2021/22
ANNUAL INTEGRATED REPORT

Molefi Motuku, PhD | 06 October 2022

MINTEK
A global leader in mineral and metallurgical innovation

Outline

- **Mintek at a glance**
- **Mintek cooperate scorecard 2021/22**
  - ✓ Learning and growth perspective
  - ✓ Research, development and innovation perspective
  - ✓ Industry development
  - ✓ Financial perspective
- **Concluding remarks**

MINTEK MANDATE

"The objects of Mintek are through **research, development** and **technology transfer,** to **promote mineral technology,** and to foster the **establishment** and **expansion of industries** in the **field of minerals** and **products** derived therefrom.**"**

(Mineral Technology Act No 30 of 1989)

Mining & minerals value chain








Exploration → Mining → Concentration → Extractive Metallurgy → Refining → Manufacturing → Post mining

SECONDARY FOCUS — **PRIMARY FOCUS**

EXPLORATION STAGE : Geochemical sample analysis and mineral ore characterization

CORE ACTIVITIES : Range from **initial investigations** to **process development** and the **design, construction**, as well as **commissioning** of **industrial plants**

OFFERINGS : Working closely with clients, and in conjunction with engineering partners, Mintek supplies a flexible package of technology for process development and optimisation, products and services

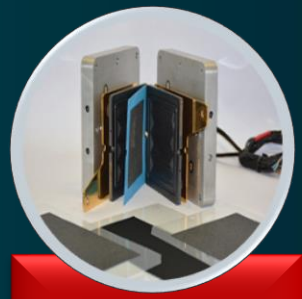
Mintek's integrated value chain

Mineralogical & Analytical Testing

Small Scale Mining & Urban Mining

Mineral Processing (Concentration)

Pyrometallurgy



Digital Platform

Value Addition / Manufacturing

Post Mining Landscape

Hydrometallurgy

Biometallurgy

Mintek's global operations

Gold	PGMs	Ferrous Metals	Equipment & Technology	Base Metals
Industrial Minerals & Diamonds	Process Control Strategies	Uranium	Rare Earth Elements	Economic & Regional Studies

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Mintek at a Glance: 2021/22 Performance

Learning and Growth

Total staff base: **556**

SET base: **237 (43%)**

SET Mid-Senior staff: **103 (43%)**

Black SET: **182 (77%)**

Female SET: **116 (49%)**

% SET Black Mid-Senior staff: **65 (63%)**

SET - PhD: **59 (25%)**

SET - MSc: **51 (22%)**

PhD Studies: **15**

MSc Studies: **37**

Financial Perspective

Products & Services: **R142.17 m**

Total Income: **R600.19 m**

Total Expenses: **R591.05 m**

Deficit/Profit: **R9.1 m**

Investment in PPE: **R21.44 m**

Investment in HCD: **R9.13 m**

BEE Spent: **103.32%**

Liquidity ratio: **1.5:1**

Research, Development & Innovation

Journal papers: **61**

Conference presentations (& webinars): **36 (89)**

Books Chapters: **9**

Books : **0**

Accredited methods: **17**

Accredited facilities: **3**

Certified reference materials **8**

New patents: **0**

New trade marks: **3**

Invention disclosures: **8**

New technologies/prototypes: **14**

Mintek Corporate Scorecard 2021/22

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About Mintek – how we operate

1. **Conduct relevant, applied research and technological innovation** by pursuing a focussed approach to research and technology development that emphasises high-impact scientific outputs and outcomes;

2. **Fostering the establishment of new industries** and expansion of existing ones, as well as addressing the challenges facing nascent, emerging, mature and declining industries;

3. **Develop a capable workforce** that has the requisite skills, expertise and capabilities to drive and support rigorous scientific research and technological development in pursuit of Mintek's mandate of conducting research and fostering industry development and expansion. The workforce profile is reflective of the demographic profile of South Africa;

4. **Ensure financial sustainability** and securing Mintek's future by achieving a solid research portfolio that is funded through both private and public sources and commercialising Mintek's technologies;

5. **Develop and maintain world-class Research, Development and Innovation (RDI) infrastructure** that supports Mintek's research, technology innovation and the development of products and services that encourage industry growth and expansion.

Learning and Growth Perspective

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Performance with respect to KPI's - 2021/22

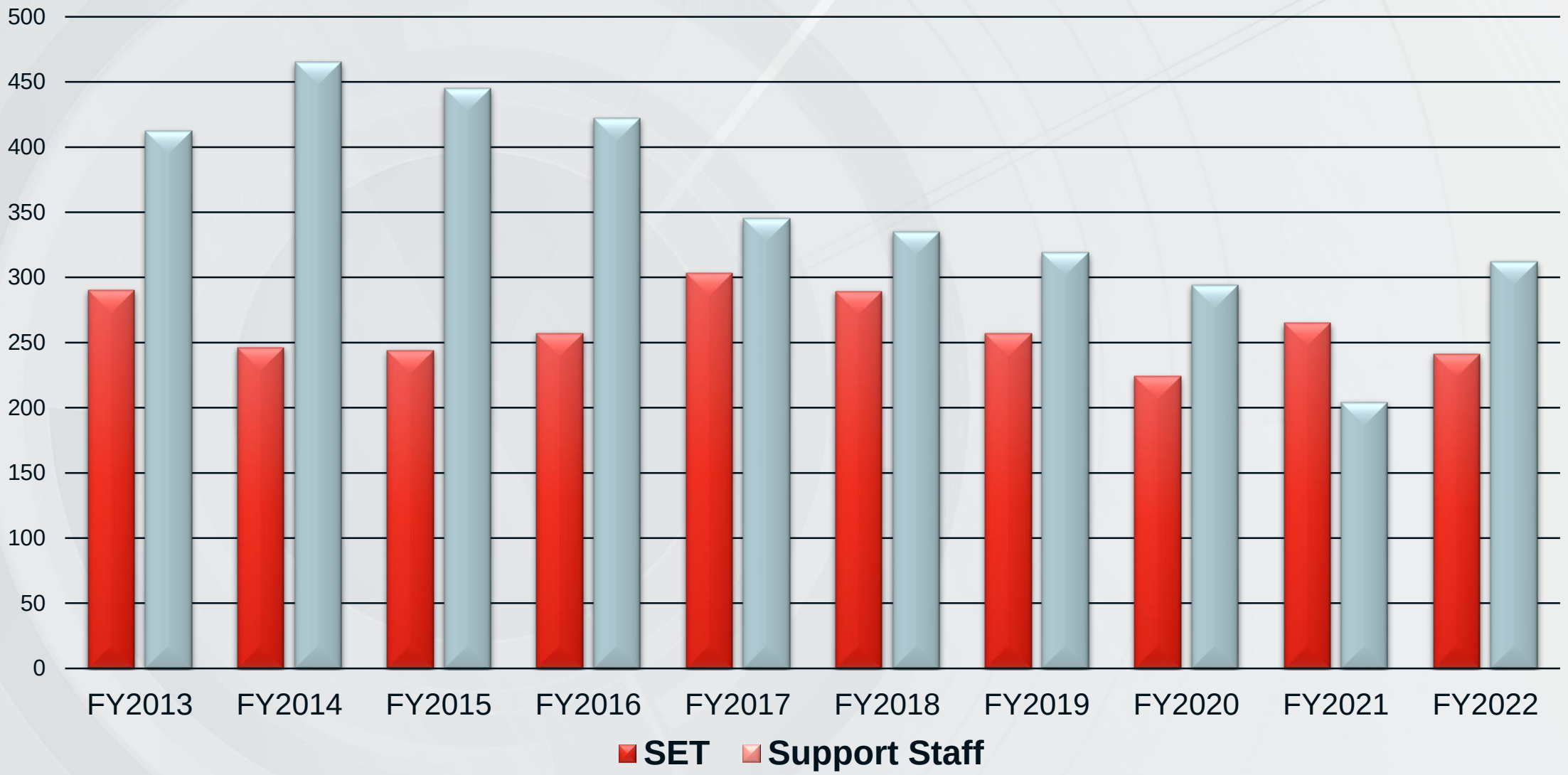
STRATEGIC OBJECTIVE #3: Develop a Capable Workforce

Key Performance Indicators	Target 2021/22	Performance 2021/22
Total number of SET employees	220	**237**
Percentage of Black SET staff	80%	**77%**
Percentage of Female SET staff	52%	**49%**
Total number of SET staff with doctoral degrees	55	**59**
Percentage of SET staff with doctoral degrees	25%	**25%**
Total number of SET staff with masters degrees	70	**51**
Percentage of SET staff with masters degrees	32%	**22%**
Total number of SET staff at middle and senior levels (SP, MP and SE)	115	**103**
Percentage of Black SET staff at middle and senior levels (SP, MP and SE)	65%	**63%**

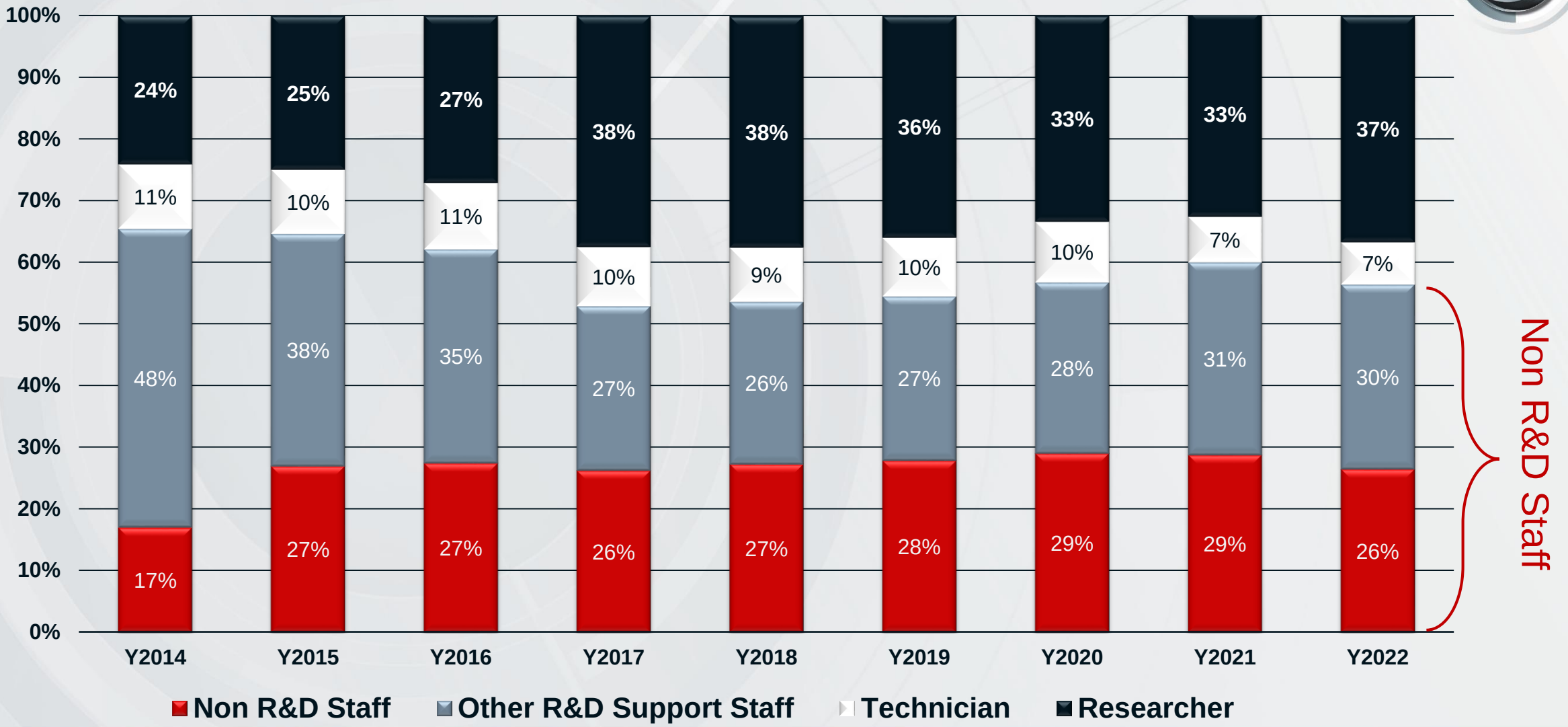
Employment statistics

OCCUPATIONAL LEVELS	MALE					FEMALE					TOTAL
	A	C	I	W	NSA	A	C	I	W	NSA	
Top Management	3		1						1		5
Senior Management	6			2		3		1	2		14
Professional qualified and experienced specialist	20	2	4	12	6	18	1	3	8	3	77
Senior technical, qualified work, junior management, Supervisor	94	4	2	17	7	133	5	5	13	3	283
Semi-skilled and discretionary decision	68	4		1		22	1				96
Unskilled and defined decision making	54	1				26					81
GRAND TOTAL	245	11	7	32	13	202	7	9	24	6	556
PERCENTAGE	44%	2%	1%	6%	2%	36%	1%	2%	4%	1%	
GENDER PERCENTAGE	55%					45%					100%

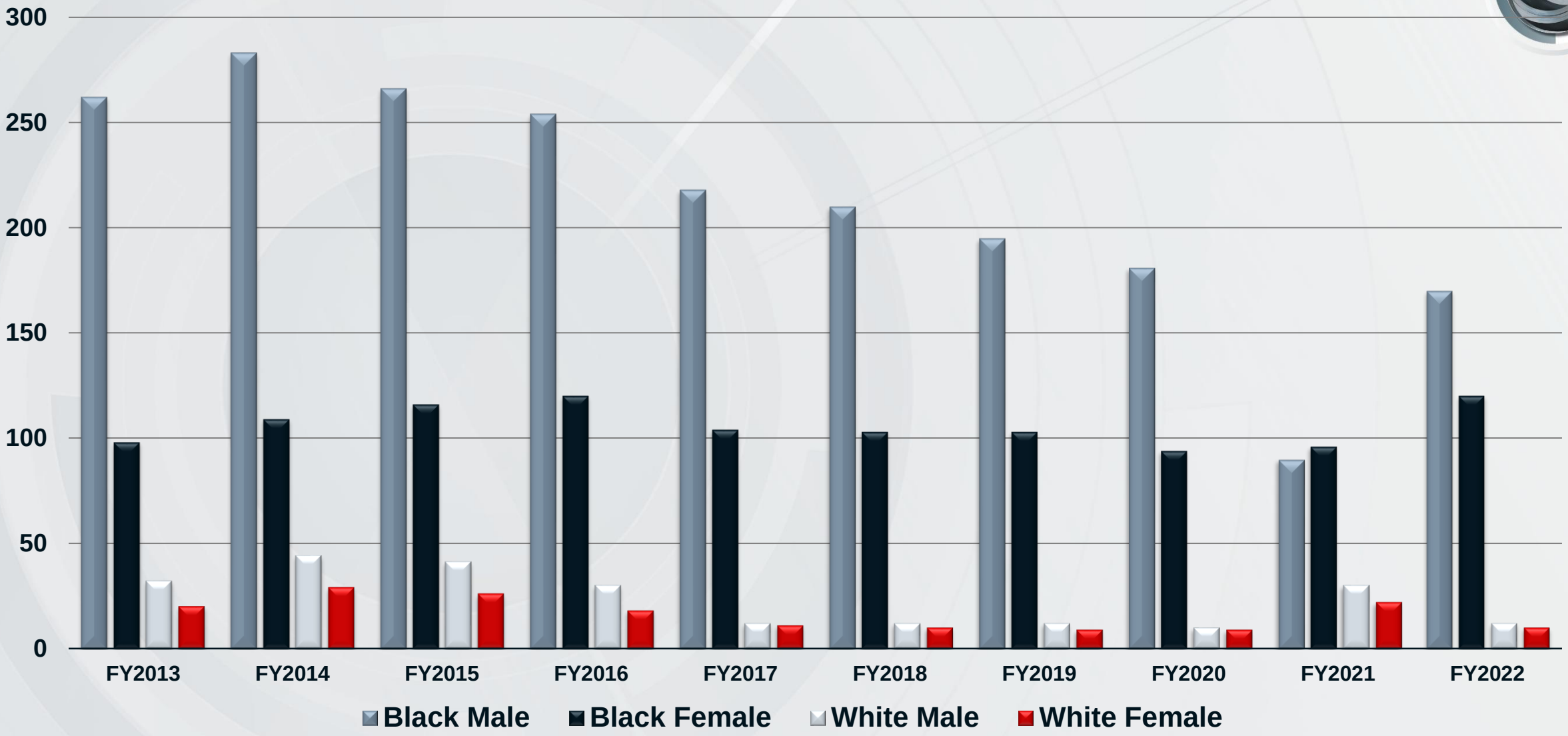
SET vs Support staff



Support staff vs SET



Support staff profile



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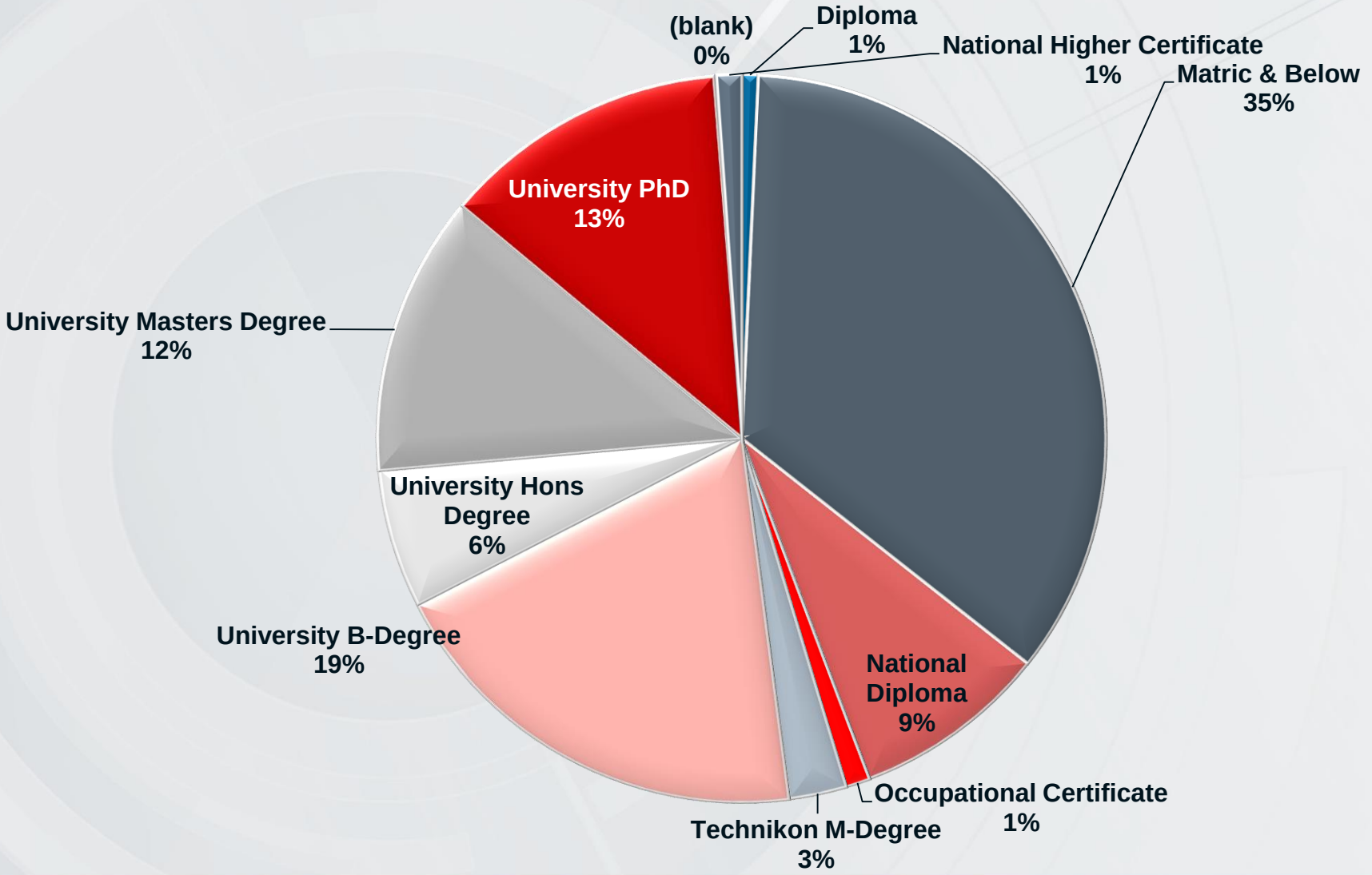
Staff qualifications profile



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Developing research leaders, some new doctorates awarded

Dr Sandile Nkwanyana was awarded a PhD in Chemical Engineering by the University of KwaZulu-Natal. His research project was in the field of comminution, looking at the method of grinding that can potentially save about 15% of energy consumption and 25 % of media consumption in ball mills, particularly in SABC circuits, without a compromise in productivity. The study was a combination of experimental work (pilot scale) and modelling using the state of the art discrete element method (DEM) software. Dr Nkwanyana works as an Engineer-in Training in the Minerals Processing Division.

