# *The Emerging Force in the Premium Zircon Industry*

PYX RESOURCES

*PYX is the 3rd Largest Producing Mineral Sands Company Globally By Zircon Resources*

*Company Presentation*
*April 2024*

# Disclaimer

This presentation is not intended to be, nor should it be construed as, an advertisement or an offer or solicitation of an offer to buy, subscribe for or sell any securities in PYX Resources Limited (PYX or the Company) or an inducement to make an offer or invitation with respect to those securities. By receiving this document you agree to be bound by the following limitations. The information herein, or upon which opinions have been based, has been obtained from sources believed to be reliable, but no representations, express or implied, or guarantees, can be made as to their accuracy, timeliness or completeness. Although reasonable care has been taken to ensure that the facts stated in this document are accurate and that the opinions expressed are fair and reasonable, no representation or warranty, express or implied, is made as to the fairness, accuracy, completeness or correctness of the information and opinions contained in this presentation and no reliance should be placed on such information or opinions. Neither the Company nor any of its respective directors, officers, employees or agents accepts any liability whatsoever for any loss, however arising, from any use of such information or opinions. Potential investors shall seek and rely on the information published by the Company on the National Stock Exchange of Australia (NSX) and London Stock Exchange (LSE) platforms. The information and opinions in this document may not be current as of the date it is viewed. We do not endeavor to update any changes to the information and opinions in this presentation. The value of securities mentioned may go up or down, and investors may realize losses on any investments. Past performance is not a guide to future performance. Future terms are not guaranteed and loss of capital may occur. Accordingly, potential investors are advised to seek appropriate independent advice, if necessary, to determine the suitability of this investment.

# PYX Resources: Company Overview

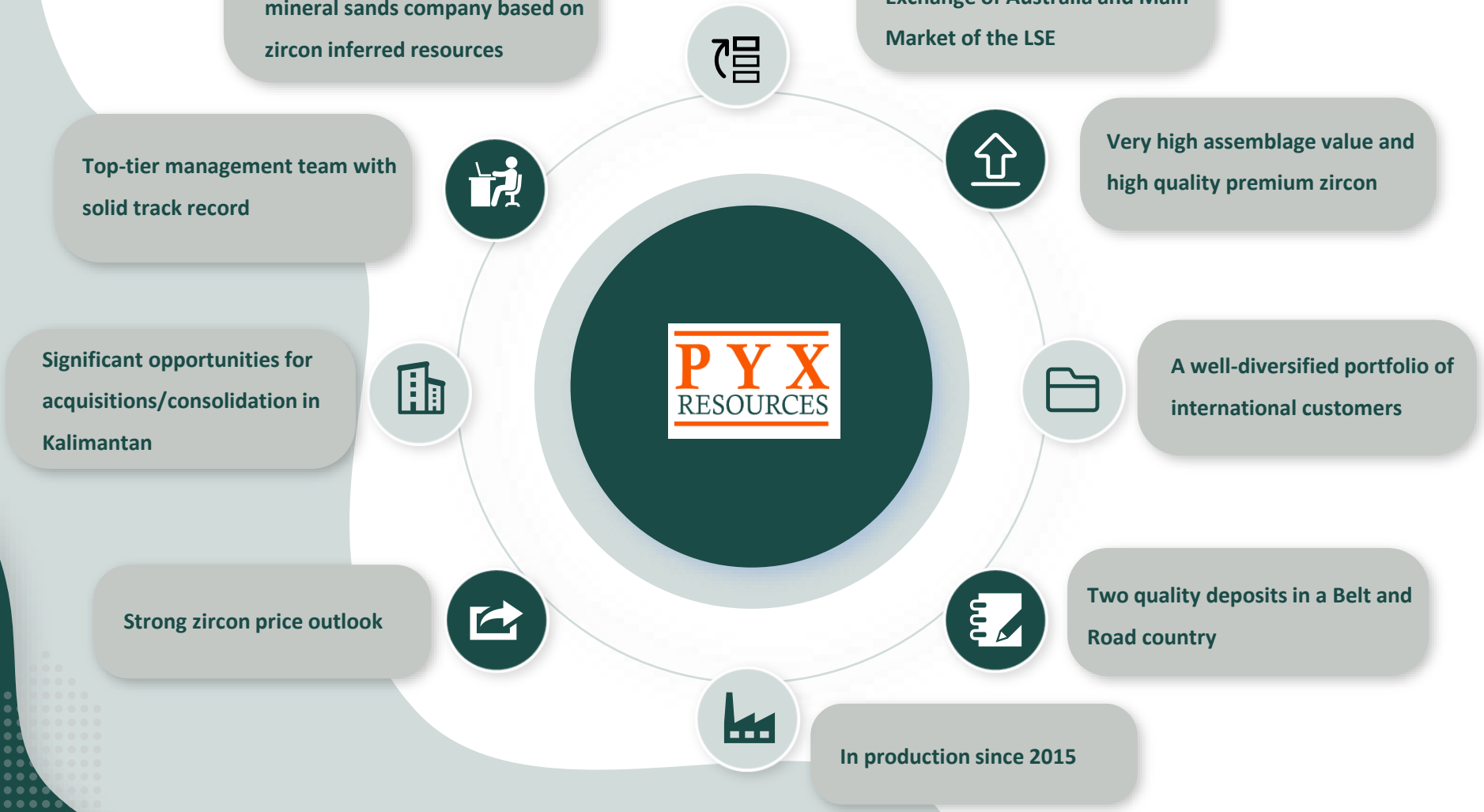
- PYX Resources Limited (NSX: PYX, LSE: PYX) is a global mineral sands company and a leading producer of premium zircon dual listed on the National Stock Exchange of Australia (NSX) in February 2020 and Main Market of London Stock Exchange (LSE) in November 2021.
- PYX's flagship assets are the Mandiri and Tisma deposits, which are located in the alluvium sediment rich region of Central Kalimantan, Indonesia.
- PYX has been in operation since 2015 at its Mandiri deposit. Exploration has indicated the presence of, among other things, additional valuable heavy minerals such as rutile and ilmenite in both Mandiri and Tisma deposits.

*As at 15 March 2024*


| | |
|---|---|
| Chairman & CEO | **Mr. Oliver B. Hasler** |
| Non Exec Directors | Dr. Raden Sukhyar |
| | Mr. Bakhos Georges |
| | Mr. Alvin Tan |

| Items | Year ended 31 Dec 2023 | Year ended 31 Dec 2022 |
|---|---|---|
| Revenue (US$ '000) | 22,672 | 22,703 |
| Revenue Growth | 0% | 83% |
| Net Assets (US$ '000) | 84,123.1 | 83,554.4 |
| Underlying EBITDA (US$ '000) | 676.3 | 419.3 |
| *As of 15 Mar 2024* | | |
| Outstanding Shares | 458.8 MM | |
| Market Cap (GBP) | 76.4 MM | |

# Investment Highlights



# Business Update: Strong Results with Solid Fundamentals

Substantial increase in Zircon prices and very bullish outlook (Dec 2024 US$2,400/t, Dec 2025 US$2,500/t)*

Achieved strong volume and revenue growth in FY21 (2%/39%), FY22 (38%/83%) and FY23 (20%/0%)

Very strong order book as a result of PYX's superior quality, the unique whiteness of Kalimantan zircon

PYX achieved a positive Underlying EBITDA of US$676k, only 3 years after the IPO

PYX zircon demand is picking up across its end markets with increased customer diversification

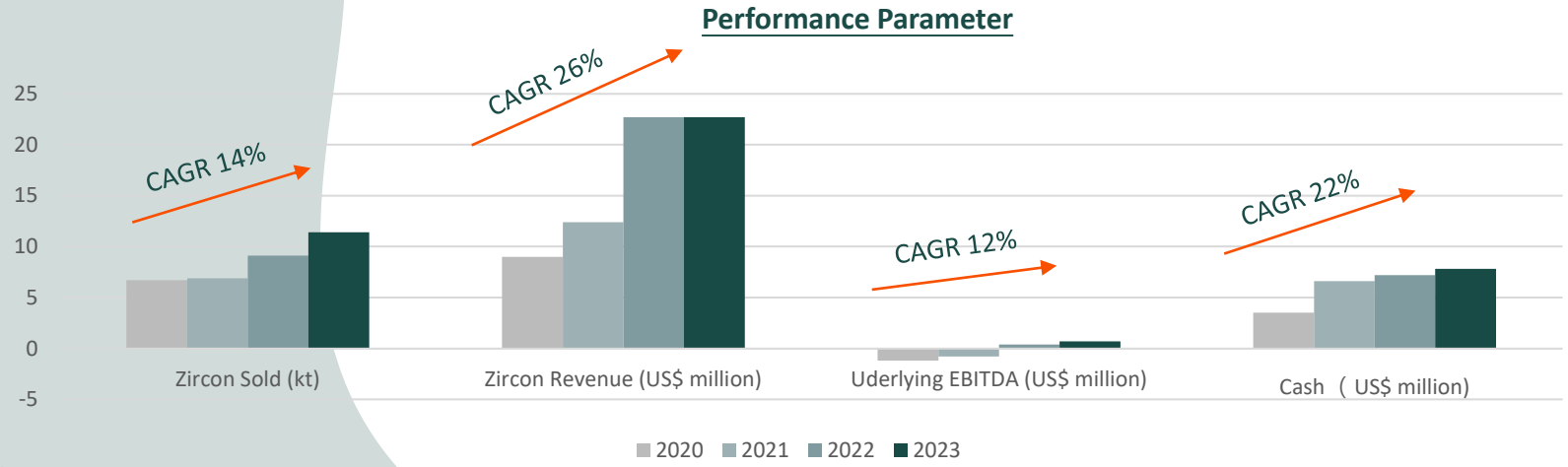
PYX management's objective is to consolidate the Indonesian zircon supply base, leveraging on its proven ability to execute this type of deals

Structural demand/supply gap boosting zircon prices

*Source: * Cedrus analysis*

# Review of PYX Historical Performance

| Performance Parameter | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Zircon Sold (kt) | 6.7 | 6.9 | 9.1 | 11.4 |
| Zircon Revenue (US$ million) | 9.0 | 12.4 | 22.7 | 22.7 |
| Underlying EBITDA (US$ million) | (1.2) | (0.8) | 0.4 | 0.7 |
| Cash (US$ million) | 3.5 | 6.6 | 7.2 | 7.8 |




*Source: Pyx Annual Report*

# Mineral Sands Overview

- Mineral sands is a group of minerals commonly found and mined together from water or wind concentrated deposits. The principal valuable minerals include zircon ($ZrSiO_4$), rutile ($TiO_2$), ilmenite ($Fe.TiO_3$), leucoxene ($FeTiO_3$, $TiO_2$) and monazite (Ce, La, Th).

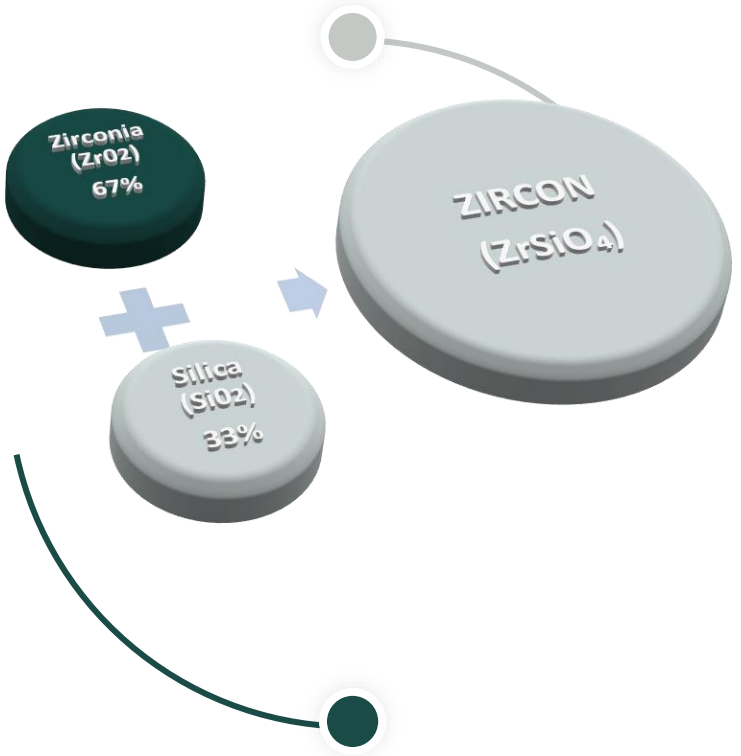
- Mineral sands share similarities with other alluvial mining commodity types such as diamonds. However, they are different to most commodities. The exploration, development, mining and processing of mineral sands is atypical within the resource sector**, because at virtually every stage it is possible to visually estimate the grade and composition of the Heavy Mineral (HM) and valuable heavy mineral (VHM).**

- Mineral sands consists of two principal product streams: 1) zircon; and 2) titanium dioxide minerals – in the form of rutile, ilmenite and leucoxene.

