



Dr Michael Green
Independent Mining Analyst

DOC Investments Limited,
Kemp House,
152 City Road,
London EC1V 2NX

doc@docinvest.co.uk

MINING RESEARCH

CADOUX KAOLIN

- GEOLOGY
- RESOURCE
- FEASIBILITY STUDIES
- METALLURGY
- HPA PROCESSING
- KEY TAKEAWAYS



Client: InterGroup
Mining

FYI Resources data

Ticker: FYI
Share price: A\$0.19
52 week high/low:
A\$0.033-0.205
Market cap: £18.9m
EV: £19.0m

25 September 2020

FYI Resources – a route to HPA production

Analysis of the Cadoux Kaolin Project, geology, exploration, HPA processing technology, feasibility studies and timelines

- ❖ **Developing a world-class Australian high purity aluminium (HPA) project.** ASX-listed FYI Resources is rapidly driving its Cadoux Kaolin Project in WA towards production. Kaolin is an aluminium rich fine white clay which results from the natural weathering of feldspathic rocks like granitoids. FYI has made great strides in advancing kaolin to HPA processing technologies as the project was only acquired in 2017 at a pre-Scoping Study stage and has swiftly been taken through feasibility studies to a DFS (March 2020). Now in the project funding stage which could see production begin as early as 2023, following commissioning (2021-23).
- ❖ **FYI uses “open file” flowsheet to process kaolin into HPA.** These days, HPA is seen to be a key ingredient of the modern world as it has a myriad of uses in new age industries such as LEDs, coating cathode and anode electrode separator sheets in the lithium-ion battery. HPA produced from kaolin is less expensive as it is less energy intensive than the traditional processing route which uses bauxite as the feedstock material. World demand for HPA has surged with the product fetching prices US\$10,000 to 40,000/t (3N – 5N) on increasing purity.
- ❖ **Cadoux DFS has outlined a long life, high quality, high margin HPA kaolin project.** The DFS determined an IRR of 46% and a US\$543 million after tax NPV(10) for Cadoux, based on lowest quartile capex and opex of US\$189 million and US\$6,217/t respectively. The resource would provide more than 100 years of production with reserves of 3.2Mt grading 24.8% Al₂O₃ which support a DFS mine life of more than 25 years. Annually, EBITDA came in at US\$133 million with US\$88 million of cashflow after finance and tax for 25 years with a 3.6-year payback period. All based on a flat long-term 4N HPA price of US\$24,000/t.
- ❖ **Emerging growth sector gaining tremendous traction from new applications.** The big benefits provided by high purity Al₂O₃ (>99.99%) are increasingly becoming better understood. Market researchers believe that the current global 4N HPA market demand of 60ktpa is forecast to rise to 90ktpa by 2022 and then to more than 130ktpa by 2025. In dollar terms, by 2022 the HPA market is forecast to be worth some US\$4.9 billion on the back of dramatic consumer driven growth.
- ❖ **Globally significant and strategic blue-chip partners look poised to enter the HPA space.** Recent news is that FYI has the opportunity to potentially partner with Alcoa to co-develop the HPA process flowsheet and refine technologies which would serve to commercialise the HPA business model outlined in the recent DFS. Such a development shows that globally significant and strategic blue-chip partners are watching the HPA space diligently and can be attracted into HPA plays to provide capital and serve as a tremendous validation of the technology/opportunity.

INTRODUCTION

This report has been prepared for InterGroup Mining (IGM) and is a review of the progress that FYI Resources (ASX:FYI) has made towards its goal of High Purity Alumina (HPA) production. We have investigated the stages of development and the advances that has been made by FYI and its research partners in developing a processing technology. Whilst also looking at the expenditure incurred and project timelines. This research has been undertaken to provide information which may be useful for the management of IGM in the development of the Surprise Saprolite Project.

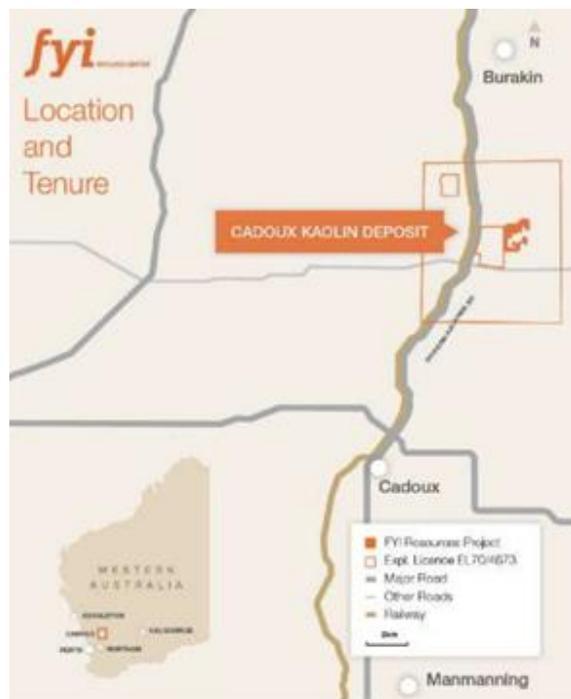
Global demand for kaolin is forecast to increase by a compound annualised growth rate (CAGR) of 4.4% to reach 43.1Mt by 2025 with the main use of kaolin continuing to be in manufacture of white paper. HPA represents a small subsection of the kaolin market but the big benefits provided by high purity Al_2O_3 (>99.99%) are increasingly becoming better understood. HPA is highly versatile and seen to have important uses in the modern world such as in LEDs, coating cathode and anode electrode separator sheets in the lithium-ion battery. Increasing purity of HPA from 99.9% to 99.9999% purity Al_2O_3 generates a large and fast expanding premium to the current LME cash price of US\$1,700 per tonne for aluminium.

