AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

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

May 2019

INDEPENDENT
INVESTMENT RESEARCH

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Contents

INDEPENDENT INVESTMENT RESEARCH

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

Initiation - May 2019

Note: This report is based on information provided by the company as at May 14, 2019.

Investment Profile	
Share Price as at May 14, 2019	A$0.105
12 month L/H ($)	A$0.105/0.215
Valuation	A$0.26/share
Issued Capital	
Ordinary Shares	703.7 m
Placement Shares Pending	36.9m
Performance Rights	28.70 m
Ordinary Shares Post Placement	740.6 m
Market Capitalisation - Diluted for Placement	A$77.8 m
Cash - March 31, 2019	A2.12 m
April 2019 Placement - Received	A$14.23 m
April 2019 Placement - Pending	A$4.00 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 Director
Mr Shane Volk: CFO/Company Secretary

Major Shareholders (post placement)	
Deutsche Balaton, Delphi	13.55%
SMS Investments	7.75%
Melewar Equities - Tunku Khyra	4.78%
MAA Group Berhad - Tunku Khyra	4.46%
Directors	13.25%
Top 20	55.14%
Number of Shareholders	2,850

Price Chart

Mark Gordon - Senior Analyst

MALAYSIAN SITE VISIT HIGHLIGHTS PROGRESS

As confirmed by our April, 2019 site visit to Johor Bahru in Malaysia, Altech Chemicals Limited ("Altech" or "the Company") has made considerable progress on the 100% owned 4,500 tpa HPA Project ("the Project"), which is planned to become a low cost provider of 99.99% ("4N") High Purity Alumina ("HPA") into global markets.

Demand for HPA is forecast to grow by at least 16% CAGR over the next 5 to 10 years, on the back of the growing LED lighting market and growth in demand for HPA coated separators ("HPACS") for the lithium-ion battery markets - the growth of the latter is due to the increasing energy density, and hence heat generation of the batteries, with the HPACS being able to withstand significantly hotter operating temperatures than the traditional polymer separators - this also provides improved safety, battery life and efficiency.

Altech, in association with others, has developed a patented acid leach process to produce 4N HPA from high purity clays, with the planned feedstock to come from the Company's Meckering deposit located near Perth in Western Australia. It is planned to ship the clay to a purpose built HPA production facility in the Tanjung Langsat Industrial Complex, located 40 km from Johor Bahru, across the Straits of Johor from Singapore - construction has now commenced on the HPA facility, with photos included in the appendix to this report.

Altech's process caught the attention of the major German engineering group, SMS group Gmbh ("SMS group"), which, in addition to signing up for a fixed price, guaranteed EPC contract for the HPA plant in Malaysia, has agreed to take a US$15 million equity position in the Company.

The involvement of SMS group has also enabled Altech to source German Export Credit Agency ("ECA") backed funds through the German government owned KfW IPEX-Bank - a US$190 million facility has been finalised, with this comprising US$170 million of ECA finance under favourable terms, and US$20 million of finance under standard commercial terms. The Company has also signed an indicative term sheet for up to US$90 million of mezzanine finance with Macquarie Bank.

Altech is now looking to finalise the equity portion of the expected remaining US$380 million finance requirements (which includes an allowance of US$100 million for working capital, debt service etc in addition to the estimated US$280 million remaining project capital costs) - this may include a sale of an equity stake at the Project level. Market headwinds over the past 12 months have led to a fall in the share price, effectively precluding raising the required equity from shareholders due to what would be substantial dilution.

The closing of finance will trigger the main two year construction period, which, with all going well could lead to first production in 2022, with 100% of the first 10 years of production subject to an offtake agreement with the Mitsubishi Corporation.

KEY POINTS

- **Key partners in place:** With EPC, offtake and the majority of the debt partners in place, Altech is well positioned to progress once the equity finance is finalised.
- **Key cornerstones:** Altech has a strong register, with key German and Malaysian groups on board - this includes SMS group, which gives a vote of confidence in Altech and the planned operation.
- **Disruptive technology:** Altech's HPA process has the potential to be a low cost (US$8.55/kg HPA), disruptive technology in the 4N HPA sector - the involvement of SMS group (including the due diligence for the ECA finance) gives confidence that the process will be successful.
- **Fully permitted:** Both sites, Meckering and Tanjung Langsat are fully permitted and licenced for the planned operations.
- **Proven, low cost industrial destination:** Malaysia is a low cost destination for industrial operations (including chemicals), with the Company estimating that the operating costs for the HPA plant will be ~60% lower than they would be in Australia.
- **Infrastructure rich**: The strong development of the industrial and port estates in southern Johor State has included the development of the infrastructure and supporting industries required for the planned operations; in addition, Meckering is adjacent to quality transport infrastructure, and is just ~153 km from the port at Fremantle.
- **Strong management and committed personnel**: Company personnel have extensive relevant experience as well as shareholdings in the Company, thus aligning their interests with other shareholders.

SWOT ANALYSIS

Strengths

- **Guaranteed EPC contract with SMS group:** The fixed price EPC contract with SMS group (including completion and performance guarantees) removes a significant amount of development and execution risk, and provides confidence in the process. SMS group's investment in Altech also provides further confidence and support.
- **Thorough due diligence:** The Company went through a 15 month due diligence process for the ECA finance, and this should give confidence that the final design will work as expected. The downside is that this resulted in a significant increase in the Project capital cost than that presented in the original BFS, however again this gives support to a viable process.
- **ECA debt in place:** The Company has reported that the US$170 million of ECA debt has been provided under attractive terms, including a long tenure and relatively low interest rate - this, as well as the US$20 million commercial facility will be available for drawdown once the mezzanine and equity finance are in place.
- **Fully permitted at both sites:** This will enable the main construction, and then operating activities to get underway without any regulatory delays.
- **Low cost operating environment with infrastructure:** Malaysia, and in particular Johor, provides an ideal destination for manufacturing industries (particularly those, like Altech, with no environmental issues), with low operating costs and required infrastructure in place.
- **Low environmental impact:** The only waste from the planned operation is benign silica sand and fine silica, which may be able to be sold locally. All acid (HCl) is recycled in the process.
- **Strong team:** Personnel, both within the Company and the Company's partners have extensive experience in industrial/chemical industry developments and operations.
- **Large resource:** The Meckering clay deposit has Resources that should be capable of supporting an operation a number of times the size of the planned Malaysian HPA operation.

Weaknesses

- **Site size:** Although a minor factor, the 4 ha Malaysian HPA plant site provides no storage space for the silica produced as waste or a by-product - this will require that the product be sold, else disposed of elsewhere. However tonnages are relatively small, being some 40,000 tpa in total.
- **Relatively weak share price:** Market headwinds have driven the Company's share price down from ~A$0.20 in mid 2018 to A$0.11 recently - this has made the equity financing of the Project problematic. However, should a sale of an equity stake at the Project level be successful any associated share issues at the head company level will likely be relatively small.

Opportunities

- **Growing HPA market:** This is the key opportunity for Altech, with the company ideally placed to take advantage of the forecast growth in 4N HPA markets.
- **Expanded production:** The plant design and production parameters are conservative, and there is the scope to increase the planned production from 4,500 tpa HPA as modelled and on which financing is based to up to 6,000 tpa - given the expected high margin this will have an appreciable effect on the bottom line.
- **Licencing:** Should the process prove commercially successful, there may be the opportunity to licence the process, or for the Company to build additional plants.

