Alpha HPA Ltd

(A4N $0.32) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Analyst	Date	Price Target
Steven Clark	**November 2020**	**$0.70/sh**

A Precursory Opportunity Leveraged to Decarbonisation

Key Points

- A4N intends to commercialise its proprietary solvent extraction and refining process to produce 10ktpa of >99.99% (4N) high purity alumina (HPA) equivalent;
- A4N is the sole advanced ASX-listed HPA play that is not reliant on mining a kaolin resource for feedstock;
- Our investment case is predicated on the ability of the HPA First project to generate significant FCF in perpetuity (we assume LT avg. FCF of >A$180m pa);
- Nameplate production at current 4N+ HPA prices of US$24/kg implies EBITDA of >A$240m;
- Demand for A4N's product suite is firmly aligned with the uptake of electric vehicles;
- Commissioning of the HPA First project coincides with the emergence of a significant decarbonisation-driven HPA supply deficit;
- CY'20 has seen material third party validation of the HPA First project in the form of:
  - An MoU executed with Orica Ltd (ORI.ASX, market cap A$6.3bn) for the supply of reagents and by-product offtake;
  - A marketing, financing and offtake MoU with international commodity trader Traxys;
- We highlight the significance of the imminent execution of offtake agreements, particularly given A4N's flowsheet is of a proprietary nature;
- A recently expanded product offering including high-purity pre-cursor products presents tangible upside to our DCF model assumptions;
- Assays of pilot plant HPA calcinations delineate an upward trend in HPA purity (reaching 99.998%), instilling confidence that 5N+ HPA purity is realisable at scale;
- The heightening appeal of A4N as an ex-China source of HPA provides a highly supportive backdrop to our investment thesis, with China currently accounting for ~58% of global HPA supply;
- We highlight the following near term catalysts:
  - Finalisation of a definitive reagent supply and by-product offtake agreement with Orica Ltd;
  - A DFS update incorporating production of pre-cursors;
  - Execution of binding offtake agreements and securing of project finance;
  - Potential achievement of 5N purity;
  - Project permitting updates;
- We Initiate Coverage with a Speculative Buy recommendation and Price Target of $0.70/sh in line with our risk-adjusted NPV_{10} valuation. A successfully commercialised HPA First Project will warrant a market capitalisation significantly in excess of A$230m.

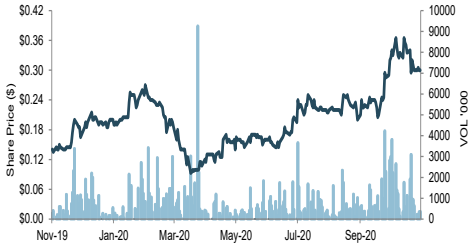
Alpha HPA Ltd	Year End 30 June	
Share Price	**0.32**	**A$/sh**
Price Target	**0.70**	**A$/sh**
Valuation	0.70	A$/sh
Shares on Issue	748	m (dil)
Market Capitalisation	239	A$m
Enterprise Value	234	A$m
Cash	5	A$m
Debt	-	A$m
Largest Shareholder	Regal	12.9%

Production F/Cast	2023f	2024f	2025f
4N+ HPA Production (kt)	5.2	9.2	10.0

Assumptions	2023f	2024f	2025f
4N+ HPA Price (US$/kg)	20.0	20.0	20.0
Operating Costs (US$/kg)	8.7	8.7	8.7
AUD/USD (x)	0.72	0.72	0.72

Key Financials	2023f	2024f	2025f
Revenue (A$m)	144	256	313
EBITDA (A$m)	99	175	225
NPAT (A$m)	50	95	131
Cashflow (A$m)	58	110	147

Share Price Chart



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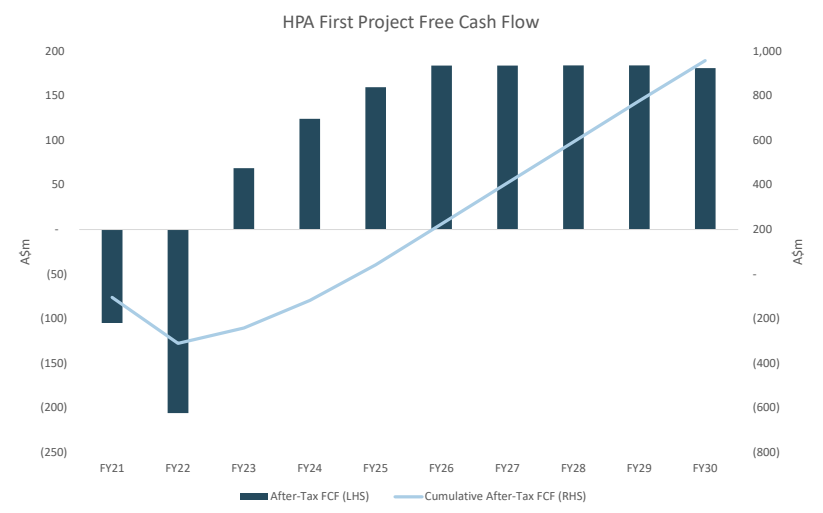
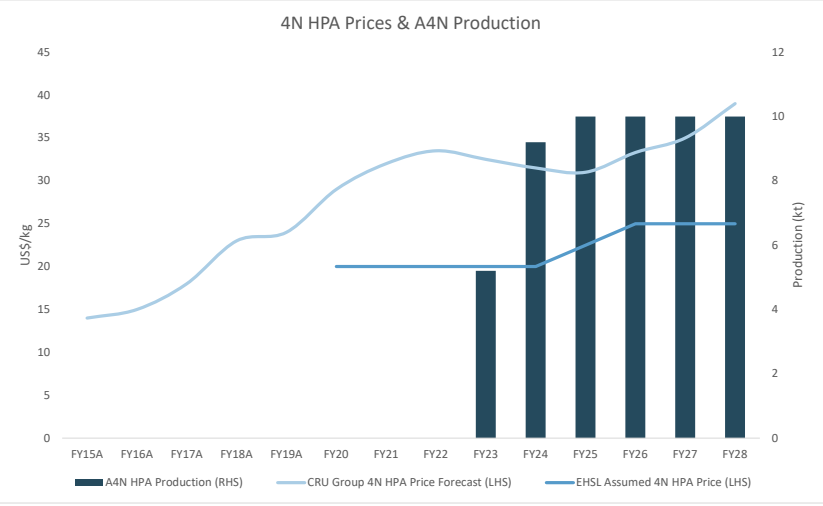
Key Variables