# Zircon Characteristics

- Zircon is the mineral sand component with the highest market value and is a major product of the mineral sands industry. In most projects zircon and titanium minerals exist as co-products.

- An increase in the importance of zircon has resulted in increasing zircon prices and a reduction in the amount of high grade mineral sand resources available.



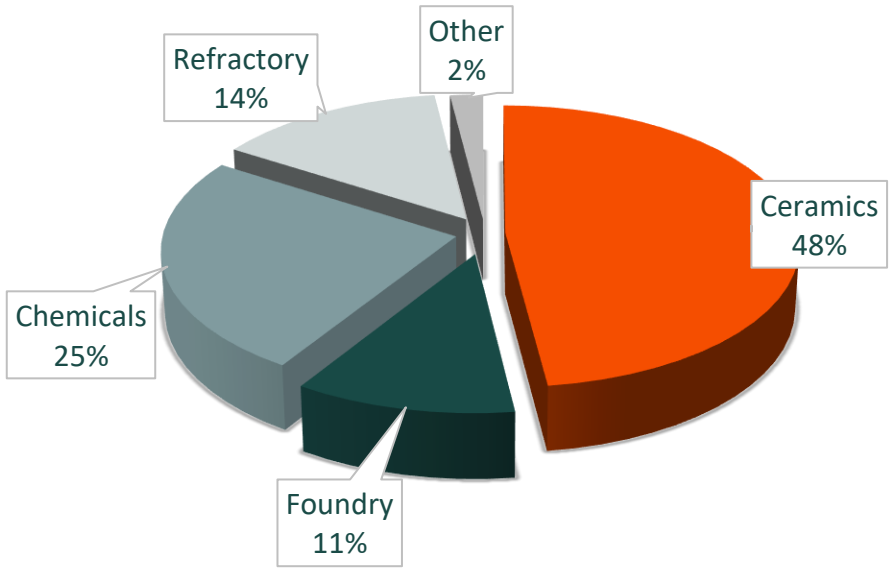

**Zircon Attributes :**

- Opacity-Whiteness
- Hardness
- Low Thermal Expansion
- High Melting Point
- Low Thermal Conductivity
- Chemically Inert
- Low Neutron Absorption

# Broad Applications of Zircon

- Zircon is used in ceramics, precision and specialty castings, various refractory applications, catalysts, fuel cells, fiber optics, nuclear power generation, water treatment and medical prosthetics are some of the major applications of zircon.
- Zircon and its derivatives have remarkable properties of strength, hardness, heat resistance and wear resistance.
- Zircon is also used to produce synthetic gemstone and diamond simulant.

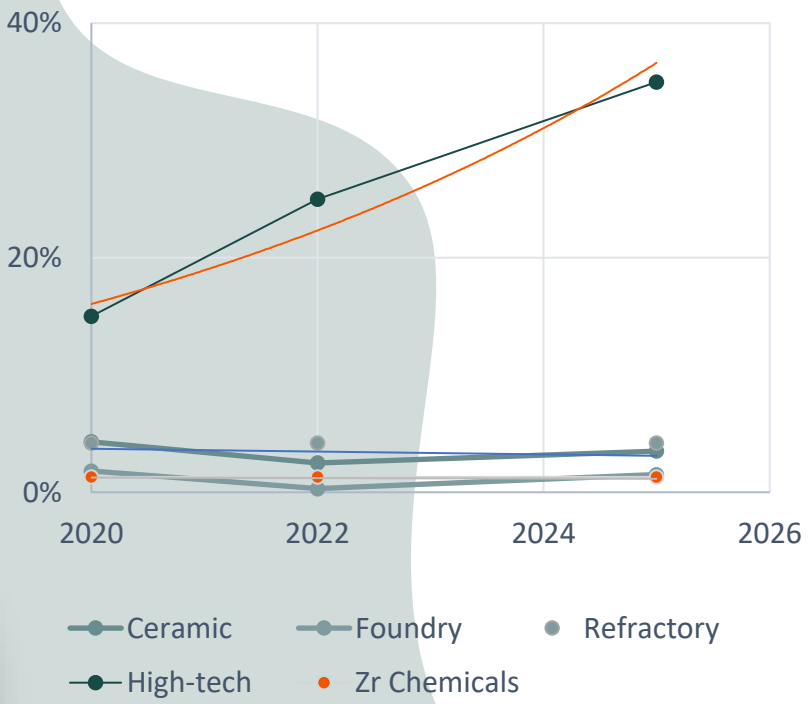
**ZIRCON DEMAND BY END USE, 2022**




*Source: Zircon Market Update, TZMI*

# Zircon High Tech Applications

## Growth Rate of Zircon End Markets Volumes (%)




*Source: MarketWatch, China Building Sanitary Ceramics Association and Prospective Industry Research Institute, and Cedrus' research, Dec 2022*

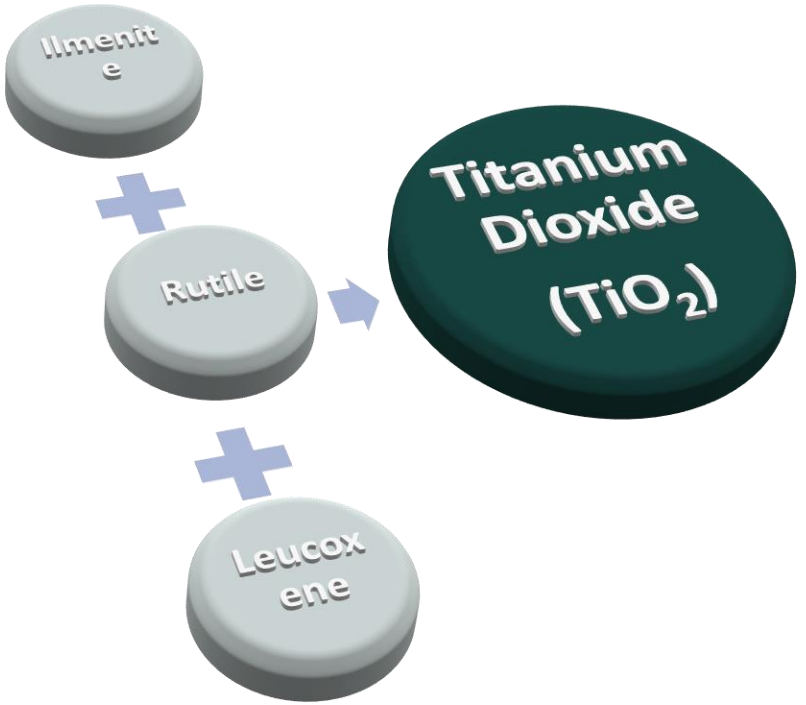
The Zircon end market can be categorised by:

- Traditional Uses - typically used for ceramics manufacturing, high tolerance casting/foundry, refractory and zirconium chemicals;
- High-tech Applications – zircon are also becoming more popular in novel applications (typically high-tech uses), including additive manufacturing, semiconductors, implants, solar cells, fuel cells and batteries;
- Intermediate Use – such as fused zirconia and other zirconium chemicals for a wide variety of applications including electronics, nuclear fuel rods, paper, brake pads, investment casting, and catalysts.

High-tech applications is gaining its importance as they grow almost 10X faster than traditional uses. They include: 3D printing, semiconductors, solar cells, implants, fuel cells and batteries, share memory alloys/coating and catalysts.

# Titanium Characteristics

- The 9th most common element in the Earth's crust that naturally occurs in the form of titanium oxides.
- Titanium dioxide is a white color found belongs to the transition metal oxides and has been used for a century in a range of industrial and consumer products.
- Improvement in living standard, increased needs for high tech and high end uses of titanium metal as well as technology advancement are key demand drivers for titanium dioxide




**Titanium Attributes:**

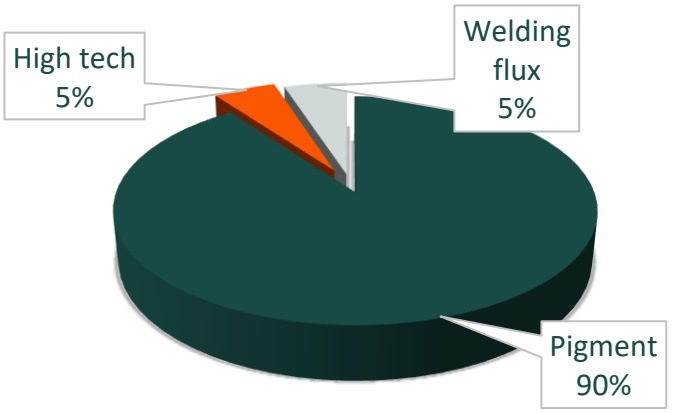
- Hardness
- High strength to weight ratio
- corrosion resistance
- Thermal conductivity
- Opacity (whiteness) – high refractive index
- UV protection

# Broad Applications of Titanium

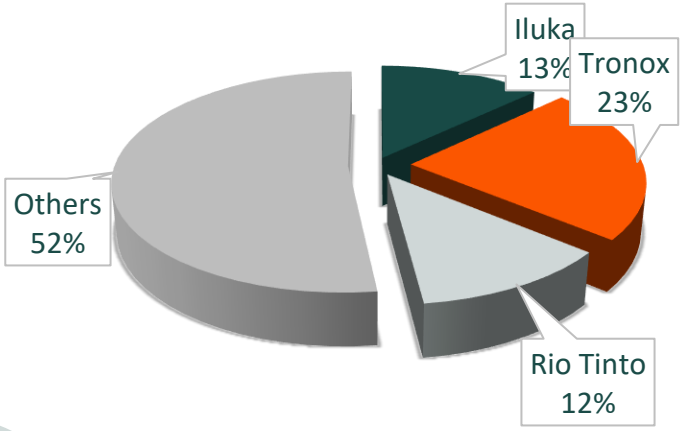
- Titanium Dioxide ($TiO_2$) has been used for a century in a range of industrial and consumer products, including paints, coatings, adhesives, paper, plastics and rubber, printing inks, coated fabrics and textiles, as well as ceramics, floor coverings, roofing materials, cosmetics, toothpaste, soap, water treatment agents, pharmaceuticals, food colorants, automotive products, sunscreen and catalysts.

- Titanium (metal produced from $TiO_2$) possess favorable properties including high strength to weight ratio, corrosion resistance and thermal conductivity and therefore has many cutting-edge high-tech applications including photocatalysis, semiconductors and green energy transition initiative related applications.

