5th August 2022

Sector: Lithium, Energy, EVs

Lithium hydroxide production

Market data

Markets	LSE Main Market
Ticker	ALK
Price (p/sh)	109
12m High (p/sh)	210
12m Low (p/sh)	50
Ordinary shares (m)*	7.19
FD share capital (m)	7.19
Mkt Cap (£m)*	7.8

**includes 1.2m new shares from placing, to be admitted to trading on 9th Aug*

Source: Alpha

Description

Alkemy is seeking to develop a UK-based refinery to produce a low carbon-footprint lithium hydroxide product to supply the burgeoning European battery market.

www.alkemycapital.co.uk

Board & key management

Non-Exec Chair	Paul Atherley
NED	Sam Quinn
NED	Helen Pein
CEO (TVL)	John Walker

Analyst

phil.swinfen@shardcapital.com
020 7186 9008
Phil Swinfen

Alkemy Capital Investments plc

The missing link in Europe's lithium evolution

We initiate full coverage on Alkemy Capital Investments plc (Alkemy). Alkemy's 100%-owned subsidiary Tees Valley Lithium (TVL) is developing a world-class, low carbon, lithium hydroxide (LHM or LiOH) refining facility at the Wilton International Chemical Park in the Teesside Freeport, UK. Vying to be the first of its kind in the UK, the plant will process a variety of lithium feedstocks to produce a low-carbon footprint, battery-grade lithium hydroxide product suitable to supply the rapidly expanding European battery market for electric vehicles ("EVs") and renewable energy storage.

- **UK hydroxide project.** TVL envisages production of **96,000tpa of battery-grade LHM** via staged/modular development, comprising 4 processing trains, each with a 24,000tpa capacity. Train 1 will follow a conventional process route, with subsequent Trains 2-4 employing a lower carbon electrochemical route using substantially fewer chemical reagents by utilising green, renewable power. Metallurgical testwork completed by leading lithium laboratories has yielded **ultra-pure LHM exceeding industry standards** and other saleable by-products. LHM is the key input for nickel-rich NMC lithium batteries favoured in European EVs. TVL's process also provides the option to produce a percentage of lithium carbonate alongside LHM, allowing access to the growing LFP (lithium-iron-phosphate) battery market which requires lithium carbonate.

- **Superlative location:** a Freeport zone within an established chemicals park proximal to the UK's 5th largest port provides a range of incentives and direct access to the burgeoning European market, not least renewable power meaning that TVL will be a **100% certified green energy operation from day zero.** We visited the site in June 2022 and were impressed by the true "plug & play" credentials. With green energy, ready access to reagents and local skilled labour, the area is likely to attract more 'active material' and battery industries to Teesside.

- **Europe needs to play catch up.** The ban on petrol/diesel vehicles from 2030 is driving a seismic shift for the demand of electric vehicles. By 2030, the European battery gigafactory landscape will have evolved significantly to an expected 1,400 GWh capacity potentially requiring c.675ktpa of lithium hydroxide. **Current LiOH production capacity in Europe is zero**. Despite any increase in the use of LFP batteries, LiOH remains likely to retain a significant portion of the market in Europe with NMC batteries alleviating the 'range anxiety' of European consumers. But there's a problem, EVs roll off the production line with a 5–7-year carbon deficit to reach parity with internal combustion engine vehicles due to the significant carbon footprint of mining, processing and transportation. This is particularly acute for LiOH produced from hard rock sources mined in Australia and refined in China. New EU and UK **legislation is increasingly putting scrutiny on OEMs and battery makers to reduce CO_2 emissions** across the entire lithium supply chain. Carbon pricing mechanisms could add a significant cost to lithium imports into Europe.

- **TVL's solution. TVL's solution is to lower the carbon footprint of imported lithium** by processing a range of imported, low-carbon lithium feedstocks and avoid the bulk shipping of unrefined spodumene concentrates around the world. TVL plans **to become a major supplier of lithium hydroxide** by 2030. TVL can use a variety of feedstocks, such as lithium sulphate (LSM), a precursor lithium product. LSM can also be accepted from **battery recycling**, an industry that can only increase in scale. TVL can also process crude/technical grade lithium carbonate from brine and mica projects, the latter could help to unlock and fastrack Europe's nascent lithium mica mining projects. **TVL has an MOU with leading global metals trader, Traxys,** to source and supply lithium feedstock for Train 1 of TVL's planned processing facility in Teesside, significantly de-risking the first development phase of the project.

- **Feasibility metrics.** April 2022 Feasibility, project economics: **post-tax NPV8 of £2.2bn**, a **post-tax IRR of 32.9%**, a 26% EBITDA margin and short payback period. **A fast-track timeline is anticipated with commercial production from Q4 2024,** with no requirement to develop a mining operation.

- **Shard Valuation.** Our indicative valuation for the current stage of development is £45m versus the current market capitalisation of £7.8m*. On a per share basis, this equates to 614p/sh FD. ALK is trading at 0.12x to our risked NAV, with a 742% return to the share price (3-8-22 at close) and 0.18x/463% to today's 109p/sh intraday. This is based on a highly risked scenario-based NAV driven by our NPV8% of £442m for the first stage (Train 1) of the TVL Project. We see annual revenue and EBITDA at £429m and £98m respectively based on our conservative numbers. Compelling upside is available from higher lithium prices in addition to capacity increases.

Alkemy has an unrivalled opportunity to become a first mover and beat other lithium hopefuls to the punch by directly supplying the European market with low carbon-footprint lithium. There are hydroxide projects in gestation by other companies, but the TVL plant has fast-track credentials to be envied with low capital intensity and a superlative site location. TVL could win this race.

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Strategy overview - low-carbon lithium for Europe

TVL has entered into an MOU with metals trader, Traxys to source and supply lithium feedstock.

Lithium sulphate feedstock could also be sourced from battery recycling

- Alkemy and TVL (Alkemy's wholly-owned subsidiary) is aiming to become **Europe's first independent lithium chemical processing hub**. The company's April 2022 Feasibility Study sets out a route to produce a high specification, battery quality lithium hydroxide product for sale directly into the European battery market. Despite Europe being set to host >30 battery gigafactories by 2035, the current lithium hydroxide production capacity in Europe is zero.
- TVL plans to build a modular plant capable of processing a wide range of imported low-carbon lithium feedstocks including lithium sulphate and lithium carbonate with the **plan to supply 15% of European hydroxide demand by 2030[1].**
- The shipping of higher intrinsic value primary lithium sulphate and other feedstocks rather than spodumene drastically reduces the logistics/shipping carbon footprint of converting lithium concentrate and feedstocks to battery-grade lithium chemicals.
- The feasibility envisages production of **96,000tpa of battery-grade LHM** (lithium hydroxide monohydrate) via staged/modular development. This will comprise 4 processing trains, each with a 24,000tpa capacity. TVL also has an option to produce a lithium carbonate stream.
- **The proposed location: a Freeport zone within an established chemicals park proximal to the UK's 5th largest port** provides a range of incentives and direct access to the burgeoning European market. Powered by renewable offshore wind and dedicated to low waste, TVL will be a 100% certified green energy operation from day zero.

The opportunity - European battery landscape

- **A now familiar thesis** that hardly needs repeating. Due to the UK/EU's ban on petrol/diesel ICE vehicles from 2030 onwards, EVs will become more prevalent. The unrelenting build out of lithium-ion battery manufacturing capacity means that the European gigafactory landscape in 2030 is expected to be an annual 1,400 GWh industry by 2030 according to S&P. This battery capacity will require both lithium carbonate and lithium hydroxide in varying proportions dependent on the prevailing battery chemistry. This projected battery capacity implies an annual requirement of approximately 675,000tpa of lithium hydroxide by 2030[2]. This could be even higher if the nickel-rich NMC battery chemistry gains further traction.
- **The current situation is that Europe has no domestic production** of lithium hydroxide and is entirely reliant on imports. Europe will need sources of both lithium carbonate and lithium hydroxide due to the differing needs of cathode and battery makers.

The carbon problem

Lithium responsible for 38% of the CO_2 footprint of a NMC811 battery[4]

Lithium is not substitutable in a Li-ion battery

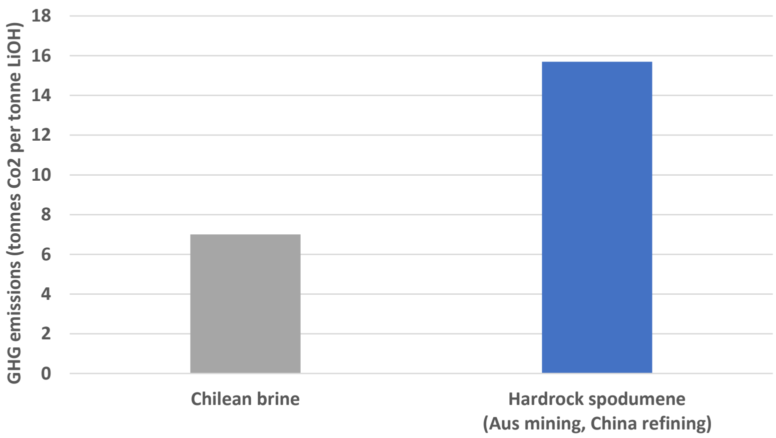
- **Greenhouse gases.** The manufacture of battery electric vehicles (BEV) currently emits more greenhouse gases than the production of comparable vehicles with internal combustion engines (ICE). From rolling off the production line, electric vehicles can take over 5 years[3] to reach carbon parity due to the higher carbon footprint of the combined vehicle and battery manufacturing process.
- **Increased scrutiny.** Although the current focus for OEMs is on measurable CO_2 emissions from vehicles across the fleet, battery makers and vehicle OEMs will come under increasing scrutiny to meet targets that also incorporate the impact of the entire lithium supply chain. This will likely be the case for most raw material inputs into an EV including other metals, graphite etc. The situation is particularly acute for lithium given the additional processing (and logistics) required to produce the requisite battery-grade lithium chemicals.
- **Downstream improvement.** With limited opportunities to improve the carbon footprint of the mining stage over and above utilising clean energy sources, the main focus areas for improvement will involve relocating segments of the battery value chain to within Europe and reducing transport. Even if any of the limited number of potential UK-based lithium

[1] Based on our assumption of 675ktpa European hydroxide market by 2030
[2] Assuming the 1,400GW European battery capacity, 50% hydroxide and 0.88 LiOH for 1 tonne of LCE
[3] Neometals (ASX: NMT) estimates
[4] Benchmark forecasts – SQM World Tour

projects come on stream (e.g., Cornish Lithium), the scale of production is woefully inadequate to meet current and forecast demand and production is likely many years away, especially for projects pioneering commercially untested DLE (direct lithium extraction) processing technology.

- **Hardrock lithium sources are a key focus.** At present, the majority of lithium units to make battery-grade lithium hydroxide tend to come from hard rock sources of lithium, predominantly spodumene hosted by pegmatites. Lithium from brines can be processed into lithium hydroxide but the initial brine-derived product is lithium carbonate. The production of hydroxide from brines requires an additional processing step to convert carbonate to hydroxide. This is certainly the case until the various derivatives of direct lithium extraction have been commercially proven. Thus, high quality and high purity spodumene tends to be the favoured feed stock for hydroxide production.

Figure 1 – Lifecycle GHG emissions by input and process for LiOH production



Source: Kelly et al, Resource, Conservation & Recycling 174 (2021) 105762

- **The carbon footprint issue.** The issue is that producing high-purity lithium chemicals such as lithium hydroxide ("LiOH" or alternatively "LHM" an abbreviation of lithium hydroxide monohydrate) from hard rock sources is significantly more carbon intensive than equivalent production from brine sources. There are a multitude of reasons for this but primarily it comes down to location, transport and energy consumption (brines not as reliant on diesel).. The problem is that the majority of large-scale, high-quality spodumene deposits and mining operations are located in Australia, the hydroxide conversion capacity is located in China and the likely end market is Europe.

- **The culprits.** The spodumene ore is mined and concentrated at the mine site often using diesel generated power, before being trucked to port for shipping to China as a concentrate containing only around 6% LiO_2 (less than 3% Li content). I.e., transporting a bulk cargo that is c.97% waste. The spodumene concentrate is then trucked inland to China for refining into LiOH which relies heavily on coal-fired energy. The finished LiOH product is then transported to Europe or elsewhere. *See page 19 for further details*

Why Europe will need lithium hydroxide

- **The fast-paced lithium sector** is evolving quickly, and it is challenging even for industry experts to accurate forecast lithium demand and the requirements for the main two lithium chemicals used in batteries – lithium carbonate and lithium hydroxide. The answer to this question will be dependent on the mix of battery chemistries employed by auto makers. In practice we believe that both variations will be required in large quantities as it's not an either/or (VHS vs Betamax analogy) situation where one product will prevail exclusively. It is not possible for European battery makers to focus only on imported brine-sourced lithium carbonate with a lower carbon footprint because certain batteries require lithium units in the form of hydroxide.

TVL's initial focus will be on producing lithium hydroxide as required by NCM-811 batteries

- **Different inputs.** Lithium hydroxide tends to be the used in nickel-rich NMC-811 batteries and in NCA (nickel, cobalt, aluminium) cathode materials. NMC stands for Nickel, Manganese, Cobalt and the 811 means 8-parts nickel, 1-part cobalt and 1-part manganese. Thus NMC-811 is a nickel-rich chemistry. Lithium carbonate can still be used for the lower nickel NMC batteries (NMC-111, NMC-442, NMC-532, NMC-622) but the high nickel chemistries require lithium hydroxide.
- **Nickel-rich chemistries well suited to European EV market.** In general, the NMC batteries have a much higher energy density and higher voltage than other battery chemistries which increases range and also lowers the size/weight of the battery pack required for a given range. Thus, the adoption of NMC batteries in electric vehicles addresses one of the key barriers perceived by potential customers – **range anxiety.** The flipside is that cobalt plays a major part in the thermal stability of the NMC batteries. According to *Argus*, as the nickel content approaches 60%, the high temperature required to synthesis cathode material with lithium carbonate can damage the crystal structure of the electrode and change the oxidation state of the nickel metal. One solution to stability issues is to use lithium hydroxide which allows rapid and complete synthesis at lower temperatures increasing the performance and life span of the battery.

With capability to divert some of the LHM capacity to make lithium carbonate, TVL can be an active player in the market for all battery chemistries from NCA and NMC to LFP.

- **An evolving sector.** That said, preferred battery chemistry may change over time. For example, the use of lower cost LFP (lithium-iron-phosphate) batteries is significantly more prevalent in China and increasingly so with other western companies e.g., Tesla and Ford. The LFP battery still contains lithium but does away with the need for nickel (cost) and cobalt (ethical DRC supply issues). LFP batteries have a lower energy density and thus lower range, but they are more stable and much cheaper, resulting in a lower cost EV and bringing other advantages including the ability to repeatedly charge to 100%. LFP batteries typically use technical-grade lithium carbonate. TVL has an option to produce carbonate as well as LHM.

  Range anxiety is something that is likely to remain much more important for European and UK consumers than the typical Chinese buyer of an EV. Consequently, this is why we believe that nickel-rich batteries with a high energy density (requiring hydroxide) will continue to have a place in the European market.

Alkemy’s and TVL’s solution

- **New European lithium hub.** Alkemy and its 100%-owned subsidiary, TVL, plans to develop a new lithium processing hub in the UK to be located at the Wilton international Chemicals Park, the first of its kind in the UK.
- **Imported lithium feedstock.** The facility will process imported low-carbon lithium feedstock from a variety of sources. The feedstock will include higher value-add lithium products such as LSM (lithium sulphate monohydrate) and crude lithium carbonate from several sources. The processing of these intermediate lithium products helps to reduce the carbon footprint of shipping bulk, unrefined spodumene concentrates around the world. This strategy will replace two long shipping journeys of unrefined concentrate, with a single shipping journey of a smaller volume, intermediate lithium product.
- **Modular build out.** Alkemy envisages total production of **96,000tpa of battery-grade LHM** (lithium hydroxide monohydrate) via staged/modular development. This will comprise 4 processing trains, each with a 24,000tpa capacity. Train 1 will follow the conventional Glauber’s Salt process route whilst Trains 2 to 4 will employ **a low-carbon Electrochemical route** utilising renewable sources of low-cost green power.
- **Hydroxide for Europe.** At full 96,000tpa capacity, the Tees Valley Lithium project has the potential to make a meaningful contribution towards Europe’s lithium hydroxide requirement by 2030. Europe’s decarbonisation legislation, “Fit for 55” and the proposed Carbon Border Adjustment Mechanism (CBAM) will add a premium (based on the CO_2 footprint and carbon price) to lithium chemicals imported to Europe. This will provide a strong incentive for European customers to source low-carbon lithium. Irrespective of any carbon cost added to UK produced material as a result of carbon pricing, TVL’s product will start with a significant carbon advantage over the typical Australia via China sourced imports. *See page 21*

No mining. Not exposed to timelines of developing a mineral resource and subsequent mining operation with can be fraught with delays and permitting issues.

- **Fast track and low capex.** The TVL plant will be located at Wilton, a “plug & play” site which offers the opportunity for a fast-track development and lower capex by virtue of the existing connections to power, utilities and access to reagents. The Wilton site location also brings benefits such as pre-consented planning which removes a long permitting process, and access to a technically skilled workforce. With other industrial customers on the doorstep, TVL also has options to sell any by-products locally. In addition to vastly speeding up the development and construction period and reducing capex, the infrastructure and logistics-rich site will significantly reduce development and execution risk. *See page 23*

Multiple feedstocks, multiple product choices

Ability to process crude/technical grade carbonate from lithium mica operations may give the emerging European mica-derived lithium producers a faster track option to production – alleviating the hassle and complexity of making EV-spec carbonate. TVL could be the ideal partner in this regard

- **Multiple input feedstocks.** The TVL plant has been designed to accommodate various types of feedstock from multiples sources including primary lithium sulphate (LSM or Lithium Sulphate Monohydrate) and crude/technical grade lithium carbonate. These feedstocks can be an intermediate lithium product from existing mining/processing operations, or sourced from recycled batteries.
- **Flexibility.** This provides flexibility of supply and the ability to respond to changes in market dynamics, pricing and material availability. At present the plan is based on sourcing LSM from third parties for processing at the TVL site. However, in the future, potential exists to accept material from a variety of sources. The plant is configured to be able to deal with material of differing grades and impurity profiles. This means that it could be possible to source material derived from different lithium deposit types, such as crude carbonate from brines and lithium mica projects, in addition to LSM sourced from spodumene. TVL is confident that it will be able to secure sufficient LSM for all 4 trains (see Traxys deal).

  This has important implications for European based projects such as European Metals' (ASX/AIM: EMH) Cinovec project in the Czech Republic, Zinnwald Lithium's (AIM: ZNWD) Zinnwald project in Germany, Infinity Lithium's (ASX: INF) San José project in Spain, along with British Lithium and Cornish Lithium. These are all mica hosted deposits, essentially all Zinnwaldite.