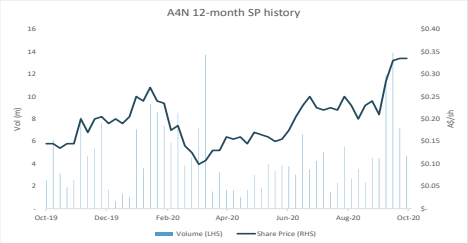
Annual EBITDA (A$m)	4N HPA Price (US$/kg)									
Total Operating Costs (incl. by-product credits) (A$/kg)	$12.5	$15.0	$17.5	$20.0	$22.5	$25.0	$27.5	$30.0	$32.5	$35.0
$13.0	$44	$78	$113	$148	$183	$217	$252	$287	$321	$356
$12.0	$54	$88	$123	$158	$193	$227	$262	$297	$331	$366
$11.0	$64	$98	$133	$168	$203	$237	$272	$307	$341	$376
$10.0	$74	$108	$143	$178	$213	$247	$282	$317	$351	$386
$9.0	$84	$118	$153	$188	$223	$257	$292	$327	$361	$396
$8.0	$94	$128	$163	$198	$233	$267	$302	$337	$371	$406
$7.0	$104	$138	$173	$208	$243	$277	$312	$347	$381	$416
$6.0	$114	$148	$183	$218	$253	$287	$322	$357	$391	$426
$5.0	$124	$158	$193	$228	$263	$297	$332	$367	$401	$436

Val/ Sh	4N HPA Price (US$/kg)									
AUDUSD	$0.70	$12.5	$15.0	$17.5	$20.0	$22.5	$25.0	$27.5	$30.0	$32.5	$35.0
0.76	$0.07	$0.19	$0.31	$0.43	$0.56	$0.68	$0.80	$0.92	$1.05	$1.17
0.75	$0.07	$0.20	$0.32	$0.45	$0.57	$0.70	$0.82	$0.94	$1.07	$1.19
0.74	$0.08	$0.21	$0.33	$0.46	$0.59	$0.71	$0.84	$0.96	$1.09	$1.22
0.73	$0.09	$0.22	$0.35	$0.47	$0.60	$0.73	$0.86	$0.98	$1.11	$1.24
0.72	$0.10	$0.23	$0.36	$0.49	$0.62	$0.75	$0.88	$1.01	$1.14	$1.26
0.71	$0.11	$0.24	$0.37	$0.50	$0.63	$0.77	$0.90	$1.03	$1.16	$1.29
0.70	$0.12	$0.25	$0.38	$0.52	$0.65	$0.78	$0.92	$1.05	$1.18	$1.32
0.69	$0.13	$0.26	$0.40	$0.53	$0.67	$0.80	$0.94	$1.07	$1.21	$1.34
0.68	$0.14	$0.28	$0.41	$0.55	$0.69	$0.82	$0.96	$1.10	$1.23	$1.37





Our Share Price Sensitivity



Our Market Sensitivity

Price Target $0.70/sh

Valuation $0.70/sh

Bull Scenario $1.50/sh

A4N realises prices materially in excess of our LT assumption of US$25/kg subsequent to commercialisation. HPA purity of 5N+ is achieved with margins assisted by the successful penetration of A4N's pre-cursor products.

Base Scenario $0.70/sh

A4N successfully commercialises the HPA First project and ramps up production to 10ktpa. A4N realises LT 4N+ HPA prices aligned with our LT assumption of US$25/kg whilst achieving an operating cost profile aligned with DFS metrics.

Bear Scenario $0.10/sh

A4N's proprietary flowsheet is replicated by competitor(s) and/or A4N fails to secure offtake agreements and in turn funding for commercialisation of the HPA First project.

Company Summary

Alpha HPA Ltd (A4N.ASX) is pursuing the commercialisation of its proprietary solvent extraction and refining technology (the HPA First Project) to produce High Purity Alumina (HPA). Located in Queensland's Gladstone State Development Area, the HPA First Project is capable of delivering 10ktpa of HPA into the burgeoning lithium-ion battery and LED battery markets.

Disclaimer

The projections and information above is based on the set assumptions outlined. Due care and attention has been used in the preparation of this information. However actual results may vary from forecasts and any variation may be materially positive or negative. Forecasts by their very nature, are subject to uncertainty and contingencies, many of which are outside the control of Euroz Hartleys.

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Market Statistics			Year End 30 June	
Share Price	**$0.32**	**A$/sh**	**Directors**	
Issued Capital			Norman Seckold	Chairman
Fully Paid Ordinary	692	m	Rimas Kairatis	MD
Options	56	m	Peter Nightingale	Director
Total Dil. FPOrd	**748**	**m**	Justin Werner	Director
			Anthony Sgro	NE Dir
Market Cap (dil)	$239	m		
Enterprise Value	$234	m	**Shareholders**	
Cash	$5	m	Regal Funds Mgmt	12.9%
Debt	$-	m	Norman Seckold	9.9%

Asset Valuation	A$m	A$/sh
HPA First Project (60% Risk Adjusted)	528	0.71
Corporate Overheads	(15)	(0.02)
Wonogiri Consideration	3	0.00
Cash (30 Sept. 2020)	5	0.01
Debt	-	-
Total	**522**	**0.70**

F/Cast Production	(A$m)	2021f	2022f	2023f	2024f
4N+ HPA Production	kt	0.0	0.0	5.2	9.2
4N+ HPA Price	US$/kg	20.0	20.0	20.0	20.0
Operating Costs	US$/kg	0.0	0.0	8.7	8.7
AISC	US$/kg	0.0	0.0	9.3	9.1

Ratio Analysis (A$m)	2021f	2022f	2023f	2024f
CF (A$m)	-17.5	-17.5	57.9	110.1
CFPS (Ac/sh)	-2.3	-2.4	8.2	15.9
CF Ratio (x)	na	na	3.9	2.0
Earnings (A$m)	-17.5	-17.5	49.6	95.2
EPS (Ac/sh)	-2.3	-2.4	7.0	13.8
EPS Growth (%)	na	na	199%	95%
P/E Ratio (x)	na	na	4.5	2.3
Enterprise Value (A$m)	277	496	429	318
EV/EBITDA (x)	na	na	4.6	1.9
EV/EBIT (x)	na	na	5.0	2.0
Net Debt (A$m)	37.5	258.0	203.2	96.2
ND/(ND + Equity) (%)	36%	84%	62%	28%
EBIT Margin (%)	na	na	59%	61%
ROE (%)	-26%	-36%	39%	39%
ROA (%)	-5%	-5%	12%	18%
Div. (Ac/sh)	0%	0%	0%	0%
Div. Payout Ratio (%)	0%	0%	0%	0%
Div. Yield (%)	0%	0%	0%	0%
Div. Franking (%)	100%	100%	100%	100%

Profit and Loss (A$m)	2021f	2022f	2023f	2024f
(+) HPA sales revenue	-	-	144	256
(+) Interest income	-	-	-	-
(+) Other revenue	1	1	-	-
Total Revenue	**1**	**1**	**144**	**256**
(-) Costs of production	-	-	(45)	(80)
(-) Corporate overheads	(5)	(5)	(5)	(5)
(-) D&A	-	-	(8)	(15)
(-) Exploration expensed	-	-	-	-
EBITDA	**(4)**	**(4)**	**94**	**170**
EBIT	**(4)**	**(4)**	**86**	**155**
(-) Interest Expense	(14)	(14)	(14)	(14)
NPBT	**(18)**	**(18)**	**72**	**142**
(-) Minority Interest	-	-	-	-
NPBT (ex-min.)	**(18)**	**(18)**	**72**	**142**
(-) Tax	-	-	(23)	(47)
Net Profit	**(18)**	**(18)**	**50**	**95**

