20 June 2022

METALS & MINING

Initiation of Coverage

Marketing Communication (Connected Research)

Alkemy Capital#

BBG Ticker: ALK LN *Price: 113p/sh.* *Mkt Cap: £6.7m*

SPECULATIVE BUY

Tees Valley Lithium

Lithium Conversion Capacity in the UK

Alkemy Capital (ALK LN)# wholly owns the **Tees Valley Lithium (TVL)** lithium conversion project in the North of England. The European lithium-ion battery manufacturing industry has grown from a standing start to 106GWh in 2022 and is projected to increase to 789GWh by 2030 and is currently entirely dependent on imports. Conversion and refining forms a vital part of the lithium supply chain, however, and 95% of global capacity is located in China. Aside from the geopolitical implications, battery quality lithium chemicals ship poorly over long distances and experience degradation, and it therefore makes practical sense to build out this side of the supply chain closer to the end users.

Fast Tracked, Scalable and Green

The company recently produced a Class 4 engineering study showing a pathway to producing 96ktpa of lithium hydroxide, in four phases. The proposed location at the Wilton International Chemicals Park is on a site with pre-approved planning permission, where TVL gains access to infrastructure provided by **Sembcorp** and logistics from **PD Ports** at **Teesport**, just 4km from the site. This deep seaport provides easy access for import and export of feedstock, reagents and saleable products as well as providing freeport benefits to the project. The existing infrastructure and streamlined permitting process gives TVL an advantage compared to the other similar projects in Europe. All such capacity will likely be required but in our view, demonstrating lower execution risk will be an advantage for securing feedstock and offtakes, meaning TVL will likely be the first such project to be commissioned as early as 2025. TVL is differentiated by its intention to process lithium sulphate rather than spodumene concentrate; this implies a lower carbon footprint from reduced shipping volumes, a notable benefit given proposed carbon border taxes. Furthermore, TVL has designed its own electrochemical process which significantly reduces reagent use and creates a zero-waste process in close proximity to low carbon power sources.

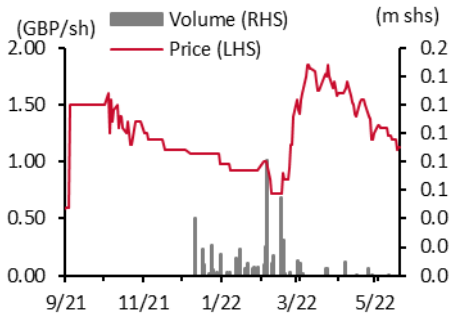
Recommendation and Target Price

Our valuation is based on phase 1 of the project which utilises proven conventional technology. Our more conservative macro assumptions produce an NPV8 of £490m, highlighting the disconnect between the market capitalisation of the recently formed listed entity of £6.7m. This is then risked to account for the current resources of the company and stage of development producing a near term target of £50m. **We therefore initiate with a Speculative Buy recommendation and £8.40/sh. target price.**

Company Description

Alkemy Capital is an investment company which wholly owns Tees Valley Lithium.

One Year Price Performance



Price % chg	1mn	3mn	12mn
	-27.4%	25.0%	n/a
12mn high/low			185p/60p

SOURCE: Eikon, as of 17 June 2022 close.

Market:	LSE
Shares in issue	6m
Target Price (p/sh.)	840
Free float:	37%
Net cash (Jan 22):	£1.1m
Enterprise value:	£5.6m

Major shareholders

Paul Atherley	50.00%
Sam Quinn	4.17%
Colin Stone	3.33%

Oliver O'Donnell, CFA, Natural Resources

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#VSA Capital acts as Corporate Broker for Alkemy Capital.

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Investment Case

Fast Tracked, Scalable and Green Lithium Conversion Plant

TVL is providing a vital missing piece in Europe's lithium-ion battery supply chain. The company has announced a derisked development strategy, which has not yet been appreciated by the market, valued today at just £6.7m with £1.1m in cash. Currently, we believe that with the strategy laid out, the company is well-positioned to secure the resources it requires to execute the project successfully and with a number of milestones coming up over the next 12-18 months, we see numerous potential catalysts to drive a rerating with the project then being valued based on project economics. There are a number of factors which we believe give this project an edge, but the combination of scalability, fast tracked development and low environmental impact make this a compelling opportunity in our view. Over the longer term, we believe that the nature of the business being less geared to lithium prices will provide useful exposure, potentially more defensive, for lithium investors in what will remain a volatile market until it reaches maturity. It is also the only listed entity providing pure exposure to lithium conversion capacity currently. However, the near-term opportunity is value being unlocked as the company progresses development.

Fast Tracked

TVL has developed a heavily derisked strategy which we believe will enable the company to be the first lithium conversion plant online in Europe. This is in large part due to the location of the project at the Wilton International Chemicals Park, with TVL benefiting from the existing infrastructure, streamlined permitting process and support services provided by **Sembcorp Energy UK**. Furthermore, with the park 4km from Teesport, the UK's fifth largest port, capable of receiving vessels up to Capesize and a freeport providing additional tax advantages (particularly valuable for companies manufacturing products for export), this provides a logistical advantage. It also means that TVL has access to **PD Ports** which will be a valuable partner providing logistical support during the construction process helping to ensure prompt delivery of equipment, and once in operation, supporting the import of feedstock and reagents as well as the export of lithium hydroxide. Furthermore, the first train uses a conventional Glauber's salt flowsheet with limited technical risk which should speed up the commissioning process. These combined with a management team with significant experience in lithium and the development of mineral projects around the world give us confidence in TVL's ability to execute.

Scalable

We are aware of four other lithium conversion plants in development in Europe. TVL recently released a Class 4 engineering study demonstrating a plan to build four trains each capable of producing up to 24ktpa of lithium hydroxide meaning 96ktpa in total: AMG Lithium is targeting 100ktpa but has not presented any public studies to support this. TVL's study produced an NPV8 of £2.2bn post tax for the project as a whole using a lithium hydroxide price of US$25,000/t, c60% below the current spot price. Our long-term forecast is more conservative and we use a forecast of US$19,800/t for lithium hydroxide resulting in an NPV8 of £1.4bn with phase one as a standalone valued at £490m although we highlight that at US$35,000/t (in line with recent quarterly reporting from SQM), the NPV rises to £1.6bn for phase 1 and £4.8bn for the full four trains. Our forecast steady state EBITDA for all four trains is £363mpa and the company has identified a number of additional opportunities to increase value through the sale of by-products etc. which are not incorporated into the Study or our analysis.

Green

TVL is providing a solution in an industry where growth is predicated on the requirement to reduce the environmental impact of personal transportation. The Government legislation that seeks to ban the sale of petrol cars from 2030 will only achieve its aims if the full supply chain for electric vehicles and the electricity source has a lower carbon footprint. This has been a key area of focus in the design of the TVL plant and the company has appointed **Minviro** to provide a full life cycle analysis of the project to confirm this independently.

By encouraging lithium companies to adopt greener practices including producing lithium sulphate as an intermediate product, the reduction in shipping volumes of products like spodumene concentrate which are typically only 4-5% Li2O

will likely reduce the carbon footprint of the supply chain. Furthermore, the location in the UK and specifically at the Wilton International Chemicals Park gives TVL significant access to renewable energy with Teesport a hub for the development of the UK's wind energy industry. Wind power accounts for 24% of the UK energy mix and the location also enables access to additional sources of green power. This will become increasingly important as trains 2-4 come online, which are planned to use an electrochemical flowsheet currently being optimised. Using renewable power for this flowsheet would likely be substantially less carbon intensive than the Glauber's salt process.

With end users attempting to demonstrate that their vehicles have reduced carbon footprints, lowering the impact of the raw materials will be of benefit and could give TVL an advantage in securing offtakes, particularly if independently verified. Tesla has reported that the mining process accounts for around half of the carbon footprint of a battery cell and it is supportive of efforts to reduce this. Secondly, with the EU planning to implement a Carbon Border Adjustment Mechanism and other nations considering similar carbon taxes, minimising the carbon footprint of lithium also makes economic sense making TVL's approach attractive for both suppliers of feedstock and customers.

Project Economics

The company recently published a Class 4 Feasibility Study, however, given the focus is on processing this can be advanced relatively more quickly and inexpensively than a mining project. It demonstrated the potential for strong cashflow generation, attractive margins, and strong returns for investors with the company's base case NPV8 of £2.2bn and EBITDA margins of 26%. This is based on a long-term lithium hydroxide price of US$25,000/t, which although well below the current spot price, is above our long-term estimate. Our base case using a 10% premium to our US$18,000/t lithium carbonate forecast produces an NPV8 of £1.4bn. In this scenario with a 23% lower price, the EBITDA margin drops just 2% to 24% and implies steady state annual free cash flows of over £250mpa.

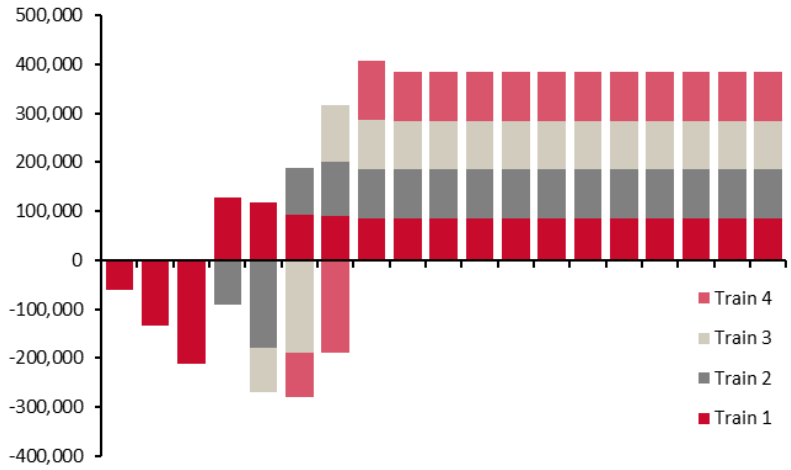
Project highlights, VSA Capital Analysis

	Train 1	Average over Project
LiOH Output, ktpa	24	96
Revenue, £mpa	380	1,343
EBITDA, £mpa	100	345
Free Cash Flow £mpa steady state	71	258
Initial Capital, £m	(215)	(1,055)
Sustaining Capital, £mpa	(5)	(16)
NPV, £m	490	1,416

SOURCE: *Company data, VSA Capital Research.*

We also highlight that our analysis suggests that TVL once established offers a relatively more stable exposure to the lithium market than direct mining meaning lower through cycle volatility and steady cash margins due to the fact that the major cost input, the feedstock, is geared to the broader lithium price trend.

