AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

Altech Chemicals Limited (ASX: ATC, FRA: A3Y)

November 2022

INDEPENDENT
INVESTMENT RESEARCH

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Altech Chemicals Limited (ASX: ATC, FRA: A3Y)

Comprehensive Update - November 2022

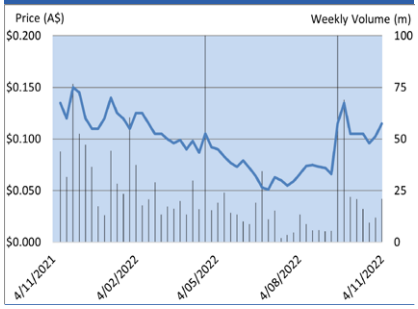
Note: This report is based on information provided by the company as at November 10, 2022.

Investment Profile	
Share Price as at Nov 10, 2022	A$0.115
12 month L/H ($)	A$0.043/0.014
Issued Capital	
Ordinary Shares	1,426 m
Performance Rights	30.05 m
Market Capitalisation	A$164.1 m
Cash - September 30, 2022	A$8.50 m
Receivable - Current	~A$7.12 m

Board and Management
Mr Luke Atkins: Non-Executive Chairman
Mr Iggy Tan: Managing Director
Mr Dan Tenardi: Non-Executive Director
Mr Peter Bailey: Non-Executive Director
Tunku Yaacob Khyra: Non-Executive Director
Mr Uwe Ahrens: Alternate Non-Executive Director
Mr Hansjoerg Plaggemars: Non-Executive Director
Mr Martin Stein: CFO/Company Secretary
Dr. Jingyuan Liu PhD AAICD: General Manager (Operations & Marketing)
Mr Neil Jameson; Engineering Manager
Ms Summer Qi M.ChemEng: Processing Manager

Major Shareholders	
Deutsche Balaton, Delphi	16.76%
Melewar Equities/MAA Group - Tunku Khyra	9.46%
SME Investments	4.02%
Directors	11.50%
Top 20	47.44%
Number of Shareholders	6,436

Price Chart



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

TECHNOLOGY BREAKTHROUGHS

Altech Chemicals Limited ("Altech" or "Company") has strongly advanced research and development ("R & D") into downstream battery materials and applications subsequent to our 2019 Initiation Note. At that time the focus was on the 4,500 tpa High Purity Alumina ("HPA") Project, however due to delays in financing (caused by COVID, and headwinds generally in project financing), the Company has been nimble in identifying and advancing battery technologies that have the potential to be game changers.

The first of these is the CERENERGY® Sodium Alumina Solid State ("SAS") battery, which are safer batteries than standard lithium ion batteries ("LIB") for stationary (including grid) applications. These are composed of common materials that can be readily and ethically sourced, and not reliant on supply chains concentrated in jurisdictions, such as China, that may prove problematic in times of geopolitical strife. Also all materials are readily recyclable.

R & D into solid state batteries has been slow to catch to that for liquid electrolyte lithium ion batteries ("LIB"), but more recent work has now solved some of the challenges associated with this type of battery, including solid electrolytes that will perform efficiently, and cost.

With a wider operating temperature range than LIBs, no risk of fires and thermal runaways, and low maintenance requirements, SAS batteries provide an ideal grid battery that can be used in a wide variety of climates and terranes.

The Company has entered into a 75/25 JV with the developer of the CERENERGY® battery, Fraunhofer IKTS ("IKTS") to undertake a Definitive Feasibility Study ("DFS") on a 100 MWh production facility, planned for a ~14 ha industrial plot the Company holds at the Schwarze Pumpe Industrial Park in Saxony, South Eastern Germany.

The second key technology breakthrough involves the development of a battery anode which includes silicon - the technology, Silumina Anodes™, has produced anode material that has an energy density that is ~30% higher than that for traditional graphite anodes, and is comprised of graphite and silicon coated by HPA using a proprietary coating technology.

The breakthrough here is the use of silicon in the anodes - silicon has a significantly higher energy density than graphite, and thus has the potential to result in lighter and smaller batteries, with material developed by Altech delivering an energy density some 30% higher than in current graphite only electrodes. An issue with the use of silicon as an anode material is ~30% expansion on charging, leading to severe capacity degradation.

The work by the Company looks as though it has broken through this "silicon barrier", and if the DFS is positive and qualification successful there is potentially a very large market for the product and possibly licencing of the technology. Tesla is one group which is looking to add silicon into battery anodes.

Like CERENERGY®, the potential for commercial production is now the subject of a fully funded DFS, with a 35,680 kgpa (120 kgpd) pilot plant now under construction at a facility next door to the Schwarze Pumpe plot, and with accelerated product qualification to be undertaken by IKTS.

The Company is undertaking this work at an opportune time, with growth in the targeted applications forecast to grow strongly over coming years with the mandated and un-mandated drive towards a decarbonised economy.

Altech is also cognisant of ESG credentials, and as part of the overall ESG strategy is getting projects and products independently audited by CICERO Shades of Green AS ("CICERO").

With A$8.5 million in the bank as of September 30, 2022, and over A$7 million to be received from the sale of part of a subsidiary over the next 12 months, and the potential for EU grants, Altech is fully financed for the ongoing studies, with this work to provide steady newsflow through 2023.

Additional funds may come from the Kerrigan kaolinite deposit in Western Australia, for which the Company is exploring options, and there is also potential for positive newsflow on the HPA Project financing front.

Although we have not undertaken a formal valuation of Altech, ASX-listed companies with similar projects at similar stages have market capitalisations of up to A$450 million, and thus we see upside potential in the value of Altech, a company that is operated by quality personnel with the requisite commercial and technical experience.

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SWOT ANALYSIS

Strengths

- **Technology breakthroughs:** Work to date on all three main projects has resulted in technology breakthroughs, or meaningful improvements on existing technologies, thus de-risking ongoing activities.
- **Burgeoning decarbonisation:** Altech is operating on the right technologies at the right time, with both mandated and un-mandated factors driving the decarbonising economy.
- **Green credentials:** Projects have been successfully independently audited for their green credentials.
- **Strong and experienced team:** Personnel, both within the Company and the Company's partners have extensive experience in industrial/chemical industry developments and operations.
- **Strong and well regarded development partners:** Altech has partnered with well regarded partners in the development of the various facets of the business.
- **Supportive and strong register:** The register enjoys strong cornerstone investors, as well as including development partners.
- **Well sited in Germany:** The industrial block in Schwarze Pumpe is well sited with regards to infrastructure (including green electricity), access to skilled labour and markets.
- **Fully permitted at both HPA sites:** Dependent upon successful financing, this will enable the main construction, and then operating activities to get underway without any regulatory delays.
- **Funded:** Altech is fully funded through to completion of the DFSs for both the CERENERGY® and Silumina Anodes™ projects, and the pilot plant for the latter. There is also the chance to get additional funding through EU and other government grants.

Weaknesses

- **Funding of the HPA project:** Market headwinds amongst other things have made financing of the HPA project difficult, despite having the senior debt in place.

Opportunities

- **Successful development and commercialisation:** This is the main opportunity (and the Company's aim) for all three projects.
- **Expansion:** Dependent upon successful commercialisation, acceptance by customers, and growing markets, there is always the potential for expansions down the track - this has already been quoted as one of the CERENERGY® aims.
- **Licencing:** Technology is commonly licenced, and can be a way for the IP owner to earn additional income without the financing, construction and operating risk.

Threats/Risks

- **Negative study results:** This is a risk that goes without saying, and, in the case of technology materials, can include the failure to successfully qualify products.
- **Markets:** These can affect funding, and in particular development funding of projects. Given the current financial position and project stage (except for the HPA project), Altech is reasonably well placed at the moment, being fully funded for the two DFSs and pilot plant.
- **Ramp up and operational risk:** This is a risk with most projects, and especially so with projects that have produced on at a pilot scale, and are scaling up to commercialisation, particularly in new technologies.

COMPANY OVERVIEW

STRATEGY AND PROJECT OVERVIEW

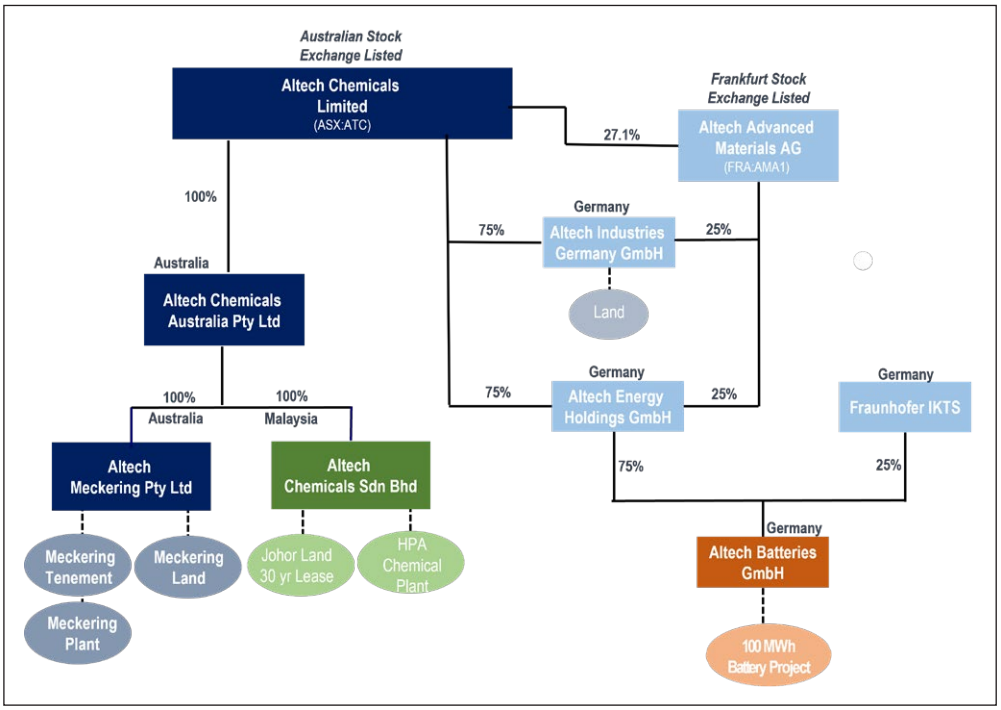
- Altech is a technology development company, with activities largely focussed on the burgeoning EV and grid battery, and battery materials sector, with Definite Feasibility Studies ("DFS") currently underway on a 100 MWh production facility for the CERENERGY® SAS battery, and Silumina Anode™ compound anode project, which is based on HPA coated silicon/graphite anode materials.
- Developments are planned for a site at the Schwarze Pumpe Industrial Park in Saxony, South Eastern Germany, which the Company has purchased.
- Despite delays, the Company is still progressing the Western Australian/Malaysian HPA Project - activities are focussed on closing off the financing for the planned 4,500 tpa 4N HPA product facility.
- The CERENERGY® SAS project is being undertaken in a JV with leading German technology R & D institute Fraunhofer IKTS ("IKTS") to commercialise the solid state battery, with plans to construct a 100 MWh production facility on the Schwarze Pumpe site, however with the ultimate aim to construct a "gigawatt" scale facility.
- Altech will have 75% of the project, and will free carry IKTS's 25% share through to any development decision.
- The batteries are targeted at the burgeoning grid power sector, and follow on from eight years of R & D and pilot plant studies by IKTS, which at the time of signing the JV had successfully produced and tested 10 MWh battery modules - the JV has subsequently announced the design and launch of a 60 kWh battery pack.
- The Company (75%) in partnership with Altech Advanced Materials AG ("AAM", 25%) through Altech Industries Germany GmbH ("AIG") has recently completed a positive PFS on a 10,000 tpa Silumina Anodes™ plant, which has now triggered the construction of a fully funded 35,680 kgpa pilot plant, with this located in a facility adjacent to the ~14 ha site that the Company has acquired at the Schwarze Pumpe Industrial Park.
- The aim of the anode R & D is to produce battery anodes with higher energy capacities, and better reliability, charge retention and safety - a key breakthrough has been lab scale work demonstrating that the Company's alumina coating process can produce silicon anode material that overcomes a major issue with silicon as an anode material, namely severe degradation due to expansion during charging.
- Silicon has a ~10x higher energy capacity than graphite as an anode and thus has the potential to make batteries significantly smaller and lighter (the anode takes up the most volume in a battery), but it is the issue as mentioned above that has prevented widespread adoption - Tesla however has signalled the intention to increase the use of silicon.
- Development of the ~US$300 million HPA Project, which includes facilities at Meckering in Western Australia and Johor State in Southern Malaysia has been delayed over the past two years by issues obtaining subordinate debt (although US$190 million of senior debt is in place with the German Government owned KfW IPEX-Bank), however the Company is now confident of obtaining the required funds through the issue of "Green Bonds".
- It is estimated that US$144 of bonds will be required (including US$44 million to cover the first two years interest expenses), with finalisation of debt finance being expected to trigger raising of the US$100 million of required equity - one equity option is to sell 49% of the Project.
- Finally, the Company also holds the Kerrigan kaolin deposit in Western Australia - in April 2022 an Inferred Resource upgrade to 125 million tonnes @ 85.23% brightness was announced to the market.