Figure 2 - Multiple feedstocks possible and options to produce a variety of end products

Source: Tees Valley Lithium

It may be possible to produce nickel sulphate from recycling nickel and recovered sulphuric acid

- **Multiple Products.** The current plan is for all 4 Trains to produce lithium hydroxide, but the modular nature of the development means that it could be possible develop subsequent processing trains to produce battery-grade lithium carbonate depending on prevailing battery chemistry and offtake demand. As sulphate is a by-product of hydroxide production, it may also be possible to produce nickel sulphate by bringing Class 1 nickel via the adjacent port.
- **Stability.** Battery-grade Lithium Hydroxide does not travel particularly well. It is more complicated to handle and store and tends to have a short shelf life, typically of around only 6 months before being unsuitable for use in high-quality batteries. Hydroxide tends to absorb water (it's hygroscopic) and is subject to oxidation which makes it difficult to stockpile. Thus, a UK based source of hydroxide should be highly sought after by off-takers working on a just-in-time basis versus hydroxide from China that's already been on a ship for a month.
- **By-products and zero waste.** A combination of plant design and location means that TVL is aiming for a zero-waste operation. Some of the main by-products from the production of lithium hydroxide can be sold such as Anhydrous Sodium Sulphate from the Glauber's Salt route and Gypsum from the Electrochemical route. The proximity of a wide variety of other industrial users means that even by-products with a low intrinsic value can likely be sold into a ready market. On the process side, a Zero Liquid Discharge system is incorporated to capture water excess and return it to the processes (resulting in zero environmental liquid discharge). The UK already imports around US$38m worth of gypsum annually, largely from Spain, Germany and Norway[5] and in fact British Gypsum has a contract with PD ports to import gypsum from Europe via Teesside for despatch by rail to British Gypsum's plants at Kirkby Thore in Cumbria and Sherburn-In-Elmet in Yorkshire.

[5] World Bank 2020

What is Primary Lithium sulphate?

- **Primary lithium sulphate** ($Li_2SO_4.H_2O$, LSM or sometimes called PLS) is an intermediate, higher value lithium chemical product which can be used as a raw material for the production of lithium carbonate, lithium hydroxide and other lithium products. It can be produced from a variety of flow sheets as an intermediate step but typically from spodumene where the LiO_2 in the ore is converted to lithium sulphate through calcining and leaching. Lithium sulphate could also potentially be produced from lithium battery recycling. The lithium sulphate market is in its infancy, but we expect the market to continue to grow given the demand base is similar to that for spodumene concentrate and due to the desire to reduce shipping volumes. LSM is regularly traded between Chinese convertors.
- **The production of LSM from spodumene is not a trivial process** and requires an additional lithium sulphate plant as a bolt-on after spodumene concentration. A typical flowsheet takes spodumene concentrate and crushes it further before calcining, acid roast, leaching, solution purification, followed by evaporation and crystallisation. Thus, it requires access to more reagents, foremost sulphuric acid, and ideally natural gas for the calcining process although diesel could be used. Electricity tends not to be used to power the kilns which operate at over 1,000°C, but some companies are developing large electricity powered calciners.
- **Advantages.** One of the main advantages of producing LSM at the mine site is that it typically takes c.3.4t of spodumene (SC6) concentrate to make one tonne of lithium sulphate. Therefore, it drastically reduces shipping volumes in the onward distribution chain and stops waste being shipping around the world. As a higher value product (assumed to trade at 50% discount to technical grade lithium carbonate), producing LSM could help spodumene miners capture higher margins. As mentioned, LSM is also more stable and easier to transport and store.
- **Supply likely to grow.** Given the general lack of vertical integration in the lithium sector, and added complexity of producing LSM vs spodumene concentrate, current supply direct from miners is limited. We believe this will start to change, as we have seen with more companies contemplating vertically integrated operations to produce hydroxide on site (e.g., RockTeck, Piedmont Lithium, Keliber Oy). One company pursuing this strategy is AVZ Minerals (ASX: AVZ), where the April 2020 feasibility study sets out plans to produce 700ktpa spodumene SC6 and 45ktpa of primary lithium sulphate from the company's Manono project in the DRC. The capital cost for the construction of the PLS plant is US$178m.

Battery scrap and recycling could be an important source of LSM and other feedstocks.

- **Recycling and scrap as a source.** Another very important source of feedstock for batteries is from the gigafactories and active materials manufactures themselves. The two main types will be cathode scrap (off-spec batteries) and recycled batteries resulting in mechanically shredded "black mass".

  The obvious source of recycling is end of life (10-15 year) batteries which will of course gradually increase year by year. However, often overlooked is that gigafactories produce scrap from day 1 of operation. Material wastage from all production processes can range from 10%-30% of material inputs[6]. Alkemy takes a conservative estimate of 8% immediate battery scrap available and added to this, material from off-spec batteries which can be substantial. Alkemy assumes 2% of battery production could be off-spec, but the figure may be much higher, especially in the early years of gigafactory operation. From 2017 to 2020, Panasonic cell production for Tesla averaged 39% cell production loss[7] for example. Taking a 10% scrap and off-spec assumption to 2030 forecast LCE supply of 1.2Mt implies 120,00tpa secondary material available just in Europe.

  Creating a more fluid market for LSM could mean that some battery recyclers can sell material at the LSM stage and avoid the more technically/economically challenging small-scale conversion of LSM to lithium carbonate.

[6] Gigascrap: The Path To Matching Li-ion Production & Recycling Capacity In Europe. C. Parker, medium.com

[7] Panasonic, Tesla, American Manganese Inc

TVL has an MOU with Traxys to source/supply feedstock

- **Source and supply.** TVL has entered into a memorandum of understanding (RNS 21-7-2022) with Traxys to source and supply lithium feedstock for TVL's planned processing facility in Teesside.
- **Feedstock for Train 1.** Under the MOU, Traxys has agreed to cooperate and collaborate with TVL to source and supply lithium feedstock for train 1 (24,000tpa LiOH) of TVL's processing facility located at the Wilton. TVL plans to commence construction of Train 1 later this year. Based on our own modelling assumptions and chemically derived ratios, we estimate that this could imply an LSM feedstock requirement of just under 40,000tpa.
- **De-risking.** The ability to consistently source feedstock at an appropriate cost is one of the primary risks of the planned operation, in our view. Consequently, we see this MOU with Traxys as helping to significantly de-risk the project.
- **Traxys is a major player.** Traxys is a leading, privately owned, physical commodity trader and merchant in the metals and natural resources sectors. Its logistics, marketing, distribution, supply chain management, and trading activities are conducted by over 450 employees in over 20 offices worldwide, with annual turnover in excess of US$8bn.
- **Lithium business expanded.** Traxys sources and finances raw materials in every major market but recently the group expanded its lithium trading business as part of a commitment to continue building its technology and battery materials franchise globally. Traxys Europe recently joined the International Lithium Association, an industry membership organisation dedicated to ensuring that Lithium is ethically supplied worldwide and to share best practices in determining and achieving lithium supply chain efficiencies. In 2019, Traxys established a battery materials joint venture the Pallinghurst Group to invest in large, low-cost projects predominantly located in investment grade jurisdictions across North America, Europe and Australasia. The JV focuses on the entire value-chain, from sourcing raw materials to managing the beneficiation and value-add process, as it supplies battery grade materials to major battery makers and their intermediate suppliers globally. Traxys also has offtake agreements with various companies including Lepidico (ASX: LPD) and European Lithium Ltd (ASX: EUR).
- **Other supply initiatives.** TVL is also investigating the possibility of building an intermediate lithium product refinery in Western Australia. The rationale would be to act as a regional refinery hub which could take existing SC6 material from the plethora of Western Australian spodumene producers. This spodumene concentrate could then be refined into an intermediate product such as LSM before shipping to TVL's refinery in the UK. We don't have any more details of this initiative yet, but it makes sense given that many spodumene producers will not have sufficient production scale to justify a standalone refinery and it gives companies an opportunity to sell SC6 domestically.

Battery-grade lithium hydroxide already produced

- **Testwork.** TVL has already completed comprehensive metallurgical testwork programmes with work undertaken by several leading laboratories in the field of lithium processing and treatment. *See page 29*
- **Battery-grade.** This work demonstrated that an ultra-pure battery grade lithium hydroxide product, exceeding industry-recognised standards can be produced from low quality industrial grade (95%) lithium sulphate.
- **High-spec.** The product specification of TVL's battery-grade lithium hydroxide was also independently validated by an internationally recognised cathode active material manufacturer as well as a prominent European-based battery technology manufacturing company. The specification was found to be superior to prevalent Chinese standard specification GB/T 26008-2020 D1.

TVL can take advantage of margins

- **Price dynamics** in the lithium market have been extremely volatile and we see this trend continuing. For TVL, the absolute level of lithium prices is not as important as the margin between input feedstock and output saleable product. In this case, it is the margin between the cost of primary lithium sulphate as the feedstock and the realised price of saleable lithium hydroxide. Alkemy's feasibility study assumes a long-term lithium sulphate price of US$10,000/t and a long-term lithium hydroxide price of US$25,000/t. The cost of feedstock represents around 85% of total operating costs[8] per finished tonne of lithium hydroxide and therefore the margin between the two remains critical.
- **Opportunities.** This does give TVL an opportunity to take advantage of changing pricing trends and volatility. Although we would typically expect hydroxide to be sold on a long-term contracts to off-takers due to the stringent spec and quality requirements, TVL will have more freedom to be fleet of foot and act as a merchant lithium refiner for the feedstock side of the business. In practice, the company and its chosen trading partners will be able to source feedstock from multiple sources and prices depending on supply dynamics and any temporary market anomalies. Lithium prices can be complex and will continue to change, tied to the fortunes of prevailing battery chemistry but also influenced by contract pricing and liquidity in the spot market. For example, the premium price of hydroxide over carbonate has flipped to a negative spread at times over the last year or so. Long-term, TVL still retains the option to produce a carbonate product with future trains. In this way, we believe TVL can respond positively to changes in the lithium market and not get left behind.

[8] Based on our own modelled assumptions

TVL should “beat competitors to the punch”

► **Europe does have some hydroxide ambitions.** Given the pressing need for Europe to develop its own integrated battery value chain, there has actually been a raft of potential projects announced that could result in UK and European lithium hydroxide supply. In broad terms, these are a mix of 1) mining projects with integrated refining capability, 2) standalone refineries and convertors and 3) Geothermal/DLE projects.

Figure 3 - Potential sources of European lithium hydroxide supply

Company	Mkt Cap (£m equiv)	Project	Product	Type	Prod (tpa)	Capex (US$m)*	Stage	Estimated 1st production	Location	Capital Intensity (US$/t annual capacity)	Geol
Alkemy (TVL Train 1)	**5.6**	**TVL**	**LiOH**	**Refinery only**	**24,000**	**265.68**	**Feasibility**	**Q4 2024**	**UK**	**11,070**	**-**
Green Lithium (+Trafigura)	private	-	LiOH	Refinery only	50,000	615.0	site selection	2024	UK	12,300	-
Galp / Northvolt	private	Aurura JV	LiOH	Refinery only	31,500	707.0	site selection	2026	Portugal	22,444	-
Livista	private	-	LiOH	Refinery only	30,000	n/a	unknown	unknown	C.Europe		-
European Metals	73.1	Cinovec	LiOH	Mining/refining	29,386	644	Feasibility	unknown	Czech Rep	21,908	mica
Bondalti	private	-	LiOH/Li_2CO_3	Refinery only	25,000	n/a	Pilot plant	unknown	Portugal		-
Viridian	private	-	LiOH	Refinery only	25,000	n/a	Feasibility	2025	France		-
RockTeck Lithium	209	Guben Convertor	LiOH	Refinery only	24,000	468.0	Engineering	2024 onwards	Germany	19,500	-
AMG Lithium	private	-	LiOH	Refinery only	20,000	n/a	Construction	Late 2023	Germany		-
Infinity Lithium	32.2	San Jose	LiOH	Mining/refining	19,480	532	Scoping Study	2026 ?	Spain	27,310	mica
Keliber OY	private	Keliber	LiOH	Mining/refining	15,000	482	Feasibility	2024-2026	Finalnd	32,133	spod
Vulcan Energy (Phase 1)	619	Upper Rhine	LiOH	Geothermal & DLE	15,000	715.0	PFS/Feas	2024	Germany	47,667	-
European Lithium	59.2	Wolfsberg	LiOH	Mining/refining	10,500	508	PFS/Feas	unknown	Austria	48,411	spod
Zinnwald Lithium	24.4	Zinnwald	LiOH	Mining/refining	10,000	n/a	Feasibility	unknown	Germany		mica
Cornish Lithium	private	Trelavour	LiOH	Mining/refining	7,800	243.8	Scoping study	2026	UK	31,256	mica
Cornish Lithium	private	United Downs	LiOH	Geothermal & DLE	500-1,000tpa	n/a	Pilot plant	unknown	UK		-
Weardale Lithium	private	County Durham	LiOH/Li_2CO_3	Geothermal & DLE	unknown	n/a	Resource eval	unknown	UK		-
				sum	*337,166*				*Avg*	*29,215*	

**Capex converted to US$ equivalent*

Source: Shard Capital, company reports, press releases

► **Timelines, capex and execution look uncertain**. After doing a deep dive into the sector, we were actually surprised how many potential European/UK hydroxide projects have appeared over the last 18 months or so. Some of these projects have target dates attached for first production, but having been through presentations, reports and press releases, many of these timelines look wildly optimistic, in our view. This is especially true for some the large mining-based projects in the PFS/feasibility stage. Delays due to permitting, financing or technical considerations are part and parcel of the mining industry. Some of these projects are in danger of missing the boat, in our view.

► **Refinery projects look to have shorter lead time**. The standalone refinery/convertor projects by virtue of dispensing with the upstream mining component, look to have a better chance of meeting timelines. Although, putting aside the fact that most of these projects are being developed by private entities (thus details are scant), there appears to be little substance behind some of the new entrants, with projects at a seemingly very early stage of development, yet with timelines and production numbers attached. It’s challenging to work out which of these projects have a reasonable chance of development and what the real timeline might look like. Green Lithium, a private company with a similar strategy to TVL is seeking to develop a UK hydroxide refinery. The company has recently signed a supply-chain agreement with metals trader Trafigura, in a similar vein to TVL and Traxys. No UK site location has been revealed yet, but Green Lithium is currently raising development capital.

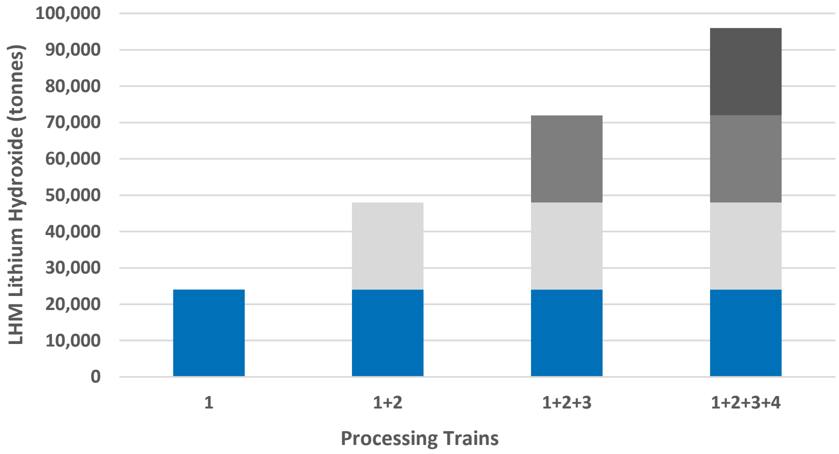
TVL's project has a much lower capital intensity than other hydroxide projects by being a refinery only, and we believe it has a greater likelihood of development

- **Technology shift required.** We note that some of the potential capacity slated to come online is dependent on relatively new technology. Take geothermal projects using DLE (direct lithium extraction) for instance. This has by and large, been unproven beyond pilot plant stage to a commercial scale and due to variable chemistries, we believe that what works for one particular project may not be directly transferrable to another project, location or deposit.
- **Production scale still insufficient**. Referring to the table on the previous page, we don't believe that all these projects will be successful in getting over the line, and certainly not within the indicated timeline. Even if they did, summing the slated annual capacity for all these potential projects only adds up to c.337kpta lithium hydroxide which falls significantly short of projected 2030 demand levels. Clearly, battery chemistry trends may change, but based on current understanding, it seems clear that Europe has a challenge to fill the projected lithium hydroxide deficit from domestic, lower carbon sources.
- **Capital intensity**. Beyond technical and permitting issues, these projects all need to be funded. The capex tag for these types of projects is significant. It's not necessarily an apples/apples comparison to mix in mining projects with refineries but if you take the view of what capital expenditure is required to produce the finished product irrespective of upstream process, then looking at capital intensity is instructive. TVL's capital intensity for Train 1 is c. $11,000/t of annual LiOH capacity, around 1/3 of the $29,000/t average for peer European hydroxide projects. This is clearly not an apples-to-apples comparison, because it's a mix of refineries and 'mine to concentrate' or 'mine to refinery'. However, the rationale for including it here is to point out the large capex tags for the integrated mine-based projects that will require financing. So, if we're saying "who can start producing hydroxide in the critical 2025-2030 window and what might it cost to get there?", in order to gain exposure to the hydroxide market, it's the refiners who will get into production first because they have a smaller, more manageable capex and quicker timeline. Thus, we still think it's worth referencing as a data point as an all-in capex in order to get to the end point of producing a single tonne of LiOH. Although the margins are different between miners and refiners once in production, the point here is the cost to get to production, irrespective of upstream process.
- **Winners**. We believe the winners in the European lithium space will be the producers and refiners that can get into production and ramped up in the 2025 to 2030 window. Given TVL's infrastructure and logistics advantages and low capital intensity, we believe that TVL will one of this select group of first movers. Investment options in terms of listed equity are limited and apart from Alkemy, most refining projects remain private at this stage.
- **Big projects, big problems**. There are no large "super projects" that can come to the rescue in terms of supply Europe with low-carbon lithium. Even the major miners are struggling. Rio Tinto for example was planning to develop the Jadar project in Serbia by exploiting a jadarite deposit, a lithium sodium borosilicate mineral. Production of c. 58,000tpa lithium carbonate along with boric acid and sodium sulphate was planned for 2027 onwards. However, in January 2022, the Serbian Prime Minister announced Serbia was withdrawing the spatial plan and revoking licences related to the project.

Feasibility Study summary

► **Feasibility completed.** In April 2022, Alkemy reported results of the Feasibility Study for the TVL lithium hydroxide processing facility to be located at Wilton. The project economics were based on the modular development of four trains each with a 24,000tpa capacity, to produce up to 96,000tpa of battery-grade lithium hydroxide.

Figure 4 - TVL Feasibility Study – capacity build ramp up – tonnes LHM



Source: Shard Capital after Alkemy Capital Investments plc

► **Outcomes - £2.2bn NPV[8].** A total of 2.7Mt of lithium hydroxide sold over a 30-year life. Initial capital cost for Train 1 £216m, subsequent trains £281m per train. Life of project capital of £1.49bn. Post-tax NPV using 8% discount rate £2.2bn and IRR of 32.9%. Average EBITDA margin of 26%. Feasibility financial model developed for a Base Case scenario using a long-term LSM price forecast of US$10,000/t, a long-term LHM price of US$25,000t and UK corporate tax rate of 19%. For further details, *see page 27*

► **Timeline.** TVL anticipates commercial production commencing during Q4 2024 after 12-month construction period. Alkemy expects ground activities to commence later this year.