Project Cash Flows, GBP'000

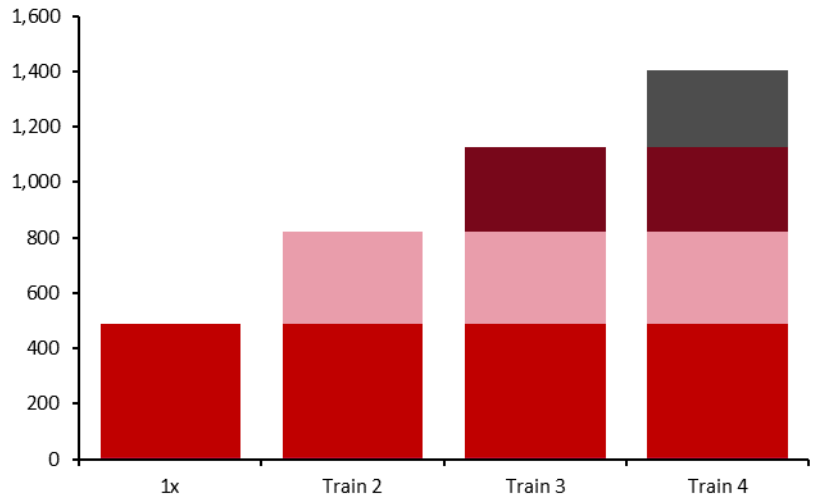


SOURCE: *Company data, VSA Capital Research.*

The planned approach to modularly expand the operation from an initial 24ktpa up to 96ktpa in four instalments will enable capital to be phased and expansion to be ramped up taking account of the actual ramp up in lithium demand over the rest of the decade and optimising the financing and capital deployment accordingly. The capital is significant with each train projected at around £215m for the first and £280m for the each of the remainder which use a different flowsheet developed by the company. This is consistent with the requirements for vertically integrated lithium projects, but we anticipate that the nature of the business lends itself to higher gearing and therefore stronger potential returns for early equity investors owing to the combination of higher leverage and lower dilution.

We have assumed that each train takes around two years to build although once train 1 is established, we assume that the ground-breaking for each subsequent train could be conducted sooner each time given the workforce will better understand the commissioning process with each train. Using the company's base case assumptions, we believe the incremental breakdown of the NPV across the four trains takes the NPV from £490m to £1.4bn. Given our expectation that European lithium demand will growth to close to 400ktpa by 2030, there is ample market capacity to support the full rollout, however, more technical work does need to be completed by the company before it is incorporated into our valuation.

NPV by Train, GBP'000



SOURCE: *Company data, VSA Capital Research.*

As a conversion business the main operating cost relates to the purchase of the feedstock, in this case the base case is acquiring lithium sulphate. In the base case scenario, TVL assumed a US$10,000/t lithium sulphate price compared to the above lithium hydroxide price. We have assumed the same ratio of 40% for our base case analysis and also note that with the process taking just hours, TVL is unlikely to be caught out by short-term price volatility and impacts on working capital. Identifying a reliable lithium sulphate price is clearly key to a robust forecast of TVL's potential and currently this is not a widely benchmarked product so transparent pricing is not available. We do note though that **AVZ Minerals (AVZ AU)** intends to produce a lithium sulphate product and in its DFS has assumed a 50% discount to the lithium carbonate price. Clearly, it is in the interest of each respective company to minimise / maximise its assumption, but the point is that the assumption TVL has used is reasonable. Indeed, the actual result will come down to contract negotiations which may include fixed pricing, profit sharing and other mechanisms which lead to stable and relatively more predictable cashflows relative to lithium mining projects.

With both the price of the feedstock and end product likely to move broadly in line with the cycle, TVL will take a margin. Our analysis shows how with pure pricing the NPV would be impacted by the changes in prices and that at current spot prices the NPV rises to £4.8bn. We also highlight that the EBITDA margin is relatively defensive given the softening impact of the lower lithium sulphate cost as prices fall and that at US$12,500/t, annual EBITDA is likely to be close to £270m per annum. This is due to a relatively low proportion of processing costs which we estimate to account for about 12% of the cost base in our base case pricing scenario, while lithium sulphate prices are expected to move in line with the broader market. Clearly, higher prices and a larger percentage derive stronger absolute earnings but the natural hedge will provide some protection during cyclical downturns making TVL an attractive addition to investors' lithium portfolios.

Capital costs primarily relate to processing plant and equipment, however, with the location at the Wilton International Chemicals Park this negates the need for significant additional infrastructure reducing upfront costs. Indeed, £215m for phase 1 is a significantly lower capital hurdle than an integrated project, most likely in a remote region requiring additional infrastructure. Furthermore, freeport status brings tax advantages and we do not expect the company to be eligible for tax until year seven of production.

Zero Waste and Upside Opportunities

There are a number of potential additions and modifications to the flowsheet which could lead to additional upside strengthening the future economics of the project as well as diversification. By-products are likely to play an important role, not only in boosting revenues but in helping the company to strengthen its green credentials through a zero-waste project.

In the published report, the company has indicated that it could produce sodium sulphate from the train using the Glauber's salt process and the electrochemical train could potentially produce gypsum. Gypsum is already imported through Teesport, often from as far afield as Argentina to meet UK demand. These are relatively generic products that are commonly associated with the chemistry of lithium deposits. We also expect that depending on the producers from which TVL secure offtake agreements with the different deposits may throw up further potential in terms of by-products such as caesium and magnesium.

The nature of lithium deposits means that other critical metals are often present in small quantities. By using lithium sulphate as the feedstock this does mean that the by-product potential is more limited than a mining project so we anticipate that the potential volumes would be limited to around a few thousand tonnes per annum depending on the feedstock. However, being located on the chemicals park creates a ready market of potential customers with significant requirements for critical minerals.

Aside from the potential impact of a carbon border tax and the reduced emissions footprint that end users are increasingly demanding, the UK has a landfill tax of £98.6/tonne providing a significant incentive for a zero-waste project. At the Wilton International chemicals park site, Sembcorp Energy UK manage the discharging clean waste water while the flowsheet will maximise recycling of water where possible.

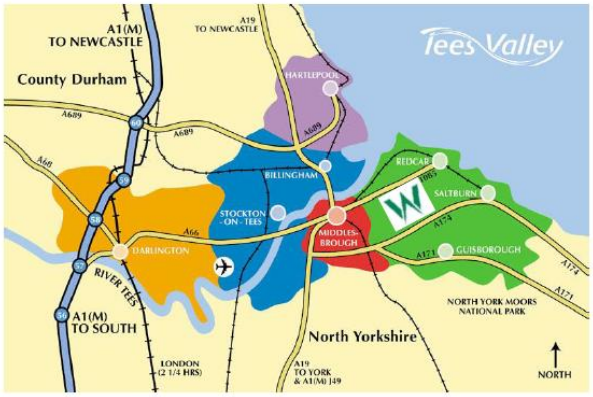
Derisked Development Strategy:
Wilton International Chemicals Park (Plug and Play)

TVL has chosen to develop its site on Teesside at the Wilton International Chemicals Park due to the strong existing infrastructure and chemical manufacturing industry. The location derisks project execution for a number of reasons, reduces upfront capital relative to alternative locations and is a major factor in why TVL can become the first and biggest lithium conversion operation in Europe. There are two aspects to this; firstly, the site at the Wilton International Chemicals Park is owned and operated by **Sembcorp Energy UK** and also the proximity to **PD Ports,** a 150 year old ports and logistics company that runs Teesport.

Sembcorp

Sembcorp Energy UK is part of Singapore based **Sembcorp** Industries; an international business involved in renewable energy, urban management for industry as well as the provision of conventional energy. The company is valued at US$3.6bn and is 49.5% owned by the Singaporean Sovereign Wealth Fund **Temasek Holdings**. Through its subsidiary Sembcorp Energy UK, the company provides energy, infrastructure and land within the Teesside industrial cluster enabling major global companies to leverage off the regional infrastructure and industry. The Wilton International Park is a 2,000-acre industrial park and Sembcorp Energy UK has a 1,150 acre site within this. The park has attracted global industrial groups such as **Huntsman**, **Sabic** and **Anglo American,** demonstrating that Sembcorp is a reliable partner to major companies and can be an ideal partner for TVL.

Wilton International Location

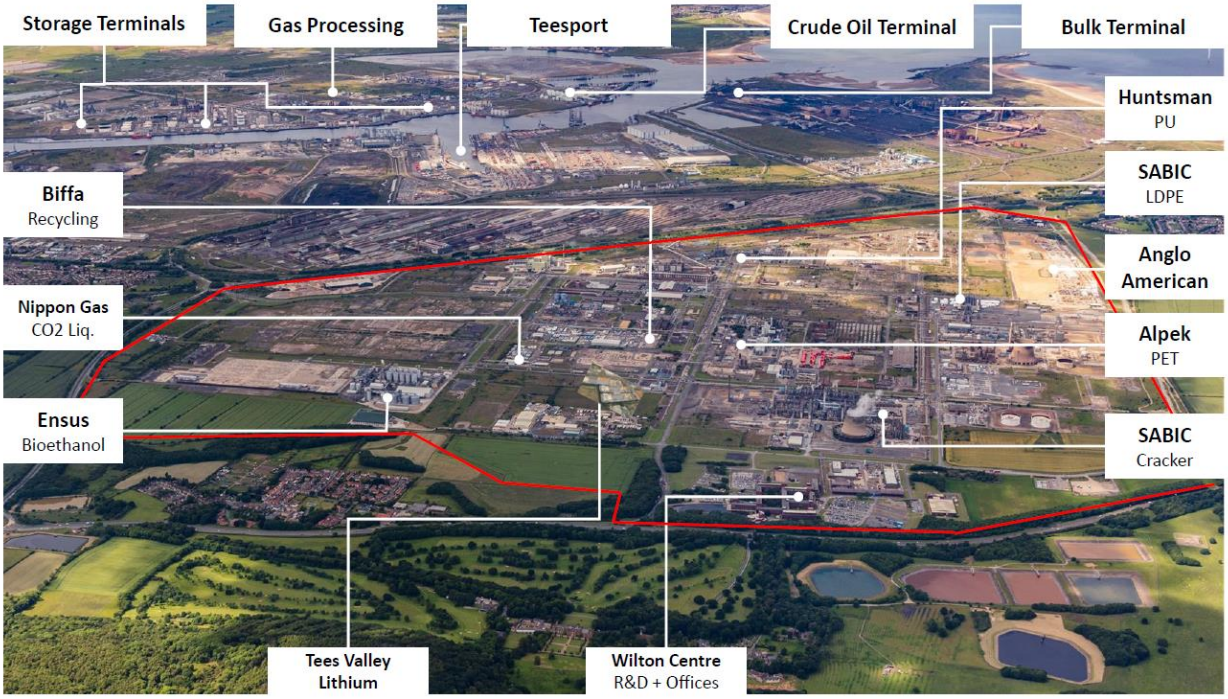


SOURCE: *Company data, VSA Capital Research.*

Currently Wilton International supports the first sustainable bioethanol plant in the UK, the largest (low density polyethylene) LDPE plant in the UK and other renewable opportunities are being explored including battery storage projects.