CORPORATE STRUCTURE

- Figure 1 presents Altech's corporate structure.
- AIG was initially a 100% owned subsidiary of Altech, however in December 2020 the Company sold a 25% interest in AIG to the now 27.1% owned AAM for €5 million (A$8.3 million) - 29% of the Frankfurt listed AAM (then Youbisheng Green Paper AG) was acquired from Deutsche Balaton AG for €1,000,000 in fully paid ATC shares and €500,000 cash in late 2019.

- The settlement for the AIG stake included an initial cash payment of €250,000, and a deferred consideration of €4.75 million (plus interest) payable in three equal installments on each anniversary of the initial consideration.
- AAM holds an option to purchase 49% of the HPA Project for US$100 million.

Figure 1: Corporate structure



Source: Altech

FINANCIAL POSITION

- As of September 30, 2022 the Company had A$8.50 million in cash and no debt; there is also a receivable of A$7.12 million being for the deferred consideration of the sale of the AAM stake.
- A$5 million of the receivable is expected to be received in December 2022, with the balance due in September 2023.
- Development expenditure over the 12 months to September 30, 2022 was A$3.950 million, with expenditure on staff and administration being A$5.173 million.
- The most recent capital raise was A$10.3 million in December 2021 through a placement (A$8.1 million) and SPP (A$2.2 million) at A$0.107/share; an additional A$3.5 million has been raised through the conversion of options over the past twelve months.
- The cash balance and receivable means that the Company is fully funded for the Silumina Anodes™ pilot plant and DFS, and the CERENERGY® DFS.
- There is also the potential for funding through EU grants - one example is the 2021-2022 Horizon Europe programme, with around €5.8 billion to be invested in energy research and innovation projects.

CAPITAL STRUCTURE

- Altech currently has 1,427 million fully paid ordinary shares and 30.05 million performance rights on issue.
- On a consolidated basis, significant shareholders include the German funds Deutsche Balaton/Delphi with 16.76% of the register, and MAA Group Berhad/Melewar Equities (entities associated with Director Tunku Khyra) with 9.46%.
- Other large shareholders include SMS Investments with 4.02% - the Top 20 hold 47.44% and directors beneficially hold 11.50%.

DOWNSTREAM PROJECTS

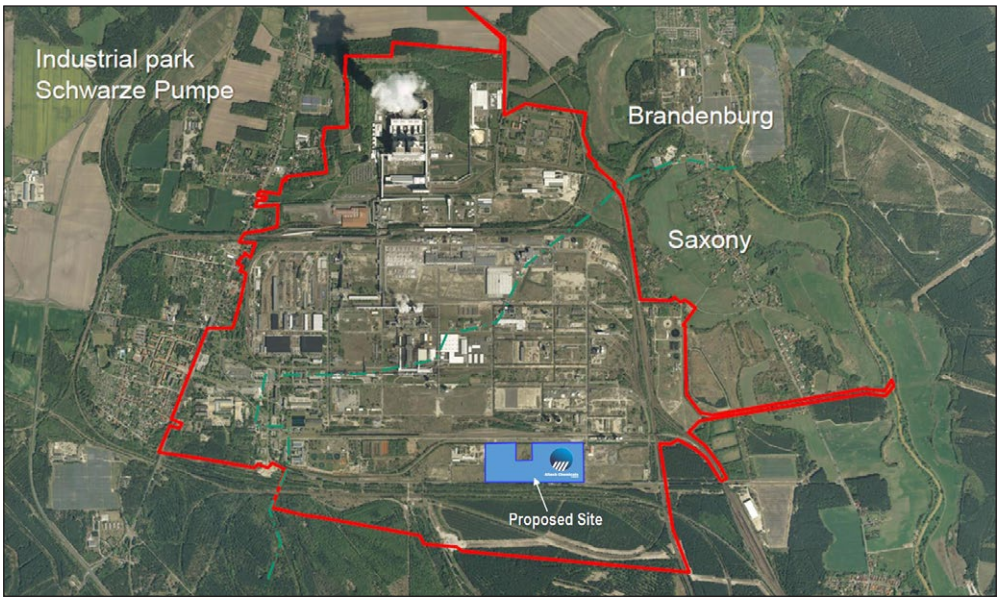
BACKGROUND, LOCATION AND INFRASTRUCTURE

- The Company's focus is downstream battery and battery materials development, focussing on either disruptive or innovative technologies, designed to solve current challenges and thus make breakthroughs in the use of the respective applications.
- These include:
  - The CERENERGY® solid state salt battery, designed for stationary applications, and,
  - Silumina Anodes™, a HPA coated silicon-graphite anode material, which appears, thus far, and subject to ongoing qualification, to have solved issues, particularly degradation, associated with the use of silicon as an anode material.
- Both projects are now entering the DFS stage, with the CERENERGY® study being a joint venture between Altech (75%), and IKTS (25%), and the Silumina Anodes™ project being operated by AIG - these applications are discussed in detail below.
- IKTS, previously known as the "Fraunhofer Institute for Ceramic Technologies and Sintered Materials IKTS" was formed in 1992, and is also undertaking the accelerated qualification process for the Silumina Anodes™ - IKTS is one of 76 institutes operated under the parent company, Fraunhofer Gesellschaft which was founded in 1949.
- As part of ongoing R & D activities, Altech set up a dedicated laboratory in Perth, with more recent activities being on the development of pouch cell batteries, which will not be discussed further here.
- The main activities however are to be run out of the Schwarze Pumpe Industrial Park located 100 km NE of Dresden,in Saxony, Germany (Figures 2 and 3).
- The catalyst for a German based operation was the invitation, in September 2019, by the Saxony State Government for Altech to consider setting up a second HPA production plant, with the suggested site being in the industrial area.

Figure 2: Schwarze Pumpe location

Source: Altech

Figure 3: Schwarze Pumpe Industrial Park layout



Source: Altech

- The Saxony State Government has also, in September 2020, provided a commitment letter for a grant of €7,380,000 (~A$12.2 million at the time) to support a total investment for the construction of a HPA plant, however which will be available to be used for the Silumina Anodes™ and CERENERGY® work.
- The Company has subsequently purchased, through the 75% owned AIG, the ~14 ha site (Figure 3), with this announced to the market on January 20, 2022, and will be using ~300 m^2 of floor space in the neighbouring "Dock 3" building for the Silumina Anodes™ pilot plant.
- The region is well positioned with regards to infrastructure, including road and rail, and with access to ports on the navigable Elbe River which empties into the North Sea at the major international port of Hamburg.
- The site also has access to 100% green electricity, with this supplied through power purchase agreements ("PPAs") or Guarantees of Origin ("GoOs") through the suppliers in the region - being able to source green energy has been positive in independent reviews of the "green" credentials of the proposed project.
- Saxony is also well placed with regards to the German automobile industry, as well as the forecast growth in European EV battery factories to an estimated 600 GWh by 2030 - some 15 factories are either planned or under construction.

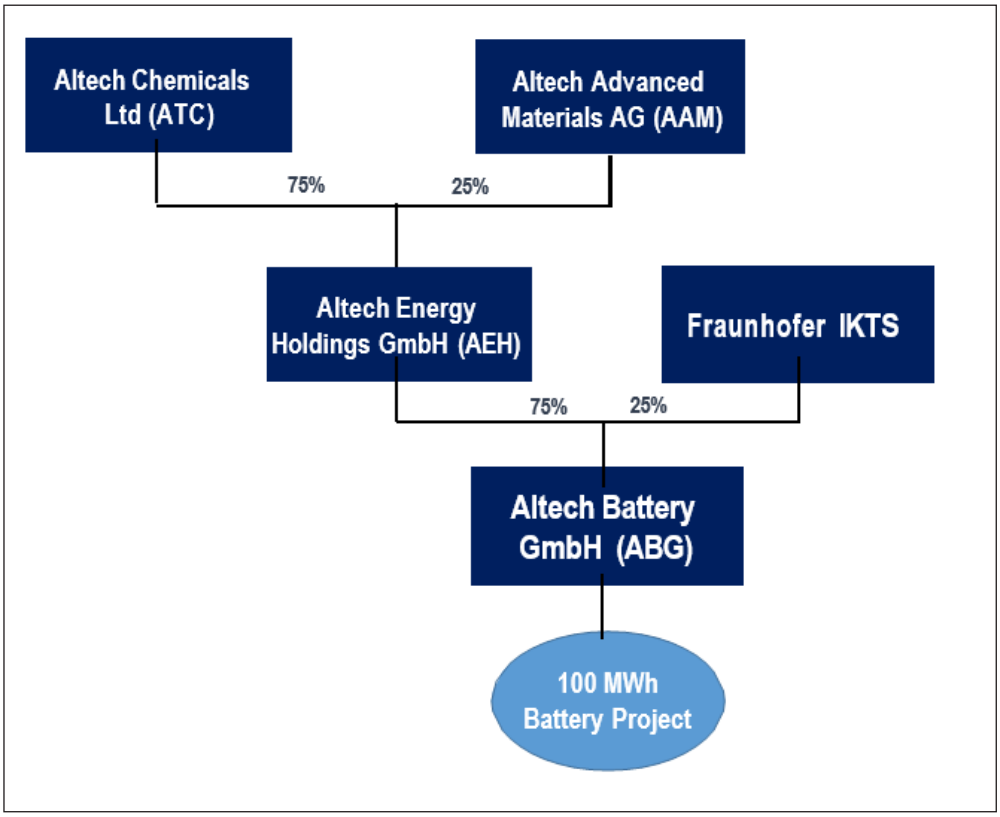
CERENERGY® SOLID STATE BATTERY - ATC 75%

