

Analyst

Stuart Howe 613 9235 1856

Associate Analyst

Ritesh Varma 613 9235 1658

Authorisation

James Williamson 613 9235 1692

IperionX Ltd (IPX)

Initiation - Disrupting Titanium*

(* and stainless steel, and aluminium)

Recommendation
Buy (Initiation)

Price
\$2.00
Valuation
\$3.70 (Initiation)

Risk
Speculative
GICS Sector
Materials
Expected Return

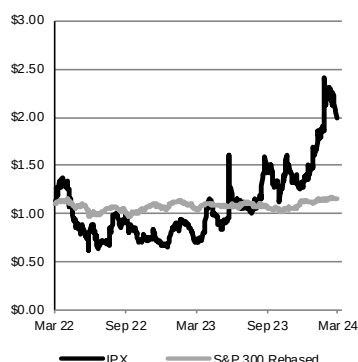
Capital growth	85%
Dividend yield	0%
Total expected return	85%

Company Data & Ratios

Enterprise value	\$431m
Market cap	\$457m
Issued capital	229m
Free float	78%
Avg. daily val. (52wk)	\$439,922
12 month price range	\$0.69-\$2.47

Price Performance

	(1m)	(3m)	(12m)
Price (A\$)	1.93	1.25	0.74
Absolute (%)	3.6	60.0	170.3
Rel market (%)	1.5	53.7	161.3

Absolute Price


SOURCE: IRESS

Disruptive technology addresses US security of supply

IPX's technologies will potentially disrupt titanium markets through materially lowering production costs (energy consumption, carbon emissions, and yield losses): HAMR (Hydrogen Assisted Metallothermic Reduction) converts titanium scrap or minerals into high spec titanium powders; HSPT (Hydrogen Sintering & Phase Transformation) converts titanium powders to high-end titanium components. Lowering costs of production will enable titanium to compete with other speciality alloys (e.g. stainless steel). The technologies address US security of supply concerns, with around 95% of the country's titanium metal currently sourced from imports (predominantly from Japan). China and Russia account for more than 70% of global titanium production.

Commercialisation imminent; near-term earnings potential

In mid-2024, IPX will commission a 125tpa Phase 1 commercial titanium production facility in Virginia, USA. An expansion to 2,000tpa by 2026 (Phase 2) could generate +US\$120m EBITDA annually for a circa US\$70m capital investment. IPX has received a US\$12.7m Department of Defense grant to fund Phase 1. We expect that Phase 2 will also be eligible for government-backed grants and concessional financing. The IPX technologies are the result of more than a decade of R&D, principally at the University of Utah, and have been successfully demonstrated at industrial-scale pilot facilities.

Investment view – Speculative Buy, Valuation \$3.70/sh

IPX has the potential to disrupt the incumbent titanium supply chain through materially lowering production costs and manufacturing waste. Large-scale production will commence this year, further de-risking the company's technologies and enabling IPX to progress commercial relationships with several high-profile aerospace, automotive, luxury goods and government end users. Our valuation is mostly supported by Phase 2 earnings using relatively conservative assumptions with respect to process margins. There is potential for IPX to rapidly scale Phase 2 and cement itself as a key supplier in the US and global titanium value chains.

Earnings Forecast

Year ending 30 June	2024e	2025e	2026e	2027e
Sales (US\$m)	-	7	21	146
EBITDA (US\$m)	(19)	(13)	(5)	75
NPAT (reported) (US\$m)	(21)	(21)	(23)	37
NPAT (adjusted) (US\$m)	(21)	(21)	(23)	37
EPS (adjusted) (A¢ps)	(14.7)	(11.9)	(12.7)	20.0
EPS growth (%)	na	na	na	na
PER (x)	-13.6x	-16.9x	-15.7x	10.0x
FCF Yield (%)	-6%	-23%	-8%	10%
EV/EBITDA (x)	-14.5x	-21.0x	-57.9x	3.8x
Dividend (A¢ps)	-	-	-	-
Yield (%)	0%	0%	0%	0%
Franking (%)	-	-	-	-
ROE (%)	-88%	-54%	-60%	81%

SOURCE: BELL POTTER SECURITIES ESTIMATES

Contents

Initiation: Disrupting Titanium* (* and stainless steel, and aluminium).....	3
Valuation & financial assumptions.....	7
Titanium Manufacturing Campus, Virginia	10
Core technology 1: HAMR.....	13
Core technology 2: HSPT	16
Intellectual property rights.....	17
Commercial relationships	18
Titanium market; focus on the US.....	20
Titan Project: Strategic upstream position.....	23
IperionX (IPX) company summary.....	26
Appendix 1: Capital structure	27
Appendix 2: Board & management	28
Appendix 3: Company timeline.....	32
Appendix 4: Incumbent Ti technologies	34
Appendix 5: Incumbent Ti producers.....	36
Investment risks.....	38

Initiation - Disrupting Titanium*

(* and stainless steel, and aluminium)

Global patents for disruptive Ti manufacturing technology

TITANIUM COST BREAKTHROUGH

IPX owns the global license to and patents for novel technologies which can potentially disrupt the current titanium, stainless steel and other specialty alloy markets in terms of costs of production at several points across the supply chain (mineral and scrap processing through to manufacture of titanium components). The technologies provide a raft of ESG benefits (recycling, net zero, waste reduction) and addresses security of supply risks for a key critical mineral/material (titanium, USGS 2022).

TWO KEY TECHNOLOGIES: HAMR & HSPT

The IPX technologies were developed at the University of Utah, USA:

- 1 **HAMR** (Hydrogen Assisted Metallothermic Reduction) produces titanium powders from scrap titanium or titanium minerals with no direct CO₂ emissions (Zero Scope 1 & 2). Titanium powders are either "spherical" and used in additive manufacturing processes (3D printing) or "angular" and used in titanium forging technologies.
- 2 **HSPT** (Hydrogen Sintering & Phase Transformation) converts angular titanium powders to high specification mill products (billets, slabs, plates etc.) and forged titanium componentry (intermediate products) that can be at near final component shape, substantially reducing customer's manufacturing process waste.

DISRUPTING HIGH-COST INCUMBENT TITANIUM MANUFACTURING

Compared with incumbent titanium production methods (Kroll Process), the IPX technology operates at substantially lower temperatures, reducing energy input costs. The IPX technology eliminates several highly corrosive, energy intensive and low yielding steps in titanium production. The ability to recycle titanium scrap and reduce waste are the other key cost benefits. There are no direct CO₂ emissions from the process; incumbent production methods have high direct CO₂ emissions from the titanium reduction process.

DISRUPTING STAINLESS STEEL, ALUMINIUM & SPECIALTY ALLOY MARKETS

Materially reducing production costs will enable titanium to capture market share from other specialty alloys (including stainless steel and aluminium), thereby growing titanium's addressable market. A key impediment to titanium's widespread adoption in metal applications has been its prohibitively high cost. Traditional markets for titanium have therefore centred on high-end uses such as aerospace and defence.

TITAN PROJECT: LARGEST UNDEVELOPED TITANIUM RESOURCE IN THE US

IPX is also progressing the Titan Project, one of the largest undeveloped titanium mineral resources in the US (Tennessee). The Titan Project provides an opportunity to backward integrate titanium mineral feedstock for the HAMR and HSPT processes. A 2022 Scoping Study identified a project capable of producing 16.7ktpa rutile and 99.5ktpa ilmenite (among other minerals and rare earths) to generate average annual EBITDA of US\$117m and a post-tax NPV8 of US\$692m. The project's capital cost was estimated at US\$237m.

COMMERCIALISATION OF IPX TECHNOLOGY IS IMMINENT

In mid-2024, IPX will commission a 125tpa Phase 1 commercial titanium production and manufacturing facility in Virginia, USA. The facility will convert scrap titanium into high specification angular titanium powders and then into mill products (bar, plates etc.) and

forged titanium componentry (near-net shapes and titanium parts). IPX will then scale this modular facility to 2,000tpa by 2026 (Phase 2). Importantly, the IPX technology uses readily available, off-the-shelf bell furnace technology extensively used in heat treatment applications (metallic annealing and diffusion coatings).

The facility will leverage more than a decade of process research and development, principally at the University of Utah and the company's Pilot Facility (~1.5tpa capacity) in Salt Lake City.

Why Titanium? Strength; corrosion resistance

Three properties which make titanium unique are its high specific strength, its corrosion resistance and its biocompatibility. In the absence of cost of production considerations, titanium's light weight and high strength make it ideal for applications in the automotive industry and where structural steel is currently used. Corrosion resistance also supports titanium's durability and applications in maritime applications. Biocompatibility makes titanium a common choice for biomedical implants.

ADDRESSING US TITANIUM SECURITY OF SUPPLY: US DOD SUPPORT

IPX has received US Department of Defense funding (US\$12.7m) under the Defense Production Act Title III to address US titanium supply chain vulnerabilities. The US now sources around 95% of its commodity titanium supply from imports, principally from Japan. China and Russia currently account for more than 70% of global primary titanium metal supply. To address security of supply risks, US Government agencies are actively supporting developments in the titanium sector.

Commercialisation: Near term earnings potential

PHASE 2 COULD GENERATE +US\$120M EBITDA ANNUALLY

At 2,000tpa, we estimate the Phase 2 facility in Virginia could generate +US\$120m EBITDA annually for a circa US\$70m capital investment.

This earnings scenario is based on:

- **Titanium powder production costs US\$30/kg:** Product costs (including scrap feed) of US\$30/kg to produce 2,000tpa angular titanium powder for sale into existing additive manufacturing markets and for value adding.
- **Conversion costs US\$3-20/kg:** Costs to convert angular titanium powder into near-net shape products or more traditional titanium mill products (sheet, bar, wire).
- **Average sales price US\$97/kg:** Based on IPX target pricing, Bell Potter Securities' production mix estimates and supported by US import-export data unit values.
- **Margin of +US\$60/kg over 2,000tpa = project EBITDA of +US\$120m**

UPSIDE CASE 1: EXPANSION OPPORTUNITIES

Phase 2 is readily expandable through a modular roll-out of the IPX technology through the addition of subsequent furnaces or new facilities. At 2,000tpa, IPX would be producing less than 4% of the US's annual titanium metal import requirements. Through lowering the cost of titanium products, new markets will emerge which were traditionally serviced by stainless steel and other alloys.

UPSIDE CASE 2: VALUE ADDING TO MATERIALLY INCREASE REALISED PRICES

Our scenario estimates are based on IPX's current market pricing targets for titanium products and components. There are at least two opportunities for IPX to increase its average realised price:

- **High-end near-net shape components:** Providing near-net shape components for high value luxury and consumer electronics applications. IPX is currently working with Panerai (Richemont) in producing near-net shape titanium watch case blanks which are then CNC (computer numerical control) machined into final products. Applications across consumer electronics include smart phones and smart watches (Apple's iPhone 15 currently uses a titanium band; the Apple Watch Ultra 2 has a titanium case).
- **Customer process integration:** IPX's forged components provide benefits to customers through eliminating processing steps and therefore reducing energy consumption and scrap losses. These benefits materially lift the value-in-use of the IPX products compared with currently available titanium commodity products. IPX has the potential to become an integral part of customer's manufacturing process giving IPX a strong competitive advantage.

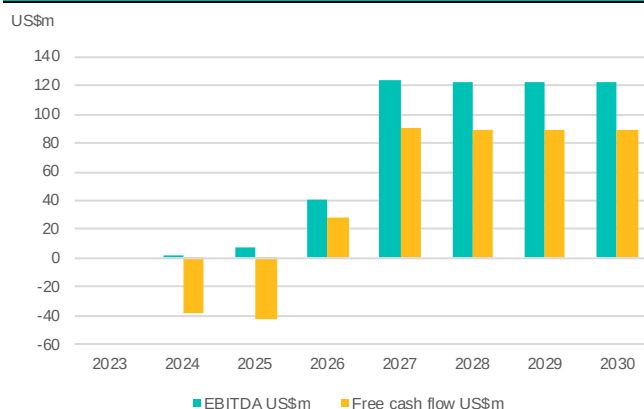
Phase 2: 2,000tpa generating +US\$120m EBITDA

Figure 1 - IPX titanium production outlook



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Figure 2 - IPX titanium earnings outlook



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Near-term capital requirements: Current cash US\$17.3m

At 31 December 2023, IPX had cash of US\$17.3m.

- IPX is nearing the completion of the Phase 1 Titanium Production Facility (125tpa) in Virginia, with an expected total capital spend of circa US\$20m.
- Subsequent to the end of 2023, IPX received the first US\$2.4m payment from a US\$12.7m Department of Defense DPA Title III grant to fund Phase 1 ramp-up.
- We estimate a further US\$5m will be required to finish the first stage of investment at the Advanced Manufacturing Center.
- IPX estimate that the Titanium Production Facility Phase 2 (2,000tpa) will cost approximately US\$70m and IPX will take a Final Investment Decision in late-2024 or early 2025.