Sembcorp provides park users on its site with energy from a mixture of sources including natural gas, waste and biomass. It is able to provide a mixture of reliable and consistent energy that balances certified green, low carbon intensity and traditional fossil fuels. Users are provided with a pro rata mix of these energy types as standard, but this can be tailored to the requirements of end users based on their contracts. Renewable energy comes from the National Grid (NG) as although there are major wind farms currently operating nearby and in development, these cannot be connected directly to private sites legally and must be initially routed through the NG. Biomass, waste and natural gas energy can, however, be produced separately and directly for park users at more competitive rates implying a trade-off that must be considered. The park supports the largest private wire network for electricity. Currently this energy provision means that Sembcorp is a net exporter to the grid indicating there is significant capacity for new developments on the site.

Wilton International Sitemap



SOURCE: *Company data, VSA Capital Research.*

Wilton is described as a plug and play park for energy intensive industries with around 500 acres available for development across green and brownfield sites. In addition to energy, Sembcorp provides demineralised water, raw water, potable water, natural gas, compressed air, industrial gases and steam.

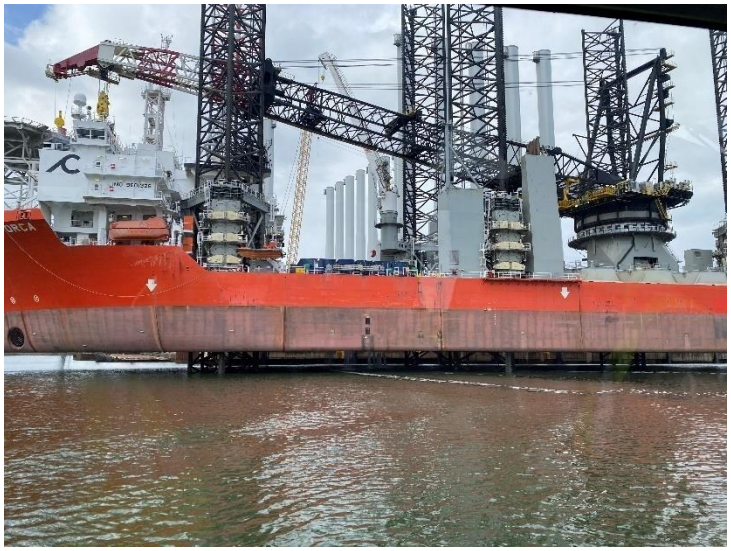
One of the park's major advantages is the designation of an Instrument of Consent. This applies only to greenfield areas within the industrial site and means that TVL does not need to apply for planning permission to develop its project nor apply to the Environment Agency for the main aspects of development. The company will submit an application to the Council to demonstrate its commitment to Governance principles, however, with this being a formality this is a key factor in why we believe that TVL can be the first facility up and running in Europe as the streamlined process gives it a major competitive advantage to its peers.

This consent is specific to the plot and brownfield sites within the park do need to apply for planning permission, however, the Instrument of Consent is only valid once. This is because once a development has been completed that land use may have created externalities that should be investigated before the site is repurposed. We note though that an application by **Peak Rare Earths (PEK AU)** last year to build a rare earths processing facility on a brownfield site was approved, highlighting the ease of the process. TVL's should be even more straightforward, significantly derisking project execution.

TVL has exclusivity for six months from February to agree an option to lease an 22 acre site at the park and negotiate options on service and utilities and agreements, which should then give the company sufficient time to progress the project and financing to a point where both parties have confidence to fully commit to a long term lease which would typically be multidecade.

The concentration of industry around the Tees cluster means there is an existing pool of talent from which to train workforce for the facility who will likely have past experience in the speciality chemicals industry. Data produced by Wilton International and the ONS indicates that aside from a large local specialised workforce, regional wages are 9% lower than other parts of the UK and internationally competitive compared to other European locations such as Germany where other refining facilities are proposed.

Teesport Staging Site for North Sea Renewables Development

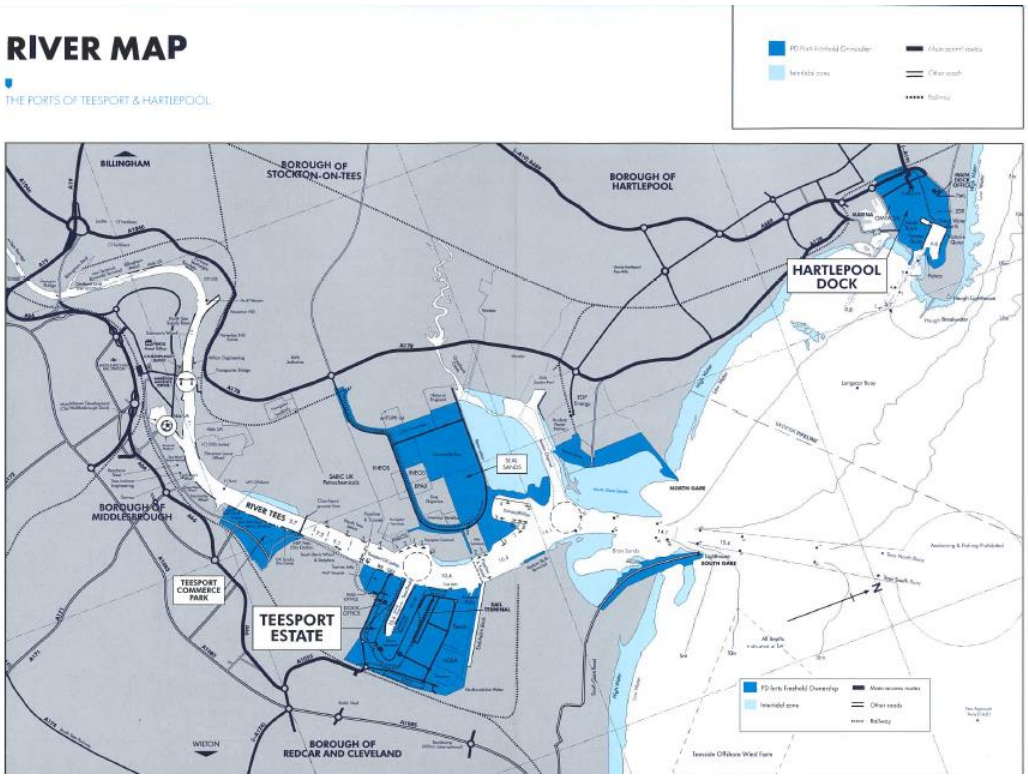


SOURCE: *Company data, VSA Capital Research.*

PD Ports: Tees Valley Freeport

2.5 miles (4km) from the Wilton International Park is Teesport which is operated by **PD Ports**. Teesport is the fifth largest port in the UK with deep port capability making it accessible for vessels including Capesize. The port handles around 28mntpa of freight including bulks and containers including a number of commodities, as well as providing a staging post for oil and gas decommissioning in the North Sea as well construction of major renewable projects including the 3.6GW Dogger Bank windfarm.

Teesport Site Map



SOURCE: *Company data, VSA Capital Research.*

Anglo American is planning to build the Woodsmith Mine in North Yorkshire with the tunnel entrance for the polyhalite mine at Wilton and the redevelopment of a major portion of the Teesport area to facilitate the export of millions of tonnes of product. The port currently supports **Cleveland Potash** which currently produces polyhalite for the global fertiliser market.

Fifth Largest UK Port

SOURCE: *Company data, VSA Capital Research.*

There are a number of key advantages to the close relationship between PD Ports and Wilton which strengthen the choice of location, in our view. By linking the plant with a port facility, it is likely to be more competitive in terms of freight costs for competitors who need to ship feedstock in from global locations and then rail inland. As well as operating the port itself, PD Ports operates in logistics and freight forwarding: TVL can leverage this in sourcing and transporting equipment, raw material and reagents in the construction and operating phases of development.

Teesside has been designated as a freeport and is the largest in the UK. Freeports enable companies to defer the payment of taxes until their products are moved elsewhere or avoid them altogether if manufactured on site and then exported. The planning regime mentioned above, reductions in national insurance and other VAT exemptions combined make the freeport and proposed site a highly competitive location further strengthening the decision to locate the facility here.

Alignment with Lithium Experts

TVL has appointed a number of key technical advisers to support the experience project management team. Each of these has a strong track record of successful project execution and has been active in the lithium space for a number of years; this valuable experience is important as with the recent growth of the market, the pool from which to choose is relatively limited. The key consultants along with their areas of focus are listed below and this builds on the internal expertise that TVL has in lithium from John Walker, the CEO, who has 30 years of experience in mineral processing for **Imerys (IMTP PA)** and **Piedmont Lithium (PLL AU)**. Vikki Roberts, who previously headed up in Johnson Matthey's Lithium Sourcing team and Rob Gruar, as technical battery specialist who previously worked at Dyson, Sharp and British Lithium.

Wave International

Wave is an Australian development consultancy established over 20 years ago with a focus on the development of industrial and mining projects from feasibility through to operations. The company has a ten-year track record in the battery metals and minerals space and has worked on both upstream and downstream lithium projects. Wave has already delivered on the Class 4 Study and will be supporting TVL in executing the next phases of development and optimisation of the final design.

