The Department of Mining Engineering
Vision

The Department of Mining Engineering aligns itself with the vision of the University of Pretoria to be a leading university in Africa, recognised internationally for its quality, relevance and impact, developing people, creating knowledge and making a difference locally and globally.

Mission

Our mission is to create excellence in Mining Engineering education, be internationally recognised and well-rounded in technical and non-technical skills.
The University of Pretoria is a people-orientated institution driven by a spirit of innovation, striving to be the academic home for the rich diversity of South Africa’s academic talent. Our quest for excellence has made us leaders in the field of research and academic achievement, which has earned us the status of a significant role player in our community as well as a distinguished international competitor.

One of the major roles of the Faculty of Engineering, Built Environment and Information Technology (EBIT), is to develop students that will be able to change the world. In the University of Pretoria strategic plan for 2025 emphasis is placed on developing high-level skills in students that are needed to advance the economy and society of South Africa. The strategy of the Faculty is to provide education of the highest quality and to develop the top researchers in their fields in order to deliver graduates who are recognised as the most knowledgeable and competent in the industry.

The Faculty consists of 14 departments spread across four schools with the focus to optimally develop the talent of students to be ‘well-rounded and multi-faceted’ and able to operate in industry and society. The faculty served 7 380 undergraduate and 3 981 postgraduate students in 2013.

The School of Engineering is the largest of its kind in the country in terms of student numbers, graduates and research contributions and offers programmes and research activities in all the major engineering disciplines: chemical, civil, electrical, electronic and computer, industrial and systems, materials science and metallurgical, mechanical and aeronautical as well as mining engineering. Based on citations, it is rated by the Institute for Scientific Information (ISI) as the best school of engineering in South Africa. It is also one of only four engineering schools in the country to be listed in the top 1% of engineering schools in the world. The School of Engineering produces nearly a third of the country’s professional engineering track graduates.

The Department of Mining Engineering is proud to have contributed to the success of the Faculty.
Over the past 55 years, the Department of Mining Engineering at the University of Pretoria (UP) has made a huge contribution to the mining industry by providing it with world-class mining engineering leaders. It serves as a sound foundation for future development of its teaching, research and community service. The Department is actively involved with the community through the participation of staff in activities of professional societies, expert consultation and community projects within the Faculty.

The development of our students as future managers and technical specialists remain a priority and the development of life skills and responsible leadership through participation in student activities is actively encouraged. Mentorship and coaching as an exercise in experiential leadership adds to the quality of the fourth-year academic programme. Measuring the habits of our students have become part of our support strategy and deficiencies are addressed through a personal development plan for each individual student.

The Department is supported by the South African Colliery Managers’ Association (SACMA), the Association of Mine Managers of South Africa (AMMSA) and the Mining Alumni Society University of Pretoria (MASUP) and guided by the Mining Advisory Board. The Department is also financially supported through generous contributions of the Mine Qualifications Authority (MQA) and the Southern African Institute of Mining and Metallurgy (SAIMM). A special note of contribution must be made of the Minerals Education Trust Fund (METF) responsible for lecturers’ salary subventions to industry equivalent and departmental financial support. This enables the Department to attract the high-quality of lecturers currently employed.

We offer instructionally designed material for all our mining-related subjects, including non-technical skills (soft skills) as part and parcel of every mining module in the third and fourth year of studies. In this way we enhance the learning experience for all our students. The Department employs a full-time instructional designer (to visualise our lecture notes) and an English literacy instructor to facilitate language proficiency for our students (English is the 2nd language of 93% of the department’s students). We are one of few mining departments in the world that offer instructionally designed material for all our mining related subjects and in this way enhance the learning experience for all students.

The Mining Industry Study Centre which was officially opened in October 2013 can accommodate 758 students – 252 individual workstations, 30 conceive, design, implement and operate (CDIO)-type venues and 296 study cubicles. A virtual reality centre is on the cards for 2015.

"The undergraduate programme is accredited by ECSA and internationally recognised through the Washington Accord, The Dublin Accord as well as the Sydney Accord."

The Department boasts with 334 undergraduate students and 70 postgraduate students in 2014
The prime resource of the Department is its teaching staff who are encouraged to improve their teaching and research skills, remain active in the industry and contribute to departmental administration and community service. Active participation of contracted-in industry experts and guest lecturers on an on-going basis keeps us in touch with industry needs and trends.