Cash Flow (A$m)	2021f	2022f	2023f	2024f
Net Profit	(18)	(18)	50	95
(+) Working Capital Adj.	-	-	-	-
(+) D&A	-	-	8	15
(+) Tax Expense	-	-	23	47
(-) Tax Paid	-	-	(23)	(47)
(+/-) Other	-	-	-	-
Operating Cashflow	**(18)**	**(18)**	**58**	**110**
(-) Capex & Development	(105)	(206)	(3)	(3)
(-) Exploration	-	-	-	-
(+/-) Other	(2)	-	-	-
Investing Cashflow	**(107)**	**(206)**	**(3)**	**(3)**
(+) Equity Issues	70	-	-	-
(+) Loan Drawdown	270	-	-	-
(-) Loan Repayment	-	-	-	-
(-) Dividends	-	-	-	-
Financing Cashflow	**340**	**-**	**-**	**-**
Net Cashflows	**215**	**(224)**	**55**	**107**
(+/-) FX Adj.	-	-	-	-
EoP Cash Balance	**223**	**(0)**	**54**	**162**

Balance Sheet (A$m)	2021f	2022f	2023f	2024f
Assets				
Cash	223	(0)	54	162
Current Receivables	0	0	29	51
Other Current Assets	-	-	-	-
Non-Current Assets	105	311	306	294
Total Assets	**328**	**311**	**389**	**506**
Liabilities				
Borrowing(s)	270	270	270	270
Current Accounts Payable	1	1	2	4
Other Liabilities	-	-	-	-
Total Liabilities	**271**	**271**	**273**	**274**
Net Assets	**57**	**39**	**116**	**232**

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Discussion

Leverage to decarbonisation trend without mining risk

A pregnant leach solution generated from acid leaching of laterite ore from A4N's Collerina Ni-Co-Sc project in NSW was initially planned as feedstock for the solvent extraction circuit prior to the identification of aluminium chemical feedstock as an alternative feed source in Jul'18. The Mar'20 DFS assumes the purchase of 18.6ktpa of readily accessible industrial feedstock at an implied cost of A$425/t (inclusive of transport costs) under A4N's simplified flowsheet. Unlike its ASX-listed peers, A4N's HPA First project is not confined by mine life and does not bear the risk (and associated costs) of developing a resource and acid leach circuit.

LT base case assumptions imply earnings of A$260m

The below data table sensitising EBITDA at steady state production of 10ktpa provides the foundation for our investment thesis. Our base case incorporating HPA pricing of US$20/kg from FY'23-24 and a DFS aligned operating cost profile of US$6.3/kg implies near term EBITDA of A$190m and a payback period of 2.3 years. The HPA First Project has the potential to generate EBITDA of US$260m under our LT HPA price assumption of US$25/kg. We highlight that industry analyst CRU Group forecast a nominal price of US$25/kg for A4N's HPA product across CY22-26 and >US$30/kg through to CY28 under its constrained demand scenario. The HPA First project can generate EBITDA of >A$120m under our bear case scenario which assumes 4N+ HPA prices of US$15/kg.

Annual EBITDA (A$m)	4N HPA Price (US$/kg)									
Total Operating Costs (incl. by-product credits) (A$/kg)	$12.5	$15.0	$17.5	$20.0	$22.5	$25.0	$27.5	$30.0	$32.5	$35.0
$13.0	$44	$78	$113	$148	$183	$217	$252	$287	$321	$356
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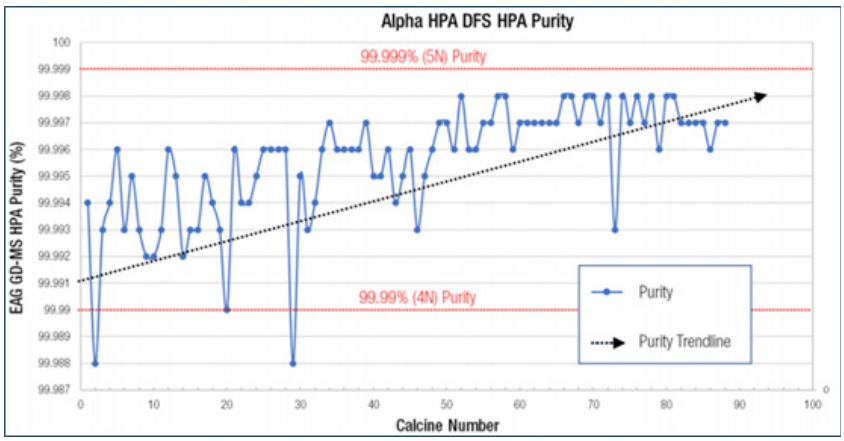
$6.0	$114	$148	$183	$218	$253	$287	$322	$357	$391	$426
$5.0	$124	$158	$193	$228	$263	$297	$332	$367	$401	$436

Purity trend is A4N's friend

Our base case excludes the material upside of A4N achieving HPA purity of 5N+ (>99.999%) and accordingly realising prices in excess of those assumed within our DCF valuation. Purity of 99.998% has been achieved under the pilot plant, instilling confidence that purity levels are likely to improve as the project is scaled up. Although we concede that reported 5N+ prices in the vicinity of US$50/kg will not be realised in the context of A4N establishing a market for its product, we highlight the increasing focus of end users on high-quality and consistent HPA as opposed to cost-conscious 3N/4N product offerings.



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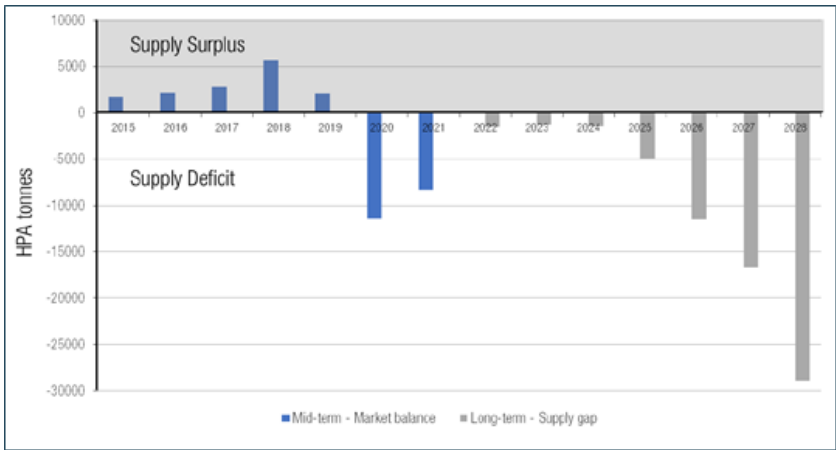
Continued third party validation is key

Feb'20 saw the signing of an MoU with the world's largest explosives manufactuerer in Orica Ltd for the supply of two key chemical reagents (121ktpa) and offtake of by-products (119ktpa) recycled within the HPA production process over an indicative 20-year term. The extensive technical and commercial due diligence undertaken by Orica Ltd over a 12-month period prior to the signing of the MoU has not only provided significant third party validation of the project but has also opened up NAIF funding eligibility given the project will be located within 2km of Orica's plant in Queensland's Gladstone State Development Area. We anticipate further third party validation in the form of the execution of an HPA offtake agreement to drive further share price appreciation, noting an MoU for marketing and financing has already been signed with a leading global commodities trader in Traxys.