Dr Taswald Moodley, Senior Engineer in Minerals Processing Division obtained a PhD in Chemical Engineering from the University of KwaZulu-Natal. His thesis focused on comminution, specifically using measured data from nuclear imaging experiments to validate computer-simulated data at the continuum scale. Dr Moodley is a member of the Particle Technology Group (PTG) that straddles UKZN and University of Cape Town (UCT). His research interests include Discrete Element Modelling (DEM), Positron Emission Particle Tracking (PEPT), the development of continuum scale granular flow models and flotation.

Dr Masaku Kgatle, Scientist-in-Training in the Advanced Materials Division graduated with a PhD in chemistry from the University of the Witwatersrand. Her PhD was awarded for a research titled “Trimetallic nanoparticles immobilized on polymeric membranes for the degradation of organicpollutants in water”. The study focussed on employing nanocomposite membranes to reduce organic pollutants in water at a lower cost with the potential to provide a solution for the reuse and recycling of dye-polluted wastewater in the textile industries. Her research was fully completed in the Mintek Nanotechnology InnovationCentre (Water Unit).

Mintek currently has **15 SET staff members** pursuing doctorate degrees in engineering and science as part of the **SET Postgraduate Qualifications Enhancement Programme.**

The topics undertaken by these candidates are aligned with Mintek’s core research focus areas and are aimed at **strengthening and developing new divisional competencies.**

Developing research leaders, some new doctorates awarded

Dr Reagan Mohlala, Scientist in the Advanced Materials Division was conferred with a PhD in Organic Chemistry from the University of the Witwatersrand under the Professional Development Program (PDP) of the National Research Foundation (NRF). His research focuses on the design and development of drug-like compounds, which target various major diseases such as HIV, TB and Cancer.

Dr Marandela Mulaudzi graduated with a PhD in Metallurgical Engineering from the University of the Witwatersrand in July 2021. His research thesis was titled ‘Mechanistic study of metal dusting corrosion for austenitic alloys in the petrochemical industry. Dr. Marandela Mulaudzi is a Senior Engineer at Physical Metallurgy Group in the Advanced Materials Division. His main interests are in the Alloy development, Phase diagrams, High temperature corrosion, and Thermo-Calc™.

Developing research leaders, some new MSc's awarded

Bongiwe Nkabane, Senior Engineer in the Hydrometallurgy Division graduated with an MSc in Metallurgy and Materials Engineering from the University of the Witwatersrand. Her research was titled "The treatment of a double refractory gold ore using pressure oxidation".

Absalom Mabeba, Scientist in the Advanced Materials Division obtained a Master of Science in Material Science and Metallurgy from the University Pretoria. His research was titled "Development of high vanadium grinding media materials for the comminution of gold ore". Mabeba is engineer in the Advanced Materials Division.

Unali Hall, Senior Engineer in the Pyrometallurgy Division graduated with a Masters in Engineering Management (CUM LAUDE) from the University of Pretoria. Her research thesis was titled - "The effect that organizational antecedents have on entrepreneurial orientation in a South African science council".

Mintek currently has **37 SET staff members pursuing Masters degrees** in various fields of science and engineering as part of the **SET Postgraduate Qualifications Enhancement Programme.** The degrees are all being undertaken at South African universities and the topics selected by these candidates are aimed at strengthening and developing new divisional competencies in core research areas.

Sr Faith Motaung, Supervisor, Occupational Health & Wellness in the Mintek Occupational Health Clinic, graduated with a Master's in Public Health from the University of Johannesburg. Her research was titled "Assessment of the implementation of controls for lead (Pb) exposure amongst laboratory workers at a science and research institution in Gauteng, South Africa".

Staff recognition by industry bodies

Professor Lucky Sikhwivhilu, Chief Scientist in the Advanced Materials Division, has been appointed Professor of Nanotechnology in the Department of Chemistry at the University of Venda. The appointment is expected to improve collaboration and visibility with research outputs. Prof Sikhwivilu was nominated for the International Research Awards (ISSN), IIRA-2022 in the category of "International Best Researcher". The nomination was awarded in association with the World Research Council in recognition of his ongoing contribution to scientific research. In addition to serving as the editor of the South African Journal of Chemistry (SAJC), Prof Sikhwivhilu has been appointed to the Editorial Board of Current Chinese Science: Nanotechnology. Prof Sikhwivhilu was also appointed as a member of the International Advisory Board of the HORIZON project PRIME "SSBD of PFAS-free Coating Alternatives for Industrial and Consumer Products". The PRIME consortium comprise of 14 entities, from Italy, Spain, Sweden, Switzerland, Netherlands and Turkey.

Dr Hein Möller (Chief Engineer in the Advanced Materials Division) has been appointed to the Council of the Corrosion Institute of South Africa (CorrISA). As a member of the council, he contributes to enhancing and expanding Mintek's corrosion research activities. Other notable achievements include an invitation to the SAIMM Editorial Board and an appointment as an Extraordinary Lecturer by the University of Pretoria. In addition, he participated on the Technical Committee as a Track director for rapid sand casting at the 22nd Annual International RAPDASA 2021 Conference.

Dr Elias Matinde, Executive Manager in the Pyrometallurgy Division, was conferred with a C3 NRF rating effective 01 January 2022. The rating will unlock opportunities to tap into future NRF funding calls for rated researchers. Dr Matinde holds a PhD and MSc in Metallurgy from Tohoku University in Japan, MBA (University of Zimbabwe), BSc (Hons.) Metallurgical Engineering (University of Zimbabwe) and PGDip in Education (Wits).

His expertise includes the development of nascent pyrometallurgical processes across various commodities, with particular emphasis on process flowsheet development in ironmaking and steelmaking, base metal and refining, production of ferroalloys, and processing of complex rare earth deposits.

Staff recognition by industry bodies

Duduzile Nkomo, was invited as a guest lead editor in the special issue of Recent Advances in Osmium-based Research of International Journal of Materials Science and Applications (IJMSA). The special issue published in 2021 consist of prominent researchers from around the world who bring different expertise in this research field. She is a scientist in the Advanced Materials Division, where she works on precious materials research.

Dr Joalet Steenkamp and Dr Quinn Reynolds, Technical Specialists in the Pyrometallurgy Division were invited to serve on the Organising Committee and as Editors of the Furnace Tapping 2022 Proceedings. The Furnace Tapping 2022 event was co-hosted at the TMS Annual Meeting and Exhibition in Anaheim in the USA on 27 February – 03 March 2022. In addition, Dr Reynolds guest-edited a special edition of the JOM Journal on Computational Modelling in Pyrometallurgy. The response to the topic was overwhelming and the Journal published it in two parts in the October and December edition.

Staff recognition by industry bodies

Dr Maje Phasha, Chief Scientist in the Advanced Materials Division was appointed as an Advisory Board Member for the Department of Metallurgy at University of Johannesburg. Participating in this committee provides an opportunity to guide the department in preparing students for their career and to promote and improve technical education.

Dr Deshenthree Chetty, Head of Mineral Science in the Mineralogy Division, was invited to represent Mintek as a supporting partner on the Advisory Board of the Doctoral Network Marie Skłodowska- urie Action Holistic Ore to Metal Optimisation for a Circular Economy (HOME) project proposal for EU Horizon funding. The proposal and project is being co-ordinated by the Helmholtz Institute Freiberg, and focuses on the development of holistic geometallurgical models with one of three case studies being the Copperton Cu-Zn deposit in South Africa.

Senior Scientist in the Mineralogy Division, Susan Brill was nominated to serve on the Kimberley Process Certification Scheme (KPCS) as Chair of the Scientific Subgroup. The Scientific Subgroup is responsible for collecting scientific data on diamonds to assist the Kimberley Process to mitigate conflict diamonds entering legal trade. The role of Mintek is to detect and quantify the trace element content of diamonds using LA-ICP-MS. Trace element signatures are unique to diamond deposits and regions. Mintek has been capturing this information since 2008 and hosting the resulting trace element concentration database.

Research, Development and Innovation Perspective

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Performance with respect to KPI's_2021/22

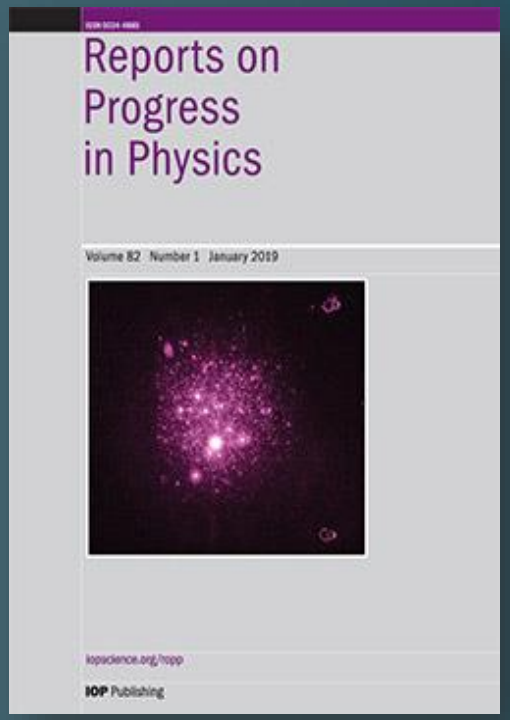
SO1: Conduct Relevant, Applied Research & Technological Innovation

Key Performance Indicators	Target 2021/22	Performance 2021/21
Number of journal papers	30	**61**
Number of conference papers	35	**36***
Number of book chapters	5	**9**
Number of books	1	**0**
Number of invention disclosures	16	**8**
Number of patents	4	**0**
Number of trademarks	6	**3**

* **89** Conference presentations & webinars

Research published in top journals

- Mintek published 61 journal articles in accredited journals
- Examples of high-impact factor publications:

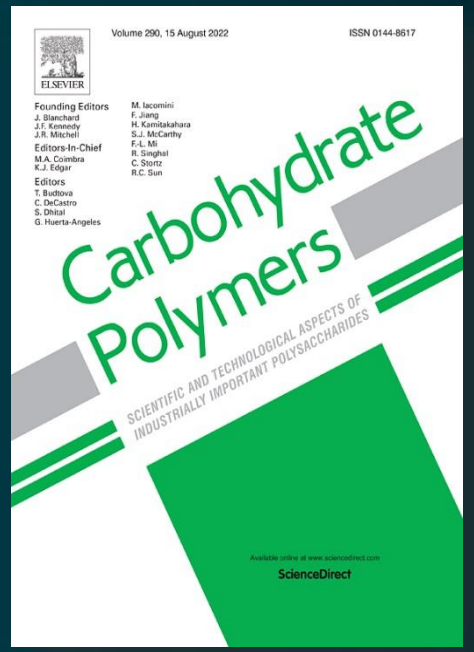


Recent advances in positron emission particle tracking: a comparative review.

Impact factor 17.26

Assessment of asbestos contamination in soils at rehabilitated and abandoned mine sites, Limpopo Province, South Africa

Impact factor 10.58



Mechanical Properties of Cellulose Nanofibril Papers and their Bionanocomposites: A Review

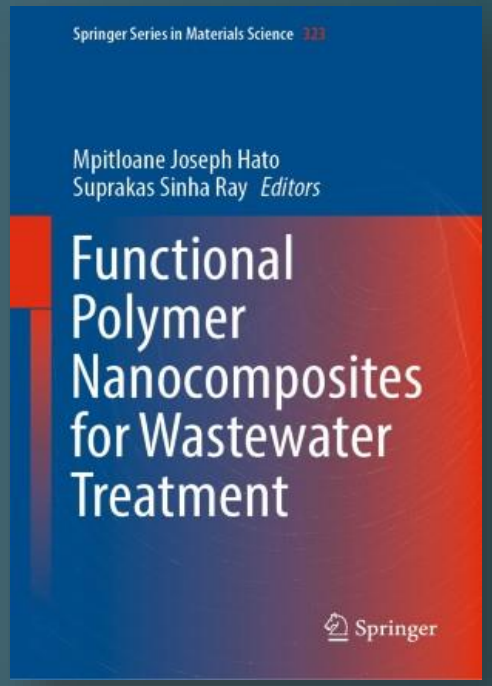
Impact factor 9.381

Efficient and durable gas diffusion electrode for proton exchange membrane fuel cell via in-situ growth of Pt nanowires on dual microporous layer

Impact factor 9.127

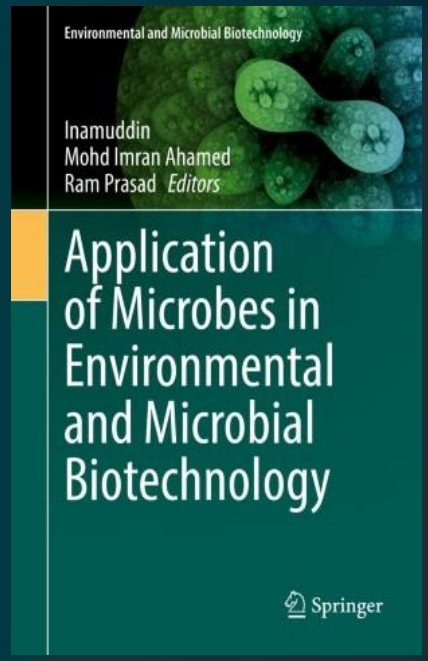
Book chapter publications

- Mintek published 9 book chapters in accredited books
- Examples of book chapters published:

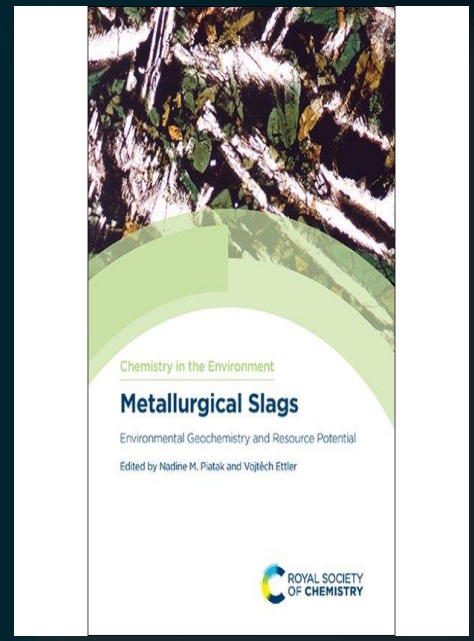


Electrospun Nanofiber-Based Composites for Arsenic Removal in Water and Wastewater.

The Evaluation of the Comparative Corrosion Behaviour of Conventional and Low Nickel Austenitic Stainless Steel: Hercules™ Alloy.