FYI is developing an HPA processing operation in WA with the target of becoming a leading producer with a low industry capex and low opex process. Mining lease M70/1388 was granted in July 2019 which covered the complete Cadoux HPA project area. This was followed by FYI receiving approval in January 2020 from the WA Department of Mines which is a crucial milestone that paves the way for the Company to commence works on site at Cadoux. Following the announcement of a robust DFS in March 2020, production looks as though it could begin as early as 2023.

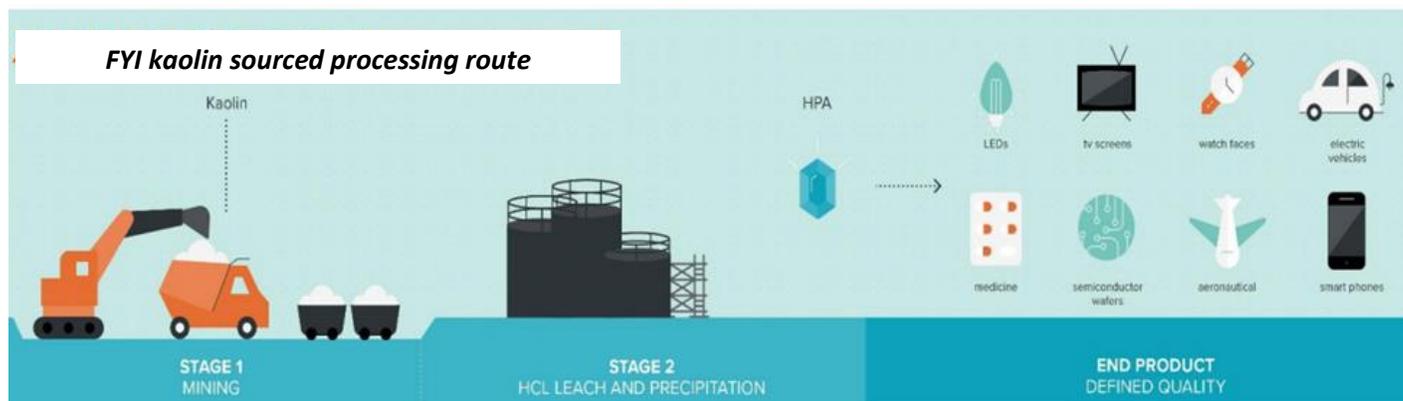
CADOUX KAOLIN PROJECT

FYI had been focusing on its Sino-Loa Potash joint venture in Laos. However, in May 2017, the Company acquired Kokardine Kaolin Pty Ltd to pursue a HPA development opportunity in WA. Kokardine had been evaluating a vertically integrated HPA production strategy using mined material from its 100% owned kaolin resources in WA as feed stock for processing into HPA. The acquisition price looks to been around the A\$1.5 million mark paid in shares which included milestone payments to Kokardine's management.

With this acquisition, FYI became the 100% owner of the Cadoux Kaolin Project situated on Exploration Licence 70/4673, which lies 220km NE of Perth. The project then had a JORC Inferred Resource of 10.5Mt @ 11.25% Al (@ - 45 microns) with low levels of deleterious elements. FYI's initial 1,077m of aircore drilling allowed further laboratory analysis to begin together with resource definition. Met test work was designed to confirm the suitability for HPA production ahead of the move into feasibility studies.



Project location



GEOLOGY

The Cadoux Kaolin Project is easily accessible and is located in flat lying countryside. Simplistically, the deposit is 1km long by 500m wide with a kaolin profile which is 4m to 25m thick. There are no outcrops although, granitoid fragmental rocks are sometimes found just beneath the surface. Early drilling revealed a weathering profile which is pretty common in WA where granitoid rocks become deeply weathered and form a leached, kaolinized zone sitting beneath a laterite crust. Laboratory tests show particle size distributions typical of primary style kaolins produced from weather granites.

Basically, a layer of overburden averaging about 5m in thickness made up of gravels and sands lies on top of reddish to off-white clay. Underneath this is the white kaolin which has an average thickness of 16m, which is followed by weathered orange to yellow sandy and mottled clays that are particularly oxidised. Beneath that in the profile is recognisable rounded fresh granitoid material at depth. Fresh granitoids are found interspersed at depths between 10m – 30m. All kaolin resources are within 4m to 11m of the surface.

The geology and mineral distribution of the system is reasonably consistent. Very closely spaced holes from the Geostatistical L drill programme confirmed this distribution but have also revealed some local internal variability. This in depth interpretation of this deposit has revealed that a high-quality white kaolin zone extends through a fully kaolinized low K_2O upper zone (called K2OCD=1) to a higher K_2O less fully kaolinized lower zone (KSOCD=2) with higher K_2O with a 1% difference in K_2O cut-off grade between these two zones. The higher K_2O content in the lower part of the kaolinized material has been interpreted as a feldspathic component that has not been fully weathered to kaolinite.

The upper low K_2O zone (K2OCD= 1) is generally thicker up to around 20m than the lower zone ('high' K_2O – K2OCD=2) which is up to approximately 10m thick. The mineralisation is close to horizontal, dipping on average about 1° towards 070° . The strike extent is around 1km and across strike width is roughly 500m for the bulk northern/central part of the deposit, with the total north south dimension being approximately 1.4km including the un-mineralised central/south portion. The combined thickness of the mineralisation zones is greatest in the north-eastern part of the deposit (15m - 25m) becoming thinner to the northwest (4m) and southwest (4m - 12m).

DRILLING & RESOURCE DEFINITION

Since acquisition, FYI has substantially increased the amount of drilling leading to a series of resource upgrades which have formed the basis for the Pre-Feasibility Study (PFS) and Definitive Feasibility Study (DFS) which were published in September 2018 and March 2020 respectively.