Source: CRU Group

High-purity pre-cursors add further strings to the bow

The production of high-purity LiB and LED pre-cursor materials presents upside to our valuation. A4N's flowsheet is capable of producing high purity pre-cursors suitable for particle level alumina coating of cathode and anode particles at 5N purity without any significant process alterations, providing a cost-effective and additional avenue to penetrate these segments of the market. The increasing nickel weighting of cathode chemistries (and in turn the requirement to stabilise such high nickel cathode chemistries with alumina or Al-dopants, i.e. 8-1-1 NMC) underpins strong demand for A4N's pre-cursor products. We highlight an established and relatively less opaque market for these products, along with potential pre-production capex and opex reductions given the pre-cursor circuit does not incorporate the back end of the HPA First flowsheet.

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Valuation

Valuation: $0.70/sh

Price Target: $0.70/sh

Our SOTP valuation is outlined below:

	A$m	A$/sh
HPA First Project (60% Risk Adjusted)	528	0.71
Corporate Overheads	(18)	(0.02)
Wonogiri Consideration	3	0.00
Cash (30 Sept. 2020)	5	0.01
Debt	-	-
Total	**519**	**0.70**

We value the HPA First project using a 20-year DCF valuation in line with the indicative term of the signed MoU with Orica Ltd, with cognisance of this valuation methodology excluding the ability of the HPA First project to generate significant FCF in perpetuity upon successful execution.

Our NPV_{10} valuation incorporates an HPA price of US$20/kg in the HPA First project's first 2 years of production (FY23-24) in recognition of the likelihood of A4N accepting a discount to the established premium for 4N+ HPA in the course of establishing a market for its product, in addition to the impact of prospective HPA producers coming online in the near term. We assume a LT 4N+ HPA price of US$25/kg from FY26 with reference to consensus supply deficit forecasts.

We assume a debt to equity split of 80/20 in our financial model on the grounds that the HPA First project is eligible for concessional NAIF funding. We hold the view that A4N's project can and should carry debt, particularly in the context of the availability of cheap NAIF debt. Given the interlinked nature of pending offtake agreement(s) and project financing, we apply an all-encompassing risk adjustment factor of 60% to our valuation of the HPA First project. This is reflective of the risk of dilution under equity issues for working capital requirements and pre-production capex, in addition to execution risk upon commercialisation of the project.

We conservatively assign a nil value to the company's wholly owned Collerina project based in NSW, whilst assuming the receipt of aggregate consideration of $3.5m for the conditional divestment of A4N's 45% participating interest in the Wonogiri copper-gold project in Indonesia. Corporate overheads reflect our forecast of administrative and corporate outflows, risk adjusted to the same extent as the cash flows from the HPA First project.

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ASX-listed Peers

Being prospective pure-play ASX-listed HPA producers with definitive level studies, we consider FYI Resources Ltd (FYI.ASX) and Altech Chemicals Ltd (ATC.ASX) pertinent for comparable analysis. ATC is objectively the most advanced of the three projects in terms of project development, with early stage construction of ATC's Malaysian HPA plant underway and a 10-year offtake agreement executed with Mitsubishi. FYI has signed an MoU with Alcoa (Sep'20) outlining the potential joint development of FYI's project for commercialisation and establishment of offtake customers, whereas A4N has most recently signed an MoU with Traxys in Aug'20 for product offtake, marketing and financing.

Pure-play 4N+ HPA ASX plays		Alpha HPA Ltd	FYI Resources Ltd	Altech Chemicals Ltd
Ticker		A4N.ASX	FYI.ASX	ATC.ASX
Share Price	A$/sh	0.32	0.17	0.05
Shares on Issue	m	692	266	892
Market Capitalisation	A$m	222	45	40
Enterprise Value	A$m	216	45	40
Cash (30 September 2020)	A$m	5.4	0.4	0.6
Project Stage		DFS	DFS	BFS / Construction
Study Date		Mar-20	Sep-18	Jun-15
4N Price Assumed (Study)	US$/kg	25.0	24.0	27.0
Feedstock		Alumina chemical	Kaolin	Kaolin
Processing Method		Solvent extraction	HCl leach	HCl leach
Resource Location		n/a	Cadoux, WA	Meckering, WA
Processing Location		Gladstone, QLD	Kwinana, WA	Johor, Malaysia
Offtake Partner(s)		Pending	Alcoa	Mitsubishi
Guided HPA Purity		4N+	4N+	4N+
Nameplate Production	tpa	10,000	8,000	4,500
Targeted Commencement		Q4 CY22	Q2 CY21	CY23
Capital Hurdle	US$m	209	179	298
Capital Intensity	US$/kg	20.9	22.4	66.2
Operating Cost	US$/kg	5.9	6.5	9.9

Prices as of 10 November 2020

We highlight commonality between the abovementioned projects in the form of flowsheets that do not incorporate expensive feedstock material (i.e. aluminium metal) in line with established HPA producers. Both ATC and FYI aim to produce HPA from the hydrochloric acid leach of kaolin clay, a process requiring the recycle of hydrochloric acid at high temperatures. The HPA First process alternatively involves wet chemical purification at atmospheric temperature and pressures ahead of the drying and calcination stages, with the recycle of raffinate as a saleable by-product further facilitating a comparatively lower operating cost profile at US$5.9/kg, equivalent to ~40% less than ATC's unit costs.

