



The importance of engineers in the mining sector against the current skills shortage in the country

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National Society of Black Engineers

Breakfast Briefing

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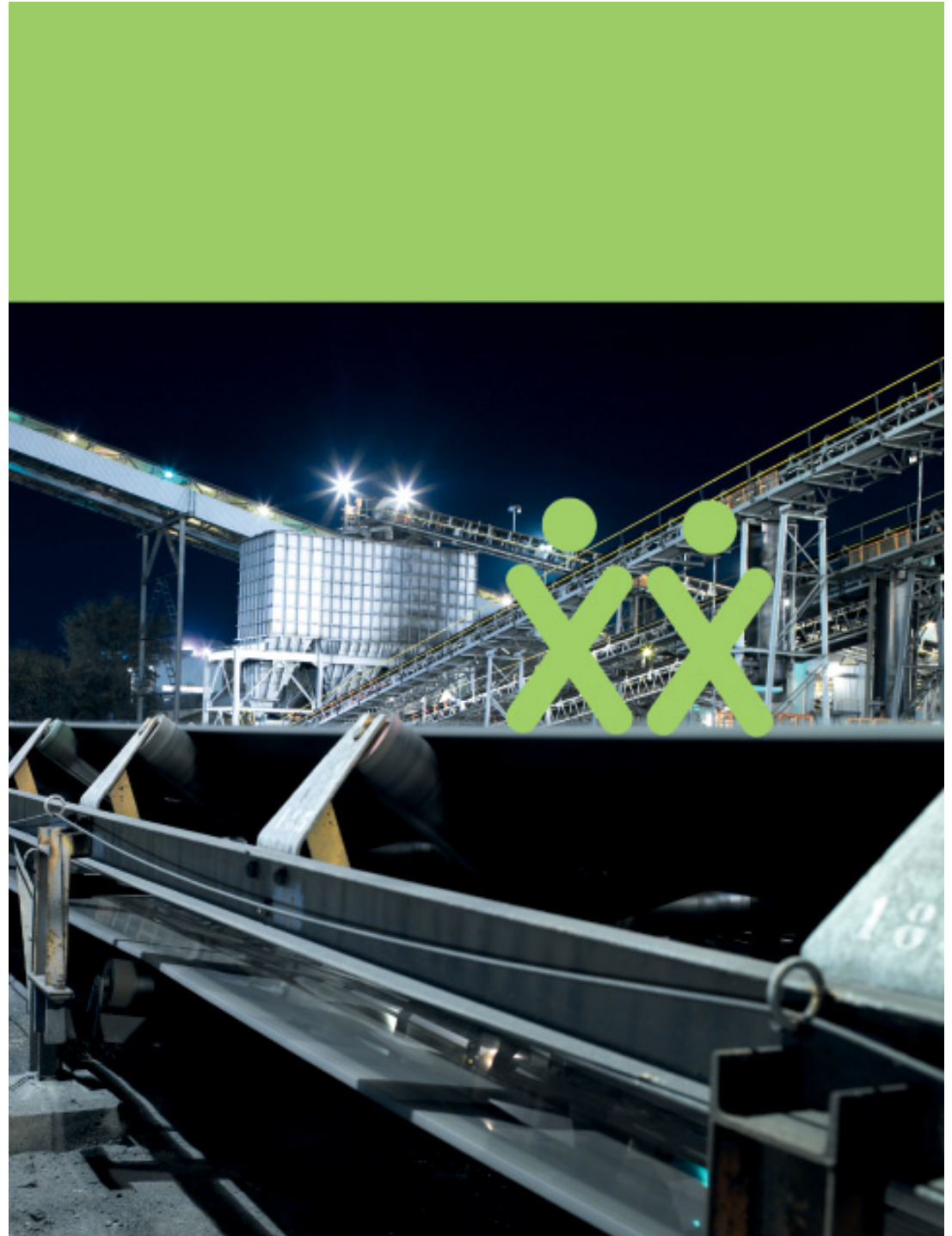
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POWERING POSSIBILITY