For the past seven years, honours degree students have been appointed on a year-to-year period to assist lecturers in their daily teaching responsibilities. Eight full-time students were appointed in 2014.

Three extra-ordinary professors and one honourary professor have been appointed in the Department to supervise research students.

Prof Francois Malan and Prof John Napier, both rock engineers with special emphasis on rock engineering and numerical engineering, form part of the research staff employed in the Harmony chair.

Prof William Spiteri is an explosives engineer and has contributed significantly to the establishment of an explosive rock breaking course for the mining industry.

Prof Con Fauconnier is an honourary professor and alumnus of the Department and has been instrumental in several initiatives in the department, including fundraising to establish new facilities at UP, the most recent being the Mining Industry Study Centre on the Hatfield campus.

Prof Francois Malan
Prof John Napier
Prof William Spiteri
Prof Con Fauconnier
The demographics of our students have significantly changed over the last number of years. At present our undergraduate students are 77% black and 23% white. The female undergraduate student population is 29%. A significant number of foreign students are also enrolled in the Department. All 11 official South African languages are represented in the Department (93% of whom English is their second language).

Undergraduate student numbers have increased from 311 in 2013 to 346 in 2014. Postgraduate numbers have remained basically the same as 2013 with 53 honours, nine masters and six PhD enrolled in 2014.
The Kumba Virtual Reality (VR) Centre for mine design is a major new expansion of the Department’s facilities. This impressive first-in-Africa project will change the face of teaching on the continent and establish the UP as the leading, state-of-the-art institute in mining engineering in Africa.

The Kumba Virtual Reality Centre forms part of a new development of approximately 1 600 square meters, built on top of the existing Mineral Sciences Building on the Hatfield Campus. Kumba Iron Ore, a member of the Anglo American plc group, is the sponsor for the virtual reality section. This immersive 3D-360 cylinder (accommodating 15 learners at a time), will be supported by a state-of-the-art 66-seat mine design lecture hall and a 3D cinematic theatre which will seat 47 people.

The 4.5 meter high 3D-360 cylinder will have a diameter of 10 meters, surround sound and overhead projectors that will take students right into the heart of a mine, whether speeding down a shaft or walking along tunnels and expose them to every facet of mining engineering.

With this contemporary teaching approach in an immersive three-dimensional environment, the different packages (such as hazard awareness, mine design and various mining methods) will be developed by Simulated Training Solutions (STS) which is currently collaborating with the Department in developing software to be utilised in the VR centre.

Difficult and dangerous conditions such as accident recreation and potential bad planning prevention can be simulated, addressed and understood in a safe and controlled immersive virtual environment.

The completed structure of steel and glass is planned to be completed in the first half of 2015. Due to the high sophistication levels of the equipment used in this facility it is designed to withstand power cuts or even minor fluctuations in electricity supply.
The University of Pretoria has approved funding and building plans for new offices for the Department of Mining Engineering on the fifth floor of the current Mineral Sciences Building. This forms part of the Kumba initiative making this a R50 million new infrastructure project to be completed in the first quarter of 2015.
Images in the proposed 3D-360 immersive environment (Recognition UNSW)
Sasol Chair: Safety, Health and Environment

The objective of the Sasol Chair is to assist in improving the health and safety performance of the mining industry mainly through the establishment of the Executive Certificate in Safety, Health, Environment and Community (SHEC) Resilience for Managers in the Mineral Resources Industry.

This comprehensive online programme is exclusively designed for the mineral resource sector and covers critical issues related to safety, health and the environment within the industry. The purpose of the programme is to enable managers, through improving their knowledge and application ability, in the transition from being reactive and compliant to becoming resilient in issues which include safety, health, the environment and community management.

The establishment of the Chair has created new research opportunities including a noise induced hearing loss research project. This project is aimed at reducing the noise exposure associated with a scrubber which is mounted on a continuous miner. Further research needs in the industry will be identified and the research focus will be directed as required.

Harmony Chair: Rock Engineering and Numerical Modelling

Mining at depth or the mining of highly stressed areas is a common occurrence in the South African gold mining industry due to the age of the operations and the extent of mining conducted over the last century. The safety concern related to mining of these areas, especially in terms of seismic activity, has the potential to limit gold production in future unless methods to select and manage the mining within acceptable risk levels are found.