Threats/Risks

- **Markets:** Soft markets may affect the ability of Altech to attract an equity partner into the Project - we consider this the key risk.
- **HPA markets:** There is a chance of significant new production coming on stream (possibly from China), that may push 4N HPA prices down; in addition forecast demand may not turn out to be as strong as expected, again weighing on price. The opposite market factors can also apply however, which would likely positively impact prices.
- **Ramp up and operational risk:** Being a relatively new process, there is the chance that the planned operation may not perform as expected and produce the quality and consistency of product required for customers; this risk however is somewhat mitigated by the due diligence process and with the terms of the EPC contract with SMS group also passing part of this risk onto the contractor.

OVERVIEW

STRATEGY AND PROJECT OVERVIEW

- Altech's strategy is to become a significant producer of 99.99% ("4N") HPA, using a patented acid leach process to treat high purity aluminous clays.
- Significant growth in demand for high quality HPA is forecast over coming years, with this to be driven by growth in the use of LED lighting (which uses sapphire glass produced from HPA as a substrate) and the growing use of HPA in separator sheets for lithium ion batteries, replacing polymer-only separators as battery temperatures increase with increasing battery energy density.
- Clay is to be mined from the Company's 100% owned Meckering deposit, 130 km from Perth in Western Australia, and then will be shipped to be processed at its HPA plant located within the Tanjung Langsat Industrial Complex, near Johor Bahru in southern Malaysia.
- Both sites are fully permitted, with construction having commenced on the HPA plant; the Company is now looking to finalise the mezzanine debt and equity portions of the remaining expected ~US$380 million financing (which may include the sale of a direct equity stake in the Project), with the majority of debt facilities in place with the German Government owned KfW IPEX-Bank and a term sheet signed with Macquarie Bank - closing of the financing will lead to commencement of the estimated remaining two year construction period, with first production expected in 2022.
- The Company expects a three year ramp up to the planned 4,500 tpa HPA full scale production, with a binding offtake agreement in place with Mitsubishi Corporation for 100% of the first ten years production.

FINANCIAL POSITION

- As of March 31, 2019 the Company had A$2.124 million in cash and no debt.
- Subsequent to the end of the quarter the Company raised A$18.227 million (before costs) via a placement of 168 million shares to new and existing investors - this is being issued in two tranches, with the initial tranche of A$14.227 million already being issued, and with the remaining A$4 million expected to be received in early June, 2019 following a general meeting of shareholders - the A$4 million includes subscriptions of $2 million each by existing shareholders SMS group and MAA Group (Melewar).
- This latest capital raise followed a A$21.214 million placement and SPP (before costs) in August 2018.
- Expected expenditure for the year ended June 30, 2019 includes A$4.0 million on development, A$14.1 million on payments/pre-payments for Stage 1 and 2 construction of the HPA plant and A$3.1 million for administration and staff costs.
- During CY2018 the Company spent A$7.822 million on property, plant and equipment, including Meckering and Johor land purchases/leases.

HIGH PURITY ALUMINA PROJECT - ATC 100%

LOCATION, TENURE AND INFRASTRUCTURE

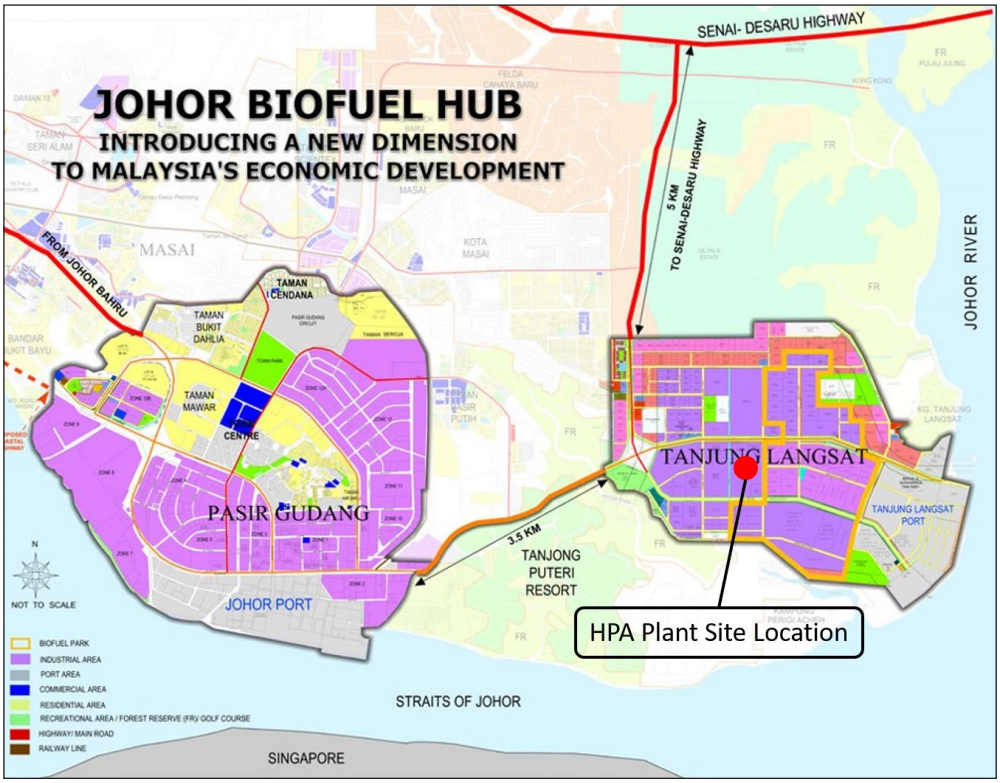
- The HPA Project is divided between two sites - the Meckering kaolin deposit in Western Australia, and the HPA plant site in the Tanjung Langsat Industrial Complex, located near Johor Bahru in Southern Malaysia (Figures 1 and 2).
- The Meckering deposit is covered by the 84.62 ha ML70/1334, which was 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.

Figure 1: Meckering location

Source: Altech

- 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.
- 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 scale of the developments was confirmed by our recent site visit.
- 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.

Figure 2: HPA site location



Source: Altech

- The container port for the region is located at Tanjung Pelepas at the western end of the Straits of Johor some 90 km by road from the plant site - this is the 17th largest container port in the world, with additional capability now being built.
- The area is well served by transport infrastructure and utilities; importantly for Altech is the location of a hydrochloric acid plant within 15 km of its HPA facility site.
- Attractions of Malaysia as an operational jurisdiction include low operating costs when compared to Australia - for the HPA plant these are expected to be 60% lower than those for an equivalent plant in Australia, with key contributors being power and acid.
- The country also has a relatively attractive corporate tax regime with a corporate tax rate of 24%, and the potential for a 5 year to 10 year tax holiday. On the flip side there has been recent uncertainty with the April 2015 change from a Sales and Service Tax ("SST") to a Goods and Services Tax ("GST"), reversed back to SST in September 2018, with GST abolished and a 6% sales or services tax imposed (dependent upon the category of goods/services) - the SST has a cost to business, however construction services are exempt as are the sale of exported goods. Under the former GST regime, input GST was offset against output GST (as in Australia), so there was no net cost to business.
- Johor Bahru is the capital of Johor State, with the city having a population of ~500,000 and the metropolitan area a population of ~ 1.8 million and as such is well served by facilities typical for large cities.

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.

History and Previous Work

- Previous work at Meckering included exploration by CRA Exploration ("CRAE") in the 1980's and the calculation of a 64 Mt JORC-compliant resource and mining of a bulk sample trial pit by Swan River Kaolin ("SRK") in 2005 - SRK extracted 48 tonnes of raw kaolin for bulk sample processing in their Northam pilot plant.
- Work by Altech has included additional drilling, the estimation of Mineral Resources and Ore Reserves (Table 1) and bulk sampling for use in metallurgical testwork.