Content

- The Exxaro story
- Global scarcity of skills
- Importance of engineers in the mining industry
- Engineering as a scarce skill
- Training and development in Exxaro
- Possible solutions to the problem





The Exxaro story





Introduction to Exxaro

Our commodities



COAL

the fourth largest coal producer in South Africa



MINERAL SANDS

one of the world's top three producers of zircon and chlorinatable TiO_2 slag



BASE METALS AND INDUSTRIAL MINERALS

the only zinc producer in South Africa

IRON ORE

20% holding in Sishen Iron Ore Company

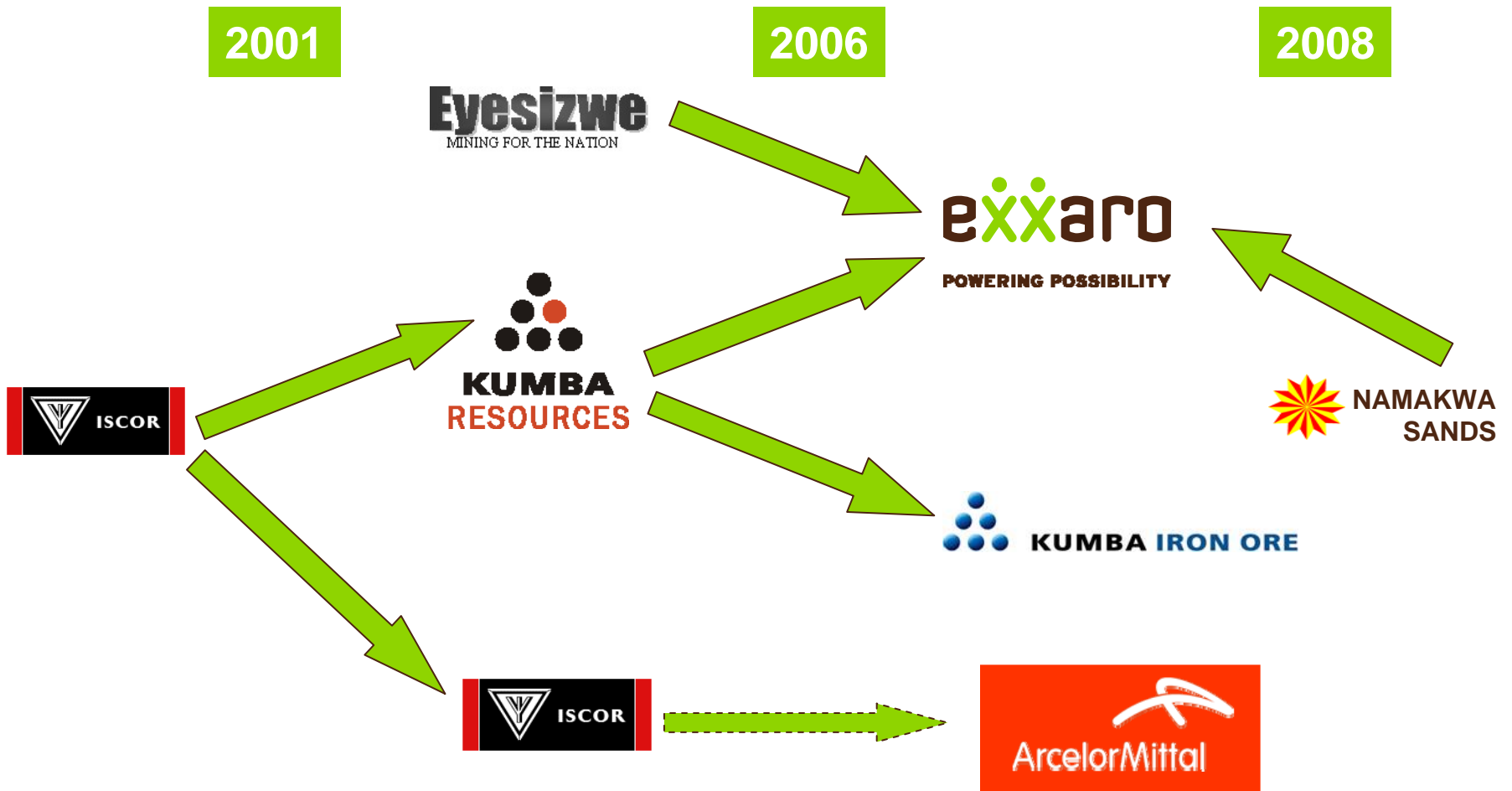
At a glance...