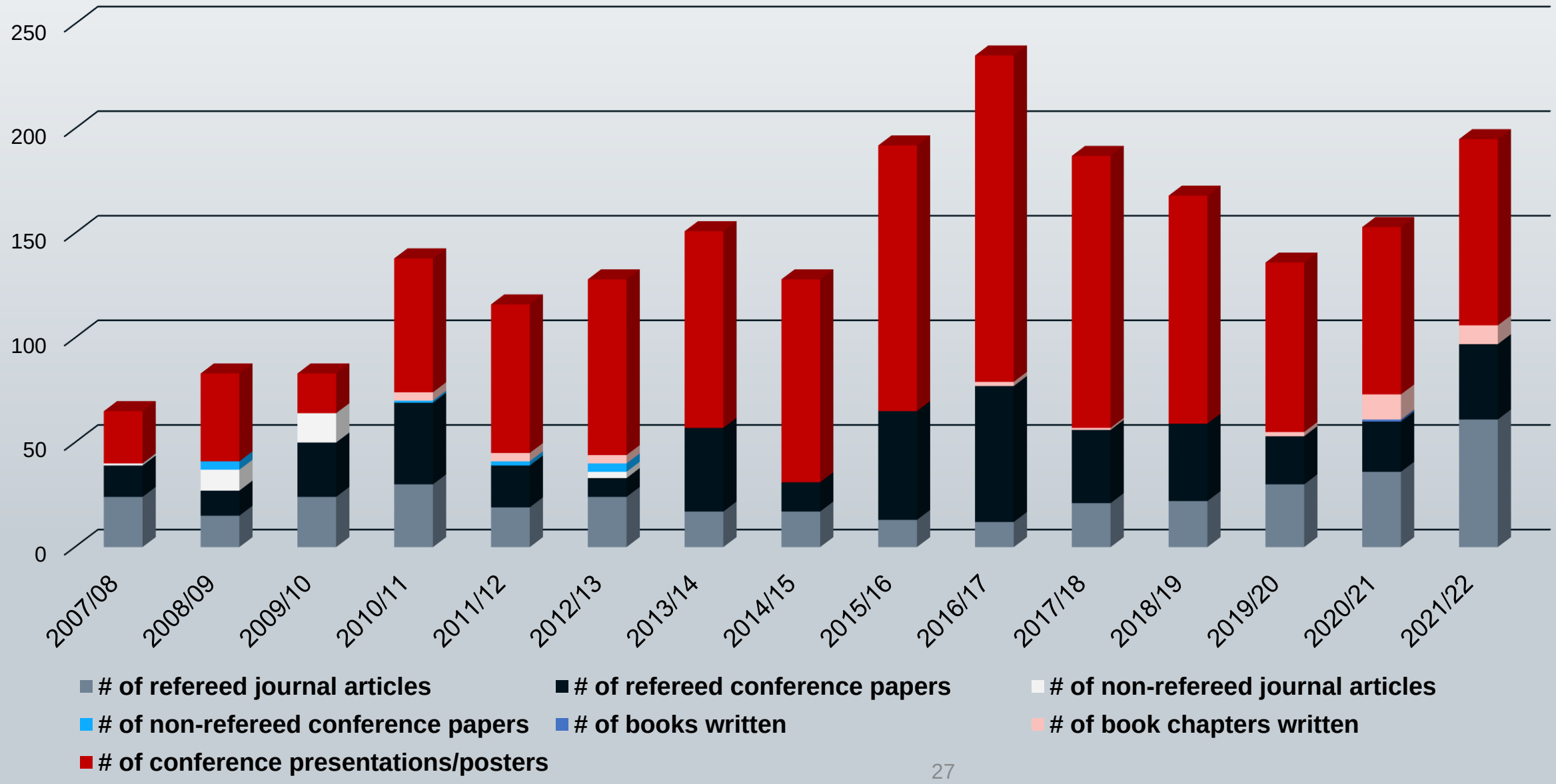


Applications of Microbes in Antibiotics.

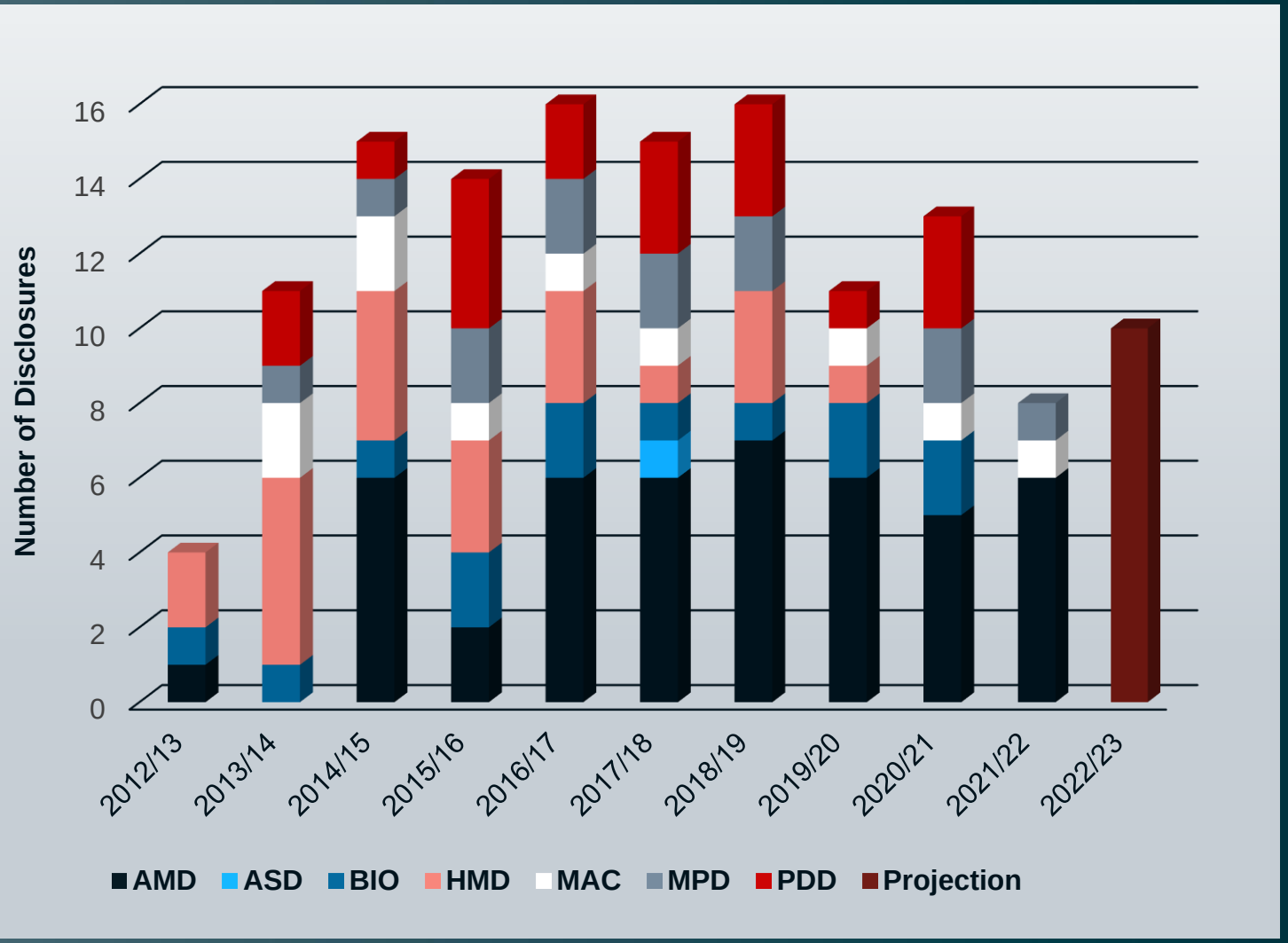


Metallurgical Overview and Production of Slags

Publications by type

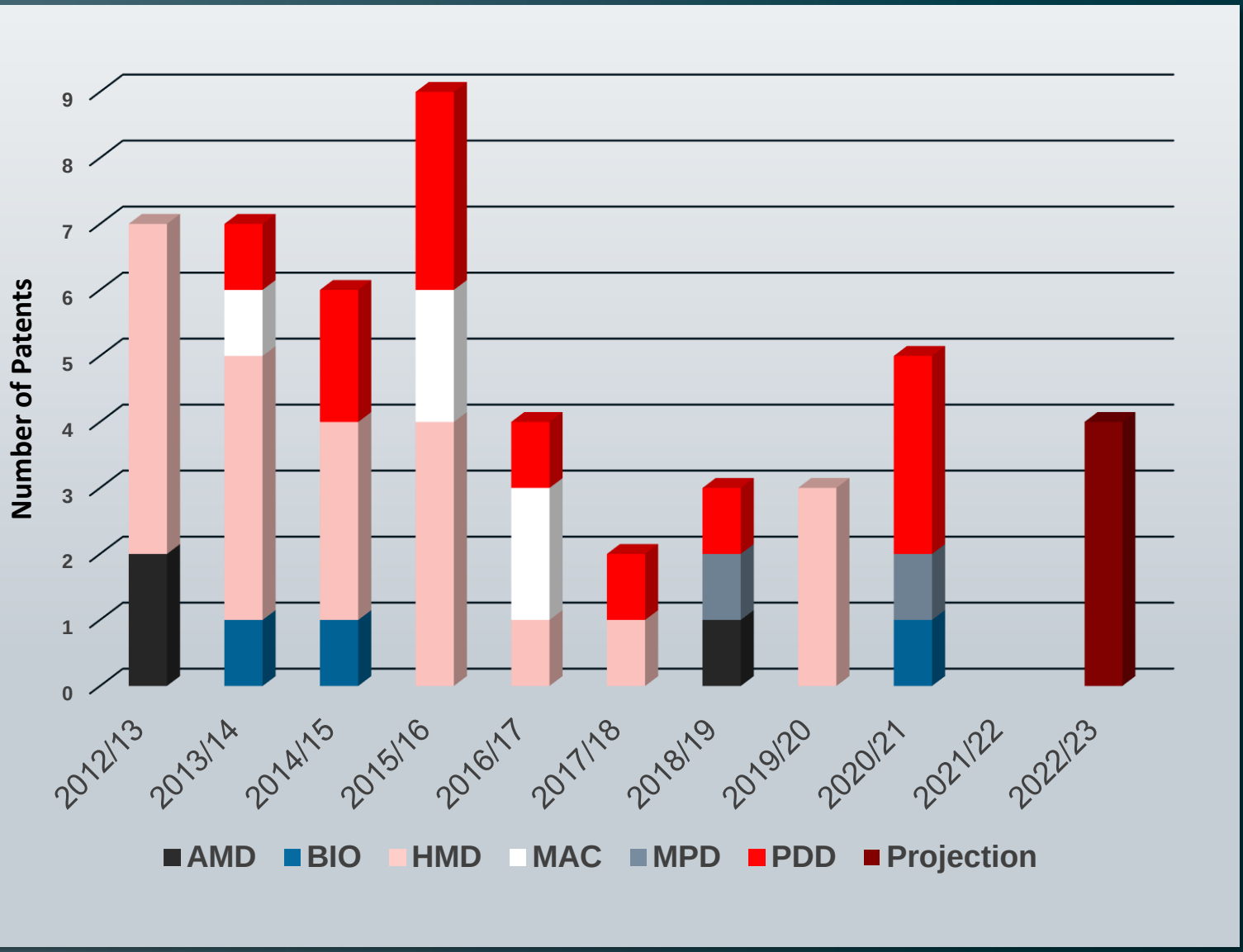


Invention disclosures



- **Over the past 10 years Mintek has filed 124 invention disclosures and 45 provisional RSA patents applications.**
- **In 2021/22 Mintek filed 8 invention disclosures, these include:**
  - Design and production of a recombinant HIV-1/HIV-2 Fusion Antigen;
  - Continuum-armed bandit for optimizing minerals processing operations;
  - Platchem Technology;
  - Development of the SARS-CoV-2—Opt—Nano Silver photoluminescence nanobiosensor for the detection of SARS-Cov-2 viral particles;
  - Synthesis of PtNi nanoframes, applied in electrocatalysis, via thermal reduction;
  - The Development of PtCo/C Electrocatalysts for Hydrogen Proton Exchange Membrane Fuel Cells at Commercial Scale;
  - The Scale-up of Pt/C Heat Stabilized Fuel Cell Catalysts; and
  - Nano Alginate Resin – for uses in biomedicine

Patents / Designs filed



- Mintek has 222 active patents and designs in 66 patent families spanning 2010 to 2021. Besides locally, include countries such as Australia, Brazil, Canada, Chile, Eurasia, Indonesia, Malaysia, Saudi Arabia, and countries under ARIPO and OAPI conventions.
- Mintek registered 46 provisional RSA patents over the period 2012-2021
- In 2021/22 No new patents were filed Mintek Office of Technology Transfer has reviewed a number of new invention disclosures for patentability and none of them met the patenting criteria. Therefore no new patents were filed.
- Some international patents filed in 2021/21 are pending and include countries such as South Korea, USA, Hong Kong, India, Europe and Brazil
- All patents are in force and more than 60% will expire after 2029.

Industry Development

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Performance with respect to KPI's - 2021/22

SO2: Foster Industry Establishment and Expansion

Key Performance Indicators	Target 2021/22	Performance 2021/22
Number of new prototypes, processes and/or models demonstrated/validated in a relevant environment	20	**14**
Income from the sale of products & services, royalties and licences, (Rm)	108.78	**142.17**
Number of IP Licences	1	**0**
Number of certified reference materials	6	**6**
Number of accredited methods	19	**17**

Unlocking value from the treatment of acid mine drainage through demonstration of integrated treatment technologies

Objective

Sulphate, acid and a range of metals are common contaminants of mine-impacted waters from certain sectors of the mining industry, especially coal and gold mining. Mintek has developed a biological technology to treat the water and render it suitable for use in irrigated agriculture.

Biological Sulphate Reduction (the cloSURE™ process)

cloSURE
Passive sulphate reduction process for treatment of water after mine closure

Achievements for 2021/2022

- Proved at pilot scale (0.5m^3/day) that mine water can be treated and is suitable for for re-use in irrigated agriculture.
- Demonstration plant for treating 50m^3/day of AMD has been constructed at Thungela Resources and will be commissioned and operated in FY2022/2023.
- Aim is to develop design parameters for a commercial-scale plant.
- Thungela Resources has provided funding for construction of the plant.
- Mintek has secured funding from TIA for participation in design, commissioning and operation of the demonstration plant.

Next steps: Commissioning and operation of the demonstration plant. Treated water will be applied in an agricultural programme in partnership with the University of Pretoria.

Establishing eWaste Processing Capacity in South Africa

Objective

Development of an integrated process flowsheet to recover valuable metals such as copper, tin, lead, zinc and precious metals such as silver, gold, palladium and platinum from low grade waste electrical and electronic waste (WEEE) streams. Processing technology specifically designed for low value cathode ray tubes (CRTs) and printed circuit boards (PCBs)

95% Pb alloy

95% Cu alloy

Achievement for 2021/22

- The eWasteSmelt™ process was successfully demonstrated at pilot-scale by processing printed circuit boards (PCBs) and cathode ray tubes (CRTs) in a top-blown rotary converter to recover alloys of copper and lead.
- The two processes were integrated by recycling slag from the CRTs furnace to the PCBs furnace to be utilised as a fluxing agent and fume from the PCBs furnace was recycled to the CRTs furnace to be utilised as a source of lead oxide.
- Produced a crude Cu alloy containing 95 wt% Cu with the recovery of more than 98 wt% precious metals (Au, Pt, Pd), as well as a crude Pb alloy containing 96 wt% Pb with a recovery of more than 80 wt% Ag and 50 wt% Sn in an integrated flowsheet.
- Complete patent filed with the South African patent office.

Next step: Advance the technology readiness level of the eWasteSmelt™ process to TRL6.

Derelict and ownerless mine rehabilitation

SOME NOTABLE ACHIEVEMENTS IN THE ASBESTOS REHABILITATION PROGRAMME DURING THE PAST YEAR INCLUDE:
Achieving practical completion of **two (2) asbestos mine rehabilitation projects**; Uitval and Uitkyk Asbestos Mines in Limpopo Province. Partial completion was achieved for Lagerdraai Asbestos Mine, also in Limpopo Province.
Works also continued at the **Riries Asbestos Mine** Rehabilitation in Northern Cape. Planning work and designs for new sites also continued.

Top: Construction of storm-water control channels and blankets at Uitval Asbestos Mine in Limpopo Province.
Bottom: Reshaping of the dump and construction of storm-water control channels at Uitkyk Asbestos Mine in Limpopo Province.

Derelict and ownerless mine rehabilitation

SOME NOTABLE ACHIEVEMENTS IN THE HOLINGS CLOSURE PROGRAMME DURING THE PAST YEAR INCLUDE:
Sealing of **54 goldmine holings** in the Gauteng Province
Finalised designs for **26 holings** in the Gauteng Province.
Continued with planning work and site investigations for new sites.

Top: *Unsealed ML 08 shaft in Dobsonville, Gauteng Province.*

Middle: *Construction in progress for ML08 holing in Dobsonville, Gauteng Province.*

Bottom: *Marker post for the DSC476 shaft sealed in Westrand, Gauteng Province.*

Performance with respect to KPI's - 2021/22

SO4: Develop and Maintain World-Class RDI Capacity

Key Performance Indicators	Target 2021/22	Performance 2021/22
Total investment in plant, property and equipment, (Rm)	52.2	**21.44**
Total investment in human capital, (Rm)	14	**9.13**
Lost Time Injury Frequency Rate	<1	**0**
Client Satisfaction Rate	>90%	**100%**
Number of accredited facilities	5	**3**
Safety, Health, Environment and Quality	Maintain Accreditation	Accreditation Maintained

Facilities accreditation

- **ISO 13485 accreditation: Medical Device Manufacturing**
  - Focus Audit Visit (Lloyds Register): successfully completed in June 2022 – next (review) visit scheduled for June 2023

- **BSL-3 Facility**
  - Recertification completed in September 2022
  - Continues to enable COVID-19 PCR Testing (as needed) and RDT development activities (for infectious agents)

Financial Perspective

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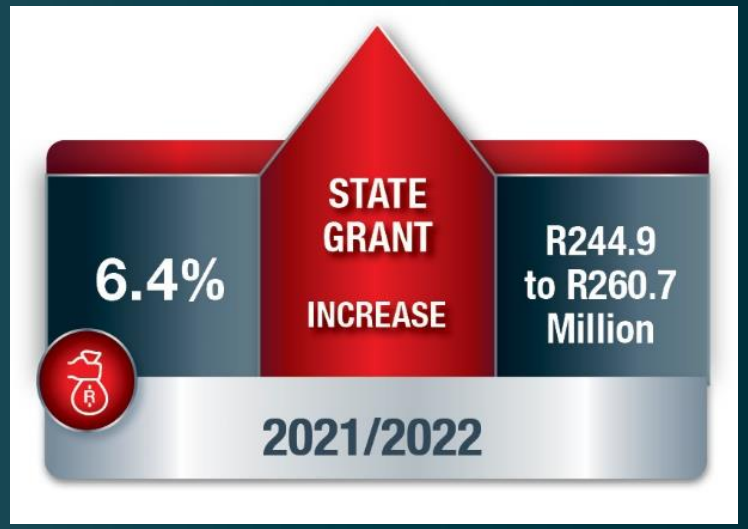
Performance with respect to KPI's - 2021/22