Joint Venture and Corporate Structure

- In September 2022 the Company announced that it had entered into a JV with IKTS to undertake a DFS looking at the commercialisation of the CERENERGY® battery as developed by IKTS - planned commercialisation is to be through the development of a 100 MWh plant in Germany (the subject of the DFS), with the potential then to further develop gigawatt scale production facilities.
- The DFS is expected to take around 12 months, with Altech fully funded to undertake the work - IKTS is free carried until any decision to build a manufacturing facility.
- The DFS is predicated on a facility planned for the Schwarze Pump block.
- On October 26, 2022 Altech announced that Leadec Automation & Engineering GmbH ("Leadec") had been appointed as lead engineering company for the project.
- IKTS had spent some €35 million on R & D and €25 million on a pilot plant over eight years, and thus was at the point to engage with a suitable partner to take the battery to commercialisation, with the partner to have the resources (including cash and land) to take the project forward - Altech fitted the requirements.
- Key points of the agreements regarding the JV include:
  - Joint Venture Company – Altech Batteries GmbH ("ABG"),
  - Ownership of ABG – AEH 75%, IKTS 25% free carried,

- Ownership of AEH – ATC 75%, AAM 25% (Figure 4),
- In exchange for the free carried interest of 25% of ABG, IKTS has executed an exclusive background intellectual property (IP) and know-how license agreement ("License") to ABG,
- ABG has no license royalties' obligations for the first Train 1, 100 MWh project,
- IKTS provides access to pilot plant, trials and technical expertise,
- Altech Group will provide land for a Train 1, 100 MWh site in Saxony,
- A service development contract has been executed to use IKTS services and personnel over a period of 4 years, to progress a DFS, funding, construction, commissioning and start up of the 100 MWh plant,
- The service contract payment terms are commercially confidential,
- During development, any IP (developmental, commercialization, product and marketing IP known as "foreground IP" developed will be property of ABG,
- On completion of the DFS, if ABG decide to move to funding stage of the project, IKTS will be free carried,
- ABG will have the right to use "CERENERGY® trademark for SAS batteries,
- ABG will operate the 100 MWh battery business,
- Once the pre-agreed IKTS service payment plan has been completed, the exclusive background IP will be owned by ABG,
- At any time, ABG could proceed to expansion to Train 2 or Gigawatt Project ("Giga" Project),
- On completion of the Giga Project DFS, ABG may decide to fund the Giga project,
- For the Giga factory case, IKTS can contribute to the equity component of the financing (own 25% of the Giga project) or covert the future ownership of the project to a background IP royalty agreement,
- The background IP royalty agreement will consist of 1.5% of product sales ex gate for all future sales of battery products; and,
- ABG by mutual agreement of both shareholders, could issue licenses to other parties.

Figure 4: CERENERGY® JV structure

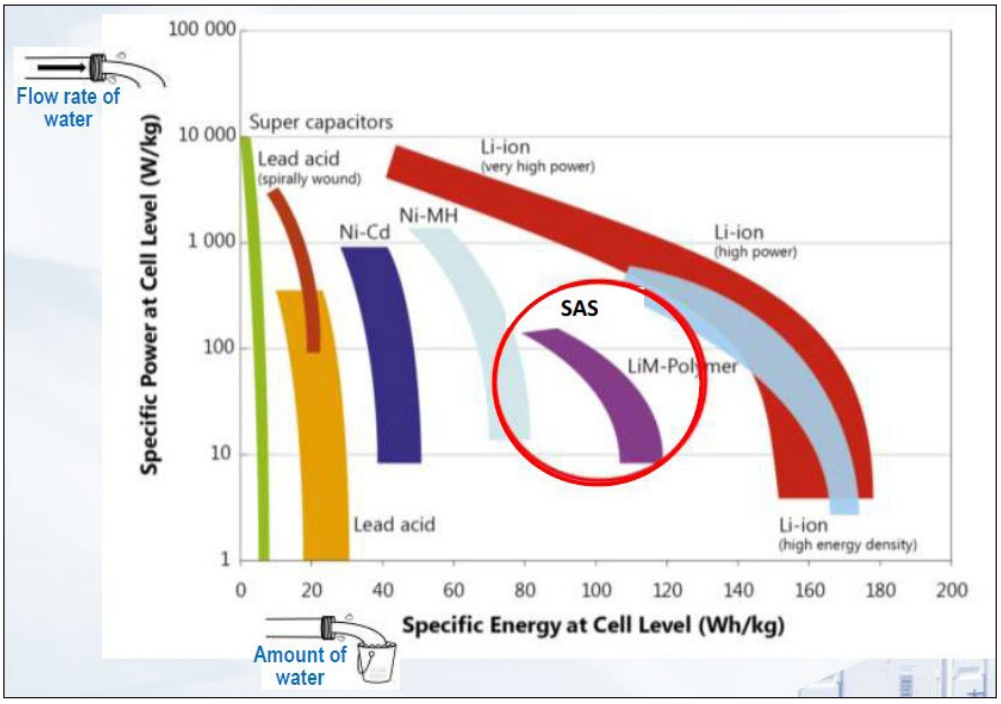


Source: Altech

SAS Batteries - What and Why?

- Solid state batteries are those that have a solid electrode, rather than the liquid electrode and separator as found in most current lithium-ion batteries - in the case of "salt" batteries sodium replaces lithium as the active cation in the battery operation.
- Solid state batteries are suitable for grid but not mobile applications - they have a lower energy capacity and power delivery than most recent LIBS that makes them unsuitable for the high power/energy EV requirements, however have energy densities similar to LFP LIBs.
- Comparisons between various battery types are shown in Figure 5 and Table 1.

Figure 5: Battery power and energy comparison



Source: Altech

Table 1: Grid battery comparison

Grid battery comparison			
Parameter	**CERENERGY® Battery**	**Redox Flow Battery**	**LFP Battery**
Practical Energy Density (Wh/kg)	100 - 120	10 - 25	120 - 160
Energy Conversion Efficiency	80 - 85%	70%	75 - 80%
Cycle Life	>6,000	12,000	3,000 - 5,000
Safety	Very High	High	Medium
Capex	Low	High	Medium
Operating Temp (°C)	-40° - +60°	Sensitive to Temp	15° - 35°
Self Discharge (%/day)	0	small	0.1 - 0.3
Maintenance Cost (USD/kW)	minimal	28	10

Source: Altech

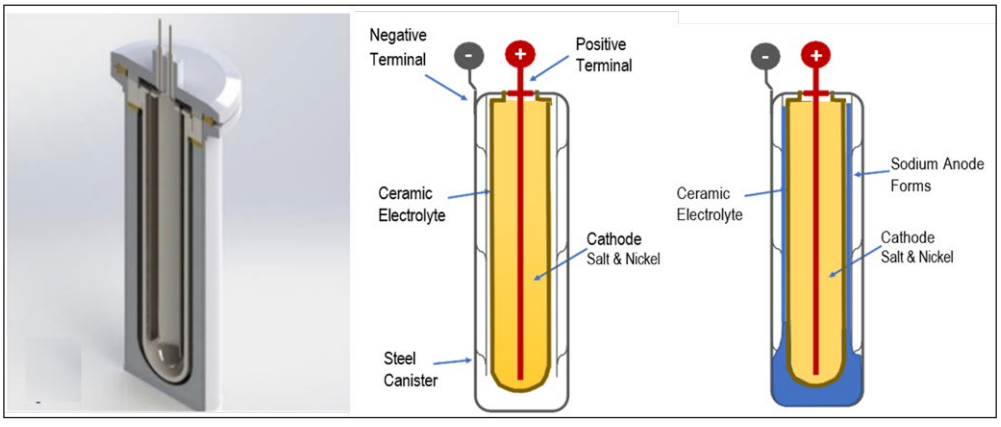
- Advantages of SAS batteries over LIBs include (particularly those being developed by IKTS):
  - All materials are readily available when compared to LIBs, and readily recyclable,
  - The ability to operate at a wider range of temperatures than "normal" LIB batteries - -40°C to +60°C as compared to +15°C to +35°C, thus suitable for cold and desert climates,
  - Fireproof - there is no danger of fire, explosions and thermal runaways as is the case with LIBs,
  - Significantly longer life span, lower degradation and many more charging cycles - the batteries have an expected life span of 15+ years and 6,000+ charging cycles as compared to LIBs' which have estimated life spans of 7 - 10 years and up to 5,000 charging cycles before reaching a 70% capacity level; and,

  - Not reliant on the China supply chains, which currently provide some 90% of anode material.
- Materials used in LIBs and not in SAS batteries include:
  - Lithium - currently commanding extremely high prices with restricted supply chains,
  - Cobalt - 70% of current global supply is from the DRC with ethical mining issues,
  - Graphite; and,
  - Copper - with the growth in EVs some are expecting a supply crunch in the metal with not enough production coming on stream.
- R & D into SAS (and for that matter all solid state) batteries has lagged behind that for LIBs, with the R & D generally concentrating on developing higher power and energy batteries for the mobile EV applications (partially to overcome "range anxiety"), with these technologies, being well developed, also being used in stationary applications.
- More recently however the advantages (as presented above) of SAS over LIB batteries for stationary applications have led to an increase in R & D into the batteries, however there have been some challenges, including amongst others:
  - The development of a solid state electrolyte that allows for efficient ionic conductivity but zero electrical conductivity,
  - Maintaining a good contact between the electrolyte and anode/cathode; and,
  - Cost.
- Until now the cost per unit of storage capacity of developing solid state batteries has been significantly higher than that for LIBs, due to several factors, including amongst others a significant amount of the manufacturing being manual and in high wage jurisdictions and immature supply chains.
- Cost is a key criteria in gaining penetration for "new" technology, and this will be a key aspect of the DFS.
- Currently, stationary, small grid (including home solar) batteries, with a capacity of around 13.5 kWh, have a completed module retail price in the order of A$1,000 to $A1,500/kWh.
- The cost for grid scale batteries is broadly similar allowing for economies of scale - the estimated cost of the initial 100 MW/129 MWh Horndale LIB in South Australia was A$90 million.

CERENERGY® SAS Battery

- The batteries as developed by IKTS contain five main materials, being a ceramic electrolyte (developed by IKTS), a steel casing, solid electrode materials including powdered nickel and salt, and a liquid sodium aluminium chloride medium.
- The ceramic electrolyte, as developed by IKTS, completely encloses the cathode, which is initially filled with powdered nickel and salt, and then flooded with a sodium alumina chloride medium to ensure contact between the cathode materials and the solid electrolyte (Figure 6).
- The ceramic electrolyte as developed by IKTS, along with the use of the Na-Al-Cl medium are the key elements in overcoming some of the SAS battery issues as mentioned above.

Figure 6: CERENERGY® battery section (L), schematic section (C) and fully charged schematic section (R)



Source: Altech

- On charging the sodium ions and electrons form a molten sodium anode (Figure 6) at a temperature of around 250° C to 300° C, however insulation ensures that the outsides of the cells are able to be readily handled, with the chlorine ions in the cathode combining with the nickel to form nickel chloride salt.
- On discharge, the electrons flow from the anode to the cathode through the load, with the sodium ions moving through the ceramic electrolyte back to the cathode - the overall reaction is:
  - $2Na + NiCl_2 <--> 2NaCl + Ni$
- At the time of the signing of the JV, IKTS had successfully produced 10 kWh battery modules, however Altech has recently announced the successful design of, and launch of a 60 kWh, 620 V, 100 Ah "ABS60" battery pack, especially designed for the renewable energy and grid storage market, and given an operating range of down to -40° suitable for cold European climates.
- The ABS60 pack is comprised of 240, 2.5 V CERENERGY® cells, packaged in five modules, each of four rows of 12 cells, with benefits including:
  - Can be installed inside (where LIBs are prohibited) as well as outside,
  - A 6x reduction in battery management systems (from six to one) over the previously envisaged 10 kWh modules; and,
  - Reduced installation, casing and connection costs.