The Cadoux kaolin deposit has been well defined by drilling. In all some 4,177m of drilling has been completed from a total of 199 aircore, reverse circulation and diamond drill holes. All these holes have been drilled vertically and intersected kaolin ranging in thickness from 1m to 28m.

On top of that drilling total, recent drilling included 18 additional RC holes which are referred to as the Geostatistical "L" programme for a total of 416m. Plus, a further four RC water bore test holes were also drilled for 198m together with the drilling of four diamond (PQ) geotechnical holes for a total of 100m.

Assay results from drilling have demonstrated that the material is high grade kaolin with ideal characteristic quality, grade and low deleterious elements which makes the material very amenable to HPA processing.



Drilling at Cadoux in 2018

DRILLING AND MINERAL RESOURCE ESTIMATES		
Date	Metres	Comments
2013	824.4	47 aircore drill holes (average depth 17.5m) – vertical (-90°) to the geological basement on a 200m x 200m spacing. Sampling involved a total of 69 samples being taken from the drill core/chips for analysis. Only the visibly white kaolin was sampled in each hole. At that stage all the current kaolin resource was within 4m – 11m of the surface.
Inferred JORC Resource (10.5Mt @ 11.24% Al) – historic resource reported on 08 May 2017 Based on these drill results and 27 bulk samples, which were of the kaolin mineralised intercept, one bulk sample from each hole.		
May/June 2017	1,023	58 aircore drill hole programme for 1,023m (average depth 17.6m) Number of samples submitted (2m composites) 153 of which 138 samples ≥ 18% Al ₂ O ₃ , highest value 34.4% Al ₂ O ₃ with an average grade of 22.5% Al ₂ O ₃ . Average metres of kaolin per drill intercept – 16.1m. Results confirmed the consistency in grade of the current Mineral Inferred Resource. At that time, the resource was still open on 3 sides and extendable.
Mineral Resource Estimate (MRE) July 2017 (16.1 Mt @ 11.76% Al) - 26 July 2017 Indicated 13.0Mt at 11.58% Al, 0.47% Fe and 0.34 Ti & Inferred 3.1Mt at 12.5% Al, 0.51% and 0.37% Ti		
April/May 2018	1,613	75-hole RC drilling programme for 1,613m (average depth 21.5m) to provide more information for the PFS. All vertical holes drilled to depths between 12m and 36m – most holes intersected over 4m of kaolin with several intersections of up to 27m thickness of kaolin. 46 holes were completed to infill a portion of the Mineral Resource to a 50m x 50m drill spacing. 20 fence holes were drilled around the existing resource beyond the previously tested area. Six twin holes were completed to check the results of the previous phase of aircore drilling. 3 holes were drilled over the remainder of the Mineral Resources at 100m x 100m. Approximately 800 composite samples were collected for assaying and 3 tonnes of kaolin for advanced metallurgical tests.
MRE September 2018 (9.6Mt at 23.0% Al₂O₃) – September 2019 Indicated 3.2Mt at 24.4% Al ₂ O ₃ , 1.0% Fe ₂ O ₃ and 1.0% K ₂ O & Inferred 6.3Mt at 22.3% Al ₂ O ₃ , 0.7% Fe ₂ O ₃ and 1.2% K ₂ O. Revised MRE focused on a targeted subset of the larger Cadoux Indicated Resource reported in July 2017. The targeted area was selected for optimal mining/economic return for the HPA strategy. Maiden probable Ore Reserve Estimate of 2.89Mt grading 24.4% Al ₂ O ₃ was announced on 24 October 2018.		
March/April 2019	714	Detailed (close spaced) phase of infill test drilling of 22 vertical (-90°) RC drill holes totalling 614m (4 holes for hydrological purposes). Plus 4 angled (-70°) PQ triple tube diamond drill holes totalling 100m. Key purpose was the upgrading of the then current Measured Resource to Proven Reserve status with closely spaced (5m x 5m) in-fill RC drilling pattern to progress the BFS and project permitting. Drill programme generated 441 samples which were submitted to Intertek Laboratories in Perth. The samples were tested for standard kaolin suite analysis (total acid digest and Inductively Coupled Plasma (ICP) Mass Spectrometry). Analysis showed that 93% of the samples had samples ≥ 18% Al ₂ O ₃ . Highest value was hole GLRC003 at 34.7% Al ₂ O ₃ with the average being 23.9% Al ₂ O ₃ . Average kaolin per drill intercept was 17m.
MRE October 2019 (11.3Mt at 22.51% Al₂O₃) – used in DFS where results announced 11 March 2020 Measured 480,500t at 23.56% Al ₂ O ₃ , 1.24% Fe ₂ O ₃ and 1.18% K ₂ O; Indicated 5.7Mt at 23.36% Al ₂ O ₃ , 1.19% Fe ₂ O ₃ and 1.09% K ₂ O; & Inferred 5.0Mt at 21.45% Al ₂ O ₃ , 0.59% Fe ₂ O ₃ and 0.91% K ₂ O.		