Forthcoming news flow & catalysts

- **Q1-2 2024:** On site arrival and installation of the HAMR titanium furnace at the IPX Titanium Production Facility.
- **Q3 2024:** Commissioning and first production of angular titanium powders at the Titanium Production Facility.
- **Q2-3 2024:** IPX to release study on optimised Phase 2 project.

- **Q3 2024:** Commissioning of the Advanced Manufacturing Center.
- **Q4 2024 – Q1 2025:** A Final Investment Decision to progress with the US\$70m Phase 2 expansion.
- **Ongoing:**
 1. HAMR and HSPT research and development.
 2. Customer engagement news and developments.
 3. Strategic funding grants and opportunities

Valuation & financial assumptions

Valuation summary

At 31 December 2023, IPX had cash of US\$17.3m.

The following table outlines our risked and diluted valuation assumptions. We assume dilution of a US\$40m equity raise by the end of 2024 to support the Phase 2 construction and ongoing research and development of the IPX technologies.

Diluted shares on issue represents total shares plus in the money options, and performance rights. We have excluded 39.6m performance shares (Class A and Class B) as these shares relate to milestones associated with the Titan Project which we view as unlikely to be met.

Table 1 - Risked & diluted valuation

	Valuation 100% US\$m	IPX ownership %	IPX share unrisked US\$m	Risk disc %	IPX share risked \$m
Titanium Manufacturing Campus (Phase 2)	844	100%	844	45%	464
TMC near-term upside (double Phase 2 capacity)	620	100%	620	75%	155
Titan Project	300	100%	300	50%	150
Other					38
Total projects					808
Corporate overhead assumption					-63
Enterprise value					745
Net (debt)/cash					17
Options in the money					3
Equity value (diluted)					765
Diluted shares on issue m					276
Equity value (diluted) US\$/sh					2.78
FX (long run estimate) US\$/A\$					0.70
Equity value (diluted A\$/sh)					4.00
Assumed capital raise US\$m	40				
Assumed raise price A\$/sh	1.70				
Assumed new shares issued	36.1				
Assumed diluted shares on issue post raise	311.9				
Post-raise assumptions					
Net (debt)/cash					57
Options in the money US\$m					3
Equity value (diluted, after capital raise)					805
Equity value (diluted, after capital raise) US\$/sh					2.58
FX (long run estimate) US\$/A\$					0.70
Equity value (diluted, after capital raise) A\$/sh					3.70

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Titanium Manufacturing Campus assumptions

We have modelled the IPX Titanium Manufacturing Campus:

- The Titanium Production Facility Phase 1 commencing production in mid-2024 at rates ramping up to 125tpa titanium powder then development of Phase 2 over 2025 taking production to 1,000tpa titanium powder in 2026, then 2,000tpa titanium powder from 2027.
- The Advanced Manufacturing Center value-adding to around 25% of the Titanium Production Facility's production from mid-2025.

A summary of our modelled Titanium Manufacturing Campus assumptions are outlined in the following table.

Table 2 - Titanium Manufacturing Campus (Virginia) - Model summary									
		2023	2024	2025	2026	2027	2028	2029	2030
Prices									
Titanium scrap	US\$/kg	12	12	12	12	12	12	12	12
Spherical powder price	US\$/kg	129	129	129	129	129	129	129	129
Angular powder price	US\$/kg	86	86	86	86	86	86	86	86
HSPT basket price	US\$/kg	125	125	125	125	125	125	125	125
HAMR Production									
Spherical Ti powder	t	0	1	6	33	100	100	100	100
Angular Ti powder	t	0	19	119	618	1,900	1,900	1,900	1,900
Total Ti powder	t	0	20	125	650	2,000	2,000	2,000	2,000
HSPT value adding									
Percentage value added	%	0%	0%	12%	24%	24%	24%	24%	24%
Tonnes value added	t	0	0	15	154	475	475	475	475
Revenue									
Spherical Ti powder	US\$m	0	0	1	4	13	13	13	13
Angular Ti powder	US\$m	0	2	9	40	123	123	123	123
HSPT value added	US\$m	0	0	2	19	59	59	59	59
Total	US\$m	0	2	12	63	195	195	195	195
	US\$/kg	0	88	93	97	97	97	97	97
Costs									
HAMR	US\$m	0	-1	-4	-21	-64	-64	-64	-64
HSPT	US\$m	0	0	0	-2	-7	-7	-7	-7
Royalty	US\$m	0	0	0	0	0	-1	-1	-1
Total	US\$m	0	-1	-4	-23	-71	-72	-72	-72
	US\$/kg	0	-32	-34	-36	-36	-36	-36	-36
EBITDA									
	US\$m	0	1	7	40	124	123	123	123
	US\$/kg	0	56	59	62	62	61	61	61
Tax	US\$m	0	0	0	-7	-28	-28	-28	-29
Capex	US\$m	0	-39	-49	-5	-5	-5	-5	-5
Free cash flow	US\$m	0	-38	-42	28	91	90	89	89
NPV									
	708								
NPV/EBITDA		0.0	751.3	114.4	21.0	6.8	6.9	6.9	6.9

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Titanium Manufacturing Campus near-term upside

We expect that within 4 years, IPX could duplicate the Titanium Manufacturing Campus currently in development in Virginia. We attribute a heavily risked value to this potential expansion.

Funding arrangements: EXIM Bank & US Dept. of Defense

EXIM BANK LOI FOR US\$11.5M IN EQUIPMENT FINANCE

19 October 2023: Export-Import Bank of the United States (EXIM Bank) issues a Letter of Interest to provide US\$11.5m in equipment finance with a repayment tenor of 7 years for the development of the Titanium Manufacturing Campus (Virginia).

DEPARTMENT OF DEFENSE US\$12.7M GRANT

1 November 2023: The US Department of Defense contracts to award IPX US\$12.7m in funding under the Defense Production Act (DPA) Title III authorities to address US titanium supply chain vulnerabilities. Funds will be applied to the Titanium Manufacturing Campus (Phase 1, 125tpa). The US\$12.7m grant will be matched on a 1:1 cost share basis by IPX.

Titan Project assumptions: Consistent with Scoping Study

We have modelled the Titan Project with parameters consistent with the June 2022 Scoping Study. We have then adjusted the model as follows:

- **Discount rate:** We have increased the discount rate to 10% real (IPX 8% real);
- **Delay:** Our NPV assumes development commences in 2 years;
- **Prices:** We conservatively apply a 10% discount to the average basket price assumed by IPX over the life of the project;
- **Costs:** We conservatively apply a 10% premium to cost estimates to reflect cost inflation since 2022; and
- **Stage of assessment risk discount:** We have applied a 50% stage of assessment risk discount to take into account the project's Scoping Study level, consistent with our methodology of valuing pre-production assets.

Titanium Manufacturing Campus, Virginia

In September 2022, IPX announced its first commercial scale production facility will be constructed in Halifax County, Virginia USA. This facility is expected to commence first titanium powder production in mid-2024. The facility will comprise of two buildings: The Titanium Production Facility (1080 Building); and the Advanced Manufacturing Center (1092 Building). Collectively, these facilities are referred to as the Titanium Manufacturing Campus.

Titanium Production Facility: Powder production using HAMR

PHASE 1: +125TPA ANGULAR TITANIUM POWDER FROM MID-2024

The IPX Titanium Production Facility will convert scrap titanium primarily into angular titanium powders using HAMR's titanium de-oxygenation process, with first production expected in mid-2024.

The angular powders produced will be marketed to customers for use in additive manufacturing processes, and used internally to manufacture titanium plate, bar, near-net forged shapes and titanium parts at the neighbouring IPX Advanced Manufacturing Center.

The Titanium Production Facility is a scaled-up version of previous production equipment at the Salt Lake City industrial pilot facility.

IPX has purchased a conventional commercial scale bell furnace from a European Manufacturer. This furnace will support the HAMR process at an initial rate of +125tpa angular titanium powder. The estimated capital cost to IPX of Phase 1 is circa US\$20m.

PHASE 2: EXPANSION TO 2,000TPA ANGULAR TITANIUM POWDER FROM 2025

Phase 2 of the Titanium Production Facility is a modular expansion of Phase 1, lifting production capacity to 2,000tpa of angular titanium powder. Construction will take place over 2H 2024 to late 2025, enabling full rates of production from 2026.

Production from Phase 2 will also act as feedstock for the Advanced Manufacturing Center and support angular titanium powder sales to external customers.

Phase 2 has an estimated capital cost of US\$70m and unit cost of production of US\$30/t (when producing 100% angular powders).

While the Titanium Production Facility will focus on the production of angular titanium powders, we do expect that incremental amounts of spherical titanium powders (perhaps up to 5%) will be produced for market sounding and research and development purposes.

Advanced Manufacturing Center: Manufacturing using HSPT

The Advanced Manufacturing Center is designed to produce high-performance forged titanium products using the IPX HSPT process. Feedstock for the facility is angular titanium powder produced at the Titanium Production Facility.

The Advanced Manufacturing Center is expected to produce a range of traditional semi-finished titanium mill products (bar, rod, sheet), near-net shape forged titanium components (for CNC machining into final shapes) and high-value titanium products using additive manufacturing.

The Advanced Manufacturing Center is expected to have an initial capital cost of around US\$5m. We expect the capacity of this initial facility to be around 5-10% of the Titanium Production Facility. The unit costs of converting angular titanium powders using HSPT into

near-net shape components is estimated at US\$3-5/kg and semi-finished titanium mill products is estimated at US\$8-20/kg.

Figure 3 - Near-net shape watch cases produced by IPX



SOURCE: IPX 2023 ANNUAL REPORT

Figure 4 - Near-net shape watch cases produced by IPX



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Titanium Manufacturing Campus: Near-term earnings

IPX have estimated production volumes and costs as outlined in the following table. The Titanium Manufacturing Campus will sell angular titanium powders at the Titanium Production Facility and convert these powders into titanium components at the Advanced Manufacturing Center and through third party arrangements.

UNIT OPERATING COSTS OF US\$33-50/KG FOR TITANIUM PRODUCTS

The initial (April 2023) engineering work studied a Titanium Production Facility producing 1,125tpa of spherical titanium powder at a unit cost of US\$42/kg. Subsequent engineering and market studies have favoured a facility producing mostly angular titanium powder at higher production rates of 2,000tpa. Focusing on angular powders increases furnace and equipment productivity, reducing unit costs to US\$30/kg. The focus on angular titanium powders removes the granulation, sintering and de-oxygenation (GSD) steps required for spherical titanium powder production.

Table 3 - Titanium Manufacturing Campus costs

Titanium Production Facility		100% Spherical Powder		100% Angular Powder	
Annual capacity		1,125tpa		2,000tpa	
Capex		~US\$70m		~US\$70m	
Operating costs		US\$42/kg		US\$30/kg	
Advanced Manufacturing Center			Near-net shape products		Forged products (sheet, bar, wire)
Operating costs			US\$3-5/kg		US\$8-20/kg
Titanium Manufacturing Campus (Total)			US\$33-35/kg		US\$38-50/kg

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

PRICES RANGE FROM US\$60/KG TO OVER US\$200/KG

IPX have also provided target pricing for the planned product range as outlined in the following table. These prices range from US\$60/kg for lower-end titanium mill products (sheet, bar, wire) to over US\$200/kg for near-net shape products (for example the Panerai watch case blanks).

Key points to note are:

- IPX will flex the product mix to balance optimising cash flow while establishing new markets;
- Producing angular powders alone (at US\$30/kg) could generate margins of US\$40-70/kg;
- The Advanced Manufacturing Centre has the ability to lift average prices to over US\$100/kg, providing margins of over US\$50/kg; and
- These prices are supported by US Trade import and export values (see report section “Titanium market; focus on the US”).

Table 4 - Titanium product target pricing

Product	Target pricing
Angular titanium metal powders	US\$70-100/kg
Spherical titanium metal powders	US\$100-250/kg
Titanium mill products (sheet, bar, wire)	US\$60-200/kg
Titanium near-net shape products	+US\$200/kg

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Core technology 1: HAMR

Hydrogen Assisted Metallothermic Reduction (HAMR) is a process developed by Dr Zak Fang and his team at the University of Utah in the US. The technology is the result of more than a decade of research and development and has been demonstrated from lab scale work through to pilot scale at IPX's industrial pilot facility in Salt Lake City.