SILUMINA ANODES™ - SAXONY - GERMANY - ATC 75%

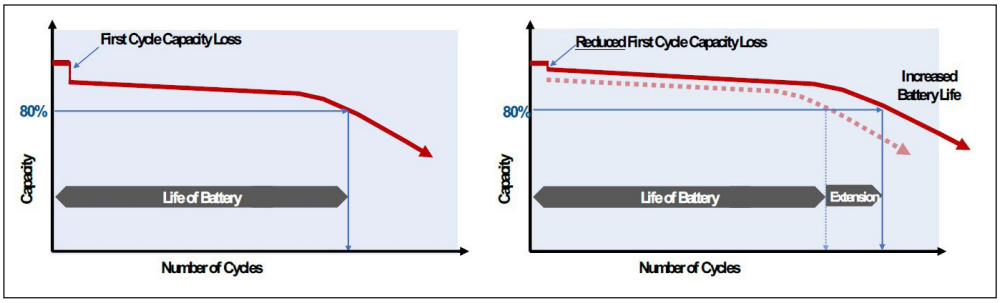
- As an offshoot of the original HPA production project, ongoing research in the downstream applications of HPA by the Company has led to lab scale successes, with these including:
  - HPA coated graphite for use in battery anodes,
  - HPA coated silicon for use in battery anodes; and
  - The patented Silumina Anodes™, which comprise a mix of HPA coated graphite and silicon in anodes for LIB batteries.
- The HPA coating work has resulted in the completion of a positive PFS for a 10,000 tpa anode coating and Silumina Anodes™ production plant at Schwarze Pumpe, with development of a 36,680 kgpa (120 kgpd) pilot plant now underway.
- The PFS modelling resulted in a pre-tax NPV_8 of US$507 million, with an up-front capex (including contingency) of US$95 million.
- This also presented an EBITDA of US$63 million per annum (from revenue of US$185 million), with modelling undertaken to a +- 30% accuracy.
- These cash flow figures show:
  - Revenue of US$18,500/tonne of anode; and,
  - Cash costs of US$12,200/tonne of anode.
- The pilot plant (which has an estimated total cost of A$7.177 million, of which 75% or A$5.382 million is attributable to Altech) has several aims, including to provide data to be used in planning of the full scale plant and providing qualification samples amongst others, as well providing data and results to be used in a Definitive Feasibility Study.
- The construction contract for the pilot plant was executed with Kuttner GmbH & Co ("Kuttner") in June, 2022, and at that time long lead time items procurement had commenced, and with the final engineering design and cost estimations being completed.
- On the qualification side, the Company has engaged IKTS for the independent performance testing and qualification of the Silumina Anodes™ that will be produced by the pilot plant - product qualification is a critical part of introducing, and gaining acceptance of a new product into the market.

Why Coated and Silumina Anodes™?

- With the growth in applications for batteries, including both mobile and fixed, research is ongoing into increasing the energy density of batteries, with the aim of reducing size and cost for a given capacity, and also to produce larger capacity batteries.
- Significant current research has gone into different cathode chemistries, however the anode chemistry is also a focus of research - currently graphite is the main anode material, and one that works well.
- However graphite takes up the most volume in a battery, and with the drive for smaller and cheaper batteries, there is the need to look at alternative anode materials.

- One such material, with suitable electrochemical properties is silicon (Si, of which one common oxide is quartz).
- Silicon has significantly higher energy capacity weight and volume advantages over graphite:
  - Silicon - theoretically 3,472 mAh/g vs 372 mAh/g for graphite; and,
  - Silicon - theoretically 2,100 mAh/cc vs 700 mAh/cc for graphite.
- Silicon has a higher bulk density of 1.7 g/cc compared with 0.53 g/cc for graphite - note that this is not "tap density".
- However, an issue that has precluded the widespread take up of silicon is that it expands by ~30% during charging, leading to degradation of the anode (up to 50% capacity loss on the first charge), and resultant loss in ongoing battery performance and life.
- One method of overcoming anode degradation is to coat the anode material, with initial work by Altech being on the coating of graphite using HPA - in the case of graphite this was to find a way of resolving the "first cycle capacity loss", whereby typically 10% of the lithium ions are irreversibly lost during the first charge.
- Reducing this loss would allow more lithium ions to be used in the ongoing operation of the battery (Figure 7).

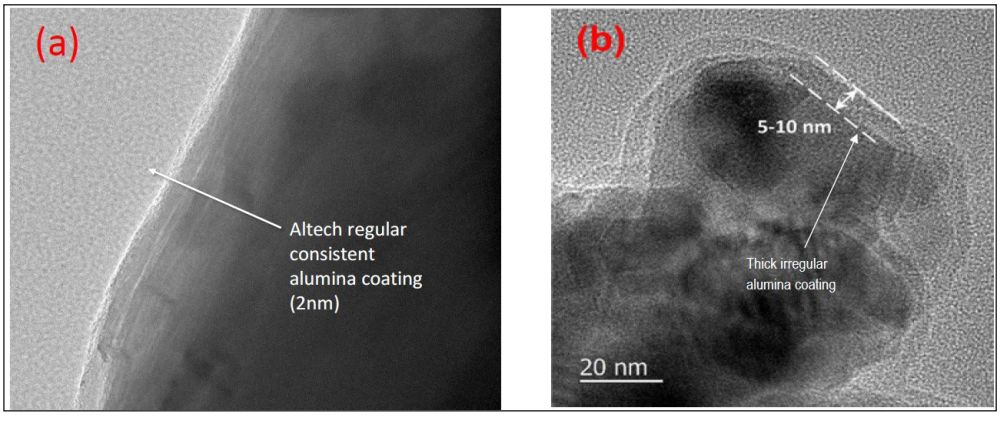
Figure 7: Illustration of potential impact of reduced "first cycle capacity loss"



Source: Altech

- The Company has developed a proprietary process for the even coating of anode material with a 2nm HPA layer, as compared to current coating systems with are thicker and irregular (Figure 8).
- A first phase demonstration was undertaken at Curtin University, Western Australia in November 2020, and examined using a transmission electron microscope ("TEM") at the University of Western Australia (Figure 8).

Figure 8: Electron Microscope images of alumina coated graphite particles: (a) Altech (b) Current



Source: Altech

- The use of HPA over lower purity alumina as a coating material (which also brings in an additional market for the Malaysian HPA operation) will also mean less battery degradation due not introducing the impurities inherent in the lower grade material.
- As a follow on, the use of HPA coating on silicon anode material has also been successfully developed at a laboratory scale, which has led to the development of the Silumina Anode™ product.

- This looks to have provided a key breakthrough is solving the expansion issue in the charging of batteries with silicon in the anodes - initial tests on composite silicon/graphite coated anodes as developed by Altech, and as announced on November 25, 2021 indicated an energy increase to ~430 mAh/g from the normal 330 mAh/g.
- The results of this work were the catalyst for the commencement of a PFS into a 10,000 tpa Silumina Anodes™ manufacturing plant, which has led onto the commencement of the pilot plant and a DFS.

Silumina Anodes™ PFS Results

- The results of the PFS were released to the market on April 20, 2022, and indicated a robust project with a relatively low initial capital cost (including contingency) of US$95 million.
- As mentioned above, the strategy, depending upon a successful DFS, product qualification and FID, is to construct a 10,000 tpa plant on the Schwarze Pumpe site, ideally placed to supply the burgeoning German and broader European EV and battery manufacturing industries.
- The plant would be built by the 75% owned AIG, and operated under an exclusive European Licence from Altech.
- PFS results are presented in Table 2, and capital cost items in Table 3 - the Company states that the estimates have been undertaken at a plus or minus 30% accuracy level, with capital items including quotes from European vendors.

Table 2: Model assumptions - 100% basis - US$ - pa

Model assumptions - 100% basis - US$ - pa		
Parameter	**Figure**	**Unit**
Annual Production	**10,000**	tonnes
Exchange Rate	**0.83**	EUR/USD
Project Capex	**95**	million
NPV	**507**	million
Discount Rate	**8**	%
Payback (real)	**3.1**	years
IRR	**40**	%
Revenue p.a.	**185**	million
EBITDA p.a.	**63**	**million**

Source: Altech

Table 3: Capital cost estimate - US$, 100%

Capital cost estimate - US$ - 100%	
Cost Centre	**US$ m**
Plant	**69.5**
Contingency	**13.9**
Insurances	**3.1**
Commissioning	**7.0**
Land	**1.2**
Total	**95**

Source: Altech

- A key part of the estimates are the costs of the anode raw materials, including silicon, graphite and HPA - to that end AIG has entered into supply agreements for the graphite and silicon:
  - For graphite, a development and supply MoU has been executed with SGL Carbon GmbH ("SGL"), a leading producer and supplier of graphite in the EU; and,
  - A high purity silicon supply MoU has been executed with Ferroglobe Innovation S.L. ("Ferroglobe").
- The lab scale test work completed to date, and the upcoming pilot plant work is only using materials from these two companies, which also have the production facilities to meet the stringent EU environmental regulations as AIG, and to use green electricity.

Comparitive Costs

- Given the paucity of equivalent projects, it is hard to authoritatively comment on and compare the costs as presented in the Altech PFS, however comparisons may be drawn with Talga Group Limited (ASX: TLG, "Talga"), which is developing a mine to final product integrated coated graphite anode material project in Sweden.
- Some parameters and financials of this project, as presented in the DFS as released to the market on July 1, 2021 include:
  - Talnode® - C anode annual production of 19,500 tpa,
  - Revenue - US$12,312/tonne anode material,
  - Cash costs - US$2,363/tonne anode material
  - Total capex, including mine, infrastructure (including an additional US$72 million in infrastructure costs to allow for a significant future expansion) of US$484.3 million plus contingency.
- However, this includes the upstream mining and concentration costs, with direct and indirect processing plant costs being US$283.4 million for 19,500 tpa of Talnode® - C - this includes an additional US$153 million above the anode production equipment capex as presented in the PFS to meet the requirements of Talga's Tier 1 automotive customers.
- Talga has recently commissioned a qualification plant producing Talnode® - C anode material.
- What is clear is that there a differences between Altech's PFS and Talga's DFS in cash parameters per tonne and the capex attributable to the anode material plant, however some of these can be explained by Altech's costs being predicated on buying ready to use materials, including graphite and silicon, which will result in higher raw material cash costs and lower capital costs.
- In addition the products are different - the pricing of pure graphite anodes is well understood, however that for silicon-graphite composite materials is still immature.
- It needs to be noted that the input raw materials pricing for Altech will be within reasonable limits, given the supply MoUs as discussed earlier.

