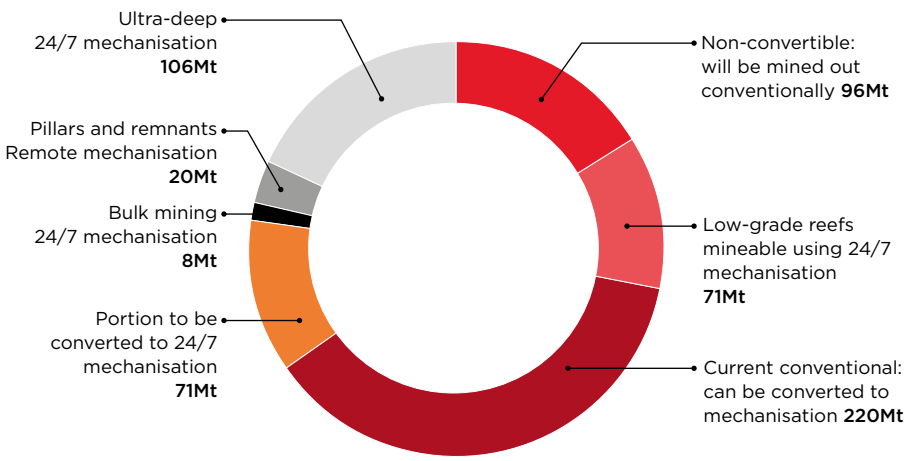
WHAT IS AT STAKE? A CASE STUDY

A study, drawing on the estimates of South Africa's three principal gold companies – AngloGold Ashanti, Harmony and Sibanye – indicates that, for one mine, every 1g/t reduction in the cut-off grade would result in 10Mt of additional ore containing 200t of gold to be mined over the operation's extended life.

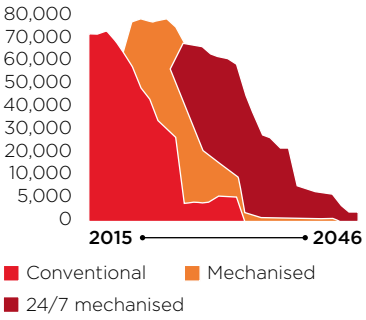
This is an indication of the benefits of using fully mechanised mining techniques, operating 24/7. Extrapolating this across the industry as a whole – to its currently working and dormant mines – profitable gold-mining operations might be expected to continue well beyond the year 2045. Looked at as a whole, with conventional mining, the industry can look forward to a sharp decline in gold production by 2019-20 and for mining to die out almost completely by 2033. The picture changes radically with mechanisation: annual output persists at current levels until at least 2025 and until 2030 or even beyond with 24/7 mechanised operations.

GOLD

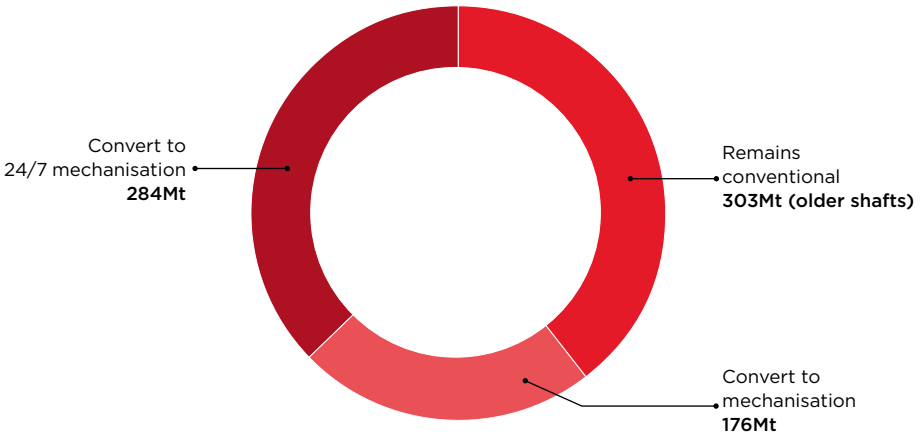


Total resources: 592Mt (496Mt can be mined using mechanisation, which is equivalent to 11 large gold mines that would otherwise be sterilised)

