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Nick Holland
CEO, Gold Fields

The Coalition for Eco-Efficient Comminution Update July 2013

Pease and Battersby welcomed to CEEC Board

CEEC's Board of Directors welcomed two new members in late 2012. Joe Pease, Chief Executive of Xstrata Technology Ltd and Michael Battersby, Managing Director, Maelgwyn Mineral Services bring their global commercial experience and insight to the CEEC Board. Current board members include Elizabeth Lewis-Gray, Chairman of Gekko Systems Pty. Ltd; Prof Tim Napier-Munn of JKTech Pty Ltd, Dr Michael Daniel of CMD Consulting and Ms Zeljka Pokrajcic, Principal Process Engineer at Worley Parsons.

Michael Battersby *(pictured top)* is a co-founder and Managing Director of Maelgwyn Mineral Services Ltd (MMS), based in Cardiff, Wales. He has over 35 years experience in the minerals industry in operations, general mine management, technical consulting and equipment sales management.

Michael has led MMS to be one of the leading new technology development companies in the minerals industry. To date the company has invented, patented, developed and commercialised five different technologies and processes in the areas of froth flotation and gold processing. In 2001 the company won a Smart Wales award for the development of G-Cell pneumatic flotation. In 2006 MMS won the "Celebration of Innovation" award for having the most innovative product to come out of Wales for the previous 25 years.

Michael has degrees in Mineral Processing (Cardiff University) and Enterprise & Innovation (Swinburne University of Technology). He is a Chartered Engineer and a Member of the Institute of Materials, Minerals & Mining (London), the Australasian Institute of Mining & Metallurgy and the Society of Mining Engineers of AIME (USA). Michael is also listed as a co-inventor on a number of patents and has co-authored many technical papers.

Joe Pease *(below)* has degrees in Metallurgical Engineering and Economics. He has spent 21 years in operations in a variety of research, project and production management roles. Most of this was at Mount Isa in Australia, including Manager of the Mount Isa lead, zinc and copper concentrator for eight years, and lead smelter manager for two years.

For the last decade, Joe has been Chief Executive of Xstrata Technology, which develops and markets technologies to improve the efficiency of minerals processing, smelting, refining and leaching.

From his time in operations, Joe saw the perspectives of all stages of the processing chain, from mining to final refining. This left him with a passion to improve and find efficiencies both within, but especially, between, the traditional "silos" in processing and organisations.

In addition to CEEC, Mr Pease serves on several industry bodies, including the Board and Executive Committee of AMIRA, the Board of the Julius Kruttschnitt Mineral Research Centre, the Ian Wark Institute Advisory Board, and the Steering Committee of the Australian Minerals Education Partnership.

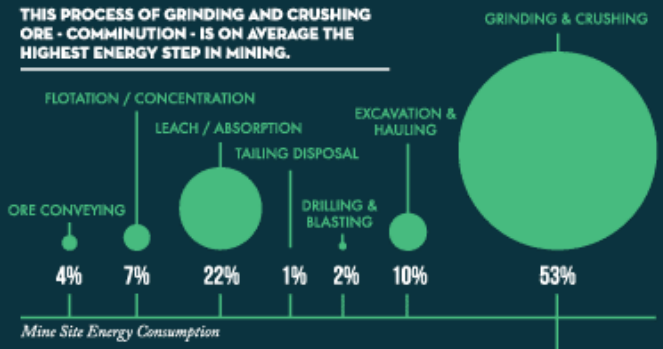
COMMINUTION

AND WHY SMART COMPANIES ARE FOCUSING ON IT

IMPROVEMENT IN COMMINUTION PRESENTS A HUGE OPPORTUNITY FOR INCREASED EARNINGS.

ONCE MINED, ORES TYPICALLY MUST BE CRUSHED AND BROKEN BEFORE THE DESIRED MINERAL CAN BE EXTRACTED FOR USE IN THE MODERN WORLD.