HIGH PURITY ALUMINA PROJECT - ATC 100%

Location, Tenure and Infrastructure

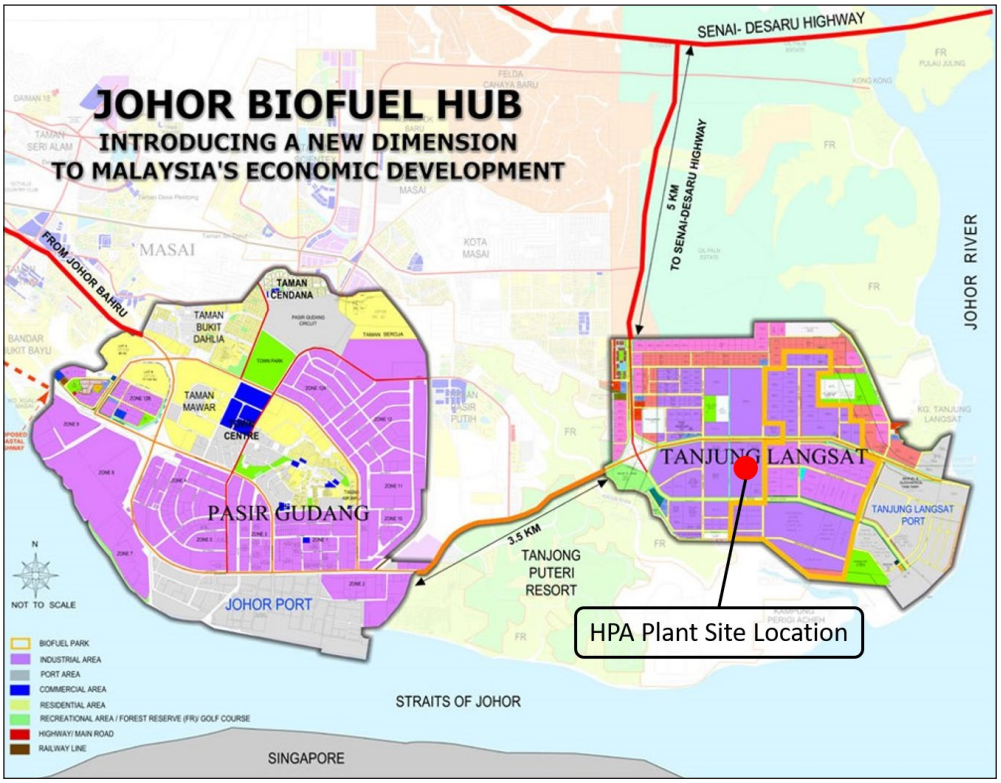
- The HPA Project is divided between two sites - the Meckering kaolin deposit in Western Australia, and the HPA plant site in the Tanjung Langsat Industrial Complex, located near Johor Bahru in Southern Malaysia (Figures 9 and 10).

Figure 9: Meckering location

Source: Altech

- The Meckering deposit is covered by the 84.62 ha ML70/1334, which was granted for a period of 21 years on May 19, 2016 - the Company also owns ~94 ha of freehold land covering the ML.
- The Meckering site, which is fully permitted for the proposed mining and loading operations, is located within 8 km of the town of Meckering, which itself is located 130 km east of Perth on the Great Eastern Highway and Trans-Continental Railway Line; the area is also serviced by grid power.
- The Company has a 30 year lease (with a 30 year option) over a 4 ha industrial block in the Tanjung Langsat Industrial Complex, located ~40 km to the east of Johor Bahru in southern Malaysia (Figure 10) - Johor Bahru is the capital of Johor State.

Figure 10: HPA site location



Source: Altech

- Tanjung Langsat, the neighbouring Pasir Gudang industrial area and the associated ports (Johor and Tanjung Langsat) comprise a fast developing industrial and port complex, just across the Straits of Johor from Singapore.
- The industrial complexes host a mix of high technology, industrial and chemical (including refineries) industries, including significant biofuel production; in addition adjacent port facilities include bulk and liquids facilities.

Meckering Kaolin Operations - Western Australia

Introduction

- Meckering is one of three aluminous clay deposits originally held by Altech - it was selected to supply the feedstock for the HPA Project due to the quality of the clay and proximity to the port at Fremantle.
- Work by Altech has included additional drilling, the estimation of Mineral Resources and Ore Reserves (Table 4) and bulk sampling for use in metallurgical testwork.
- The current Reserves are sufficient to feed the planned 30 year operation, with additional Resources available to be converted for a much longer term operation.
- The overall Meckering resource has an alumina (Al_2O_3) content of around 19%, with this being upgraded to ~30% Al_2O_3 through simple 0.3 mm screening.
- The upgraded 30% Al_2O_3 material is marked by very low impurities (due to the long term weathering), which results in the suitability for use as the HPA feedstock - of critical importance is the very low sodium content, with sodium having the ability to substitute into the crystal lattice and being very difficult to remove, and with a low sodium content being critical for the electronics industry.

Table 4: Meckering JORC 2012 compliant MRE and Ore Reserves

Meckering JORC 2012 compliant MRE and Ore Reserves				
Category		**Quantity (Mt)**	**Yield % of minus 300µm**	**Minus 300µm Al_2O_3 (%)**
Ore Reserve	Proved	0.45	69	30.1
	Probable	0.77	71	30
	TOTAL	**1.22**	**70**	**30**
Mineral Resources (inc Ore Reserves)	Measured	1.5		30
	Indicated	3.3		30
	Inferred	7.9		29.1
	TOTAL	**12.7**		**29.5**

Source: Altech

Planned Operations

- Planned operations at Meckering will include just free dig mining and loading the ROM material into standard 20 foot sea containers for transport by truck to the port at Fremantle, 153 km by road from site, from where it will be shipped to the port at Tanjung Pelepas.
- It is estimated that 43,500 tonnes of material will be required for the planned 4,500 tpa HPA production, with total requirements of up to 1.36 Mt for the planned 30 year operation being mined on a campaign basis.
- It is considered more cost effective, given the relatively low volumes, to ship all of the ROM material to Malaysia rather than to beneficiate it on site.

HPA Plant Operations - Johor State, Malaysia

Introduction

- The HPA plant has been designed and will be constructed under a fixed price EPC contract with SMS group (discussed later), with the layout shown in Figure 10. The plant design is based on the process route developed by Altech and partners, including SMS group.
- Construction activities commenced on site in late 2018 (site clearance), with initial works which concentrated on retaining walls and the maintenance facility commencing in February 2019. The completed Stage 1 and 2 construction activities are part of the fixed price EPC contract with SMS group.

Figure 10: Tanjung Langsat HPA plant layout

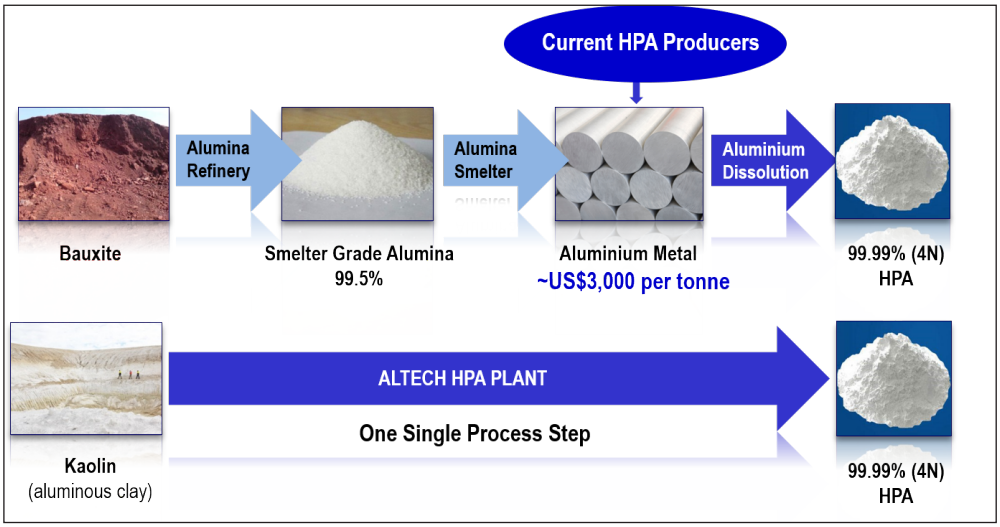
Source: Altech

Altech's Patented HPA Process

- The key to Altech's strategy is the successful processing of the clay feedstock to HPA using a process originally developed by Altech in conjunction with TSW Analytical Pty Ltd ("TSW") and Simulus Engineering Pty Ltd ("Simulus").

- The Company aims to produce what is known as 4N HPA, which has a purity of 99.99% alumina. Other products, which Altech is not targeting, include 5N HPA (99.999% purity) and 6N HPA (99.9999% purity) – the Company considers the risks and returns on additional investment to produce these higher purity products not worthwhile pursuing considering the small market size; in addition Altech will not target the lower value smelter grade alumina ("SGA") or 3N HPA.
- The Altech process has a number of advantages over existing producers, including:
  - Expected lower operating costs due to low cost feedstock and the recycling of hydrochloric acid,
  - The use of hydrochloric acid doesn't introduce potential contaminants (e.g. sodium as the case with the Bayer Process) into the process, and hence simplifies the process of producing 4N HPA; and,
  - The waste product, silicon, is benign and potentially marketable.

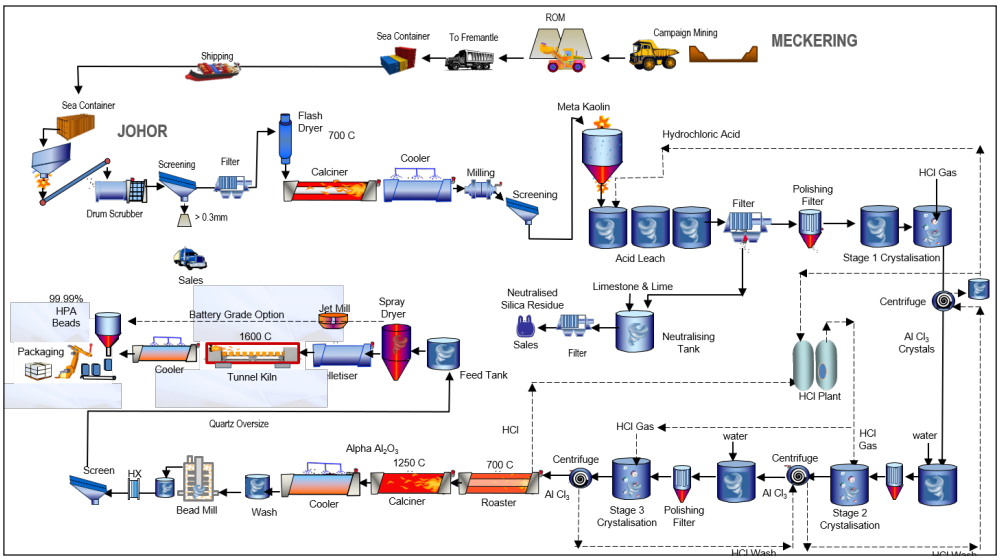
Figure 11: HPA production comparison



Source: Altech

- The final flowsheet is shown in Figure 12, with the processing to be carried out at the Malaysian plant including:
  - Unloading, scrubbing and screening (to -0.3 mm) of the ROM material, which upgrades the feedstock to 30% Al_2O_3 with a recovery of ~75% of the Al_2O_3 - "waste" products include silicon sand which can potentially be sold,
  - Drying and then calcining at 700° C which activates the kaolin to produce metakaolin,
  - Leaching of the metakaolin using hydrochloric acid - this produces the leachate (which contains the Al^{3+} ions) and a silicon residue - the residue is neutralised to form a fine silicon product for sale,
  - $AlCl_3$ is crystallised by introducing HCl gas into the leachate - there are three stages of crystallisation with these being separated by dissolution of the $AlCl_3$ crystals in water; and,
  - Production of 99.99% Al_2O_3 through roasting of the $AlCl_3$ at 700° C, calcining at 1,200° and then cooling - this is then washed and milled into beads using a bead mill.
- The beads are then further processed dependent upon whether powder or beads are to be produced, with the final production stages including jet milling (for powder) or pelletising followed by heating and cooling for HPA beads.
- The final products will then be packed into 20 kg bags for delivery to customers - daily production will be around 750 bags at a production rate of 4,500 tpa.