- South Africa's largest diversified resources company
- One of the top 40 companies on the JSE
- 8 688 employees
- Head office in Pretoria, South Africa
- Revenue: R10,16bn*
- Net operating profit: R1,44bn*

* Annual results for 12 months ended
31 December 2007



To summarise the history ...





Geographical locations



Detailed maps on pages 62-64

■ Operations ● Growth projects ▲ Representative offices

COAL

- | | |
|-----------------------------|-----------------------|
| 1 Grootegeluk | 8 Belfast |
| 2 Leeuwan | 9 Mmamabula Central |
| 3 Arnot | 10 Eerstelingsfontein |
| 4 Matla | 11 Inyanda |
| 5 North Block Complex (NBC) | 12 Moranbah South |
| 6 New Clydesdale | 13 Mafube |
| 7 Tshikondeni | 14 RBCT Phase V |

MINERAL SANDS

- | |
|--------------------|
| 15 KZN Sands |
| 16 Tollara Sands |
| 17 Namakwa Sands |
| 18 Australia Sands |

BASE METALS AND INDUSTRIAL MINERALS

- | |
|----------------------------|
| 19 Chifeng Zinc Refinery |
| 20 Rosh Pinah |
| 21 Zincor |
| 22 Glen Douglas |
| 23 FerroAlloys |
| 24 Black Mountain |
| 25 Sishen Iron Ore Company |



Global scarcity of skills





A few interesting examples

- Russia will have to entice 20 million immigrants to overcome their shortage of skills over the next two decades, mainly due to high economic growth rate, decline in birth rate and poor training systems
- Australia cannot supply the increasing demand for its mineral resources due to a shortage of skilled workers
- BHP Billiton says the shortage of engineers and technicians worldwide is its biggest stumbling block for expansion of its production
- According to Time Magazine, the shortage of engineers and project managers hampers the search for new deposits of oil
- Two thirds of the members of the American society of petroleum engineers are older than 40 and more than half will retire in the next decade



A few interesting examples (cont)

- According to the Christian Monitor, NASA has three times more engineers who are older than 60 than those who are younger than 30 and 25% of its 19 000 employees are due for retirement in the next five years
- Altogether 63 000 engineers graduated in 2000 in the USA – 47% less than 1991
- According to McKinsey consultants, 75 000 posts in advanced accounting and engineering positions are presently created in China – only 5 000 Chinese citizens are qualified to be appointed
- The UK is presently training 250 000 artisans and envisages to double this number by 2020
- India produces more than 200 000 engineering graduates per year. 500 of them complete post-graduate studies annually. By contrast, South Africa produces 200 engineering graduates per year (*Source: The Star, 16 Oct 07*)



**Why is engineers
so important for
the mining
industry?**





Importance of engineers in the mining industry

- Engineers ensure that new processes and technologies are introduced and that current businesses are optimised and utilised. This can only be done by innovative ideas to ensure a quantum leap in performance and competitiveness
- Engineers have scarce and crucial skills and are much in demand
- Engineers are employed mainly in three categories:
 - Operations
 - Projects
 - Management



Categories of employment

Operations

- Work at mines, mainly in the following disciplines:
 - Mining : mine planning, improvement and mining operations
 - Metallurgical and Chemical : operation and improvement of beneficiation and processing plants
 - Mechanical and Electrical : maintenance and improvement of plant and mining equipment
 - Civil : improvement and maintenance of infrastructure
 - Industrial : evaluation of operations and improvement of operations