Table 1: 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

- 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.

Geology

- The aluminous clay at Meckering has been formed by the ancient natural weathering of underlying granites, and is comprised largely of silica/quartz (SiO_2) and kaolinite - clays have been recognised to a depth of at least 42m.
- 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 (Table 2) - 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 2: Screened (-0.3 mm) Meckering deposit chemistry

Oxide (%)	Darling Range Bauxite	Canadian HPA Project	Altech Feedstock (after 0.3 mm screen)
Al_2O_3	34.5	22.77	30.5
SiO_2	21.5	53.29	56.3
Fe_2O_3	21.2	8.36	0.7
TiO_2	2	0.98	0.7
K_2O	0.24	3.41	0.2
CaO	0.02	0.85	0.1
NaO	0.01	1.42	0.1
MgO	0.01	1.67	0.1

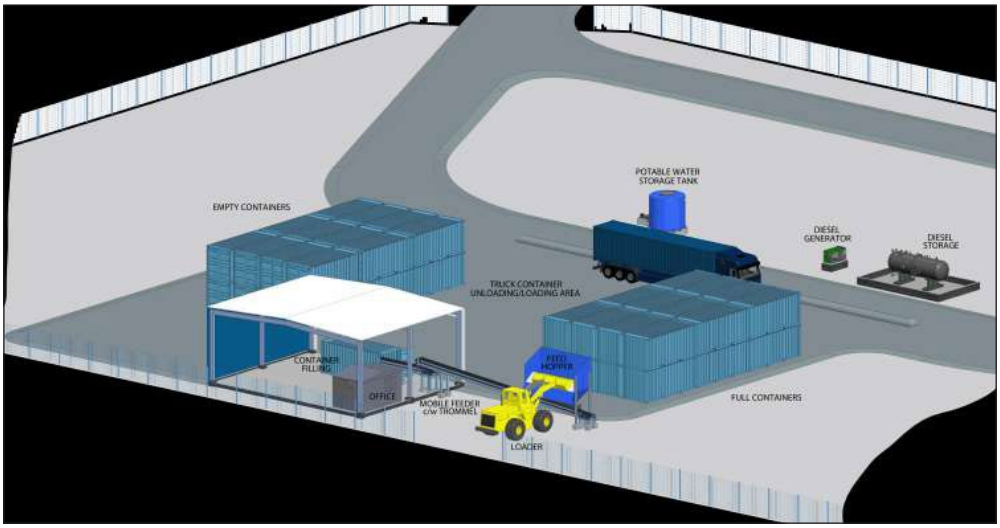
Source: Altech

- Pure kaolinite ($Al_2Si_2O_5(OH)_4$) comprises the following oxides:
  - Alumina – Al_2O_3 – 39.5 weight percent,
  - Silica – $2SiO_2$ – 46.6 weight percent; and,
  - Water – $2H_2O$ – 13.9 weight percent.

Planned Operations

- Planned operations at Meckering will include just mining and loading the ROM material into standard 20 foot sea containers (Figure 3) for transport by truck to the port at Fremantle, 153 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.
- Mining, which will be free dig, with be undertaken on a campaign basis every three years - it is estimated that each mining campaign, to be carried out in summer, will take between two and three months, with contract mining being used - the life of mine strip ratio is estimated at 0.64:1.
- Mined ore will be stockpiled on the ROM pad, from where it will be loaded into the containers using a retreating conveyor belt. It is estimated that 36 containers per week will be required, with these being despatched to Malaysia on a weekly basis - screening and loading operations will be year round, an a 5 day/12 hour roster.

Figure 3: Meckering screening and loading schematic



Source: Altech

- 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. Although on-site beneficiation would have resulted in smaller volumes and lower shipping costs, the cost to supply power, purchase water and supply natural gas to dry the material from the wet beneficiation process would be in excess of the additional shipping charges.In addition, the ability to operate the beneficiation plant 24 hours per day in Johor rather than 12 hours per day in Meckering has resulted in a smaller "front end" of the plant.

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 4. The plant design is based on the process route developed by Altech and partners, including SMS group - the plant will have the flexibility to produce both high quality 4N HPA beads (for sapphire boule production for uses such as LED lighting) and powder (for use in lithium-ion battery separators).
- 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 current Stage 1 and 2 construction activities are part of the fixed price EPC contract with SMS group.

Figure 4: Tanjung Langsat HPA plant layout

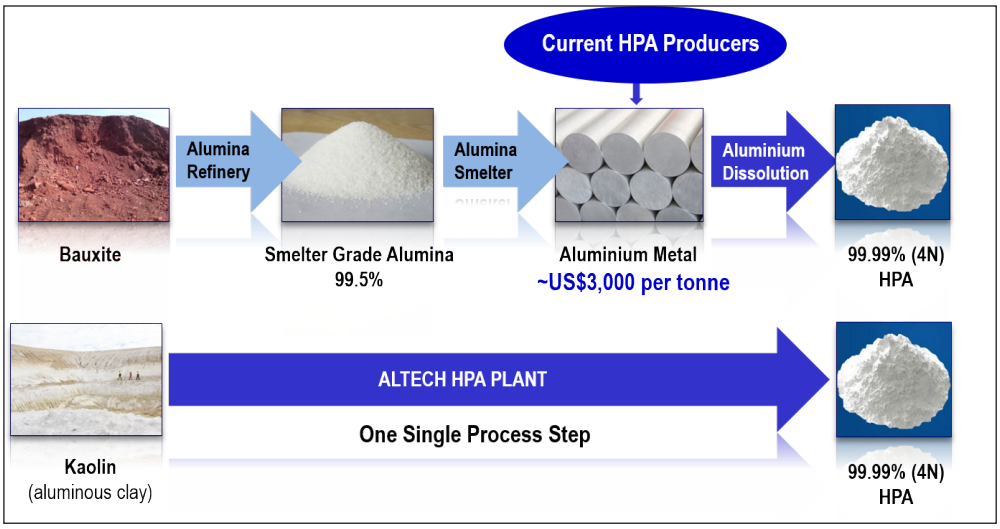
Source: Altech

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 key to the success of the process (in addition to the purity of the Meckering feedstock) is the three stage $AlCl_3$ crystallisation/washing circuit and following calcining circuit to produce the final 99.99% Al_2O_3 - these retain the purity and do not reintroduce contaminants into the final product - this is the process that caught the attention of SMS group, and which has been an issue with other leach processes.
- One patent for the process has been granted, with eight pending.
- The acid leach method of extracting alumina from aluminous clays was originally developed by the Swiss in the early 1900s, and developed further by the US Government and Alcoa in the early 1980's as a possible smelter grade alumina ("SGA") process - this however couldn't compete at that time with the Bayer Process for extracting alumina from bauxite on costs due to the low value of the SGA end product.

- Current producers use relatively high cost feedstock, predominantly aluminium metal to produce HPA - for example, Sumitomo synthesise aluminium alkoxide from aluminium metal and alcohol, which is then hydrolysed to form hydrated alumina - this is then calcined to form HPA (Figure 5).
- 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, silica, is benign and potentially marketable.