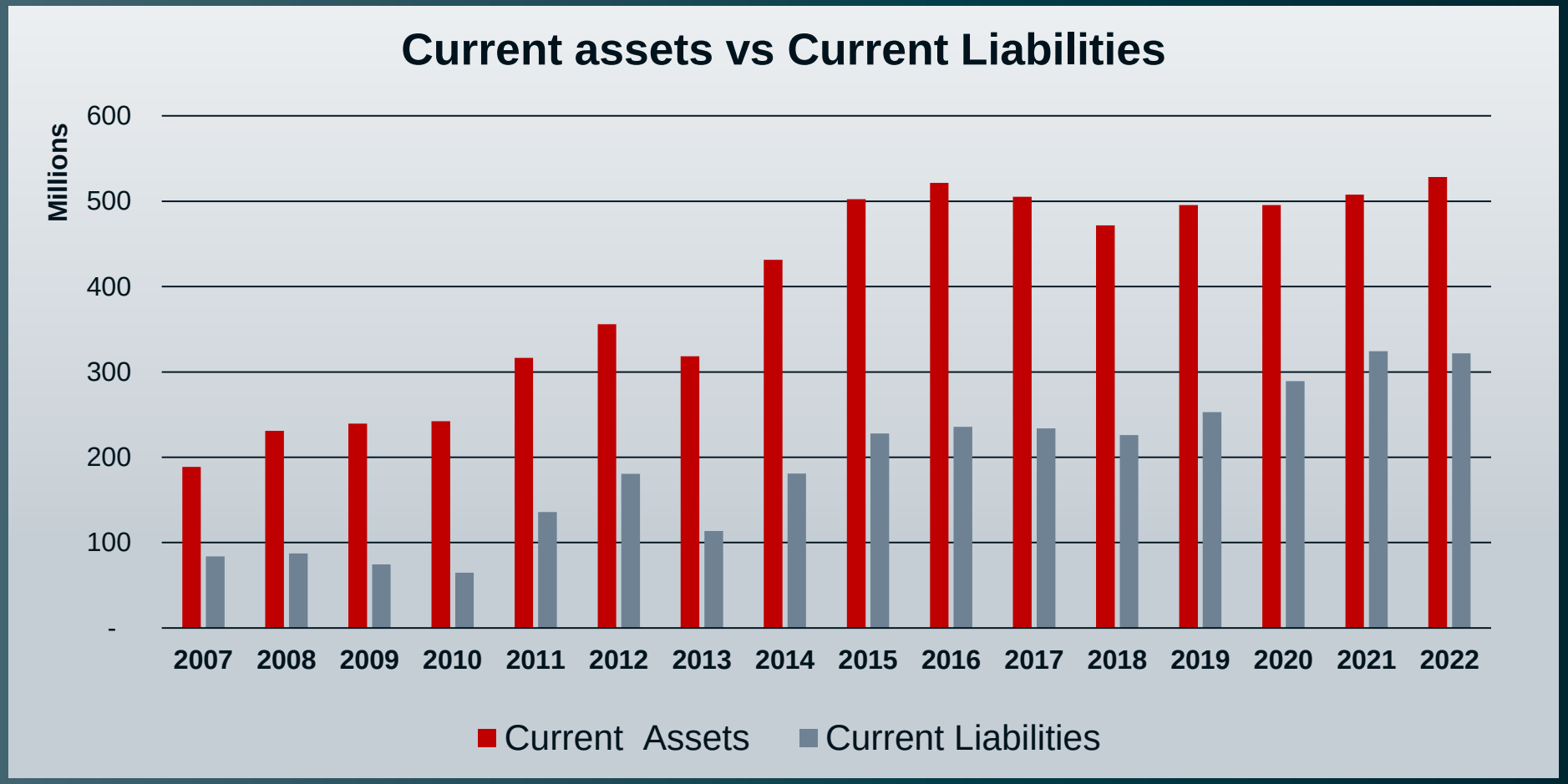
SO5: Financial Sustainability

Key Performance Indicators	Target 2021/22	Performance 2021/22
Total income, (Rm)	568.7	**600.19**
Net result, (Rm)	0.6	**9.1**
Contract R&D Income, (Rm)	14.7	**74.48**
BEE Spend as % of Procurement Spend	85%	**103.32%**
Audit opinion	Unqualified	**Unqualified**

Financial Performance



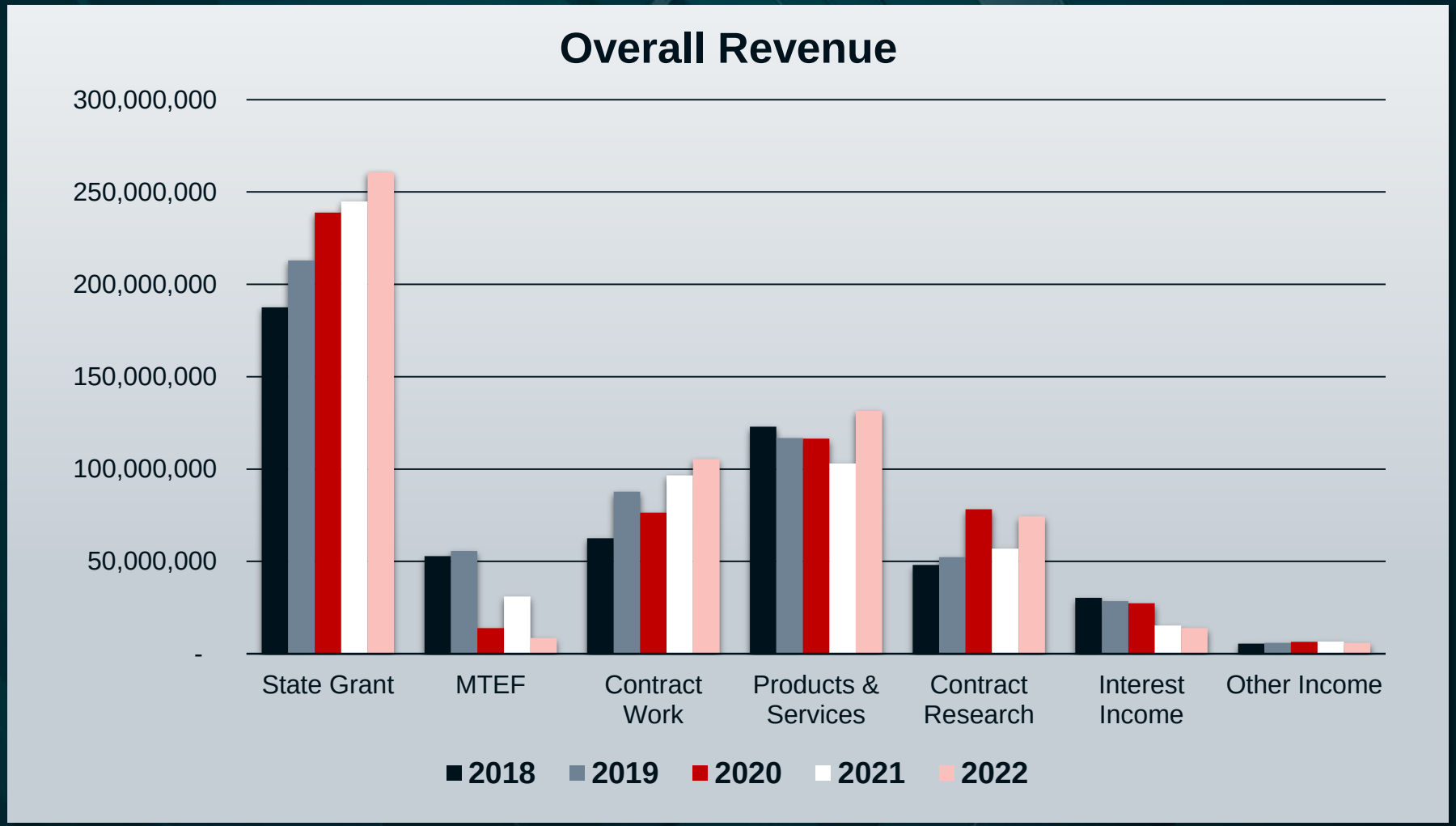
Financial position: working capital management



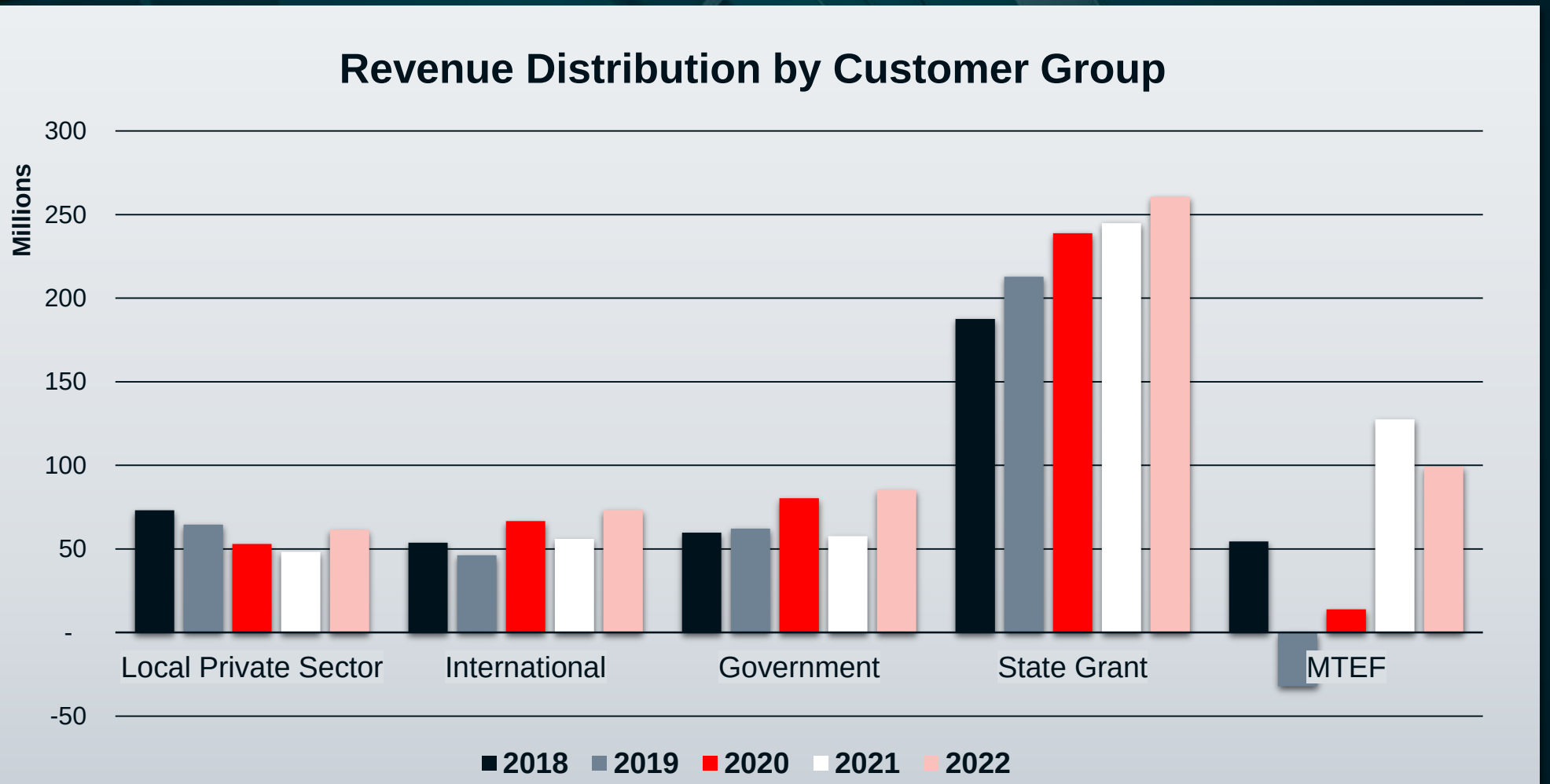
Cash locked up in working capital is a continuous focus area for Mintek. The current ratio declined further to 1.6:1

The ratio indicates that Mintek's short term obligations were adequately covered by current assets