Category	Volume m ³	Metric tonnes (dry)	Al ₂ O ₃ %	Fe ₂ O ₃ %	K ₂ O %
Measured	292,300	480,500	23.56	1.24	1.18
Indicated	3,501,300	5,742,700	23.36	1.19	1.09
Inferred	3,111,700	5,045,500	21.45	0.59	0.91
Total	6,905,300	11,268,700	22.51	0.92	1.02

Cadoux Mineral Resource Estimate 29 October 2018

Category	Ore Kt	Al ₂ O ₃ %	Fe ₂ O ₃ %	K ₂ O %	Ti ₂ O %
Proved	290	24.9	1.1	0.5	0.8
Probable	2,914	24.8	1.1	0.6	0.9
Total	3,205	24.8	1.1	0.5	0.9



Updated Ore Reserves March 2020 (based on a 7.06% Al₂O₃ cut-off)

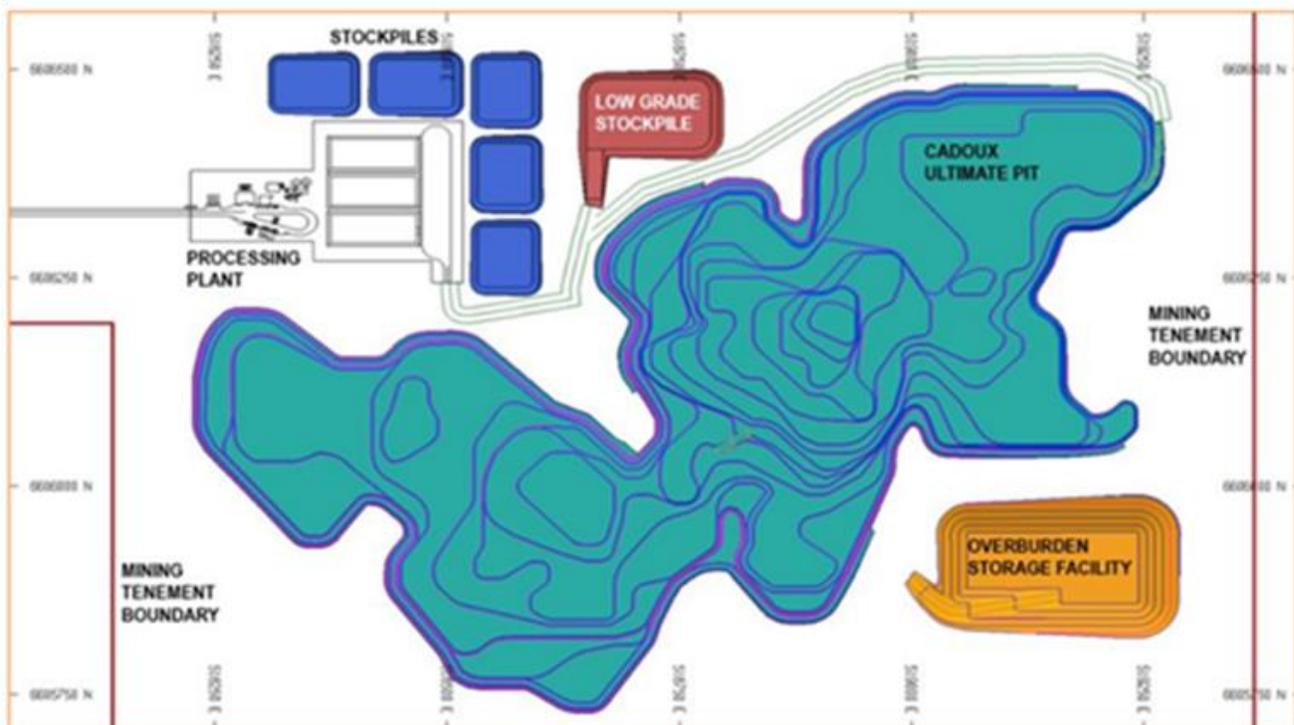
Core samples from geotechnical hole CXGT02

FEASIBILITY STUDIES

FYI is in the midst of delivering on its strategy to develop a world-class Australian HPA project. In March 2020, FYI published a robust Definitive Feasibility Study (DFS) along with an upgrade for the Cadoux reserves, which served to further de-risk the project from the PFS stage. At the same time, the board was also able to report that it had secured a A\$80 million strategic project development equity financing facility for the HPA project. The DFS outcome results were within 5% of the PFS key metrics, which is quite unusual and probably highlights the uniformity of the mineralisation.

FYI HPA – KEY PFS AND DFS PROJECT ECONOMICS			
	Metric	PFS (25 September 2018)	DFS (11 March 2020)
HPA production	tpa	8,000 (with capacity to expand)	8,000
Production grade	Al ₂ O ₃	>99.99	>99.99
Capital cost	US\$m	178.8	189
Operating cost	US\$/t	6,467 ¹	6,217
Project NPV (@10%)	US\$m	506	543
Project IRR	%	46	46
Assumed HPA selling price	US\$/t	24,000	24,000
Annual revenue	US\$m	190 ²	192
Operating margin	US\$/t	17,533	17,783
Annual EBITDA (average)	US\$m pa	128	133
Total project revenue (~25 yr LOM)	US\$bn	11.376 ³	4.7
Capital intensity	US\$/t	22,344	23,575
Project payback	years	3.6	3.6
Exchange rate	A\$:US\$	0.75	0.70

¹ - forecast average cost pf production (C1) ² - first phase of operation ³ - first phase of operation – total revenue (>50 years)



Cadoux site layout with final pit design from the DFS

The shallow orebody allows for a conventional open pit. The material here is suitable for free digging and hard ripping with no drilling and blasting required. Backfilling is planned to minimise the disturbance of this small operation and reduce the environmental impact. The operation is planned to use a fleet of 45t articulated trucks and a 75t excavator, with both the stripping of the overburden and the mining of the kaolin being undertaken by contractor mining.