Categories of employment (cont)

Projects

- Work at mine or company headquarters in the following disciplines:
 - Mining : mine design, selection of mining equipment
 - Metallurgical and Chemical : design of processing and metallurgical plants and R&D
 - Mechanical and Electrical : infrastructure design, detail plant design, selection of mining equipment
 - Civil : detailed plant design, infrastructure design
 - Industrial : planning, option evaluation



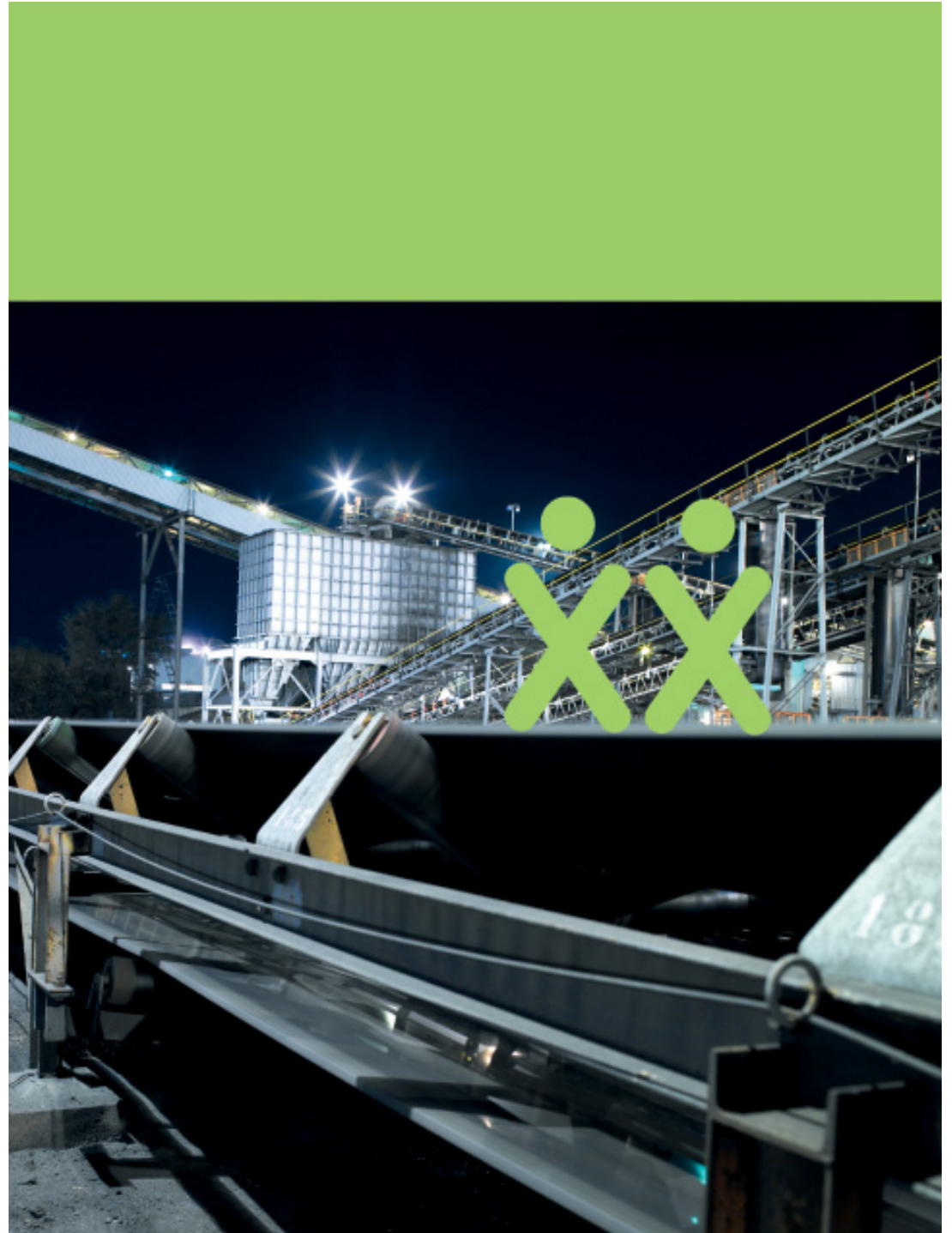
Categories of employment (cont)