Shard valuation summary

► **Our indicative valuation for ALK for the current stage of development is £45m** versus the current market capitalisation of £7.8m[9]. On a per share basis, this equates to 614p/sh fully-diluted, versus the current share price of 109p/sh. This is based on a highly risked scenario-based NAV valuation driven by our $NPV^{8\%}$ of £442m for the first stage (Train 1) of the Tees Valley Lithium Project (TVL) project risked at 0.1x NAV and pre-funding. This implies ALK is currently trading at 0.18x to our risked NAV, with a 463% return to NAV compared to the current share price. Incorporating additional processing trains into our model has a profound impact on the overall NAV valuation. For instance, adding in Train 2 which would be the first module to employ the electrochemical processing route increases our $NPV^{8\%}$ to £738m (US$908m). *See page 32 for further details…*

► **Compelling financials.** Based on Train 1 economics only, our model indicates average annual revenue and EBITDA of £429m (US$527m) and £98m (US$120m) respectively at full 24,000tpa capacity. Even at a modest increase in our LT price assumption to US$30,000/t, steady-state revenue and EBITDA increases to £585m and £151m respectively.

► **Scaling up** the operation with additional processing trains starts to produce some exceptionally high numbers. At full four Train capacity of 96,000tpa LHM, our model (at US$22,000/t LHM) indicates steady-state average annual revenue and EBITDA of US$1.7bn and US$392m respectively.

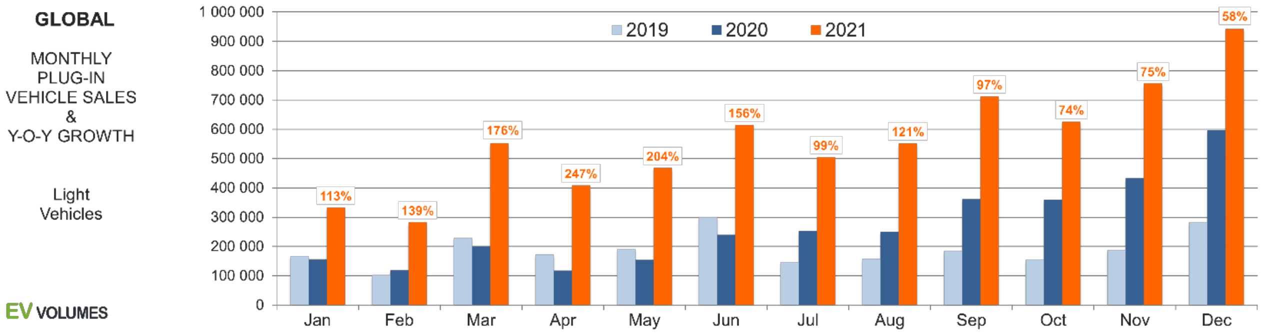
[9] Assumes admission of 1.2m shares from 3-8-22 placing and current share price of 109p/sh. Share price at close on 3-8-22 was 87.5p/sh and Mkt cap was £5.2m.

Europe needs to play catch up

The demand side of the equation

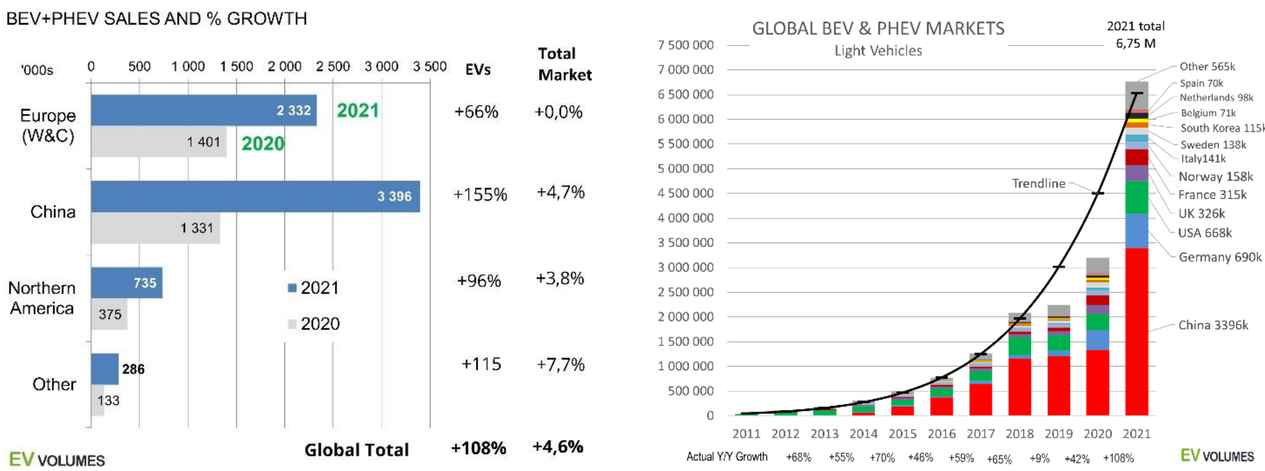
There are numerous sources of EV related data, but we prefer to reference publicly available data from EV Volumes (ev-volumes.com), one of the leading EV database generators. The latest data covers 2021 and the trend remains clear. EV-volumes indicates that global EV sales reached 6.75m units in 2021, up 108% from 2020 with EV's representing 8.3% of total light vehicle sales, up from 4.2% in 2020.

Figure 5 - Global growth in EV sales year-on-year – EV Volumes data



Source: EV-Volumes

Figure 6 - European EV market continues to expand (LHS) and 108% growth in BEC/PHEV from 2020 to 2021 (RHS)



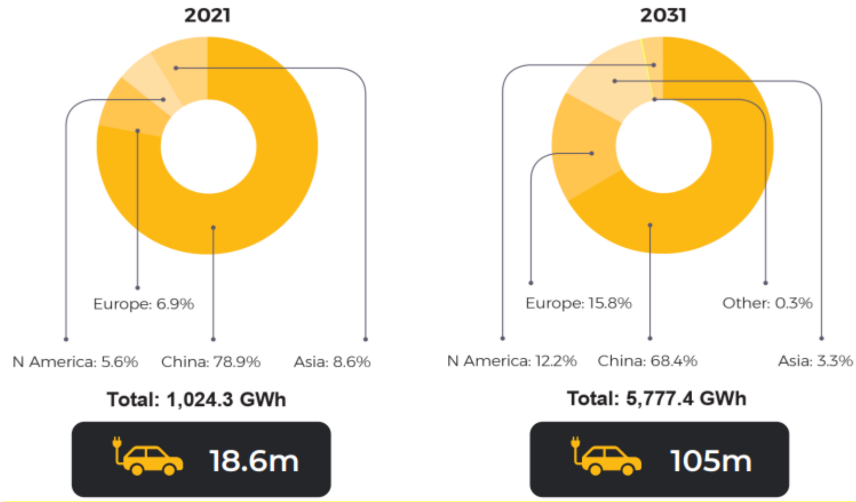
Source: EV-Volumes

- **A now familiar thesis.** There is no need to recap the EV/lithium investment thesis in depth in this note. The main drivers and levers are now well known. Due to the UK/EU's ban on petrol/diesel ICE vehicles from 2030 onwards, EVs will simply have to become more prevalent. Commentary in Alkemy's feasibility study states that a typical NMC EV battery requires approximately 1.15kg of LiOH per kWhr of energy storage. Typically, NMC EV's have 40kWhr batteries which would imply c.46kg of LiOH for such an EV. The UK is forecast to produce 1.5m EVs in 2030, with the EU producing a further 15m EVs.

The charts below are self-explanatory. Given the large build out in planned EV and battery manufacturing, the current data suggests that significantly more lithium in either form, carbonate or hydroxide will be required to meet demand. Benchmarks' graph indicates that by 2037, the LHM deficit could be in the order of 1Mt (million tonnes) of LCE (lithium carbonate equivalent).

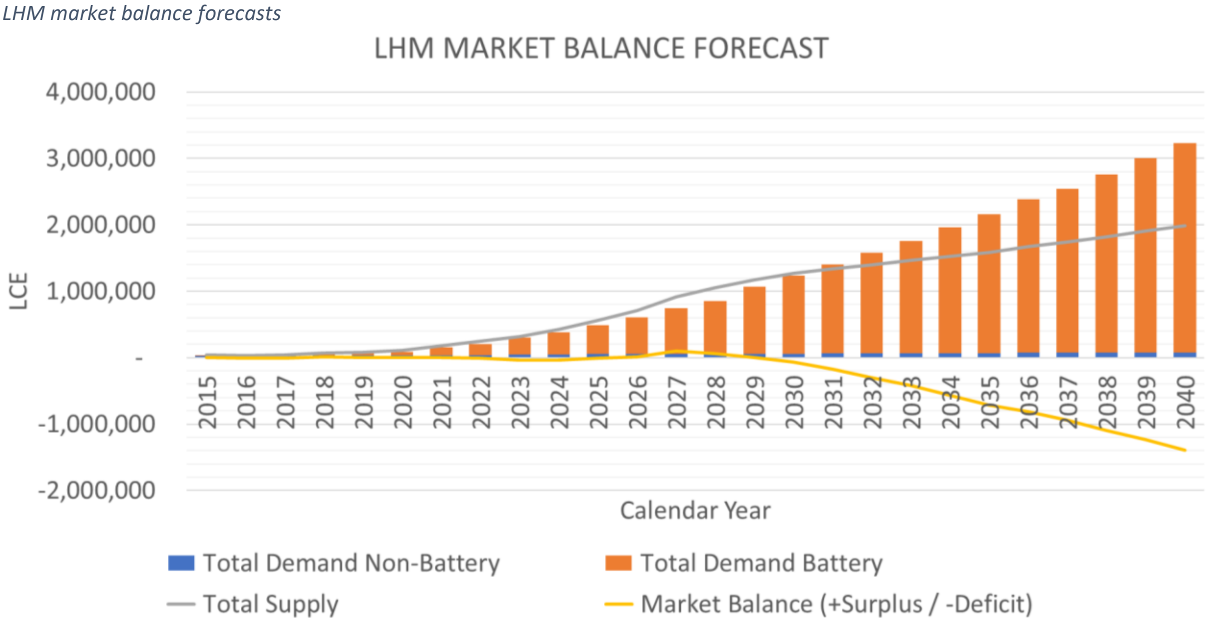
► **It will take numerous new lithium mines and operations to plug the gap**. Even proposed "large" projects slated to come into production will struggle to make a dent in the forecast supply deficit. To put this into perspective for Europe, European Metals' Cinovec project (PFS stage) is forecast to produce only 29,000tpa of LiOH. Globally, the situation is similar whether you are looking at carbonate or hydroxide and to illustrate the point, the scale of a large new Tier 1 operation such as Lithium America's Thacker Pass project in the US is only expected to produce 80,000tpa lithium carbonate at full phase 2 ramp-up according to the scope of the nearly completed feasibility study. It is clear that numerous new Tier 1 operations will be required.

Figure 7 – Battery manufacturing forecast



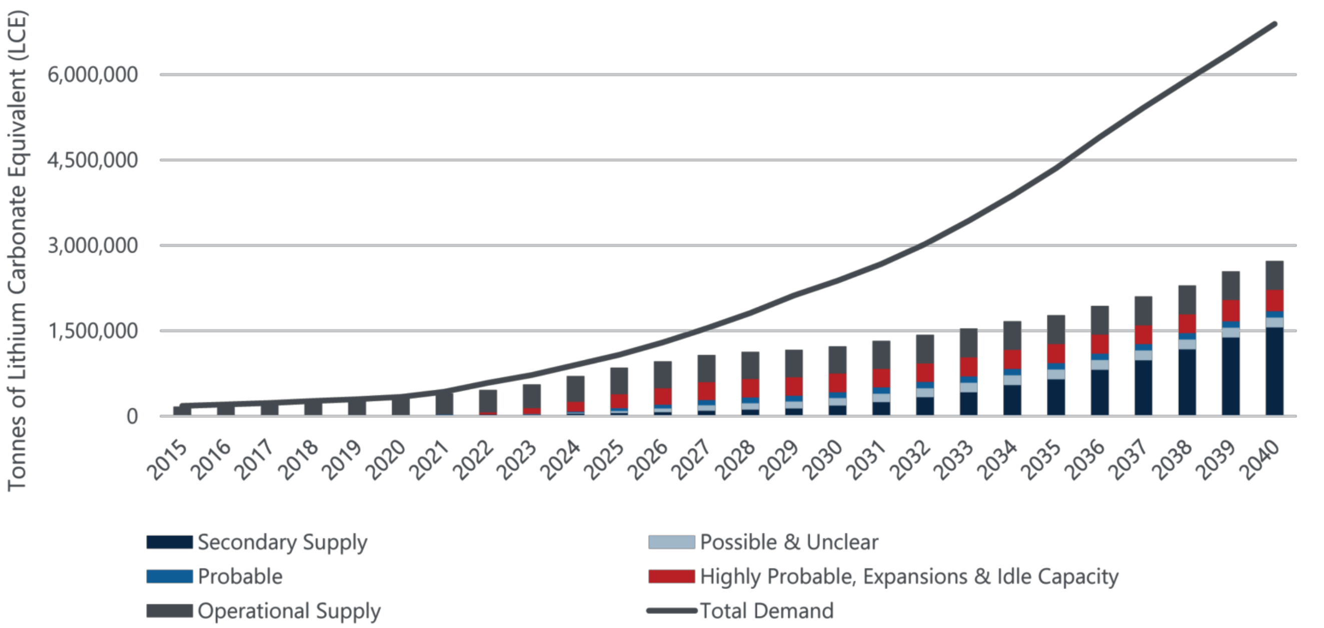
Source: Alkemy Feasibility Study, data source: Benchmark Minerals Intelligence, Battery Gigafactories 2021

Figure 8 - LHM market balance forecasts



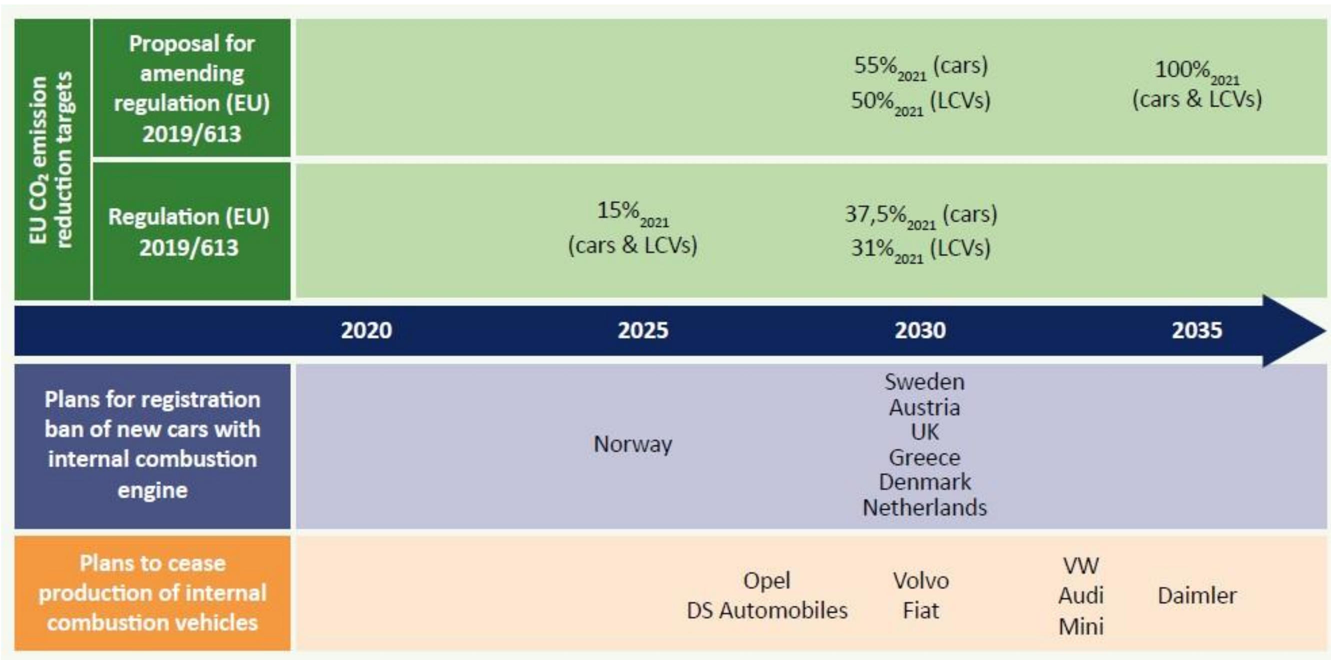
Source: Alkemy Feasibility Study, data source: Benchmark Minerals Intelligence, Wave international

Figure 9 - Lithium supply/demand forecast (Benchmark Mineral Intelligence)



Source: Piedmont Lithium – Lithium Hydroxide plant PEA, March 2022, original source: Benchmark Mineral Intelligence

Figure 10 - Changing EU legislation



Source: IPCEI Batteries, Q4 2021 review

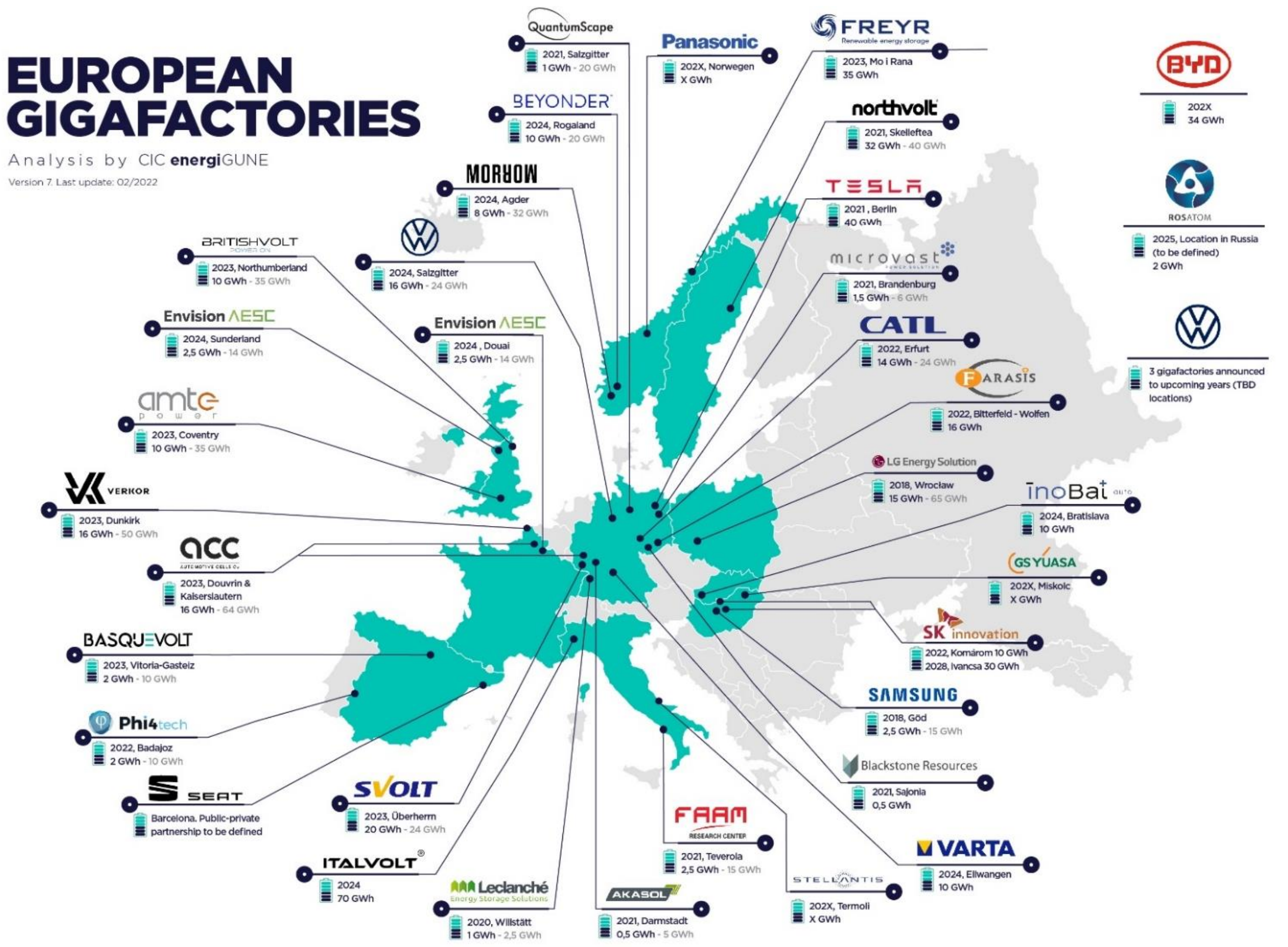
- **European Gigafactory build-out continues.** The plan to build large scale battery gigafactories in Europe appears to be on track. There are 5 major gigafactories in production and according to press releases and data by *Benchmark Mineral Intelligence*, there will be 27 gigafactories from 18 different battery cell producers operating by 2030. European battery capacity is anticipated to grow more than 6-fold by 2030.