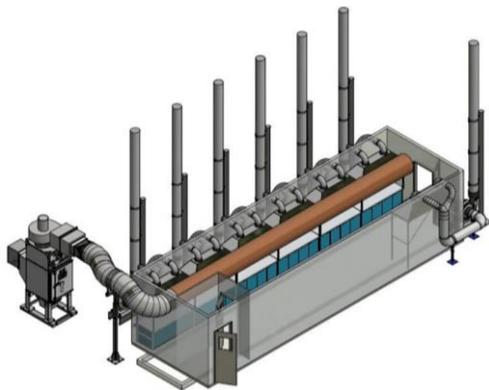
The break-even cut-off grade for material to be treated as ore is 7.06% Al_2O_3 which is substantially lower than the grade of the ore body (which averages 23.83% Al_2O_3 in the Measured and Indicated categories). All the mineralised material that meets this grade is classified as ore, however the basement and saprolite rock is not classed as ore. Although all these rocks may have some alumina grades, the presence of deleterious elements and poor metallurgical performance means that this material is treated as waste. A 5m bench height is planned over most of the project although this will be reduced to 1m to selectively mine ore along the ore/waste boundary.

The DFS was based on the mining and beneficiation of kaolin at Cadoux and with kaolin concentrates refined at Kwinana. Kaolin concentrates plan to be transported to the refinery at Kwinana along an existing road network using a b-double combination road train with a combined capacity of 68m³, a round trip distance of 590km. Operating two 12 hour shifts five days a week would provide total weekly capacity of 570t. At Kwinana the concentrate would be refined into HPA (>4N) followed by sales and shipping of HPA to the market.

The DFS highlighted that FYI's Cadoux kaolin deposit provides a unique combination of favourable geology, chemistry and physical characteristics which present an ideal source of HPA feedstock. This study was also able to point out that the corresponding innovative and efficient processing route developed by the Company, combined with the location of the refinery at Kwinana and its proximity to the source of inexpensive reagents and utilities, helped to drive FYI's enviably low capital and operating costs.

METALLURGY

Since FYI acquired Cadoux, there looks to have been a substantial investment in metallurgical test work which has focused on understanding the chemistry of Cadoux ore and designing a processing flowsheet to suit the ore's specific characteristics. This work has led quite swiftly into the construction of a pilot plant and subsequent successful testing.