HAMR addresses challenges of low-cost titanium production

The key challenges in titanium metal production are:

1. **The low-cost reduction of TiO_2 minerals to produce titanium metal:** Titanium dioxide (TiO_2) is a very stable compound requiring significant energy to reduce to titanium metal (break the titanium-oxygen bonds).
2. **Titanium's strong affinity to oxygen:** Once reduced from titanium dioxide, titanium metal can carry up to 14% by weight in oxygen, versus the technical specifications of less than 0.2% (grade 5) or less than 0.13% (grade 23) that are required for strength.

INCUMBENT TITANIUM PRODUCTION METHODS (SEE APPENDIX 4)

- **Kroll Process:** Primary titanium metal is currently produced using the Kroll process which creates an intermediate titanium commodity called titanium sponge. Titanium sponge is a porous sinter of titanium crystals with a high oxygen content.
- **Vacuum Arc Remelting (VAR):** VAR technology is then used to convert titanium sponge and titanium scrap to ingot titanium at high temperatures and under high vacuum.
- **Rolling & milling:** Titanium ingot is then rolled and milled into final wrought product shapes. These steps require heat and mechanical energy to form final shapes and metallurgical properties.

These incumbent titanium production processes are energy intensive (VAR operates at +1,600°C), use highly corrosive processes (Kroll), have direct carbon emissions and are highly waste generative (scrap titanium). For further information on incumbent titanium production processes, see Appendix 4 of this report.

HAMR: Reduction of TiO_2 ; then deoxygenation of Ti-O

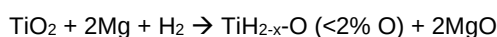
The principle discovery behind the HAMR process is the effect of hydrogen on the reduction of titanium dioxide (TiO_2) and then the deoxygenation of titanium metal. A hydrogen atmosphere effectively destabilises the Ti-O system, enabling the reduction and deoxygenation to occur at relatively low temperatures (less than 800°C) and produce angular titanium metal powders with an extremely low oxygen content (less than 0.2%).

STEP 1: REDUCTION OF TiO_2 : FROM PURIFIED TiO_2 FEEDSTOCK TO TiH_2

INPUTS: Purified titanium dioxide minerals (rutile); magnesium; and hydrogen

OUTPUT: Titanium hydride powder $\text{TiH}_2\text{-O}$ (<2% O)

The first step of the HAMR process is the reduction of purified titanium dioxide minerals to produce a porous titanium hydride. The reductant in this process is magnesium and the process is achieved in a furnace with a hydrogen atmosphere at less than 800°C. The use of off-the-shelf electric furnaces results in no direct carbon emissions.



A subsequent heat treatment increases the density of the porous titanium hydride produced in this process. The titanium hydride produced has an oxygen content of less than 2%.

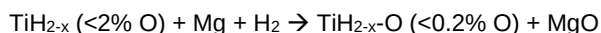
Per kilogram of titanium hydride produced, approximately 0.25kg of magnesium (~US\$13/kg) and approximately 10g of hydrogen is required. IPX expect to recycle a large component of the magnesium and hydrogen consumed in the reduction process.

STEP 2: DEOXYGENATION OF TiH_2 : REDUCING THE OXYGEN CONTENT TO <0.2%

INPUT: Titanium hydride powder TiH_2 -O (<2% O) (or titanium scrap)

OUTPUT: Titanium hydride powder TiH_2 (<0.2% O)

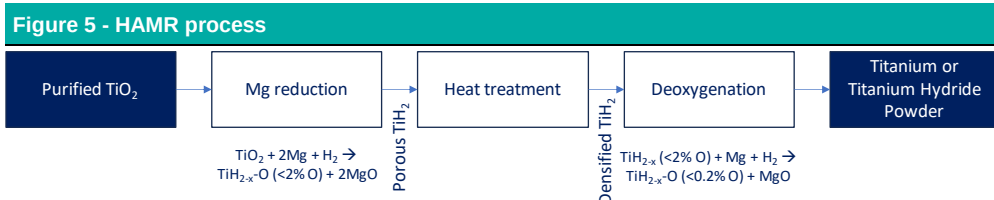
The second step largely repeats Step 1 to further reduce the oxygen content of the titanium hydride to less than 0.2%.



Finishing: Dehydrogenation of TiH_2 to produce titanium powder

A finishing step of dehydrogenation, where the titanium hydride is heated under vacuum, removes the hydrogen from the titanium to produce very low oxygen angular titanium powder.

Per kilogram of titanium hydride produced, a further 0.12kg of magnesium (~US\$13/kg) and 10g of hydrogen is required, before recycling. IPX expect to recycle a large component of the magnesium and hydrogen consumed in the deoxygenation process.



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

GSD: Applying HAMR to produce spherical titanium powders

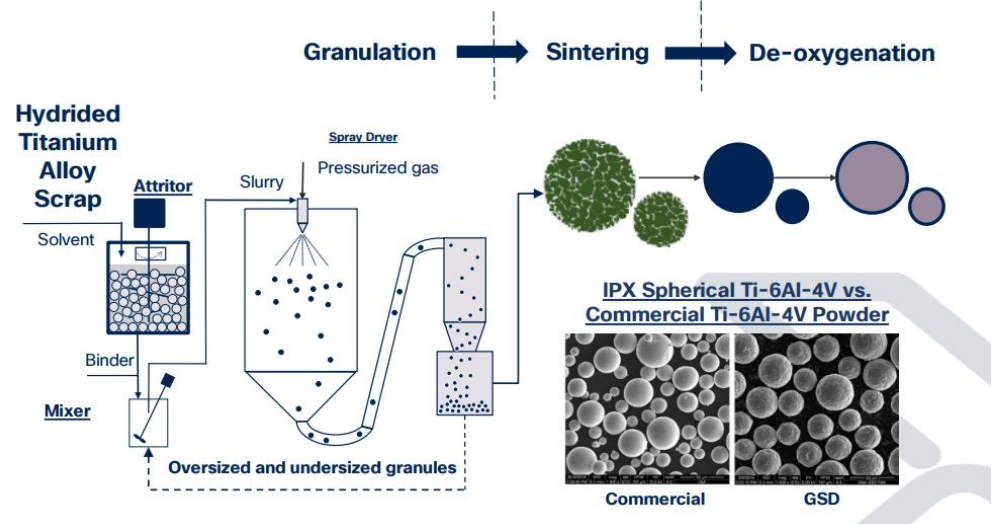
Granulation, Sintering and Deoxygenation (GSD) is a sub-application of the HAMR process to produce low-oxygen spherical powders for additive manufacturing (3D printing).

The steps in GSD are:

- Granulation of titanium feedstock (titanium scrap):
 - Hydrogen is dissolved into the feedstock at low temperatures to produce a brittle titanium hydride.
 - Titanium hydride is milled to produce a uniform titanium hydride slurry.
 - Titanium hydride slurry is combined with a binding agent and then spray dried to produce a uniform titanium hydride powder.
- Sintering to produce a titanium hydride spherical powder (high oxygen):
 - Heating the spray dried powder to remove the binding agent and densify the spherical particles to produce sintered powder briquettes.
 - Crushing and rolling of sintered powder briquettes to produce a titanium hydride spherical powder with relatively high oxygen content.
- Deoxygenation using HAMR and dehydrogenation to produce low oxygen spherical titanium powders:

- Use HAMR process to deoxygenate the titanium hydride spherical powder.
- Leach process byproducts and reagents from the powder.
- Dehydrogenate the with heat under high vacuum.
- Final conditioning to maximise product flowability.

Figure 6 - Granulation, sintering & deoxygenation steps



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Core technology 2: HSPT

Hydrogen Sintering Phase Transformation (HSPT) takes angular titanium powders from the HAMR process and produces high-specification titanium components with wrought-like properties (ultra fine grain microstructures) without the wrought process (mechanical working such as rolling, extruding, forging). This technology was also developed at the University of Utah by Dr Zak Fang and his team.

HSPT addresses challenges of titanium powder metallurgy

Powder metallurgy is used extensively in the manufacturing of metal components. The process refers to the blending of fine powdered metal feedstocks, pressing into moulds to form desired shapes, and then heating (sintering) the compressed powders in a controlled atmosphere to produce near-net shape or final shape components.

The application of powder metallurgy in titanium component production has been largely unsuccessful to date due to:

- The high cost of acceptable titanium powders for feedstock; and
- The poor mechanical properties/performance of the products produced compared with wrought titanium parts (e.g. fatigue properties due to the relatively coarse and porous microstructures after sintering).

Successful attempts to produce high quality titanium components using powder metallurgy have been high cost due to the feedstock used and the high pressures employed during the sintering phase.

HAMR provides a solution by enabling the low-cost production of high-quality angular titanium powders. HSPT addresses the mechanical property/performance issues through producing components with ultra fine grain microstructures.

HSPT: Sintering titanium powders in a hydrogen atmosphere

HSPT is a pressure-less sintering process under a dynamically controlled hydrogen atmosphere. After sintering, the hydrogen is removed by heating the product under a vacuum or inert gas environment.

HSPT feedstock is the low-cost angular titanium hydride powders produced through the HAMR process.

During HSPT, sintering results in a phase transformation in the titanium hydride system thereby refining product to have an ultra-fine grain microstructure. This ultra-fine grain microstructure provides mechanical properties equivalent to traditional wrought titanium products.

HSPT can also be employed to produce titanium alloys using blended elemental powders.

HSPT can effectively be used to produce traditional titanium products (sheet, bar, rod) and higher value near-net shape products which are subsequently CNC machined to final shapes and dimensions.

Intellectual property rights

IPX option to acquire Blacksand Technology, LLC

Blacksand is the entity which holds exclusive commercial licensing rights for more than 40 global patents relating to the HAMR, GSD and HSPT technologies through a license agreement with the University of Utah. The company was founded by Dr Zak Fang in 2013.

In February 2021, IPX signed an agreement and option with Blacksand for an exclusive license to develop titanium metal powders using the HAMR technology. In June 2021, IPX added exclusive license rights to develop Blacksand's GSD technology.

By October 2021, IPX secured the exclusive option to purchase Blacksand, and with it, the development rights to Blacksand's entire portfolio of titanium processing technologies including HSPT and others. In December 2022, IPX extended the exercise date of the exclusive purchase option to 31 December 2024.

The purchase option agreement between Blacksand and IPX provides IPX with two exclusive options over Blacksand's titanium processing intellectual property:

1 Asset purchase option - covering all Blacksand assets and intellectual property:

- Purchase price US\$12m (4 x US\$1.5m over 18 months, plus 1 x US\$6m on 31 December 2024).
- Equity consideration of up to 30% of the purchase price can be paid in IPX shares.
- Royalty 0.5% of net sales in excess of US\$300m over the life of the patented technology.
- Expires 31 December 2024.

2 Exclusive Royalty-Bearing License Option:

- Over all Blacksand intellectual property.
- License fee \$8m.
- Royalty 3% of net sales for HAMR products and 5% of net sales for GSD products, with a minimum annual royalty of US\$400,000 from the third anniversary of exercising the option through the life of the patented technologies.

We expect that IPX will exercise the first of these options before the end of 2024.

Commercial relationships

GKN Aerospace (October 2023)

IPX to supply titanium plate test components manufactured with IPX's technologies. GKN Aerospace is a leading supplier of aerospace components and systems to aircraft and engine manufacturers including Boeing, Airbus and Lockheed Martin. The company has 38 manufacturing locations across 12 countries. The order with IPX is priced on precedent open market transactions for the provision of similar products and technology services. IPX expects the initial work program to be completed in early 2024.

US Army (September 2023)

IPX execute a Test Services Agreement and Statement of work with the US Army Combat Capabilities Development Command Ground Vehicle Systems Centre (DEVCOM GVSC). IPX will supply titanium plate for US Army ballistic testing and consideration for use in future ground vehicle designs.

Heroux-Devtek (September 2023)

Heroux-Devtek to supply IPX with Ti-6Al-4V alloy scrap metal generated from landing gear manufacturing. Heroux-Devtek specialises in the design, development manufacture and repair of landing gear, actuation systems and components for the global aerospace market. In turn, IPX will employ its titanium processing technologies to convert the scrap into low-carbon titanium for future applications.

Lockheed Martin (August 2023)

IPX agrees to the delivery of titanium plate components under a prototype order. The order is priced on precedent open market transactions for the provision of similar products and technology services. The initial work program is expected to be completed with six months. Lockheed Martin is a global security and aerospace company employing around 116,000 people worldwide.

Aperam Recycling (July 2023)

IPX and Aperam's American entity ELG Utica Alloys execute an agreement to create a low-carbon 100% recycled titanium supply chain. ELG will supply clean titanium scrap metal for use in IPX's titanium processing technologies. Aperam is a global player in stainless, electrical and specialty steel recycling. ELG is a global specialist in sourcing and processing titanium, stainless steel and super alloys. The company processes more than one million metric tonnes annually.