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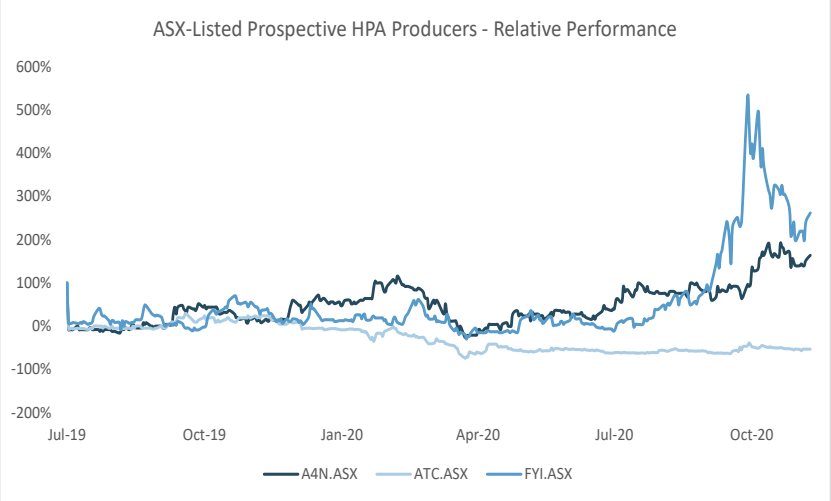

The market discernibly views A4N as the superior prospective HPA producer, as demonstrated by A4N's market capitalisation exceeding that of ATC and FYI by ~5x. FYI's outperformance on a relative basis is attributable to the de-risking of FYI's integrated project upon the emergence of Alcoa as a potential JV partner in Sep'20. We hold the view that third party validation carries a heavier weighting for A4N given the proprietary nature of the HPA First flowsheet (in comparison to the proven flowsheets of A4N's competitors), and as such we anticipate A4N to materially rerate on delivery of executed offtake agreements.

Market Engagement

Over the last 12 months A4N has significantly extended its market outreach program into the application of HPA across the LiB and LED sectors and has identified a number of large HPA end-users across multiple jurisdictions, including the USA, Germany, Japan, South Korea and China. Incorporating the HPA First project's recently expanded product offering, A4N's market outreach program has established clear interest for pre-cursor products, which present as tangible avenues to revenue stream diversification and capex reductions. Recent market updates released by the company have outlined encouraging results in the form of:

- A >90kg HPA test sample order from a US-based sapphire glass counterparty;
- A 2.5kg test order for HPA pellets to a South Korean sapphire glass manufacturer;
- The shipment of three separate products (including A4N's 5N pre-cursor product) in response to a test order from a leading German based LED phosphor development and manufacturer;
- The provision of an initial 4 samples of 5N pre-cursor product a US-based HPA wholesaler;

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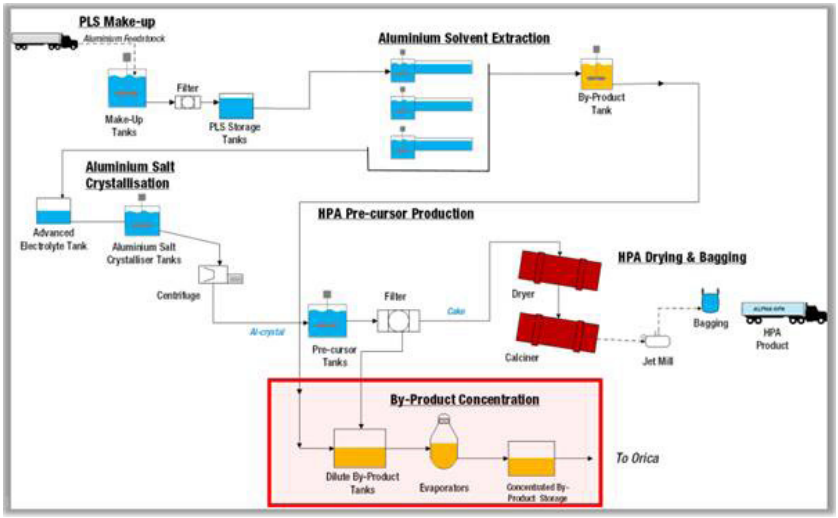
We anticipate further news flow around the issue of samples under A4N's expanded global outreach with Traxys in addition to test-work feedback over the approaching quarters. A4N has encouragingly noted a heightening focus of end users on both the carbon footprint and security of existing supply chains, which bodes well for the Queensland domiciled HPA First project for which there is minimal waste given the main by-product of the HPA First process in the aluminium depleted raffinate will be sold directly back to Orica Ltd. We once again emphasise A4N's distinctive position as the sole advanced ASX-listed HPA play that is not reliant on mining a kaolin resource for feedstock.

The HPA First Project

The HPA First Project is the application of A4N's proprietary licenced solvent extraction and refining technology to produce HPA from an industrial aluminium feedstock.

The project will be located in Queensland's Gladstone State Development Area in order to facilitate reagents supply and by-product offtake from/to Orica Ltd's chemical manufacturing complex which lies adjacent to A4N's 10ha land parcel. A4N has finalised contract negotiations with the Queensland Government for the purchase of the optioned project site, with a purchase consideration of A$2.5m payable on FID within 24 months of contract signing.

The HPA First project flowsheet is detailed below:



Source: A4N

Feedstock

The aluminium feedstock (~18.6ktpa) is an internationally traded industrial commodity, which will be provided by a local Gladstone supplier with pricing referenced to published international indices. The solvent extraction component of the third pilot plant campaign featured a switch between two different bulk feedstocks, with no measurable impact on process stability or final HPA product quality noted. The aluminium feedstock is prepared for the solvent extraction step as an aluminium bearing solution of approx. 5-6% Al (pregnant liquor solution).

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Aluminium Solvent Extraction

Aluminium is extracted from the PLS through a three stage counter-current solvent extraction process which delivers a high purity, aluminium loaded organic. The loaded organic is then washed, and the aluminium stripped into a high-purity aqueous aluminium solution, referred to as the advanced electrolyte. The stripped organic is recycled back to the aluminium extraction circuit.

Aluminium Salt Crystallisation

Advanced electrolyte from the SX circuit is stored in two quality assurance tanks prior to crystallisation. Advanced electrolyte is cooled to precipitate very high-purity aluminium salt crystals as a batch process. The crystal slurry produced is centrifuged and sluiced with de-ionised water. The aluminium salt slurry is then sent to the HPA Pre-cursor production area. The aluminium salt crystallisation stage represents a key purification step, with typically <10ppm impurities in the Al-salt crystals. A4N's high-purity pre-cursors are generated with minor adjustments to this part of the process flowsheet.

HPA Pre-Cursor Production

Aluminium salt is redissolved in a high purity aqueous solution and batch precipitated as HPA pre-cursor. The HPA pre-cursor is then filtered with the filtrate returned to the start of the HPA Pre-cursor circuit, and the pre-cursor cake sent to the start of the drying circuit.

By-Product Concentration

The two major process reagents are recycle to a by-product via the by-product concentration area. By-product is treated, concentrated and delivered back to the chemical counterparty in Orica by pipeline.

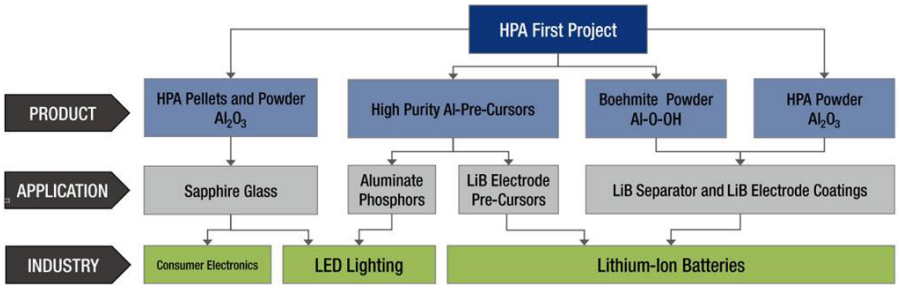
Drying and Calcination

HPA pre-cursor is indirectly dried to remove moisture and then calcined to alpha form HPA, prior to cooling and direction to the jet-milling circuit.