**TITANIUM DIOXIDE DEMAND BY END USE, 2021**




**TITANIUM DIOXIDE SUPPLY, 2021**



# Titanium High Tech Applications

- More recently, innovative technologies utilise titanium for various cutting-edge applications including thermal storage, energy harvesting and other green energy transition initiative related applications.
- High-tech applications of titanium including:
- Medical Implants
- Titanium Metal in Aviation & Military
- Nanomaterial Products
- Photocatalysts
- Thermal Utilisation
- Energy Harvesting
- Thermal Energy Storage
- Water Splitting (hydrogen production)
- Energy Conversion
- Self-cleaning & Self-sterilizing
- Air cleaning and water disinfection

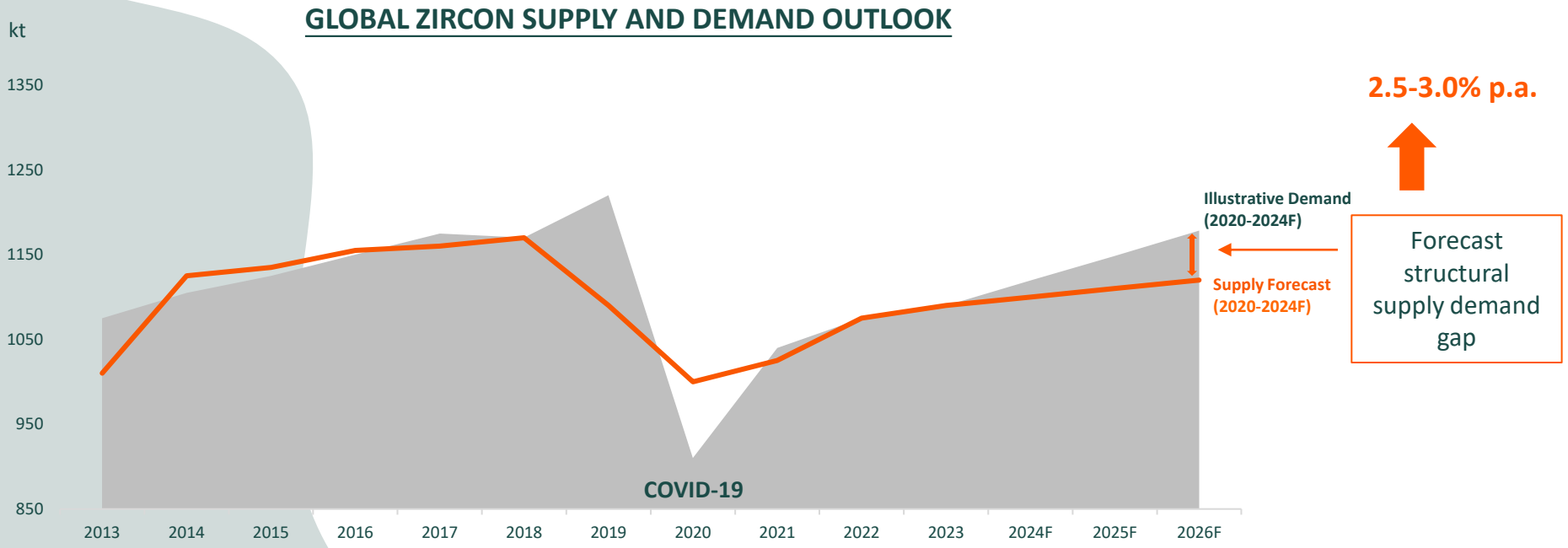


Titanium is one of 26 critical minerals (essential for modern technologies, economies or national security) identified by the Australian government.

It is an important and popular metal in aircraft engines and frames, military applications, medical implants, ship building, fabrication, semiconductors.

# Post COVID-19, a Substantial Zircon Undersupply Has Emerged

- Post COVID-19 pandemic, a substantial supply gap has emerged, which is likely to support a robust zircon price environment in the long term
- Zircon prices have risen strongly over the year, in combination with a major commodity price upcycle during the post COVID 19 recovery phase



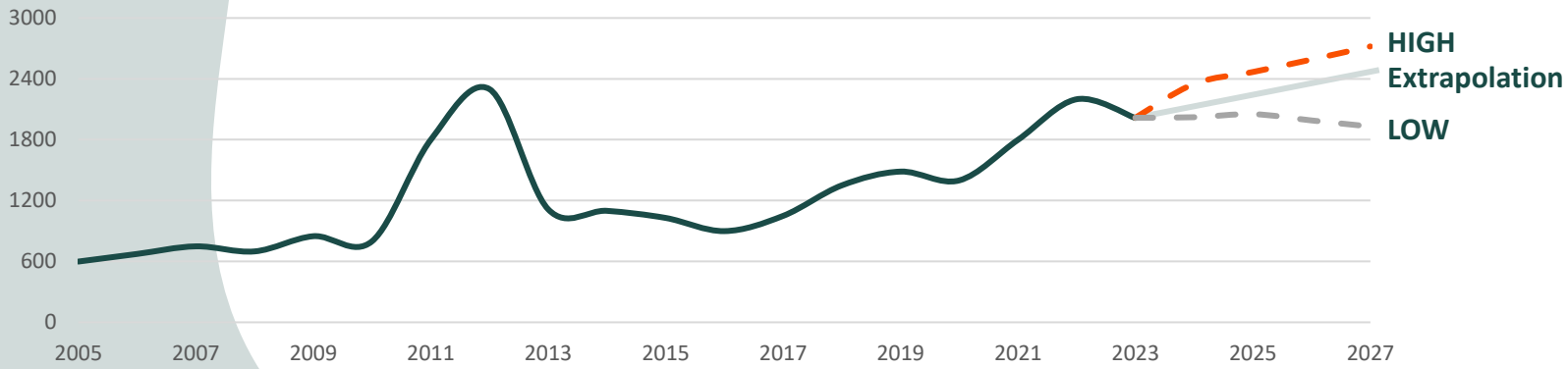

*Note: Illustrative demand and supply forecast are indicative only. Supply data assume no new project going into production stage*

*Source: ILUKA, TZMI (September 2023)*

# Zircon Scarce and Concentrated Supply is Boosting Price

- Zircon prices have increased dramatically during 2021 and 2022 as a result of the growing demand, lack of supply and no supply increase in sight
- It is a fact that the grade of known deposits is declining
- Following industry consolidation in the last 10 years, the top 5 producers Iluka, Tronox/Cristal*, Rio Tinto, TiZir and Kenmare control approximately 72% of global supply in 2018 while the latest research by IBISWorld in October 2023 showed that the top 2 players, Iluka and Tronox, accounted for over 50% of global zircon supply. Therefore pricing environment remained strong
- There is a lack of supply potential for the foreseeable future and the future demand is projected to exceed supply
- The global trade tensions, the COVID-19 pandemic, a very strong increase of demand and a reduction of productivity from several producers since the first quarter 2021, has resulted in very bullish Zircon prices.

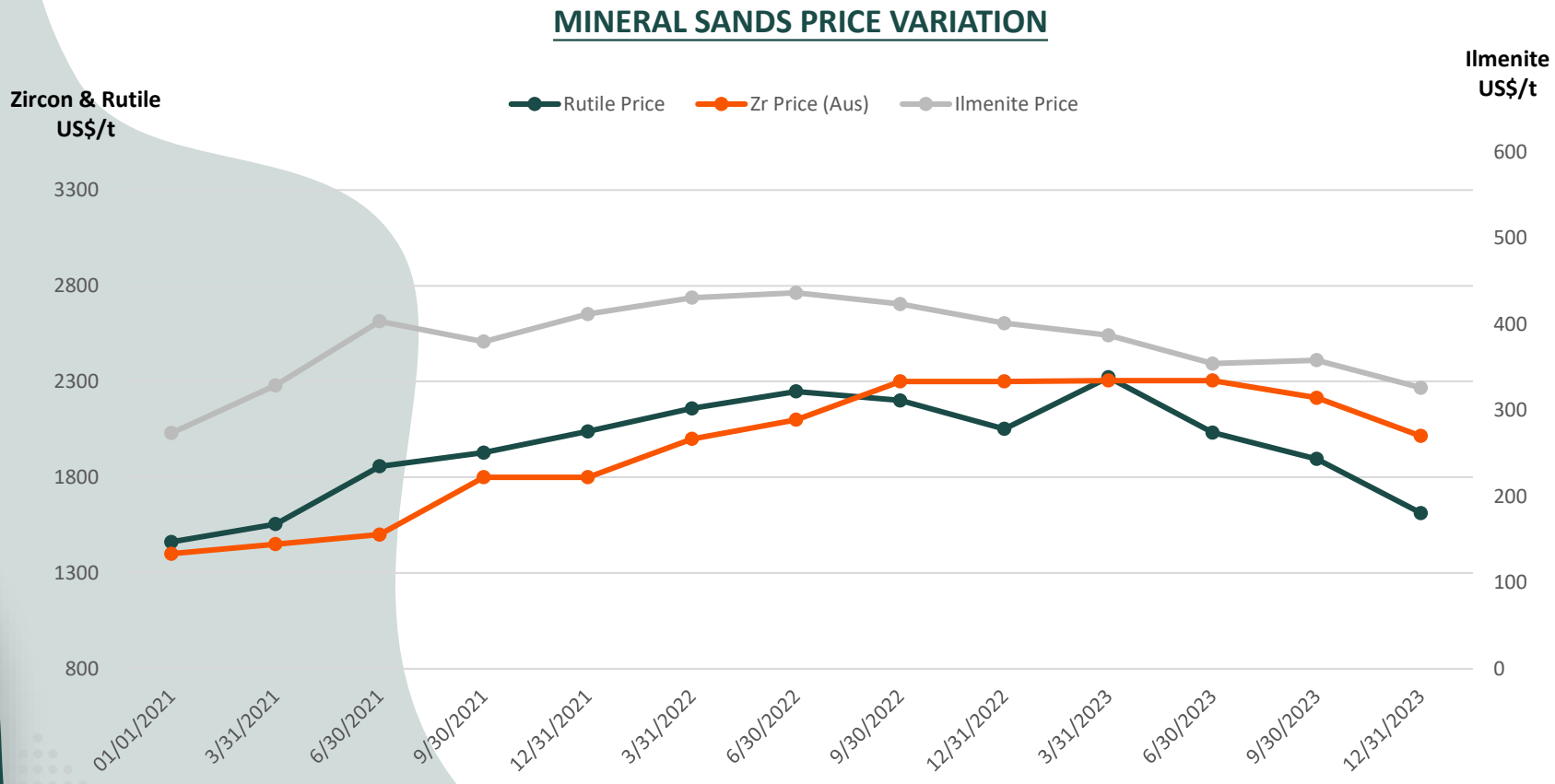
**ZIRCON (PREMIUM GRADE) PRICE AND OUTLOOK TO 2027**




*Source: ILUKA Investor Briefing, TZMI, Company Analysis as of December 2023*

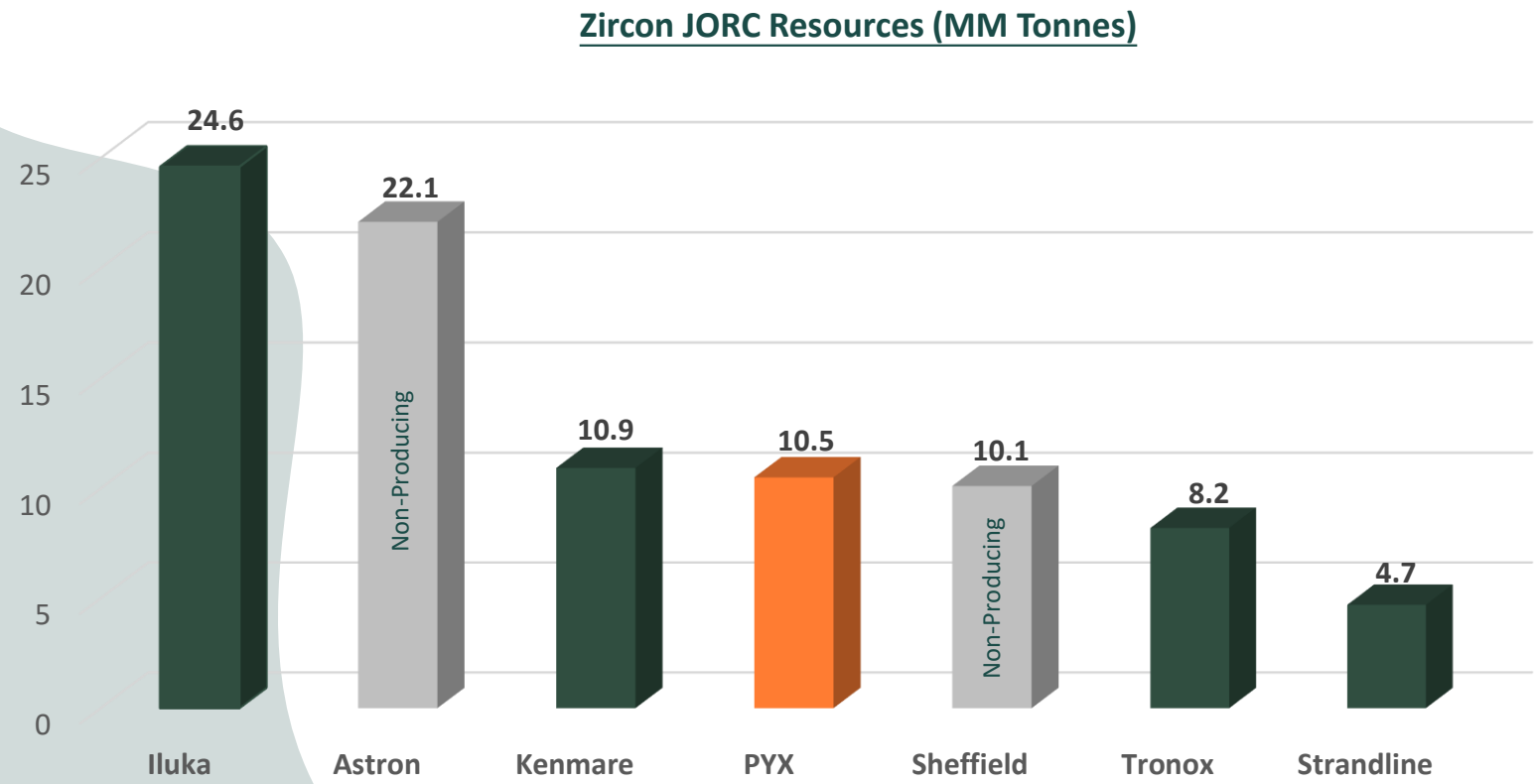
** Cristal, one of top 5 Zircon producers in 2016, completed the sale of its titanium dioxide business to Tronox in April 2019.*