Figure 12: Altech HPA production flowsheet



Source: Altech

Quality Control and Environmental Considerations

- Given the high purity of the final products and the need to maintain consistency of this, quality control will be a critical part of the operations, with customers having real time access to data from the production process - the quality control also includes bags being packed to the exact weight, and the packing being done in a "clean room".
- Given the need to maintain the high purity process, premium quality equipment (which however is largely off the shelf) needs to be used - the Company is sourcing a large part of the equipment from Germany, and, along with engaging SMS group as the EPC contractor, has given Altech access to German government ECA covered finance.
- The plant will meet IFC guidelines with regards to environmental standards, which are stricter than the already high Malaysian standards; the Malaysian standards also mandate at least 10% of the site be green area.
- Waste products, being silicon sand and fine silicon, are benign, with all HCl being recycled in the processing - these silicon products however will need to be disposed of or sold as they are produced, as there is only limited storage space for them on site - the Company has already had interest from potential customers for these products.

Upside

- There is upside in the production profile at the HPA plant - the plant has the capacity to produce up to 6,000 tpa of HPA, with this upside potentially being able to be achieved by:
  - Increasing plant utilisation to 90% from the 79% currently assumed,
  - Achieving 90% Al_2O_3 in the processing - 60% has been assumed; and,
  - Using feedstock head grade of 34% Al_2O_3 that has been achieved in testwork rather than the 30% as modelled.

Development Studies

- The Project has been the subject of a number of development studies, with the latest being the Final Investment Decision Study ("FIDS") as released to the market in October 2017 for a 4,500 tpa 4N HPA operation.
- This study followed a 15 month due diligence process carried out by SMS group and others on behalf of the KfW IPEX-Bank, and includes capital and operating cost estimates updated from the previous BFS, which was undertaken by another group.
- The capex estimate of US$297.6 million as presented in the FIDS is considerably higher than that of US$78.7 million as in the 2016 BFS - this change came about as a result of the due diligence work, and was caused by a number of incremental factors as detailed in the 2017 FIDS release; operating costs however remained largely unchanged.
- The Study resulted in a pre-tax NPV, using a 7.5% discount rate, of US$505.6 million for an average US$27/kg HPA price, and US$1,087 million using a US$40/kg price.
- More detail is included in our previous note as well the Company releases, however, given the time that has elapsed since the study was completed, we would expect that costs and prices have changes.

- Also, should financing be completed, we may expect some adjustments to the EPC contracts.

EPC Contracts - SMS Group and Simulus Engineering

- The Company has EPC contracts with the SMS group for the construction of the Malaysian plant, with Simulus Engineering of Perth to construct the Meckering container loading facility.
- These are fixed price turnkey contracts, with the US$280 million contract for the HPA plant having throughput, process and quality guarantees in place, thus moving a lot of the execution risk from the Company to the contractor.
- As mentioned above, we may expect adjustments should the project progress.

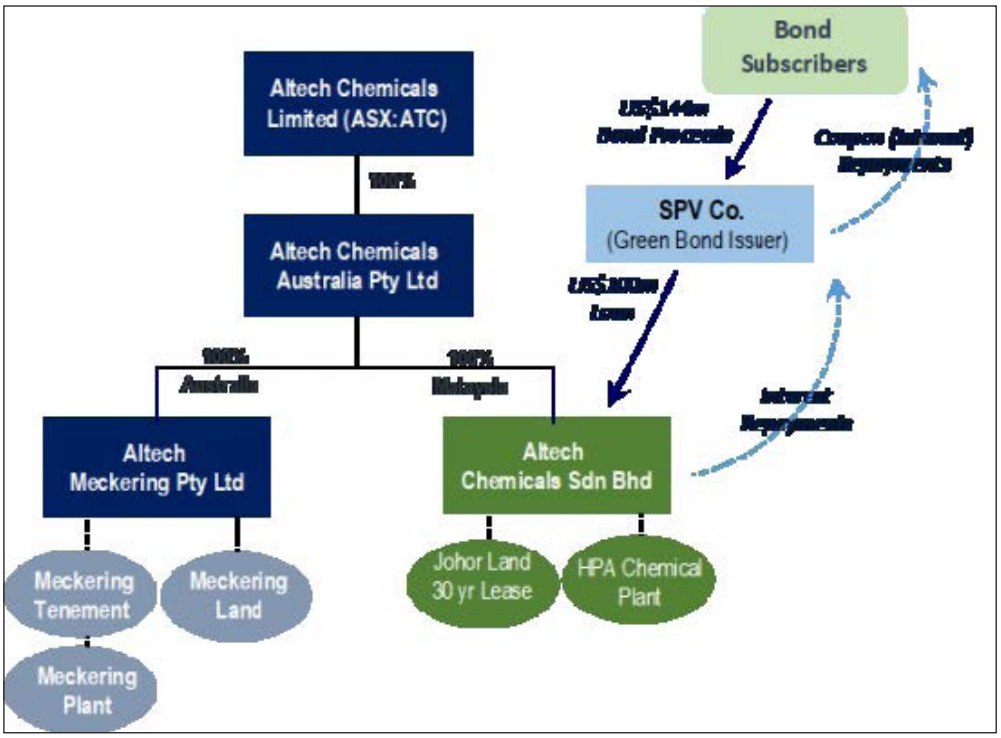
Offtake - Mitsubishi

- A key derisking event was the September 2015 signing of a 10 year sales and distribution agreement with Mitsubishi Corporation; although initially targeted at the Japanese market only, the agreement was revised in May 2016 with Mitsubishi to purchase 100% of the planned production from the first 10 years - as part of the agreement Mitsubishi will be paid a sales fee of 5% of revenue.
- Having a binding offtake agreement in place is a key piece of the financing process.

Financing - Various Groups

- The Company has experienced delays in getting financing in place, due to various factors including COVID and market headwinds - resource and downstream projects in general have found it difficult to close off on financing.
- The Company continuing financing activities, with senior debt already in place, and the second tier strategy looking to involve the issuance of Green Bonds.
- Overall financing involves three sources, including:
  - Senior debt - US$190 million
  - Subordinate debt - Green Bonds - US$100 million for project funding, plus US$44 million to cover interest over the first two years; and,
  - Equity - US$100 million.
- The senior debt is with the German government owned KfW IPEX-Bank (and will be made available on the finalisation of mezzanine and equity financing), and includes two parts:
  - A US$170 long term export credit backed facility, which offers very attractive terms; and,
  - A US$20 million facility under standard commercial terms.
- KfW has recently reaffirmed commitment to the senior debt.
- Altech has been working with London based structuring agent Bedford Row Capital plc ("Bedford Row") and Perth based Bluemount Capital (WA) Pty Ltd ("Bluemount") on the potential bond issue, with these planned to be issued to Altech Chemicals Sdn Bhd through an SPV subsidiary (Figure 13).
- To enable the Company to issue "green" bonds, the HPA project has undergone certification by the independent second opinion provider CICERO Shades of Green AS ("CICERO"), with the HPA project being classed as "light green".

Figure 13: Proposed bond issue structure



Source: Altech

- The Company is also looking at options regarding equity - a preferred path is to raise the majority of this through selling an equity stake at Project level, this would preferably include the sale of 49% in either of the 100% owned Australian or Malaysian subsidiaries for ~ US$100 million.
- As such the US based global investment bank DelMorgan & Co has been engaged, and continues to source leads and potential investors.

VALUATION AND PEERS

- Given the delays in financing, and expected changes in pricing, costs and financing structure, any updated valuation of the HPA project is likely to be misleading at best, and thus we will not present an update of the valuation as presented in our 2019 note.
- Given that Altech is a battery technology company, the best way of assessing value is by comparison with peers, as presented in Table 5.

Table 5: ATC Peers

ATC Peers		
Company	**Market Capitalisation**	**Projects**
Talga Group Ltd	$461,372,300	Developing graphite battery anodes from Swedish feed owned by the Company, DFS completed, qualification plant commissioned, also looking at graphite-silicon anode material.
Alpha HPA Limited	$402,057,100	HPA developer, with a production facility for 5N HPA precursor materials now being commissioned in Gladstone.
Magnis Energy Technologies Ltd	$373,577,600	LIB manufacturing facilities - New York - operating and Townsville, QLD - development studies undertaken
Altech Chemicals Ltd	$164,078,100	Silumina Anodes™, CERENERGY® and HPA projects, financing and development studies
Ecograf Limited	$150,861,700	Development of battery anode business, including recycling. Partnership with FYI on HPA coating - WA and deposits in Tanzania
FYI Resources Limited	$53,050,800	HPA production JV with Alcoa and HPA anode coating testwork with EGR - Kwinana, WA - proceeding to demonstration plant

Source: IRESS, company reports, IIR analysis

- All companies are looking at either HPA, battery anodes or both, with all except for Magnis's New York facility being pre-production, and all (except for Magnis) also owning their own mineral deposits, being it either kaolinite or graphite.
- What this highlights is that Altech is near the bottom of the value chain, with significant scope for increase in value with advancement of projects - given the value of Talga, even meaningful progress on just one of the projects could drive significant value accretion.

BOARD AND MANAGEMENT

- **Mr Luke Atkins – Non-Executive Chairman:** Mr Atkins is a lawyer by profession and one of the founders of the company. Mr Atkins brings to the board extensive experience in the areas of mining, exploration, and corporate governance. Mr Atkins is also Non-Executive Director of the successful ASX listed mining and exploration company, Bauxite Resources Ltd (BRL). Mr Atkins formerly held the role of Executive Chairman of BRL after co-founding the company in 2007. He has played a key role in BRL third party negotiations to successfully access funding, joint venture partnerships, land and infrastructure.

  Mr Atkins has had extensive experience in capital raisings and has held a number of executive and non-executive directorships of private and publicly listed companies including a number of mining and exploration companies.

- **Mr Iggy Tan - B.Sc MBA GAICD - Managing Director:** Mr Tan is a highly experienced mining and chemical executive with a number of significant achievements in commercial mining projects such as capital raisings, funding, construction, start-ups and operations. Mr Tan has over 30 years' chemical and mining experience and been an executive director of a number of ASX-listed companies. He holds a Master of Business Administration from the University of Southern Cross, a Bachelor of Science from the University of Western Australia and is a Graduate of the Australian Institute of Company Directors.

  Mr Iggy Tan became the Company's managing director in August 2014. He is responsible for managing and implementing the next stage of the Company's strategic business objectives, which includes the commercialisation of the high purity alumina (HPA) project. Having been involved in the commissioning and start-up of seven resource projects in Australia and overseas, including high purity technology projects, Mr Tan is an accomplished project builder and developer.