Ford Motor Company (June 2023)

IPX agree to a scope of work for the supply of titanium metal components to Ford, following active collaboration between IPX and Ford Performance relating to the design, test and additive manufacturing. The agreement followed quality and strength testing of IPX titanium products.

Canyon Bicycles GmbH (March 2023)

IPX partners with Canyon to develop a more sustainable titanium supply chain for the bicycle industry through the production of bicycle components using IperionX's 100%

recycled and low-carbon titanium. The parties agreed upon an initial project to prototype Canyon bicycle parts, including for bicycle frames.

SLM Solutions (March 2023)

IPX and metal 3D printing technology company SLM Solutions announce a strategic Memorandum of Understanding. SLM have invented selective laser melting and pioneered metal additive manufacturing via the Laser Powder Bed Fusion additive manufacturing modality. IPX acquired two SLM additive manufacturing machines in 2022.

Carver Pump & the US Navy (February 2023)

IPX and Carver partner to use IPX technology to manufacture titanium pump components for the US Navy. Carver will design the components and guide IPX on prototyping to lead the qualification of the components for the US Navy. Carver is a leading American designer and manufacturer of high performance centrifugal pumps.

Officine Panerai (November 2022)

Officine Panerai (Compagnie Financière Richemont SA, SWX:CFR) place an initial purchase order for production series titanium watch cases to be additively manufactured using IPX's titanium technologies. The order follows testing on prototype watch cases produced in a test run. The initial commercial partnership was signed in August 2022.

Oak Ridge National Laboratory (July 2022)

IPX and ORNL collaborate on developing low-cost titanium alloys for additive manufacturing using IPX technology. A US Department of Energy approved User Agreement is executed to advance work between ORNL and IPX at the DoE's Manufacturing Demonstration Facility at ORNL. ORNL was established in 1943 as part of the Manhattan Project and aims to deliver scientific discoveries and technical breakthroughs needed to realise solutions in energy and national security and provide economic benefit to the US.

MRL (March 2022)

IPX and MRL formally partner to qualify and demonstrate the performance of IPX titanium powder for additively manufactured aerospace parts. The partnership supports an MRL project with the US Navy to test titanium flight critical metal replacement components for the US Department of Defense.

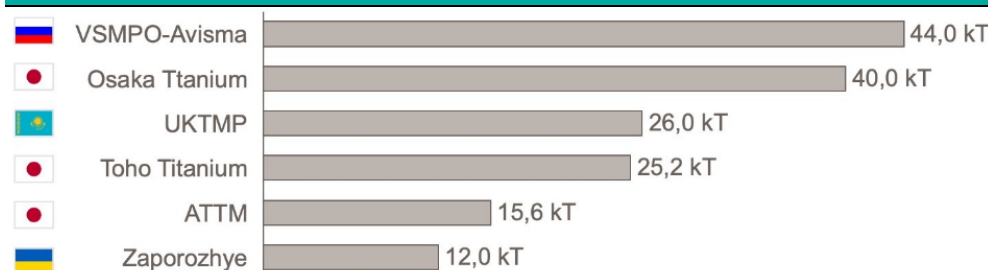
Titanium market; focus on the US

Key global facts & figures

- **Titanium broadly used in two applications:**
 1. Metals markets (includes alloys of titanium), leveraging the titanium metal's high strength to weight ratio, chemical and corrosion resistance, biocompatibility and high melting point; and
 2. Pigment markets, leveraging titanium dioxide's intensively white, opaque and chemically inert properties.
- **Primary titanium supply - Global TiO₂ production of 9.4Mtpa:** Titanium dioxide (TiO₂, 86% by weight titanium) occurs naturally within the minerals rutile (typically 92-95% TiO₂) and ilmenite (FeTiO₃). Synthetic rutile is produced by upgrading ilmenite in a rotary kiln, resulting in an 88-95% TiO₂ feedstock. In 2022, the USGS estimates global TiO₂ production of 9.4Mt of which ilmenite contributed 8.8Mt and rutile 640kt. China accounted for around one third of global TiO₂ production.
- **Less than 10% of TiO₂ production is used to produce titanium metals (less than 800ktpa Ti metal):** Around 90% of TiO₂ production is used for pigments in the manufacture of paint, plastic, paper and fibre. A small proportion of production is used welding flux wire cord used in the steel construction and shipbuilding industries.
- **Titanium sponge and scrap are the key traded metal commodities:** Titanium sponge is a precursor titanium metal product from the Kroll titanium manufacturing process. Titanium sponge requires further refining to become a useable titanium metal input. Titanium scrap is principally sourced from the manufacturing sector (as offcuts, turnings etc.) where subtractive processes are employed.
- **China and Russia currently account for more than 70% of primary titanium metal supply:** The USGS estimates that in 2023, China (220kt) and Russia (60kt) accounted for 73% of global titanium sponge production. Japan (60kt) is the next largest titanium sponge producer, contributing 18%.

Major global titanium manufacturers

Figure 7 - Major global titanium producers



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

US focus: IPX key initial titanium market

IPX will initially focus on titanium production and sales into the US market. The remainder of this section will focus on what we view as the key aspects and opportunities of this market.

- **The US imports more than 95% of its titanium metal requirements:** Primary production of titanium metal (sponge) in the US is limited to only one operation located in Utah with an estimated capacity of 500tpa. Other facilities located in Utah and Nevada have been idle since 2016 and 2020, respectively.
- **The USGS classifies titanium as a critical mineral:** The USGS critical minerals list (updated 2022) is created based on directives of the Energy Act of 2020. The Energy Act defines a critical mineral as a non-fuel mineral or mineral material essential to the economic or national security of the US and which has a supply chain vulnerable to disruption.
- **In 2023, the US imported around 73kt titanium metal commodities & components:** This level of imports has grown from around 45kt in 2014.
 1. Principal titanium imports included: waste and scrap 27kt; titanium sponge (metal commodity precursor) 37kt and wrought titanium products 4.7kt.
 2. Japan accounts for more than 80% of the USA's titanium sponge imports.
 3. Titanium waste and scrap imports are mostly from a broad range of western countries with developed manufacturing sectors.
- **Import-export unit values as a guide to price:** Data in the following tables relates to value per tonne (value divided by volume). This data provides some guide as to the potential pricing for IPX products. However, the import-export data's lack of granularity and encapsulation of legacy contracts makes the values presented conservatively low.

Table 5 - USGS titanium metal import data

Volume t	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Waste & scrap	19,261	22,067	18,499	25,203	26,705	30,106	15,799	10,646	19,258	27,026
Sponge	17,062	18,099	16,148	21,587	22,171	27,078	17,304	14,231	27,756	37,113
Ingot	699	403	690	1,551	1,951	2,099	1,214	875	733	1,748
Powder	120	129	161	157	191	189	195	214	194	258
Wrought	5,736	6,361	6,230	8,069	7,775	8,962	6,030	7,305	7,012	4,656
Castings	24	34	31	25	85	77	58	44	38	85
Other	2,036	1,993	2,004	1,726	1,871	1,955	1,223	1,848	1,708	1,774
Total	44,938	49,087	43,763	58,317	60,749	70,466	41,823	35,163	56,698	72,658
Value US\$/kg	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Waste & scrap	5	6	5	5	5	4	5	5	8	9
Sponge	11	11	9	10	10	10	10	10	10	11
Ingot	22	27	22	15	15	17	16	12	14	16
Powder	56	64	74	81	87	105	90	110	125	82
Wrought	41	35	35	36	38	36	40	28	25	35
Castings	68	51	82	145	98	116	120	166	179	135
Other	69	67	78	81	72	81	104	53	74	87
Average	15	14	15	14	14	14	16	15	13	14

SOURCE: USGS & BELL POTTER SECURITIES ESTIMATES

- **In 2023, the US exported around 38kt titanium metal commodities & components:** US exports are weighted to higher value commodity products (bar, rod, bloom, sheet) and wrought components.

Table 6 - USGS titanium metal export data

Volume	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Waste and scrap	4,605	6,856	9,723	9,454	11,860	15,021	14,083	10,371	8,612	9,706
Sponge	2,223	1,649	697	3,090	533	869	711	117	105	247
Ingot	4,868	5,611	7,717	9,007	10,592	7,256	3,699	2,594	3,629	5,107
Other unwrought	0	0	0	2,726	2,767	2,348	1,571	2,031	1,493	2,185
Bar, rod, profiles, wire	5,463	6,191	5,726	5,560	5,986	7,369	5,177	4,207	6,505	8,527
Bloom, sheet, bar, slab	2,422	2,586	3,091	3,480	2,601	1,330	1,544	1,702	1,789	2,420
Other wrought	11,500	10,380	10,063	10,908	11,306	12,140	8,040	6,187	8,520	9,415
Total	31,080	33,273	37,016	44,226	45,645	46,334	34,826	27,209	30,653	37,606
Value US\$/kg	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Waste and scrap	4	4	3	3	3	3	2	4	5	5
Sponge	13	10	8	9	8	7	6	16	12	10
Ingot	16	15	15	14	16	15	16	14	15	19
Other unwrought	0	0	0	24	29	31	30	12	21	27
Bar, rod, profiles, wire	46	46	46	46	46	47	50	51	51	57
Bloom, sheet, bar, slab	32	33	31	30	28	25	28	28	28	27
Other wrought	89	93	101	102	104	105	106	107	101	114
Average	48	44	41	39	40	41	37	38	45	49

SOURCE: USGS & BELL POTTER SECURITIES ESTIMATES

Scrap titanium markets

IPX will initially source its titanium feedstock as high quality titanium and titanium alloy scrap in the form of turnings, shavings and other manufacturing off-cuts from speciality metal recycling participants.

THE INCUMBENT TITANIUM SUPPLY CHAIN IS HIGHLY SCRAP GENERATIVE

The industry refers to this low yield of titanium components from primary titanium metal inputs in reference to a “buy-to-fly” ratio. In some aerospace applications, a buy-to-fly ratio of 8 to 1 is quoted, meaning for a final titanium component to be produced, around 8 times the weight of that component is required in the form of upstream titanium units (e.g. billet). The implication is a yield of 12.5% (1 divided by 8) or a manufacturing loss of 87.5%.

Titanium scrap is principally generated from:

- **The Kroll Process:** The incumbent means of titanium metal production is highly scrap generative; and
- **Subtractive manufacturing of titanium components:** The incumbent processes of manufacturing titanium components mostly involves extrusion, machining and material removal processes (i.e. subtractive manufacturing) from commodity titanium shapes.

US SCRAP MARKET EASILY ACCOMMODATES IPX’S FEED REQUIREMENTS

IPX’s initial Phase 2 production rates are expected to expand to 2,000tpa and we expect the company’s ambitions are to then expand materially above this level. The US titanium scrap market is large enough to provide feed for the Phase 2 project and expanded production levels.

- In 2023, the US imported 27,026t scrap titanium; and
- The USGS estimates that in 2018 (the USGS has since reduced its disclosure of US titanium markets), US scrap titanium consumption was over 52ktpa.

Titan Project: Strategic upstream position

Largest Ti, RE & Mineral Sands deposit in US

The Titan Project is the largest JORC-compliant mineral resource of titanium, rare earth and zircon mineral sands in the US. The project covers approximately 11,062 acres of surface and associated mineral rights in Tennessee, of which approximately 1,486 acres are IPX-owned and approximately 9,576 acres are subject to exclusive purchase option agreements.

In mid-2022, IPX completed a Scoping Study which highlighted simple, low-impact, low-cost and sustainable mineral extraction from the near-surface mineral sand hosted deposit.

In August 2023, IPX announced that the Tennessee Department of Environment & Conservation had confirmed all regulatory requirements for the Titan Project and that it is fully permitted for development and operations.

IPX sees the potential for the Titan Project to re-shore the USA's titanium mineral production. The Titan Project could be backward-integrated into IPX's HAMR and HSPT manufacturing aspirations through providing upstream rutile feedstock.