Jet Milling & Bagging

The jet mill circuit uses autogenous milling under compressed air to mill the material to the desired PSD ahead of bagging and shipping.

A4N's product offering has recently expanded beyond traditional HPA to include boehmite powder (an alternative ceramic coating product able to be produced at an average purity of 99.995%, peak 99.997%) and two high-purity aluminium pre-cursors. A schematic of the HPA First project's product offerings and corresponding applications is included below:



Source: A4N

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The HPA Project has completed three end-to-end pilot plant campaigns across FY20, totalling over 600 hours of operating time and including >80 calcinations to HPA. The project has subsequently been scaled up to a demonstration-scale pilot plant in anticipation of further orders and to cater for larger scale HPA test orders from sapphire glass/LED manufacturers, with additional required capital equipment (i.e. pellet press and sintering kiln) now installed.

Three solvent extraction and Al-salt crystallisation campaigns at ~2x pilot plant rates have produced >500kg of high-grade intermediary Al-salt which were progressively converted into ~250kg HPA pre-cursor before final calcination into ~60kg of HPA. The pre-cursor circuit has successfully generated HPA at 100% alpha form and assaying at 99.998% purity under the demonstration scale plant. A4N have been operating the Brisbane plant at demonstration scale since Oct'20, and is now largely directed at delivering product for end-user test order and qualification.

HPA Market

HPA is a high purity form of Aluminium oxide (Al_2O_3) with a minimum purity level of 99.99% (i.e. <100ppm total impurities). 4N HPA commands high demand and margins due to the advantages of its chemical and physical properties of extreme hardness and chemical stability. HPA is typically defined by the overall purity specification (i.e. 4V vs 5N) which is determined by the concentrations of trace elements in the alumina compound (e.g. Fe, Mg and Na), with 4N quality HPA products comprising ~75% of the total market for HPA. The market for HPA currently sits at ~40kt, of which ~23kt is estimated to be Chinese.

The two industries upon which HPA demand rests are Lithium-Ion Battery (Li-B) separators and LEDs, with global demand for HPA currently dominated by synthetic sapphire producers at c. 78% ~31kt. Although demand for LED substrates is expected to grow materially over the coming decade, the composition of HPA demand is expected to transition to a higher weighting of demand for application in LiB separator coating in line with the penetration of EVs.

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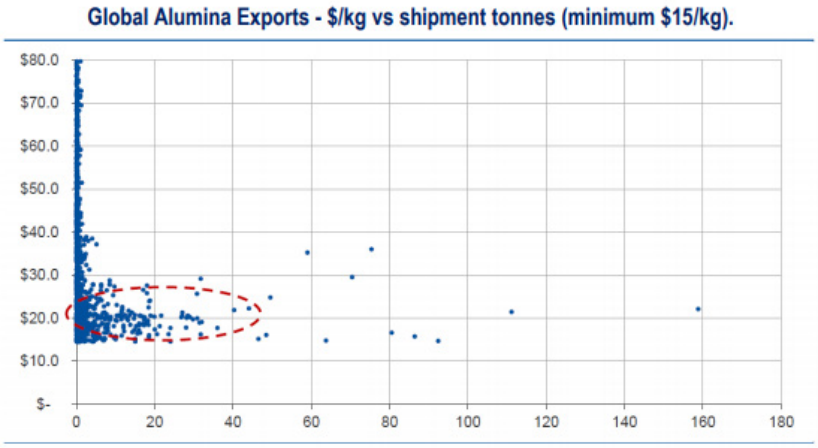
Pricing

The market for HPA is highly opaque. HPA is not exchange traded, with pricing negotiated in confidence. Pricing is largely a function of the degree of purity and end user specifications (i.e. density and particle size) among other considerations. Industry analyst reports provide a widely used reference point for HPA pricing in the absence of benchmark pricing.

The below chart of global 4N HPA exports in CY'19 outlines a price range from a low of US$15/kg (in line with our bear case scenario) to highs of US$100/kg, with these higher prices applying to higher quality/ specification products (i.e. 5N).



Source: CRU Consulting High-purity alumina market outlook

Demand

Demand for HPA is primarily being driven by the increasing adoption of LED products, separators in lithium ion batteries (LiBs) and scratch resistant artificial sapphire glass for smartphone screens and watches. Demand is dominated by the APAC region (estimated at 70% in CY'16), and more specifically China, Japan and South Korea, placing A4N favourably to service the most dominant region of global HPA demand.

CRU group forecast overall HPA demand to grow at a CAGR of 17.6% under a supply-constrained demand scenario (in acknowledgement of the technical hurdles noted in the production of HPA) and a CAGR of 31.6% under an unconstrained demand profile. As detailed by the below chart, CRU's constrained scenario would imply an expansion in the 4N+ HPA market to >270kt by CY'28 (equivalent to a ~7x increase in market size).

CRU Group forecast the total number of LiB cells to grow at a CAGR of 25.4% through to 2028. HPA is established as one of the preferred ceramics for coating of LiB separators on account of its physical properties, the importance of which is anticipated to grow as cell manufacturers undertake the transition to more energy-dense cell chemistries. Purity requirements (and in term price inelasticity for 4N+ HPA product offerings) are also forecast to increase given the impact of impurities on battery cycle life, resulting in an increasing preference for higher quality HPA as opposed to cost-conscious HPA offerings.

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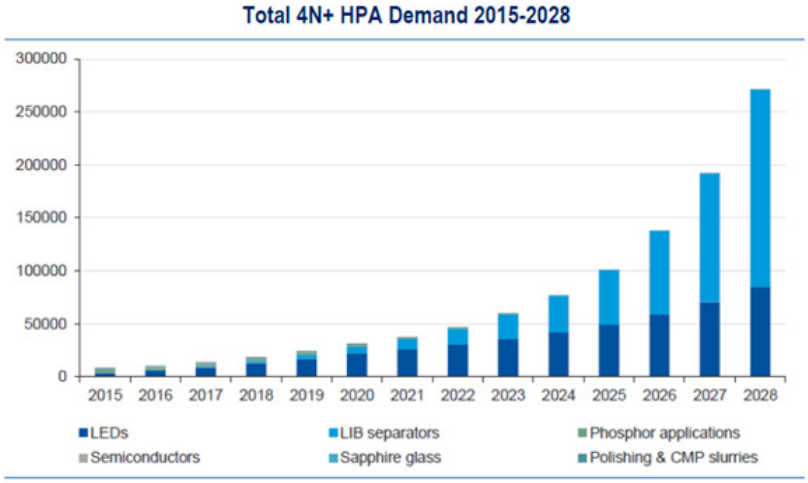
The shift towards larger sapphire wafers in the interest of lower LED production costs and low tolerance of impurities is expected to drive a 20.7% CAGR for 4N HPA demand in LED units.