  Mr Tan previously held the positions of managing director of Nickelore Limited, Galaxy Resources Limited and Kogi Iron Limited. At Galaxy Mr Tan was responsible for the capital raising, construction and start-up of the company's Mt Cattlin spodumene mine ($80m) and the Jiangsu lithium carbonate plant ($100m), which resulted in Galaxy becoming the world's leading producer of high purity lithium carbonate. The Jiangsu plant was eventually sold for $260m in 2014.

- **Mr Daniel Lewis Tenardi - Non-Executive Director:** Mr Tenardi is a highly experienced mining executive with some 40 years in the industry, including with a number of global resource industry leaders across a range of commodities, including iron ore, gold, bauxite, and copper. Mr Tenardi previously spent 13 years with Alcoa, at its bauxite mines in the Darling Range in Western Australia, and a further two years at Alcoa's Kwinana refinery. He has substantial gold mining experience, including with Roche Mining at the Kalgoorlie Superpit and at Anglo Gold Ashanti's Sunrise Dam. Mr Tenardi subsequently worked at executive level for Rio Tinto's Robe River Iron Associates and their East Pilbara Division, and was appointed as a Director of Robe River Iron Associates in the latter years of his employment with Rio Tinto.

  Prior to this appointment, Mr Tenardi was Managing Director of Bauxite Resources Ltd, where he led the rapid growth of the company from its initial exploration phase, expansion of land holdings, to the commencement of trial shipments and securing supportive strategic partnerships with key Chinese partners. Mr Tenardi also held the positions of General Manager of Operations and Chief Operating Manager at CITIC Pacific Mining.

  Mr Tenardi is currently non-executive director of Grange Resources Ltd.

- **Mr Peter Bailey - Non-Executive Director:** Mr Bailey is a highly experienced and qualified engineer with over 40 years' experience in the mining and industrial mineral production industry and has an electrical engineering degree from the University of London. Mr Bailey spent the majority of his career in the iron ore mining, bauxite mining, zinc-lead-copper mining, alumina refining and alumina chemicals industries respectively.

Mr Bailey was President of Alcoa Bauxite and Alumina in 1996, and was responsible for Alcoa's eight alumina plants outside of Australia. He was also the chairman of the Alcoa Bauxite joint venture in Guinea, Africa.

In 1998, he was appointed President of Alcoa Worldwide Chemicals' industrial chemicals department from 1998. He was responsible for Alcoa's worldwide chemicals business, comprising 13 plants across eight countries, with an annual revenue of approximately $700 million. Post Alcoa, Mr Bailey was chief executive officer of Sherwin Alumina, an alumina refinery based in Texas, USA. The Sherwin alumina plant was capable of producing 1.4 mtpa of smelter grade alumina and 300,000 tonnes of chemical grade or specialty alumina per year. The Sherwin alumina plant was eventually sold to China Minmetals (51%) and then the remaining 49% to Glencore in 2007.

- **Tunku Yaacob Khyra - Non-Executive Director:** Tunku Yaacob Khyra is the Executive Chairman of the Melewar Khyra Group of Companies (Melewar), a Malaysian base diversified financial and industrial services group. He is the major owner and shareholder of Melewar. Tunku Yaacob Khyra sits on the Boards of Khyra Legacy Berhad, Mycron Steel Berhad, MAA Group Berhad, Melewar Industrial Group Berhad, Ithmaar Bank B.S.C.(listed on Bahrain Stock Exchange) and several other private companies.

  Tunku Yaacob Khyra graduated with a Bachelor of Science (Hons) Degree in Economics and Accounting from City University, London. An accountant by training, he is a Fellow of the Institute of Chartered Accountants in England & Wales and a member of the Malaysian Institute of Accountants. He started his career as an Auditor with Price Waterhouse, London from 1982 to 1985 and subsequently joined Price Waterhouse Kuala Lumpur from 1986 to 1987. He joined Malaysian Assurance Alliance Berhad in 1987 and retired as its Chief Executive Officer in 1999.

- **Mr Uwe Ahrens - Alternate Director:** Mr Uwe Ahrens is executive director of Melewar Industrial Group Berhad and managing director of Melewar Integrated Engineering Sdn Bhd. He also sits on the Board of several other private limited companies. Mr Ahrens holds Masters in both Mechanical Engineering and Business Administration from the Technical University Darmstadt, Germany. Upon graduation, Mr Ahrens joined the international engineering and industrial plant supplier, KOCH Transporttechnik GmbH in Germany, now belonging to FLSmidth Group, where he held a senior management position for 12 years, working mainly in Germany, USA and South Africa.

  In 1997, he was based in Kuala Lumpur as General Manager of KOCH in South East Asia and became its Managing Director in 1999. He joined Melewar Group in 2002 and is also currently chief technical officer of the Melewar group of companies being responsible for engineering, upgrading, modification and extension of machinery and plant as well as the overall maintenance.

- **Mr Hansjorg Plaggemars - Non-Executive Director:** Mr Plaggemars was previous member of the board of Delphi Unternehmensberatung AG and Deutsche Balaton AG (ATC major shareholder) and currently acts as their representative. Mr Plaggemars is based in Hiedelberg, Germany and is an experienced company director and manager. He studied business administration at the University of Bamberg from 1990 to 1995.

  Mr Plaggemars has been a management consultant since June 2017 and is a board member of various companies within the scope of projects. Mr Plaggemars is currently a member of the management board of Frankfurt Stock Exchange listed Altech Advanced Materials AG. Mr Plaggemars also currently serves as a non-executive director at ASX listed Davenport Resources Limited (now South Harz Potash Ltd), Kin Mining Limited and Azure Minerals Limited.

- **Mr Martin Stein - Chief Financial Officer and Company Secretary:** Mr Stein is a finance and corporate executive with over 20 years' of international experience.

  Mr Stein has held the positions of Chief Financial Officer and Company Secretary in several ASX listed companies. In these roles, Mr Stein has been responsible for all aspects of capital raising, financial management, shareholder liaison and corporate governance.

  Prior to this, Mr Stein held senior positions with Anvil Mining Limited as well as with PwC at its London office. Whilst with PwC, Mr Stein provided corporate services for companies listed on the LSE, NYSE and AIM, including Colgate-Palmolive, Sony, Heinz, DHL Express and Bosch.

- **Dr. Jingyuan Liu PhD AAICD - General Manager (Operations & Marketing):** Dr. Liu has over 20 years' experience in project management, process and equipment design for minerals processing and in the chemicals, non-ferrous metals, iron & steel and energy industries, both in Australian and internationally. He was awarded a PhD in chemical engineering from the University of Newcastle, Australia. He has worked in senior chemical engineering roles with leading companies such as Hatch Engineering and Metso Minerals in Australia and Malaysia. Dr Liu was previously General Manager, Development and Technologies with Galaxy Resources Limited, a high purity lithium carbonate producer. Dr Liu's extensive chemicals and processing experience, including plant construction, commissioning and the manufacture of high purity chemicals will be invaluable for Altech's next phase of development.
- **Neil Jameson - Engineering Manager:** Neil brings a wealth of engineering and project delivery experience to the Altech team. Neil's background spans 30 years, delivering projects locally and internationally, across multiple industries including: Alumina, Mineral Sands, Iron Ore and chemicals. Having a Mechanical Engineering background, Neil understands project development with the ability to identify practical solutions and tailored delivery strategies with successful outcomes achieved through clear communication, team motivation and mentoring. Working with AS standard construction contracts over a number of years, Neil brings contract and commercial knowledge supporting successful relationships and financial outcomes.
- **Ms Summer Qi M.ChemEng - Processing Manager:** Ms Qi is a process engineer with 10 years experience in minerals and chemicals project. She has a Master's degree in Chemical Engineering from the University of Adelaide. Ms Qi joined the Company in August 2010 and is responsible for research and development in mineral processing technologies, feasibility studies and costing of these processes. This includes contributing to the Company's R&D activities for the chemical engineering of the high purity alumina (HPA) project, including research for the optimisation and advancement of the HPA processing technology; as well as method development and project management for Malaysian operations.

  Prior to joining Altech, Ms Qi was the Chemical Engineer for an ASX-listed company, Reclaim Industries. She was responsible for researching a variety of topics relating to chemical engineering to investigate possible products in rubber recycling industries.

APPENDIX 1 - BACKGROUND – THE LIB BATTERY SECTOR

Introduction

- This discussion will largely concentrate on the EV sector, which is expected to drive growth for LIBs, and for which the Company's Silumina Anodes™ are targeted.
- That however is not to ignore the expected growth in the residential battery sector, which, with data as presented by Altech, is expected to grow to ~120 GWh by 2030, which however is <10% of our mid-point forecast of 1,500 GWh for vehicles as presented later.
- The forecast growth in the grid battery market (which will not be discussed further) is however many orders of magnitude greater than the Company's production plans, and thus should initial development be successful, we would expect that sales and future expansion plans also be successful.

LIB Batteries and Materials

- The expected takeup of EVs, including plug-in electric vehicles ("PEV") and hybrid electric vehicles (PHEV) over coming years will drive the demand for the so called "battery materials".
- These materials include five main groups:
  - The anode materials, dominantly graphite, but with new technologies including silicon and silicon composites,
  - The cathode materials, including lithium, nickel, manganese, cobalt and aluminium,
  - The separators, which to date have largely been polymers, but with higher capacity (and hence hotter) batteries now being used, include materials such as high purity alumina ("HPA"),
  - The current collectors, which include copper and aluminium; and,
  - The lithium electrolyte materials, including liquids and solids.
- Graphite by far and away makes up the largest component of a lithium ion battery, comprising between 40% and 50% of the "active" components of a battery.
- The graphite anode usually includes two types, generally split 50:50 - spherical graphite ("SpG") and synthetic graphite.
- Table A1 presents the approximate material intensities for a range of common battery types, including nickel cobalt aluminium ("NCA"), as favoured by Tesla, and two types of nickel manganese cobalt, as commonly used in other EVs - there are several other cathode types not listed here, but these are less common.

Table A1: Current LIB material intensity - kg/kWh

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

Source: IIR analysis

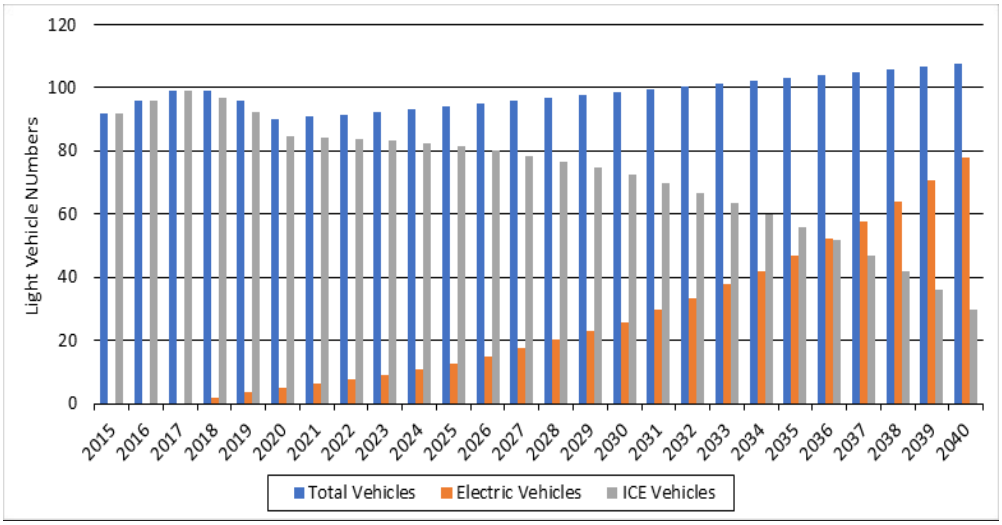
- The two types of NMC (nickel, manganese, cobalt) batteries reflect two cathode metal mixes, with the numbers representing the proportions of the different metals in the cathode - users are tending towards the 8:1:1 mix given a higher energy storage capacity, and a lower cost, given lower cobalt content.
- The figures are approximate - NMC 1:1:1 batteries have a capacity of ~0.9 kWh/anode kg, with the NMC 8:1:1 units having a capacity of ~ 1.2 kWh/anode kg.
- Note that the figures are in kg/kWh - a usual light electric passenger vehicle will have a battery in the order of 50 kWh to 80 kWh.