The Harmony Chair is responsible to execute research on rock engineering and specifically the impact of mining sequences and mining rate on seismic activity in deep level mines or highly stressed areas such as remnants or shaft pillars. The research will initially focus on seismic and mining related parameters that have historically been used to measure the risk involved with mining these areas, but will ultimately search for more appropriate parameters and even methods of determining these parameters.

This will include the use of numerical modelling packages and the potential to develop a constitutive law that could simulate strain softening, or a stress drop in areas where stress fracturing has occurred, normally ahead of the mining faces. This potential constitutive law could allow the dissipation of a portion of the energy available to generate seismic activity within the model and could assist in the comparison of different mining sequences to decide on the lowest risk option for implementation.

Research outcomes will continuously be applied to specific sites on mines for which sufficient seismic data exists in an attempt to correlate results or at least indicate applicability of the findings to date.

Research will be conducted by external rock engineering practitioners within the industry as part of their individual study programmes (MSc and PhD students) with the help of postgraduate students at UP and under the leadership of Profs Francois Malan and John Napier.
The research outcomes not only have huge potential to affect the safety of deep level mine workers, but will be used to expose undergraduate and postgraduate students to the potential impact of well-designed and well-managed mining practices on safety and profitability. At the same time, the value of a team approach in mining, where the manager should use all skills available to him (in this case high level rock engineering skills), to facilitate safe and profitable mining practices, is emphasised.
An innovative approach

It is widely acknowledged that mining in South Africa should be a source of economic growth and social transformation. During informal discussions held in 2013 with a large number of Heads of Departments at the University of Pretoria, the general perception was developed that mining in South Africa was not meeting the full expectations of investors, government, employees, organised labour, communities and other stakeholders for a number of complex reasons. The view was expressed that UP has the potential to play a significant role in improving the situation. It was felt that UP could be instrumental in improving the resilience of the mining industry in South Africa by researching some of the underlying causes of the underperformance of mining in South Africa in collaboration with other organisations working on related topics.

This led to a decision by UP to establish the Mining Resilience Research Institute (MRRI) which would, through rigorous, integrated, scientific research, contribute practically implementable solutions, leading in turn to increased resilience of the mining industry and establishing the University as a leading international contributor to solutions for complex mining industry problems. The MMRI also forms part of the Sasol Chair: Safety, Health and Environment initiative.

Introducing the MRRI’s three initial projects

Initially, the MRRI will conduct research in three areas which will demonstrate the power of adopting an integrated approach to analysing and proposing solutions to extremely complex problems facing the mining industry.

The three pilot projects focus on issues which are deemed among the most urgent to address in the mining industry and will assist the MRRI to refine its approach.

Labour relations

The project will consolidate existing research into a coherent analysis of the reasons for the current labour relations crisis in the industry. This includes research on the reasons for the strike action, negotiations in the post-Marikana period, labour and production relations on mines, union health and safety structures, mining towns and changing patterns of accommodation.

The project will develop further research which will survey major mining investors on the impact of the social and labour crisis in the mining industry on their investment strategies. It will then formulate policy responses in association with industry, government and labour representatives.
The contribution of mining and beneficiation to development in localities with strong mining economies in South Africa

There is a widely-held belief that South Africa is not making enough of its mineral endowment. Lack of, or limited ‘beneficiation’ of these resources and a perception that there is far more value to be extracted from the huge exports of these resources, is seen as ‘wrong’ and incomprehensible, given the country’s high level of unemployment and manufacturing ability. While the idea of beneficiation comes across as sensible and potentially beneficial from a variety of economic and societal angles, it may do so more on paper than in practice.

In addition to this, the concept of beneficiation is often defined within in a rather narrow range of either downstream benefits arising directly from mining and converting the mineral extracted into a saleable commodity, or as upstream benefits arising from the production of the tools or equipment required for production.

Key areas of focus will be:

• the real value of mining to the economy and society which conducts mining,
• the value-propositions, evaluations and trade-offs faced by the mining sector,
• perspectives held by investors, regulators, organised labour and regional and local stakeholders in terms of alternative value-precepts, and
• the potential value which can be realised with a different approach to defining a framework for beneficiation decisions.

The use of virtual reality to improve the health, safety and productivity of mining

Mines can be made safer and more productive through the application of virtual reality technology. The research project will create and utilise virtual reality models of both underground and surface mines to demonstrate safe working practices and analyse changes in mine design and operating parameters, without exposing employees to hazardous conditions or incurring major investment cost and risk.