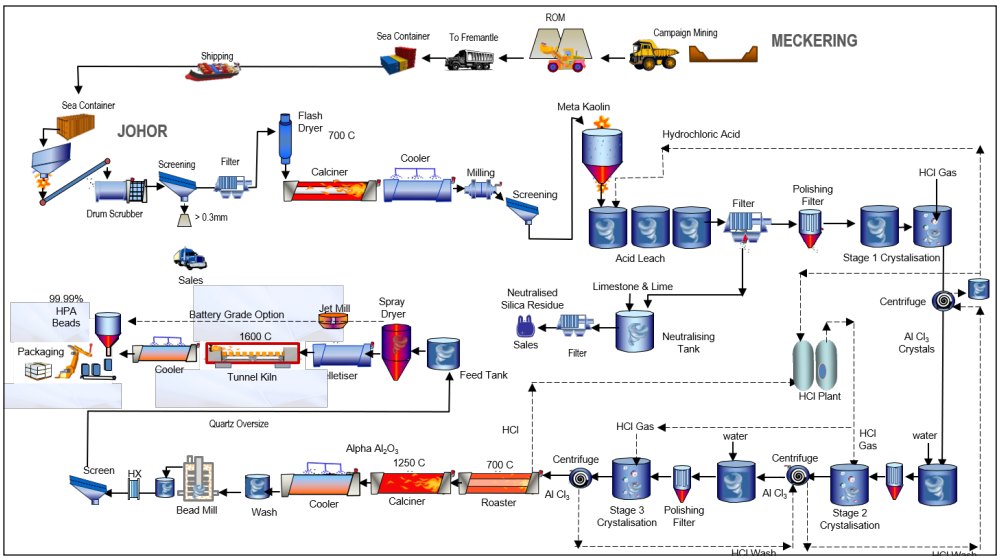
Figure 5: HPA production comparison



Source: Altech

- The final flowsheet is shown in Figure 6, 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 silica 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 silica residue - the residue is neutralised to form a fine silica 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 6: 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 silica sand and fine silica, are benign, with all HCl being recycled in the processing - these silica 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, with the figures as presented being conservative, partly due to the requirements of the project due diligence and the banks.
- 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 - current costs are based on this study, which includes the final design as presented in the sections above.
- 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.

- Study outcomes are presented in Table 3, capital cost estimates in Table 4 and operating cost estimates in Table 5.
- The numbers also assume a 6 to 12 month product qualifying period with suppliers - this will result in a little over half (~1,800 t) of the 3,000 t of HPA produced in the first year of production actually providing revenue.
- Subsequent to release of the Study the target debt as provided by KfW IPEX-Bank has increased to US$190 million, which includes US$170 million of ECA debt and $20 million debt under standard commercial terms; total production costs are estimated at US$8.55/kg HPA, not including the Mitsubishi sales fee of 5% of revenue.
- 4N HPA pricing has been determined from market studies undertaken by Persistence Market Research ("PMR").
- We have used the capital and operating costs in our modelling (presented later) - given that they are the result of the extensive and exhaustive due diligence process by SMS group and KfW IPEX-Bank, we consider them to be reasonable.
- There are however no other similar operations that we are able to compare Altech's capex and operating cost estimates to.
- 4N HPA pricing has been determined from market studies undertaken by Persistence Market Research ("PMR").

Table 3: FIDS outcomes - 4,500 tpa HPA

FIDS outcomes - 4,500 tpa HPA		
Parameter	**Ave Price ~$27/kg**	**Price $40/Kg**
Project Capital Costs	US$ 297.6 million	US$ 293.6 million
Revenue p.a.	US$ 120.3 million	US$ 180.0 million
Operating Costs p.a.	US$ 44.6 million	US$ 46.9 million
EBITDA p.a.	US$ 75.7 million	US$ 132.7 million
Net Present Value (@7.5%)	US$ 505.6 million	US$ 1,087.0 million
Payback (incl. ramp-up)	4.5 years	3.3 years
Payback at full production	3.9 years	2.2 years
Internal Rate of Return (IRR)	21.90%	32.90%
NPV/Capex Ratio	1.7	3.66
Project Life	30 years	30 years
Annual HPA Production	4,500tpa	4,500tpa
HPA Production Costs	US$ 8.85/kg	US$ 8.85/kg
Long term HPA Sale Price (Avg)	US$ 26.9/kg	US$ 40.0/kg
Mitsubishi Sales Fee	5% of revenue	5% of revenue
Gross Margin on Sales	63%	74%
USD:AUD	0.75	0.75
Construction Period	24 months	24 months
Production Ramp-up	3 years	3 years
Corporate Costs	US$ 7.7 million	US$ 7.7 million
Target Total Project Debt	US$ 185 million	US$ 185 million
Target ECA Covered Debt	US$ 165 million	US$ 165 million

Source: Altech

Table 4: Capital cost estimate

Capital cost estimate	
Area	**US$ Million**
Meckering EPC (incl. contingency & land)	5.3
HPA plant land	4.1
Johor HPA plant EPC fixed price	280
Owner cost and Insurances etc	8.2
TOTAL CAPITAL COSTS	**297.6**

Source: Altech

Table 5: Operating cost estimate

Operating cost estimate	
Activity	**US$ per kg HPA**
Meckering Mining	$0.06
Meckering Kaolin Loading	$0.08
Transport (Meckering to Malaysia)	$1.41
WA State Royalty	$0.05
HPA Manufacturing (Johor)	$5.45
Corporate (Aust)	$0.96
Corporate (Malaysia)	$0.54
Operating Costs per kg	**$8.55**

Source: Altech

EPC CONTRACTS - SMS GROUP AND SIMULUS ENGINEERING

- The Company has entered into EPC contracts with the SMS group for the construction of the Malaysian plant. Simulus Engineering of Perth will 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.
- SMS group is the world's largest supplier of metallurgical equipment, with an annual turnover in the order of US$3 to US$4 billion - the group is headquartered in Dusseldorf, Germany and was formed in 1871, it has been operated by the same family since inception.
- One of the group's subsidiaries is South African based Metix, which is undertaking the HPA site EPC activities - Metix has recent Malaysian construction experience, including in Sarawak, West Malaysia.
- SMS group has also given an undertaking to invest US$15 million in equity in Altech - to date SMS has subscribed for ~US$5.4 million (including A$2 million in the latest placement), with the remainder due on the close of financing.

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 is now in the process of finalising project financing, with senior debt already in place.
- It is expected that ~US$400 million will be required, with this including US$297.6 million for the Project capital (which is largely comprised of the fixed price EPC contracts), as well as allowances for working capital, debt coverage and finance costs amongst others.
- The expected debt proportion will be 65% to 70%, and allowing for expenditure to date of ~US$13 million, results in the order of US$250 to US$270 million in debt, and hence US$117 to US$137 million in equity.
- 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.
- The remaining debt is expected to be raised through a mezzanine facility - the Company has recently mandated Macquarie Bank as the preferred lender, with an indicative US$90 million term sheet in place.

- The Company is 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 50% in either of the 100% owned Australian or Malaysian subsidiaries for ~ US$100 million.
- A successful project equity sale would result in only a relatively minor share issue being required at financial close given that around US$11 million of project equity is committed from SMS group.

UPCOMING ACTIVITIES

- The Company is now completing Stage 1 of the HPA plant construction (which includes siteworks, retaining walls and completion of the maintenance building), with a majority of the recent A$18 million raising to be put towards Stage 2 construction.
- The timing of the main construction phase is dependent upon successful close of financing.