- What is significant is that the intensity of graphite remains largely the same with changing cathode chemistries; also, given the wastage in spherical graphite production, approximately double the amount of flake graphite (which is preferred as synthetic graphite is relatively expensive) is required to produce the anode material as presented in Table A1.

Forecast Demand

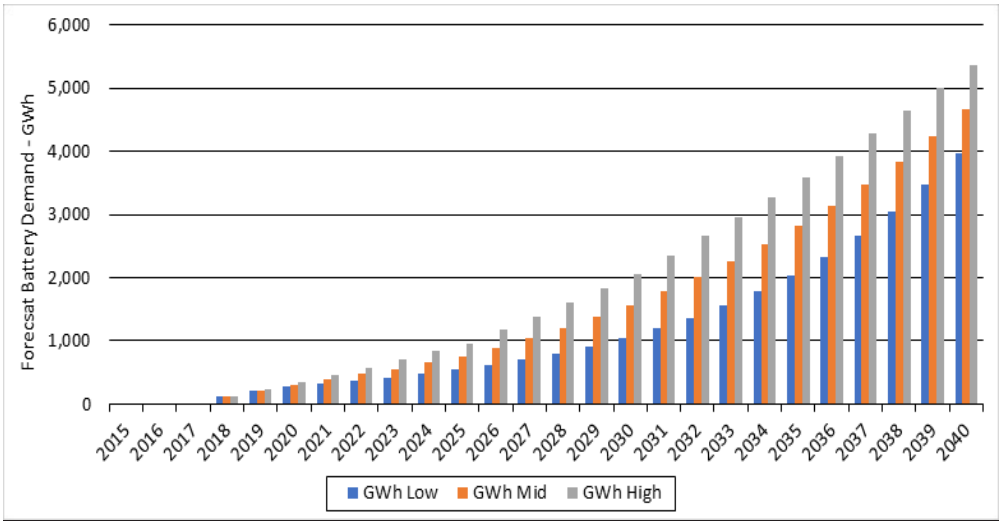
- We will concentrate here on the EV markets, which, under current forecasts, will provide the bulk of increased demand for battery materials in coming years, although traditional markets for the materials will continue to grow, albeit at a slower rate.
- As a guide to the numbers used, a gigawatt hour ("GWh") equals one million kilowatt hours ("kWh"), or in the order of 12,500 to 20,000 light electric vehicles, based on batteries with capacities of between 50 kWh and 80 kWh.
- Figure A1 presents our analysis of the growth in light and commercial vehicle markets, with this being adapted from a number of publicly available documents, including company presentations - source data suppliers include Mackenzie, Benchmark Mineral Intelligence and Deloitte amongst others.
- All forecast that EVs will have an average total vehicle market share of ~30% by 2030, with forecasts indicating that this could reach somewhere between 60% and 80% by 2040, with this significantly driven by Government legislation and agreements, with some examples of regulations shown in Figure A4.
- Pre-COVID forecasts indicated total vehicle sales of ~110 and 120 million in 2030, however COVID, according to the OICA, reduced sales by some 13% in 2020 over 2019 - we have adjusted our figures accordingly, hence the dip in Figure A1.
- The base case figures as used in Figure A1 show an increase from 2.34 million vehicles in 2020 to close to 80 million in 2040, a CAGR of ~19%, with a range of 18% to 20%.
- Figures A2 and A3 show respectively the expected growth in battery capacity and requirements for graphite - in these we have used an average battery size of 60 kWh and an estimated requirement of 1,000 tonnes/GWh of graphite.
- Note these latter two figures are more prone to variation than the forecast for the number of units, particularly when forecasting out past 2030 - these will depend on changes in battery size (they may get larger as costs come down and technology changes), and developments in new technologies, for example the development of silicon and silicon-graphite anodes.

Figure A1: Forecast growth in different vehicle types



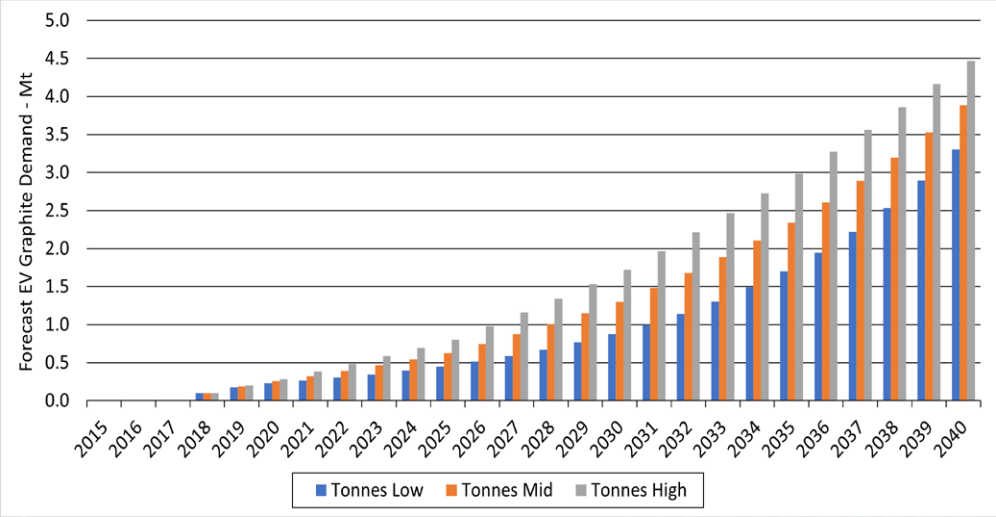
Source: Various, IIR analysis

Figure A2: Forecast growth battery capacity



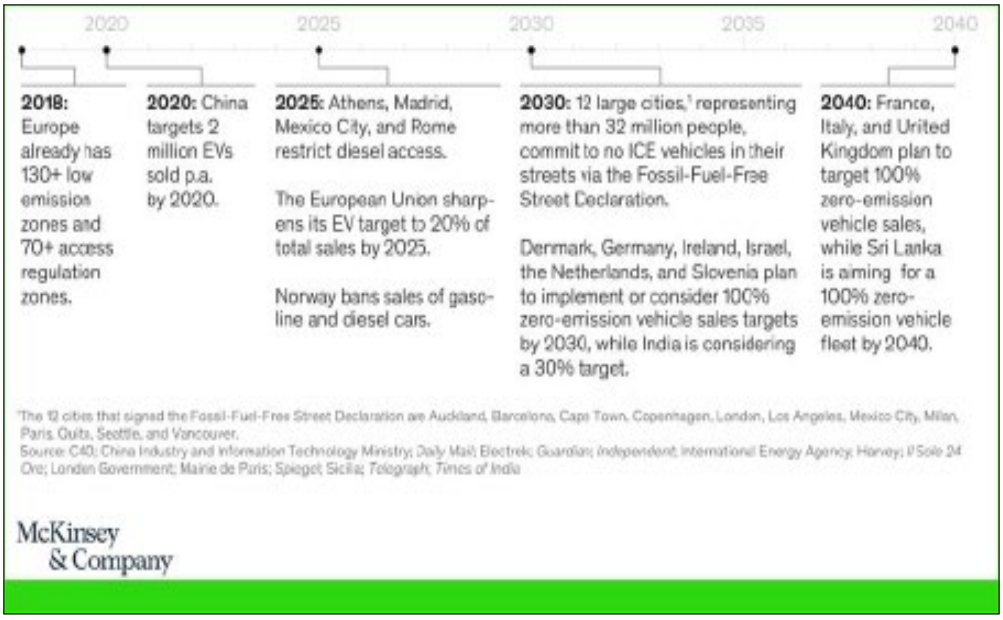
Source: Various, IIR analysis

Figure A3: Forecast growth in EV graphite anode demand



Source: Various, IIR analysis

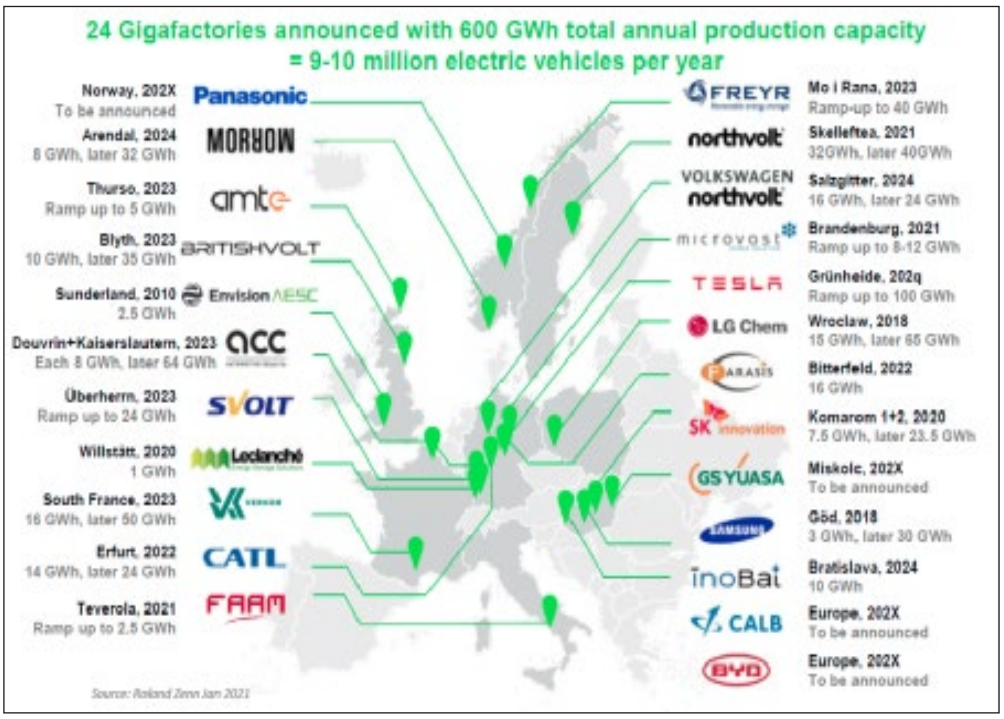
Figure A4: Legislative timeline



Source: EGR presentation

- Another factor to be considered is production split between regions - some forecasts have these at ~40% for China, 17% for Europe, 14% for the USA and 39% for the rest of the world by 2030.
- The expected growth in Europe is evidenced by the number and capacity of gigafactories planned, under construction or operating - this currently stands at 24 factories for a capacity of 600 GWh as shown in Figure A5.

Figure A5: European gigafactories



Source: Altech

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