Gold mines TEC

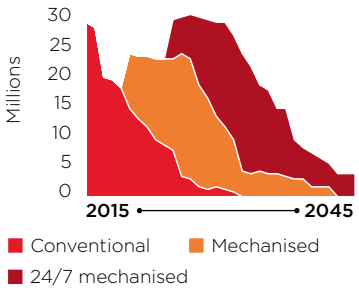


PGMs



Mechanisation can preserve 360Mt of production equivalent to eight large mines (without mechanisation, these resources are not economical)

Gold tonnes per year



Similar considerations apply to South Africa's platinum mines although their resources are nowhere near exhaustion as those of the gold mines.

IN CONCLUSION

If this process of modernisation and the manufacture of high-tech, robust and specialised mining equipment is to be achieved, an ad hoc approach cannot be contemplated. The industry, manufacturers, researchers and developers will need to collaborate to the full, sharing their knowledge and skills for common good. The aims are to develop, manufacture and use remotely controlled mobile equipment to break, load and haul ore continuously. Breaking will need to be explosives-free and the equipment must, as far as possible, be self-correcting. However, work on developing continuous miners that satisfy these criteria has yet to begin in earnest.

Learning from the past and, particularly from past mistakes, the R&D process will need to be carefully planned and carried out:

- It must create an environment where everyone (all stakeholders) want it to succeed
- The R&D structure must not slow down progress
- Mechanisation: a 50% reduction in cost per ounce as well as zero-harm operations
- 24/7 mechanisation: a step-change improvement in costs
- A mechanised implementable solution in three to five years
- A workable 24/7 rock-breaking system in 10 to 15 years
- Learn from the past: successes and failures
- Restrict any tendencies to return to conventional mining and allay any resistance to change
- Allow sufficient time for maturity at each phase of R&D

The process cannot be completed overnight so we have to prepare for a staged approach that may differ in the gold and PGM sectors.

The first part of the venture should build on existing knowledge in the gold and PGM sectors. The eventual objectives are systems that combine to deliver 24/7 mechanised operations with costs that permit the exploitation of ores at significantly lower cut-off grades. Extensive and fundamental research is required into mine-worthy, reliable, non-explosive rock breaking in a hard and high-stress rock environment. Targets and milestones will be exacting but reaching for the stars has always motivated humankind.

"Learning from the past and, particularly from past mistakes, the R&D process will need to be carefully planned and carried out."

MINING HUB

To facilitate and accelerate the process of mining modernisation, a Mining Hub is being set up to co-ordinate R&D, mining equipment manufacture and skills development by mining companies, original equipment manufacturers (OEMs), research entities, skills-development entities and government.

The hub is envisaged as a public-private partnership with a view to "open innovation" so that the costs and rewards of R&D can be divided equitably among contributors.

Open innovation goes beyond drawing on external sources of innovation, such as customers, rival companies and academic institutions. It can integrate adaptations in the use, management and employment of intellectual property by systematically encouraging and exploring a wide range of internal and external sources for opportunities, integration and exploitation through various channels.

The primary objective of the hub is to be a partnership that advances the mining cluster by:

- co-ordinating research and development with initial focus on future underground narrow reef, hard-rock mining systems
- developing South African mining manufacture that supports the country's narrow-reef, hard-rock mines and promotes export potential of locally manufactured mining equipment
- facilitating skills development for future narrow-reef, hard-rock mining systems

The hub will only co-ordinate (not manage) R&D, manufacturing and skills development. The organisations involved will be selected as "centres of excellence", which will engage voluntarily, complementing the ideals and objectives of the hub, and not competing counter-productively.

It will be a virtual centre connecting an established network through a central database that monitors the progress of certain pilot projects.