# Zircon Prices Showing Continuous Support




*Source: Asian Metal, Bloomberg*

# Operating the 3rd Largest Zircon Producing Resource Base



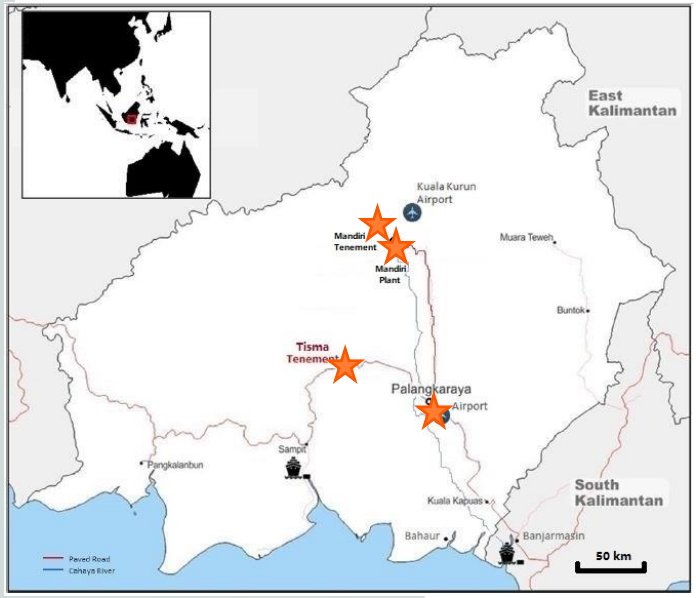

*Source: Companies public filings*

# Unique Alluvial Deposit Region

- With the acquisition of Tisma, PYX is consolidating the Kalimantan zircon mining business and transformed itself into the 3rd largest producing mineral sands company by zircon resources
- Kalimantan contains well established alluvial deposit mining for zircon, rutile, ilmenite and placer gold and platinum among others
- Economic minerals were derived from the uplift and deep erosion of the Paleozoic to Cretaceous basement rocks which contains low-grade disseminated and vein gold mineralisation
- The Chinese Kongsi dominated for gold and diamonds from 100 AD to the 18th century, Indian trading companies were also active since the 4th century, while the Dutch East India Company controlled the alluvian operations by the end of the 18th century
- Currently, significant gold and Zircon production is derived from numerous producers
- The Kahayan River system contains an enormous undeveloped mineral sands and gold resource

**The Location of the Main Producing Districts in Kalimantan**

# Mineral Resource

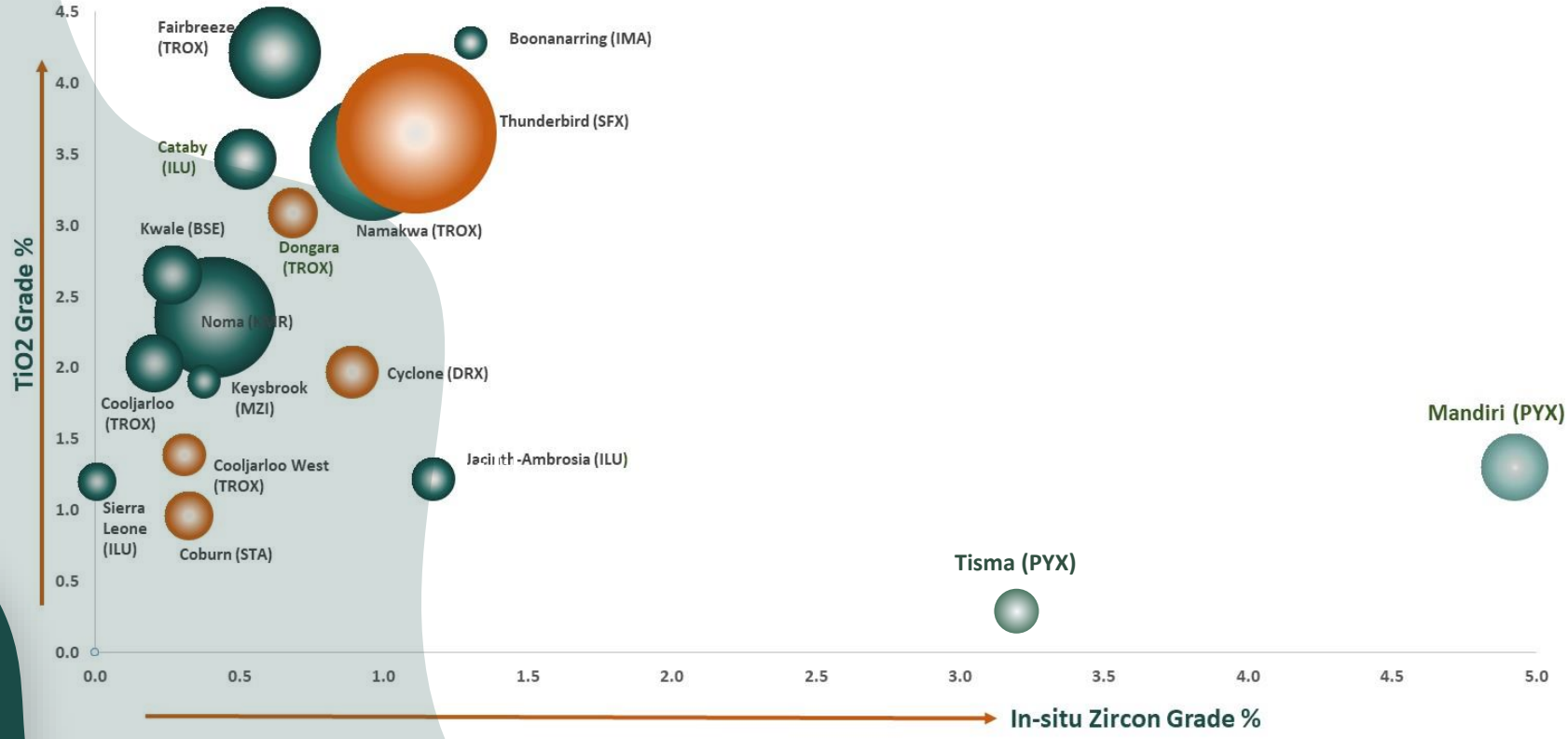



| Deposit Specs | Mandiri Deposit | Tisma Deposit | PYX's Mandiri and Tisma Deposit Combined |
|---|---|---|---|
| **Mineral Resources** | 126.3 Mt | 137.2 Mt | 263.5 Mt |
| **HM Grade** | 7.43% | 3.99% | 5.65 % |
| **HM Tonnage** | 9.4 Mt | 5.5 Mt | 14.9 Mt |
| **Contained Zircon** | 6.0 Mt | 4.5 Mt | 10.5 Mt |
| **Assemblage** | ZIR: 68%<br>RUT:8.5%<br>ILM: 9.5% | ZIR: 82%<br>RUT: 2%<br>ILM: 8.5% | ZIR :73%<br>RUT :6%<br>ILM :9.1% |
| **Assemblage Value** | US$1,695 /tonne | US$1,916 /tonne | US$1,824 /tonne* |

PYX's assemblage value is calculated based on the assumed Zircon price of US$1,900/t, a conservative estimate as the actual prevailing Zircon price of Indonesia Zircon is US$1,935, Rutile price of US$1,800/t and Ilmenite price of US$400/t

*Source: Company's Annual Report (FY2023), as at 31 December 2023*

# Mandiri and Tisma are Clear Outliers in Terms of Zircon %




*Source: Public Filings, Cedrus Research*

*Notes:*

1. *Mandiri Zircon grade ranked the highest among current major mineral sands operations and projects under investigation globally.*
2. *Bubble size proportional to tonnes of Valuable Heavy Mineral (VHM) resources.*
3. *Blue bubbles projects in production phase, orange bubbles projects in exploration/development phase.*
4. *$TiO_2$ grade calculated as the VHM grade of Ilmenite, Leucoxene, and Rutile.*
5. *Data compiled from public sources and PYX's' research.*

# Superior Assemblage

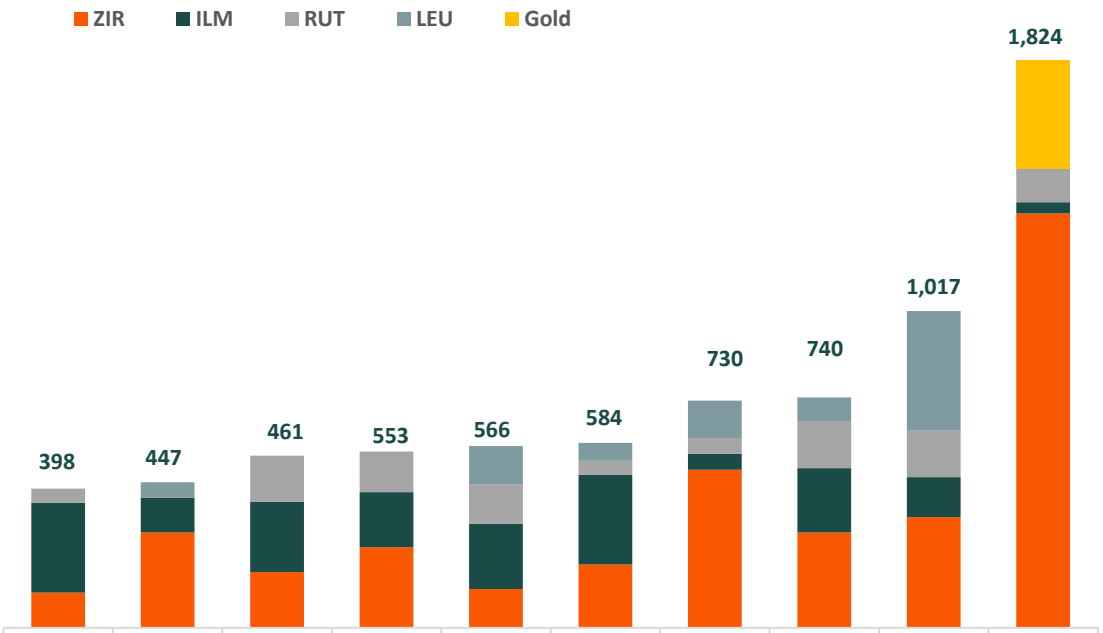
- PYX's Mandiri deposit has the highest assemblage value amongst its peer group, and it is already in production. The Tisma deposit has an even higher assemblage value

- Assemblage is the relative percentage of each different valuable minerals found within a heavy mineral sands deposit, such as zircon (ZIR), Ilmenite (ILM), Rutile (RUT), and Leucoxene (LEU).