PEERS

- Altech is one of a handful of ASX listed companies active in the HPA space as shown in Table 6.
- These companies are at various stages of development and use (or plan to use) different methods for HPA production - two, Alpha HPA and Pure Alumina (through the proposed acquisition of Polar Sapphire, for which a conditional binding agreement has been signed) are based on aluminium feedstocks, with the remainder looking at acid leaching of clays.
- Of the clay based feedstocks Altech is the most advanced (which is reflected in the market capitalisation), and the only one with offtake agreements and debt financing in place.

Table 6: Altech peers

Altech peers						
Code	**Description**	**Last Price**	**Market Cap**	**Cash**	**EV**	**Project/Notes**
ATC.ASX	Altech Chemicals	$0.110	$77.41 m	$16.39 m	$61.02 m	Johor Bahru, Meckering. Patented process to develop 4N HPA from high purity kaolin. Fully permitted, with offtake in place and under construction.
A4N.ASX	Alpha HPA	$0.110	$62.38 m	$1.98 m	$60.40 m	PFS completed for a 10,200 tpa HPA operation using the "HPA First" process, that uses an atmospheric solvent extraction process on aluminium feedstock to produce HPA.
ABX.ASX	Australian Bauxite	$0.110	$16.06 m	$1.68 m	$14.38 m	Primarily a bauxite miner, however has the ALCORE subsidiary to produce AlF3 and other high value products from bauxite (although not HPA)
FYI.ASX	FYI Resources	$0.066	$12.97 m	$1.33 m	$11.64 m	Cadeaux kaolin deposit WA, PFS completed on an acid leach flowsheet. DFS underway for a +8,000 tpa operation, with work commencing on a pilot plant.
PUA.ASX	Pure Alumina	$0.060	$10.27 m	$0.29 m	$9.98 m	Acquiring Canadian company Polar Sapphire for C$25.75 m - Polar has developed a patented low cost modular process to produce HPA from aluminium, with 5N material being produced from a pilot plant in Toronto.
ADN.ASX	Andromeda Metals	$0.008	$10.84 m	$2.40 m	$8.45 m	JV on the Poochera halloysite-kaolin deposit in SA with Minotaur - testwork has produced 4N HPA. Other base and precious metals projects
ALY.ASX	Alchemy Resources	$0.014	$6.17 m	$0.66 m	$5.51 m	Looking at the potential for an Al resource at the West Lynn Ni-Co-Al Project in NSW, with an initial Al MRE expected in Q3, 2019. HCl leach testwork has commenced looking towards HPA production. Also holds other precious and base metals projects.

Source: IRESS, company reports and releases

CAPITAL STRUCTURE

- Altech currently has 704 million fully paid ordinary shares and 28.7 million performance rights on issue - it is expected that a further 36.87 million shares will be issued as part of Tranche 2 of the most recent placement.
- The largest shareholders are the German funds Delphi (7.20%) and Deutsche Balaton (7.11%) - both of which came onto the register with the recent placement.
- SMS Investments however will become the largest holder upon completion of Tranche 2 of the placement - it currently holds 5.54% of Altech, with this expected to increase to 7.75%
- The Top 20 currently hold 49.81% of shares, with directors directly and indirectly holding 10.86% of Altech - the largest holdings are those of Tunku Khyra with 6.75%, through his association with the MAA Group and Melewar Equities - this will increase to 9.24% with the issuing of Tranche 2 placement shares to Melewar Equities.

VALUATION

ALTECH VALUATION

- We have completed a valuation for ATC, with this including a DCF valuation for the HPA Project and cash - our summary valuation is shown in Table 7 - this is based on Altech's share of estimated cash flows with per share values based on a share structure diluted for funding.

Table 7: Altech valuation - A$

Altech valuation - A$						
Item	**Value - Unrisked**	**Value per Share - Unrisked**	**Risk Factor**	**Value - Risked**	**Value per Share - Risked**	**Notes**
HPA Project	A$ 438 m	A$ 0.52	50%	A$ 219 m	A$ 0.26	$NPV_{7.5}$
Cash	A$ 15 m	A$ 0.02	100%	A$ 15 m	A$ 0.02	
Total	A$ 453 m	A$ 0.54		A$ 234 m	A$ 0.28	
Shares on Issue - Diluted		839,310,992				

Source: IIR analysis

- The valuation is based on a conceptual project finance model, with an estimated funding requirement in the order of US$380 million - this includes:
  - Project capital requirements of US$297.6 million,largely under fixed price EPC contracts,
  - Working capital, debt service etc requirements of US$100 million; and,
  - Less expenditure to date of ~US$18.2 million.
- The finance structure used in our modelling is shown in Table 8.
- Part of the financing includes a potential sale of 50% equity in the Project for US$100 million - this results in varying project ownership over the initial years.

Table 8: Finance structure

Finance structure				
Item	**Amount - US$ m**	**Term/Price**	**Interest Rate**	**Notes**
ECA Debt	$170.0	10 years	5%	Pre-production interest capitalised
Commercial Debt	$20.0	5 years	6%	
Mezzanine Debt	$75.6	5 years	8%	Pre-production interest capitalised
Equity Raised (Post 2019)	$13.8	A$0.20		Weighted Average
Project Equity Sale Proceeds	$100.0	Sale of 50% of the HPA Project		
Total Initial Financing	$379.4			

Source: IIR analysis

HPA PROJECT VALUATION

- The ultimate Altech cashflows are derived from our modelling and valuation of the HPA Project an a 100% basis, with results presented in Table 9 - these are generally in accordance with figures as published by Altech.

- We have also used a higher LOM average LOM HPA price of US$32,500/tonne - this is about midway between Altech's base case of US$26,900/tonne (which could be considered conservative) and the current average price for the premium producers of ~US$40,000/tonne.
- In our modelling we have then discounted our HPA sales price by 5% to take account of the Mitsubishi sales fee.

Table 9: HPA Project valuation - 100% basis, US$

HPA Project valuation - 100% basis, US$			
Model	**NPV7.5, Mid-Year**	**IIR**	**Notes**
Pre-Tax, Pre-Financing	US$ 645 m	21%	HPA price of US$31,000/t after Mitsubishi 5% sales fee
Post-Tax, Pre-Financing	US$ 515 m	18%	No tax holiday
Post-Tax, Financed	US$ 604 m		70:30 D:E

Source: IIR analysis

- We have largely used inputs as used in the 2017 FIDS - model inputs are presented in Table 10.

Table 10: Model inputs - US$

Model inputs - US$		
Item	**Units**	**Phase 1**
HPA Peak Production Rate	tpa	4,500
Construction Start	Year	2019
Construction End	Year	2021
Production Start	Year	2022
Mine Life	Years	30
Meckering Mining	US$/Tonne HPA	$60
Meckering Loading	US$/Tonne HPA	$80
Transport to Malaysia	US$/Tonne HPA	$1,410
HPA Production Costs - Malaysia	US$/Tonne HPA	$5,450
HPA Selling costs and Misc	US$/Tonne HPA	$1,350
G & A Australia	US$/Tonne HPA	$960
G & A Malaysia	US$/Tonne HPA	$540
WA Government Royalty	US$/Tonne HPA	$50
Total Operating Costs (exc Marketing)	US$/Tonne HPA	$8,550
Up Front Capex	US$ Million	$297.60
Up Front Capex	US$/Tonne HPA	$2,199
Sustaining Capex Rate	% of Upfront pa	2.50%
LOM Sustaining Capex	US$ Million	$219.32
Sustaining Capex	US$/Tonne HPA	$1,649
Revenue	US$/Tonne HPA	$31,000
Operating Margin	US$/Tonne HPA	$22,450

Source: IIR analysis, Altech guidance

- Key model financial parameters are summarised in Table 11
- Using a global average EV/EBITDA multiple of 10 for specialty chemicals companies results in a potential future EV of A$1.41 billion, which supports the DCF valuation.