JordProxa

JordProxa has been retained to provide technical and laboratory support in developing and commissioning the first train using the conventional Glauber's salt flowsheet. The company is a specialist provider of crystallisation and evaporation plant and systems, crystallisation being the key step in transformation from lithium sulphate to lithium hydroxide. To date, TVL and JordProxa have confirmed a suitable flowsheet for the first train and demonstrated the production of battery grade lithium hydroxide from lithium sulphate; this using JordProxa's Zero Liquid Discharge technology which is in use across multiple types of mineral processing operations. Given TVL's approach to waste this was an important reason for selecting the group.

Dorfner Anzaplan

Dorfner Anzaplan provides consultancy across a range of engineering services with a particular focus on metallurgical testwork. They cite lithium as a speciality and have been used by many lithium juniors around the world, particularly those in Europe. TVL is utilising DA to progress the electrochemical route which still requires further optimisation; to date bench scale testwork has confirmed the conceptual approach and now work is progressing to the next stage. Work has also been done to establish the impact of different impurities within feedstocks as the electrochemical flowsheet uses membranes to isolate the elements some may be permeable to different impurities in addition to lithium potentially altering the remaining parts of the flowsheet and enabling TVL to identify the most appropriate feedstocks.

Nagrom Laboratories

Nagrom has been engaged to focus on impurity removal for both flowsheets. Impurity removal and achieving the same level of impurity removal on a consistent basis is one of the most important targets for TVL in achieving a high-quality refinery. For TVL's customers, consistency will be a top priority as their battery manufacturing is built upon narrow tolerances which can support some low levels of impurities as long as these remain consistent. One of the major focus areas will be on optimising reagent quantities to balance economics versus recoveries.

Proposed Timetable

The Class 4 Study was a major milestone for the company and sets in motion a number of workstreams to be completed over the coming 12 to 18 months.

Although there is limited permitting and planning required, TVL has submitted the documentation that would otherwise be required were the instrument of Consent not in place. This goes for environmental studies as well and an

EIA scoping study was approved in May and the various Environmental studies are now in progress. The planning application should be submitted in July, with approval soon afterwards: we prefer to view this as an acknowledgement of TVL's plans rather than approval.

Given that the flowsheet for Train 1 is conventional and the Class 4 Study has been completed, TVL can actually focus on executing project optimisation and financing in a relatively short time period. The latter trains using the electrochemical flowsheet are expected to be delivered sequentially, meaning the company can continue to optimise the flowsheet at the same time as Train 1 is being delivered.

Front End Engineering and Design will be the focus for the remainder of 2022 with the order of long lead items such as crystallisers likely to be commenced as financing allows. The company has allowed 12 months for this with construction commencing in H2 2023 on this basis. This is a further 12 months with a 6-month commissioning period thereafter implying first commercial production in early 2025. This timeline is clearly dependent on a concurrent project financing programme.

Aside from these direct construction and development type milestones, there are two further key milestones: securing supplies of lithium sulphate and gaining product acceptance from OEMs. The latter may be contingent on the first so that testing is completed using a representative raw material. We do note though that given the flexibility of the first train, TVL may only partially secure lithium sulphate feedstock with the balance of capacity utilisation being covered on a shorter timescale.

Lithium in Europe

Aside from a nominal amount of lithium production in Portugal which is used in the glass and ceramics industry, Europe has no producing sources of lithium despite a number of development projects. It does, however, have a rapidly growing battery manufacturing industry with around 35 confirmed lithium-ion battery manufacturing plants being advanced meaning that Europe's reliance on lithium imports is growing rapidly towards 15% of the global market based on current projections. The difference between now and the last few years is that Europe's battery manufacturing factory is now becoming an established industry and large new factories are not a medium to long term prospect but are being financed for construction now.

Europe currently accounts for around 20% of global lithium demand each year and 9% of global battery manufacturing capacity. **Benchmark Mineral Intelligence** forecast that by 2030 the continent will have 789GWh of capacity accounting up from 77.4GWh expected by the end of 2022. Europe's reliance on lithium imports is therefore growing rapidly as these plants have only been established in the last few years. Future projects include projects such as **Britishvolt** for which the site in the UK is around 50 miles from Wilton International. **CATL, Samsung SDI, LG Chem, SK Innovation, Farasis**, **Northvolt, VW** and **Mercedes Benz** all have plans to build lithium-ion battery manufacturing capacity.

European Battery Gigafactories

SOURCE: *Google Maps, VSA Capital Research.*

European Battery Gigafactories Legend

Number	Country	City/Town	Company	Operational Start	Starting GWh	Planned GWh	Lithium kt
1	England	Blyth	Britishvolt	2023	10	35	
2	England	Coventry	Amte Power	2023	10	35	
3	England	Sunderland	Envision AESC	2024	2.5	14	
4	France	Douai	Envision AESC	2024	2.5	14	
5	France	Douvrin	Automotive Cells	2023	16	64	
6	France	Douvrin	PSA Group	2024	24		
7	France	Dunkirk	Verkor	2023	16	50	
8	Germany	Berlin	Tesla	2021	40		
9	Germany	Bitterfeld-Wolfen	Farasis	2022	16		
10	Germany	Brandenburg	Microvast	2021	1.5	6	
11	Germany	Darmstadt	Akasol	2021	0.5	5	
12	Germany	Ellwangen	Varta	2024	10		
13	Germany	Erfurt	CATL	2022	14	24	
14	Germany	Kaiserslautern	Automotive Cells	2023	16	64	
15	Germany	Sajonia	Blackstone Resources	2021	0.5		
16	Germany	Salzgitter	QuantumScape	2021	1	20	
17	Germany	Salzgitter	Volkswagen	2024	16	24	
18	Germany	Uberherm	SVolt	2023	20	24	
19	Germany	Willstatt	Leclanche	2020	1	2.5	
20	Hungary	Göd	Samsung	2018	3	15	
21	Hungary	Ivancsa	SK Innovation	2028	30		
22	Hungary	Komárom	SK Innovation	2022	10		
23	Hungary	Miskolc	GS Yuasa	TBD			
24	Italy	Termoli	Stellantis	TBD			
25	Italy	Teverola	FAAM	2021	2.5	15	
26	Italy	Turin	ItalVolt	2024	70		
27	Norway	Agder	Morrow	2024	8	32	
28	Norway	Mo I Rana	FREYR	2023	35		
29	Norway	Rogaland	Beyonder	2024	10	20	
30	Poland	Wroclaw	LG Chem	2018	15	65	
31	Slovakia	Bratislava	InoBat Auto	2024	10		
32	Spain	Badajoz	Phi4tech	2022	2	10	
33	Spain	Barcelona	Seat	TBD			
34	Spain	Vitoria-Gasteiz	BasqueVolt	2023	2	10	
35	Sweden	Skellefteå	Northvolt	2021	32	40	

SOURCE: *VSA Capital Research.*

Europe's lithium demand in relation to electric vehicles is expected to be primarily for lithium hydroxide due to the concentration of top tier battery manufacturers serving the high-end vehicle market. Whilst safety regulations in China prompted a switch towards lithium iron phosphate (LFP) batteries which tend to require lithium carbonate , Europe's automotive market has a higher weighting of high value cars above £20,000 where the cost of a battery can be more readily absorbed. Cost cutting in NMC battery manufacturing in China led to safety issues which the Government responded to by enforcing use of the safer and cheaper but less energy dense LFP technology . Higher-end vehicles using top quality batteries are expected to use NMC batteries due to the energy density factor. These typically require lithium hydroxide rather than lithium carbonate and is why TVL has opted to produce lithium hydroxide as an end product. We expect that for vehicles retailing over around £20,000, the cost of a higher quality NMC battery can be

more easily absorbed, whereas short range city cars that tend to be smaller and priced below this level may be more suited to a less expensive battery. Given LFP is being rolled out in China at scale, it seems unlikely that this technology is not going to be used in Europe, but we believe it will be less prevalent.

One other important factor to note is that Europe is currently focused on producing premium quality batteries which require the highest quality raw materials including lithium. It is therefore not enough for Europe's lithium mines to be producing lithium, the requirements of the local end users are for the highest battery quality product with low impurities due to Europe's auto industry, high safety standards and weighting to high value performance cars. Currently, substandard lithium carbonate and hydroxide is typically reprocessed by converters in China before it can be used by battery manufacturers as Europe lacks this type of conversion capacity, therefore TVL will be able to fulfil this role in the future. However, it highlights the challenge for individual mining companies that it is not enough simply to get into production of a lithium carbonate or hydroxide. One important benefit for the European OEMs is that by buying from a converter such as TVL, the value-add created in the conversion process is sufficient to enable this to be considered a European product satisfying their sourcing requirements.

Aside from the security of supply aspect to producing lithium hydroxide directly in Europe, the product degrades quite quickly, and so local sources of supply are of significant benefit to battery manufacturers. This means imports of feedstock for conversion would be preferable, in our view, as intermediate feedstocks are less likely to degrade during shipping. Indeed, TVL may end up reprocessing imports of off spec lithium hydroxide or lithium carbonate.

Currently, none of Europe's lithium mining projects intend to produce lithium sulphate as a final product although have realised that producing spodumene concentrate is not a viable strategy without nearby converters. Indeed, as far as we can tell only **European Metals (EMH AU)** and **Infinity Lithium (IF AU)** have presented definitive process routes to produce lithium hydroxide. The remainder have ambitions to upgrade concentrates themselves, but a lithium sulphate may be more achievable. We do note though that in both cases (EMH and INF) the Glauber's salt process is an intermediate step highlighting both the conventional nature of TVL's train one flowsheet and the relatively easy adaptation of the proposed flow sheets to provide feedstock to TVL.