- Each valuable mineral has a different market price. The assemblage value is the weighted average value of all the valuable heavy minerals in the ore based on the following price assumptions:

    - Zircon price = US$1,900
    - Rutile = US$1,800
    - Ilmenite = US$400

***Assemblage Value US$/tonne***




| | Base | Sheffield | Tronox | Iluka | Image | TiZir | Diatreme | Strandline | Astron | Pyx |
|---|---|---|---|---|---|---|---|---|---|---|
| Zir % | 8.4 | 5.9 | 5.4 | 9.4 | 13.6 | 6.5 | 26.7 | 16.1 | 18.7 | 73.0 |
| Rut % | 2.7 | 1.4 | 1.7 | 7.6 | 6.2 | 4.1 | 2.8 | 8.3 | 8.3 | 6.1 |
| Ilm % | 28.0 | 72.3 | 81.2 | 56.0 | 44.3 | 52.5 | 12.8 | 51.5 | 32.1 | 9.1 |

*Notes: PYX's gold exploration target not included in JORC Resource Statement*

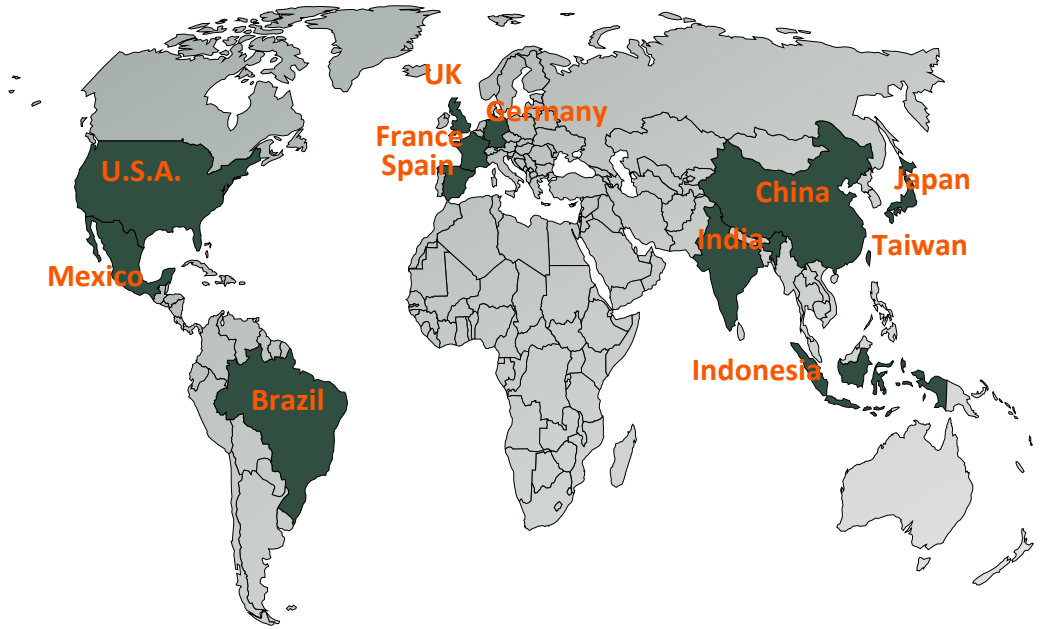
*Source: Public filings, Cedrus' research, December 2023*

# PYX – In Production since 2015

- The Mandiri deposit commenced production in August 2015.
- Mandiri is currently in operation with an installed production capacity of 2,000 tpm (or 24,000 tpa) of Mineral Sands.
- The existing Mandiri Mineral Separation Unit consists of a conventional wet concentration process (Wilfley tabling) followed by the batch dry mineral separation processing (electrostatic rolls, electrostatic plates and magnetic rolls)
- The primary product of the Mandiri project is >65.5 grade zircon (premium grade for export). Other by-products include rutile and ilmenite.
- Further expansion is planned and will take place over the next 5 years to expand to a capacity of 4,000 tpm.

# Well Diversified Customer Mix

- The PYX customer base consists of a pool of well-diversified international customers, providing protection against any concentration risks.
- Key customers are located across major European, American and Asian markets.
- 100% of its revenues are US$ denominated, resulting in limited currency risk.



# Indonesian 2009 Mining Reform

- Indonesia is a key mining destination for mineral sands, and will play an increasing role as a supplier to the industry going forward, especially as a result of increased investor protection offered by the new 2009 Mining Law
- Highly ranked in prospective minerals. Indonesia hosts premium quality deposits with high zircon content on Heavy Minerals, low radioactivity, low $Al_2O_3$ and high whiteness
- Low labour cost index of 1.6^ and a minimum monthly wage of US$204 in 2021
- Indonesia has stable social environment with minimal interruption of production due to social disturbances.
- Indonesia is committed to improving its infrastructure aiming to invest US$430 billion on infrastructure by 2024, up 20% from last 5 years.
- Indonesia has a long history of scientific exploration activity since 1800's and exploration costs is relatively low in Indonesia

## Investment Right Protection

Investments into mining projects is better protected after the introduction of the IUP-OP regime in 2009, replacing the CoW regime.

## Enviable Record on FDI

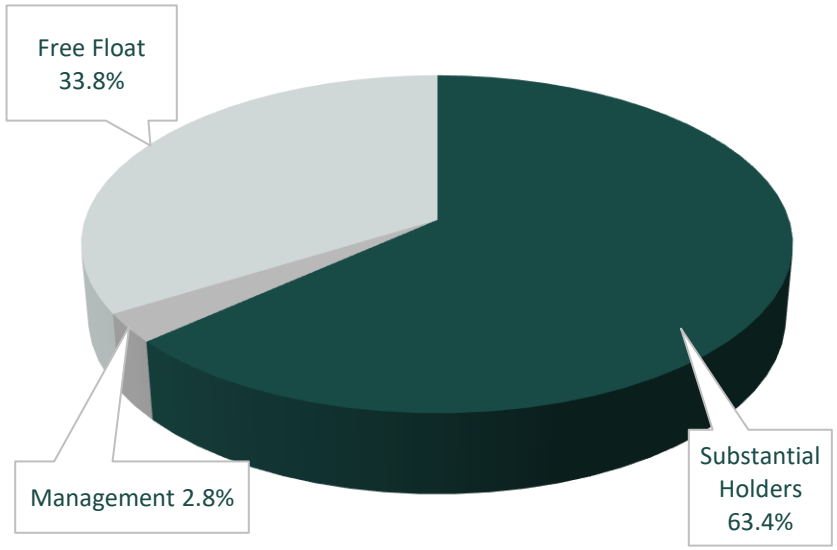
Indonesia received US$ 2.3 billion of Foreign Direct Investment into its mining sector in 2020# to support sustainable growth.

# 33.8% of the Shares are Deemed to be Free Float

## Substantial Shareholders

| Name | % Holding |
|---|---|
| Phoenix Fund Solutions Ltd | 20.17% |
| Takmur SPC Limited | 18.33% |
| Phoenician Group Ltd | 13.65% |
| TGN Holdings (HK) Ltd | 11.25% |
| **Total** | **63.40%** |

## Composition of PYX Issued Capital




**Total Shares Outstanding: 458.8 Million**

**Free Float Shares Outstanding: 155.2 Million**

# Our Strategic Focus Remains Unchanged

PYX RESOURCES

## Business Focus

| Countries | Minerals | Mining | Elements of the value chain | Selling route to market |
|---|---|---|---|---|
| **Indonesia** | **Zircon** | **In-house** | HMC | **Direct** |
| | Gold | | **High-Grade** | Indirect partners |
| Others | **Rutile** | Contract | Processed | |
| | **Ilmenite** | | Products | Local Distribution |

**Strategic Plan**

# Competent Person Statement and Cautionary Note

**Competent Person's Statement**
The information in this Report that relates to Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves is based on the review Mr. Phil Jones did on the information compiled by Dr. John Chisholm, a Competent Person who is a Fellow of AusIMM (Australian Institute of Mining and Metallurgy). Mr. Jones is engaged by PYX and has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration, and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code). Mr. Jones consents to the inclusion in the Report of the matters based on his information in the form and context in which it appears.

**Forward-looking Statement**
This presentation contains forward-looking statements and forward-looking information within the meaning of applicable Australian securities laws, which are based on expectations, estimates and projections as of the date of this presentation.

This forward-looking information includes, or may be based upon, without limitation, estimates, forecasts and statements as to management's expectations with respect to, among other things, the timing and amount of funding required to execute the Company's exploration, development and business plans, capital and exploration expenditures, the effect on the Company of any changes to existing legislation or policy, government regulation of mining operations, the length of time required to obtain permits, certifications and approvals, the success of exploration, development and mining activities, the geology of the Company's properties, environmental risks, the availability of labour, the focus of the Company in the future, demand and market outlook for precious metals and the prices thereof, progress in development of mineral properties, the Company's ability to raise funding privately or on a public market in the future, the Company's future growth, results of operations, performance, and business prospects and opportunities. Wherever possible, words such as "anticipate", "believe", "expect", "intend", "may" and similar expressions have been used to identify such forward-looking information.

Forward-looking information is based on the opinions and estimates of management at the date the information is given, and on information available to management at such time. Forward looking information involves significant risks, uncertainties, assumptions and other factors that could cause actual results, performance or achievements to differ materially from the results discussed or implied in the forward-looking information. These factors, including, but not limited to, fluctuations in currency markets, fluctuations in commodity prices, the ability of the Company to access sufficient capital on favourable terms or at all, changes in national and local government legislation, taxation, controls, regulations, political or economic developments in Indonesia and Australia or other countries in which the Company does business or may carry on business in the future, operational or technical difficulties in connection with exploration or development activities, employee relations, the speculative nature of mineral exploration and development, obtaining necessary licenses and permits, diminishing quantities and grades of mineral reserves, contests over title to properties, especially title to undeveloped properties, the inherent risks involved in the exploration and development of mineral properties, the uncertainties involved in interpreting drill results and other geological data, environmental hazards, industrial accidents, unusual or unexpected formations, pressures, cave-ins and flooding, limitations of insurance coverage and the possibility of project cost overruns or unanticipated costs and expenses, and should be considered carefully. Many of these uncertainties and contingencies can affect the Company's actual results and could cause actual results to differ materially from those expressed or implied in any forward-looking statements made by, or on behalf of, the Company. Prospective investors should not place undue reliance on any forward-looking information.

Although the forward-looking information contained in this presentation is based upon what management believes, or believed at the time, to be reasonable assumptions, the Company cannot assure prospective purchasers that actual results will be consistent with such forward-looking information, as there may be other factors that cause results not to be as anticipated, estimated or intended, and neither the Company nor any other person assumes responsibility for the accuracy and completeness of any such forward-looking information. The Company does not undertake, and assumes no obligation, to update or revise any such forward-looking statements or forward-looking information contained herein to reflect new events or circumstances, except as may be required by law.

No stock exchange, regulation services provider, securities commission or other regulatory authority has approved or disapproved the information contained in this presentation.

**Compliance Statement**
The Mandiri mineral sands deposit hosts a 6 Mt Inferred JORC Resource of Zircon. The Company originally announced this resource in its Prospectus released on 20 February 2020 and confirms that it is not aware of any new information or data that materially affects the information included in the Prospectus. All material assumptions and technical parameters disclosed in the Prospectus that underpin the estimates continue to apply and have not materially changed.

The Tisma mineral sands deposit hosts a 4.5 Mt Inferred JORC Resource of Zircon. The Company originally announced this resource in its Announcement "PYX Resources Limited Agrees to Acquire Tisma Development (HK) Limited, a World-Class, Fully Licensed Mineral Sands Deposit" on NSX on 13 January 2021 and confirms that it is not aware of any new information or data that materially affects the information included in the Announcement. All material assumptions and technical parameters disclosed in the Announcement that underpin the estimates continue to apply and have not materially changed.

Together the Mandiri mineral sands deposit and Tisma mineral sands deposit total 10.5Mt of contained Zircon resource.