Project location & transport infrastructure

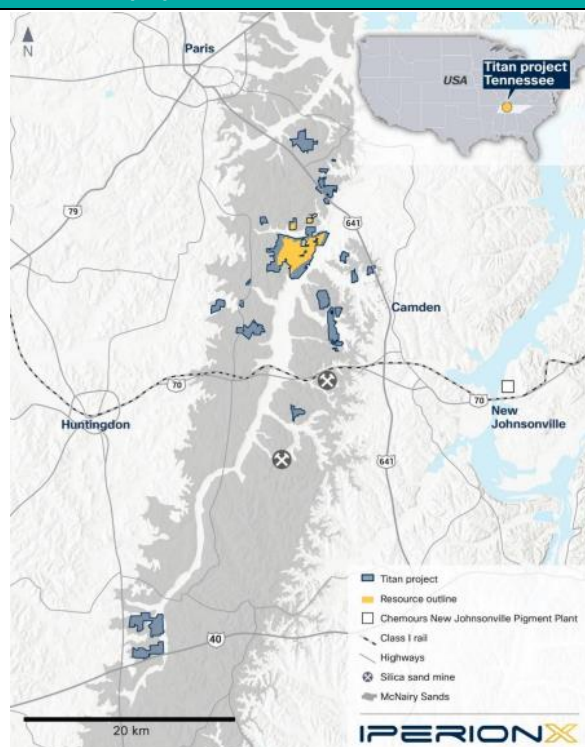
The Titan Project is located near Camden (Tennessee), approximately 80 miles west of Nashville. This location has ready access to power and logistics infrastructure (road, rail, river, power) and skilled labour. The Titan Project is also strategically located close to significant manufacturing capacity, including the Chemours facility in New Johnsonville, one of the world's largest producers of titanium dioxide.

Figure 8 - Titan Project location



Figure 7: Titan Project location and proximity to major transportation infrastructure.

Figure 9 - Titan project location



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Mineral Resource Estimate

Table 7 - The Titan Project Mineral Resource Estimate

Oct 21 Mineral Resources Estimate	Cut off Grade	Material Tonnes	THM Grade	THM Tonnes	THM assemblage				
					Zircon	Rutile	Ilmenite	REE	Staurolite
Mineral Resource Category	(THM %)	(Mt)	(%)	(Mt)	(%)	(%)	(%)	(%)	(%)
Indicated	0.4	241	2.2	5.3	11.3	9.3	39.7	2.1	15.6
Inferred	0.4	190	2.2	4.2	11.7	9.7	41.2	2.2	13.7
Total	0.4	431	2.2	9.5	11.5	9.5	40.3	2.1	14.8

SOURCE: COMPANY DATA

Scoping Study highlights US\$692m project NPV

Key June 2022 Scoping Study metrics included after-tax NPV of US\$692m, life of mine average annual EBITDA of US\$117m, and an after-tax IRR of 40%. The development capital cost was estimated at US\$237m implying a payback period of 1.9 years. The following table summarises the key scoping study high-level metrics.

Table 8 - Key scoping study metrics

	Unit	Value
Production		
Life of mine (LOM)	years	25
Mineralized resource mined	Mt	242.6
Annual average throughput	Mt/y	9.7
Annual average production – rare earth concentrate	t/y	4,650
Annual average production – rutile	t/y	16,700
Annual average production – ilmenite	t/y	95,500
Annual average production – premium zircon	t/y	22,400
Annual average production – zircon concentrate	t/y	16,100
Operating and Capital Costs		
Unit operating costs (incl. royalties & transport)	US\$/t ROM	6.91
Annual average operating costs (incl. royalties & transport)	US\$m/y	67
Total initial capital cost	US\$m	237
Direct capital cost	US\$m	158
Indirect capital cost	US\$m	30
Contingency (30%)	US\$m	49
NPV to capex cost ratio		2.9x
Financial Performance		
LOM revenue	US\$m	4,600
LOM EBITDA	US\$m	2,923
Annual average revenue	US\$m/y	184
Annual average EBITDA	US\$m/y	117
Payback from start of operations	Years	1.9
Project NPV (after tax, 8% discount rate)	US\$m	692

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Subsequent metallurgical testing

In August 2023, feasibility study metallurgical test work conducted by Mineral Technologies Ltd confirmed that the Titan Project can produce high quality titanium, rare earths and zircon materials with conventional processing and high recoveries. Recoveries of highly valuable rutile, rare earths and zircon minerals were materially above the June 2022 Scoping Study assumptions.

Table 9 - Comparison of Feasibility Study recoveries vs Scoping Study assumption

Product	Scoping Study Recovery	Feasibility Study Recovery
Rare Earths	77%	83%
Rutile - Titanium	62%	67%
Ilmenite - Titanium	84%	80%
Premium Zircon	69%	78%

SOURCE: COMPANY DATA

Strategic & offtake partners being considered

Multiple strategic partners have commenced due diligence on the Titan Project in preparation for sales offtake agreements and project investment opportunities. One of these parties – a large Japanese conglomerate –sole funded a bulk sample and due diligence test work at the Titan Project in September 2023. IPX is also in discussions with several other Japanese parties that have expressed interest in sales, marketing, and investment proposals focused on the offtake of titanium and rare earth minerals.

IperionX (IPX) company summary

Company description

IPX is commercialising novel titanium production technologies which have the potential to disrupt the current global titanium supply chain. The technologies: HAMR (Hydrogen Assisted Metallothermic Reduction) converts titanium scrap or minerals into high spec titanium powders; and HSPT (Hydrogen Sintering & Phase Transformation) converts titanium powders to high-end titanium components. These technologies have materially lower production costs than incumbent forms of titanium production through lower energy consumption, reduced waste and lower carbon emissions. The IPX technologies are the result of more than a decade of R&D, principally at the University of Utah, and have been successfully demonstrated at industrial-scale pilot facilities.

In mid-2024, IPX will commission a 125tpa Phase 1 commercial titanium production facility in Virginia, USA. An expansion to 2,000tpa by 2026 (Phase 2) could generate +US\$120m EBITDA annually for a circa US\$70m capital investment.

The technologies address US security of supply concerns, with around 95% of the country's titanium metal currently sourced from imports (predominantly from Japan) and China and Russia accounting for more than 70% of global titanium production.

Investment view – Speculative Buy, Valuation \$3.70/sh

IPX has the potential to disrupt the incumbent titanium supply chain through materially lowering production costs and manufacturing waste. Large-scale production will commence this year, further de-risking the company's technologies and enabling IPX to progress commercial relationships with several high-profile aerospace, automotive, luxury goods and government end users. Our valuation is mostly supported by Phase 2 earnings using relatively conservative assumptions with respect to process margins. There is potential for IPX to rapidly scale Phase 2 and cement itself as a key supplier in the US and global titanium value chains.

Valuation assumptions

Components of our IPX valuation include:

- **Titanium Manufacturing Campus (TMC):** Risked financial model of IPX's Phase 1 2,000tpa facility in Virginia, USA.
- **Near-term upside (double Phase 2 capacity):** We expect that within 4 years, IPX could duplicate the Titanium Manufacturing Campus.
- **Titan project:** Risked financial model with production parameters consistent with the June 2022 Scoping Study, adjusted by Bell Potter Securities as a level of conservatism.

We assume dilution of a US\$40m equity raise by the end of 2024 to support the Phase 2 construction and ongoing research and development of the IPX technologies.

Appendix 1: Capital structure

Capital structure

IPX shares are listed in the Australian Securities Exchange, with American Depositary Shares (ADRs, 1-for-10 ordinary IPX shares) listed on the Nasdaq.

Table 10 - Capital structure

	A\$	US\$
Share price	\$2.00/sh	
Shares on issue	229m	
Market capitalisation	\$457m	\$298m
Net debt/(cash)	-\$27m	-\$17m
Enterprise value	\$431m	\$281m
Performance rights & options in the money	47m	
Shares on issue (diluted)	276m	-17%
Cash from options	\$5m	\$3m
Market capitalisation (diluted)	\$552m	\$360m
Net debt (diluted)	-\$31m	-\$20m
Enterprise value (diluted)	\$521m	\$340m

SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

PERFORMANCE SHARES EXCLUDED FROM CAPITAL STRUCTURE

IPX has 19,800,000 Class A and 19,800,000 Class B Performance Shares on issue. These performance shares relate to milestones associated with the Titan Project:

- Each Class A performance share will convert to one ordinary share upon completion of a positive pre-feasibility study for heavy mineral sands mining and processing on any of the Titan Project area which demonstrates a net present value of at least A\$200m before 17 September 2024.
- Each Class B performance share will convert into one ordinary share upon the commencement of commercial production from the Titan Project area before 17 September 2025.

Given IPX's current focus on the Titanium Manufacturing Campus, we do not expect that these performance shares will vest.

Major shareholders

Figure 10 - Substantial shareholders

Substantial shareholders	Shares	% of IPX held*
BNY Mellon Asset Management (ADR program)	27.1m	11.8%
Fidelity International Ltd	19.0m	8.3%
FMR LLC	16.8m	7.3%
DITM Holdings Pty Ltd	16.6m	7.3%
B. Riley Capital Management, LLC	16.6m	7.3%
Other	132.6m*	58.0%
Total	228.6m	100.0%

SOURCE: IPX 2023 ANNUAL REPORT
NOTE: * BASED ON CURRENT SHARES ON ISSUE

DITM Holdings Pty Ltd is an entity associated with IPX Executive Chairman Todd Hannigan.

Appendix 2: Board & management

Board of Directors

TODD HANNIGAN – EXECUTIVE CHAIRMAN

Todd Hannigan has over 25 years of global experience in natural resources as company founder, chief executive officer, private capital investor and non-executive director. In these lead roles Mr. Hannigan has helped build multiple companies in the private and public markets. Mr. Hannigan has worked internationally in the natural resources sector including for Piedmont Lithium Inc., Aston Resources, Hanson PLC and BHP Billiton. Mr. Hannigan holds a Bachelor of Engineering (Mining) from The University of Queensland and an MBA from INSEAD.

Mr. Hannigan was appointed Executive Chairman of the Company on May 24, 2021.

ANASTASIOS ARIMA – FOUNDER, CHIEF EXECUTIVE OFFICER & MANAGING DIRECTOR

Anastasios Arima has over 15 years of experience in founding and developing critical material companies in North America. Mr. Arima was a founder and director of Piedmont Lithium and was instrumental in the development of the company. Mr. Arima attended the University of Western Australia and earned a Bachelor of Commerce whilst studying for a Bachelor of Engineering.

Mr. Arima is a founder of IperionX and was appointed as Chief Executive Officer and Managing Director of the Company on March 1, 2021.

LORRAINE M. MARTIN – NON-EXECUTIVE DIRECTOR

Lorraine M. Martin is a director, President and CEO of the National Safety Council, serving in this position since June 2019. She is also co-founder and President of Pegasus Springs Foundation, a nonprofit organization focused on education and mentoring. In 2021, Ms. Martin was appointed to the Board of Directors of IperionX Limited. Ms. Martin is the retired Executive Vice President and Deputy of Rotary and Mission Systems (RMS) for Lockheed Martin Corporation, a global aerospace, defence, security and advance technologies company. Prior to RMS, Ms. Martin was Executive Vice President and General Manager for the F-35 Lightning II Program for Lockheed Martin Aeronautics Company. Her leadership of the F-35 program earned Pentagon recognition for reducing program costs while increasing production and fielding more aircraft worldwide. She joined Lockheed Martin in 1988 and during her tenure, held a variety of high visibility leadership positions across the corporation. Prior to joining Lockheed Martin, she served as an officer in the U.S. Air Force, holding various leadership positions for software intensive technology and development programs. She has a Master of Science degree in Computer Science from Boston University and a Bachelor of Arts degree in Computational Mathematics from DePauw University.

Ms. Martin was appointed as Non-Executive Director of the Company on September 13, 2021.

Continued over page...

VAUGHN TAYLOR – NON-EXECUTIVE DIRECTOR

Vaughn Taylor has been a Non-Executive Director of IperionX since March 2021. Mr. Taylor previously served as Executive Director and Chief Investment Officer of AMB Capital Partners, or AMB, the global investment platform of the Bennett Family. Mr. Taylor was at AMB since the formation of the investment platform in 2010, and was responsible for executing on the investment strategy, expanding the investment portfolio into international markets and sourcing new investment opportunities. Mr. Taylor is also currently a board member of international companies including Chairman of Alta, Urban Rest, and Frontier Pets. Mr. Taylor holds a Bachelor of Business (Accounting) and a Master of Business (Real Estate) from RMIT University. Mr. Taylor also holds a Graduate Diploma in Applied Finance and Investment from Financial Service Professional Body, FINSIA, and is a member of FINSIA and the Australian Institute of Company Directors.

Mr. Taylor was appointed as Non-Executive Director of the Company on March 3, 2021.

MELISSA G. WALLER – NON-EXECUTIVE DIRECTOR

Melissa G. Waller has over 30 years' experience as a senior finance executive and is President for the AIF Institute, providing essential education, research and resources to investors and investment firms globally with over US\$50 trillion assets under management. Ms. Waller is the former Deputy Treasurer and Chief of Staff for the North Carolina Department of State Treasury, where she successfully oversaw Department strategic planning, operations, and public-policy implementation, along with a staff of more than 400 employees, including the North Carolina Retirement Systems, the pension fund for the state and the tenth largest public pension fund in the United States, with assets in excess of US\$90 billion. Ms. Waller has served as Chair of the Department's Corporate Governance Committee, as well as on the Council of Institutional Investors Board of Directors and the Governor's Board of Innovation for the North Carolina University System. She currently serves as Executive Program Director for the National Institute of Public Finance, as well as Director of Public and Private Partnerships for the Kenan Institute. Ms. Waller has a bachelor's degree in journalism and mass communications from the University of North Carolina.