Source: CRU Consulting High-purity alumina market outlook

The risk of substitution is low for both of the main applications of HPA. There is currently no substitute for 4N HPA as the critical raw input in the production of substrates for LED lights. In LiBs, lower purity substitutes only have limited application on account of the risks to battery safety, performance and life imposed by the impurities. Such separators will be used only in low density, low performance battery applications such as low cost consumer electronics as opposed to EVs. 4N+ HPA quality material will continue to be the material required for coated separators in high density batteries for the EV space.

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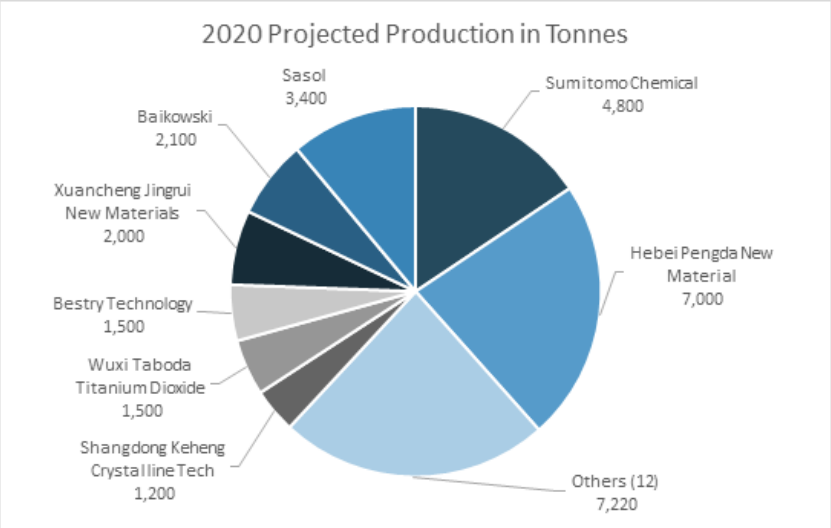
Supply

Global 4N HPA supply is bifurcated between materials provided by established international producers (often diversified chemical producers for which HPA is a non-core offering) and material from Chinese producers. Diversified chemical producers receive premium prices based on a reputation for consistent and high quality products (i.e. the world's largest producer and gold standard in Sumitomo is estimated to receive an average price of US$28/kg) whereas Chinese producers are known for inferior and inconsistent product quality. This is demonstrated by an analysis of Japanese export data undertaken by CRU Group in CY'19 outlining the non-existence of Chinese exports to Japan and South Korea.

A breakdown of global HPA supply in 2020 demonstrates the extent to which global supply is concentrated among a small group of producers is as follows:



Source: CRU Group

Although the impact of prospective producers coming online over CY'22-23 (i.e. A4N and ATC.ASX) is anticipated to alleviate an immediate term supply deficit, we highlight that the risk of substitution is negligible, with >50% of supply comprising Chinese product offerings that cater to cost-conscious end users amidst an emerging trend of preference for lower impurities upon the penetration of EVs.

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Risks

A4N is currently undertaking the commercialisation of its proprietary licensed solvent extraction and HPA refining technology, which is yet to be operated on a large scale. Key risks to our investment thesis include but are not limited to:

Replication Risk – A4N derives a competitive advantage from its proprietary solvent extraction and refining process. The potential replication of the HPA First project by competitor(s) and the resultant impact on A4N's market penetration presents a material risk to our investment thesis.

Commodity Price Risk – HPA is an industrial commodity company. A4N's market valuation is inextricably linked to the outlook for HPA pricing, which is highly opaque. Whilst the DFS metrics for the HPA First project support the notion that A4N can remain profitable at HPA prices materially below those currently reported, sustained periods of depressed pricing present downside risk to our investment thesis. Although the number of executed offtake agreement(s) and integrated pricing mechanisms are currently (and likely to remain) unknown variables, we flag the risk of upside commodity price exposure being limited in the event that 100% of offtake is contracted at a fixed price.

Execution Risk – Failure to consistently produce HPA at purity levels in excess of 99.99% (i.e. 4N) at scale is a key risk to our valuation. Although trend would suggest HPA purity is increasing as the HPA First project is scaled up, failure to achieve purity grades aligned with that of the pilot plant on a repeatable basis is a key risk.

Technical Risk – The HPA First process is proprietary in nature and is yet to be operated at scale, with the flowsheet currently operating at demonstration scale. We flag technical risk inherent with the scaling up of the project to nameplate capacity of 10ktpa HPA upon commercialisation.

Funding and Dilution Risk – The HPA First project DFS outlines a capital hurdle of A$309m. It is our expectation that a portion of this balance will be funded by the issue of equity. Both the ability to attract funding, the form it takes and accordingly potential dilution encountered under an equity issue represent risks to our valuation.

FX Risk – A4N is AUD denominated with all costs currently incurred in AUD. Given HPA sales will be denominated in USD, an appreciation of the AUD against the USD will adversely impact A4N's sole revenue stream. At the time of our initiation of coverage we assume a LT AUD/USD exchange rate of 0.72 whereas the DFS assumes an exchange rate of 0.68.

Sovereign Risk – The HPA First project is located in Gladstone, Queensland, with land agreements already signed. Consequently, we view sovereign risk to be very low.

Permitting and Approvals Risk – Lodgement of all outstanding permit applications is expected in early Q2 FY'21. Failure to secure such approvals and in turn delays to the targeted commencement of production in late CY'22 presents downside risk to our valuation. We assume commencement of production at the beginning of CY'23.

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Board and Management

Norman Seckold (Chairman) - >30 year's experience in the management of natural resources companies. Past Chairman and Director of Bolnisi Gold NL, Timberline Minerals Inc., Perseverance Corporation Ltd, ValdoraMinerals NL and PalmarejoSilver and Gold Corp. Currently Chairman of Santana Minerals Ltd and Sky Metals Ltd and Deputy Chairman of Nickel Mines Ltd.

Rimas Kairatis (Managing Director) – 20+ years experience in minerals exploration and resource development in gold, base metals and industrial minerals. Led the geological field teams to the discovery of the Tomingley and McPhillamy's gold deposits in NSW and steered the Hera gold-lead-zinc Project from discovery through to successful commissioning and commercial production. Previously founding Managing Director and CEO of Aurelia Metals Ltd. Currently Non-Executive Director of Sky Metals Ltd.

Peter Nightingale (Director and CFO) – 20+ years as a Director or Company Secretary for a range of resource companies including Pangea Resources Ltd, Timberline Minerals Inc., Perseverance Corporation Ltd, Valdora Minerals NL, Mogul Mining NL, Bolnisi Gold NL and Planet Gas Ltd (now Sky Metals Ltd). Currently a Director of Nickel Mines Ltd and Prospech Ltd.