Schematic view of FYI's HPA pilot plant



HPA produced



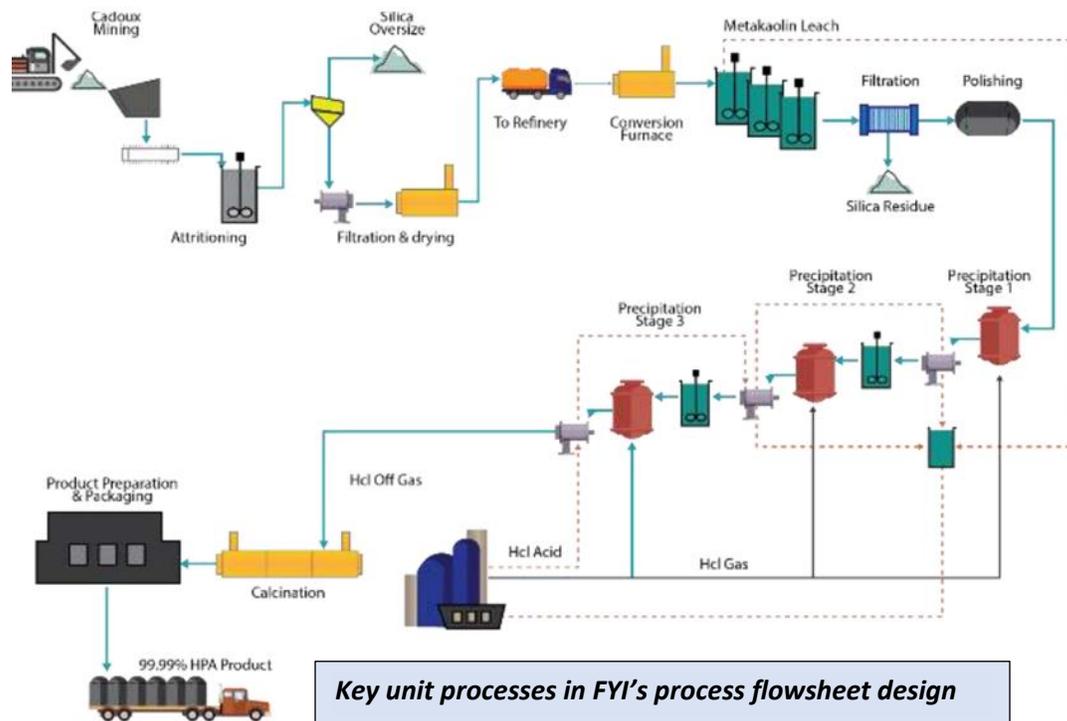
Commissioning of FYI's HPA pilot plant

METALLURGICAL TEST WORK ¹		
Date	Tests	Results
September-October 2017	<p>First stage metallurgical testing for HPA</p> <p>To determine the amenability of the Cadoux Kaolin Project to HPA extraction. Programme comprised of pre-beneficiation, calcination, acid leach testing and selective precipitation of alumina on Cadoux kaolin samples.</p>	<p>Aluminium leach recoveries > 82%.</p> <p>Selective precipitation and calcination achieved a grade of targeted 99.99% alumina.</p> <p>HPA process flowsheet shown to be effective.</p> <p>Extremely low contaminants (especially iron and titanium).</p>
February 2018	<p>Leach extraction tests</p> <p>Aimed at validating the HPA PFS flowsheet with tests designed to understand leaching outcomes over a series of variables including feedstock variances and varying operating temperatures and leach durations; with a goal of determining the optimal recovery and operating ranges.</p> <p>Results provided the framework for favourable project economics in the PFS.</p>	<p>Leach extractions of up to 97.2% Al₂O₃ at atmospheric pressure and low temperatures.</p> <p>Combined with achieving 99.99% grade showed that Cadoux provided ideal feedstock and validated the HPA flowsheet being designed and tested under the PFS.</p> <p>Rapid leach kinetics indicated an excellent metallurgical response to the feedstock.</p> <p>Leach results demonstrated ideal selective leaching of aluminium.</p>
September 2018	<p>Independent certification for Cadoux HPA</p> <p>Certified test work to independently confirm the quality of the final product (Al₂O₃) that the Company intended to produce commercially under its HPA strategy. The results were derived using high accuracy and precision laser ablation and sum of species methodologies.</p> <p>Verification of FYI's HPA grade was undertaken by metallurgical laboratory, Metallurgy Pty Ltd</p>	<p>Consistent HPA grade that could deliver an intermediate product ranging from 99.996% to 99.997% Al₂O₃.</p> <p>Result exceeded the Company's target grade of 99.99% Al₂O₃ (4N) which has since become the standard intermediate product.</p> <p>Potential for further upgrading to higher grade product such as 5N HPA.</p>
March 2019	<p>Locked Cycle and concentrate test work</p> <p>The Locked Cycle tests targeted high grade alumina production for increased recoveries and operating efficiencies which may reduce process plant capital and operating costs.</p> <p>Results were to provide the basis for possible process improvements in the subsequent pilot plant test programme.</p>	<p>Successfully produced 99.999% alumina (5N) via FYI's standard process flowsheet and within standard operating conditions.</p> <p>Achieving the 5N product demonstrated the quality of the process design and suggested scope for improvements to the project capex, opex and returns contained in the PFS; as well as providing key fundamental technical and economic inputs for inclusion in the then on-going BFS.</p>
October - December 2019	<p>Pilot plant trial production</p> <p>The key function of the pilot plant was to validate and improve the HPA flowsheet for technical and economic purposes.</p> <p>To this end the pilot plant was scheduled to run continuously over a week on a 24/7 basis to demonstrate "end to end" processing.</p> <p>Commercial samples were made available to potential customers for testing and application qualification.</p>	<p>Performance matched modelled expectations.</p> <p>All anticipated operating parameters were met with final product (HPA) appearing to be of an excellent quality.</p> <p>The optimised pilot plant material handling phase achieved 99.997% HPA.</p> <p>Trial HPA sent to the US for independent analysis.</p> <p>Subsequent optimised pilot plant results exceed FYI's original expectations with faster reaction speeds.</p> <p>Refinements have positive implications for production of 5N HPA.</p>
July - August 2020	<p>Stage Two HPA production trial</p> <p>The pilot plant was operated continuously (24/7) over a week producing at a rate of 1kg per hour. Test work was designed to allow FYI to deliver larger size samples to selected potential off-take parties.</p> <p>When test results were announced, FYI's HPA trial product was being prepared to be shipped to meet customer.</p> <p>Moving ahead, further variation and efficiency test work planned shortly, along with further planned pilot plant operations and other test work.</p>	<p>Pilot plant performed in line with operational parameters and expectations.</p> <p>Trial HPA production samples sent to USA for independent analysis to confirm purity.</p> <p>Dedicated HPA product to receive additional finishing to specialty specifications as was requested by several parties for detailed qualification.</p> <p>Process design improvements tested and incorporated into flowsheet design.</p>

¹ Metallurgical test work programme undertaken and managed by Independent Metallurgical Operations Pty Ltd (IMO) in Perth.

PROCESS FLOWSHEET

FYI uses “open file” processing flowsheet and basic chemistry refined to suit Cadoux ore characteristics. The Company is developing a HPA processing operation in WA with the target of developing a low industry capex and low opex process where kaolin concentrate goes to a refinery where the material passes through a conversion furnace prior to a metakaolin (anhydrous calcined form of kaolinite) leach process which is followed by a 3-stage precipitation process adding HCL gas. The resulting metakaolin is finally subject to calcination. FYI has been undertaking detailed development work to further refine and de-risk the HPA process and design flowsheet. Major test work completed for the DFS included bench scale, bench scale variability, Locked Cycle and the operation of a pilot plant.



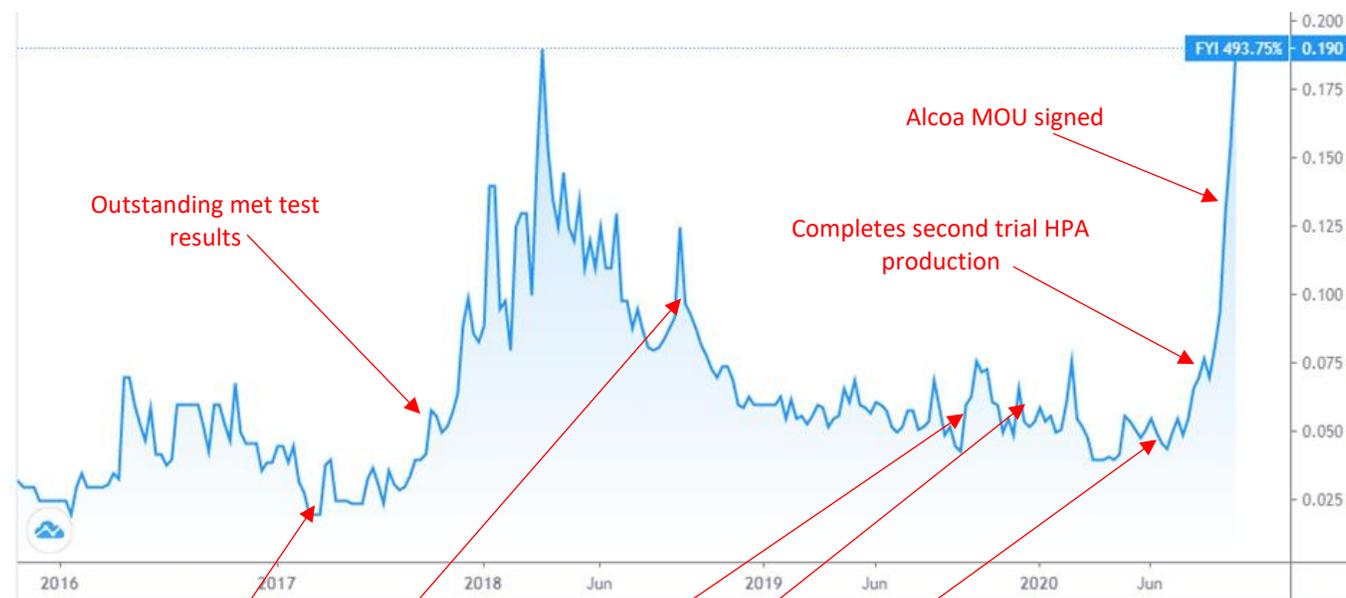
Key unit processes in FYI's process flowsheet design