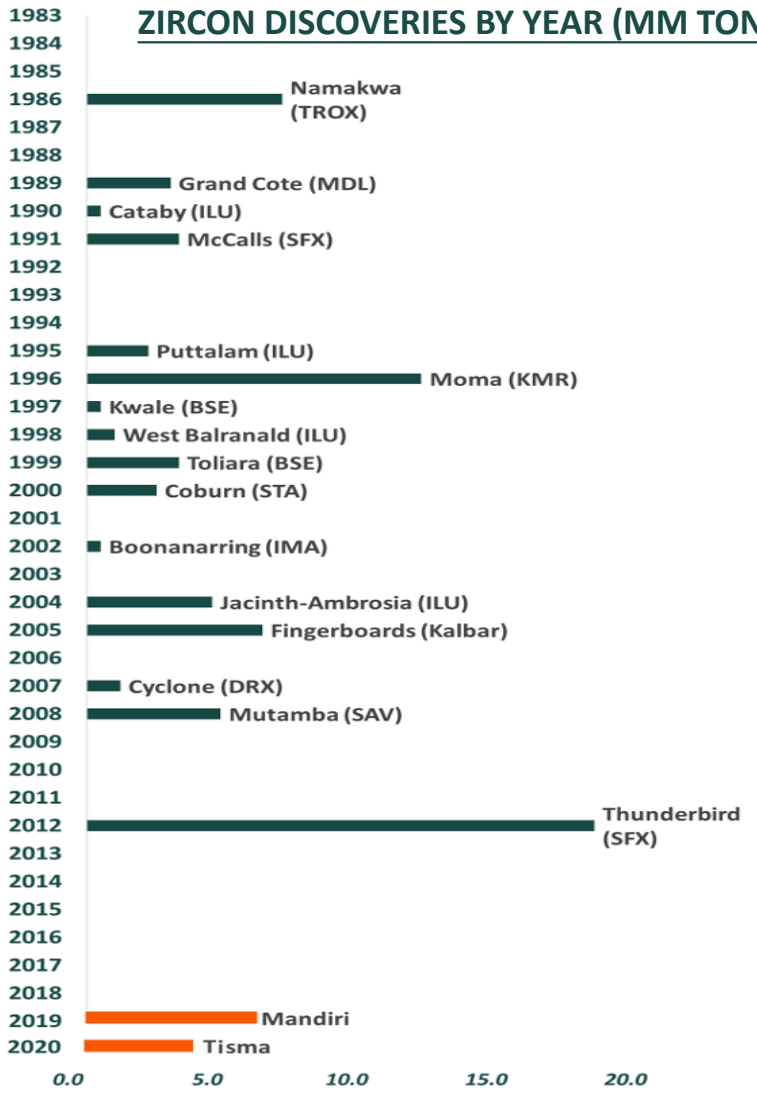
## Contact Details

| | |
|---|---|
| Website: | www.pyxresources.com |
| **Email:** | **ir@pyxresources.com** |
| Registered Office: | Level 5, 56 Pitt Street, |
| | Sydney NSW 2000 |
| **Investor Relations:** | **+852 3519 2860** |
| Fax: | +852 3519 2869 |

# Appendix

# PYX Major Discoveries

- PYX's discoveries are uniquely positioned **as the largest zircon discoveries in the world since 2012**.
- The chronologic table to the right indicates that PYX's deposits are the most recent significant discovery of Zircon globally.
- **PYX is the world's 3rd largest producing mineral sands company based on zircon resources.**



# Limited Alluvium Bed Thickness Enables Open Pit Mining

# PYX Cares Program: PYX Commitment to Sustainability

*"PYX Cares" was established as PYX's blueprint for making meaningful and environmentally sustainable contributions to the communities in which the company operates. The "PYX Cares" initiative was inspired by the United Nations Development Program's Sustainable Development Goals (SDGs). PYX is dedicated in using our platform as a force for positive change.*

- **Employees**
  Prioritise the health, wellbeing and safety of all of its employees and contractors
- **Stakeholders**
  Engage its stakeholders at multiple levels of the company as a critical part of its UNSDGs
- **Community**
  PYX collaborated with Indonesia's National Blood Donor Program and give back to their community.
- **Environment**
  prioritises making conscious efforts to sustainably maintain the biodiversity within the land in which it operates.

PYX RESOURCES CARES

SUSTAINABLE DEVELOPMENT GOALS


A holistic sustainability program, PYX Cares has adopted 17 goals in the Central Kalimantan surroundings of our operations, from empowering local **communities** and protecting the **environment**, to promoting diversity, to making sure our **employees** and the people of Kalimantan fully participate in our long-term success, and delivering sustainable value to all our **stakeholders.**

# Zero Carbon Transition to Increase Zircon Demand

## Zircon

plays a crucial role in supporting industrial re-alignment toward **Zero Carbon Transition.**

Australia has included zirconium as a critical mineral to achieve low carbon economies[+].

PYX included a sustainability goal in its PYX Cares Program to ensure adoption of affordable, reliable, and sustainable energy sources

**16%**

**Lower Global Warming Potential***

*Note: * compared to alumina*
*^ solar cells with zirconium-doped electrodes and thermal barrier coating using Zircon*
*[+] Geoscience Australia and Mineral Commodity Summaries 2021*
*[#] Marrakech Partnership for Global Climate Action: Pathways to Zero Carbon*
*Source: ZIA, Praxair Technology*

*Source:TZMI*

Replacing alumina with Zircon for **casting and refractory** significantly reduces energy waste

**Industry Pathway[#]**


Zirconia is widely used as the electrolysers material for **hydrogen fuel cell and solid oxide fuel cells**, a key **renewable energy source**

**Decarbonised Power Pathway[#]**

Zirconium based alloys are used for **nuclear energy** (capacity in 2020 was 393GW expected to triple by 2050)

**Alternative Sources Pathway[#]**

*Source: International Atomic Energy Agency (IAEA)*

Zircon-containing ceramic roof and façade tiles increase solar reflection, reducing cooling demand and **minimising buildings' carbon footprint**

**Human Settlement Pathway[#]**

*Source: Study by ZIA and Centro Ceramico for ECerS conference, June 2019*

**Car and aircraft** manufacturers will use Zircon to increase fuel efficiency, reduce the environmental impact

**Transport Pathway[#]**

*Source: The Role of Thermal Barrier Coating in Maximizing Turbine Engine Efficiency and Lowering CO2 Emissions, June 2017, Praxair Technology. Note: All changes in Zircon volume assume constant demand in end-use markets.*

# Zircon Plays a Major Role in the Innovation of Key Industries

PYX RESOURCES

## Zircon Innovation

**Currently, governments have set the year 2050 as the goal for Net-Zero emissions and various technologies essential to this goal including solar cells, nuclear energy, and catalysis are utilising zircon in the manufacture of emerging products for its various benefits. The Australian government considers zirconium to be a crucial mineral vital for the economic well-being of the world's major and emerging economies. As the world moves toward decarbonisation, the demand for zircon is expected to continue increasing.**

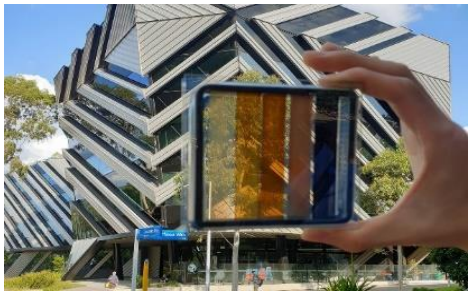
**Zircon is also finding its way into a variety of modern technologies. It is becoming more prominent as a casing material for 5G smartphones and a framework material for 3D printing.**

## Nuclear power

Zirconium alloys are a proven structural material for nuclear fuel cladding and can satisfy all safety requirements due to Zirconium's unique properties. Like solar panels, nuclear power plants also produce no emissions during procedure with the added benefit of continuous operation. This makes the technology essential in the goal of Net-Zero and is especially important for countries in the northern hemisphere, where solar panels are less effective.

## Solar Cells

Zirconium oxide is not only a cheaper but a more efficient alternative to the current semiconductor doping technology. Currently, there is a push to implementing this Zircon derivative into the promising dye sensitised cell technology, which can be used in architecture as coloured glass windows doubling as solar panels. This would revolutionise home energy systems and solve the current problem of limited roof space, which residential solar panels suffer from - taking us one step closer to Net-Zero.



## Fuel Cells

Yttria stabilised zirconia (YSZ) is increasingly in demand for electrolyte material in solid oxide fuel cells. Our premium zircon mined in Indonesia has low uranium, aluminium and thorium content. This enables the manufacturing of fused zirconia for high-tech products that cannot be made with conventional zircon.

## Smartphone

Zirconia provides ultra-thin but scratch resistant phone case covers, which enable stronger signals, wireless charging and much faster download speeds compared to aluminium. It's also radio wave transparent, which is crucial for fast data downloads on 4G and 5G networks' high frequencies

## Energy storage

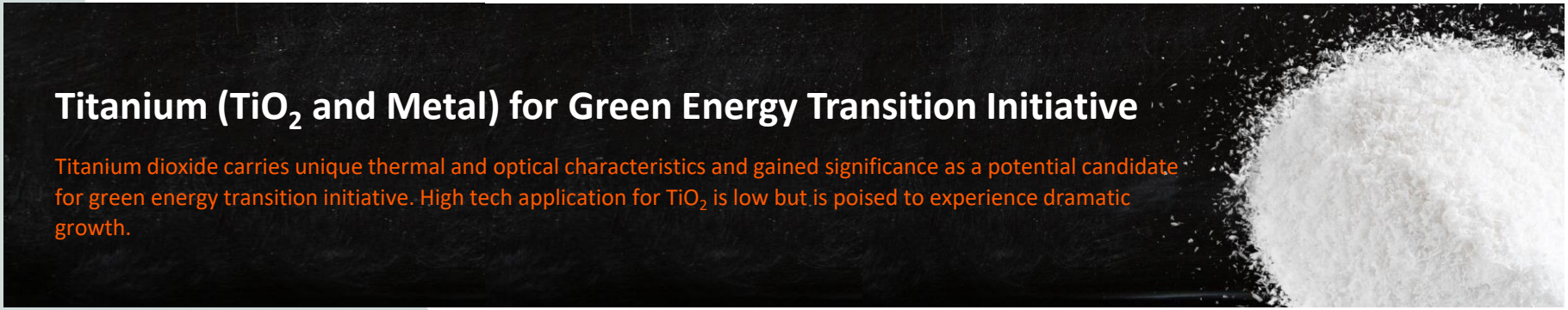
Zirconium oxide is already an excellent component for the safety of Li-ion batteries and this technology is the most promising solution to the intermittency of most renewable power sources, especially for home energy systems. Essentially, these batteries can provide energy at times when renewable sources cannot and therefore fossil fuels can be eliminated entirely from homes power sources.

## Hydrogen Storage

Green hydrogen produced using renewable electricity is stated to be critical in the goal to Net-Zero by the UK government. Practical, large sale deployment of the storage technology has been proven to rely heavily on the zircon derivative, $ZrMn_2$. With increasing research into applying hydrogen energy to areas such as the automotive industry by Japan, and into the hydrogen storage industry by Mitsubishi Power, we could potentially see the market for this zircon derivative explode.

# Titanium Applications for Green Energy Transition Initiative

PYX RESOURCES



## Titanium ($TiO_2$ and Metal) for Green Energy Transition Initiative

Titanium dioxide carries unique thermal and optical characteristics and gained significance as a potential candidate for green energy transition initiative. High tech application for $TiO_2$ is low but is poised to experience dramatic growth.

### Thermal Utilisation

Titania has been utilized for various thermal applications such as heat relieving, photoprotection, storing heat, heat transportation, solar thermal energy cultivation.

Utilization of titania has been carried out in the form of bulk titania, titania nanoparticles, titania-based nanofluids, and titania nanoparticle enhancement phase change heat storage materials.

### Energy Harvesting

Titania is used for harvesting photoelectric and photothermal energy in various energy harvesting applications.

Dye-sensitized $TiO_2$ is used in Grätzel photoelectric solar cells, known as dye sensitized solar cells (DSSC), to generate electricity from solar energy. Titania is the essential element of these solar cells. These modules are cheaper and produce good efficiency.

### Thermal Energy Storage

Titania is extensively used in thermal energy storage applications such as thermal energy-storing phase change materials (PCMs) have good thermal storage capacity, though at a slower rate of thermal storage

The addition of titania nanoparticles improves thermal conductivity and optical advantages including 26% elevation in thermal conductivity of polyethylene glycol (PEG)

### Water Splitting

Solar water splitting has been intensively researched as a possible approach to achieve the effective conversion of solar into chemical energy.

Titanium dioxide ($TiO_2$) is the benchmark semiconductor in photocatalysis, which possesses a suitable band structure and makes the overall water splitting reaction thermodynamically possible to produce hydrogen as a new energy source.