European Peer Table

Company	Zinnwald Lithium	European Lithium	European Metals	Infinity Lithium	Keliber	Savannah Resources
Market Cap, US$m	31.3	55.5	102.0	39.5	.	68.0
Project	Zinnwald (Germany)	Wolfsberg (Austria)	Cinovec (Czech Republic)	San Jose (Spain)	Multi (Finland)	Mina do Barosso (Portugal)
Mineral	Mica (Zinnwaldite)	Spodumene	Mica (Zinnwaldite)	Mica (Zinnwaldite)	Spodumene	Spodumene
Li2O, %	0.76%	1.17%	0.40%	0.61%	1.16%	1.00%
Contained Resource, mnt LCE	0.76	0.27	6.80	1.68	0.29	0.71
Stage	FS	FS	FS	FS	FS	FS
End-Product	LiF	Li2CO3	Li2CO3	LiOH	LiOH	Spod conc.
Opex	€13,665/t LiF	US$7,160/t LCE	US$5,211/t LCE	US$5,343/t LiOH	US$5,358/t LCE	US$271/t conc.
By-product	SOP	n/a	Tin, tungsten, SOP	n/a	n/a	n/a
Capex	US$192m	US$424m	US$393m	US$288m	US$370m	US$109m
Capital Intensity (US$/tLCE)	26,174	42,400	17,467	19,200	30,833	n/a
Production	5,122/tpa LiF (7,285tpa LCE)	10,000tpa LCE	22,500tpa LCE	19,200tpa LCE	12,000tpa LCE	175ktpa Spod conc.

SOURCE: *Company Data, VSA Capital Research.*

Conversion capacity

In terms of lithium refinery or conversion capacity, Europe is starting from scratch and there a few groups seeking to fill this gap including TVL. Two plants are planned in Germany and two in Britain with the fifth in Poland. Only TVL and

Rockteck Lithium (RCK CN) are listed entities meaning there are relatively few options for investors to gain exposure through the capital markets, although Rockteck is pursuing an integrated strategy having been developing spodumene assets in Canada for the past few years. This means that TVL offers the only listed exposure to European lithium conversion and refining capacity. Each of the projects is targeting similar capacity levels to TVL and aside from the fact that TVL has articulated a strategy to modularly expand from the initial 24ktpa to 96ktpa, the peer group is seeking to produce between 15ktpa to 50ktpa initially LiOH. Given the overall demand projections for European and indeed global lithium demand, Europe requires all of this capacity to come online, in our view.

Proposed European Conversion Plants

Company	Location	Capacity (kt) LiOH	Target Year for First Production
Tees Valley Lithium	UK	24-96	2024
Rock Tech Lithium	Germany	24	2024
Aurora JV (Galp/NorthVolt)	Portugal	35	2026
AMG Lithium	Germany	20-100	2023
Green Lithium	UK	50	2024

SOURCE: *Company data, VSA Capital Research*

Crucially, TVL is differentiated in that it is targeting the use of lithium sulphate as a feedstock rather than spodumene concentrate. Typically, at just 4-6% lithium, spodumene concentrate has a high waste content (94-96%), or 975kt for a 25kt LiOH plant and we believe that TVL has shown significant foresight in adopting a new approach that ties in with the increasing demands of end users. We highlight that just because China takes one approach to its supply chain now does not mean that as the West seeks to reshore these supply chains so that they have to remain identical; they can be improved and made more efficient. Indeed, the lithium market has seen dramatic change in processing technologies over the past 50 years; the South American salars were only commercialised in the 1990s while new technologies such as Direct Lithium Extraction are already set to upend this "normal". Consequently, we highlight that trends relating to hard rock assets can change just as quickly. Having flexibility across feedstocks across Europe's growing industry also makes sense and this is not a zero-sum game for the groups involved.

Carbon Border Adjustment Mechanism

Downstream users of lithium are increasingly cognisant of the carbon footprint and emissions profile of the raw materials used to create their batteries. The EV revolution was, of course, initiated to combat climate change and in China improving air quality was also a major driver and as EVs have gained traction, manufacturers are beginning to trace the supply chain for raw materials to consider a range of factors including the emissions footprint. The current practice of shipping intermediate product to China for processing and refining is therefore increasingly unsustainable due to the emissions footprint associated with shipping.

The EU is perhaps the most aggressive implementer of climate change legislation and is targeting a 55% reduction to 1990 levels of emissions by 2030 and consequently, industries that wish to operate in Europe must analyse their supply chains and improve their emissions efficiency so that they are not made economically uncompetitive by the proposed policies of the EU.

In addition to the Emissions Trading System (ETS) in the EU which provides a rationing system for emissions output, the EU is set to implement a border tax on carbon or Carbon Border Adjustment Mechanism (CBAM) to try to level the playing field for non-EU producers who are not subject to the same legislation in terms of emissions output. The CBAM is a levy on imports depending on the emission content of production and to cover this, EU importers will have to buy certificates linked to the carbon price. If a different carbon price has already been paid, then the importer will pay the net difference. In the past 2 years, the carbon price has increased 343% to €82/t and the structure of the system means that the emissions cap will be steadily reduced by 4.2% per annum restricting supply of credits and keeping prices supported.

Initially, the CBAM will cover the same industries as covered by the ETS, iron and steel, cement, fertiliser, aluminium and electricity. However, the EU Commission has highlighted that if successful it will be rolled out to other industries. Once material is inside the EU it can be transported freely, and this also covers the European Economic Area and

Switzerland. It is set to be implemented in 2026 after a three-year transition period although there is still significant agreement required on the implementation and workings of the mechanism before it is finalised.

Currently, the maximum output based on existing lithium projects in Europe is less than 100ktpa implying significant imports. There is therefore significant incentive for European battery manufacturers to have low carbon sources of lithium, particularly if it is coming from outside the EEA. Other countries are considering similar mechanisms including Canada and Japan.

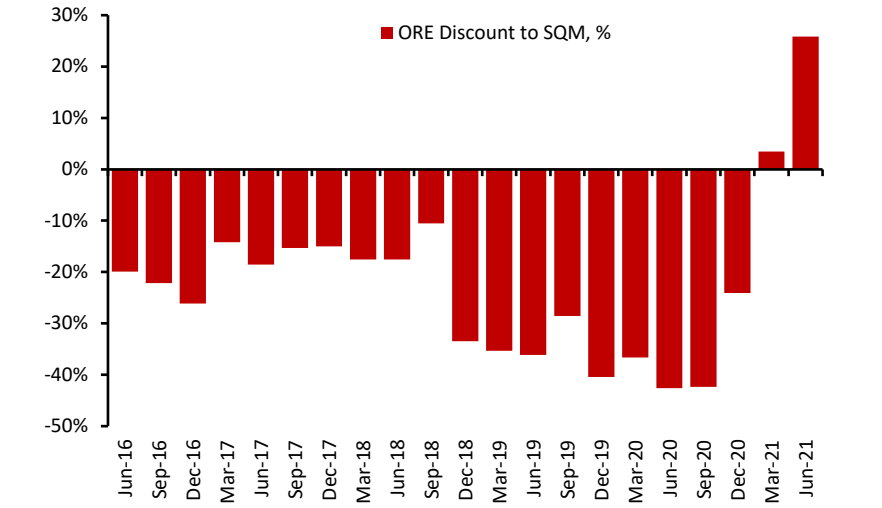
Lithium Sulphate

TVL has stated that intends to produce lithium hydroxide using lithium sulphate as its primary feedstock. Lithium sulphate is routinely produced as an intermediate step during the production of lithium carbonate and hydroxide by current lithium producers. It is typically produced after the initial beneficiation steps, and it is this chemical which is then converted into a lithium carbonate or hydroxide. We also note that the lithium sulphate solution often contains other by-products such as potassium sulphate; currently, our model does not incorporate the upside potential associate with by-products, but this could clearly add significant value.

TVL will therefore be focusing on the speciality part of the lithium hydroxide production process; removing impurities to create a battery quality product suitable for top tier OEMs. We believe that by specialising there is a higher chance of success in producing a battery quality product than for a mining company and we believe that there are a number of factors that make producing a lithium sulphate a compelling alternative for producing a hydroxide or carbonate; firstly the ability to produce a four or even five 9s product is difficult to achieve and the discounts to benchmark prices may significantly reduce the returns of a project compared to its forecast parameters. This may make the lower upfront capital of a lithium sulphate plant more attractive. Secondly, the reduction in the shipping of waste will improve supply chain economics and emissions footprint. Thirdly, we believe that the scale and product consistency that can be achieved by a dedicated conversion plant will be a more attractive partner for OEMs than multiple smaller scale sources. We also highlight that lithium sulphate is a stable product which travels well over long distances and can be stored for longer periods of time without a decline in quality. Therefore, even having conversion capacity in Africa or Australia to support the European market is of limited value and why TVL can source feedstock globally.

To highlight why returns on projects may not be as they seem when compared to feasibility studies it is important to remember that lithium is not an exchange traded product and prices are negotiated on a contract basis. Furthermore, discounts based on product quality cannot be extrapolated linearly. **Orocobre** produced a relatively low-quality product since its production commenced. The chart overleaf highlights the pricing impact relative to **SQM** that typically produces a higher quality product mix except for in the first two quarters of 2021 where product quality was reported by the company to be weaker. In Q3 2021, Orocobre merged with Galaxy making the comparison less relevant, although we note the discount has returned now SQM has reportedly strengthened its product mix. Given a full plant to produce 25ktpa of LCE typically costs around US$400m receiving a hefty discount to the pricing forecast in a Feasibility Study, having the technical capability to realise this level of pricing is not a given. Producing a value-add intermediate product for a lower capital cost comes with less technical risk relatively, in our view, and therefore potentially more attractive and realistic returns.

Orocobre Realised Lithium Carbonate Discount to SQM



SOURCE: *Company data, VSA Capital Research. *NB, ORE became Allkem after the merger with Galaxy in Q3 2021*

Lithium sulphate is not currently a benchmark product with transparent pricing; however, we note that other lithium companies are actively considering producing this: we note the Feasibility Study from **AVZ Minerals (AVZ AU)** in the DRC. Logistics costs over land from the DRC are a key factor in project economics and by reducing the waste shipped from site the company has been able to significantly improve the project economics. The lithium sulphate plant contributes around US$180m to the latest capex estimate of the total US$545m. US$120m of this larger figure relates to infrastructure and power given the remote location. The capital cost is therefore comparable to a lithium carbonate project but the pricing risk from a product quality is far lower, in our view. AVZ NPV10 is US$1.1bn despite the lower product value meaning the overall economics are comparable to projects intending to produce a lithium carbonate or hydroxide. Given our view that commissioning of new lithium projects is likely to outstrip the available chemical expertise and make achieving the benchmark prices assumed in these desktop studies difficult it makes sense for miners to focus on a midstream product with consolidation of the downstream process by experts such as TVL.

