**: Our base case assumes US$1,709/tonne (as in the DFS), while our optimistic case assumes US$1,965 – a 15% premium.
- **Ramp up of Mahenge**: Our base case assumes a more gradual ramp up, only reaching 100% by 2028, after starting at 76% in 2024 and being between 90% and 97% for 2025-7. Our optimistic case assumes 95% in 2024 and 100% from 2025.

Figure 9: Valuation of BKT

(A$ m)	Base Case	Bull Case
Net Present Value (A$ m)	**661.3**	**1,001.1**
Terminal Value (A$ m)	**984.1**	**1,208.7**
Net (debt) cash	(36.1)	(36.1)
Equity value (A$ m)	**1,681.5**	**2,246.0**
Shares on Issue (m)	2,697.3	2,697.3
Implied price (A$)	0.62	0.83
Current price (A$)	0.13	0.13
Upside (%)	379.5%	540.5%

Estimates: Pitt Street Research

Figure 10: WAAC sensitivity analysis

Sensitivity Analysis						
WAAC	**12.7%**					
Terminal Growth Rate	**1.00%**	**Change in WAAC**				
Implied Price (A$ cents)	**$0.62**	10.7%	11.7%	12.7%	13.7%	14.7%
	0%	$0.76	$0.67	$0.58	$0.52	$0.46
	0.5%	$0.79	$0.69	$0.60	$0.53	$0.47
	1.0%	$0.82	$0.71	**$0.62**	$0.54	$0.48
	1.5%	$0.85	$0.73	$0.64	$0.56	$0.49
	2.0%	$0.88	$0.76	$0.66	$0.57	$0.50

Estimates: Pitt Street Research

Risks

We see the following key risks to our investment thesis:

– **Funding and execution risk.** A critical factor for the success of the Mahenge project is the completion of project financing in a timely manner. The project is in the financing stage and requires debt and equity capital for commencement of construction. We have assumed that the company will commence graphite production in 2025. However, in case there are delays due to funding challenges (or for any other reasons), this will affect cash flows and viability of the project.

– **Underlying commodity risk**. BKT is exposed to commodity price risk, which depends on macroeconomic factors and industry demand-supply dynamics. BKT's cash flows and profitability could be impacted due to fluctuations in the Australian dollar and the price of graphite.

– **Sovereign risk.** Investment in BKT is exposed to Tanzanian sovereign risk. Although Tanzania benefits from the return to a stable and safe jurisdiction following the appointment of Samia Suluhu Hassan as President, it remains a riskier jurisdiction compared to Australia and other Western jurisdictions.

– **Geological risk.** The resources for Mahenge project are estimates. There could be a downside risk if a portion of resources is re-categorised as inferred resources at a later stage.

Appendix I – Analysts' Qualifications

Nick Sundich, lead analyst on this report, is an equities research analyst at Pitt Street Research.

- Nick obtained a Bachelor of Commerce/Bachelor of Arts from the University of Sydney in 2018. He has also completed the CFA Investment Foundations program.
- He joined Pitt Street Research in January 2022. Previously he worked for over three years as a financial journalist at Stockhead.
- While at university, he worked for a handful of corporate advisory firms.

Stuart Roberts, has been an equities analyst since 2002.

- Stuart obtained a Master of Applied Finance and Investment from the Securities Institute of Australia in 2002. Previously, from the Securities Institute of Australia, he obtained a Certificate of Financial Markets (1994) and a Graduate Diploma in Finance and Investment (1999).
- Stuart joined Southern Cross Equities as an equities analyst in April 2001. From February 2002 to July 2013, his research speciality at Southern Cross Equities and its acquirer, Bell Potter Securities, was Healthcare and Biotechnology. During this time, he covered a variety of established healthcare companies, such as CSL, Cochlear and Resmed, as well as numerous emerging companies. Stuart was a Healthcare and Biotechnology analyst at Baillieu Holst from October 2013 to January 2015.
- After 15 months over 2015–2016 doing Investor Relations for two ASX-listed cancer drug developers, Stuart founded NDF Research in May 2016 to provide issuer-sponsored equity research on ASX-listed Life Sciences companies.
- In July 2016, with Marc Kennis, Stuart co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including Life Sciences companies.
- Since 2018, Stuart has led Pitt Street Research's Resources Sector franchise, spearheading research on both mining and energy companies.

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