### Energy Conversion

The climate transition requires solutions for a carbon-free future and new innovative methods to produce green energy. A new breakthrough opens doors to personalised sustainable energy.

by coupling unique properties of Titanium Dioxide ($TiO_2$) and of Nickel Oxide (NiO), it is now technically possible to produce invisible / transparent solar cells to be integrated into windows, vehicles, cell phone screens, and other everyday products with affordability.

# Titanium Demand Driven by High Tech Applications



## High Tech Applications of Titanium ($TiO_2$ and Metal)

Titanium is another metal in the Australian government's list of critical mineral and is also finding its way into a variety of modern technologies.

Due to its high strength to weight ratio, corrosion resistance and other favorable properties, titanium is an important and popular metal in aircraft engines and frames, military applications, medical implants, ship building, fabrication, semiconductors.

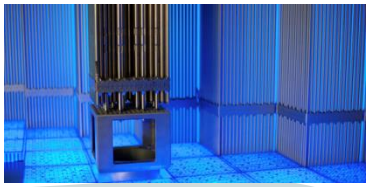
More recently, innovative technologies utilise titanium for various cutting-edge applications including thermal storage, energy harvesting and other green energy transition initiative related applications.

### Medical Implants

Titanium is similar to human bones, with good biocompatibility to human tissues and no toxic side effects, ideal for human implants. The amount of titanium alloys used in surgical implants is increasing at a rate of 5%-7% per year, due to advantages including: 1) light weight; 2) low elastic modulus; 3) non-magnetic; 4) non-toxic; 5) corrosion resistance; and 6) high strength and good toughness.

### Titanium Metal in Aviation & Military

High strength to weight ratio is a key characteristics of titanium metal, due to fuel efficiency and corrosion resistant benefits, it is widely used in aviation (aircraft engines and frame), military applications, Chemical & desalination plant components, Medical & sporting equipment.



### Photocatalysts

Photo-catalysis is the composing of photochemistry and catalysis with both light and a catalyst being desired to onset or precipitate a chemical conversion with important daily live applications. $TiO_2$ nanoparticles leveraging photocatalysis process included air purification, water purification, decontamination, antibacterial sterlisation, UV protection, photocatalysis, sensing, photocatalytic pollutant degradation, and carbon dioxide reduction.

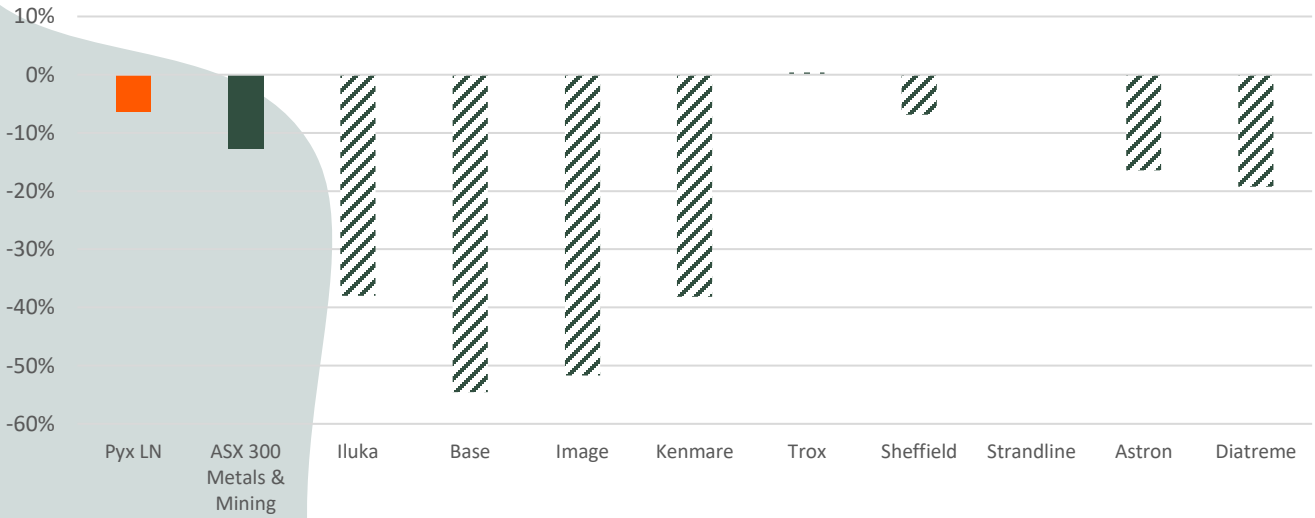

### Nanomaterial Products

Titanium dioxide is a popular material for nanomaterial products, its transparency and maximum ultraviolet light absorption made it suitable for specialty chemicals, cosmetics and sunscreens.

# PYX Shares Price Performance

## Share Performance (1 Feb 2023 – 15 Mar 2024, %)

*As at 15 March 2024*




**Since the release of the 2023 operational update in February 2023, PYX LN shares recorded a -6% return, outperforming most peers, despite challenging conditions**

*Source: Public Filings, Cedrus Research*

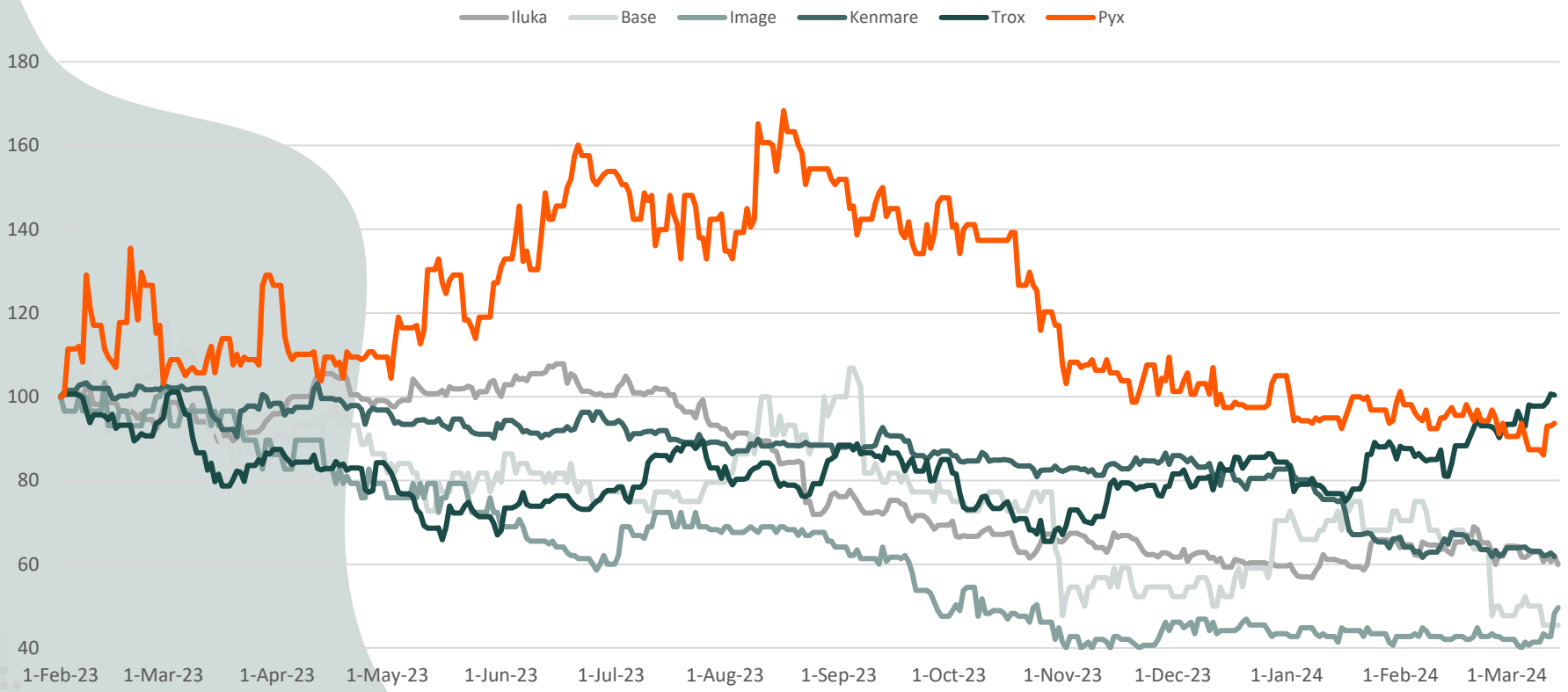
**: The S&P/ASX 300 Metals & Mining Index is based on the S&P/ASX 300. The index is comprised of ASX listed companies that are classified by the Global Industry Classification Standard (GICS®) as being in the Metals & Mining industry, which includes producers of aluminum, gold, steel, precious metals and minerals, and diversified metals and minerals (GICS Tier 3).*

*Note: % calculated from the first trading day of February 2023*

# PYX Share Price Benchmarking

## Share Performance (1 Feb 2023 – 15 Mar 2024)

*As at 15 March 2024*



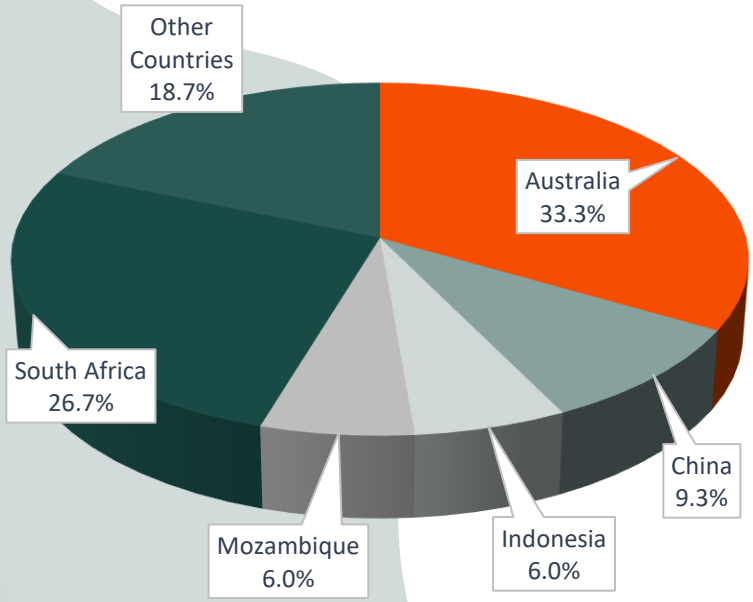

*Note: Price movements are relative to share prices on 1 January 2023 for each company, all share prices are rebased to A$*