Tony Sgro (Non-Executive Director) – Chemical Engineer with 45+ years' senior management experience in the supply of specialised equipment to the process industries with an emphasis on mining and oil & gas. Co-founder, Director and General Manager of Kelair Pumps for 36 years.

Justin Werner (Non-Executive Director) – 20+ years' mining and management experience. Previously a consultant to multiple blue chip mining companies including BHP, Rio Tinto and Freeport McMoran. Currently Managing Director of Nickel Mines Ltd.

Richard Edwards (Company Secretary) – Mr Edwards graduated with a Bachelor of Commerce degree from the University of New South Wales, is a Fellow of the Governance Institute of Australia, a member of CPA Australia and holds a Graduate Diploma of Applied Finance and Investment from FINSIA. Currently Company Secretary of Nickel Mines Ltd and Prospech Ltd.

Rob Williamson (Chief Operations Officer) - Mechanical engineer joining A4N having recently rebuilt and started up a new 155ktpa SX zinc refinery in the USA in the capacity of Vice President and GM of the facility. Ideally placed to bring 20 years of experience in large facility operations to A4N. Responsible for building a Project delivery team in Gladstone.

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Capital Structure

We dilute our valuation for all unquoted options as outlined below:

Ordinary Shares			Number of shares (m)
Fully Paid			692
Unlisted Options	**Exercise Price**	**Expiry Date**	**Number of options (m)**
A4NAA	$0.20	31-Jul-22	10
A4NAA	$0.30	31-Jul-22	29
A4NAA	$0.35	31-Jul-23	7
A4NAA	$0.35	30-Sep-23	5
A4NAA	$0.20	30-Jun-21	5
A4NAB	$0.30	31-Jul-22	10
A4NAC			66
Total Unlisted Options			**78**
Total Diluted SOI			**758**

Top 20 Shareholders

Rank	Name	Shares (m)	%
1	PERMGOLD PTY LTD	67.3	9.7%
2	CS THIRD NOMINEES PTY LIMITED <HSBC CUST NOM AU LTD 13 A/C>	65.8	9.5%
3	BT PORTFOLIO SERVICES LIMITED <WARRELL HOLDINGS S/F A/C>	37.0	5.4%
4	BUDWORTH CAPITAL PTY LTD <ROLLING HILLS CAPITAL A/C>	36.8	5.3%
5	UBS NOMINEES PTY LTD	31.7	4.6%
6	PALMER BOOKMAKING PTY LIMITED	28.0	4.0%
7	CITICORP NOMINEES PTY LIMITED	17.4	2.5%
8	MERRILL LYNCH (AUSTRALIA) NOMINEES PTY LIMITED	14.5	2.1%
9	ROSIGNOL PTY LTD <NIGHTINGALE FAMILY A/C>	13.6	2.0%
10.	NINAN PTY LTD	12.0	1.7%
11	MR ROBERT SIMEON LORD	9.9	1.4%
12	NATIONAL NOMINEES LIMITED	9.0	1.3%
13	JP MORGAN NOMINEES AUSTRALIA PTY LIMITED	7.1	1.0%
14	MR BRIAN HENRY MCCUBBING + MRS ADRIANA MARIA MCCUBBING <B MCCUBBING SUPER FUND A/C>	7.0	1.0%
15	R & C AUSTRALIA PTY LTD	6.6	1.0%
16	MR JAIME PHILLIP BOYTON	6.0	0.9%
17	AMP RACING PTY LIMITED <AMP RACING A/C>	5.8	0.8%
18	GAP BOOKMAKING PTY LIMITED <GAP BOOKMAKING A/C>	5.8	0.8%
19	MRP RACING PTY LIMITED <MRP RACING A/C>	5.8	0.8%
20	MISTY GRANGE PTY LTD <BJ&LA WINSOR S/F PENS A/C>	5.8	0.8%
Total		**392.8**	**56.7%**

Source: A4N website as at 31 October 2020

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Contact Details

Euroz Hartleys Securities Limited **+61 8 9488 1400**

Research Analysts

Jon Bishop - Head of Research	+61 8 9488 1481
Andrew Clayton - Resources Analyst	+61 8 9488 1427
Steven Clark - Resources Analyst	+61 8 9488 1430
Mike Millikan - Resources Analyst	+61 8 9268 2805
Michael Scantlebury - Resources Analyst	+61 8 9268 2837
Gavin Allen - Industrials Analyst	+61 8 9488 1413
Trent Barnett - Senior Analyst	+61 8 9268 3052
Harry Stevenson - Industrials Analyst	+61 8 9488 1429
Seth Lizee - Associate Research Analyst	+61 8 9488 1414

Institutional Sales

Andrew McKenzie - Executive Chairman	+61 8 9488 1407
Rob Black - Managing Director	+61 8 9488 1423
Timothy Bunney - Co-Head Insto Sales	+61 8 9488 1461
Carrick Ryan - Co-Head Insto Sales	+61 8 9268 2864
Jay Hughes - Executive Director	+61 8 9488 1406
Russell Kane - Executive Director	+61 8 9488 1426
Simon Yeo - Executive Director	+61 8 9488 1404
Peter Schwarzbach - Executive Director	+61 8 9488 1492
Stacy Kitsantas - Institutional Adviser	+61 8 9488 1486
Jayme Walsh - Institutional Adviser	+61 8 9488 1418
Justin Stewart - Institutional Adviser	+61 8 9268 3062
Simon van den Berg - Institutional Adviser	+61 8 9268 2867
Veronika Tkacova - Institutional Adviser	+61 8 9268 2836

Private Client Advisers

Chris Webster - Head of Private Clients	+61 8 9488 1412
Ben Statham - Executive Director	+61 8 9488 1417
Brian Bates - Executive Director	+61 8 9346 0314
Cameron Murray - Executive Director	+61 8 9488 1440
James Mackie - Executive Director	+61 8 9488 1416
Ryan Stewart - Executive Director	+61 8 9488 1441
Tim Lyons - Executive Director	+61 8 9346 0324
Brett Stapleton - Associate Director	+61 8 9488 1435
Giles McCaw - Associate Director	+61 8 9488 1462
Michael Bowden - Associate Director	+61 8 9346 0307
Richard Gardner - Associate Director	+61 8 9488 1444
Paul Berson - Associate Director	+61 8 9346 0314
Paul Cooper - Associate Director	+61 8 9346 0316
Ian Harrison - Investment Adviser	+61 8 9488 1422
Lauren Walker - Investment Adviser	+61 8 9488 1495
Michael Bartley - Investment Adviser	+61 8 9346 0352
Tom Kenny - Investment Adviser	+61 8 9488 1431
Zac Vinten - Associate Adviser	+61 8 9488 1473
Laurence Grescos - Associate Adviser	+61 8 9488 1419
Brandon Oosthuizen - Associate Adviser	+61 8 9488 1471