Mining is a complex and potentially hazardous occupation, however experience has shown that safety and productivity invariably go hand in hand in the mining industry. Mines are more likely to be safe and productive if those engaged in designing, managing and conducting mining operations have the ability and to make the right decisions for safety. Virtual Reality has been shown to be potentially a superior medium for educating people on the hazards associated with mining and the potential consequences of making uninformed changes to mine design and operating parameters.

In the interests of mine safety and productivity, Virtual Reality education systems should be available at Mining Universities and should also be made affordable, transportable and ultimately be availed to those engaged in mining. In the VR Centre at the University, research and development will develop generic low cost transportable Virtual Reality solutions, which are adaptable to remote educational environments.
Research areas and capabilities

The appointment of industry experts as part-time lecturers has contributed to the department’s postgraduate research outputs. Many collaborative and cross-cutting research initiatives were created.

The establishment of the Sasol Chair: Safety, Health and Environment and the Harmony Chair: Rock Engineering and Numerical Modelling directed research into specific mining engineering challenges and its associated solutions.

Rock mechanics and undergraduate mine design

Pillar design and extraction methodologies had been around in the mining industry for a long time. A huge amount of research was focused to the establishment of a design methodology with regard to the stability of pillars, especially in the coal mining industry. In recent years hard rock mines adopted these methodologies with some adjustments to the input parameters with varying levels of success. The research is directed to understanding of the complex loading environment of pillars at various depths and dip angles as well as how mining layouts and rates affect these loading conditions.

Adopting a pillar layout as a means of primary support in a working environment result in lower extraction ratios where pillars are over designed. As the mineral is ‘locked-up’ as a supporting system, potential revenue becomes unrecoverable. Millions of tons are left in-situ as pillars in the coal mining industry alone and if not managed, would be the future in the hard rock mines.

Optimisation of mineral resources is imperative when considering the future and sustainability in the South African mining sector. Optimised pillar layout could play a prominent role in achieving this and is applicable to all underground mines.

Rock breaking and surface mining

The importance for improved safety standards, cost-effectiveness and productivity had driven technical mining personnel to examine all facets of their operations. Efficient drilling and blasting programmes impact positively throughout the mining operation to recover an invariable increase in the overall profitability through technical advanced projects. The safe, efficient and innovative use of explosives for rock breaking makes a positive contribution to the overall mining operation.

As part of a research project in the department, a device (which has been available for many years) has now been trialled at a deep level gold mine. This device has mainly been used on surface civil projects. At this stage the results look promising, however it is a tool for a very niche market. It could be applied in remnant areas where selective rock breaking is required with no negative effects to the environment as compared to explosives.
Traditionally, gold mines leave large areas underground sterile, to create a safer environment for the workforce. These pillars contain gold and remain underground. Due to the violent nature of explosives, seismicity is a real problem during blasting. With the mechanical breaking of the rock the seismicity will be reduced. A further advantage is less dilution of the grade, thus reducing the milling costs and increasing the grade.

**Virtual Reality (VR)**

Much has been done to introduce VR in education and training in the mining industry, however many areas of research activities relating to VR can still be implemented. VR has establish itself as a credible medium to convey previously complexed technical scenarios in a clear, more visual way. Research items (some of many) that still need to be addressed include:

- A fully integrated mine design using VR to visually represent the consequences of good or poor mine design. The ways in which VR can be fully optimised and implemented as a tool for mining engineering students to experience various aspects of a mining operation working together, integrating several types of simulations into one environment.
- How the behaviour of miners can effectively be influenced or changed using VR behavioural change interventions.
- Further intervention in providing incident reconstruction simulations through VR and also include potentially preventative actions in an immersive environment.
- How students can be engaged more in the learning experience through VR interventions.
- Investigation into the level of maturity of VR education in the South African mining industry for expansion into the international mining community.
- Implementing immersive VR initiatives for education and training purposes.
Management and Leadership

The Mine Design course requires students to design a rudimentary management system for their new operation. Knowing something about fundamental management systems and procedures, they can confidently include this in their overall design. The fundamentals of management as a course is organised around the four traditional functions of management – planning, organising leading and controlling. In the ‘real’ world they will be exposed to all sorts of management issues. Having this knowledge, they can appreciate the dynamics of any system and consider the merits critically.