Table 11: Model outputs - US$

Model outputs - US$		
Parameter	**Unit**	**Value**
Financial Outcomes - 100% Basis		
Mine Life	Years	30
Total HPA Produced	Tonnes	133,000
HPA Sales Price	US$/tonne	$31,000
Pre-Tax NPV, mid-year	US$ m	$645 m
Pre-Tax IIR	%	23%
Post-Tax NPV, Mid-Year	US$ m	$515 m
Post-Tax IIR	%	20%

Model outputs - US$		
Parameter	**Unit**	**Value**
Funded, Post -Tax NPV	US$ m	$605 m
LoM Revenue	US$ m	$4,086 m
LoM Opex	US$ m	-$1,143 m
LoM EBITDA	US$ m	$2,942 m
LoM Capex	US$ m	$512 m
LoM Tax	US$ m	-$565 m
LoM Interest	US$ m	-$77 m
LoM FCF	US$ m	$1,905 m
Peak Annual FCF	US$ m	$76 m
Peak Annual EBITDA	US$ m	$101 m
Discount Rate	%	7.50%
Corporate Tax Rate	%	24.00%
Tax Holiday	Years	0
Project Financing		
Initial Capex	US$ m	$298 m
Amount Expended	US$ m	$18 m
Working Capital, Debt Service etc	US$ m	$100 m
Total Financing Amount	US$ m	$379 m
Project Finance Debt	%	70.00%
Debt Amount	US$ m	$266 m
Financing Term	Years	Various
Interest Rate	%	Various
Project Finance Equity - Shares and Project Equity Sale	US$m	$114
Equity Price	US$/share	Various
Diluted Shares on Issue	Million on Issue	839
Exchange Rate	AUD:USD	0.7

Source: IIR analysis

SENSITIVITY

- Table 12 presents the sensitivity of the HPA Project to various inputs on a 100% after-tax, ungeared basis, with Table 13 presenting the sensitivity of the Altech per share valuation to changes in the HPA price and Malaysian operating costs, the two parameters (with the exception of an increase in production rate and capex), that the project is most sensitive to.
- Given that the majority of the capex is under fixed price EPC contracts, we have not further considered the sensitivity to change in capex.
- The inherent conservative parameters used in the FIDS study present significant upside with respect to production rates; effectively the plant has been designed to a standard that can produce 6,000 tpa of HPA, however with modelling and financing predicated on 4,500 tpa - as can be seen in Table 12 the Project valuation is highly geared to changes in rates of production.

Table 12: HPA Project valuation unrisked - 100% basis - pre-tax, unfunded

HPA Project valuation unrisked - 100% basis - pre-tax, unfunded					
Change	**HPA Price**	**Site Costs - Malaysia**	**Site Costs - Australia**	**Capex**	**HPA Production**
-20%	US$ 366 m	US$ 701 m	US$ 669 m	US$ 716 m	US$ 445 m
-10%	US$ 506 m	US$ 673 m	US$ 657 m	US$ 681 m	US$ 545 m
0%	US$ 645 m	US$ 645 m	US$ 645 m	US$ 645 m	US$ 645 m
10%	US$ 785 m	US$ 618 m	US$ 634 m	US$ 610 m	US$ 746 m
20%	US$ 925 m	US$ 590 m	US$ 622 m	US$ 575 m	US$ 846 m

Source: IIR analysis

Table 13: ATC per share risk weighted post tax project sensitivity - company equity basis

ATC per share risk weighted post tax project sensitivity - company equity basis						
		Change in Malaysian Opex				
		-20%	-10%	0%	10%	20%
HPA Price per Tonne	US$ 40,000	A$ 0.41	A$ 0.40	A$ 0.40	A$ 0.39	A$ 0.38
	US$ 35,000	A$ 0.34	A$ 0.33	A$ 0.32	A$ 0.31	A$ 0.30
	US$ 30,000	A$ 0.26	A$ 0.26	A$ 0.25	A$ 0.24	A$ 0.23
	US$ 25,000	A$ 0.19	A$ 0.18	A$ 0.17	A$ 0.16	A$ 0.15
	US$ 20,000	A$ 0.12	A$ 0.11	A$ 0.10	A$ 0.09	A$ 0.08
	US$ 15,000	A$ 0.04	A$ 0.03	A$ 0.02	A$ 0.01	A$ 0.00

Source: IIR analysis

- There may also be some upside related to corporate tax "holidays" - the Project may qualify for a 5 to 10 year break from paying corporate tax - our modelling suggests that a 5 year break adds ~US$8 million to the risked value attributed to Altech.
- We also see further de-risking through the successful closing of financing.

BOARD

- **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.

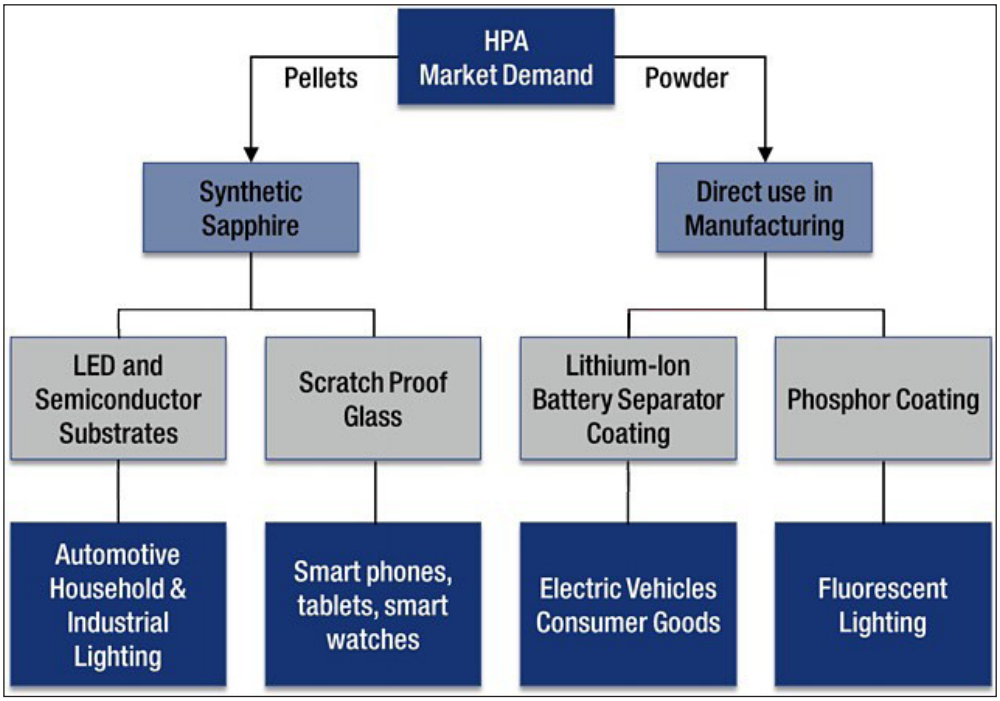
- *Bios extracted from Company website, May 6, 2019.*

BACKGROUND - HPA MARKETS

WHAT IS HPA, AND WHAT ARE ITS USES?