Management

- Engineers become well acquainted with the detail of mining operations, qualifying them for management positions. The career path of an engineer usually starts with early exposure to the management of mining operations, plants and maintenance, and may include project management experience. It often ends in senior management positions



Engineering as a scarce skill





Scarce skills

OCCUPATIONAL GROUP	NO	%
Legislators, Senior Officials, Managers and Owner Managers	82	1.3
Professionals *	659	8.3
Technicians and Associate Professionals	711	3.4
Clerks and Administrative Workers	10	0.1
Service and Sales Workers	5	0.1
Craft and Related Trade Workers	1235	3.4
Plant and Machine Operators and Assemblers	916	0.7
Labourers and Elementary Occupations	430	0.3
Apprentices and Section 18 (1) Learners	122	2.4
Total	4 170	1.1

* The vast majority of professionals are in the engineering disciplines

Source: MQA research from Workplace Skills Plans and Annual Training Reports reporting on job categories where scarcities are experienced



Distribution of engineers, technologists and technicians by sector - 2004

	Mining	Manufacturing	Electricity	Construction	Trade	Transport, storage And communication	Financial and Business services	Services	Total
Engineers and technologists	1 990	7 269	669	5 425		2 054	13 498	4 325	35 230
Technicians	653	7 682	2 433	944	1 581	2 561	6 990	1 895	24 740
Total	2 643	14 952	3 101	6 370	1 581	4 615	20 488	6 221	59 971

- In 2004, almost half (45%) of all engineers and technologists and a third of technicians were black (Du Toit & Roodt, 2006)
- Only 21% of these are employed in public sector while 78% are employed in private sector



National engineering skills profile

- Average age of engineers is 40 years¹
- Biggest cohort of technicians are between 51 and 60 years²
- Future mentoring problems is a reality for engineers, technologists and technicians

Age group	Engineers and technologists (Number (and race) ¹
Younger than 41 years	15 627 (Black) 8 533 (White)
41 – 50 years	400 (Black) 5 700 (White)
51 – 60 years	1 800 (White)
Older than 60 years	1 200 (White)

Age group	Technicians (Number (and race) ²
Younger than 30 years	5 268 (Black)
30 - 41 years	Unknown
41 - 50 years	400 (Black) 5 700 (White)
51 - 60 years	6 100 (White)

¹Du Toit & Roodt 2008, p459; ²Du Toit & Roodt 2008, p460



Gender profile of engineers, technologists and technicians

		Male	Female
2000	Technicians	88,2%	11,8%
	Engineers and technologists	83,7%	16,3%
2004	Technicians	82,1%	17,9%
	Engineers and technologists	88,1%	11,9%

Source: Du Toit & Roodt, 2008



Race profile of first year engineering students

	2000	2001	2002	2003	2004
African	260	274	290	322	355
Coloured	40	46	46	39	36
Asian	171	165	167	173	206
White	838	841	856	921	908
TOTAL	1 309	1 325	1 360	1 455	1 506

Source: State of Skills, 2006/07



Supply of engineers - Universities

Headcount enrolments in engineering at Universities:

	B(Eng) 4-year degree	Masters	Doctorate	Total
1995	8 240	1 857	397	10 495
2000	7 151	2 255	446	9 853
2004	10 821	2 888	601	14 311

Source: State of Skills, 2006/07



Supply of engineers – Universities of Technology

Enrolment and graduation at Universities of Technology:

	2000	2001	2002	2003	2004
Enrolments	24 111	26 863	27 065	28 884	32 023
Graduations	1 820	2 369	2 806	3 002	3 541



Minerals Education Trust Fund (METF)