*Source: Bloomberg, Cedrus Research*

# World Zircon Mine Productions & Reserves

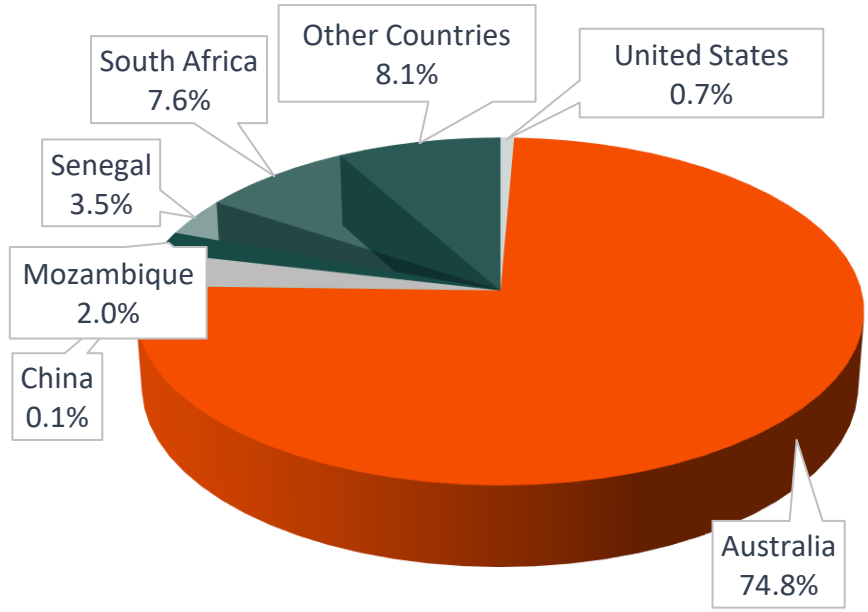
## GLOBAL ZIRCON PRODUCTION BY REGION

**2023 Total Production ~ 1.6mt**




## GLOBAL ZIRCON RESERVES BY COUNTRIES

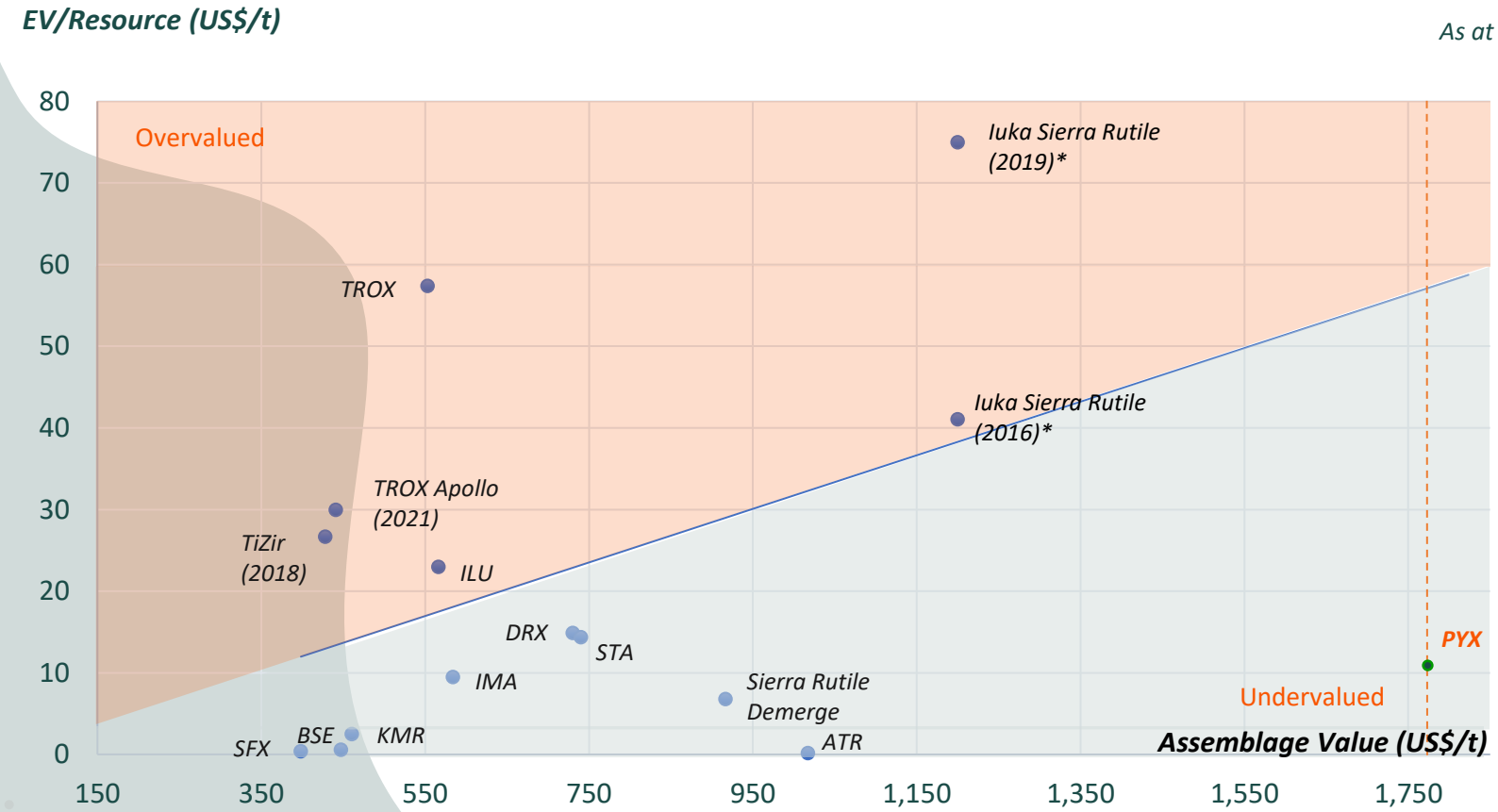
**2023 Total Reserves ~ 74Mt**




*Source: ILUKA, TZMI, U.S. Geological Survey, 2023*

*Note: Indonesian assets have no recorded Zircon reserves. Zircon Reserves Data does not include Indonesian supply base. This is because Zircon deposits in Indonesia are generally shallow, and require minimal capex and low operating expenses.*

# Based on Correlation Analysis, PYX is Undervalued




*Source: Bloomberg, Company Annual Reports & Announcements, Cedrus Analysis*

# Performance of Listed Mineral Sands Companies

*As at 15 March 2024*

| Company / Transaction | Market Cap. | Enterprise Value (EV) | Resources (In-situ THM) | Weighted Ave. Assembalge Value | EV/Resources |
|---|---|---|---|---|---|
| | AU$ mln | AU$ mln | Tonnes | US$/Tonne | US$/Tonne |
| **Iluka Sierra Rutile 2019*** | N/A | 600.0 | 8.2 | 1,200 | 75.0 |
| **Iluka Sierra Rutile 2016*** | N/A | 336.8 | 8.2 | 1,200 | 41.1 |
| **Pyx Resources** | 130.9 | 119.9 | 14.9 | 1,890 | 5.3 |
| **Diatreme Resources** | 78.3 | 67.0 | 4.7 | 777 | 9.4 |
| **Astron Corporation** | 94.9 | 106.7 | 182.4 | 589 | 0.4 |
| **Strandline Resources** | 446.5 | 448.5 | 29.0 | 588 | 10.2 |
| **Image Resources** | 74.9 | 11.8 | 3.9 | 539 | 2.0 |
| **Iluka Resources** | 2,940.0 | 2,730.0 | 206.7 | 531 | 8.7 |
| **Tronox Holdings** | 3,860.8 | 7,934.4 | 85.4 | 450 | 61.1 |
| **Tronox - mining* (Apollo bid 2021)** | N/A | 9,466.7 | 78.1 | 438 | 79.7 |
| **Base Resources** | 116.7 | - 2.7 | 70.9 | 343 | - 0.0 |
| **TiZir Limited (2018)** | N/A | 700.0 | 26.2 | 428 | 17.6 |
| **Kenmare Resources** | 517.6 | 451.3 | 185.6 | 347 | 1.6 |
| **Sheffield Resources** | 212.3 | 189.1 | 223.0 | 236 | 0.6 |
| **Sierra Rutile Demerge (2020)** | N/A | 90.0 | 13.3 | 917 | 4.5 |

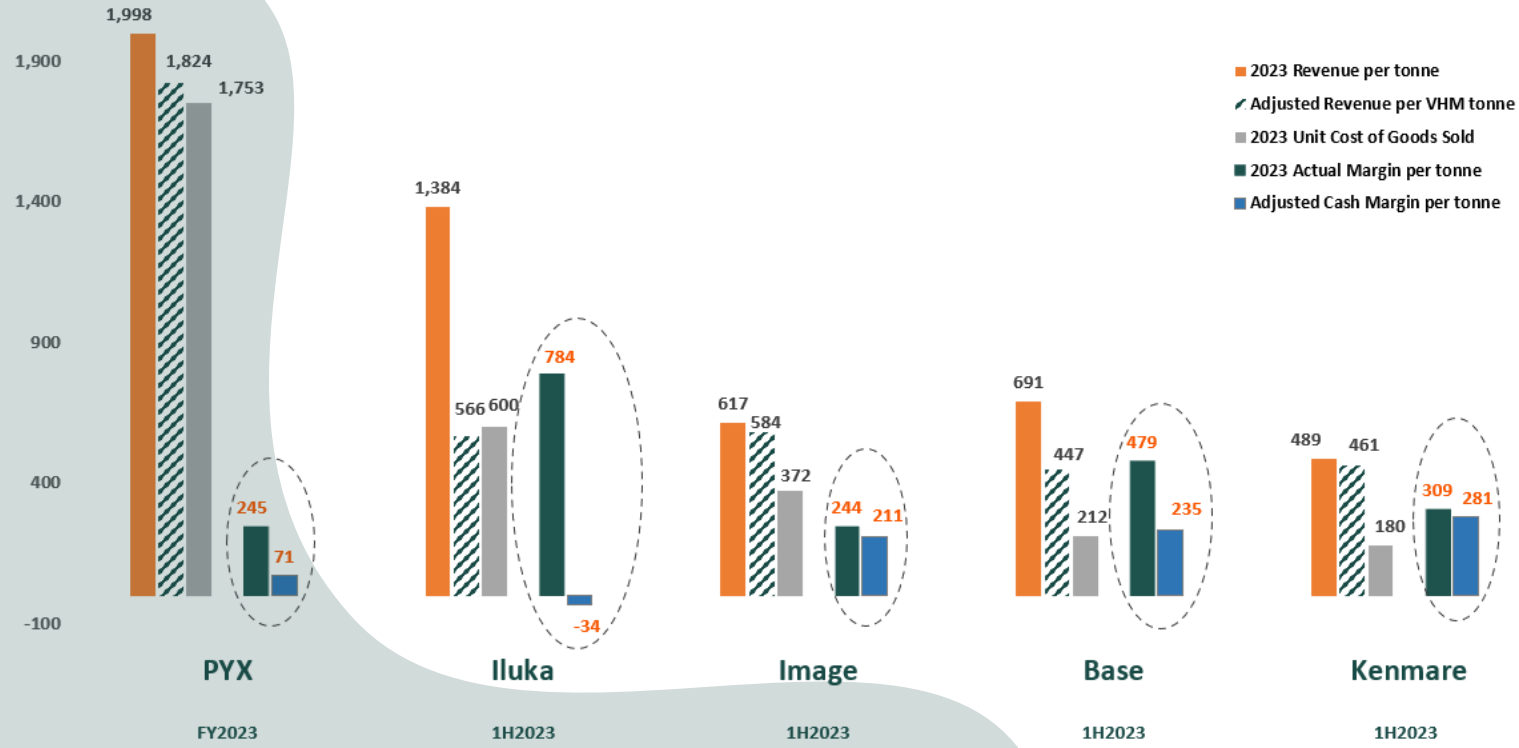
*Notes: *Iluka Sierra Rutile (2019) valuation is based on International Finance Corporation's investment of US$60 million in Iluka's Sierra Rutile for a 10% stake in 2019; while Iluka Sierra Rutile (2016) valuation is based on Iluka's acquisition of Sierra Rutile Limited for US$337 million in 2016; both with assemblage value of US$1,200/tonne (using spot price for rutile)*
*#Based on Apollo Global Management's acquisition offer and Cedrus' analysis*
*^TiZir Limited is jointly owned 50/50 by Mineral Deposits Limited of Australia and Eramet Group, which is a French multinational mining company listed on the Euronext Paris exchange*

# PYX has Sustainable Margin Upside in the Long Term

Long term sustainable cash margins depend on the in-situ assemblage mix, and might be different from the cash margins realized in one particular year, due to the fact that the production mix in a particular year might be different from the resource assemblage.

COGS per unit costs are mostly composed of Heavy Mineral mining and concentration, which are largely independent from the production mix.

## 2023 ACTUAL MARGIN AND ADJUSTED MARGIN COMPARISONS OF MAJOR MINERAL SANDS PRODUCERS (IN US$ PER TON OF VHM)




*Note: Adjusted revenue calculated as the weighted average value on mineral components disclosed on each company's latest Resource Statement.*

*Source: Public Filings*

# Review of Analysts' Forecast

| Key Indicator | Source | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| Zircon sold forecast (kt) | Cedrus | 18.0 | 24.0 | 36.0 | 48.0 |
| | WH Ireland | 18.0 | - | N/A | N/A |
| | ***Consensus*** | ***18.0*** | ***24.0*** | ***36.0*** | ***48.0*** |
| Revenue forecast (US$ mil) | Cedrus | 43.1 | 56.9 | 88.3 | 123.6 |
| | WH Ireland | 37.5 | 60.9 | N/A | N/A |
| | ***Consensus*** | ***40.3*** | ***58.9*** | ***88.3*** | ***123.6*** |
| Underlying EBITDA forecast (US$ mil) | Cedrus | 9.9 | 22.3 | 46.1 | 78.6 |
| | WH Ireland | 3.6 | 5.1 | N/A | N/A |
| | ***Consensus*** | ***6.8*** | ***13.7*** | ***46.1*** | ***78.6*** |

*Note: Based on average consensus forecast made by equity research analysts covering PYX, including Cedrus and WH Ireland.*