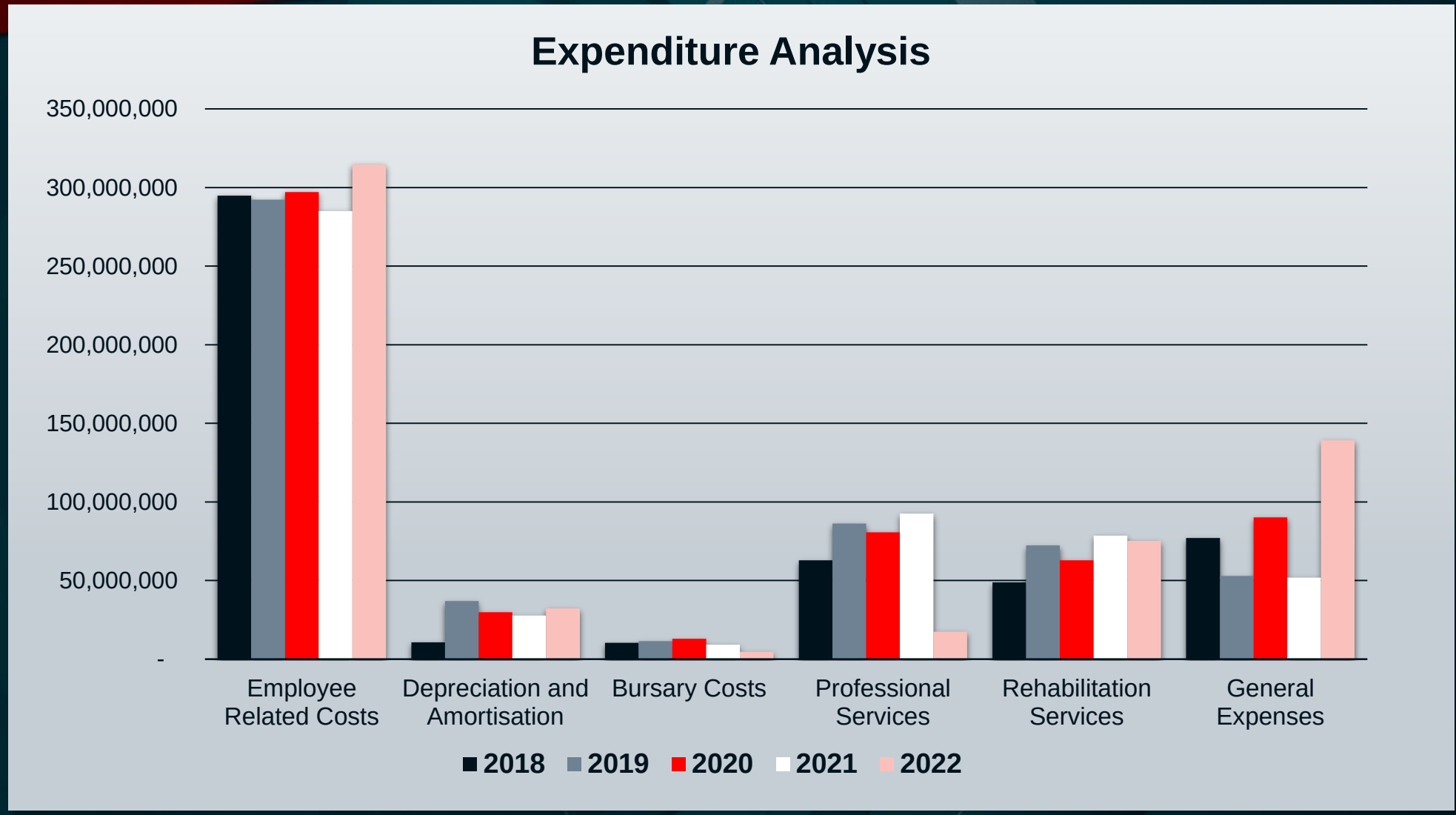
Mintek Revenue



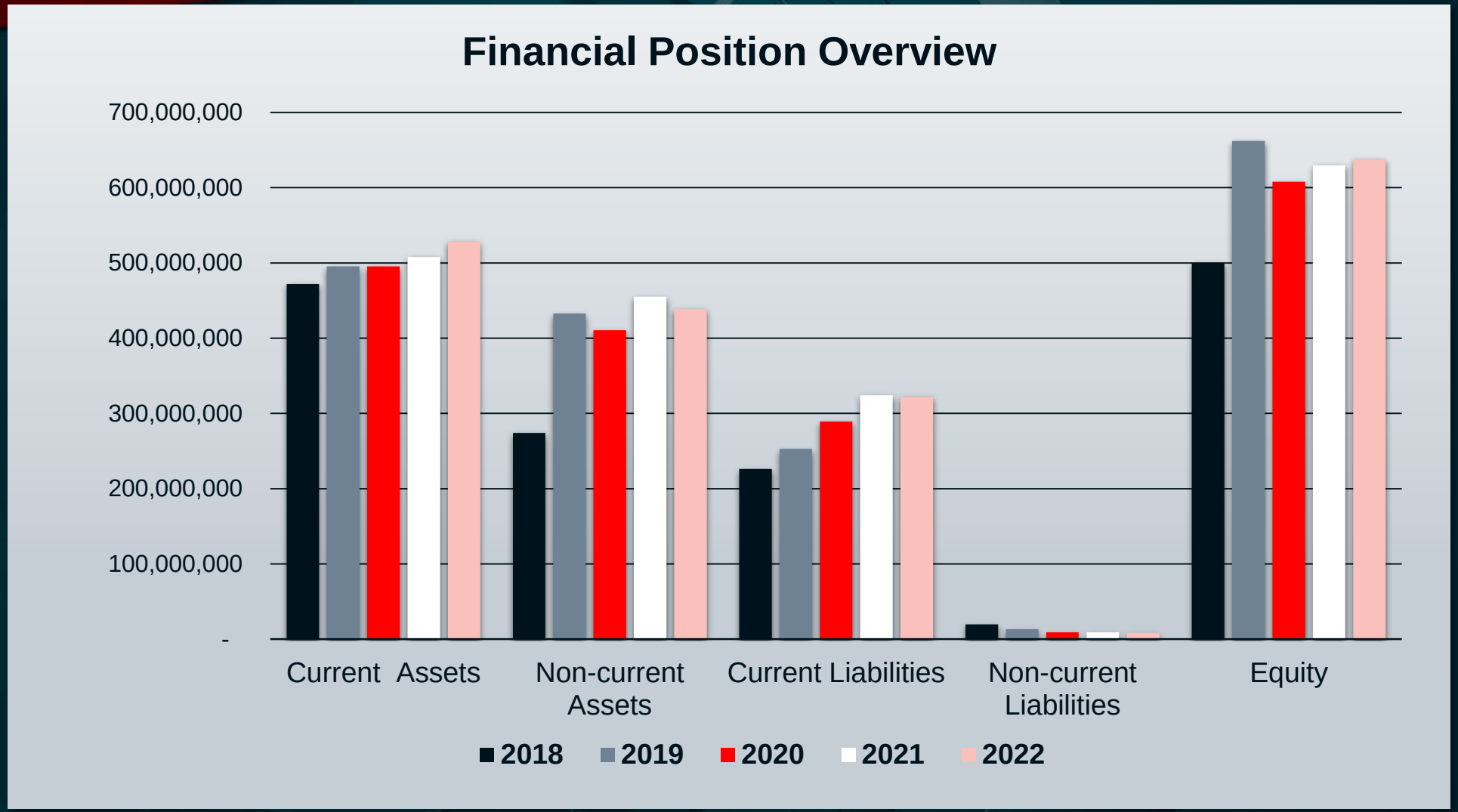
Mintek Revenue Mix



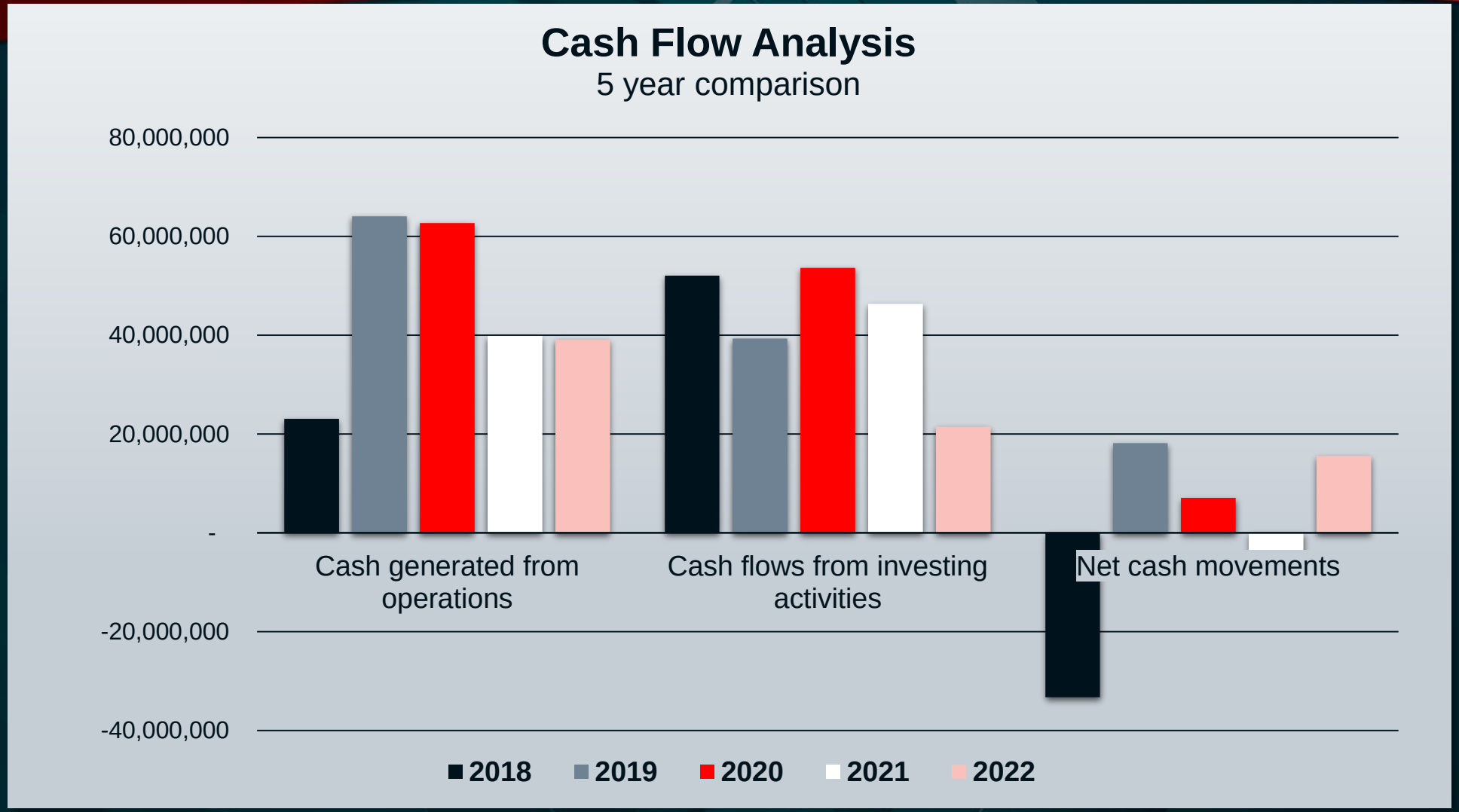
Mintek expenditure



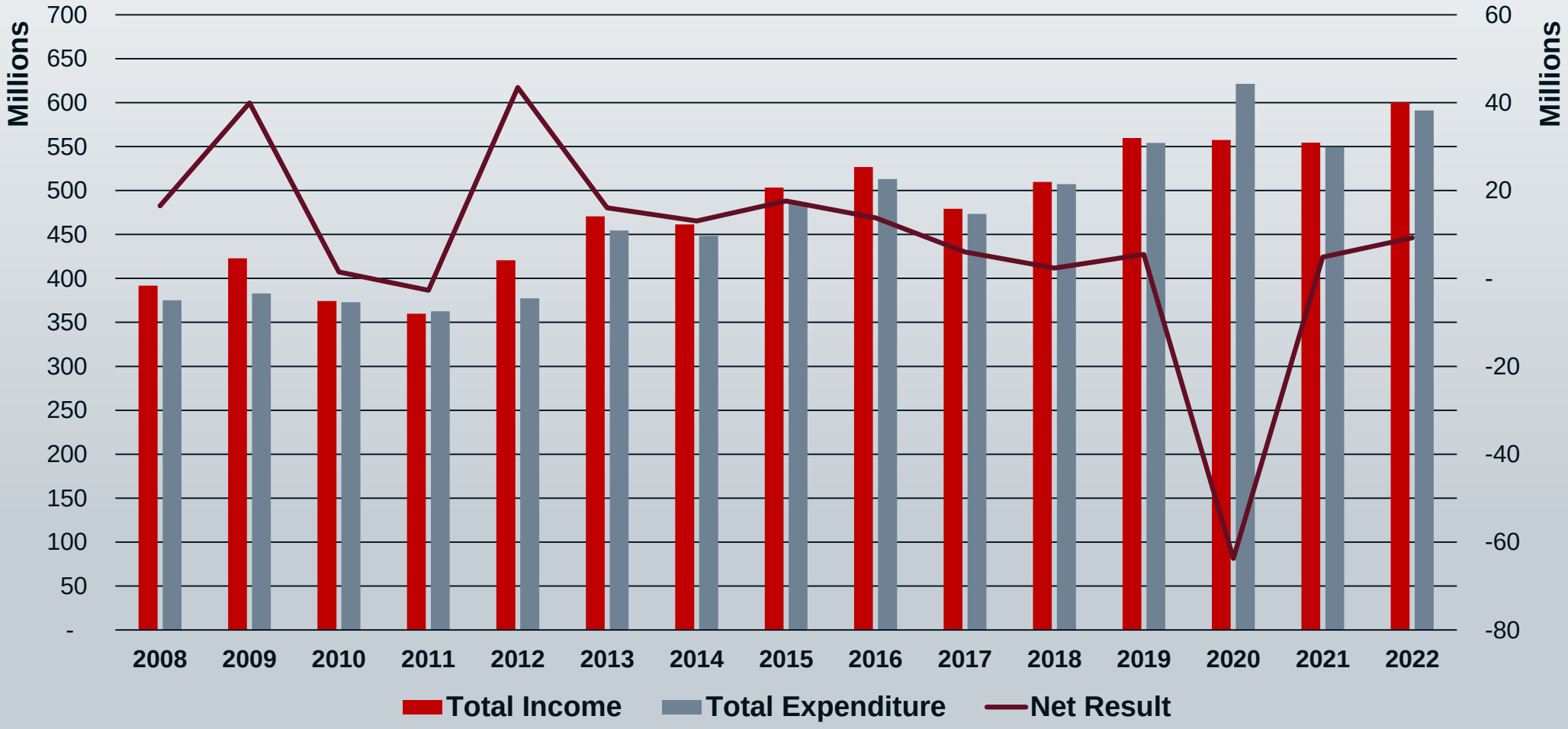
Mintek Financial Position



Mintek Cash flow



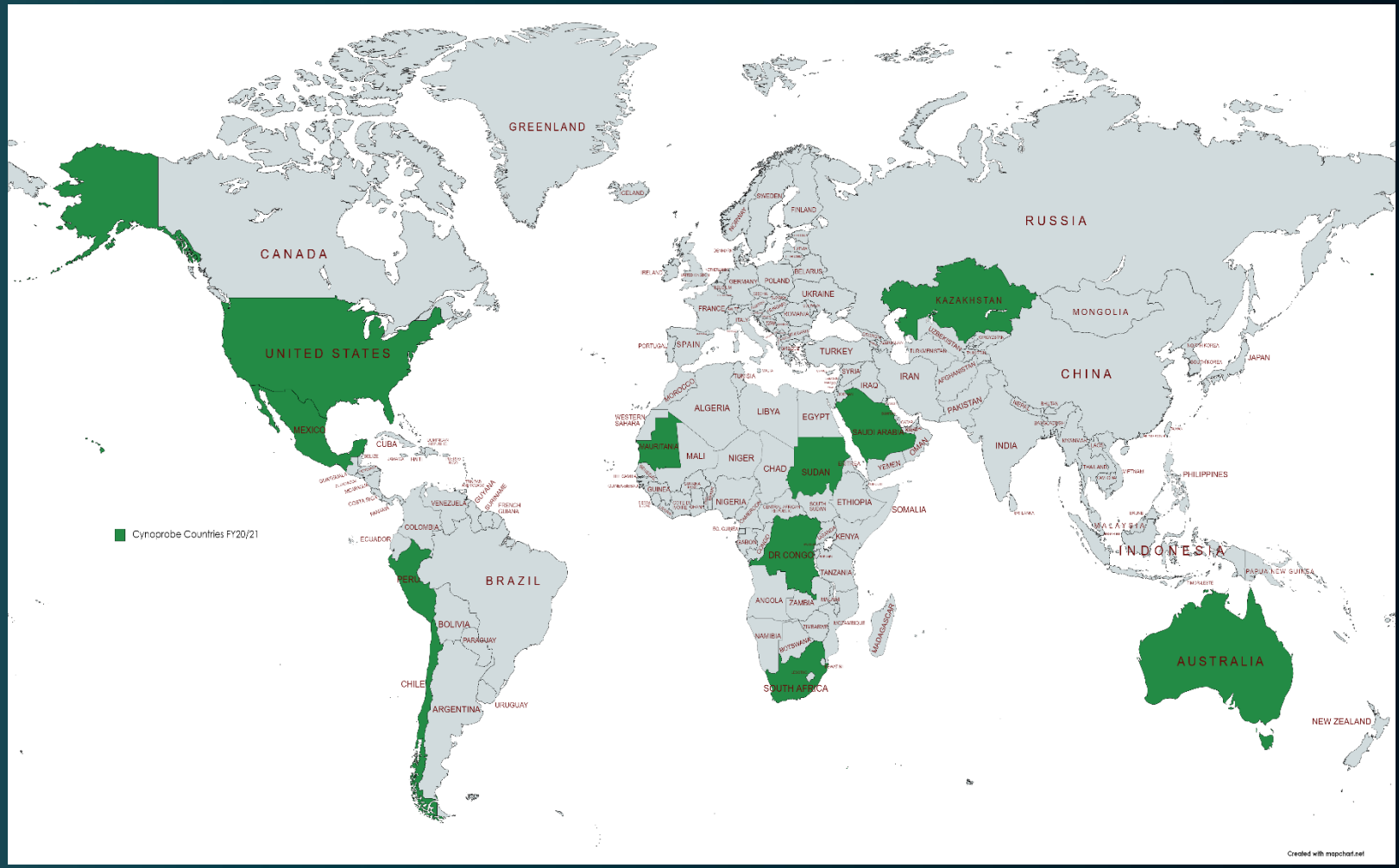
Mintek Net Surplus / Deficit



Sale of products and services – Gold Industry

Cynoprobe

- Online Cyanide Measurement
- Continued strong sales: **22 units sold** in **over 8 countries** during FY21/22 (vs 21 in FY20/21)
- Sales increased by three-fold compared to FY19/20

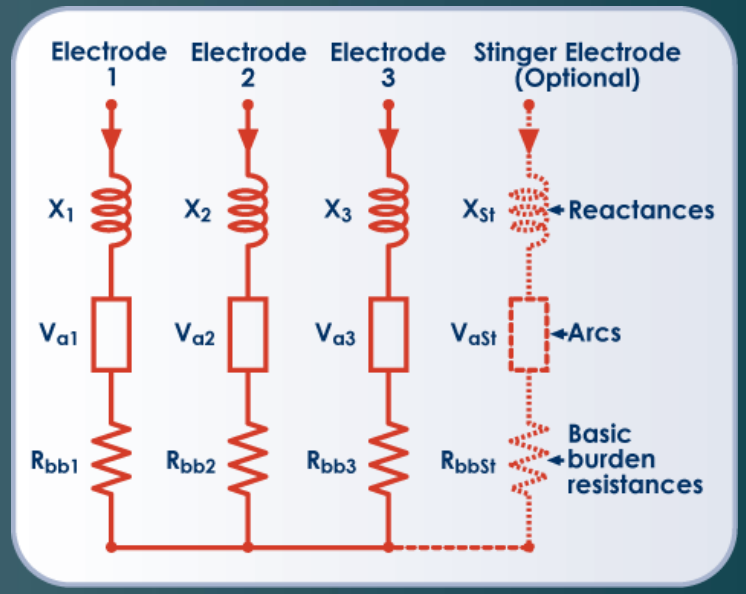


Sale of products and services – Gold Industry

Carbon Concentration Meter

- Online Carbon Concentration
- **Total of 11 units sold** during FY21/22 with some deferred to 22/23.
- Maintaining performance for last 3 years
- **Countries**:
  - South Africa
  - Australia
  - Canada

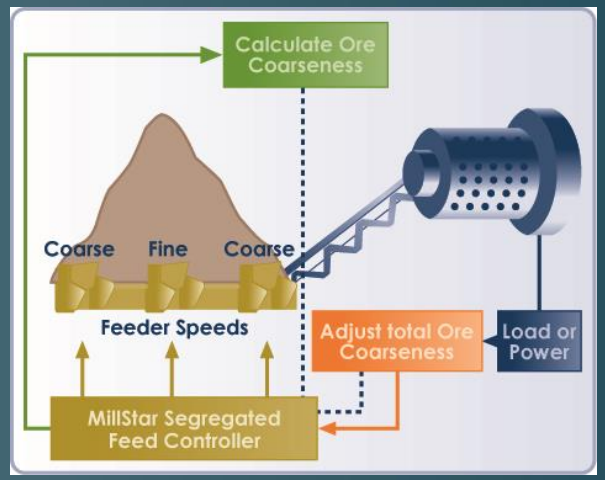
Sale of products and services - Ferroalloys



FurnStar

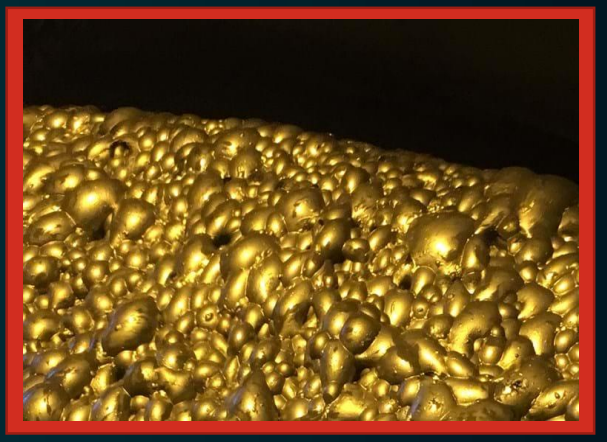
- Energy Management System for submerged-arc furnaces
- Signed a new partner for expansion into the **China and Mongolia** regions with benefit-sharing contracts. Potential of **50+ furnaces** in those regions.

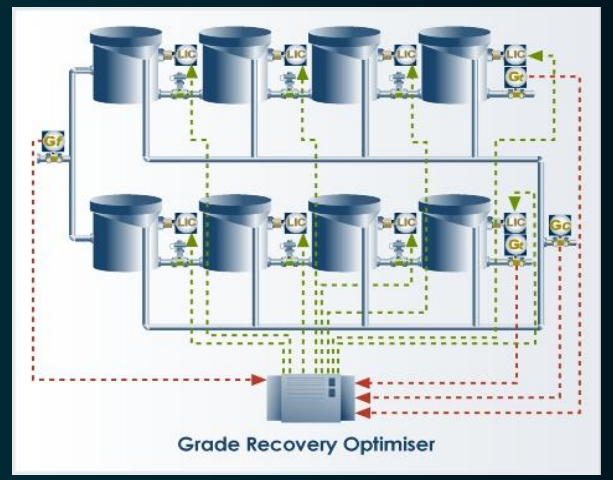
Sale of products and services – Process Control



MillStar and FloatStar

- Control systems for milling and flotation processes on various commodities
- **Commencement of Large-Scale Commissioning** of MillStar and FloatStar across 8 concentrators from one mining company
- **Use of a benefit sharing model**
- **100 MillStar and FloatStar proposals requested in 2021-22**
  - Total of R102M
  - 32 Countries





Concluding remarks

- Mintek is making visible progress to fully align with our role as a research and technology organisation, as well as an industry-focused research institution.
- We continue to redirect our efforts in order to promote mineral technology and to foster the establishment and expansion of industries in the field of minerals.
- Visible progress towards establishing partnerships and collaborations, both locally and internationally, to help maximise our multi-disciplinary expertise, accelerate innovation, develop technological solutions, transfer and commercialise technologies.
- The new strategy continues to deliver results where there has been an improvement in the SET staff number, experience and qualification profile.
- Mintek is building capacity in business development and commercialization as well as communication.
- Overall, Mintek performed well, showing improvements in RDI outputs, financial performance and improvement in staff profile, which is an indication of Mintek’s quest towards sustainability in line with the objectives of the Mintek 2030 strategy.