- The METF has been supporting tertiary education in South Africa since its inception in 1999
- METF concerned about retaining qualified lecturers in engineering disciplines at tertiary institutions, since there is currently a mass exodus of lecturers and professors at various institutions
- In the whole of South Africa, there is only about 20 full-time permanent lecturers specifically involved in the teaching and research of mineral and metal processing
- One of the key drivers is the large difference in salaries paid at universities vs the mining industry (industry is paying 2-3 times CTC packages, and if industry based share scheme options and bonuses are included this increases to a 4-5 times ratio)
- Funding decisions made by the Fund represent the interest of all sectors of the industry and have as their basis the rewarding and sustaining of excellence in tertiary minerals education
- Most major mining and minerals companies contribute and participate in the METF



Training and development in Exxaro





Programmes within Exxaro

The following training and development initiatives are provided within Exxaro to enable people to obtain a formal qualification:

- **Learnerships and skills programs**
 - Engineering (section 18.1, 18.2 and Article 28)
 - Mining
 - Metallurgical
 - Other (e.g. surveying and ventilation)
- **Bridging program** for the Mining and Engineering Disciplines
- **Bursar program** primarily for the Mining, Metallurgical, Geology, Surveying and Engineering disciplines both graduate and diplomats
- **Professional in Training Program** after graduation aimed at professional registration e.g. ECSA
- **Practical training** for technicians in the engineering and mining fields
- **Under graduate study assistance** to employees and children of employees
- **Post graduate study** for identified talent



Exxaro skills profile

- **Learner/Qualified Artisan ratio**
 - In 2006 learners comprised 28% of qualified Artisans, Master Artisans and Foremen (ratio of 1:3.5)
 - In 2007 learners comprised 44,6% of qualified Artisans, Master Artisans and Foremen (ratio of 1:2.24)
 - In 2008 learners will again comprise >40% of qualified Artisans, Master Artisans and Foremen (ratio of 1:2.25)
- **70% of Engineers and more than 50% of Engineering related technical employees are between the ages of 30 and 45, with more than 10 years experience, which makes them attractive to other employers**
- **Exxaro already lost 345 technical skilled employees during the period March 2007 to February 2008 (18%) of this category of employees**



Exxaro's contribution

- **Total skills development expenditure according to our Work Place Skills Plan submitted:**
 - 2006/7 – 6,52% of total salary and wage bill
 - 2007/8 – planned 6,5% of total salary and wage bill
 - 2008/9 – budgeted 7,61% of total salary and wage bill
- **Pipelines expenditure budgeted for 2008 constitutes 3,83% of total salary and wage bill and 50% of total skills development budget:**
 - 30 students in bridging program
 - 139 bursars
 - 81 professionals in training
 - 605 learnerships and skills programs
 - Exxaro will place at least 130 University of Technology students who passed their theoretical requirements but who have been unable to gain work placement, thereby supporting them to graduate



Exxaro's contribution (cont)