Students benefit from this course by developing a critical appreciation of the fundamentals of management systems strengths and weaknesses. They can compare alternative systems and not accept the first draft. As a graduate with limited experience they can sensibly evaluate and judge the merits of a management system or proposed changes to the system. They can enter the debate with some confidence and ideas.

This course also impacts industry in that it is a sound frame work for project management and getting to grips with early stage first line supervision. It provides them with a solid introduction to the subject which will give them, as graduates, a ‘flying start’ when attending other more advanced courses on the subject.

Mine Ventilation Engineering

The provision of adequate ventilation to dilute pollutants such as gases, dust and diesel particulate in mines, remains the primary focus of a ventilation engineer. In recent years the importance of providing an environment in which workers can perform their duties in a healthy and safe environment has had increasingly importance within the legislative framework as well as in the media. Areas that require continued focus and research efforts include:

- Improvement in coal mine face conditions to reduce dust exposure and to dilute methane.
- Reduction in noise sources, the intensity of sources and ultimately the improvement in the occurrence of noise induced hearing loss.

Due to the maturity of the South African hard rock mine most of the operations require large cooling and refrigeration infrastructure to ensure thermal environments conducive to productivity. Energy and electricity costs are major expenditure drivers in mines and in the South African context the second largest cost driver. To this end there are numerous studies to improve the efficiency of existing mines. These include studies into the existing ventilation and refrigeration systems and optimising these through a structured study. Research includes the development of energy efficient components within the network as well as research into improved networks and the control of the networks.

The risk associated with underground mine fires and explosions remains one of the top risks in underground mining. In this area research into new methods to reduce the risk continues. This also includes the development of and hosting of training seminars in the understanding and prevention of mine explosions. The Department has a strategic alliance with the CSIR managed research facility at Kloppersbos. Past and immediate work dealt with active explosion suppression systems and the evaluation of new and alternative coal dust inerting systems.
Mineral economics

Mineral economics is the study of the business and economic aspects of natural resource extraction and use. Mineral economics involves studying topics in economic and financial analysis that are developed to meet the special needs of the natural resource industries. All participants in the industry use mineral economics, including national and local governments, corporations, banks and financial companies, and consulting firms. Mineral economics includes the study of:

• Macro and micro economic principles
• Supply and demand theory in the mineral sector
• Company annual results and economic performance
• SAMREC and SAMVAL codes and its associated impact on projects and the mineral sector at large

An understanding of mineral economics is crucial when evaluating and improving mining and processing projects from an economic point of view. A mining engineer involved in developing business plans (feasibility studies), has to have an understanding of the impact of external economic parameters on the viability of projects and of the impact the project has on the economy of the environment or region it operates in.
Risk management

There are several departments in the mining industry that play an integral role in the whole mining process. Risk management is an essential component of the mining engineer’s way of thinking. The various aspects that are dealt with in this module are, legal liability, safety, health and operational risk management techniques, including mitigation methodologies, change management, behaviour based safety and safety leadership.

All these aspects form a very important contribution in establishing a safe and healthy productive working environment on any mine and it is therefore very important for the mining engineer to understand all the relevant aspects related to it. Risk Management is a discipline that affects and includes all stakeholders of a mine. This department offers risk management courses industry wide, through accredited partners.

Underground mining methods and mine design

Mining methods as learning and research area, deals with specific mining techniques. Shafts are investigated, specifically the different types, methods and equipment that are used for sinking. The most efficient economic considerations are taken into account for every specific site. The design, development techniques and equipment used in tunnelling are also an integral part of the learning area. Design and construction for large excavation, fires in gold and coal mines as well as flooding in these mines are being researched.

The knowledge of the above-mentioned concepts are tested in the designing of a mine at a conceptual business case level. In this project students have access to mining engineers in industry to assist them with practical advice and expertise. The design incorporates market analysis, layout design, working method, surface layout, environmental impacts and financial analysis.
Written language

Good communication skills are essential for students’ success in their academic endeavours and are also very valuable in the workplace. Recently an English skills instructor was appointed in the Department. She focuses on improving the communication skills of students with a strong focus on improving the language usage of students in their written work. The department believes that the language skills instruction offered will lead to UP mining graduates being even more sought after.