Thank You

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Tel: +27 11 709 4111 | **www.mintek.co.za**

Financial Trends

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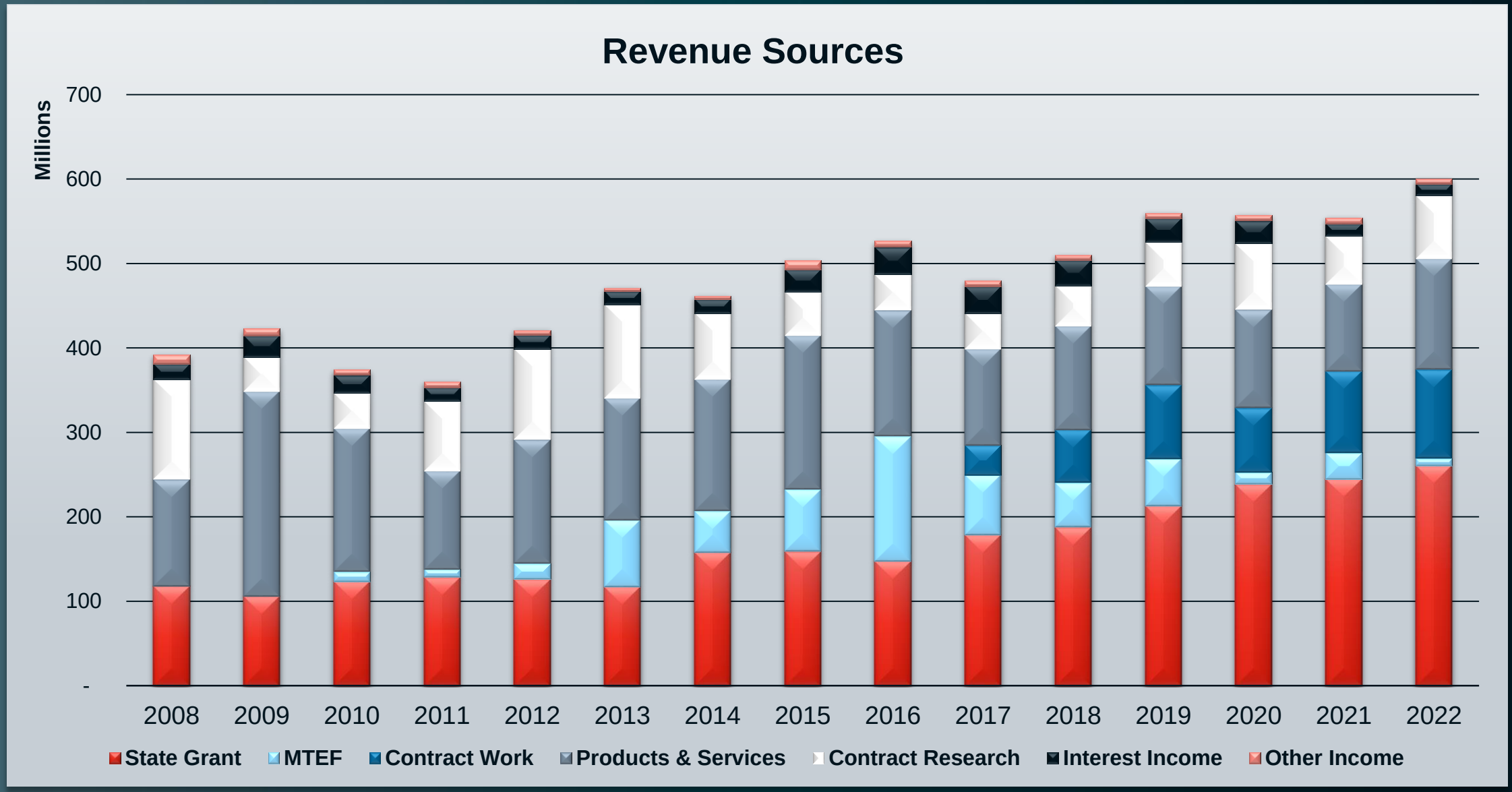
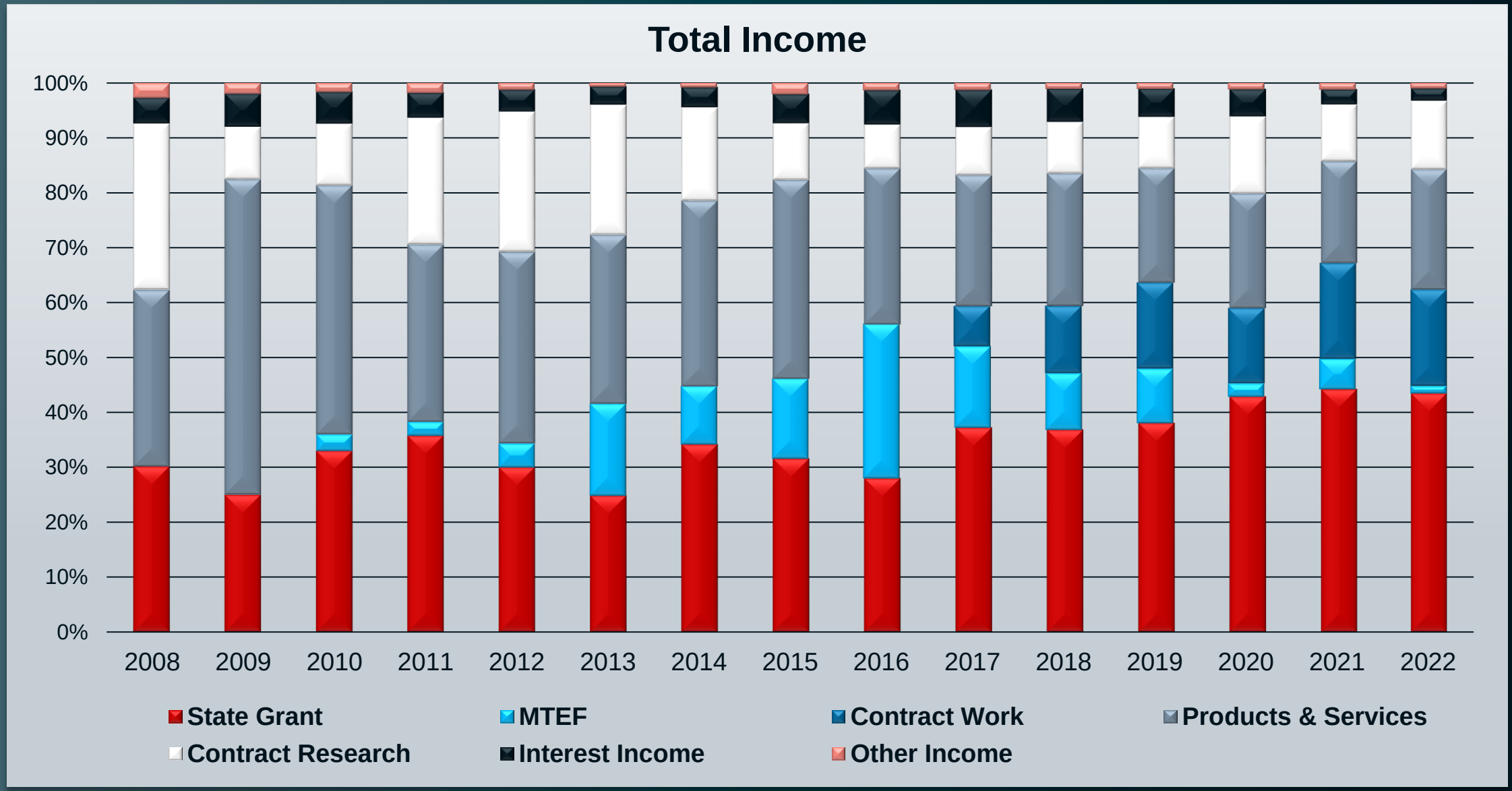
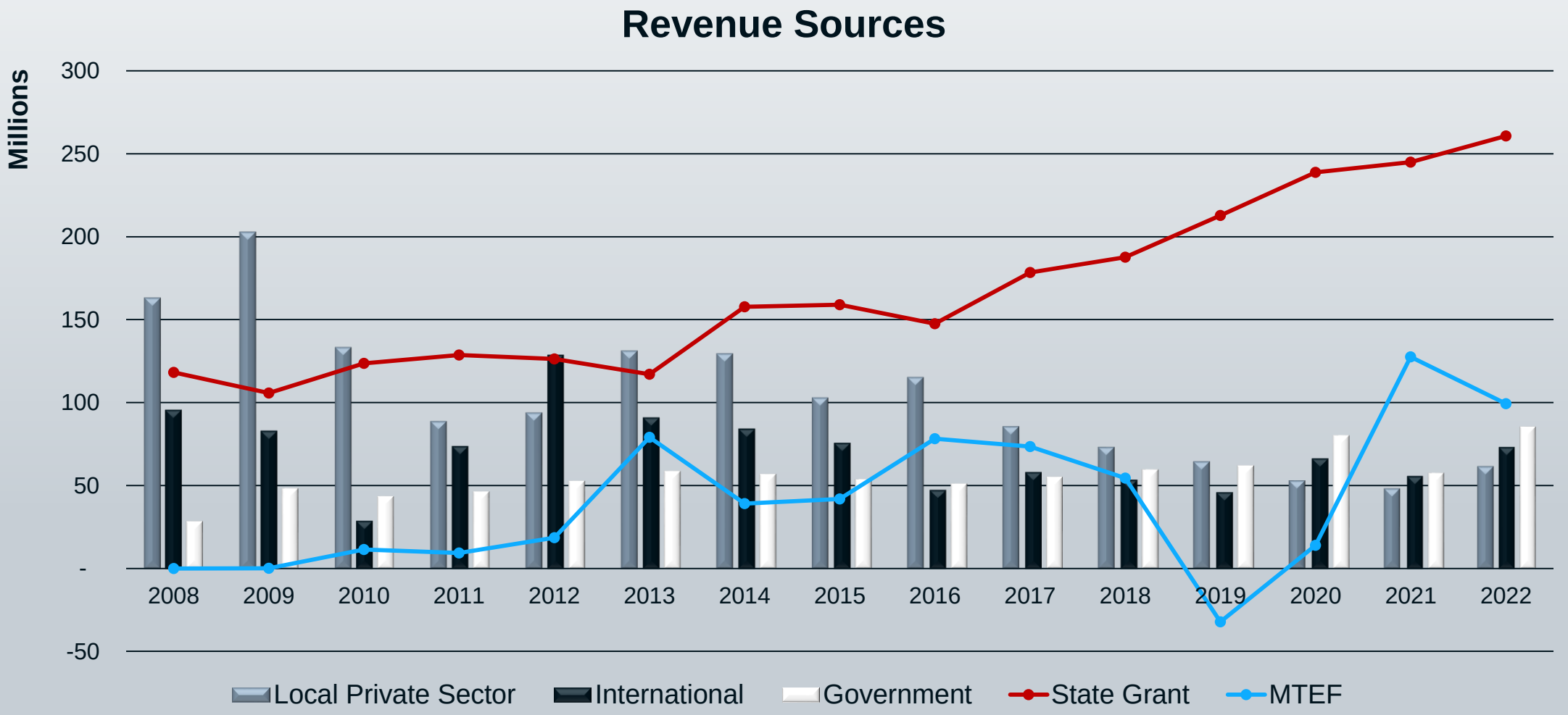
Revenue sources