- **A c.700GWh European gigafactory landscape in 2025** would require around 600,000tpa of LCE (lithium carbonate equivalent), based on a rule of thumb of an 850t of LCE requirement per GW of capacity. Assuming a 50:50 split between hydroxide and carbonate (and a 0.88x conversion of LiOH from LCE), this implies a requirement of 338,000tpa LiOH compared to Europe's current LiOH production of zero. Furthermore, S&P forecasts European Li-ion battery capacity to more than double to 1,400 GWh by 2030. Using this as an estimate would imply a European LCE market of 1.2Mtpa by 2030 and under the same 50:50 carbonate/hydroxide uptake assumption this implies a 675,000tpa lithium hydroxide market. There are numerous forecasts for European battery capacity in 2030 in the market with a large degree of variance. The numbers tend to vary between 900GW and 1,400GW and so the above calculations are just one view of life.

Implied European requirement of 338,000tpa LiOH by 2025 and 675,000tpa by 2030 compared to zero currently[10]

Increasingly news flow in relation to Europe's gigafactory buildout is helping to focus the industry on European sources of low-carbon lithium, given the dearth of European domestic lithium production and refining.

Figure 11 - European Gigafactory landscape

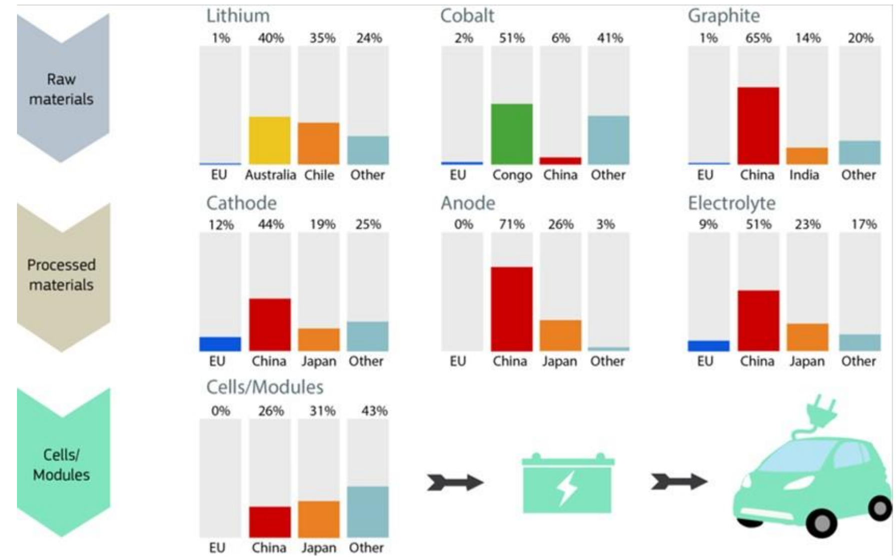


Source: CIC energiGUNE

[10] Based on our calculations using a 2030 European battery capacity of 1,400GW and 50:50 carbonate/hydroxide and 0.88 LiOH to LCE. We caution that market estimates vary wildly.

► **The EU lags at every stage of the lithium value chain** and is still highly dependent on non-domestic raw material supply. It seems inevitable that this will have to change. It is imperative that the large environmental/carbon footprint of the existing supply chain into Europe is reduced. This will necessitate domestic sources of mined lithium production in addition to developing the whole raft of downstream processing from lithium refining to cathode production to gigafactory battery assembly.

Figure 12 – Supply dependency of materials in the EV battery value chain



Source: European Commission, Joint Research Centre

► **The lithium supply/value chain needs to be disrupted.** As mentioned, Europe currently has zero domestic supply of lithium hydroxide and alarmingly China currently produces over 80% of the world's lithium hydroxide. Given that the EU is the fastest growing EV/lithium demand market in the world, this would appear to be unsustainable. In addition to carbon footprint considerations, security of supply is likely to remain the dominant theme and we believe that cathode makers, battery producers and OEMs will have to increasingly get involved further upstream in the sector.

We expect this to take many forms including further off-take and strategic deals between auto/battery manufacturers and the junior lithium developers, and an increase in potential European-based merchant lithium processors such as TVL. This should further loosen the dominance of the major lithium producers and China.

- **The current issue for European battery makers and OEMs** is that with no current European sources of raw material, the carbon footprint of battery-quality lithium chemicals delivered into Europe is very high. The three main issues here are energy usage, water consumption and greenhouse gas emissions (GHG) which includes CO_2, Ch_4 and N_2O. In terms of water consumption, the South American brine operations (e.g., in the Atacama) use significantly more water per tonne of LiOH than hard rock lithium sources.
- **The carbon problem.** Both lithium carbonate and lithium hydroxide suffer from the similar issues in terms of carbon footprint depending on the source of lithium (hard rock, brines etc) and subsequent downstream refining and manufacturing processes. However, the issue is particularly acute for lithium hydroxide which tends to be produced via hard rock lithium sources (although hydroxide can be made with an additional processing step after the production of lithium carbonate from a brine source).

  A typical supply chain to produce lithium hydroxide looks like this:

  - **Mining** of a lithium-bearing pegmatite in Australia to extract spodumene ($LiAlSi_2O_6$) ore.
  - **Processing** of spodumene ore at the mine site which includes crushing, milling, flotation to produce a spodumene concentrate which consumes water, power and reagents. Power at the mine site is unlikely to be from renewable sources (i.e., diesel gen sets)
  - **Concentrate.** The product of the previous step is a spodumene concentrate which would typically contain between 5% and 7% LiO_2 given that stoichiometrically, the theoretical maximum LiO_2 content of spodumene is 8.03%. The benchmark is an SC6 concentrate.
  - **Transport.** The lack of vertical integration in the sector means that most pegmatite mining operations produce only a concentrate and do not host a refinery to make specialist lithium chemicals such as hydroxide. Consequently, in this example, the finished spodumene concentrate would have to be transported to a refinery, of which 80% of the world's hydroxide conversion capacity is located in China. The spodumene concentrate must then be transported overland within Australia from the mines site to the coast for shipping to China. A further overland transport step within mainland China (which could be 100km) is required to the conversion facility. It is only recently (May 2022) that Chinese lithium producer Tianqi Lithium produced Australia's first battery-grade lithium hydroxide from its plant in Kwinana in Perth (sourcing spodumene from Greenbushes), but the majority of conversion capacity remains in China, largely in the Jiangxi and Sichuan provinces.

    The transport distances for SC6 that we highlight here, are likely a huge underestimate of the true distance due to journeys by empty trucks on return journeys and waste removal

    Shipping of spodumene concentrate from Port Hedland in Australia to mainland China ports is a 2,700km trip with a sea transit time of c.8.5 days. Onward shipping of finished LiOH from China to say, Rotterdam in Holland is a 17,700km trip with a sea transit time of 30.5 days. This sort of logistics chain is commonplace in the natural resource sector but increasing focus on GHG emissions highlights the gross inefficiency of this process. TVL will be planning to replace the two shipping journeys with a single shipment of lithium sulphate or other feedstock.

    A typical benchmark or reference spec spodumene concentrate would be a 6% LiO_2 (lithium oxide) and on a Li metal basis this translates to only 2.78% Li. Looking at this the other way around, for every tonne of spodumene concentrate being transported, 97% of the mass is waste.
  - **Refining.** Conversion of spodumene concentrate to lithium hydroxide in a refinery uses a significant amount of energy for the acid roasting kiln process and for steam generation. The majority of this energy in China is derived from coal.
  - **Onward transport (again)** of the lithium hydroxide chemical product to cathode manufacturers, and then onto cell manufacturing and assembly (Giga factories) and OEM vehicle makers.
  - **Battery transport issue.** Shipping batteries from China to Europe has to be enacted in a discharged state (for safety) which can cause permanent damage or degrade the batteries performance.

7 tonnes CO_2 per tonne of LiOH produced from Chilean brine

>15 tonnes of CO_2 per tonne of LIOH for spodumene mined in Australia and refined in China

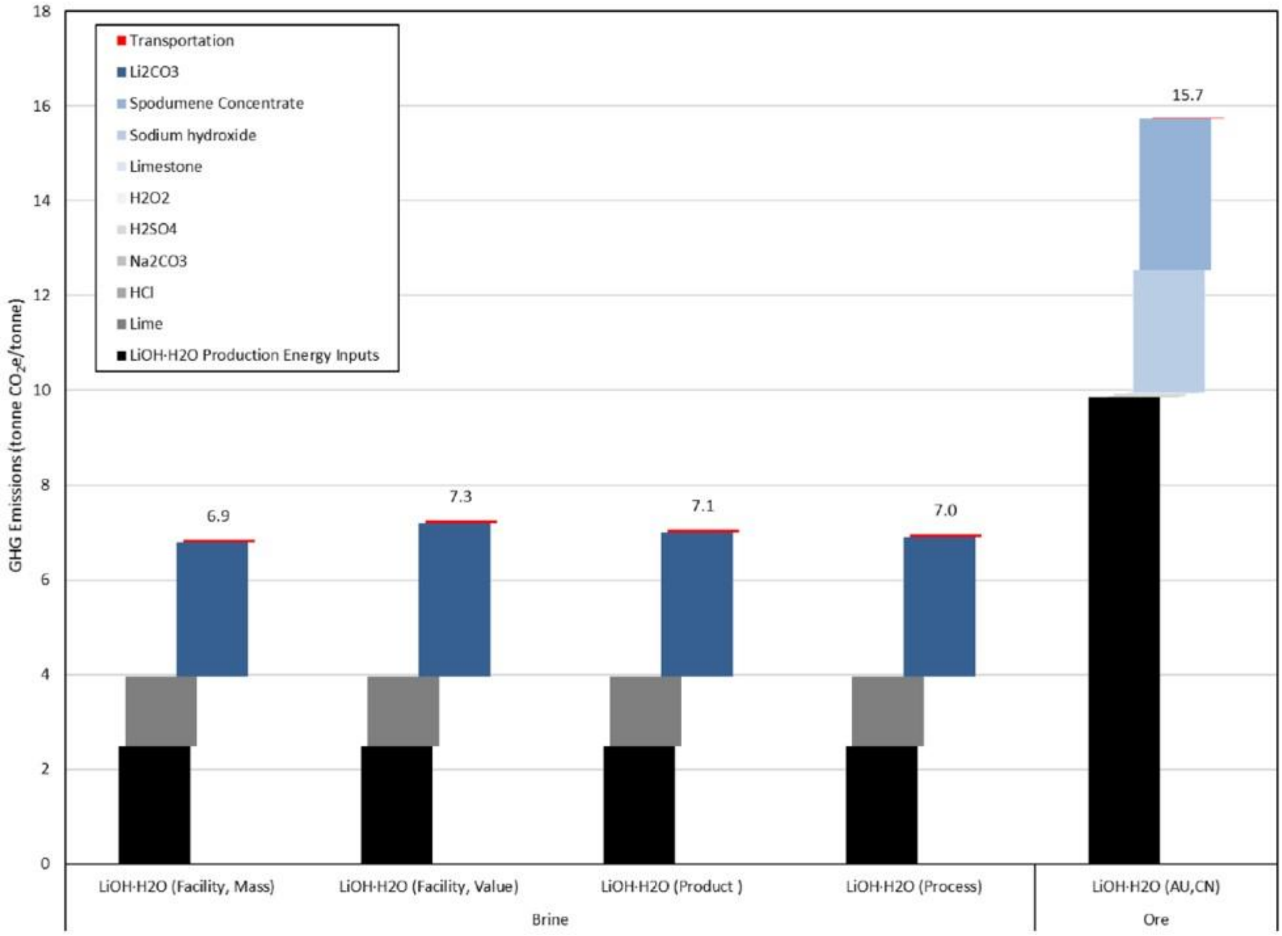
- **Carbon intensity.** Estimates of the carbon intensity of lithium production vary and it is challenging to capture the GHG emission from the entire supply chain and manufacturing process. However, some work has been done by various researchers. For the production of Lithium hydroxide from a Chilean brine, the GHG emissions are thought to be approximately 7 tonnes CO_2 per tonne of LiOH produced[11]. For the production of lithium hydroxide from spodumene mined in Australia and refined in China, the GHG emissions are estimated (by the same researchers) at 15.7 tonnes of CO_2 per tonne of LIOH (See fig 13).

  These results are in reasonable alignment with prior life cycle assessment (LCA) research undertaken by Minviro with indicated that LiOH from Chilean brine has a CO_2 intensity of 5 tonnes of CO_2 per tonne of LiOH and 14.8 tonnes of CO_2 per tonne of LiOH when the source is Australian spodumene processed in China.

  These figures also exclude onwards logistics to move the finished LiOH product further down the supply chain and thus probably represent an underestimation of the GHG produced. Cradle to gate GHG emissions are estimated at 21.95 tonnes CO_2 per tonne of cathode for NMC622 cathode materials by Kelly et al.

- **And TVL?** Alkemy has commissioned its own ISO certified LCA to demonstrate where the TVL project will sit on the CO_2 curve versus competitors and other lithium sources.

Figure 13 - Lifecycle GHG emissions by input and process for LiOH production based on Chilean brine and Australian spodumene ore refined in China.



Source: Kelly et al, Resource, Conservation & Recycling 174 (2021) 105762

[11] Energy, greenhouse gas, and water life cycle analysis of lithium carbonate and lithium hydroxide monohydrate from brine and ore resources and their use in lithium-ion battery cathodes and lithium-ion batteries. Kelly et al, Resource, Conservation & Recycling 174 (2021) 105762

European battery players will need to increasingly think about the carbon cost of imported lithium

It will be advantageous to produce lithium chemicals with the lowest possible carbon footprint due to UK and EU carbon policy

- **TVL has a lower-carbon LiOH solution for European customers**. Clearly, the strategy of TVL is focused on Europe, a region which is showing consistently high growth rates for the uptake of electric vehicles. Given the push towards carbon neutrality, it is likely that this trend will be supported by further government legislation.
- **Increased scrutiny.** The current burden of legislation for OEM vehicle manufacturers in terms of CO_2 footprint is focused on the measurable CO_2 in vehicle emissions across the fleet of produced vehicles. Thus, increased sales of EVs as a proportion of total cars sold (vs ICE vehicles) can help bring down the average fleet CO_2 footprint. However, given the large CO_2 footprint of the lithium mining, processing, transport and downstream refining industry, it seems likely that increasing scrutiny will be put on the lithium supply chain.
- **EU legislation is likely to continue evolving** in order to aid the transition to a carbon neutral economy. In March this year, the European Commission presented a proposal designed to modernise the EU's regulatory framework for batteries in order to secure the sustainability and competitiveness of battery value chains. It would introduce mandatory requirements on sustainability (such as carbon footprint rules, minimum recycled content, performance and durability criteria), safety and labelling for the marketing and putting into service of batteries, and requirements for end-of-life management. The proposal also includes due diligence obligations for economic operators as regards the sourcing of raw materials.
- **The EU's "Fit for 55" package** published in July 2021 is designed to help the EU meet its target for at least a 55% reduction in greenhouse gas emissions (CO_2) by 2030 (compared to 1990) with an additional proposal to completely cut emissions from cars and vans by 2035. Irrespective of whether these targets will be met, or whether they are realistic, the journey towards these goals will require a significant uptake in electric vehicles.
- **More investment and capacity are required in all parts of the supply chain**, with a growing emphasis on low carbon sources of lithium and high-quality lithium chemicals for batteries. In this regard, the Fit for 55 package includes a proposal for **Carbon Border Adjustment Mechanism** (CBAM) to support decarbonisation goals and attempt to stop companies circumventing carbon restrictions by moving carbon-intensive production processes out of the EU. The CBAM is a blunt instrument which applies a carbon cost to various imported goods based on the carbon emissions associated with the manufacturing process in order to bring parity to EU domestic producers whose carbon emissions are priced under the EU ETS (Emissions Trading Scheme).
- **CBAM almost certainly apply to lithium.** The CBAM is expected to be gradually phased in, with a transitional period from 2023 before applying fully from 2026. Initially the CBAM will only apply to goods with high carbon emissions (e.g., iron/steel, cement, fertiliser, and chemicals etc) but is likely to be expanded. Due to the complete reliance on lithium imports in the EU, it is anticipated that lithium will be included in the chemicals category in terms of applying the CBAM. As mentioned, CO_2 footprint of batteries very much depends on the energy source used in the refining and manufacturing process, along with subsequent transport steps, especially for the shipping of spodumene concentrates.
- **CBAM will add a price premium to imported lithium hydroxide.** For LiOH produced from Australian spodumene refined in China, the CBAM would add a significant cost premium or tax on top of the import price for European customers. A carbon price consistent with achieving net-zero GHG emissions is estimated[12] to start at £54/tCO_2 (with a range of £40–£100) in 2021, reaching £75/tCO_2 (£60–£140) in 2030. Assuming a conservative £75/t (or US$$90/t) and 15.7t CO_2 per tonne of LiOH sourced from a Chinese refiner, this adds almost $1,500/t to the LiOH import price. At a carbon price of £140/t (US$167/t) this rises to a US$2,600/t premium.
- **UK impact?** Post Brexit, the UK is not in the European Economic Area and could be potentially exposed to CBAM. At present it's unclear to what extent UK exports to the EU will be subject to additional charges under CBAM. Industry talk is that the UK ETS or another reciprocal mechanism could take into account carbon credits paid in the UK when calculating EU CBAM certificates. What is clear though, is that it will be advantageous to produce lithium chemicals with the lowest possible carbon footprint, regardless of UK-EU trade dynamics in order to reduce the potential impact of any CBAM premium. TVL should be ahead of the pack in this regard.

[12] What does an EU Carbon Border Adjustment Mechanism mean for the UK? The Centre for Climate Change Economics and Policy, Policy Report April 2021.

- **OEMs will have to get more involved in the supply chain. With more scrutiny,** we believe that OEMs will have to increasingly get involved in the upstream portion of the lithium business to varying degrees in order to secure quality on-spec supply, but also in the various downstream processing steps to gain some influence over the carbon, social and environmental aspects of the supply chain. E.g., BMW has an agreement with Gangfeng for the delivery of sustainably and ethically sourced lithium from Australian mines, Ford and Compass Minerals have struck a deal, and recently Mercedes signed an agreement with NeoMetals (ASX: NMT) pertaining to a JV for a lithium-ion battery recycling plant.