Mother tongue languages of students in the Department

- Afrikaans 25%
- SeTswana 12%
- SeSotho 8%
- TshiVenda 15%
- Xhosa 2%
- IsiNdebele 4%
- SiSwati 6%
- SeSotho 8%
- Sepedi 12%
- Other (Shona, French, Herero, Yoruba) 10%
- XiTsonga 2%
- IsiZulu 2%
Leadership programme

The Department is aware of the challenges graduates face in the transition from being students to becoming employees. We realised that our students are generally well educated in technical knowledge, but often lack self-awareness, communication skills and the abilities to work in multi-disciplinary settings and groups. The department hosts the Tuks Leadership Academy which aims to expose volunteer final year students to these essentials before entering industry. Our students are bound to become future leaders and we need to groom them to be the best they can be before leaving university life.

The philosophy of the course is to expose students to experiential situations which will teach students intra- and interpersonal skills. Psychometric assessments and real-life case studies are used amongst other techniques, to hone well-rounded habits for leadership.

Instructional design

An instructional designer was employed by the Department to design all mining modules in a format where the one dimensional script would be enhanced through the inclusion of:

- high quality pictures and illustrations
- simulations of complex mining sequences which previously were not possible to comprehend without underground visits (and even then difficult to comprehend)
- animations showing difficult concepts in mining, which also included ‘mouse over’s’ to make explanations of mining sketches and descriptions more understandable for the inexperienced mining student
- video material to make ‘dead’ picture images ‘alive’

A databank of mining industry videos have been obtained as part-time viewing material for students to enhance their understanding of difficult mining concepts and procedures, including reconstructions of typical mine incidents with 3D animations (for example incident reconstruction simulations (IRS)) and geology features. These videos have already been introduced to some modules and will further enhance the comprehension of students of aspects previously only possible through on-mine visits. The videos can also be used to introduce students to basic mining concepts.
Clausthal University of Technology

A standing arrangement between the Department and the Institut für Bergbau from the University of Clausthal, Germany, allows for lecturers to visit other university as a guest lecturer, delivering lectures on their field of expertise to groups of students varying from junior undergraduates to senior postgraduates. As part of this arrangement, students on postgraduate level were offered the opportunity to partake in an exchange programme where the German students visited and attended class at UP. UP students also attended modules at Clausthal as part of this agreement.

Society of Mining Professors

The Society of Mining Professors (Societat der Bergbaukunde) is a vibrant international society representing the global academic community and committed to make a significant contribution to the future of the minerals disciplines (represented on all continents). The main goal of the Society is to guarantee the scientific, technical, academic and professional knowledge required to ensure a sustainable supply of minerals for mankind through a well-established networking environment. The Society facilitates information exchange, research and teaching partnerships and other collaborative activities among its members. Prof. Ronny Webber-Youngmann, was appointed president of the Society for 2013/14.
Short courses are presented by the Department of Mining Engineering through Continuing Education at University of Pretoria (CE at UP) and are available to members of industry.

- Global Minerals Industry Risk Management (GMIRM) for Supervisors
- Global Minerals Industry Risk Management (GMIRM)
- Short Course on Mine Safety Risk Management Principles
- Train the Trainer Global Minerals Industry Risk Management
- Programme in Blasting Engineering
- SASOL Programme in Strata Control HIRAC (PSC - HIRAC)

All these courses can be presented in-house on demand and new courses can be developed based on client’s needs and also be presented in-house.

For more information about these courses: +27 (0) 12 434 2200 or www.ceatup.com
The Mining Alumni Society at the University of Pretoria (MASUP) is an active alumni body. It fulfils a supportive role to the Department in raising sponsorships, ensuring high skills and educational standards to be maintained, supporting mentorship, providing of external examiners, being available for industry discussions, giving guidance and serving on the advisory committee of the department. MASUP also serves as a social network for mining engineers in the industry.

TUKS Mining Society (TMS)

TMS and the Department believe that mining engineers should have all the technical knowledge prescribed by the Engineering Council of South Africa (ECSA) but in addition to that, have the skills to interact with people and be able to lead others. We believe that all UP mining engineers are being prepared for roles in leadership to fill top positions in the best mining houses.

The TMS is a sub-house with all executive members elected into their positions by the students in the Department. This ensures that the executives choosing to stand for the positions are recognised leaders in their group.

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high performance cogeneration plants, which means that for every tonne of Respecta 100, there is a saving of 100 kg of carbon emissions.