- As its name suggests, HPA is a high purity form of aluminium oxide, commonly known as alumina. Alumina is the basic feedstock for aluminium production, albeit in a lower purity form, which comprises approximately 90% of the demand for alumina - the remaining 10% is used in the non-metallurgical market for specialty or chemical use, of which HPA is the high end product.
- The gemstone sapphire is also a form of HPA, and can occur naturally as well as being formed in the laboratory from 99.99% (or higher purity) HPA, with artificial sapphire being one of the key uses for HPA.
- Artificial sapphire is produced by heating HPA powder in an autoclave to its melting point of 2,000°C under intense pressure, at which point an individual crystal is formed; the crystal is then allowed to cool (~22 day cycle), and then can be cut using diamond cutting equipment to suit individual applications.
- HPA has a number of desirable properties that make it an important part of the technology industry:
  - Hard and strong in the sapphire form – sapphire has a hardness of 9 on the Mohs scale, second only to diamond, and is important for abrasive applications, including sapphire single crystal applications (phone screens amongst others),
  - Resistant to corrosion – important in semiconductor manufacturing and display screens, where corrosion by plasma is an issue,
  - High brightness – key in effective LED lighting, which is more energy efficient than traditional incandescent bulbs – different jurisdictions have mandated requirements to introduce LED lighting as a replacement for incandescent lighting,
  - High thermal and low electrical conductivity (important in the electronic applications); and,
  - Biocompatibility – important in prosthetic devices including implants.
- The main uses for HPA are shown in Figure 7, with the use in battery separators forecast to lead growth over coming years.
- In our discussion we will concentrate on 4N HPA, which has around 70% to 75% of market share, and which is the market that Altech is targeting.
- The LED lighting markets have been the dominant driver of increases in demand for 4N HPA over recent years, with these steadily replacing incandescent bulbs due to their higher efficiency, with this replacement also being mandated in a number of countries.

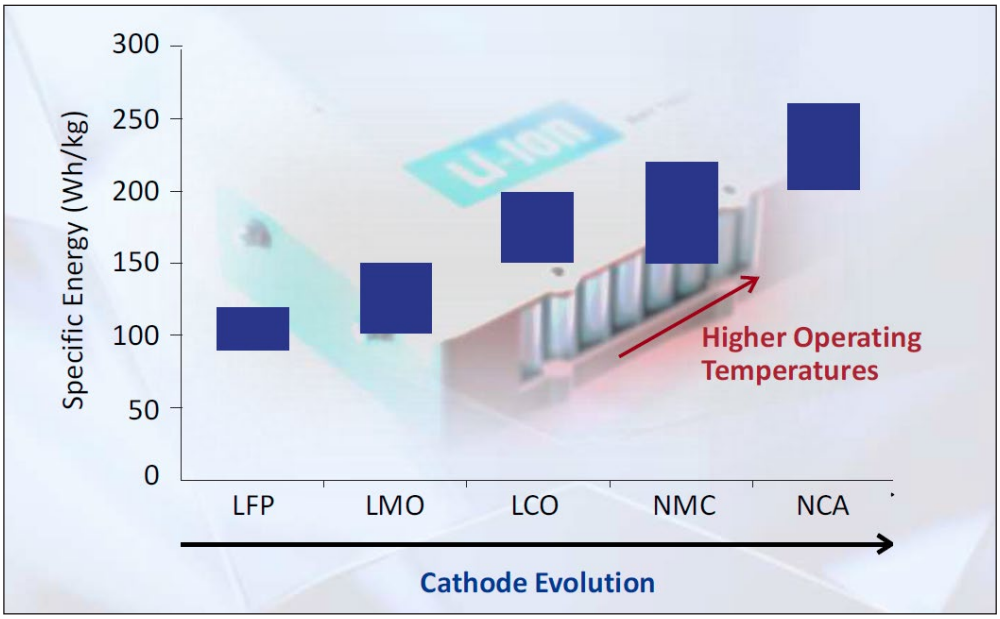
Figure 7: HPA uses



Source: Smallcaps.com.au

- However, it is expected that growth in coming years may be increasingly driven by the battery separator market, with HPA being used to coat the polymers traditionally used as the separator between the anodes and cathodes in lithium ion batteries - separators prevent the anode and cathode from shorting, however allow Li ions to pass between the anode and cathode.
- The reason for this growth in HPA coating is the growing energy density in batteries, leading to higher heat generation within them - the energy density of various battery types is shown in Figure 8.
- Traditional polymer separators are only able to handle temperatures of up to ~135° C, with HPA coated separators (HPACS) being able to withstand temperatures of over 200° C - in addition to being able to withstand higher temperatures the HPACS result in a longer battery lives, higher energy efficiencies and increased safety.
- Two main coating thicknesses are manufactured, being 1.5 um in electronics,and 2 um in electric vehicles - the estimated extra cost for a HPA separator in an EV is ~US$200, and thus whilst being important, is only a minor cost in the production of EVs.
- The expected growth in HPA in batteries will come both from the increase in HPA coating penetration and the forecast growth in batteries, largely driven by electric vehicle uptake.

Figure 8: Battery types and specific energy



Source: Altech

HPA PRODUCERS AND CURRENT PRICING

- Table 14 presents a list of HPA producers as of 2014, with these dominantly producing "4N" HPA.

Table 14: HPA producers

HPA producers		
Producer	**Country**	**Tonnage**
Sumitomo	Japan	3,020
Hebei Pengda	China	3,000
Zibo Xinfumeng	China	2,500
Sasol	South Africa	1,800
Xuancheng Jing Rui	China	1,200
Baikowski	France	1,200
Nippon Light Metal	Japan	1,100
Huantou	China	800
Dailian Rail	China	600
Others (15)	Various	3,570

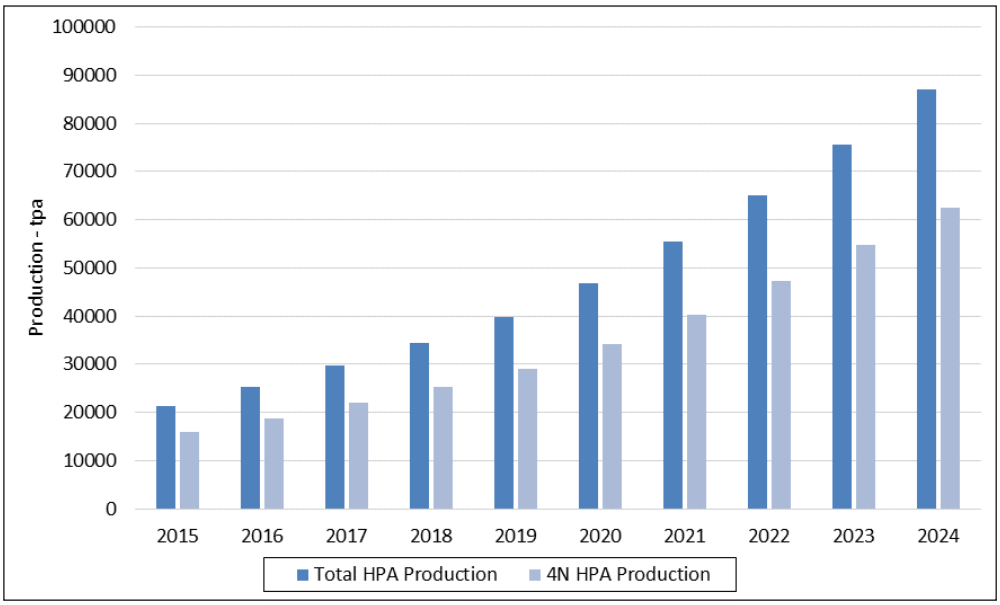
Source: Technavio Research

- The intense price pressure within the LED market has led to quality issues in particularly Chinese products; this in turn has placed pressure on some 4N HPA suppliers (again largely Chinese), with the result that product specifications from these producers are not consistent, and what is sometimes sold as 4N product is actually 3N.
- This has led to a binary market for 4N HPA, with a premium price group (which includes non-Chinese producers such as Sumitomo, Baikowski and Sasol), with current prices in the order of US$40 to US$50/kg, and a lower price group, largely comprised of Chinese producers, with prices at around US$20 to US$30/kg - Altech is looking to be a premium producer.
- However there is the potential for Chinese producers, with the development of technology, to deliver a consistent, high quality product.
- Non-Chinese end product manufacturers tend to purchase their HPA from the premium producers to guarantee quality and consistency.
- Average prices have fallen over recent years, due to both increase in supply and production costs falling - in the case of the premium group these have fallen from ~US$60/kg HPA to the current US$40/kg HPA, with the lower priced group falling from ~US$35/kg to under US$30/kg.