Site Visit - a plug & play opportunity

In June 2022, we visited both the proposed processing site location at the Wilton International Chemicals Park ("Wilton") and the Teesside Freeport operated by PD Ports. The main takeaway from the site visit was witnessing first-hand the proposed location and the opportunity presented by Wilton for a fast-track development based on the site's plug & play credentials and the surrounding Teesside industrial cluster and port.

Sembcorp, the owner of Wilton, shares the same vision as TVL with a big focus on decarbonisation and renewable energy. Two decarbonised energy plans are under possible development at the site.

On our visit to the Wilton site, we viewed the proposed site and also had an opportunity to understand the full scope of infrastructure, services and logistics network that supports Wilton's ready-to-go site solution. The contrast to our usual site visits to 3rd world/developing countries and early-stage exploration projects in remote regions was stark. At Wilton, all the prerequisites required for development are already in place and we witnessed the sheer scale of PD Ports' logistics and freight operation at the deep-water port.

Figure 14 – flat "shovel-ready" land (currently a field) ear-marked for TVL's processing site

Source: Shard Capital

Location drives ultra-low capex

Teesside has all the attributes that are likely to attract other cathode active material producers to the area which would also have a positive knock-on effect for TVL

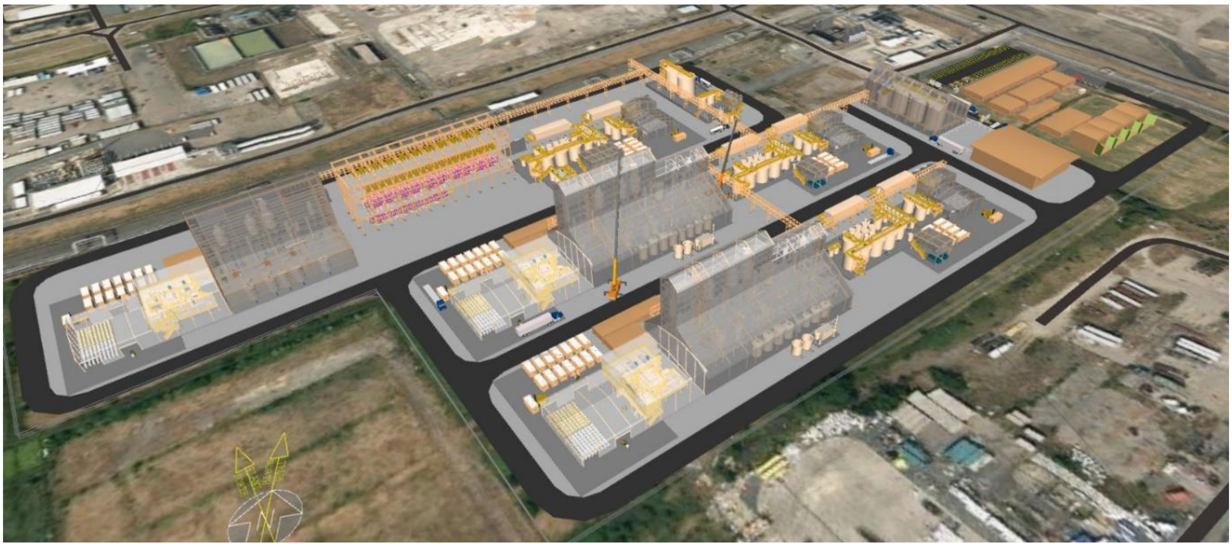
Wilton is a world-class chemicals park and the perfect location for TVL's lithium hydroxide processing plant, in our view. Wilton offers a low-risk, ready-to-go site solution for with integrated energy, development land, infrastructure, fibre networks, utilities and security. Specifically, for TVL, the following aspects are compelling:

- Seamless logistics connectivity to Teesside deep-water Freeport.
- Access to a large, technically skilled workforce, expertise and supply chain opportunities.
- On site energy generation utilising multiple assets with National Grid backup ensures energy. Access to renewable power sources from Dogger Bank wind farm and direct pipeline access to natural gas from the North Sea. Competitive electricity pricing.
- Planning can typically be achieved via "an instrument of consent" depending on the plot.
- Access to full suite of utilities including water (demineralised, potable and raw), steam distribution.
- Easy access for bringing in key reagents used in the lithium processing.
- Industrial customers on the doorstep for the sale of any potential by-products e.g., gypsum. This means that TVL could potentially realise value from even low intrinsic value by-products due to the proximity of potential customers and ease of logistics.

More about Wilton

Wilton is owned by Sembcorp Industries, a leading energy and urban solutions provider headquartered in Singapore. Sembcorp has a balanced energy portfolio of 16.5GW, with 7.0GW of gross renewable energy capacity comprising solar, wind and energy storage globally. The company operates in over 12 countries and is listed on the SGX Mainboard stock exchange.

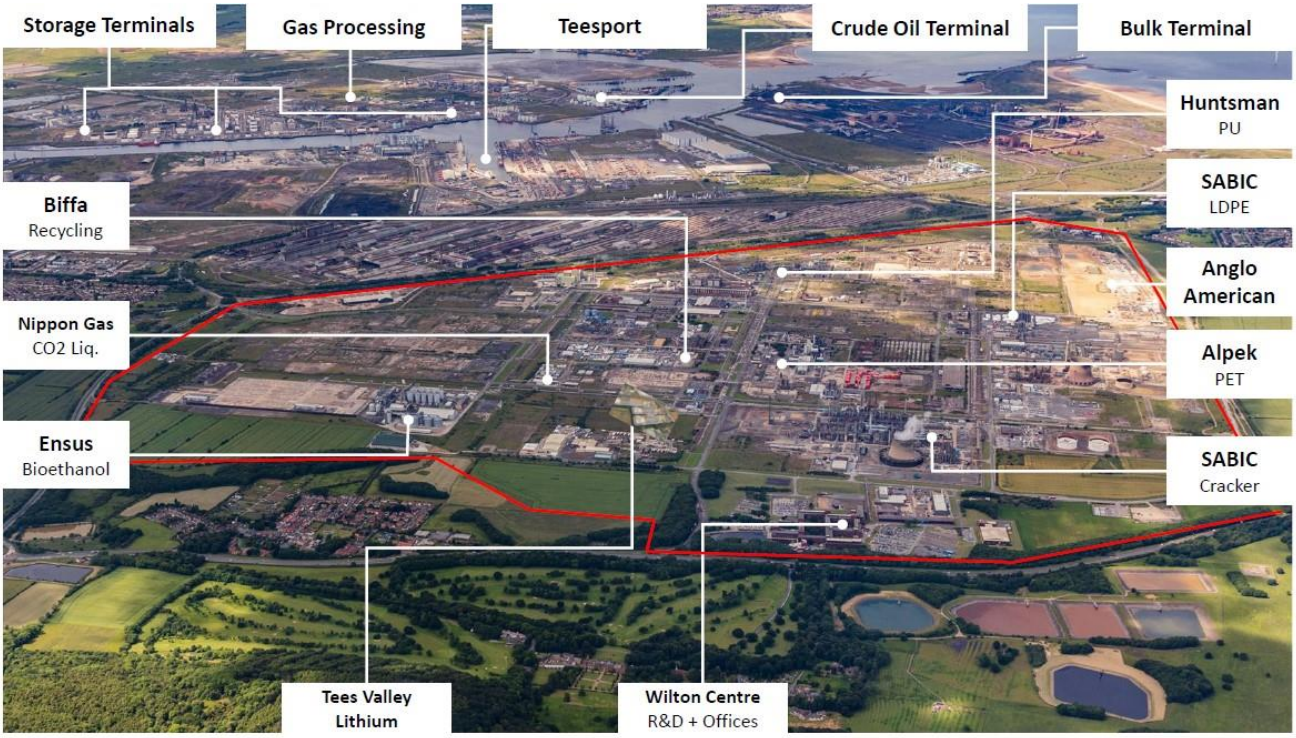
Figure 15 - Image of the proposed processing facility at the Wilton International Chemical Park, Teesside Freeport, UK



Source: Alkemy Capital Investments plc, Class 4 Feasibility Study

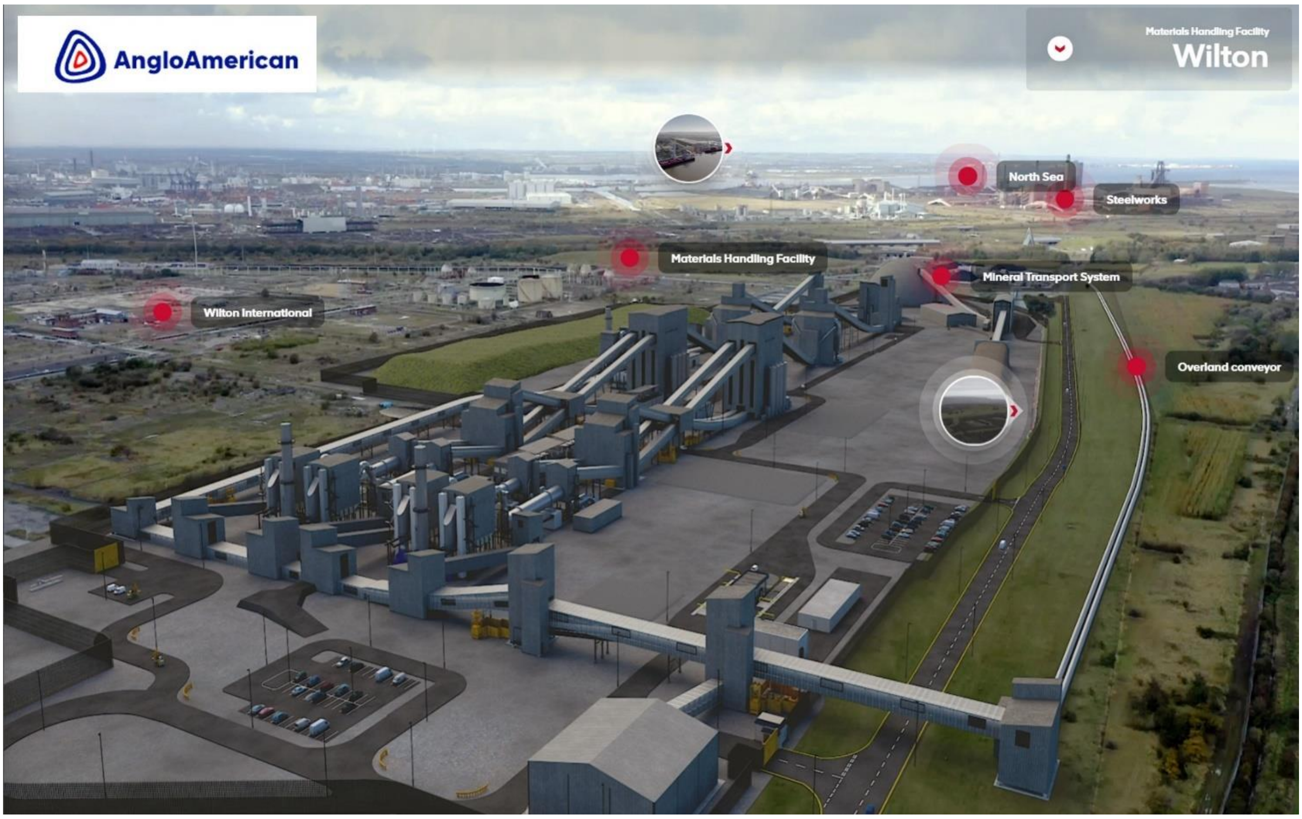
The Teesside industrial cluster is home to a vast array of large industrial operators including gas processing. Bioethanol plants and notably is the portal and materials handling facility for Anglo American's Woodsmith polyhalite mine which is currently in development.

Figure 16 - Wilton International Chemical Park, a large, fully serviced industrial complex



Source: Sembcorp

Figure 17 - Schematic of Anglo American's Woodsmith polyhalite handling facility and Mineral Transport System under development at Wilton



Source: Anglo American

Adjacent port solution

Efficient logistics is critical given that unlike lithium sulphate, the finished lithium hydroxide product has a fairly short shelf life (~ 6 months) and there is an imperative to ensure that the product reaches customers as soon as possible.

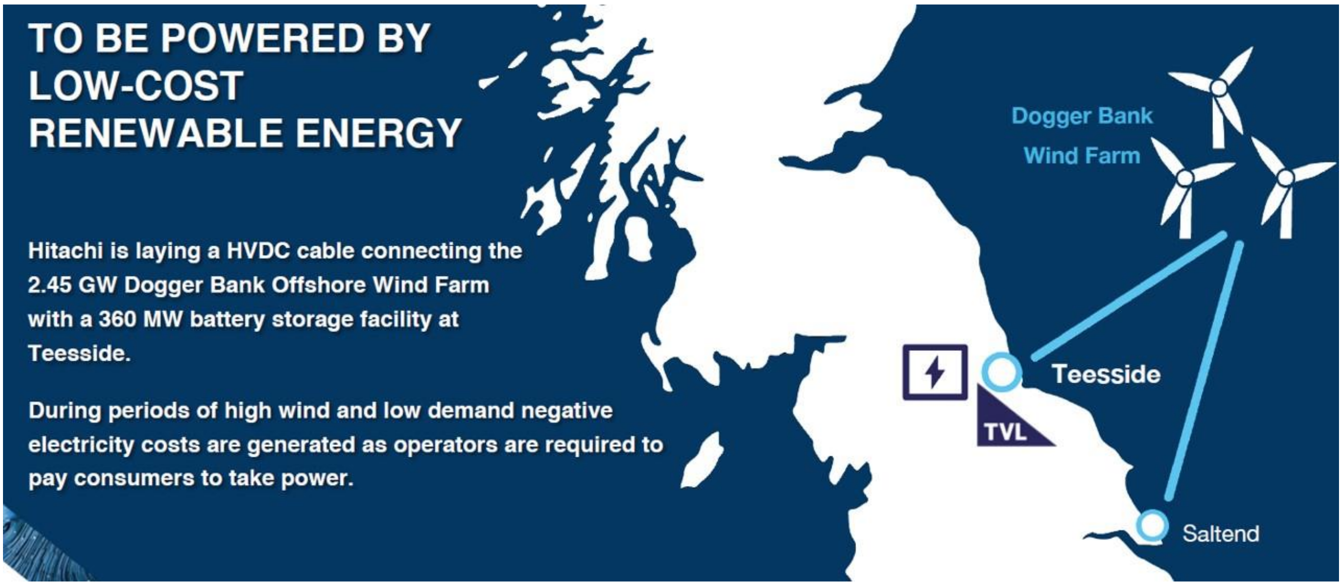
- The Teesside Freeport operated by PD Ports is located a mere 2 miles from Wilton International.
- It is a major deep-sea port, ranked 5th in the UK by tonnage and in the UK top 5 for liquid bulk cargoes.
- The port can handle multiple cargo types which will be able to cater for all manner of raw materials required by TVL. Including reagents and the critical input lithium sulphate feedstock.
- Teesside has a direct pipeline connection from Wilton International and the North Tees terminals handle diverse liquid bulk products and provide bespoke storage solutions.
- Teesport delivers a comprehensive range of sea freight services: global deep sea (e.g., to Japan), European short sea, and European hub feeders (e.g., Rotterdam) and large-scale bulk freight handling services.
- The marine network links directly to Wilton by road and private on-site rail sidings.

Power

The location at Wilton makes good sense for an energy intensive industrial process such as lithium processing. There is absolutely no point in trying to develop a low carbon source of battery-grade lithium chemicals if the power required does not come from renewable sources. The basis of the electrochemical processing route is that it will essentially be substituting chemicals with "green" power and thus the power source is important in terms of the finished product's carbon footprint.

As such, the location at Wilton is ideal with ready access to cheap, renewable wind power and certified renewable electricity. Wilton has 4 power generation plants including biomass and Energy from waste. Low-cost renewable power will also be sourced from the Dogger Bank offshore windfarm with a direct connection to Teesside and routed through the national grid.

Figure 18 - Renewable power options



Source: Tees Valley Lithium

April 2022 Feasibility study

In April 2022, Alkemy reported the completion and results of a Feasibility Study for a world-class lithium hydroxide processing facility to be located at the Wilton International Chemical Park at the Teesside Freeport in the UK.

The Feasibility Study evaluated the project economics assuming a merchant lithium hydroxide plant comprising four trains each with a 24,000tpa capacity, to produce up to 96,000tpa of battery-grade lithium hydroxide.

- Train 1 will follow the conventional Glauber's Salt process route with trains 2 to 4 following an Electrochemical route.
- Purpose built facility to be constructed on a 9.6 ha plot at the Wilton International Chemical Park in the Teesside Freeport.
- Plug & play infrastructure with a connection to reliable and cheap offshore wind and 100% certified renewable energy.
- Production of a premium, low carbon product for sale to Tier 1 customers in the UK and Europe.

The Feasibility Study identifies target production over a 30-year life. The financial model was developed for a Base Case scenario using a long-term LSM price forecast of US$10,000/t, a long-term LHM price of US$25,000t and UK corporate tax rate of 19%. Preliminary economics of the project are set out below:

Figure 19 - TVL Feasibility Study project economics

Tees Valley Lithium - Economic Summary	Unit	Value
Life of Project	Years	30
Lithium Hydroxide Sold	MT	2.7
Gross Revenue	GBP	49.2bn
Initial Capital Cost Train 1 (including a 17.5% Contingency)	GBP	216M
Life of Project Capital Cost (including initial capital)	GBP	1.49bn
Taxes	GBP	2.2bn
NPV and IRR		
Discount Rate	%	8
Pre-Tax NPV	GBP	2.8bn
Pre-Tax IRR	%	35.6
Pre-Tax Payback Period (Train 1)	Years	2.9 years
After-Tax NPV	GBP	2.2bn
After-Tax IRR	%	32.9
Peak Funding Requirement	GBP	336
EBITDA Margin	%	26%

The model uses a long-term lithium sulphate price of US$10,000/t and a long-term lithium hydroxide price of $25,000/t. Peak funding for Train 1 is GBP218m. Long term GBP/US$ exchange rate is 1.39

Source: Alkemy Capital Investments plc

Operating costs

Operating cost estimates have been prepared for the individual Glauber's Salt and Electrochemical routes, both of which have a nameplate capacity of 24,000 tpa of LHM per train. The actual operating costs on a per tonne basis have not been disclosed in the feasibility, primarily because LSM feedstock raw material is the dominant component of opex (which is price based) and due to other commercial and IP considerations. However, the feasibility opex was developed as a bottom-up estimate with key values taken from the Feasibility Study's economic evaluation report, namely the process design criteria, mass and water balance, and the mechanical equipment list. The level of effort for each of the line items meets the requirements for a Class 4 Feasibility Study estimate. See next page "Capital Costs" for Class 4 definition.

Capital Costs

The Capital Cost estimate was developed to meet the requirements of a Class 4 estimate as defined by the American Association of Cost Engineers' Cost Estimation and Classification System (as applied for mining and minerals processing industries) and represents a nominal accuracy range of ±25%, with a contingency of 17.5%. All cost data is in GBP (£).

- **Capex.** £216m for Train 1 (Glauber's Salt) and a further £280.9m for each additional processing Train (electrochemical route). Hence, the total capital cost for the full 4 Train build out is anticipated to be around £1bn.
- **Sustaining capex.** Sustaining capital of 2% of direct capital costs (excluding earthworks) has been included in the financial model for the first 25 years, increasing to 3% for the last 5 years.