In 2021, the European Parliament established targets for 2030 and beyond for minimum recycled contents for batteries, carbon footprint rules and regulations relating to the sourcing of raw materials. In 2030, a minimum of 4% of lithium used in batteries by manufacturers must be from recycled sources, rising to 10% by 2035: in our view, TVL can contribute to this. After the initial mechanical separation and sometimes magnetic separation of li-ion batteries they undergo a hydrometallurgical separation which most commonly uses sulphuric acid. This naturally means that the most common precipitate is a lithium carbonate via a lithium sulphate; it may be more efficient for recyclers to use a refinery for the last step of the process. As well as the miners, the nascent lithium-ion battery recycling industry offers another potential source of feedstock.

Lithium Market Update

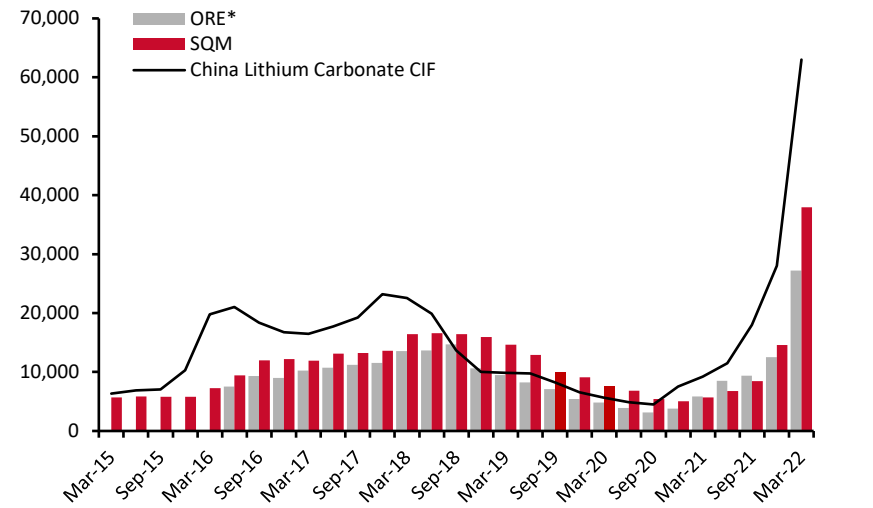
Lithium prices have remained strong YTD in 2022. Spot prices in China for lithium carbonate have pulled back from all-time highs of close to US$75,000/t to around US$67,000/t. In China, lithium hydroxide prices are trading at a small discount to lithium carbonate due to the local resurgence of LFP battery technology for electric vehicles, but the market overall remains strong with Q1 2022 being the strongest quarter for sales of electric vehicles in China of all time, up 125% YoY. The modest pullback in price is attributed to lockdowns in China but the impact on demand in this period is expected to be worked through in H2 and the major lithium producers are guiding towards higher prices in Q2 versus Q1 2022. Indeed electric vehicle sales remain strong globally, the UK being a good example where in 2021 sales increased 76% YoY increasing the share of new vehicles sales to 11.6%. This is expected to continue to rise with Europe wide legislation phasing out the sale of new petrol and diesel cars and vans between 2030 and 2035, it is to meet this expected demand that the roll out of battery manufacturing capacity is being built to meet implying strong growth in lithium demand.

While spot pricing is particularly important for trends in the lithium equities space and understanding momentum, the majority of sales are sold via longer term contracts. The market is changing though to allow greater flexibility in pricing, but this takes time. We note from SQM that 50% of their sales are now on variably priced contracts with a further 20% on contracts with floors and collars, meaning just 30% of all volumes are sold on a short-term basis. The chart below shows that in this cycle, contract pricing is moving more quickly to keep pace with the spot market, but we highlight that in the last cycle the broader contract market continued to rise for two to three years after the initial spot price rally.

Supply chains are not only a risk to demand but also supply. Execution of project construction and commissioning is, in our view, likely to hinder the timetables of near production development projects keeping markets tight. The major development projects that are close to production such as **Lithium Americas (LAC CN), Allkem (AKE AU)** and **Sigma Lithium (SGL CN)** all face logistical and labour challenges in meeting their first production and ramp up timetables.

AKE's additional 180ktpa expansion is likely to come online in H2 2022 at the earliest at the same time as the Olaroz Stage 2. **Sigma Lithium (SGL CN)** is also not anticipated to start ramping up to 33ktpa SC6 in 2022. LAC's guidance has slipped now from mid-2022 to H2 2022. We do note though that SQM achieved all-time record sales in Q1 2022 at 38kt but in order for the market to be balanced more records will need to be broken particularly with the company guiding towards an increase in global lithium demand of 30% YoY in 2022.

Lithium Carbonate Price Performance, US$/t



SOURCE: *Company data, VSA Capital Research. *ORE is now Allkem (AKE AU)*

As we have shown, there is a strong chance that newly commissioned lithium projects will at the outset not be able to produce battery quality lithium. Projects will need to be optimised to achieve this which will take months with off spec material being reprocessed to meet downstream requirements. This adds a further dynamic to the lithium supply demand balance as even as new projects come online there will be a significant lag between commissioning and the availability of lithium for batteries and will keep prices for battery grade lithium supported over the short to medium term, in our view.

Valuation

Our valuation of **Alkemy Capital (ALK LN)** which wholly owns the Tees Valley Lithium project is based on a risked DCF valuation which focuses on the first train of the recently published Class 4 model. The assumptions which underpin our financial model are below with the most notable differences being that our headline NPV figure uses our long-term assumption of US$18,000/t for lithium carbonate. To this we apply a small premium for lithium hydroxide given that it is expected to be the preferred chemical in Europe given the expected preference for NMC due to the larger market share of high-end vehicles relative to other parts of the world. Although we have provided analysis on the full proposed development and four trains, we believe that given the company's stage of development, current cash resources and the fact that the electrochemical train requires some further testwork it is appropriate at this stage to focus our base case target valuation on the first train.

There are no comparable listed pure play lithium conversion companies to provide relative analysis. **Ganfeng** and **Tianqi** have conversion capacity but are full vertically integrated and provide limited accounting details which breakdown the performance of individual operating segments.

The lithium sector as a whole has performed strongly albeit with significant volatility over the past two years. Equities and sentiment tend to follow the limited volumes and pricing of the spot market while contract pricing tends to react more slowly. With lockdowns in China compounded by high energy prices and supply chain issues raising concerns of demand destruction, lithium equities have pulled back in recent months settling at the retracement level from March 2021 before recovering decoupling from lithium prices. The rapid growth of the market implies ongoing volatile performance underpinned by the secular growth trend and therefore the current pullback may represent a buying opportunity in lithium stocks, particularly as those attempting to build projects due for commissioning in H2 2022 are being impacted by the knock-on logistical impacts of China's lockdown pushing out supply growth projections providing support for lithium prices. Given the macro uncertainty which could undermine the bullish scenario and the ongoing volatility associated with an immature market, a relatively more defensive business model such as TVL's will be of value to lithium investors. This will become more relevant after an initial rerating to a valuation that is then guided by project economics.

Global Lithium ETF

SOURCE: *Company data, VSA Capital Research.*

We use an FX rate of GBPUSD 1.25 and we evaluate the project based on a discount rate of 8%. We have applied a risk factor of 0.1x, however, given the company's ambitious timetable we see a number of milestones which could be realised in the short term that would derisk the investment case and enable us to raise our target valuation. These milestones include FEED, confirmation of supply of lithium sulphate, product acceptance from customers and project financing.

With a current cash position of £1.1m, and a capital cost to build the first train of £215m, the risk factor also takes into account in part the potential dilution given there are just 6m shares outstanding. The upside of this is that the shares are currently tightly held largely amongst founding shareholders and management. That said, we expect that an industrial project such as this in a top tier jurisdiction with potential additional support from Government could tolerate higher leverage reducing the requirement on equity investors. However, the current valuation in itself does represent a hurdle, but we believe that the company has already completed an impressive amount of work to demonstrate the viability of the project and that it has the team to successfully execute the roadmap. Given that the company is new to capital markets we expect growing awareness along with the successful completion of milestones to provide strong catalysts for a near term rerating of the stock price.

Valuation Summary

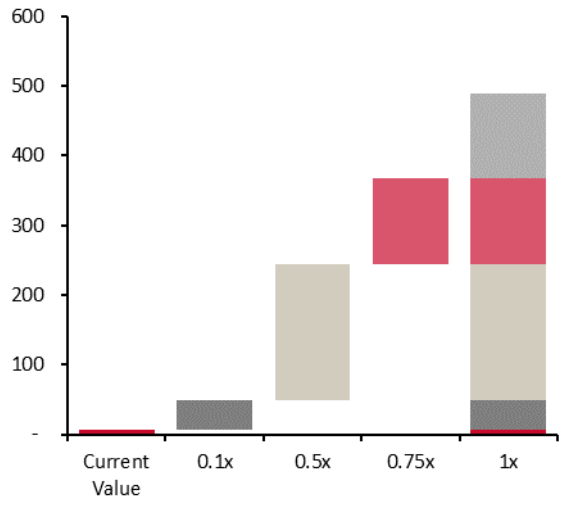
Division	Division NAV, GBP'000	Share, %	Attributable NAV, GBP'000	P/NAV	Fair Equity Value, GBP'000
Tees Valley Lithium	490,970	100%	490,970	0.10	49,097
Cash, GBP'000					(1,100)
Total Equity Value, GBP'000					50,197
# of shares (ALK)					5,999,999
Current price, GBP/share					1.13
12-mo Target Price, GBP/share					8.40

SOURCE: *Company data, VSA Capital Research.*

Our sum of the parts target price for ALK is 840p/sh, which implies 643% upside potential.