Wet attritioning and screening of the whole ore feed to produce low Silica screen undersize stream for downstream processing and a by-product Silica rich screen oversize stream.
Drying and calcination of attritioning screen undersize to activate Kaolin in preparation for acid leaching.
Staged Hydrochloric Acid leaching to extract Aluminium as Aluminium Chloride into solution.
Staged precipitation of Aluminium Chloride concentrates via Hydrogen Chloride gas phase sparging (gas flushing).
Aluminium Chloride concentrate recovery, filtering and washing.
Final high temperature Aluminium Chloride calcination and conversion to HPA – followed by packaging for export.

FYI is seeking to produce a consistent ethically sourced and reliable quality in the end-product. The Company’s bespoke pilot plant facility in Welshpool, WA has played a critical role in the validation and de-risking the innovative HPA flowsheet. Two pilot plant trial product phases have been completed. One phase was a standard process, whilst the second phase included an optimised trial with plant modifications for both flowsheet and materials handling to improve upon the targeted 4N HPA. Feedstock variability test work produced assays from 99.997% - 99.998% HPA, which highlights the efficiency and efficacy of the process flowsheet. Whilst the Locked Cycle test work achieved 99.999% alumina (5N).

The refinery is proposed to be built on a 6-hectare site at the Kwinana Industrial Estate (KIA) in Perth, known as Battery Alley. KIA is a leading manufacturing, engineering, chemical and resources processing and refining hub which is seen to be an excellent location where kaolin feedstock from Cadoux can be refined into HPA. Located at KIA are the likes of BHP, Wesfarmers, Coogee Chemicals, Bayer Corp, BP and Alcoa; which are soon to be joined by the world’s biggest and first fully automated lithium manufacturing facility (Tianqi Lithium) outside of China. FYI hopes to become an integrated component within KIA contributing to/ leverage off these leading technologies and services providers. This looks to have already begun with a recent MOU with Alcoa which could lead to the co-development of HPA processing/refining technologies and the commercialisation of FYI’s HPA business model as outlined in the DFS.

FYI'S PATHWAY TO HPA PRODUCTION



FYI HPA key project milestones – September quarter 2020	
Progress project partner development discussions	Continue off-take discussions with potential customers
Further pilot plant R&D trial operation and HPA production for continuing customer qualification	Respond to customer feedback enquiries for HPA product development
R&D on HPA speciality product finishing to potential off-take party specifications	Advance the project final engineering decision (FED)
Continued customer engagement and follow up on product qualification assessment	Progress Final Investment Decision (FID)

EXPLORATION & EVALUATION EXPENSES		
Year ending 30 June	A\$	Comments
2018	0.776	Source: Annual report
2019	3.254	Source: Annual report
2020	1.514	Source: Quarterly reports
2021	2,700	13 August 2020, FYI raised A\$2.70 million at A\$0.06/share to progress its HPA project
Total	8.244	

KEY TAKEAWAYS

FYI made a ground floor entry into the fast emerging HPA market which has been developed to possibly offer best in class project economics. The Company's highly compelling integrated strategy was based on sound technical knowledge coupled with the progressive de-risking of the project. Important lessons to be learnt from FYI are outlined below.

Well understood geology - Extensive drilling with 199 drill holes for 4,177m for an average depth of 21m (with no deep holes) has demonstrated that the deposit geology is highly favourable. The kaolin deposit at Cadoux has been shown to be shallow, flat lying with a low strip ratio. The granitoid material has been fully kaolinized, homogeneous, high quality and free digging. The resource supports more than 100 years production based on the completed detailed mine study and reserves have been delineated of 3.2Mt grading 24.8% Al_2O_3 which supports a DFS mine life of more than 25 years.

Extremely amenable to HPA processing - Assay results from drilling have demonstrated that the material has ideal characteristics concerning quality with a decent grade (22.51% Al_2O_3) and low levels of deleterious elements such as iron (0.92% Fe_2O_3) and potassium (1.02% K_2O), making the kaolin very amenable to HPA processing. This is a highly important consideration for EV batteries, as HPA purity is critical to prevent battery ageing.

Simple flowsheet design based on "open file" science – The Company has developed its flowsheet based on bringing together existing technologies to meet Cadoux's specific chemistry, quality and characteristics. Not only does the flowsheet design look simple but also highly innovative which allows for efficiency and low operating costs. Heavy-duty equipment has been specified to ensure a long life as well as making for low maintenance.

Project and technology de-risked – Detailed development work has served to further refine and de-risk the HPA process and design flowsheet. Certainly, FYI's purpose built (1kg/hr) pilot plant facility in Welshpool WA has played a critical role in the validation and the de-risking of the Company's innovative HPA flowsheet. Feedstock variability test work conducted in the pilot plant circuit produced assays from 99.997% - 99.998% HPA highlighting the efficiency and efficacy of the process flowsheet. Whilst Locked Cycle test work achieved 99.999% alumina (5N HPA).