Figure 20 – Feasibility capital cost estimates

Capital Costs (in GBP £m)	Glauber's Salt Route	Electrochemical Route
Installation	15.7	20.9
Earthworks	2.0	2.0
Civil/concrete	5.9	7.8
Structural	9.8	13.0
Architectural	9.8	9.8
Mechanical/Platework	47.0	62.6
Piping & Valves	9.8	13.0
Electrical	9.8	13.0
Controls & Instrumentation	7.8	10.4
Total Direct Cost	117.6	152.6
Indirect Cost	66.5	86.5
Sub-total	184.1	239.0
Contingency (17.5%)	*32.2*	*41.8*
Total Capital Cost (£m)	**216.3**	**280.9**

Source: Alkemy Capital Investments plc

Other

Location. The location of the process facility is strategically proposed in the Teesside Freeport, in close proximity to TVL's potential European customer base and to provide for fast development and efficient operations leveraging the established "plug & play" infrastructure at Wilton International. The Wilton site is adjacent to PD Ports, the 5th largest container port in the UK. PD Ports boasts large scale Roll-On-Roll-Off and Lift-On-Lift-Off container handling facilities, as well as bulk materials handling capability.

Permitting is well advanced with an EIA (Environmental Impact Assessment) Scoping Study and completed and a Submission for Council Opinion made. The company expects Planning Approval to be granted shortly following the submission of full planning and the final EIA.

Note that due to the nature of the proposed development, i.e., no mine site and location at existing industrial facility, the plant could be developed without planning permission (by utilising Wilton's permissions under an Instruction of Consent), however, the company is committed to best practice guidelines and has decided to seek planning approval.

Metallurgical testwork

Testwork indicates production of ultra-pure battery-grade lithium hydroxide

As part of the Feasibility Study, various metallurgical testwork programmes (see Appendix 1) were undertaken by several leading laboratories in the field of lithium and speciality minerals processing and treatment. The results formed the basis of the process flowsheets for the feasibility study. The culmination of this work yielded an ultra-pure battery grade lithium hydroxide, exceeding industry-recognised standards. Some of the salient points from the testwork are detailed below:

Impurity removal. Key testwork included an Impurity Removal programme which was designed to produce a purified lithium sulphate liquor from a low-grade lithium sulphate input to levels acceptable to both the Glauber's Salt and Electrochemical process routes. The flowsheet is based on process widely used commercially in industry, and as such the ongoing testwork is focused on examining varying reagent regimes and the impact on liquor purity ahead of either downstream process (Glauber's Salt or Electrochemical).

Glauber's Salt crystallisation work. Causticisation and crystallisation testwork to produce a final ultra-pure LHM project. This involved causticisation, Glauber's Salt crystallisation, and three stage lithium hydroxide crystallisation which produced an ultra-pure battery grade LHM product exceeding the Chinese Standard GB/T 26008-2020 D1 as well as TVL's target specification. The work also included Zero Liquid Discharge testwork.

The electrochemical route will substantially reduce the use of chemical reagents in favour of green energy, thereby reducing the CO_2 footprint

Electrochemical Testwork at Anzaplan. Designed to examine two different electrochemical cell configurations and to produce a crude LHM product through single stage crystallisation. The results from Anzaplan provide excellent justification for the proposed Electrochemical flowsheet, proving that key purity and a number of impurity targets can be met with only a single stage crystallisation.

Electrochemical Testwork at Electrosynthesis. Designed to test various process parameters against cell performance, and also to evaluate two different commercially available membrane technologies. Approximately 3kg of LHM equivalent was produced in product liquor, which is available for future crystallisation testwork.

ultra-pure battery-grade lithium hydroxide produced, validated by cathode and battery manufacturers

Product spec independently validated. Post Feasibility, Alkemy released further testwork results (23rd May 2022) that produced **ultra-pure battery-grade lithium hydroxide** from low quality industrial grade (95%) lithium sulphate. The testwork was undertaken by JordProxa Pty Ltd and overseen by Wave International. Furthermore, the product specification of TVL's battery-grade lithium hydroxide was also independently validated by an internationally recognised cathode active material manufacturer as well as a prominent European-based battery technology manufacturing company. The specification was found to be superior to prevalent Chinese standard specification GB/T 26008-2020 D1.

Figure 21 - Crystallisation testwork at JordProxa.
Top left: glass jar crystallisers. Top right: crystallisers. Bottom left: centrifuge. Bottom right: LHM crystals.

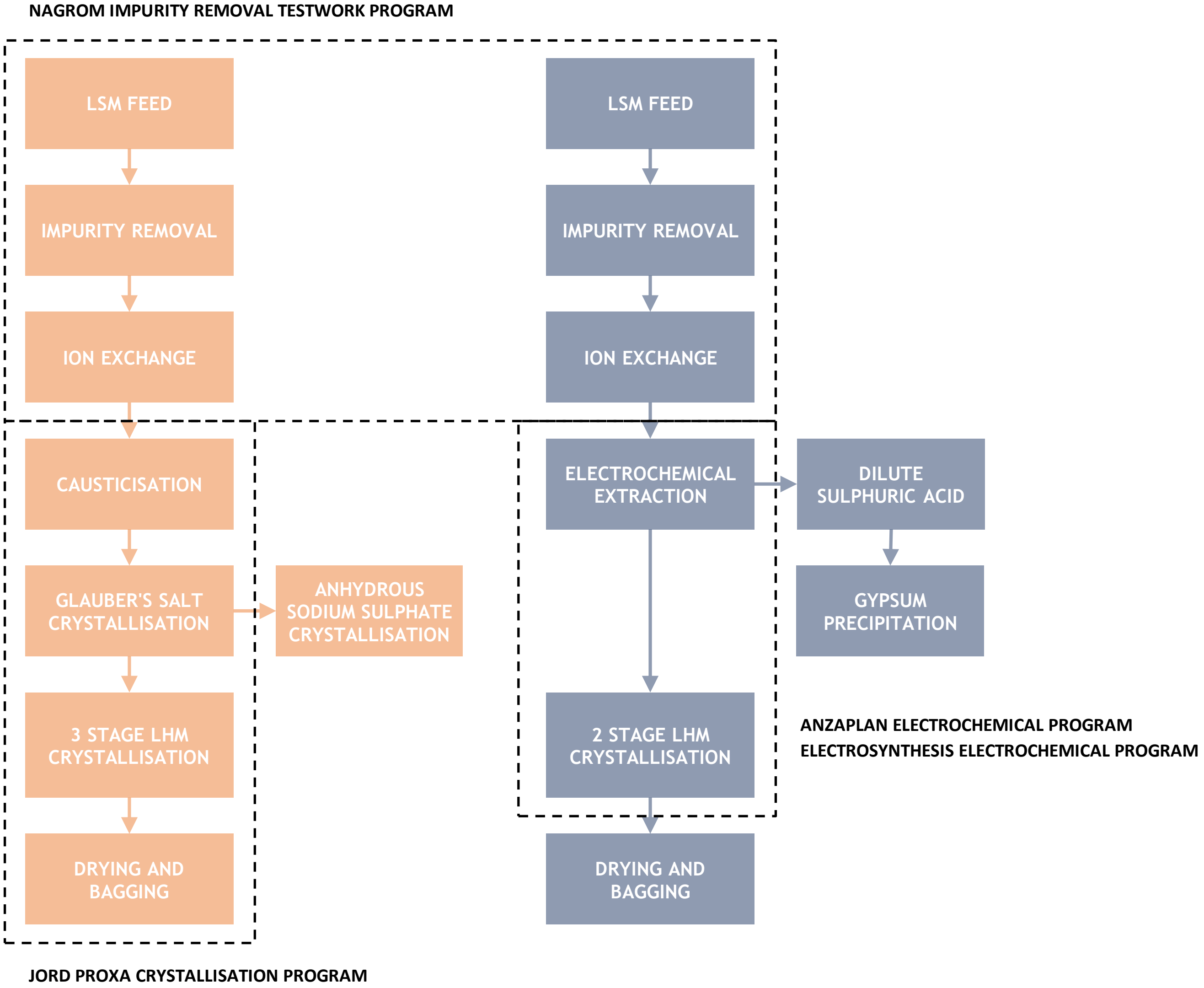
Source: Alkemy Capital Investments plc

Processing flowsheet summary

Train 1 will follow the conventional Glauber's Salt process route with trains 2 to 4 following an Electrochemical route. Trains 2 to 4 will also be designed to process LSM and lithium carbonate from multiple sources including LSM derived from spodumene, mica, brine and recycling of used batteries as well as lithium carbonate.

The two different process flowsheets are similar until after the ion exchange step although note that the purity requirements differ between the two routes with the electrochemical route requiring higher purity.

Figure 22 - Proposed flowsheet (left Glauber's Salt route, right Electrochemical route)

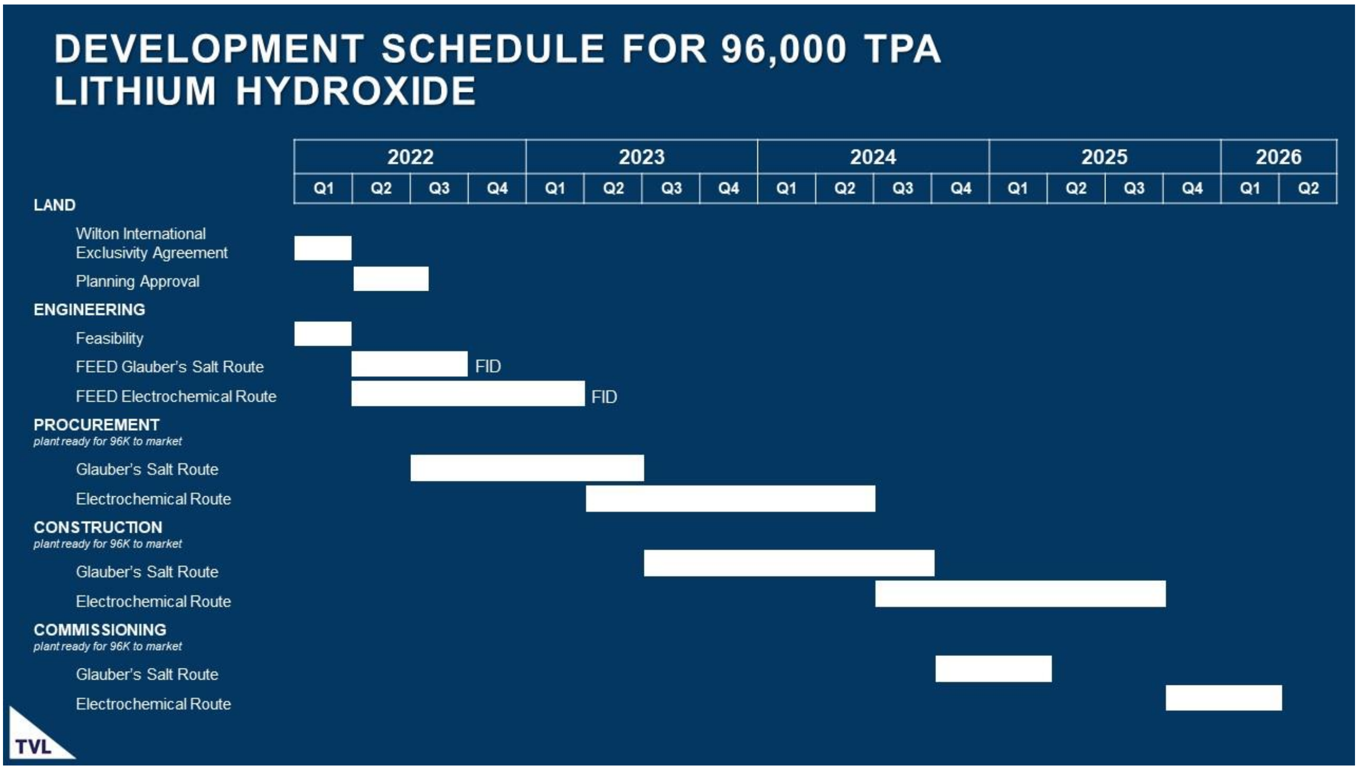


Source: Alkemy Capital Investments plc

Development schedule

The Feasibility Study anticipates commercial production commencing during Q4 2024 after 12-month construction period. Clearly, this timeline could be modified significantly depending on financing and any other potential development challenges.

Figure 23 - Development milestones to 96,000tpa – April 2022 Feasibility Study



Source: Alkemy Capital Investments plc

Value considerations

Our valuation is predicated largely on the metrics and inputs employed in Alkemy's April 2022 Class 4 Feasibility study (see section earlier in this note). In conjunction with this, we incorporate some of our own assumptions mainly surrounding timelines, capex and pricing.

- **Our indicative valuation for ALK for the current stage of development is £45m** versus the current market capitalisation of £8.2m. On a per share basis, this equates to 614p/sh fully-diluted, versus the current share price of 109p/sh (intraday 5-8-22). This is based on a risked scenario-based NAV valuation driven by our $NPV^{8\%}$ of £442m for the first stage (Train 1) of the Tees Valley Lithium Project (TVL) project risked at 0.1x NAV and pre-funding. This implies ALK is currently trading at 0.18x to our risked NAV, with a 463% return to NAV compared to the current 109p/sh intraday, and 0.12x/742% to the 87.5p/sh at close on 3-8-22 (pre placing announcement).

Our valuation is very much an initial standpoint for ALK given the stage of development the breadth of possible development scenarios. The translation into a per share value does need to be viewed with some care due to the currently low number of shares in issue as a result of the company's recent admission to the Main Board of the LSE. The likely future use of equity financing would result in a material change to the company's capital structure. We believe the £45m valuation is reasonable given the Mkt Cap of other potential hydroxide peers (EMH £73m, EUR £59m, ZNWD £24m etc. *See figure 3.*

Scenario-based approach. The scope of the Class 4 Feasibility study includes the modular development of four separate processing trains, each with a 24,000tpa capacity, for a total output of 96,000tpa of premium, low-carbon lithium hydroxide. The magnitude of potential financial output metrics for the overall development is vast compared to the current market value of the company. As such, to illustrate the significant potential for value accretion, incorporating the full 4 train development plan in the base-case valuation is not necessary at this time. Consequently, our base-case valuation standpoint is predicated solely on Train 1 (Glauber's Salt Route) which leaves the subsequent development of Trains 2-4 using the electrochemical route as future value upside. We do however include analysis and sensitivity on the build-out of additional processing trains to demonstrate the immense scale potential of the project.

Our post-tax $NPV^{8\%}$ for Train 1 is £442m (US$543m) and with additional trains incrementally boosting the NPV up to the maximum 4 train 96,000tpa development scenario which has a post-tax $NPV^{8\%}$ of £1.2bn (US$1.5bn) under our assumptions (next page). This differs from the TVL feasibility study post-tax $NPV^{8\%}$ of £2.2bn due to our use of lower long-term lithium prices, higher capex, a more cautious expansion timeline, and the fact that we start discounting cashflows in our DCF from the present day. Using the feasibility study inputs, our model is broadly in line with the reported feasibility project economics. The IRR is 27% on our numbers.

Figure 24 - Indicative NAV valuation for Tees Valley Lithium – Shard Capital assumptions

NAV Valuation

Asset	Basis	Trains	Approach	Disc Rate	*unrisked* GBP£m	US$m
Tees Valley Lithium	Glaubers' Salt (GS) route only	1	DCF	8.0%	442	543
	GS + 1 Electrochem train	1+2	DCF	8.0%	738	908
	GS + 2 Electrochem trains	1+2+3	DCF	8.0%	1,016	1250
	GS + 3 Electrochem trains	1+2+3+4	DCF	8.0%	1,205	1482

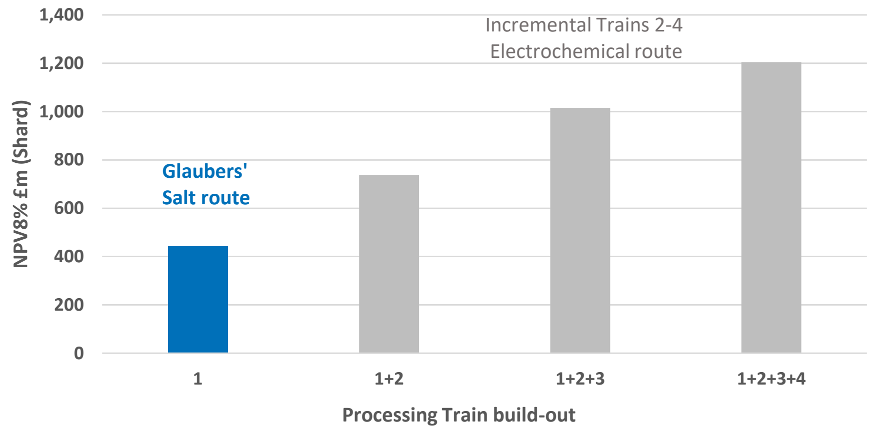
Valuation standpoint	Basis	Trains	Approach	Disc Rate	*unrisked* GBP£m	Multiple	*risked* GBP£m	p/sh	£/sh
Tees Valley Lithium	Glaubers' Salt (GS) route only	1	DCF	8.0%	442	0.1x	44.2		
Cash					1	1.0x	1.2		
Subtotal					443		45	614	6.14

Shares on issue	*7.2m*
Shares on issue (fully diluted)	*7.2m*
P/NAV (risked)	*0.18x*
Return to NAV (risked)	*463%*
Current share price (4-8-22)	109p/sh
Share price pre placing (3-8-22 close)	87.5p/sh

Source: Shard Capital estimates

Value uplift. Incorporating additional processing trains into our model has a profound impact on the overall NAV valuation. For instance, adding in Train 2 which would be the first module to employ the electrochemical processing route increases our $NPV^{8\%}$ to £738m (US$908m). Additional trains continue to add value, but with the slightly diminishing return caused by the time value of money in a DCF model.

Figure 25 – $NPV^{8\%}$ for incremental addition of processing trains – Shard Capital estimates



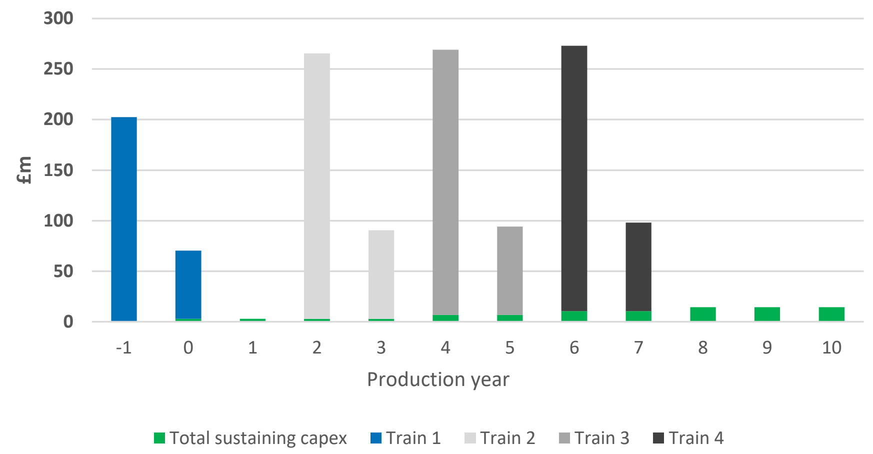
Source: Shard Capital estimates

Assumptions

In order to calculate an appropriate valuation standpoint for the company's current size and position on the development curve, some of our modelling inputs diverge from the Feasibility study. Aligned with our usual approach, we use conservative model inputs, the most important changes are outlined below:

Capex. We use an inflated capex assumption as with all our project models to account for any unforeseen capital cost increases either as a result of modifications to the original plan and more accurate costings. This remains the prudent approach in an inflationary environment. We inflate all capex assumptions in the feasibility study by 25% which is also in line with the nominal accuracy range of the feasibility study at +/- 25%. Consequently, our capex estimate for Train 1 is £270m, an increase over the £216m figure in the feasibility study. This 25% escalation applies to all Trains equating to total capex of £1.32bn (excluding sustaining capital) to build 96,000tpa capacity. We split capex over a two-year construction and commissioning window. We will review our capex numbers at pertinent junctures as figures may change and timelines accelerate.