DEMAND AND PRICING FORECASTS

- As mentioned, it is expected that demand growth will be driven by the battery separator coating market, with this being backed up by growth in the LED lighting substrate market.
- Growth in the separator market is expected to be driven by two main factors:
  - Growth in the battery markets themselves, largely driven by EV takeup; and,
  - Growth in the percentage of HPACS in the overall separator market - this has been demonstrated by separator producer W-Scope, with the percentage of coated vs non-coated separators increasing markedly over the last few years.
- A number of new EV battery plants and expansions to existing plants are on the drawing board, including a number in Germany - in a presentation W-Scope has outlined over 200 GWh of planned production increases over the next five years, and, allied with the increasing usage intensity of HPACS could lead to a 5x to 10x growth in this market.
- The demand for LED lighting will also increase, however rates of growth are expected to slow from ~15%, however still remaining strong at ~10% per annum for the foreseeable future - Navigat Research has forecast growth from 864 million units in 2015 to 4.1 billion units in 2024, a close to 5x increase.
- Figure 9 presents the expected growth in demand for both total HPA and 4N HPA; the chart highlights a forecast CAGR of ~17% for total HPA and ~16% for 4N HPA between 2015 and 2024.

Figure 9: Forecast HPA demand



Source: PMR in Altech FIDS release

- Other forecasts have 4N demand by 2024 as some 10% higher than that presented above - differences in forecast largely result from assumptions as to the take-up of EVs and hence the demand for HPA for battery separator coatings.
- With regards to price forecasting, Altech has used that by PMR in the 2017 FIDS study - this is shown in Figure 10.
- This shows forecast weighted average prices for both the high and low price groups, with Altech using a price forecast midway between the two, which, considering that they are targeting the premium market, may be considered conservative.
- In addition, prices for the high group are still averaging at around US$40/kg, some 10% higher than the forecast from the 2016 PMR study.
- Other forecasts have suggested that prices may actually remain stable, else rise with the expected growth in demand.

Figure 10: 4N HPA price forecasts

Source: Altech

- Forecasting, particularly in low volume, specialty markets is at best an inexact process, and a number of factors may affect future demand and pricing for premium 4N HPA amongst others:
  - Actual growth rates in HPACS usage intensity and EV take-up,
  - LED lighting growth,
  - Move to 5N away from 4N,
  - Improvement in quality and consistency in Chinese HPA production,
  - Quantum of new supply and increases from existing producers
  - Development of replacement material for the key HPA markets; and,
  - Disruptive technology bringing costs down.
- Despite the difficulties in forecasting, we see a strong market for 4N HPA going forward, and there is a reasonable chance that prices may stay steady, and possibly increase.

APPENDIX 1 - FINANCIALS ATTRIBUTABLE TO ATC

PROFIT & LOSS (A$M)					
Y/E June	**2019**	**2020**	**2021**	**2022**	**2023**
Revenue	0.0	0.0	0.0	39.9	88.6
Operating costs	-3.0	-1.5	-1.5	-18.3	-24.4
EBITDA	-3.0	-1.5	-1.5	21.5	64.1
D and A	-0.6	-3.4	-6.6	-6.8	-7.0
EBIT	-3.6	-4.9	-8.1	14.7	57.2
Interest	0.0	0.0	-0.4	-12.0	-10.5
EBT	-3.6	-4.9	-8.5	2.8	46.7
Tax Assessed	0.0	0.0	0.0	0.0	-8.2
NPAT	-3.6	-4.9	-8.5	2.8	38.5

BALANCE SHEET (A$M)					
Y/E June	**2019**	**2020**	**2021**	**2022**	**2023**
Assets	79.4	183.9	307.0	290.1	316.4
Cash	12.3	54.0	83.9	65.3	89.3
Debtors	0.0	0.0	0.0	3.3	7.3
PPE at Start - 100% Basis	49.1	67.1	259.9	446.2	443.1
Additions	18.6	199.6	199.6	10.4	10.4
Depreciation	-0.6	-6.8	-13.2	-13.6	-13.9
PPE at End - 100% Basis	67.1	259.9	446.2	443.1	439.6
PPE Attrib ATC	67.1	129.9	223.1	221.5	219.8
Liabilities	0.4	58.5	198.9	178.0	154.3
Creditors	0.4	0.2	0.2	2.2	3.0
Debt	0.0	58.3	198.7	175.8	151.4
Shareholders Equity	79.0	125.4	108.1	112.1	162.1

PRODUCTION and CASHFLOW (A$M)					
Y/E June	**2019**	**2020**	**2021**	**2022**	**2023**
Project Stage	Pre	Pre	Pre	Phase 1	Phase 1
Project Ownership	100%	50%	50%	50%	50%
Total HPA Production (t)	0	0	0	3,000	4,000
Total HPA Sold (t)	0	0	0	1,800	4,000
Sales Price (US$/t)	31,000	31,000	31,000	31,000	31,000
Revenue	0.0	0.0	0.0	19.3	42.9
Operating Costs	-3.0	-1.5	-1.5	-16.9	-22.6
Interest - Project	0.0	0.0	-0.4	-12.0	-10.5
Royalties	0.0	0.0	0.0	-0.1	-0.1
Income Taxes	0.0	0.0	0.0	0.0	0.0
Cashflows from operating activities	**-3.0**	**-1.5**	**-1.9**	**-8.4**	**11.4**
Proceeds From Sale of Project Equity	0.0	71.4	0.0	0.0	0.0
Capital Expenditure	-18.6	-99.8	-99.8	-5.2	-5.2
Cashflows from investing activities	**-18.6**	**-28.4**	**-99.8**	**-5.2**	**-5.2**
Equity Issues	39.4	19.8	0.0	0.0	0.0
Debt Raised - Project	0.0	54.0	135.7	0.0	0.0
Financing Fees	-5.9	-2.2	-4.1	0.0	0.0
Debt Repayments - Project	0.0	0.0	0.0	-22.9	-24.4
Cashflows from financing activities	**33.5**	**71.5**	**131.6**	**-22.9**	**-24.4**
TOTAL CASHFLOWS	**11.9**	**41.7**	**29.9**	**-36.6**	**-18.3**

APPENDIX 2 - SITE VISIT AND CONSTRUCTION PHOTOS

Photo 1: General view of the site with some site visit attendees

Source: IIR

Photo 2: Retaining wall reinforcement

Source: IIR

Photo 3: Maintenance building footings

Source: IIR

Photo 4: First fabricated steel on site

Source: Altech

Photo 5: Standing up the first column - maintenance building

Source: Altech

Photo 6: "Opstan Yster" (standup of steel)

Source: Altech

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