Robust project economics – The DFS outlined a long life, high quality, high margin HPA kaolin project with scope to deliver an IRR of 46% and a US\$543 million after tax NPV(10). This was based on lowest quartile capex and opex of US\$189 million and US\$6,217/t respectively. Annual EBITDA was determined to be US\$133 million with US\$88 million of cash flow after finance and tax per year for a 25-year LOM and a 3.6-year payback period.

US\$24,000 HPA price forecast looks conservative – Pricing information in the DFS came from four sources. Firstly, CRU and Allied Market Research price forecasts for 2019-26. Secondly, December 2019 pricing on commodity trading platforms for HPA where there was evidence of retail spot prices for 4N ranging from US\$53,000/t to US\$60,000/t. Thirdly, invoiced prices for HPA (used in independent met tests and verification of purity) of US\$100,000/t. Lastly, canvassing 30 separate groups indicated the price range for 99.99% HPA was between US\$22,000/t (China) and US\$37,000/t (South Korea).

Rapid progress to commercial production – In mining terms, FYI is demonstrating a pretty short timeline from the initial entry into kaolin in May 2017 to HPA production as early as 2023 following planned commission in 2021-23. The move from Scoping Study (March 2018), and into feasibility studies with outstanding results from the PFS (September 2018) through to the excellent DFS (February 2020) has been timely, with the project further de-risked at each stage.

Compelling focus on market engagement – FYI has benefitted from becoming heavily involved in product marketing and initial off-take discussions at an early stage, to fully explore project funding options. Obviously the DFS plays a critical role in securing project finance. Funding options being pursued to finance its future activities and development costs include off-take, joint-venture, cornerstone investor, project debt, equity and strategic investor. To this end the management team has already conducted rounds of meetings conducted in China, South Korea, Japan and Europe. At the same time HPA trial product has been sent by request to market participants such as HPA customers and traders.

A\$80 million equity funding facility - When the DFS was published, an equity funding facility provided by the private equity group GEM was announced which the management seized on as significantly reducing project risk. This look to be toxic financing with all the drawdowns terms that investors loathe. However, in a difficult market for project funding having a A\$80 million commitment provides a backstop against which to negotiate a better financing deal elsewhere.

GOOD TIME TO BE FAST TRACKING A KAOLIN PROJECT

Truth is that advances in technology have given rise to a number of truly disruptive technologies which produce HPA directly from kaolin via a less costly process than the traditional bauxite feedstock route which involves first making aluminium, prior to processing the metal into HPA. Market researchers have been quick to point out world demand for HPA has gained an incredible traction which has been put down to a powerful combination of growing technological advancements and increasing demand from applications. Just as with other battery minerals, new markets are rapidly opening for industrial minerals such as HPA propelled by the influx of high-tech industries emerging on the world stage, and it has all the makings of being a big growth story.

FYI is driving the delivery of its Cadoux Kaolin Project with impressive timing which very neatly coincides with forecasted market growth. HPA is an emerging growth sector, with this high value material playing a significant role in high-performance electronics such as sapphire glass, semi-conductors, phosphor applications, LIB separators and LEDs. New applications and technologies are creating market opportunities and driving demand growth. The current global 4N HPA market demand is 60ktpa, is forecast to rise to 90ktpa by 2022 and then to over 130ktpa by 2025 (Source: CRU HPA Market Research 2018). Dramatic consumer driven growth is forecast to propel the HPA market be worth US\$4.9bn by 2022 (Source: Allied Market Research, World High Purity (HPA) – Opportunities and forecasts 2015-2022).

In this report, we have tried to highlight the pathway that FYI has followed to de-risk and create rapidly growing value at its Cadoux Kaolin Project. The DFS suggests a project NPV(10) of US\$543 million. Given troublesome equity markets, such obvious progress has yet to be accurately reflected in the share price to any real extent. With the shares currently at the A\$0.14 level, the Company trades on an Enterprise Value of roughly £20 million or US\$26 million. Mining analysts seeking to place a target price on such a stock might reach for a well known rule of thumb for valuing mining project which suggest that a project at the DFS stage could attract a valuation based on a substantially higher percentage of the NPV, than the current 5%. Which suggests quite a large disconnect in the share price which is probably due to concerns about future funding combined with doubts about the technology and a lack of understanding of the whole HPA market opportunity.

In early September 2020, the board was able to report that FYI have the opportunity to potentially partner with Alcoa to co-develop the HPA process flowsheet and refining technologies which would serve to commercialise the HPA business model outlined in the recent DFS. Such a development at FYI shows that globally significant and strategic blue-chip partners are watching the HPA space diligently and can be attracted into HPA plays to provide capital and serve as a tremendous validation of the technology and opportunity.

About the author

Dr Michael Green is an independent analyst specialising in growth and resources companies. He gained a BSc Honours degree in Mining Engineering from Nottingham University, UK and PhD for a thesis that looked at the economic analysis of mining projects. Having been involved in consultancy work, Michael began working in the City in the 1980s as a Mining Analyst with stockbrokers Buckmaster & Moore and then HSBC-owned Greenwell Montagu Securities. Subsequently, he was involved in analysing a wide range of growth companies and became Head of Research at stockbroker Everett Financial which specialised in the small cap market. Since, 2006 Michael has been an independent analyst specialising in analysing companies in the resources sector and providing research for mining companies, stockbrokers, corporate finance houses, advisers and independent research firms. He was formerly a Non-Executive Director of Ascot Mining PLC, a quoted Central American gold mining company. In addition, Michael has also worked closely with resources companies on IR.

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