Ms. Waller was appointed as Non-Executive Director of the Company on September 13, 2021.

BEVERLY M. WYSE – NON-EXECUTIVE DIRECTOR

Beverly M. Wyse worked for over 30 years at Boeing, most recently as President of Shared Services, a multi-billion dollar operating group. In that role, she refocused and restructured the organization and also delivered improved efficiency and performance. Previously, she was Vice-President & General Manager of Boeing South Carolina, a major manufacturing, assembly and delivery site for Boeing where she led the team through successful production rate increases, major improvements in workforce relations and significant reductions in operating costs. Throughout her extensive career at Boeing, Ms. Wyse also successfully led the 737, 767 and 787 Charleston programs. Ms. Wyse holds an MBA and a B.Sc. in Mechanical Engineering from the University of Washington. She's also the Chair of the Board of Trustees of the Franklin W. Olin College of Engineering

Ms. Wyse was appointed as Non-Executive Director of the Company on September 13, 2021.

SOURCE: IPX WEBSITE

Key management

TOBY SYMONDS – PRESIDENT & CHIEF STRATEGY OFFICER

Toby Symonds has over 30 years of experience in finance and asset management. This includes advisory board roles across private equity and real estate investment firms and executive leadership positions within global hedge fund firms and investment banking firms based in London, New York and San Francisco. Mr. Symonds has core competencies in capital markets, corporate strategy, product development, business development, management information systems and project and team management. Mr. Symonds graduated from North Carolina State University with a B.A. degree in Political Science.

Mr. Symonds was appointed as President & Chief Strategy Officer of the Company effective on September 1, 2021.

SCOTT SPARKS – CO-FOUNDER & CHIEF OPERATING OFFICER

Scott Sparks brings more than 30 years of experience as an engineer and senior executive to the design, construction, and operations of industrial plant facilities in the critical resources industry. He has been a founder and senior management team member at several companies, most recently at Performance Industries, a construction and contract operations firm in West Virginia and at DRA Taggart, a Pennsylvania-based provider of construction and engineering services to the resources industry. Mr. Sparks earned a B.S. degree in Mining Engineering from West Virginia Institute of Technology.

Mr. Sparks was appointed as Chief Operating Officer of the Company effective on September 1, 2022.

DOMINIC ALLEN – CHIEF COMMERCIAL OFFICER

Dominic Allen is a Chartered Accountant with over 15 years commercial experience, previously holding senior roles with major international natural resource organizations Rio Tinto Limited, Oyu Tolgoi LLC and Sovereign Metals Limited. Dominic commenced his career with Ernst & Young Transaction Advisory Services focused on natural resource transactions in Australia and internationally. Dominic holds a Bachelor of Commerce and a Bachelor of Science (Hons) from the University of Western Australia and is a member of the Institute of Chartered Accountants in Australia and New Zealand.

Mr. Allen was appointed as Chief Development Officer, and subsequently Chief Commercial Officer of the Company on 1 December 2020.

JEANNE MCMULLIN – CHIEF LEGAL OFFICER

Jeanne McMullin is a corporate attorney and business executive with over 25 years' experience advising early and growth stage companies on legal, commercial, operational, and regulatory matters. Ms. McMullin has held senior legal and operational roles at Twist Capital, a technology investment firm in Los Angeles and at Colchester Global Investors, a global bond manager in London. Ms. McMullin has a JD from the University of Pennsylvania Law School and a BA with honors from Brown University. She is a member of the New York bar.

Ms. McMullin was appointed as Chief Legal Officer of the Company effective on December 6, 2021.

SOURCE: IPX WEBSITE

MARCELA CASTRO – CHIEF FINANCIAL OFFICER

Marcela Castro is an experienced finance professional with over 25 years' experience in global finance leadership for companies across multiple industries, including green technology, manufacturing, mining and industrial and consumer products. Ms. Castro has expertise in U.S. public company accounting, financial analysis and strategic planning. Ms. Castro started her career at Arthur Andersen and progressed across international finance roles with Colgate-Palmolive, Jaguar Mining, the Rev Group and Proterra Inc. Ms. Castro holds a Bachelor of Business Administration with Pontificia Universidade Catolica and an Executive MBA with IBMEC.

Ms. Castro was appointed as Chief Financial Officer of the Company effective on December 21, 2023.

GREGORY SWAN – COMPANY SECRETARY

Gregory Swan is a Chartered Accountant with over 15 years' experience in the formation and development of publicly listed natural resources companies. He currently serves as Chief Financial Officer and/or Company Secretary for several listed companies that operate in the resources sector. He commenced his career at a large international Chartered Accounting firm and has since been involved with a number of extraction exploration and development companies, including Piedmont Lithium Inc. (ASX:PLL, not rated), Mantra Resources Limited (ASX:MRU, not rated) and Papillon Resources Limited (ASX:PIR, not rated). Mr. Swan holds a Bachelor of Commerce from the University of Western Australia and is a Member of the Chartered Accountants Australia and New Zealand, a Fellow of the Governance Institute of Australia, and a Fellow of the Financial Services Institute of Australasia. Mr. Swan was appointed as Company Secretary of the Company on December 16, 2020.

SOURCE: IPX WEBSITE

Appendix 3: Company timeline

IPX HAMR & HSPT news flow

- **February 2021** – Hyperion (now IPX) sign a research agreement and option for exclusive license to develop titanium metal powders using Hydrogen Assisted Metallurgical Reduction (HAMR) technology invented by Dr. Zak Fang and his team at the University of Utah.
- **June 2021** – Hyperion (now IPX) secures exclusive rights to the patented Granulation-Sintering-Deoxygenation (GSD) technology developed by Dr. Zak Fang.
- **July 2021** – Hyperion to collaborate with global 3D printing leader EOS GmbH.
- **October 2021** – Hyperion executes one year option in exchange for US\$250,000 to acquire Blacksand Technology (Blacksand), the entity with ownership of the core titanium intellectual property associated with Dr. Zak Fang and the University of Utah. Blacksand has developed and commissioned a titanium metal powder production facility in Salt Lake City, Utah currently producing titanium powder for commercial qualification.
- **March 2022** – IPX successfully scales titanium metal powder production at its Titanium Pilot Facility in Salt Lake City, Utah. IPX accelerates plans to develop a Titanium Demonstration Facility (TDF) with an initial target capacity of ~125 tonnes per annum by the end of 2022.
- **August 2022** – IPX develops innovative low carbon titanium mineral enrichment technology that upgrades lower content titanium dioxide ilmenite minerals into a high titanium synthetic rutile product.
- **August 2022** – IPX applies patented technologies to produce the first low-carbon spherical titanium, aluminium and vanadium alloy powder using titanium minerals from the Titan Project (100% IPX) in Tennessee as feedstock.
- **August 2022** – IPX and Panerai, a maison of Richemont (SWX: CFR), sign a commercial partnership agreement to produce luxury, sustainable, Panerai watches using IPX titanium technologies.
- **September 2022** – IPX announce that Halifax County, Virginia, is the preferred location for the development of its first commercial scale 100% recycled, low carbon titanium metal powder production facility.
- **December 2022** – IPX has extend the purchase and license option agreements over the patented 'titanium technologies' from Blacksand. The revised agreement extends the option expiry date by two years to 31 December 2024.
- **February 2023** – IPX announce that it has partnered with Carver Pump (Carver) to use IPX's patented and award-winning titanium technologies to additively manufacture titanium pump components for the U.S. Navy.
- **March 2023** – IPX and 3D printing technology leader SLM Solutions announce a strategic MoU for the potential supply of spherical titanium powders.
- **April 2023** – IPX releases life cycle assessment (LCA) of 100% recycled titanium powder. The LCA estimates a carbon footprint 90% lower than competing titanium powders and 80% lower than titanium ingot produced from the Kroll process.
- **April 2023** – Final engineering and design for the 125tpa production facility in Virginia is nearly complete, and first titanium powder production is target for Q1 2024.
- **April 2023** – IPX plans to build world's largest 100% recycled titanium metal powder facility by 2025. Once the Virginia production facility operational, there are defined plans for a simple modular expansion to capacity of 1,125 tpa in 2025.

- **June 2023** – IPX has agreed a Scope of Work (SoW) for the supply of titanium metal components for Ford Motor Company (NYSE: F).
- **July 2023** – IPX and Aperam Recycling (Aperam) through its American entity ELG Utica Alloys (ELG) partner to create 100% recycled titanium supply chain. ELG will supply clean titanium scrap metal and IPX will use its patented titanium processing technologies to produce low-carbon titanium metal for a more sustainable and fully circular supply chain.
- **July 2023** – IPX receives key permits for titanium metal production in Virginia.
- **August 2023** – IPX to produce titanium plate for testing by Lockheed Martin
- **October 2023** – IPX has agreed an order with GKN Aerospace for the delivery of titanium plate test components manufactured with IPX's advanced titanium technologies.
- **November 2023** – IPX receives US\$12.7m US Department of Defence grant for domestic titanium production.

Project Titan news flow

- **September 2020** – TAO Commodities announces it has entered into an option to acquire 100% of Hyperion Metals Pty Ltd which holds a 100% interest over the Titan Project.
- **October 2020** – Titan Project drilling program commences for exploration of titanium and zircon rich mineral sands.
- **December 2020** – TAO complete 100% acquisition of Hyperion Metals.
- **January 2021** – Maiden drill results confirm potential for a thick, high grade U.S. titanium & zircon deposit.
- **May 2021** – Hyperion announces the commencement of a scoping study on the Titan Project.
- **October 2021** – The Titan Project's maiden Mineral Resource Estimate (MRE) establishes it as the largest titanium, zircon and rare earth minerals project in the USA.
- **June 2022** – IPX announces positive results of the Scoping Study at the Titan Project. The Scoping Study results demonstrate the Project's potential to be a sustainable, low cost and globally significant North American producer of titanium, rare earths and other critical minerals needed for a low carbon future.
- **August 2022** – IPX produces titanium metal sourced from the Titan Project.
- **September 2021** – IPX successfully commissions Stage 2 of its Mineral Demonstration Facility (MDF) at the Titan Project.
- **August 2023** – IPX confirms the Titan Project is fully permitted for development and operations. IPX also announces positive results of the feasibility study metallurgical test work results.

Appendix 4: Incumbent Ti technologies

The following hyperlink is for an animated video outlining the Kroll and Vacuum Arc Remelting processes currently used in titanium production. The video highlights that the Kroll and VAR processes are energy intensive, chemically intensive (high process reagent consumption) and are extremely waste generative.

YouTube video: [Titanium: Kroll Method](#) (Innovations in Manufacturing at ORNL – US Department of Energy – Oak Ridge National Laboratory).

Kroll Process for primary titanium metal production

The Kroll Process is a high temperature, slow batch process. Kroll requires high-quality titanium mineral feedstock (rutile) and uses chlorine gas and coke to produce titanium tetrachloride (TiCl_4) with direct carbon emissions. The TiCl_4 is then reduced by molten magnesium metal under high temperature to produce titanium sponge and byproduct MgCl_2 .

Kroll Process steps:

1. TiO_2 and coke are mixed and continuously fed into a fluidized bed chlorinator, and reacted with chlorine gas. The temperature of the chlorinator is maintained at or above $1,000^\circ\text{C}$ and high temperature TiCl_4 gas is produced.
2. The high temperature TiCl_4 gas is then cooled, precipitating impurities which are removed as solid wastes (iron chlorides). The TiCl_4 is condensed and separated from the non-condensable gases and recovered as liquid (crude TiCl_4).
3. The crude TiCl_4 is further purified to produce refined TiCl_4 prior to Mg reduction.
4. Purified TiCl_4 is fed into a reactor with molten Mg at 800°C to 900°C . The Mg reduces TiCl_4 to Ti as titanium sponge, and MgCl_2 forms. The reduction of an 8-tonne batch takes around four days.
5. The titanium sponge with retained residual MgCl_2 and Mg is vacuum distilled by heating to around $1,000^\circ\text{C}$ for four days. Vacuum distillation removes the residual Mg, MgCl_2 and other volatile species. The distillation process can be nearly 70% of the total energy consumption of the entire Kroll process.
6. The titanium sponge is then cooled to room temperature, taking around four days.
7. The cooled titanium sponge is then sheared to separate its high-grade core, the offcuts are lower-purity scrap waste.

There is a significant amount of off-grade titanium sponge generated in the Kroll process, accounting for 10-16% of initial titanium feedstock units. Titanium sponge with slight iron contamination can be used as a raw material for the production of alloy ingots. However, higher concentrations of iron are difficult to dilute and homogenize.