Figure 26 – Capex assumptions for the 4 Train build-out - Shard Capital estimates



Source: Shard Capital estimates

Sustaining capex. We model sustaining capex as a percentage of opex as per the feasibility. This equates to c.£14.5m at full Four Train capacity.

Timelines. Whilst cognizant of the fact that the Wilton International Chemical Park is "plug & play" and having witnessed first-hand (see site visit section) the likely ease of development in terms of permitting, logistics and infrastructure, we take a similarly cautious approach to development timelines. We assume president day as Year -3 with first production in Year 0 (nominally 2025) with capex spend starting in Year -2 (2024). Using this timeline, we assume a small level of production in 2025 (5,000t LHM) and full production from 2026 onwards. This compares to the company estimate of commercial production in Q4 2024.

For our multiple train models, we incrementally phase in additional processing trains every 2 years (see fig 27) The potential ease of executing and building new trains once de-risked could see a considerable acceleration in this timeline, but we retain a very conservative build-out schedule for valuation purposes at present.

Figure 27 - Indicative capacity build-out assumptions, based on Shard Capital assumptions. 1st 10 years of operations.

Capacity build-out (tonnes LHM)													
LHM (lithium Hydroxide Monohydrate)	Total LOM	Avg	0	1	2	3	4	5	6	7	8	9	10
Train 1	*725,000*		5,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Train 2	*660,000*		0	0	0	12,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Train 3	*612,000*		0	0	0	0	0	12,000	24,000	24,000	24,000	24,000	24,000
Train 4	*564,000*		0	0	0	0	0	0	0	12,000	24,000	24,000	24,000
Total LHM produced	*2,561,000*	*82,613*	**5,000**	**24,000**	**24,000**	**36,000**	**48,000**	**60,000**	**72,000**	**84,000**	**96,000**	**96,000**	**96,000**
LSM (lithium sulphate monhydrate) feedstock required			8,250	39,600	39,600	59,400	79,200	99,000	118,800	138,600	158,400	158,400	158,400

Source: Shard Capital estimates

Prices. We assume a long-term lithium hydroxide monohydrate (LHM) price of US$22,000/t for saleable product and long-term lithium sulphate monohydrate (LSM) price of US$8,800 for the LSM feedstock input cost. This compares to US$25,000/t and $10,000/t for LHM and LSM respectively in the feasibility study. We retain the same 0.4x LSM/LHM price ratio as the feasibility study to maintain a reasonable share of the economics for the producer (source mine) and the refiner (TVL).

Picking an appropriate long-term lithium price given the current sector dynamics is a precarious process, especially given the large divergence between current contract prices and the spot price for instance. Prices are volatile (current LHM price on the LME is $76,000/t) and further complicated by possible fluctuations between lithium carbonate and hydroxide where hydroxide typically trades at a premium but has flipped to a negative spread over various periods in the last couple of years.

We have thus plumped for a price deck that is higher than 2020-2021 levels to incorporate the likely continued positive momentum in lithium pricing but one that still remains conservative. Our view is that we don't need to input high prices to make the TVL plant work in an economic sense, it is robust at a range of lower prices. Our $22,000/t LHM price assumption is also the same as Piedmont Lithium's (ASX/NASDAQ: PLL) long-term price assumption in the company's March 2022 PEA for development of a second lithium hydroxide (spodumene conversion) plant.

Given the difficulty in picking what might be a reasonable price assumption, we provide various sensitivity analysis later in the note. Furthermore, the important aspect is the margin between LSM input feedstock price and LHM sales price in any case, irrespective of the absolute pricing level.

FX. We use a flat forward 1.23 GBP/USD exchange rate to reflect the current market versus 1.39 in the feasibility study.

Tax. We model with 25% UK corporate rate (assuming production post 2023) and with capital allowances assume a 6-year tax holiday before tax payments commence. Tax rates could change depending on the outcome of the Conservative Party leadership race.

Feedstock and opex assumptions. An important assumption for the integrity of the model is the lithium conversion factor in order to calculate how much LSM (the feedstock and principal operating cost) is required for a certain level of LHM production. The feasibility study does not guide on this, but it's matter of chemistry based on atomic weights and the number of lithium atoms in both the lithium sulphate monohydrate feed stock ($Li_2SO_4.H_2O$) and the final product; lithium hydroxide monohydrate ($LiOH.H_2O$). We understand that this implies ratio of 1.523 of LSM feedstock in to LHM product out. However, to account for inefficiencies and assumed process loss, we use a more conservative ratio of 1.65, i.e., 1.65 tonnes of LSM feedstock is required to produce 1 tonne of LHM product. The cost of LSM therefore represents the majority of operating costs, around $14,500/t of finished LHM product based on our price deck. We add additional £2,000/t opex for processing and general opex, which we have back calculated by reference to the published financial outcomes of the feasibility study. Although there may be an opex advantage of employing the electrochemical route for later Trains depending on power costs, we assume the same opex structure for all Trains. We assume that only lithium hydroxide is produced but we note that TVL's process may allow a proportion of lithium carbonate to be produced from the LHM stream. We risk our NAV at 0.1x to reflect stage, development and financing risks.

Outputs

The outputs generated by our DCF models are as follows. Our current valuation basis is represented by Train 1 economics only which indicates average annual revenue and EBITDA of £429m (US$527m) and £98m (US$120m) respectively at full 24,000tpa capacity. Scaling up the operation with additional processing trains starts to produce some exceptionally compelling numbers. At full four Train capacity of 96,000tpa LHM, our model (at US$22,000/t LHM) indicates steady-state average annual revenue and EBITDA of US$1.7bn and US$392m respectively.

Given the current stage of development, there are a vast number of possible variables, not least lithium price assumptions, but the multiple train models below given an indication of the potential scale of the business.

Figure 28 - Indicative processing scenario outputs, based on Shard Capital assumptions. 1st 10 years of operations.

Train 1																
		Total LOM	Avg	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Total LHM produced				**0**	**0**	**0**	**5,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**	**24,000**
Revenue	£m	*12,967*	*418*	0	0	0	89	429	429	429	429	429	429	429	429	429	429
Operating cost	£m	*-10,009*		0	0	0	-69	-331	-331	-331	-331	-331	-331	-331	-331	-331	-331
EBITDA	£m	*2,959*	*95*	0	0	0	20	98	98	98	98	98	98	98	98	98	98
Tax	£m	*-587*		0	0	0	0	0	0	-21	-21	-21	-21	-21	-21	-21	-21
Net profit	£m	*1,997*	*64*	0	0	0	18	86	86	65	65	65	65	65	65	65	65
Capital expenditure	£m	*376*		0	0	203	70	3	3	3	3	3	3	3	3	3	3
Free cashflow	£m	*1,997*	*71*	0	0	-203	-50	95	95	74	74	74	74	74	74	74	74
EBITDA margin	%		*23%*	0%	0%	0%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%

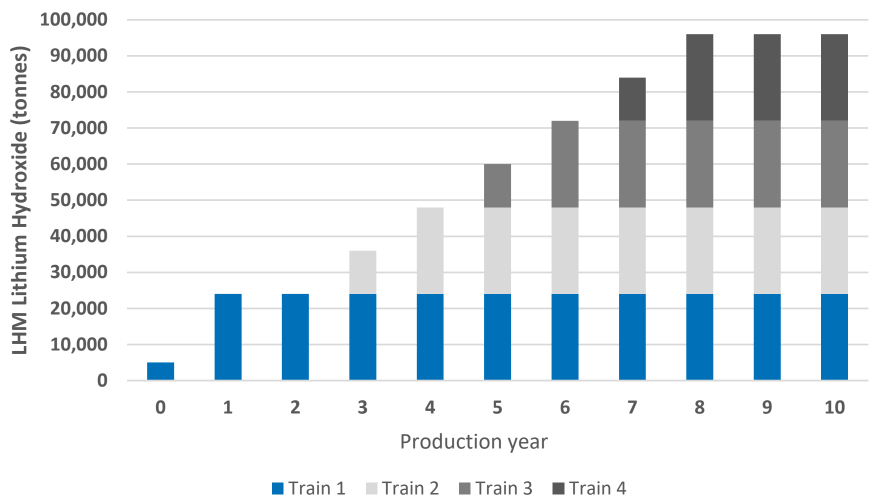
Train 1+2																
		Total LOM	Avg	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Total LHM produced				**0**	**0**	**0**	**5,000**	**24,000**	**24,000**	**36,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**
Revenue	£m	*24,772*	*799*	0	0	0	89	429	429	644	859	859	859	859	859	859	859
Operating cost	£m	*-19,120*		0	0	0	-69	-331	-331	-497	-663	-663	-663	-663	-663	-663	-663
EBITDA	£m	*5,653*	*182*	0	0	0	20	98	98	147	196	196	196	196	196	196	196
Tax	£m	*-1,102*		0	0	0	0	0	0	0	-41	-41	-41	-41	-41	-41	-41
Net profit	£m	*3,703*	*119*	0	0	0	17	83	83	125	126	126	126	126	126	126	126
Capital expenditure	£m	*848*		0	0	203	70	3	265	90	7	7	7	7	7	7	7
Free cashflow	£m	*3,703*	*126*	0	0	-203	-50	95	-167	56	148	148	148	148	148	148	148
EBITDA margin	%		*23%*	0%	0%	0%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%

Train 1+2+3																
		Total LOM	Avg	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Total LHM produced				**0**	**0**	**0**	**5,000**	**24,000**	**24,000**	**36,000**	**48,000**	**60,000**	**72,000**	**72,000**	**72,000**	**72,000**	**72,000**
Revenue	£m	*35,719*	*1,152*	0	0	0	89	429	429	644	859	1,073	1,288	1,288	1,288	1,288	1,288
Operating cost	£m	*-27,568*		0	0	0	-69	-331	-331	-497	-663	-828	-994	-994	-994	-994	-994
EBITDA	£m	*8,150*	*263*	0	0	0	20	98	98	147	196	245	294	294	294	294	294
Tax	£m	*-1,510*		0	0	0	0	0	0	0	0	0	-60	-60	-60	-60	-60
Net profit	£m	*5,328*	*172*	0	0	0	17	82	82	123	164	205	186	186	186	186	186
Capital expenditure	£m	*1,312*		0	0	203	70	3	265	90	269	94	11	11	11	11	11
Free cashflow	£m	*5,328*	*178*	0	0	-203	-50	95	-167	56	-73	151	223	223	223	223	223
EBITDA margin	%		*23%*	0%	0%	0%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%

Train 1+2+3+4																
		Total LOM	Avg	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Total LHM produced				**0**	**0**	**0**	**5,000**	**24,000**	**24,000**	**36,000**	**48,000**	**60,000**	**72,000**	**84,000**	**96,000**	**96,000**	**96,000**
Revenue	£m	*45,807*	*1,478*	0	0	0	89	429	429	644	859	1,073	1,288	1,502	1,717	1,717	1,717
Operating cost	£m	*-35,354*		0	0	0	-69	-331	-331	-497	-663	-828	-994	-1,160	-1,325	-1,325	-1,325
EBITDA	£m	*10,452*	*337*	0	0	0	20	98	98	147	196	245	294	343	392	392	392
Tax	£m	*-1,964*		0	0	0	0	0	0	0	0	0	-60	-70	-80	-80	-80
Net profit	£m	*6,719*	*217*	0	0	0	17	81	81	122	163	203	184	215	246	246	246
Capital expenditure	£m	*1,769*		0	0	203	70	3	265	90	269	94	273	98	14	14	14
Free cashflow	£m	*6,719*	*223*	0	0	-203	-50	95	-167	56	-73	151	-39	175	298	298	298
EBITDA margin	%		*23%*	0%	0%	0%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%

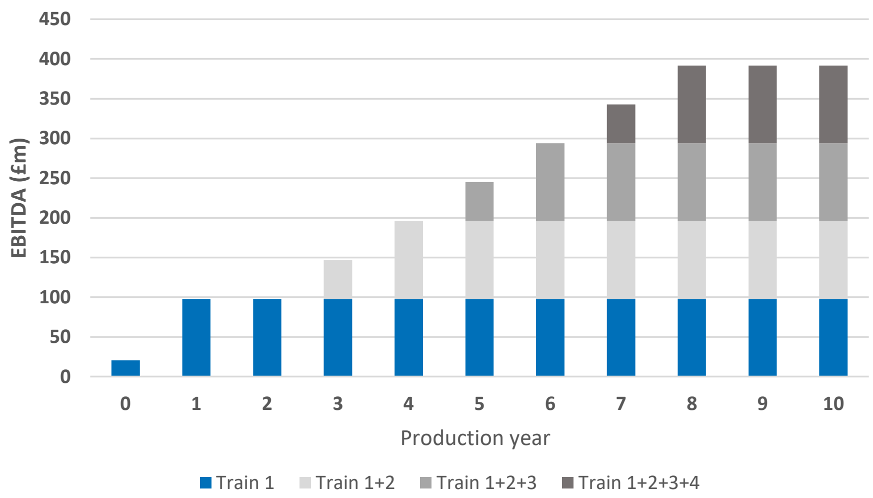
Source: Shard Capital estimates

Figure 29 – LHM production for incremental addition of processing trains – Shard Capital estimates



Source: Shard Capital estimates

Figure 30 – EBITDA for incremental addition of processing trains – Shard Capital estimates



Source: Shard Capital estimates

Sensitivity analysis

Figure 31 - Incremental NPV (£m) sensitivity to LHM price assumption and discount rate. Four different production scenarios.*

Train 1

LT LHM price assumption ($/tonne)	Discount rate (%)		
	5%	8.0%	10%
10,000	-48	-89	-103
15,000	294	140	78
20,000	616	352	244
22,000	750	442	315
25,000	931	559	405
30,000	1,260	777	576
35,000	1,589	995	747
40,000	1,878	1,178	887
45,000	2,201	1,391	1,053
50,000	2,523	1,603	1,219
55,000	2,845	1,815	1,385
60,000	3,168	2,028	1,551
65,000	3,490	2,240	1,717
70,000	3,813	2,452	1,883
75,000	4,135	2,665	2,049

Train 1+2

LT LHM price assumption ($/tonne)	Discount rate (%)		
	5%	8.0%	10%
10,000	-153	-209	-223
15,000	487	209	102
20,000	1,088	598	402
22,000	1,310	738	509
25,000	1,678	977	693
30,000	2,291	1,374	1,000
35,000	2,860	1,735	1,275
40,000	3,425	2,091	1,545
45,000	3,980	2,439	1,808
50,000	4,572	2,818	2,099
55,000	5,164	3,198	2,390
60,000	5,756	3,577	2,681
65,000	6,348	3,957	2,972
70,000	6,940	4,336	3,263
75,000	7,532	4,715	3,555

Train 1+2+3

LT LHM price assumption ($/tonne)	Discount rate (%)		
	5%	8.0%	10%
10,000	-253	-314	-324
15,000	644	261	117
20,000	1,486	793	522
22,000	1,835	1,016	692
25,000	2,318	1,318	921
30,000	3,133	1,828	1,306
35,000	3,937	2,330	1,683
40,000	4,739	2,826	2,055
45,000	5,529	3,314	2,420
50,000	6,357	3,834	2,813
55,000	7,184	4,353	3,205
60,000	8,012	4,873	3,598
65,000	8,840	5,392	3,991
70,000	9,667	5,911	4,384
75,000	10,495	6,431	4,777

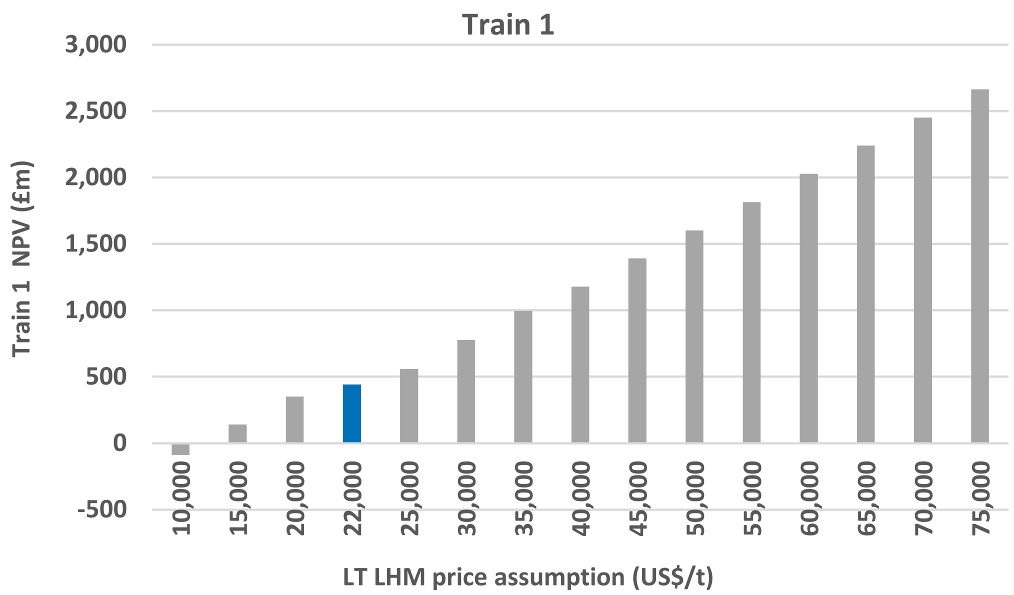
Train 1+2+3+4

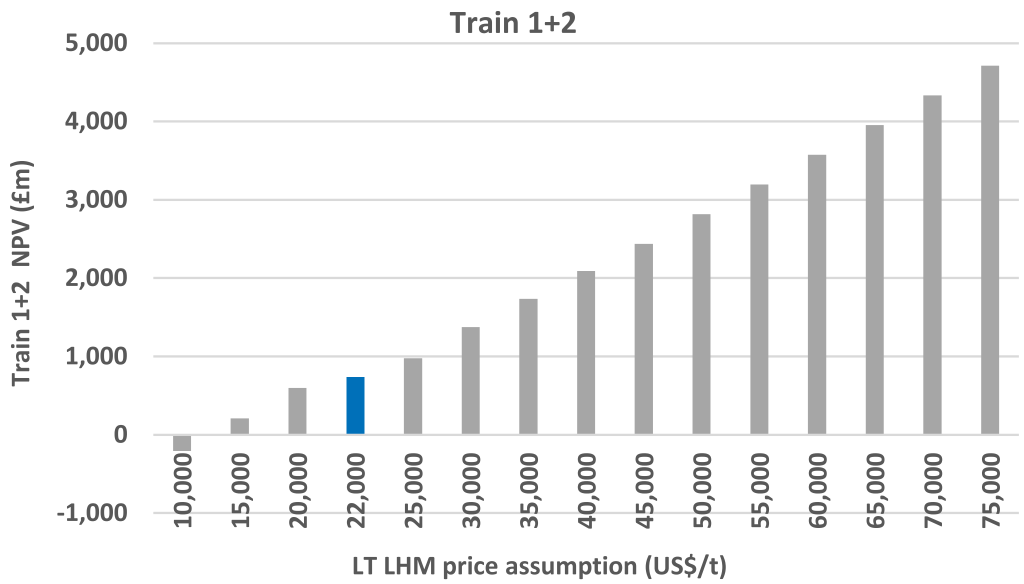
LT LHM price assumption ($/tonne)	Discount rate (%)		
	5%	8.0%	10%
10,000	-348	-405	-407
15,000	776	301	128
20,000	1,832	959	623
22,000	2,232	1,205	806
25,000	2,838	1,578	1,085
30,000	3,858	2,205	1,552
35,000	4,868	2,823	2,012
40,000	5,874	3,436	2,466
45,000	6,870	4,041	2,914
50,000	7,902	4,678	3,389
55,000	8,935	5,314	3,864
60,000	9,967	5,950	4,339
65,000	10,999	6,586	4,814
70,000	12,032	7,222	5,290
75,000	13,064	7,859	5,765