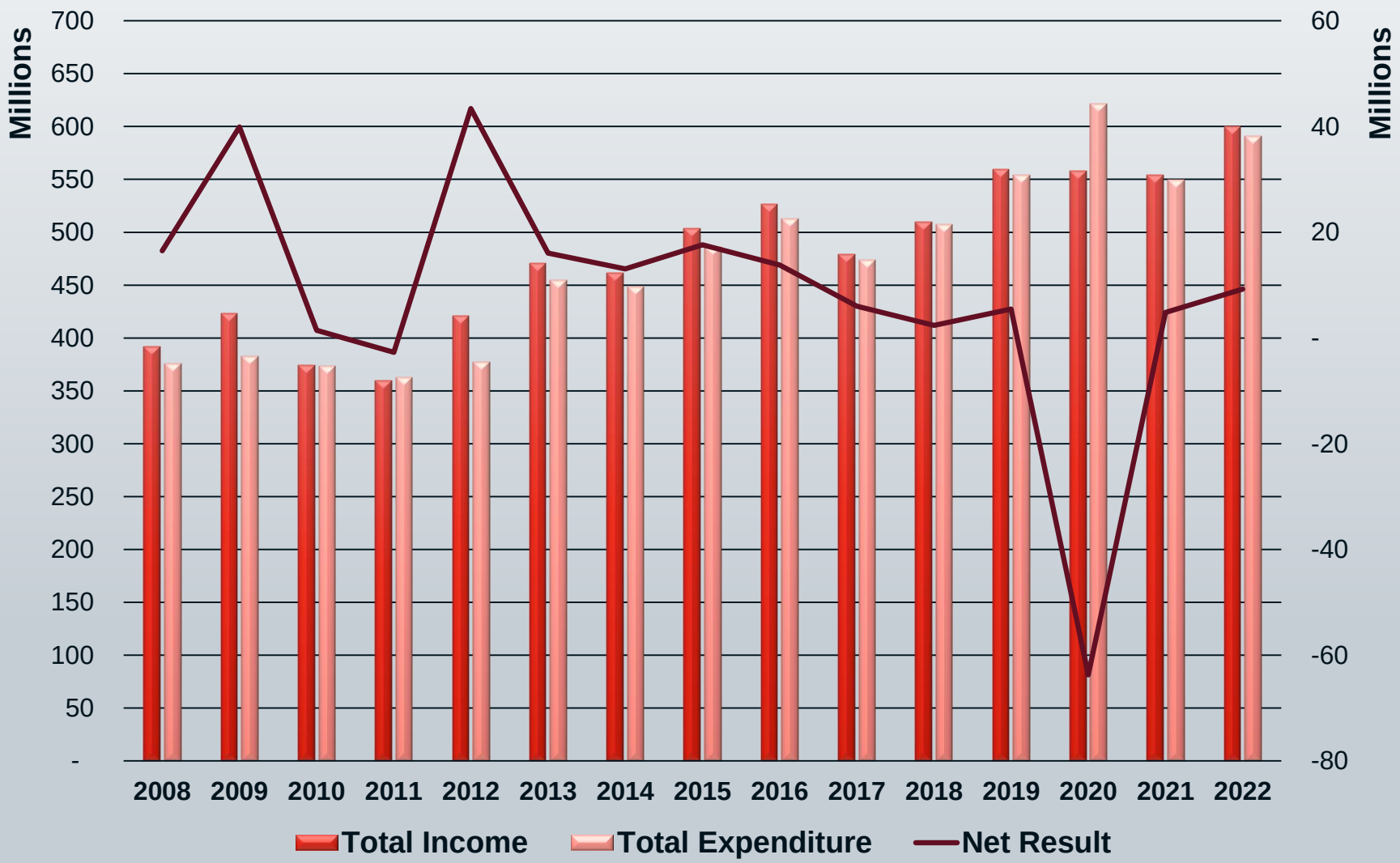
Revenue distribution



Revenue sources



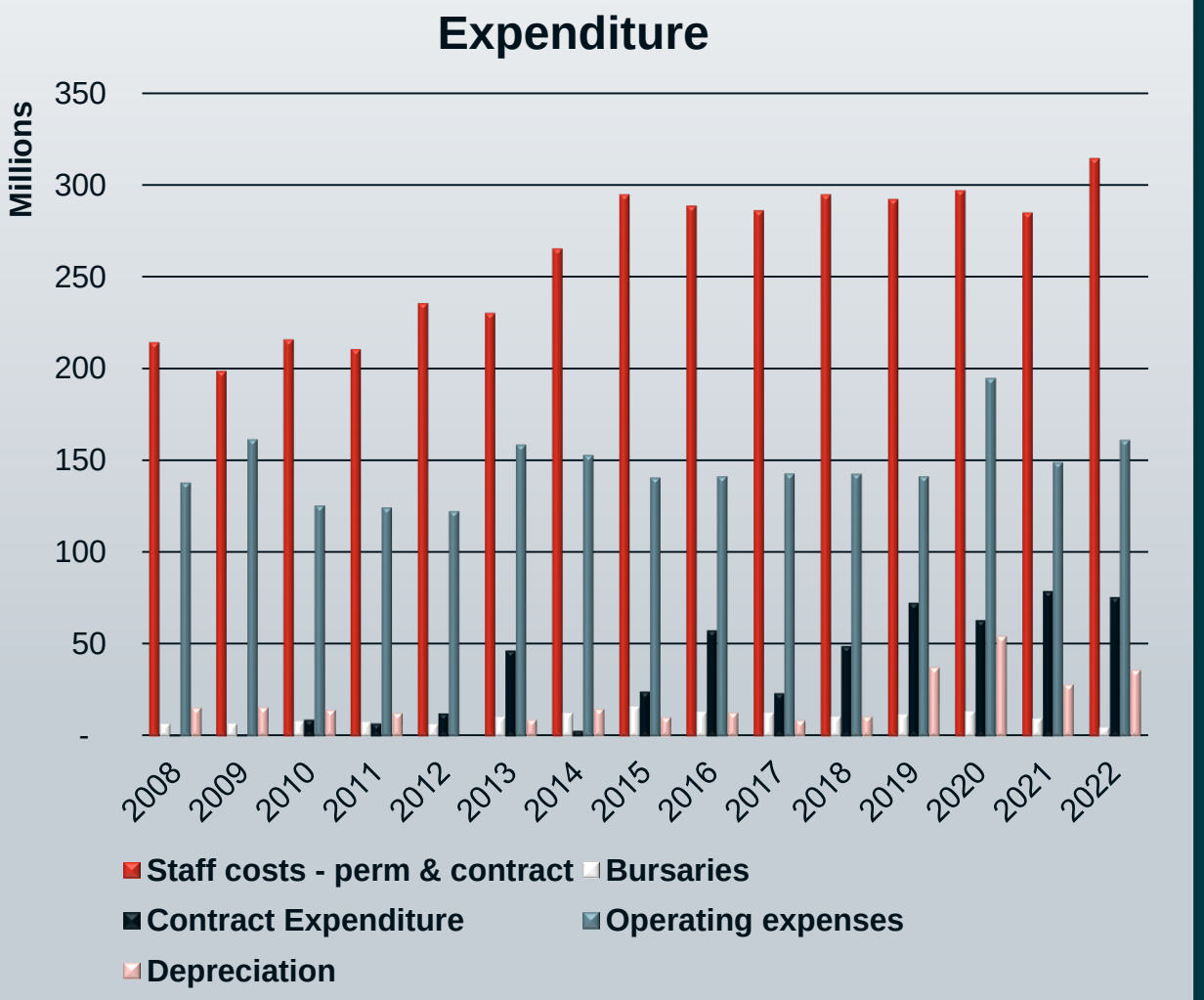
Income vs Expenditure

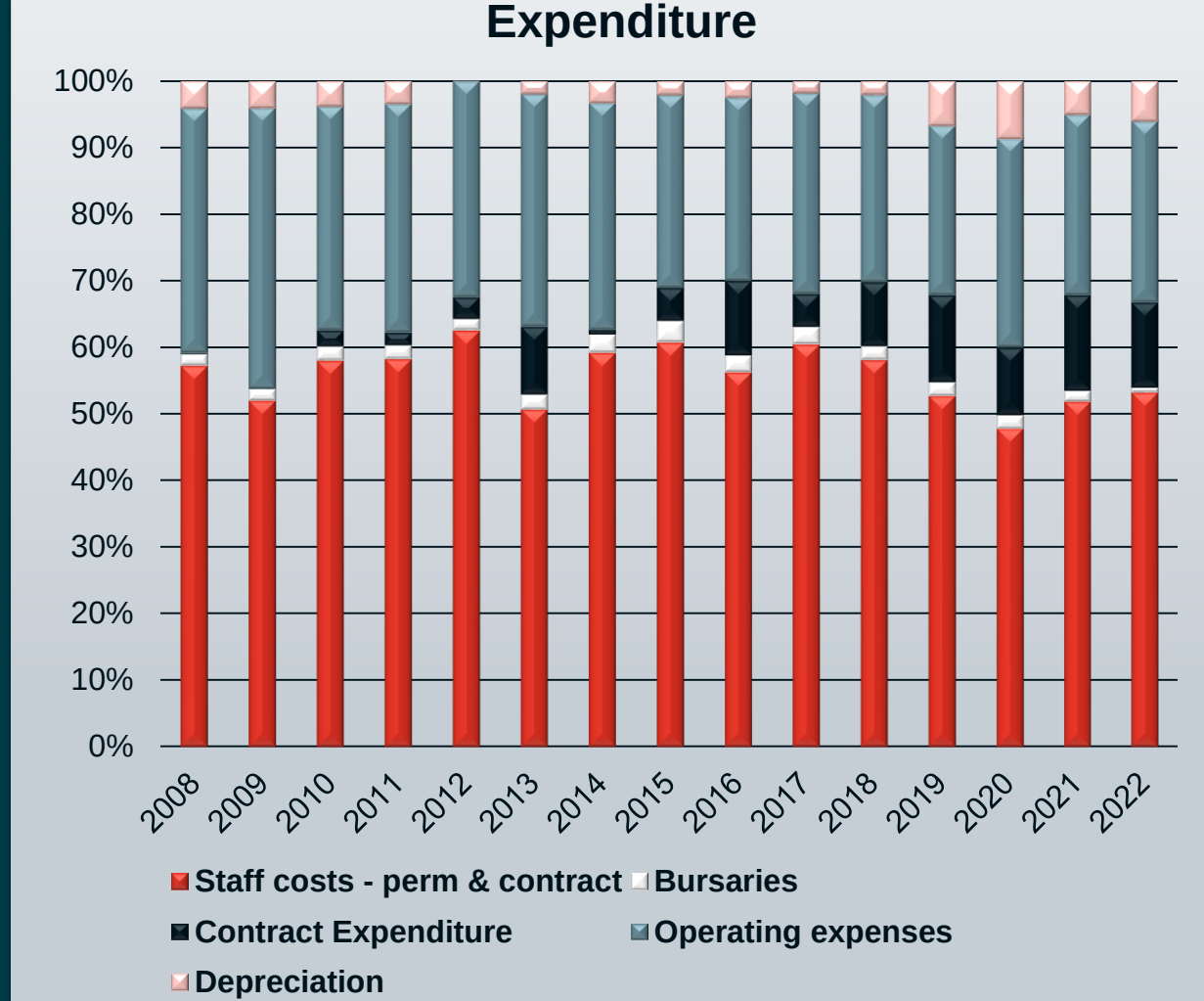


Net surplus of R9.1 million was realized in 2022, an improvement from the R3.4 million recorded in 2021.

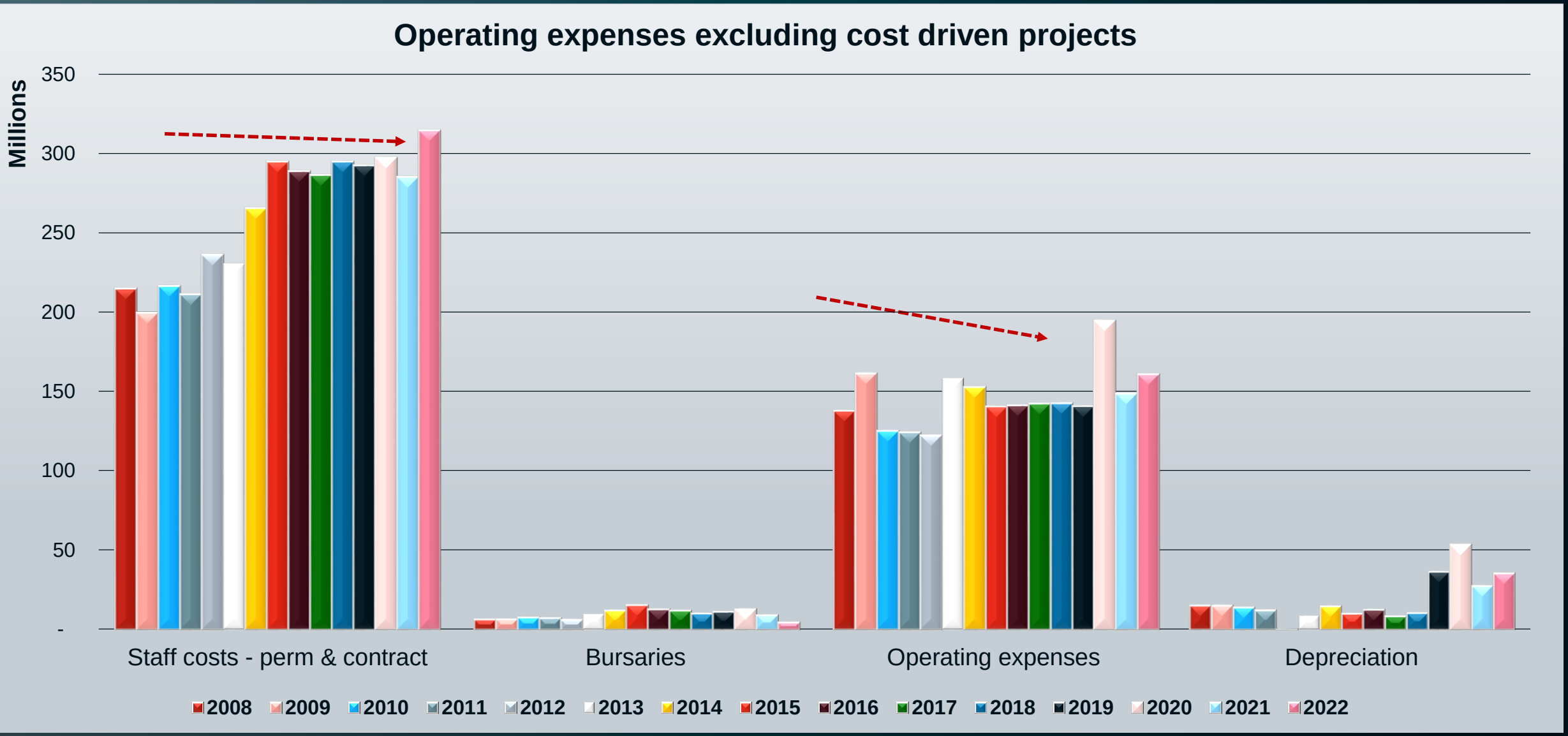
The 22% improvement in commercial revenue highlighted Mintek's ability to adapt and thrive as the global economic environment entered its second year of the COVID-19 pandemic.