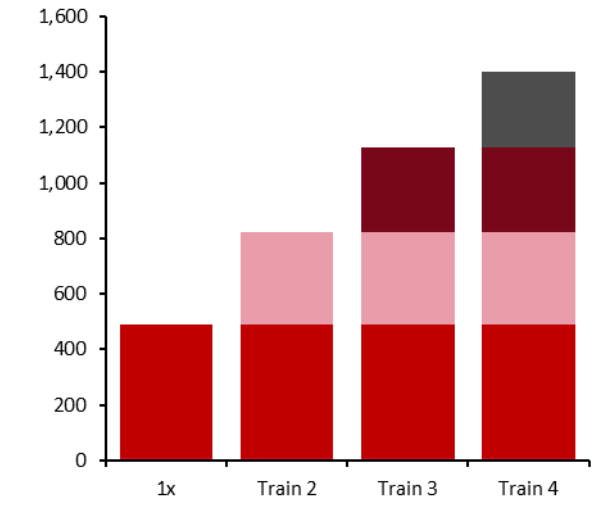
The base case provides a near-term indication of the rerating potential; however, our analysis demonstrates that over the longer term there is significant further upside more closely aligned with the figures published in the company's Class 4 study.

Phase 1 Derisking Unlocks Near Term Value, GBPm



SOURCE: *Company data, VSA Capital Research.*

Longer Term NPV Value by Train, GBPm



SOURCE: *Company data, VSA Capital Research*

Our first set of charts demonstrate how we anticipate value could be unlocked as the first train is derisked. The progression is, however, schematic and actual changes may differ. Our analysis also shows how the NPV increases as each train is added to the development. It is worth highlighting that as each train is deployed, we expect commissioning times to decrease enabling the company to bring online projects with increasing pace.

NPV Sensitivity to Lithium Prices (Lithium sulphate Y Axis, Lithium hydroxide X Axis)

	8,000	14,000	19,000	25,000	30,000	35,000
3,000	(157)	2,381	4,873	7,354	9,835	12,314
5,000	(2,109)	860	3,366	5,851	8,332	10,811
7,000	(4,113)	(807)	1,851	4,347	6,828	9,309
9,000	(6,116)	(2,810)	320	2,836	5,325	7,805
11,000	(8,120)	(4,814)	(1,508)	1,318	3,819	6,302
13,000	(10,124)	(6,818)	(3,512)	(240)	2,306	4,798

SOURCE: *Company data, VSA Capital Research. Red cells are where LITHIUM SULPHATE is 40% of LiOH price*

We have attempted to demonstrate the project's sensitivity to the lithium price, both from a revenue perspective and from that of raw material cost. Our base case assumption is that the lithium sulphate price is around 40% of the lithium hydroxide price. This is broadly in line with other estimates in the market; **AVZ Minerals (AVZ AU)** used 50% of the lithium carbonate price (we assume a discount to lithium hydroxide) for their lithium sulphate assumption. As we flex our forecast pricing this ratio remains constant, however, the ultimate performance will depend on the contracts that TVL secures for feedstock and the feedstock mix and the table shows how the changes would impact this. We assume 100% lithium sulphate whilst there may be opportunities to process lithium carbonate or reprocess lithium hydroxide which could further alter realised margins.

The main point from the sensitivity analysis is that given both operating costs and revenue are geared to lithium pricing this provides some downside protection which, in our view, means that relative to lithium mining projects TVL is potentially a more defensive option adding a useful dynamic to lithium investor's portfolios in the longer term. The rapid growth of the lithium market and number of new companies that the growth of the industry has created and will need to create suggests that cycles within the secular trend will likely continue to be volatile until the market matures.

EBITDA Sensitivity to Lithium Prices (Lithium sulphate Y Axis, Lithium hydroxide X Axis)

	8,000	14,000	19,000	25,000	30,000	35,000
3,000	106	528	950	1,373	1,795	2,218
5,000	(150)	272	694	1,117	1,539	1,962
7,000	(406)	16	438	861	1,283	1,706
9,000	(662)	(240)	182	605	1,027	1,450
11,000	(918)	(496)	(74)	349	771	1,194
13,000	(1,174)	(752)	(330)	93	515	938

SOURCE: *Company data, VSA Capital Research. Red cells are where lithium sulphate is 40% of LiOH price*

However, we also recognise that in a lower price scenario, the upfront capital does impact the NPV so we have also presented the same sensitivity applied to EBITDA to demonstrate the robust nature of the business model post the capital deployment phase. There are two factors to consider here, firstly the current valuation of ALK implies upside in almost all scenarios. The second factor is that once this hurdle is passed the project does have strong earnings potential should a period of low prices occur after the capital deployment phase. Indeed, with relatively low sustaining capital EBITDA is a reasonably reliable indicator of free cash flow and the analysis demonstrates that at cyclical lows comparable to 2018/19, the business would remain profitable.

Given the current inflationary environment we have also stress tested the NPV for rising capital costs, which highlights that the business can tolerate some modest inflation.

NPV Sensitivity to Capex Inflation

	0%	5%	10%	15%
Train 1	490	482	474	465
Train 1-4	1,402	1,370	1,337	1,304

SOURCE: *Company data, VSA Capital Research*

Risks

- **Commodity Prices**. The company is primarily exposed to the lithium market and unexpected changes to underlying prices are likely to affect our valuation.
- **Political Risk.** The UK is a low-risk jurisdiction from a political and legal perspective, the most significant risk is potential changes to the tax regime.
- **Macro Risk.** Unexpected moves in the USDGBP may impact the company.
- **Execution Risk.** The potential for delays and operating issues are an inherent industry risk, this may include delays in receiving financing or hold ups to the completion of development milestones. TVL must secure feedstock as well as offtakes, this is not yet confirmed.
- **Financing Risk.** Access to financing is a perennial risk for junior natural resources companies.

Financial Model Summary

Commodity Price Assumptions

We have assumed a flat price of US$18,000/t for lithium carbonate to which we apply a 10% premium for lithium hydroxide in Europe.

Key Macro Assumptions

Given we are using flat pricing assumptions we do not believe it is appropriate to apply an inflation factor to our forecasts at this stage. As our sensitivity analysis demonstrates, the major factor in cost is the lithium sulphate price and secondly limited detail has been published on the cost breakdown, so it is challenging to accurately apply weightings for energy inflation etc. However, as the company advance towards execution of project financing and construction, we expect to be able to provide greater visibility.

FX is primarily dependent on the USDGBP exchange rate with operating costs primarily denominated in sterling, with the exception of the acquisition of lithium sulphate most likely in USD. Revenues are realised in USD but translated to GBP. The company's share price is also denominated in GBP along with the reporting currency and our model. We use 1.25 as a long term GBPUSD rate.

Taxes & Royalties

UK corporate tax rates are set at 19% rising to 25% in 2023. Freeport status in Teesside provides certain benefits which we have attempted to capture using publicly available information; these largely relate to capital deduction allowances which mean that the project will benefit from an initial tax holiday. There are no royalties associated with the project.

Capital Expenditure

The Class 4 study has a detailed breakdown of capital expenditure for each of the two types of train planned at TVL. This forms the basis of our modelling and valuation with the capital being spent over two years for each train. We note that our model is slightly less aggressive in terms of the ramp up given that our life of project capital estimates are broadly aligned but peak funding requirements in our model are around £290m compared to the company's £336m estimate.

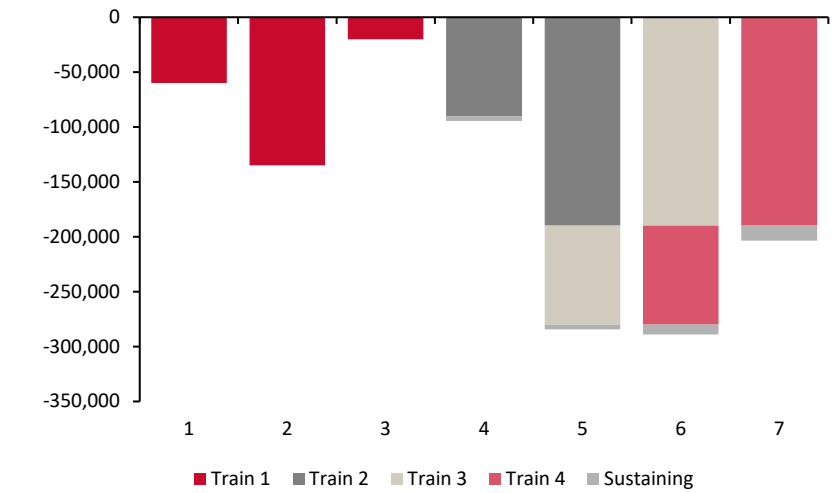
Capital Expenditure

Capital Costs, GBPm	Galuber's Salt Route (Train 1)	Electrochemical (Train 2-4)
Installation	15,681	20,862
Earthworks	1,960	1,960
Civil/concrete	5,880	7,823
Structural	9,800	13,039
Architectural	9,800	9,800
Mechanical / Platework	47,042	62,586
Piping & Valves	9,800	13,039
Electrical	9,800	13,039
Controls & Instrumentation	7,840	10,431
Total Direct Costs	117,605	152,579
Indirect Costs	66,486	86,465
Sub-Total	**184,091**	**239,044**
Contingency (17.5%)	32,216	41,833
Total	**216,307**	**280,876**

SOURCE: *Company Data, VSA Capital Research.*

Clearly, in the current environment investors are concerned about inflation of capital estimates. These are recently produced by the company and management remains in dialogue with the contractors Wave, Anzaplan and Jordproxa which have confirmed that currently the quotes for the long lead items remain valid. The capex is predominantly weighted towards the specialist processing equipment such as the crystallisers which have been covered by these discussions. Therefore, whilst we have used these estimates for our base case valuation and model, we have undertaken a sensitivity analysis of the impact of capital costs on the NPV.

VSA Estimated Capital Spending Schedule



SOURCE: *Company Data, VSA Capital Research.*

Operational Model Snapshot

We highlight that all of our ramp up assumptions and capital spending estimates are VSA's own estimates and interpretations as the company has not yet provided more detailed information. Therefore, these provide an indicative guide and is why we have at this point presented the figures in the form of Year 1, 2 etc rather than linking them into three statement analysis. We do, however, to update this in the coming months as project development advances and more specific guidance is available.

It does, however, demonstrate a robust profitable and scalable business which fills a vital part of Europe's lithium supply chain.