The U.S. Department of Energy estimates that 2.7t of titanium feedstock is required to yield one tonne of high-grade titanium with the Kroll process.

Vacuum Arc Remelting (VAR) of titanium sponge & scrap

VAR is a high temperature ($1,850^\circ\text{C}$) process where the high-purity titanium sponge, titanium scrap and alloying elements are mechanically compacted and then welded into a cylindrical electrode. The VAR process is repeated two to three times to ensure homogenous chemical composition of the electrode. The electrode is then remelted in a vacuum to form an ingot.

It is estimated that around 7-25% of the primary titanium metal used in the VAR process is lost to low-grade scrap (i.e. a yield of 75-93%).

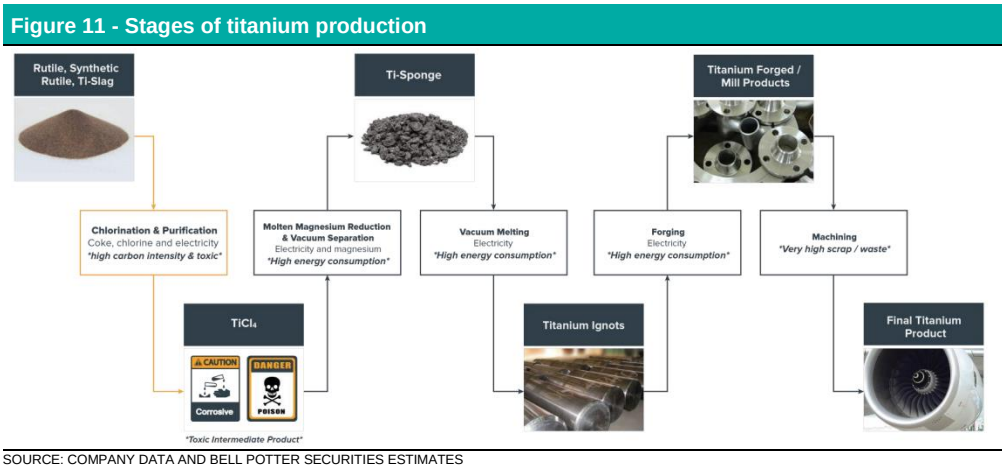
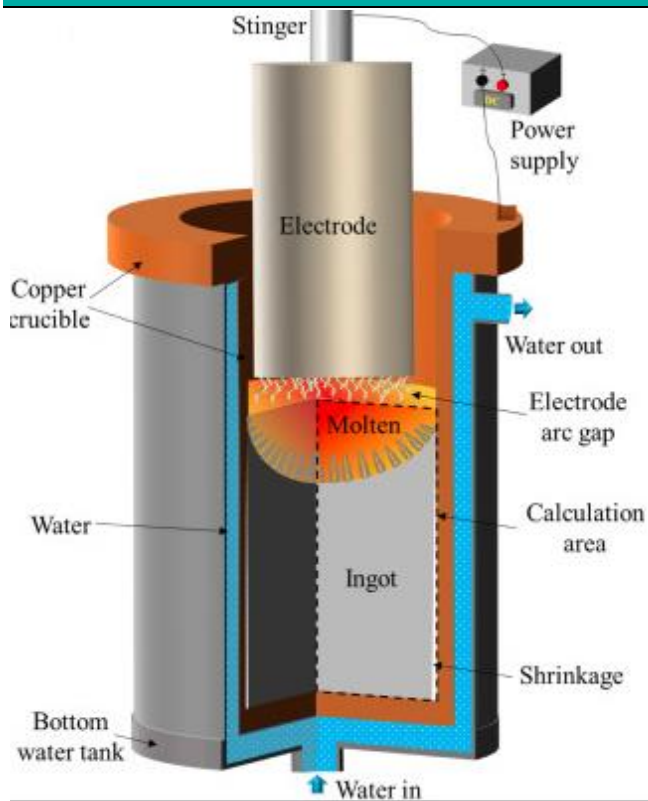


Figure 12 - VAR furnace



SOURCE: JOURNAL OF MATERIALS RESEARCH AND TECHNOLOGY

Figure 13 - Titanium sponge (top) & Ingot (bottom)



SOURCE: COMPANY DATA AND BELL POTTER SECURITIES ESTIMATES

Appendix 5: Incumbent Ti producers

VSMPO-AVISM Corporation (Russia): Market cap ~RUB\$437.9b, 1HFY23 revenue RUB\$54.373b, ~44,000t/y of titanium sponge production

VSMPO-AVISMA Corporation is the world's largest producer of titanium metal (~25% of the global titanium market). The company 1993 and is headquartered in Verkhnyaya Salda, Russia.

Toho Titanium (Japan): Market cap ~Y116.24b, FY23 revenue Y80.4b, titanium sponge capacity of more than 40,000 t/y as of May 2023

Toho is a Japan-based company mainly engaged in the metallic titanium business. The Company operates through two business segments. The Metallic Titanium segment manufactures sponge titanium, titanium ingot and high purity titanium. The Functional Chemicals segment manufactures propylene polymerization catalysts, ultrafine nickel, high-purity titanium oxide, and other products.

Osaka Titanium (Japan): Market cap ~Y96.97b, 1HFY23 revenue Y27.0b, production of 40,000t/y as of 2018.

OSAKA Titanium technologies' predecessor, Osaka Titanium Co., Ltd., became Japan's first successful industrialized titanium company in 1952 and remains the country's pioneer in titanium sponge production. The Company produces titanium and polycrystalline silicon supplying primarily the aerospace and electronics industries.

UKTMP (Kazakhstan): Revenue US\$169.027m, 26,000t/y of production at 2018

UKTMP JSC is one of the world's largest vertically integrated industrial enterprises and includes all technological steps from the extraction of raw materials to the production of finished products. Kazakhstani titanium occupies 11% of the world market. The partners of UKTMP JSC are such companies as Boeing, Airbus, Nippon Steel, SNECMA, General Electric and many others.

ATI Materials (USA): Market cap ~ US\$6.344b, FY23 revenue of US\$4.2b

ATI Specialty Metals is a metal production firm engaged in the production of titanium and titanium alloys. The company was incorporated in 1901 and is headquartered Dallas, Texas.

TIMET (USA): FY22 revenue approximately US\$1.3b

The Titanium Metal Corporation is a US-based metal manufacturing company. It is one of the key global suppliers and manufacturers of titanium metal and its alloys. TIMET is headquartered Texas, USA, and was incorporated in 1950. Since 1950, TIMET has been leading the industry in mill and melted products, supplying nearly one-fifth of the world's titanium. Timet is the only supplier with production facilities in both the United States and Europe.

Baoji Titanium (China): Market Cap CNY12.78b, FY22 revenue was CNY6.6b

Baoji Titanium Industry Co., Ltd.(stock code: 600456) was founded on 1999 and was the first company in the titanium on the Shanghai Stock Exchange. Baoji Titanium Industry is building the largest titanium manufacturing and development base in China.

Howmet (USA): Market cap ~ US\$28.22b, FY23 revenue US\$6.6b

Howmet Aerospace is a manufacturer of high-performance advanced engineered solutions for the aerospace, defence, and transportation markets.

Tronox Incorporated (USA): Market cap ~US\$2.35b, FY23 revenue US\$2.85b

Tronox Holdings plc is one of the world's leading producers of high-quality titanium products, including titanium dioxide pigment, specialty-grade titanium dioxide products and high-purity titanium chemicals, and zircon. Tronox mine titanium-bearing mineral sands and operate upgrading facilities that produce high-grade titanium feedstock materials, pig iron and other minerals, including the rare earth-bearing mineral, monazite.

Investment risks

Risks

Risk to energy sector equities include, but are not limited to:

- **Commodity price and exchange rate fluctuations.** The future earnings and valuations of exploration, development and operating energy and industrial development assets and companies are subject to fluctuations in underlying commodity prices (energy and other) and foreign currency exchange rates.
- **Technology risks.** Companies commercialising novel technologies are subject to risks associated with successfully scaling up production rates to commercial levels.
- **Infrastructure access.** Projects are reliant upon access to energy and logistics infrastructure. Access to infrastructure is often subject to contractual agreements, permits and capacity allocations. Agreements are typically long-term in nature. Infrastructure can be subject to outages as a result of weather events or the actions of third-party providers.
- **Operating and capital cost fluctuations.** Markets for key process inputs can fluctuate and cause significant differences between planned and actual operating and capital costs. Key operating costs are linked to energy, building/construction materials and labour markets. Resource development companies are also exposed to costs associated with future land rehabilitation.
- **Reserve and Resource risks.** Future earnings forecasts and valuations rely on accuracy of Mineral Resource and Reserve estimation, the ability to extract the underlying Reserve and the potential for Reserve life extensions.
- **Sovereign risks.** Assets are subject to the sovereign risk of the country and state of location and may also be exposed to the sovereign risks of major offtake customers.
- **Regulatory changes.** Changes to the regulation of infrastructure, taxation, carbon abatement and environmental management (among other things) can impact the earnings and valuations of energy companies.
- **Environmental risks.** Assets are exposed to risks associated with environmental degradation as a result of operations.
- **Operating and development risks.** Companies are subject to risks associated with their operation and development. Development assets can be subject to approvals timelines or weather events, causing delays to commissioning and commercial production.
- **Occupational health and safety (OH&S) risks.** Mineral and industrial development companies are exposed to OH&S risks.
- **Funding and capital management risks.** Funding and capital management risks can include access to debt and equity finance, maintaining covenants on debt finance, managing dividend payments and managing debt repayments.
- **Merger/acquisition risks.** Risks associated with value transferred during merger and acquisition activity.
- **Impact of pandemic infection such as Coronavirus disease (COVID-19):** This may have an adverse impact on the macro economic factors and labour availability.