Expenditure analysis

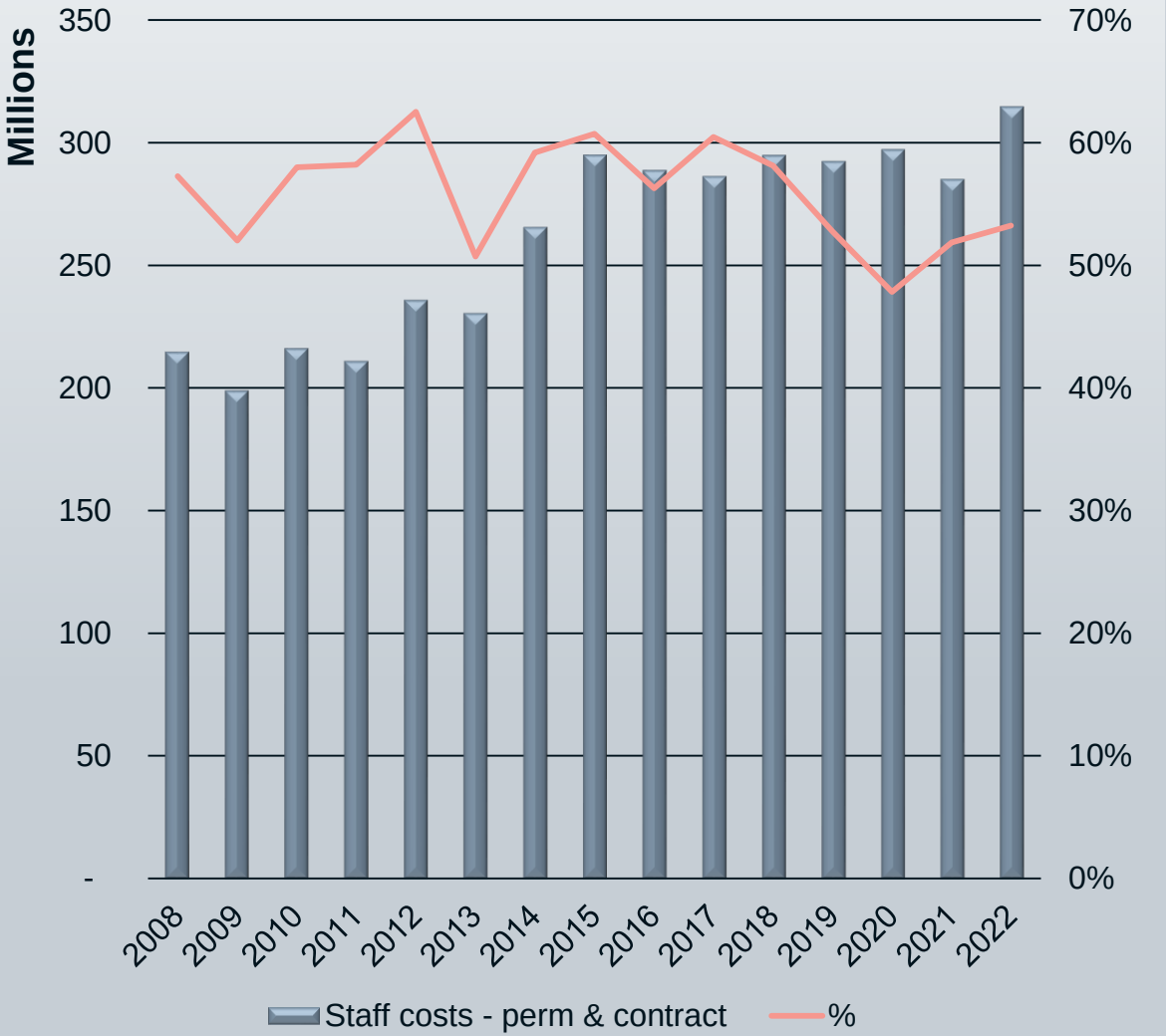


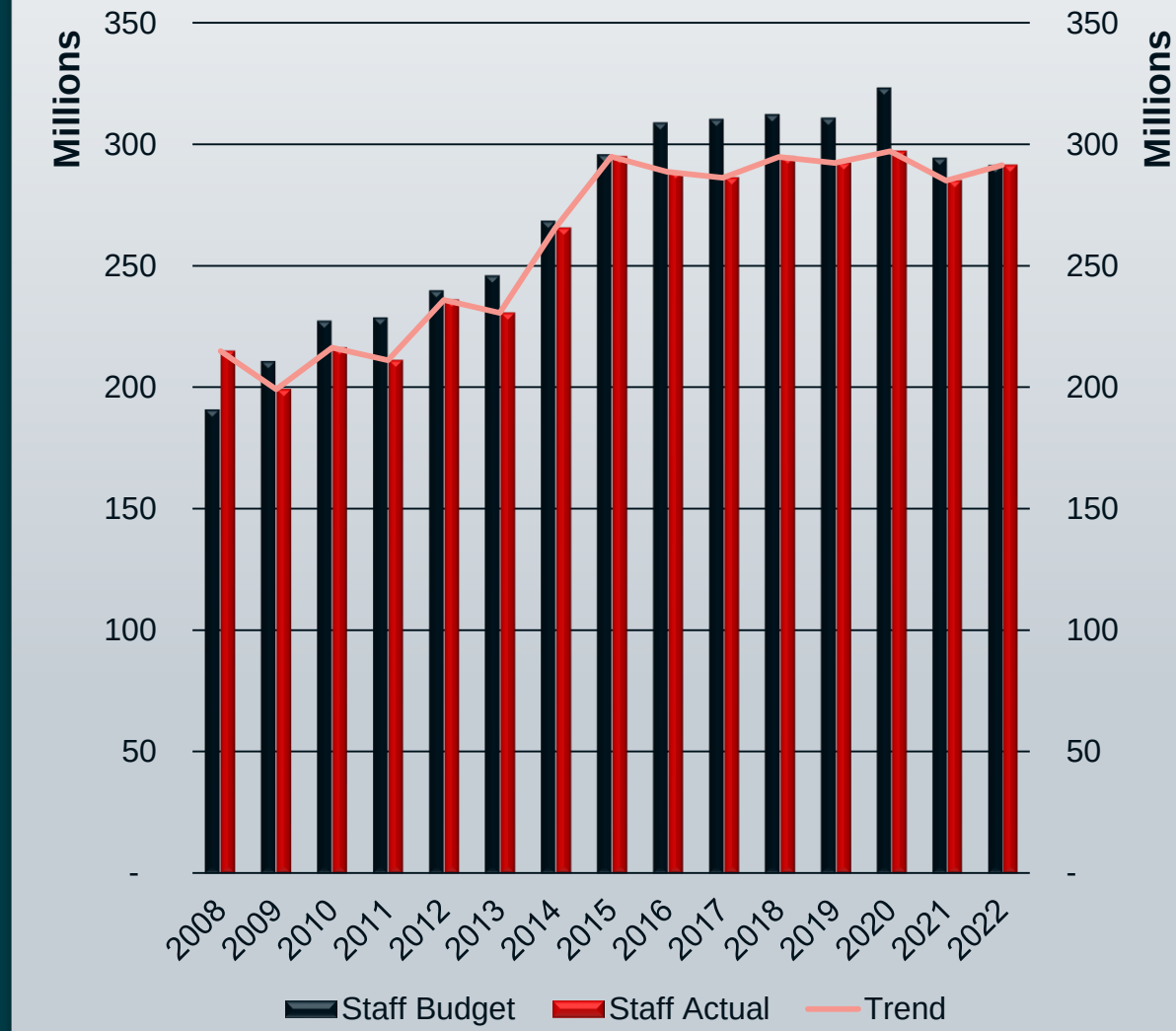


Expenditure analysis

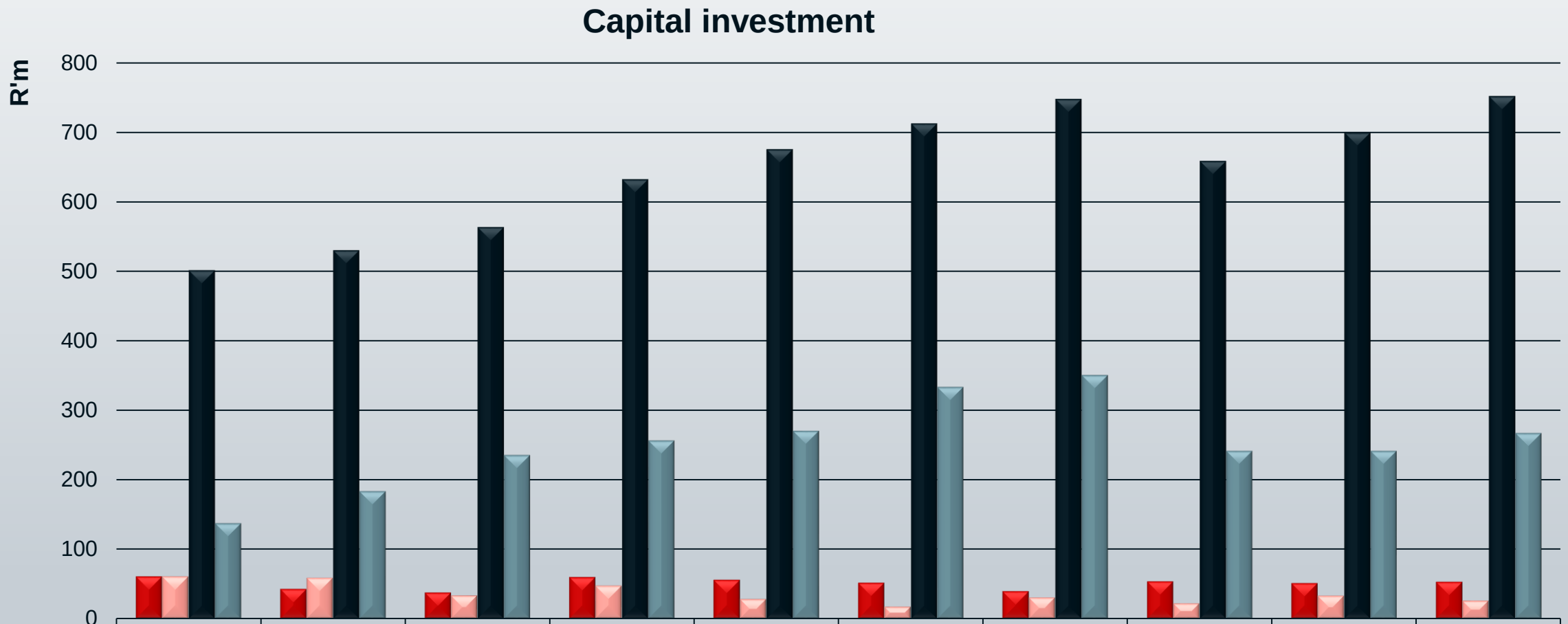


Employee costs



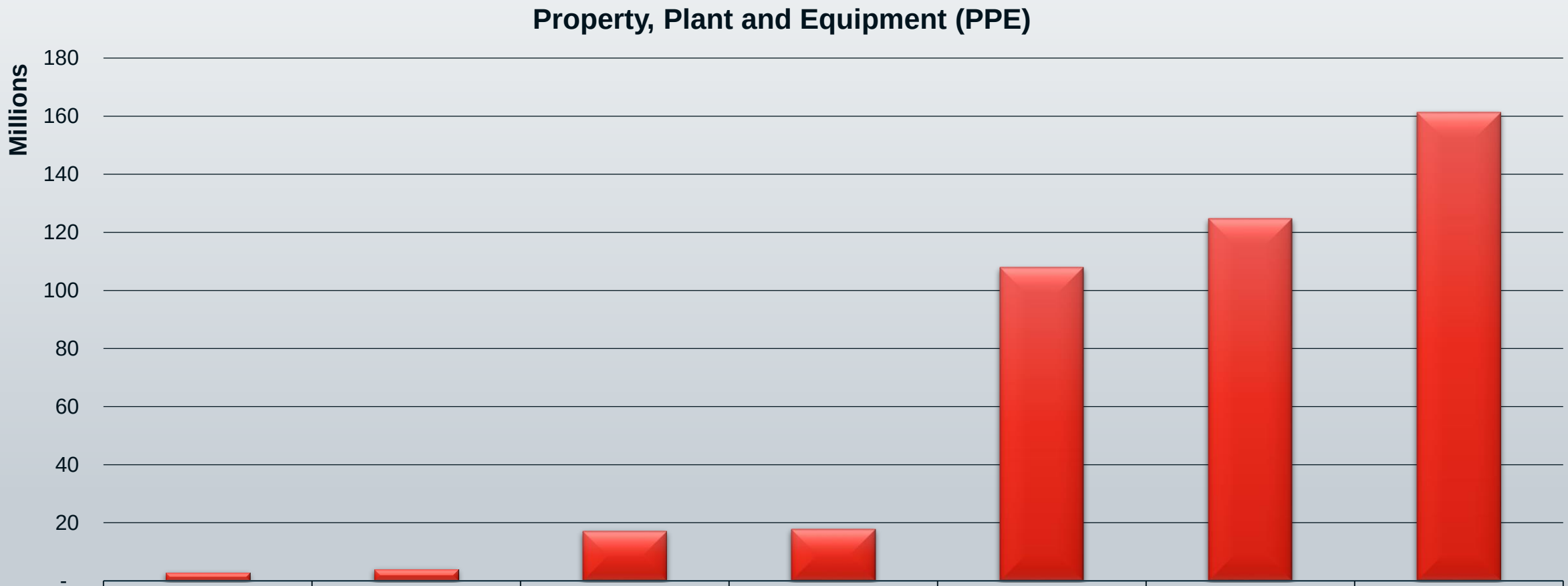


Capital investment



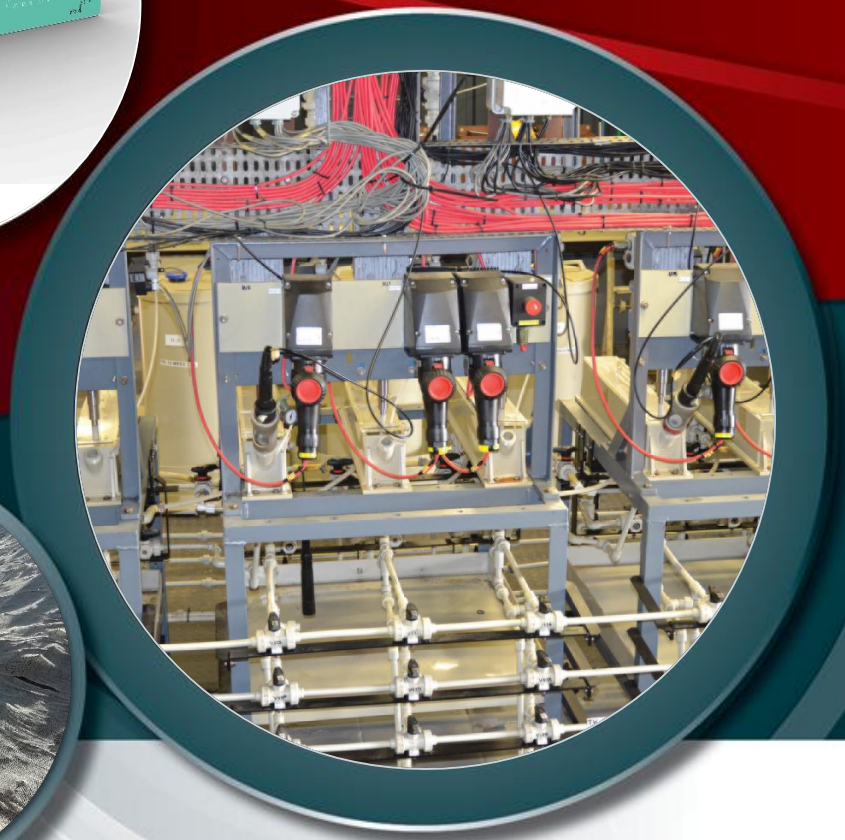
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital Acquisition	60	42	37	59	55	51	39	53	50	52
Funding	60	58	33	47	28	17	30	22	33	26
Fixed Assets	502	531	564	633	676	713	748	659	700	752
Funded Assets	137	183	235	256	270	333	350	241	241	267

Core Assets



	Motor vehicles	Furniture and Fittings	Computer Equipment	Catering, Building & Office Equipment	Buildings	Land	Plant, Machinery and Equipment
2022	2,821,227	3,952,583	17,076,158	17,776,557	107,801,754	124,656,851	161,339,466

Key Industry Development Programs



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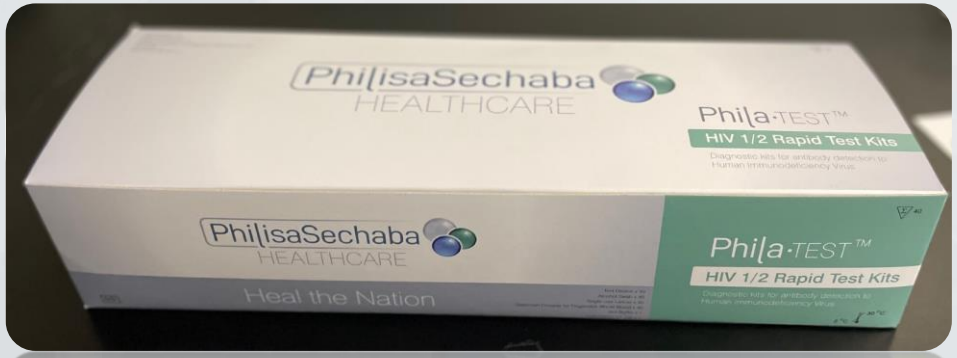
Update – HIV 1/2 Rapid Diagnostic Kit



Objective

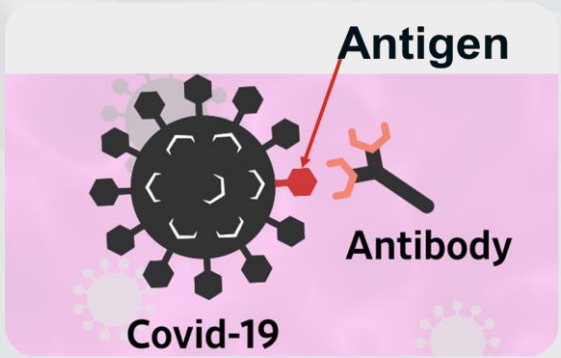
To leverage existing internal capacity and co-development partnership with WHO-accredited manufacturer to develop rapid point-of-care diagnostic kits for HIV

Achievement for 2021/2022

- Development of HIV 1&2 test kit:
  - Competitive analysis performed
  - Functioning prototype developed
  - Stability testing completed
  - Submission to NICD for validation - **in progress (awaiting results)**
- Regulatory compliance:
  - Creation of Class D regulatory pack (Device History File (DHF) and Device Master Record (DMR) - in progress

Next Steps: SAHPRA submission, WHO submission, Commercialisation activities under PhilisaSechaba (DoH and other customers identified through strategic partnerships)

Update – COVID-19 Rapid Diagnostic Kit



Objective

To leverage existing internal capacity and co-development partnership with WHO-accredited manufacturer to develop rapid point-of-care (PoC) diagnostic kits for COVID-19

Achievement for 2021/2022

- Development of COVID-19 Antigen test kit:

  (suitable for self-testing of current/active infection)

  - New biomarkers were identified and procured (local manufacturer) – to enhance test sensitivity and overall performance
  - Initial prototype working prototype of a new and improved version of COVID-19 Antigen test
  - Prototype fine-tuning – in progress

- Regulatory Compliance:
  - Creation of Class D regulatory pack (Device History File (DHF) and Device Master Record (DMR) - in progress

Next Steps: prototype fine-tuning, stability testing, external evaluation, SAHPRA submission

Commercialisation of Rapid Diagnostic Test Kits

PhilisaSechaba HEALTHCARE

Heal the Nation

Objective

To develop the first South African manufactured point-of-care diagnostic kit for HIV1&2 which meets WHO pre-qualification requirements

Achievement for 2021/2022

- **Commercialization**
  - Requirement for separate vehicle to market and sell RDTs to healthcare industry identified
  - PhilisaSechaba Healthcare (a subsidiary of Mindev) proposed
  - Commercialization strategy (including manufacture, marketing and regulatory components) completed
- **Product Development**
  - Validation testing completed with Paul Ehrlich Institute, Germany and BSI, UK. Awaiting final validation report from NICD
  - Clinical trials with 1550 participants in line with WHO pre-qualification guidelines being set up

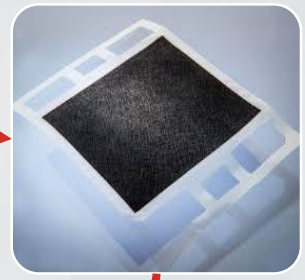
Next step: Completion of the clinical trials and dossier after which products will be submitted for WHO pre-qualification.
Submission of bid in June 2023 DoH HIV RDT tender

Fuel Cell Research Programme: Progress towards Commercialisation

HySA/Catalysis – commercial developments

Mintek commercial FC catalysts

UCT (HyPlat) commercial MEAs



PowerCell FC system deployed at Mintek

Objective

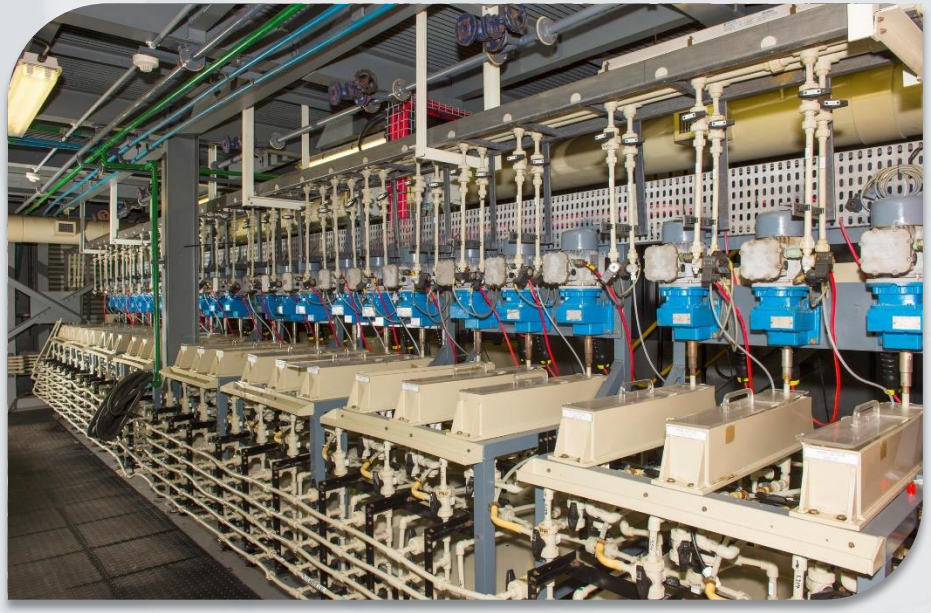
To develop platinum-based catalysts for fuel cell applications, to support the transformation of the global energy mix towards a hydrogen and fuel cell economy.

Achievement for 2021/22

- **Demonstration** (underway) of HySA fuel cell components at Mintek in a combined fuel cell and **green hydrogen production system** (PV/electrolyser). Part of DSI demonstration programme aligned with the **South African Hydrogen Society Roadmap**.
- With **local** (Mintek, HyPlat, Bambili Energy, Ario, NWU) and **international** (PowerCell, Sweden) partners growing the local capacity to manufacture and deploy FC technologies.
- Mintek has currently **developed 9 commercial fuel cell catalysts** that cover different fuel cell operating conditions required by the market.
- Initiated a **Fuel Cell Manufacturing Strategic Programme** (for catalyst production and MEA manufacturing at Mintek) with **internal funding** (~R30m/y). Now seeking external investments from BFI (R390m through DSI) and TIA (R30m).

Next Steps: Continue technical development and commercialisation efforts. Achieve FC catalyst production @10kg/batch by FY24 and demonstrate Mintek MEA fabrication technology by FY26. FC systems commercialisation with partners for deployment by 2030.

Rare Earth Element (REE) Programme



Objective

Establishing a rare-earth industry in South Africa through the provision of a centralized competitive REE processing facility (SACREF)

Achievement for 2021/22

- Forum of regional rare earth (REE) producers held.
- Owners of southern African REE deposits as well as stakeholders such as the IDC, Minerals Council and the DMRE exchanged information and debated the obstacles that had been holding back further development.
- Steenkampskraal mine was visited for an underground tour and further in-depth discussions.
- Steenkampskraal mine is, of all regional REE projects, the nearest to implementation. In process of securing funding.
- Roadmap for the SACREF concept has been further clarified and detailed.

Next step: Provide technical support to the Steenkampskraal mine. Ongoing research at Mintek on extraction of REE from different waste streams and alternative processes for the separation of REE.

High Purity Battery Materials

Objective

As the shift to renewable energy occurs energy storage solutions are required. The most significant cost contributor to battery storage is the cost of pre-cursor chemicals and Mintek is addressing the production of these materials.

Achievement for 2021/22

- Number of commercial contracts executed for clients, including development of a flowsheet for high purity manganese sulphate production.
- Mintek invited to be partner in the Energy Storage Partnership (ESP) - a global partnership convened by the World Bank to foster international cooperation to adapt and develop energy storage solutions for developing countries.
- Organisation and participation in the SAIMM Battery Materials Conference 2022.

Next step: Further technical development and participation in collaborative projects

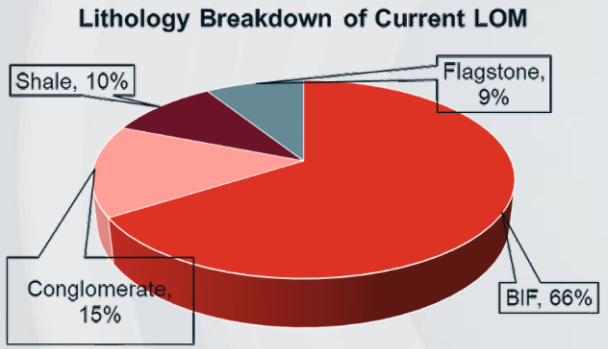
Revitalisation of the Fe Ore Industries in South Africa

Challenges facing the Industry

The South African iron ore mining sector is facing a confluence of challenges some of which entail depletion of high-grade reserves, high operational costs, market competition, lack of innovation with volatility in commodity prices exacerbating the crisis in the industry.

Mintek's Vision

Facilitate sustainable growth, development and effective transformation by unlocking value from sterile resources thereby extending the life of the iron ore sector by another two decades.



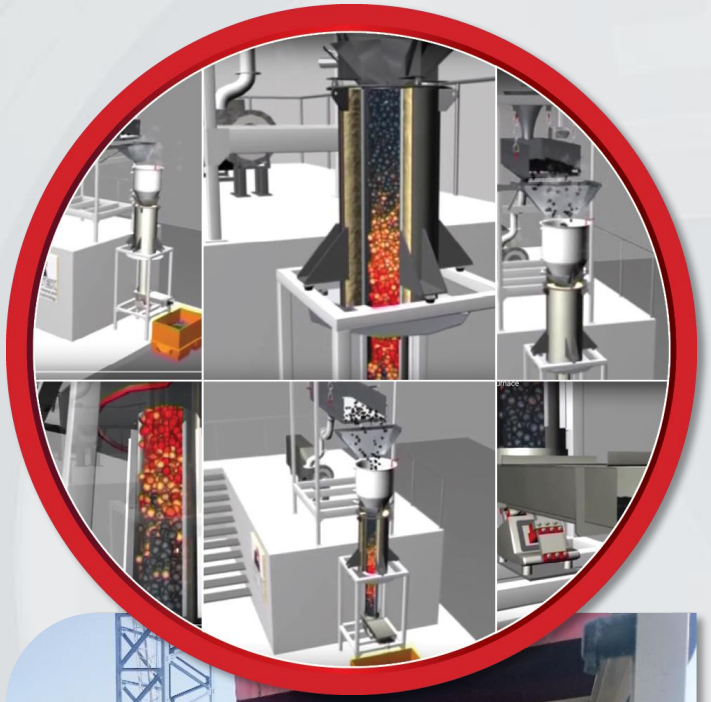
Resource Classification	Fe Grade (%)
A-Grade	>58
B-Grade	48-58
C-Grade	40-48
D-Grade	20-40

Achievement for 2021/22

- The proportion of Banded Iron Formation (BIF) ore contained within the remaining iron ore reserves in South Africa exceeds 65%.
- Lithology mapping of BIF material from the Northern Cape and Limpopo Province demonstrates that coarse beneficiation is promising by producing saleable concentrates or concentrates that can potentially be used as a blended source.
- The project has acquired the support of the two largest iron ore producers in South Africa (Kumba and Assmang) as their future low-grade deposits are aligned to this strategic programme.

Programme Milestone: Validation of BIF developed flowsheet(s) focusing on material averaging 40% Fe.

Sustaining the gold industry - Process control



Objective

The South African gold sector once dominated the global gold industry. Deeper mines and complex ores have eroded South Africa's position in the global gold industry and a range of technical solutions have been developed to support the sustainability of the sector.

Achievement for 2021/22

- Sales of **22 Cynoprobes** sold to operating plants – maintaining FY20/21 and previous years performance.
- Sales of **11 Carbon Concentration Meters** for RSA, Australia and Canada.
- Additional Minfurn carbon regeneration furnaces sold. Minfurn45 was commissioned at goldmine in Zimbabwe. A larger Minfurn200 was commissioned at Blyvoor Gold in Carletonville, SA.

Next step: Continued **c**ommercial implementation of Mintek developed technologies for the sector. To address manufacturing efficiency and profitability.

Sustaining the platinum industry

Objective

South Africa is the dominant global supplier of Platinum (Pt), but demand has been significantly impacted by perceptions relating to its primary application, internal combustion engines. A suite of technology solutions have been developed to enhance the sustainability of the sector.

Improving process performance in the platinum sector

Achievement for 2021/22

- **Contract successfully negotiated** with South Africa's newest PGM concentrator to include a full suite of MillStar and FloatStar controllers from the completion of construction.
- Continued research and development of **methods to optimize PGM recovery** using measurement and control technologies.
- Enhanced technology developed for processing of fines material for the recovery of PGM's and chromite.

Next step: Continuing with the transfer of Mintek developed technologies and solutions to the platinum sector.