**assumes constant LSM/LHM price ratio of 0.4x based on Class 4 Feasibility assumptions ($10,000/$25,000)*

Source: Shard Capital estimates

Figure 32 - Incremental NPV (£m) sensitivity to LHM price assumption and discount rate. Trains 1 & 1+2*

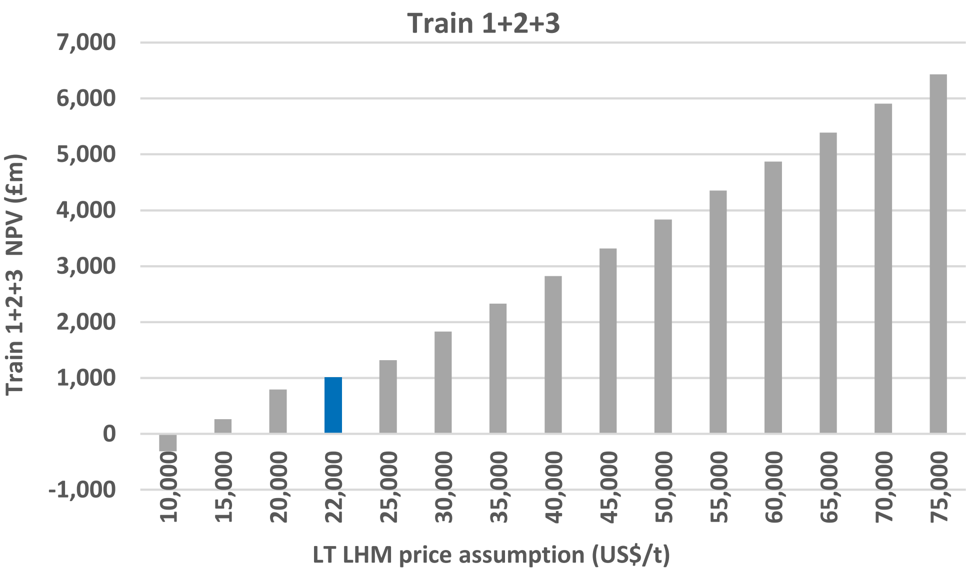


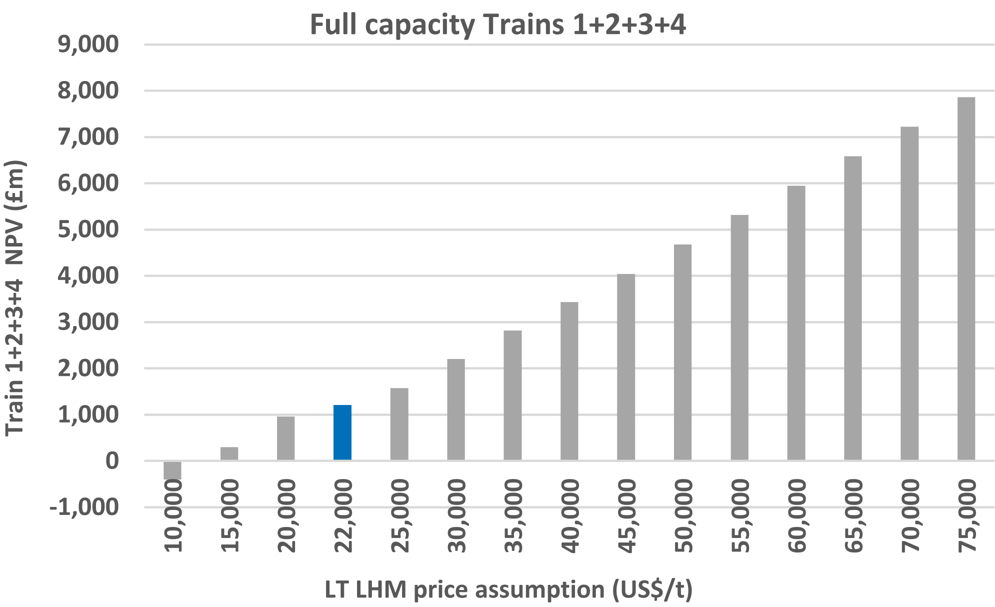


**assumes constant LSM/LHM price ratio of 0.4x based on Class 4 Feasibility assumptions ($10,000/$25,000)*

Source: Shard Capital estimates

Figure 33 - Incremental NPV (£m) sensitivity to LHM price assumption and discount rate. Trains 1+2+3 and full capacity 4 train*





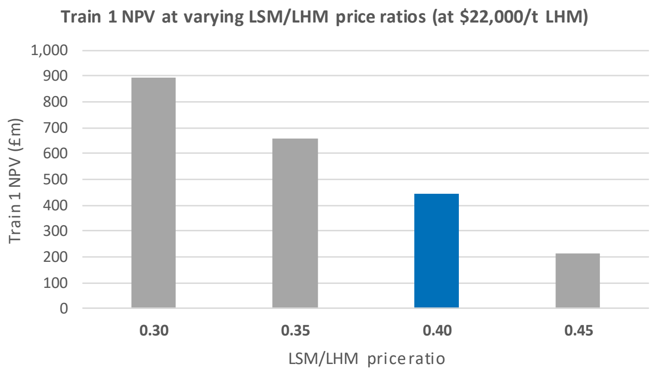
**assumes constant LSM/LHM price ratio of 0.4x based on Class 4 Feasibility assumptions ($10,000/$25,000)*

Source: Shard Capital estimates

As we have pointed out, the LHM price assumption is not the only variable as the important metric is the spread between the LSM price feedstock and bulk of opex) and the LHM price. The sensitivity charts on the previous page assume a static ratio between the two different prices. In practice, TVL will be acquiring LSM (or other feedstock) at a variety of prices and margins in order to take advantage of prevailing market dynamics. Nevertheless, we provide a sensitivity below for Train 1 on the LSM/LHM ratio, e.g., assuming the LSM price is 0.3x, 0.35x, 0.4x, 0.45x the LHM price. The takeaway from this that the project economics are robust at a variety of prices and ratios.

Figure 34 - Train 1 NPV$^{8\%}$ sensitivity to various LSM/LHM ratios. Our base case assumption is 0.4x in line with the feasibility study

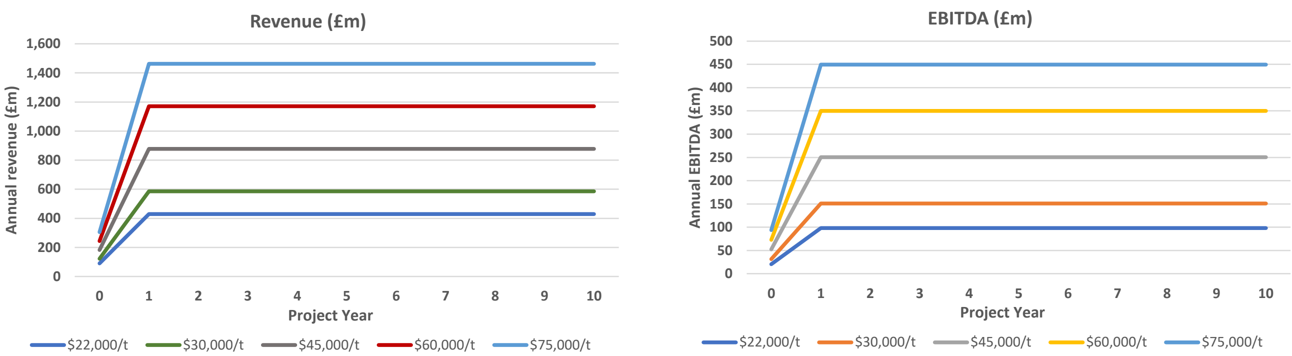
LT LHM price assumption ($/tonne)	Ratio LSM/LHM price (x)			
	0.30	0.35	0.40	0.45
10,000	133	23	-89	-217
15,000	454	292	140	-24
20,000	764	553	352	147
22,000	893	661	442	211
25,000	1,088	823	559	305
30,000	1,372	1,094	777	474
35,000	1,687	1,327	995	625
40,000	2,003	1,591	1,178	790
45,000	2,318	1,854	1,391	955
50,000	2,633	2,118	1,603	1,120
55,000	2,949	2,382	1,815	1,249
60,000	3,264	2,646	2,028	1,409
65,000	3,579	2,910	2,240	1,570
70,000	3,895	3,173	2,452	1,731
75,000	4,210	3,437	2,665	1,892



Source: Shard Capital estimates

- **At a range of higher lithium hydroxide price assumptions**, the potential upside for annual revenue and EBITDA is substantial. The sensitivity charts below for annual revenue and EBITDA are based on our own modelling and cover Train 1 only. Even at a modest increase in our LT price assumption to US$30,000/t, steady-state revenue and EBITDA increases to £585m and £151m respectively. Sustained higher prices are difficult to predict but the current disparity between contract prices and the smaller volume spot market may give an indication of price trajectory. High prices are currently being realised at present. The latest producer to report, Mineral Resources Limited (ASX: Min) which has a 51% offtake share of the Mount Marion spodumene deposit in Australia and a hydroxide tolling agreement with Gangfeng reported an average sales price in Q2 2022 of US$77,052/t for lithium hydroxide.

Figure 35 - Train 1 Revenue / EBITDA sensitivity to prevailing LHM price. Based on Shard Capital model and estimates



Source: Shard Capital estimates

Appendix 1 – Capital Structure

Capital structure and major shareholders

Following its admission to the Main Board of the London Stock Exchange on 2nd March 2022 following a reverse takeover transaction, the company had issued share capital of 5,999,999 ordinary shares. On 4th August 2022, the company announced that it had raised £1.2m through an oversubscribed placing resulting in the issue of a further 1.2m shares bringing total share capital to 7,199,999 shares. Directors subscribed for £178,000 of new shares in this placing. The net proceeds of the placing will be used to further fast track the development of TVL's lithium hydroxide processing facility in Teesside, UK and for general working capital purposes.

There are currently no options, warrants or other dilutive instruments on issue.

Figure 36 - Alkemy Capital Investments – capital structure and major shareholders (post placing RNS 4-8-2022)

Directors Shareholding	Ordinary Shares	% of ord shares
Paul Atherley	3,078,000	42.75%
Sam Delevan Quinn	325,000	4.51%
Helen Pein	25,000	0.35%
Subtotal		**47.6%**

Capital Structure	
Ordinary shares	7,199,999
Options	0
Warrants	0
Fully diluted share capital	7,199,999
Market cap (£m)	8.2

Markets	Ticker
LSE Main Board	ALK

Includes the 1,200,000 new ordinary shares to be admitted to trading on 9th August 2022

Share price as of close 4-8-2022

Source: Alkemy Capital Investments

Appendix 2 – Board & management

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 post graduate qualifications from the University of New South Wales and Deakin University Melbourne. He has held a number of mine management, senior executive and board positions and is currently Chairman and Founding Director of LSE listed Pensana Plc which is establishing the world's first independent and sustainable rare earth processing hub at the Saltend Chemicals Park in the Humber Freeport. He privately funded the early development of Tees Valley Lithium and is Chairman and Founding Director of Alkemy. Mr Atherley is a strong supporter of Women in STEM and has established a scholarship which provides funding for young women in Science and Engineering.

Sam Quinn - Non-Executive Director

Sam Quinn is a corporate lawyer with over 15 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. Mr Quinn holds various other Non-Executive directorships and company secretarial roles for listed and unlisted natural resources 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.

Management Team (TVL) >>>>>

John Walker - CEO Tees Valley Lithium

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 – Lithium supply chain advisor, TVL

Vikki has extensive experience in the battery supply chain industry. Recently led the supply chain strategy, development and control at JOHNSON MATTHEY PLC. Vikki has expertise in innovative industries related to sustainable technologies.

Robert Gruar – Technology Consultant, TVL

Robert has 15 years' experience in the batteries industry and has held several senior roles across the batteries value chain. Most recently he has been providing strategic and technical advice to UK OEM's and previously held senior roles at DYSON and SHARP.

Fuad Sillem - Business Development Manager

Alex Della Bosca – Commercial Manager

Molly Eldridge - Head of Investor Relations

Appendix 3 – met testwork summary

Summary of metallurgical feasibility testwork

Figure 37 – Metallurgical testwork programmes

TESTWORK PROGRAM	LABORATORY	SCOPE	STATUS
Impurity removal	Nagrom laboratories, Australia	Impurity removal from assumed LSM feedstock, to achieve purified LS solution requirements for both Electrochemical and Glauber's Salt routes.	Varying reagent regimes being trialled examining impact on liquor purity. Program ongoing.
Glauber's Salt crystallisation	Jord Proxa, South Africa	Production of battery grade LHM from synthetic purified LS solution, including Zero Liquid Discharge. Confirm flowsheet for crystallisation circuit.	**Complete.**
Electrochemical bench scale	Electrosynthesis, United States	Bench scale proof of concept of Electrochemical route from synthetic purified LS solution. Initial process optimisation work, assessment of different membranes suppliers.	**Complete.**
Electrochemical bench scale	Dorfner Anzaplan, Germany	Bench scale proof of concept of Electrochemical route from synthetic purified LS solution. Desktop study into impact of impurities from different feed sources. Production of crude LHM.	**Complete.**

Source: Alkemy Capital Investments plc

Appendix 4 – detailed process description

Detailed process testwork descriptions:

Figure 38 - Detailed process explantions

Glauber's Salt Route (Train 1)

The LSM 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 LSM 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 Na_2 SO (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.

Electrochemical Route (Trains 2-4)

The LSM 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 Na_2SO_4 and a mixture of NaOH, LiOH, Na_2SO_4 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 LSM 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.

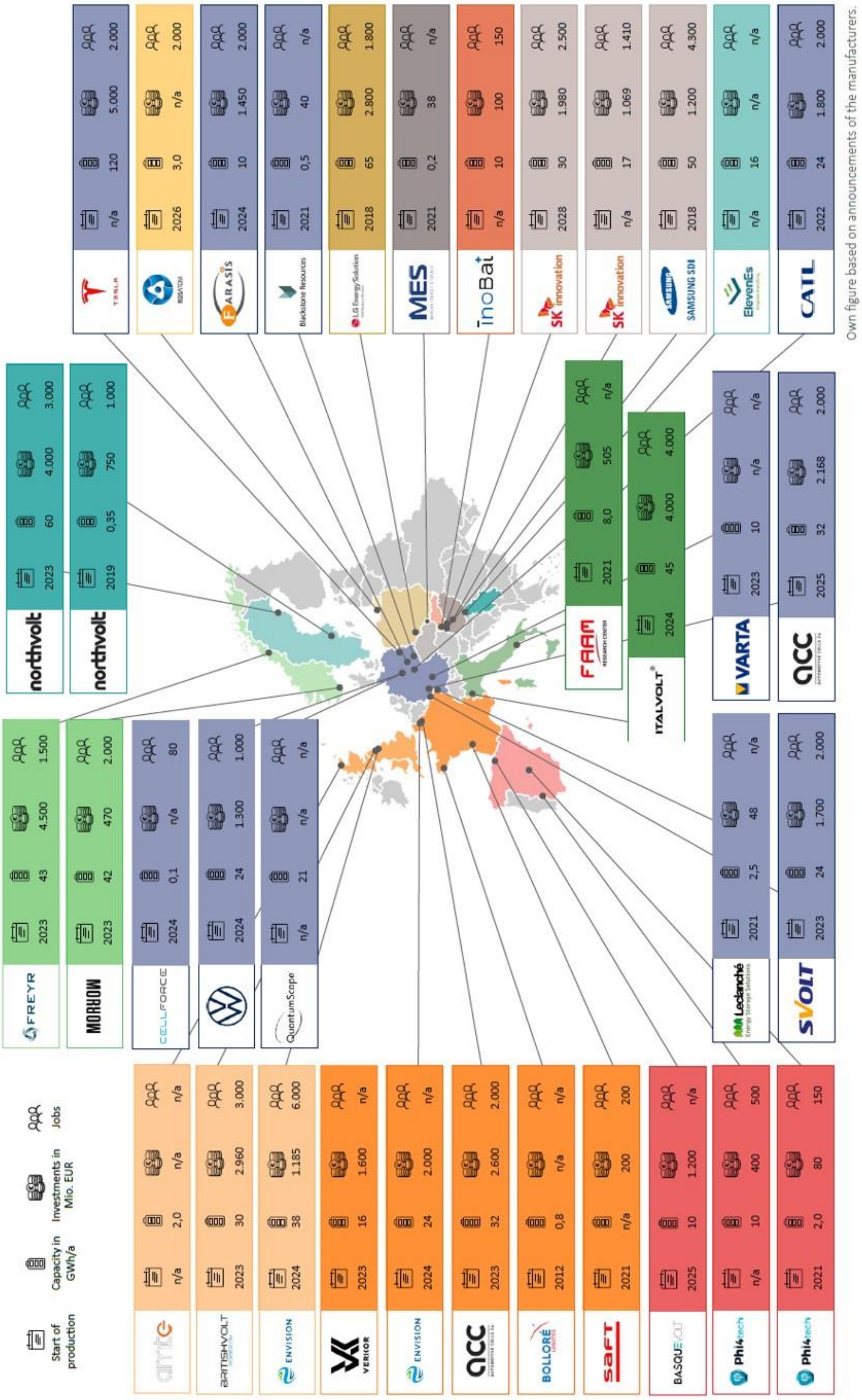
The Lithium Hydroxide is evaporated to increase the overall concentration of the solution. The concentrated LiOH is pumped to Crude Crystallization, where it exploits the saturated solubility of LiOH in the water against that of the remaining impurities. The LiOH crystallizes out of the solution, forming LiOH crystals that can be removed and reprocessed through an additional crystallization stage until the desired grade specifications are achieved. The wet precipitated crystals from the second stage are then transported into LHM 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.

Source: Alkemy Capital Investments plc

Appendix 5 – European gigafactory map

Figure 39 - European Gigafactory landscape – capacities and investment requirements



Source: Battery Cell Production, Q4 2021, Beermann et al

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Shard Capital Partners LLP
3rd Floor, 70 St Mary Axe,
London EC3A 8BE
United Kingdom

T +44 (0)207 186 9900
E info@shardcapital.com
W shardcapital.com