Operational Model Snapshot, £mm

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Production	-	-	12,000	24,000	24,000	36,000	60,000	84,000	96,000	96,000
Revenue	-	-	190	380	380	570	950	1,331	1,521	1,521
EBITDA	-	-	45	91	91	136	227	318	363	363
Tax	-	-	-	-	-	-	-	-	(38,583)	(86,220)
Capex	(60,000)	(135,000)	(20,000)	(94,500)	(284,500)	(286,750)	(201,250)	(15,750)	(18,000)	(18,000)
Free Cash Flow	(60,000)	(135,000)	25,360	(3,780)	(193,780)	(150,670)	25,550	301,770	306,298	258,660

SOURCE: *Company Data, VSA Capital Research.*

Appendix 1: Flowsheet Information

Process Description - Glauber's Salt Route

The lithium sulphate feedstock is received and dissolved in water. The crude lithium sulphate solution is transferred to impurity removal.

Impurity removal consists of two stages, where caustic and sodium carbonate solution are respectively added as pH modifiers to precipitate out key impurities of calcium, magnesium, iron, and aluminium by forming insoluble hydroxides. Precipitates are removed via filtration, prior to a final impurity removal stage using ion exchange.

The purified lithium sulphate solution is transferred to ion exchange columns, which facilitate the removal of the remaining impurities from the liquor by adsorption onto the ion exchange resin. The purified pregnant liquor solution from the IX package is sent to the causticisation stage.

The purified liquor is pumped to the lithium hydroxide reactor where caustic is added to convert Li_2SO_4 to LiOH and Na_2SO_4. Glauber's Salt is removed from the solution by exploiting its poor solubility in water at low temperatures and transferred to the sodium sulphate anhydrous crystallization circuit.

The LHM product circuit is a three-stage lithium crystallization circuit where the first stage is crude stage crystallization, the second is pure stage crystallization and the third is ultra-pure stage crystallization. The wet precipitated crystals from the third stage are then transported into the LHM drying stage with the cooled and dried LHM product bagged and dispatched to customers.

The Glauber Salt crystals that were removed report to the Glauber Salt Melter, which dissolves the Glauber Salt crystals back into the recirculating solution. This liquor is pumped to the Sodium Sulphate Anhydrous (SSA) Crystallizer, which precipitates out anhydrous Na2SO4 (or SSA) crystals. The SSA crystals are transferred to the SSA Dryer to remove all moisture and generate the final SSA product. The SSA product is then bagged and dispatched to customers.

A Zero Liquid Discharge system is incorporated to capture water excess and return it to the processes (resulting in zero environmental liquid discharge).

Electrochemical Route

The lithium sulphate feedstock is received and dissolved in Calcium rich water. The Crude Lithium Sulphate solution is transferred to impurity removal.

Impurity removal consists of two stages, where a mixture of NaOH, LiOH and Na2SO4 and a mixture of NaOH, LiOH, Na2SO4 and lithium carbonate solutions are respectively added as pH modifiers to precipitate out key impurities of Magnesium, Manganese, Iron, and Aluminium into insoluble hydroxides and silicates as Magnesium or Calcium silicates.

Precipitates are removed via filtration, prior to a final impurity removal stage using ion exchange. Target impurity levels for the Electrochemical route are different to the Glauber's Salt route, and the specifics of the process are modified for this route.

The purified lithium sulphate solution is prepared prior to ion exchange, which facilitate the removal of the remaining impurities from the liquor by adsorption onto the ion exchange resin.

The polished lithium sulphate solution from IX is mixed prepared and pH adjusted ahead of the Electrochemical cell feed. This solution is then pumped to the Electrochemical cells, whereupon with the application of an electric current, lithium sulphate is converted to

lithium hydroxide, which is transferred to lithium hydroxide Evaporation, Salt which is transferred to Salt Concentration, and Sulphuric Acid.

The lithium hydroxide is evaporated to increase the overall concentration of the solution. The concentrated LiOH is pumped to Crude Crystallisation, where it exploits the saturated solubility of LiOH in the water against that of the remaining impurities.

The LiOH crystallises out of the solution, forming LiOH crystals that can be removed and reprocessed through an additional crystallisation stage until the desired grade specifications are achieved. The wet precipitated crystals from the second stage are then transported into lithium hydroxide Drying where the cooled and dried lithium hydroxide product will be bagged and dispatched to customers.

The dilute Sulphuric Acid produced by the Electrochemical process is converted into Gypsum using Limestone or quick lime. The precipitated slurry is then transferred to Gypsum Filtration. The washed cake discharge from filtration is transported onto a stockpile where it is ready for transport off-site and sale to the market.

Lithium Conversion Factors

Species		Molecular Weight	Conversion Factors			
		(g/mol)	Li2CO3	LiCl	LiOH-H2O	LSM
Lithium Carbonate	Li2CO3	73.881	1.000	1.148	1.136	1.732
Lithium Chloride	LiCl	42.391	0.871	1.000	0.990	1.509
Lithium Hydroxide Monohydrate	LiOH-H2O	41.964	0.880	1.010	1.000	1.525
Lithium	Li	6.941	5.322	6.107	6.046	9.218
LSM	Li2SO4.H2O	127.961	0.577	0.663	0.656	1.000

SOURCE: *Company Data, VSA Capital Research.*

Appendix 2: Management Team and Key Personnel

Paul Atherley, Non-Executive Chairman

Paul Atherley is a highly experienced senior resources executive with wide ranging international and capital markets experience. He graduated as mining engineer from Imperial College London and has held a number of mine management, senior executive and board positions during his career. He is currently Chairman of LSE listed Pensana Plc and prior to that he was Chief Executive Officer of Berkeley Energia Ltd. Mr Atherley is a strong supporter of Women in STEM and has established a scholarship which provides funding for young women to further their education in science and engineering.

Sam Quinn, Non-Executive Director

Sam Quinn is a corporate lawyer with over fifteen years' worth of experience in the natural resources sector, in both legal counsel and management positions. Mr Quinn is a principal of Silvertree Partners, a London-based specialist corporate services provider for the natural resources industry. In addition, Mr Quinn holds various other Non-Executive directorships and company secretarial roles for listed and unlisted natural resources companies. During time spent in these roles, Mr Quinn has gained significant experience in the administration, operation, financing, and promotion of natural resource companies.

Previously, Mr Quinn worked as the Director of Corporate Finance and Legal Counsel for the Dragon Group, a London based natural resources venture capital firm and as a corporate lawyer for Jackson McDonald Barristers & Solicitors in Perth, Western Australia and for Nabarro LLP in London.

Helen Pein, Non-Executive Director

Helen Pein has over 30 years' experience in natural resources sector and currently serves as a director of Pan Iberia Ltd, Trident Royalties plc and Panex Resources Pty Ltd.

Ms Pein was formerly a Director of Pangea Exploration Pty Ltd, a company affiliated with Denham Capital where she was part of the team directly responsible for the discovery of a number of world-class gold and mineral sands deposit across Africa. Ms Pein is a recipient of the Gencor Geology Award.

John Walker, Chief Executive Officer

John has more than 30 years of leadership experience in the mining and advanced materials processing industries. Most recently he has been providing strategic advice to lithium mining and refining projects in the USA and UK and working as Chairman of Exawatt who provide strategic consultancy services to the battery industry.

Prior to this he served as CEO of The Quartz Corp (a joint venture between IMERYS and Norsk Mineral), a mining and processing company that supplies the world's highest-purity quartz to the solar, semiconductor and fibreoptic markets. John was a key player in driving TQC's business development, growing the company from a new entrant to the second-largest player in the high-purity quartz market.

Vikki Roberts, Supply Chain Advisor

Vikki has extensive experience in the battery supply chain industry. Most recently, Vikki was the Head of Supply Chain Strategy, Development & Control at the British multinational chemicals specialist company, Johnson Matthey Plc. Vikki's role was focused on overcoming challenges in the Lithium market, as well as establishing an ecosystem of supply partnerships throughout the industry. Vikki has expertise in innovative industries related to sustainable technologies, and now provides valuable Supply Chain consultancy to TVL.

Appendix 3: Financial Statements

Income Statement, Year Ending 31 January 2022 (GBP)

	2021
Continuing Operations	
Administrative Expenses	(466,903)
Project Development Expenses	(330,747)
Loss Before Taxation	(797,650)
Taxation	-
Loss After Taxation for the Period	(797,650)
Total Comprehensive Loss for the Period	(797,650)
Earnings per Share	
Basic & Diluted Earnings per Share (pence)	(19.875)

SOURCE: *Company data, VSA Capital Research.*

Balance Sheet, Year Ending 31 January 2022 (GBP)

	2021
Current Assets	
Trade & Other Receivables	73
Cash & Cash Equivalents	1,113,923
Current & Total Assets	1,113,996
Equity	
Share Capital	120,000
Share Premium	1,279,094
Retained Earnings	(797,650)
Total Equity	601,444
Current Liabilities	
Trade & Other Payables	512,552
Current & Total Liabilities	512,552
Total Equity & Liabilities	1,113,996

SOURCE: *Company data, VSA Capital Research.*

Statement of Cash Flows, Year Ending 31 January 2022 (GBP)

	2021
Cashflows from Operating Activities	
Loss for the Year Before Tax	(797,650)
Increase in Receivables	(73)
Increase in Payables	512,552
Net Cash Outflow from Operating Activities	(285,171)
Cashflows from Financing Activities	
Issue of Shares (Net of Share Issue Expenses)	1,399,094
Net Cash Inflow from Financing Activities	1,399,094
Net Increase in Cash & Cash Equivalents During the Period	1,113,923
Cash at the Beginning of the Period	-
Cash & Cash Equivalents at the End of the Period	1,113,923

SOURCE: *Company data, VSA Capital Research.*

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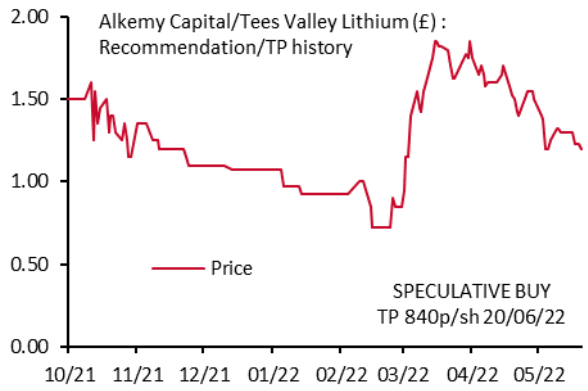
Recommendation and Target Price History



Valuation basis

Our valuation is derived from a risked NPV calculation and peer group EV/t in situ resource value.

Risks to that valuation

Commodity prices, political risk, execution risk, financing risk.

This recommendation was first published on 20 June 2022.

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