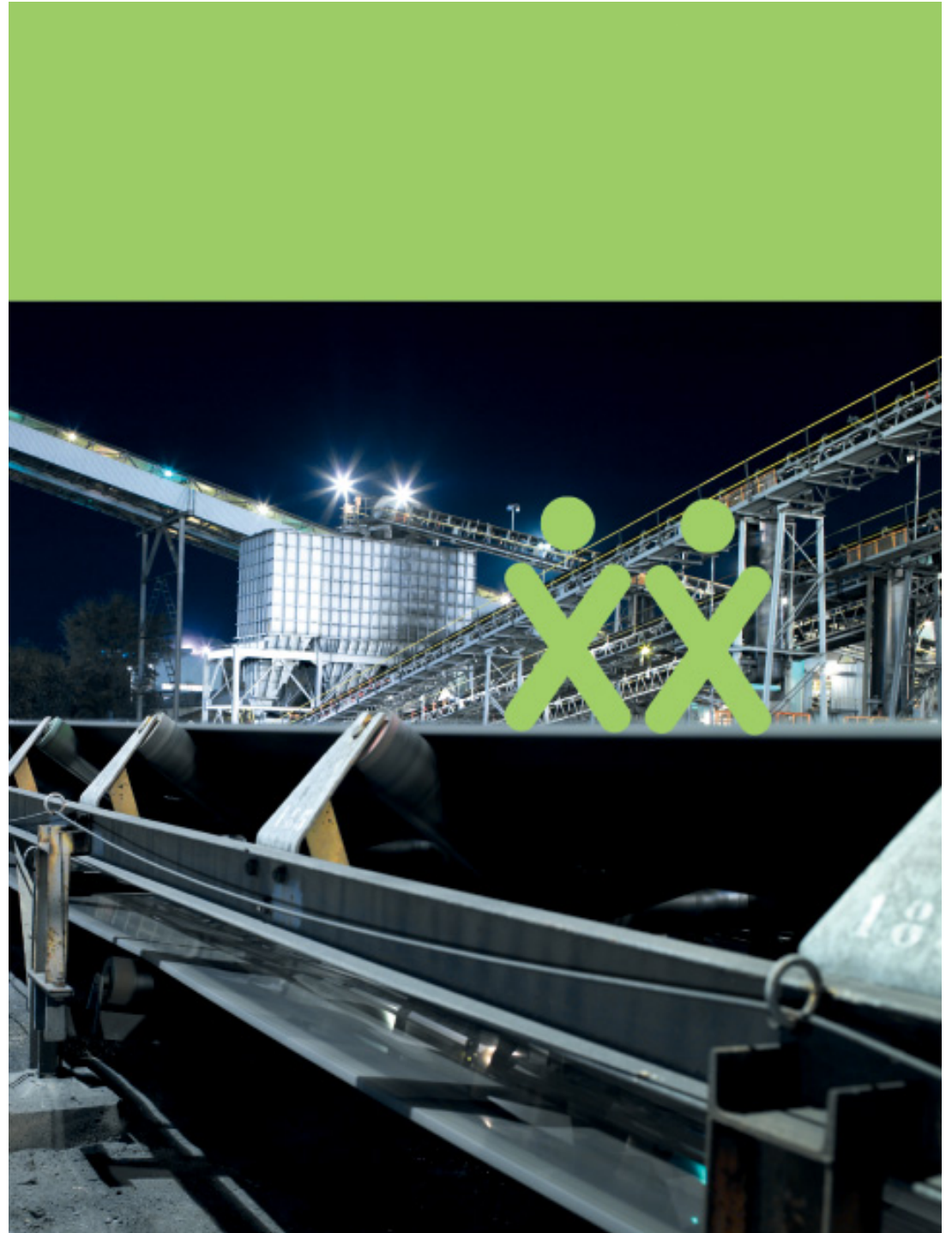
- **Exxaro Engineering learners constitute 24.5% of Engineering learners registered at MQA**
 - 75,3% of Exxaro's learners are black, although only 55,6% of learners in Engineering learnerships in South Africa (2000 – 2005) are black¹
- **Exxaro's ratio of learners/qualified Artisans is 1:2, whereas the Industry ratio is about 1:40²**

¹Department of Labour Administrative Data, September 2006

²Ratio calculated on the basis of 54 000 Artisans in the mining industry as per MQA's Sector Skills Plan and the number of Engineering learners registered with the MQA in January 2008 – just less than 1200 such learners



Possible solutions to the problem





Possible solutions

The pool of technical skills within South Africa will have to be increased for this industry and all other industries depending on skills from this pool ...

- South Africa to decrease push factors and increase pull factors to South Africa for economically active population as migration is a global challenge
- Stakeholders partnerships and commitment to deliver, e.g. SETA's, JIPSA, etc
- Paradigm shift in data collection and recording for better Artisan, Apprentices and Engineering learnership statistics
- Utilization of all training facilities to full capacity
- Better utilization by the industry of University of Technology students/graduates (Practical training)
- Qualified and skilled teachers and trainers
- Increase number of pupils passing maths and science on NQF Level 2 and higher
- Encourage women to see the career opportunities in the technical disciplines

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