IperionX Ltd

as at 19 March 2024

Recommendation

Buy, Speculative

Price

\$2.00

Valuation

\$3.70

Table 11 - Financial summary

Date	19/03/24					Bell Potter Securities									
Price	AS/sh	2.00					Stuart Howe (showe@bellpotter.com.au, +61 3 9235 1856)								
Valuation	AS/sh	3.70													
PROFIT AND LOSS							FINANCIAL RATIOS								
Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e	Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e
Revenue		US\$m	-	-	7	21	146	VALUATION							
Expenses		US\$m	(17)	(19)	(21)	(26)	(71)	EPS (adjusted)		Ac/sh	(15.4)	(14.7)	(11.9)	(12.7)	20.0
EBITDA		US\$m	(17)	(19)	(13)	(5)	75	EPS growth (Acps)		%	na	na	na	na	na
Depreciation & amortisation		US\$m	(0)	(2)	(7)	(15)	(14)	PER		x	-13.0x	-13.6x	-16.9x	-15.7x	10.0x
EBIT		US\$m	(18)	(21)	(21)	(20)	60	DPS		Ac/sh	-	-	-	-	-
Net interest expense		US\$m	0	0	0	(3)	(4)	Franking		%	0%	0%	0%	0%	0%
Profit before tax		US\$m	(17)	(21)	(20)	(22)	57	Yield		%	0%	0%	0%	0%	0%
Tax expense		US\$m	-	-	(0)	(1)	(20)	FCF/share		Ac/sh	(19.1)	(11.3)	(45.9)	(16.7)	19.4
NPAT (reported)		US\$m	(17)	(21)	(21)	(23)	37	FCF yield		%	-10%	-6%	-23%	-8%	10%
Adjustments		US\$m	-	-	-	-	-	EV/EBITDA		x	-16.1x	-14.5x	-21.0x	-57.9x	3.8x
NPAT (adjusted)		US\$m	(17)	(21)	(21)	(23)	37	LIQUIDITY & LEVERAGE							
							Net debt / (cash)		US\$m	(12)	(13)	29	59	24	
							Net debt / Equity		%	-20%	-16%	24%	50%	20%	
							Net debt / Net debt + Equity		%	-25%	-20%	20%	34%	17%	
							Net debt / EBITDA		x	0.7x	0.7x	-2.1x	-12.2x	0.3x	
							EBITDA / net int expense		x	42.9x	60.1x	167.9x	-1.7x	20.5x	
							PROFITABILITY RATIOS								
							EBITDA margin		%	0%	0%	0%	0%	0%	0%
							EBIT margin		%	0%	0%	0%	0%	0%	0%
							Return on assets		%	-107%	-63%	-28%	-22%	29%	
							Return on equity		%	-125%	-88%	-54%	-60%	81%	
ASSUMPTIONS - Prices (nominal)															
Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e	Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e
Titanium scrap		US\$/kg	12	12	12	12	12	Titanium scrap		US\$/kg	12	12	12	12	12
Titanium spherical powder		US\$/kg	129	129	129	129	129	Titanium spherical powder		US\$/kg	129	129	129	129	129
Titanium angular powder		US\$/kg	86	86	86	86	86	Titanium angular powder		US\$/kg	86	86	86	86	86
IPX value-added basket price		US\$/kg	125	125	125	125	125	IPX value-added basket price		US\$/kg	125	125	125	125	125
Sales															
Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e	Year ending 30 June		Unit	2023a	2024e	2025e	2026e	2027e
Sales - Titanium spherical powder		t	-	-	4	11	75	Sales - Titanium spherical powder		t	-	-	4	11	75
Sales - Titanium angular powder		t	-	-	78	151	1,069	Sales - Titanium angular powder		t	-	-	78	151	1,069
Sales - Total titanium powder		t	-	-	83	162	1,144	Sales - Total titanium powder		t	-	-	83	162	1,144
Sales - Value added product		t	-	-	-	50	356	Sales - Value added product		t	-	-	-	50	356
Sales - Total titanium product		t	-	-	83	213	1,500	Sales - Total titanium product		t	-	-	83	213	1,500
Revenue		US\$m	-	-	7	21	146	Revenue		US\$m	-	-	7	21	146
Costs		US\$m	-	-	(3)	(8)	(53)	Costs		US\$m	-	-	(3)	(8)	(53)
EBITDA		US\$m	-	-	5	13	93	EBITDA		US\$m	-	-	5	13	93
Revenue		US\$/kg	-	-	88	97	97	Revenue		US\$/kg	-	-	88	97	97
Costs		US\$/kg	-	-	(32)	(36)	(36)	Costs		US\$/kg	-	-	(32)	(36)	(36)
EBITDA		US\$/kg	-	-	56	62	62	EBITDA		US\$/kg	-	-	56	62	62
Valuation															
		Valuation	100% basis		IPX	IPX share	unrisked	Risk	IPX share						
			US\$m		%	US\$m	disc	%	US\$m						
Titanium Manufacturing Campus (Phase 2)		844	100%		844	45%	45%		464						
TMC near-term upside (double Phase 2 capacity)		620	100%		620	75%	75%		155						
Titan Project		300	100%		300	50%	50%		150						
Other									38						
Total projects									808						
Corporate overhead assumption									(63)						
Enterprise value									745						
Net (debt)/cash									17						
Options in the money									3						
Equity value (diluted)									765						
Diluted shares on issue m									276						
Equity value (diluted) US\$/sh									2.78						
FX (long run estimate) US\$/A\$									0.70						
Equity value (diluted) A\$/sh									4.00						
Assumed capital raise US\$m					40										
Assumed raise price A\$/sh					1.70										
Assumed new shares issued					36										
Assumed diluted shares on issue post raise					312										
Post-raise assumptions															
Net (debt)/cash														57	
Options in the money US\$m														3	
Equity value (diluted, after capital raise)														805	
Equity value (diluted, after capital raise) US\$/sh														2.58	
FX (long run estimate) US\$/A\$														0.70	
Equity value (diluted, after capital raise) A\$/sh														3.70	

Recommendation structure

Buy: Expect >15% total return on a 12 month view. For stocks regarded as 'Speculative' a return of >30% is expected.

Hold: Expect total return between -5% and 15% on a 12 month view

Sell: Expect <-5% total return on a 12 month view

Speculative Investments are either start-up enterprises with nil or only prospective operations or recently commenced operations with only forecast cash flows, or companies that have commenced operations or have been in operation for some time but have only forecast cash flows and/or a stressed balance sheet.

Such investments may carry an exceptionally high level of capital risk and volatility of returns.

Research Team

Staff Member	Title/Sector	Phone	@bellpotter.com.au
Chris Savage	Head of Research/Industrials	612 8224 2835	csavage
Analysts			
John Hester	Healthcare	612 8224 2871	jhester
Martyn Jacobs	Healthcare	613 9235 1683	mjacobs
Thomas Wakim	Healthcare	612 8224 2815	twakim
Michael Ardrey	Industrials	613 9256 8782	mardrey
Marcus Barnard	Industrials	618 9326 7673	mbarnard
Sam Brandwood	Industrials	612 8224 2850	sbrandwood
Olivia Hagglund	Industrials	612 8224 2813	ohagglund
Joseph House	Industrials	613 9325 1624	jhouse
Daniel Laing	Industrials	612 8224 2886	dlaing
Hayden Nicholson	Industrials	613 92351757	hnicholson
Chami Ratnapala	Industrials	612 8224 2845	cratnapala
Jonathan Snape	Industrials	613 9235 1601	jsnape
Connor Eldridge	Real Estate	612 8224 2893	celdridge
Andy MacFarlane	Real Estate	612 8224 2843	amacfarlane
Regan Burrows	Resources	618 9236 7677	rburrows
David Coates	Resources	612 8224 2887	dcoates
Stuart Howe	Resources	613 9325 1856	showe
Brad Watson	Resources	618 9326 7672	bwatson
James Williamson	Resources	613 9235 1692	jwilliamson
Associates			
Leo Armati	Associate Analyst	612 8224 2846	larmati
Baxter Kirk	Associate Analyst	613 9235 1625	bkirk
Kion Sapountzis	Associate Analyst	613 9235 1824	ksapountzis
Ritesh Varma	Associate Analyst	613 9235 1658	rvarma

Research Coverage & Policies

For Bell Potter Securities' Research Coverage Decision Making Process and Research Independence Policy please refer to our company website: <https://bellpotter.com.au/research-independence-policy/>.

Authoring Research Analyst's Certification

The Authoring Research Analyst is responsible for the content of this Research Report, and, certifies that with respect to each security that the Analyst covered in this Report (1) all the views expressed accurately reflect the Analyst's personal views about those securities and were prepared in an independent manner and (2) no part of the Analyst's compensation was, is or will be, directly or indirectly, related to specific recommendations or views expressed by that Research Analyst in the Research Report.

Research Analyst's Compensation

Research Analyst's compensation is determined by Bell Potter Securities Research Management and Bell Potter Securities' Senior Management and is based upon activities and services intended to benefit the investor clients of Bell Potter Securities Ltd. Compensation is not linked to specific transactions or recommendations. Like all Company employees Research Analysts receive compensation that is impacted by overall Company profitability.

Prices

The Price appearing in the Recommendation panel on page 1 of the Research Report is the Closing Price on the Date of the Research Report (appearing in the top right hand corner of page 1 of the Research Report), unless a before midday (am) time appears below the Date of the Research Report in which case the Price appearing in the Recommendation panel will be the Closing Price on the business day prior to the Date of the Research Report.

Availability

The completion and first dissemination of a Recommendation made within a Research Report are shortly after the close of the Market on the Date of the Research Report, unless a before midday (am) time appears below the Date of the Research Report in which case the Research Report will be completed and first disseminated shortly after that am time.

Disclosure: Bell Potter Securities acted as Lead Manager to IPX's US\$16.7m equity placement in November 2023 and received fees for that service.

Dissemination

Bell Potter generally disseminates its Research to the Company's Institutional and Private Clients via both proprietary and non-proprietary electronic distribution platforms. Certain Research may be disseminated only via the Company's proprietary distribution platforms; however such Research will not contain changes to earnings forecasts, target price, investment or risk rating or investment thesis or be otherwise inconsistent with the Author's previously published Research. Certain Research is made available only to institutional investors to satisfy regulatory requirements. Individual Bell Potter Research Analysts may also opt to circulate published Research to one or more Clients by email; such email distribution is discretionary and is done only after the Research has been disseminated. The level and types of service provided by Bell Potter Research Analysts to Clients may vary depending on various factors such as the Client's individual preferences as

to frequency and manner of receiving communications from Analysts, the Client's risk profile and investment focus and perspective (e.g. market-wide, sector specific long term and short term etc.) the size and scope of the overall Client relationship with the Company and legal and regulatory constraints.

Disclaimers

This Research Report is a private communication to Clients and is not intended for public circulation or for the use of any third party, without the prior written approval of Bell Potter Securities Limited.

The Research Report is for informational purposes only and is not intended as an offer or solicitation for the purpose of sale of a security. Any decision to purchase securities mentioned in the Report must take into account existing public information on such security or any registered prospectus.

This is general investment advice only and does not constitute personal advice to any person. Because this Research Report has been prepared without consideration of any specific client's financial situation, particular needs and investment objectives ('relevant personal circumstances'), a Bell Potter Securities Limited Broker (or the financial services licensee, or the representative of such licensee, who has provided you with this report by arrangement with Bell Potter Securities Limited) should be made aware of your relevant personal circumstances and consulted before any investment decision is made on the basis of this Research Report.

While this Research Report is based on information from sources which are considered reliable, Bell Potter Securities Limited has not verified independently the information contained in this document and Bell Potter Securities Limited and its directors, employees and consultants do not represent, warrant or guarantee expressly or impliedly, that the information contained in this Research Report is complete or accurate.

Nor does Bell Potter Securities Limited accept any responsibility for updating any advice, views, opinions or recommendations contained in this Research Report or for correcting any error or omission which may have become apparent after the Research Report has been issued.

Bell Potter Securities Research Department has received assistance from the Company referred to in this Research Report including but not limited to discussions with management of the Company. Bell Potter Securities Policy prohibits Research Analysts sending draft Recommendations, Valuations and Price Targets to subject companies. However, it should be presumed that the Author of the Research Report has had discussions with the subject Company to ensure factual accuracy prior to publication.

All opinions, projections and estimates constitute the judgement of the Author as of the Date of the Research Report and these, plus any other information contained in the Research Report, are subject to change without notice. Prices and availability of financial instruments also are subject to change without notice.

Notwithstanding other departments within Bell Potter Securities Limited advising the subject Company, information obtained in such role is not used in the preparation of the Research Report.

Although Bell Potter Research does not set a predetermined frequency for publication, if the Research Report is a fundamental equity research report it is the intention of Bell Potter Research to provide research coverage of the covered issuers, including in response to news affecting the issuer. For non-fundamental Research Reports, Bell Potter Research may not provide regular updates to the views, recommendations and facts included in the reports.

Notwithstanding that Bell Potter maintains coverage on, makes recommendations concerning or discusses issuers, Bell Potter Research may be periodically restricted from referencing certain Issuers due to legal or policy reasons. Where the component of a published trade idea is subject to a restriction, the trade idea will be removed from any list of open trade ideas included in the Research Report. Upon lifting of the restriction, the trade idea will either be re-instated in the open trade ideas list if the Analyst continues to support it or it will be officially closed.

Bell Potter Research may provide different research products and services to different classes of clients (for example based upon long-term or short term investment horizons) that may lead to differing conclusions or recommendations that could impact the price of a security contrary to the recommendations in the alternative Research Report, provided each is consistent with the rating system for each respective Research Report.

Except in so far as liability under any statute cannot be excluded, Bell Potter Securities Limited and its directors, employees and consultants do not accept any liability (whether arising in contract, in tort or negligence or otherwise) for any error or omission in the document or for any resulting loss or damage (whether direct, indirect, consequential or otherwise) suffered by the recipient of the document or any other person.

In the USA and the UK this Research Report is only for institutional investors. It is not for release, publication or distribution in whole or in part in the two specified countries. In Hong Kong this Research Report is being distributed by Bell Potter Securities (HK) Limited which is licensed and regulated by the Securities and Futures Commission, Hong Kong. In the United States this Research Report is being distributed by Bell Potter Securities (US) LLC which is a registered broker-dealer and member of FINRA. Any person receiving this Research Report from Bell Potter Securities (US) LLC and wishing to transact in any security described herein should do so with Bell Potter Securities (US) LLC.

Early Stage Company Risk Warning:

The stocks of early stage companies without regular revenue streams from product sales or ongoing service revenue should always be regarded as speculative in character. As IPX is yet to establish a regular income stream capable of producing net cash inflows from operations it is regarded as speculative in nature. Stocks with 'Speculative' designation are prone to high volatility in share price movements. Investors are advised to be cognisant of these risks before buying such a stock including IPX (of which a list of specific risks is highlighted within).

Bell Potter Securities Limited
ABN 25 006 390 772
Level 29, 101 Collins Street
Melbourne, Victoria, 3000
Telephone +61 3 9256 8700
www.bellpotter.com.au

Bell Potter Securities (HK) Limited
Room 1601, 16/F
Prosperity Tower, 39 Queens
Road Central, Hong Kong, 0000
Telephone +852 3750 8400

Bell Potter Securities (US) LLC
Floor 39
444 Madison Avenue, New York
NY 10022, U.S.A
Telephone +1 917 819 1410

Bell Potter Securities (UK) Limited
16 Berkeley Street London, England
W1J 8DZ, United Kingdom
Telephone +44 7734 2929