THIS PROCESS OF GRINDING AND CRUSHING ORE - COMMINUTION - IS ON AVERAGE THE HIGHEST ENERGY STEP IN MINING.



COMMINUTION ACCOUNTS FOR THE LARGEST CHUNK OF MINE SITE ENERGY CONSUMPTION

AND REPRESENTS AT A MINIMUM 10% OF THE SITE PRODUCTION COSTS.

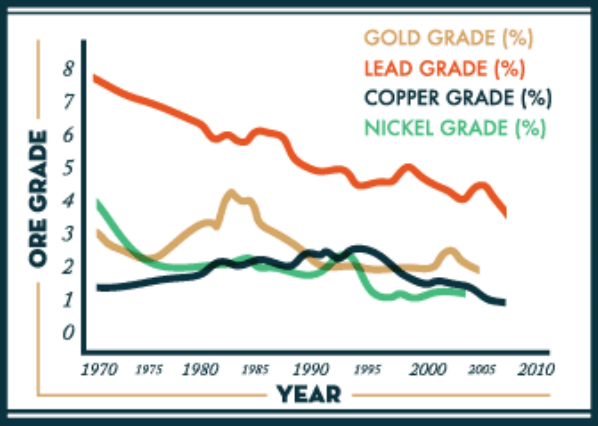
In fact: COMMINUTION CONSUMES UP TO 3% OF ALL ELECTRIC POWER GENERATED IN THE WORLD.

THE MINING SECTOR IS FACING COMPELLING DRIVERS FOR CHANGE!

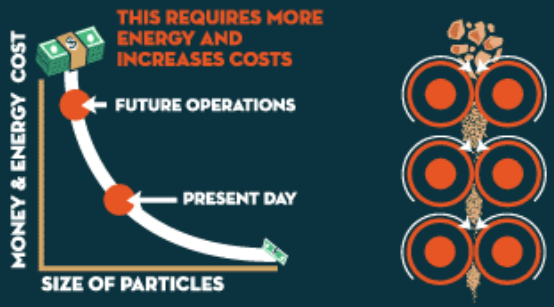
Driver One: FALLING ORE GRADES

AS THE HIGHEST GRADE OREBODIES ARE MINED AND EXHAUSTED, THE AVERAGE GRADES OF ORES ARE FALLING ACROSS THE BOARD, RESULTING IN HIGHER COSTS.

AVERAGE ORE GRADES OVER TIME



AS THE TARGET MINERALS COMPRISE LOWER VOLUMES OF THE MINED ORE, THE ORE MUST BE GROUND AND CRUSHED TO SMALLER PARTICLES.



Driver Two: RISING ENERGY COSTS

AS THE EASILY ACCESSIBLE OREBODIES ARE EXHAUSTED, MINING OPERATIONS ARE MOVING INTO MORE REMOTE AREAS OF THE WORLD, WHERE ACCESS TO INPUTS - ENERGY, LABOUR, INFRASTRUCTURE - IS LIMITED AND MORE COSTLY.

STUDIES SHOW THERE ARE ENERGY SAVING OPPORTUNITIES OF 420 TRILLION BTUS/YEAR IN INDUSTRIAL CRUSHING AND GRINDING ALONE.

A picture is worth 1000 words: The CEEC Infographic

CEEC's striking infographic illustrates the immense opportunity for mining companies to improve earnings by optimizing their crushing and grinding practices known as comminution. This infographic is designed to catch the attention of time-poor managers, to raise their awareness of the potential benefits of alternative mine to mill processing strategies. Greater knowledge of these options will empower more informed query and enable key performance measures which reflect the potential gains.

This is the first in a series of infographics CEEC plans to develop. Visit CEEC's web site to view and download the infographic.

Comment from Nick Holland, Gold Fields CEO and CEEC Patron

"Gold Fields finalised its Integrated Energy and Carbon Management Strategy in August 2012 to tackle the challenges of sharply rising energy costs and achieving greater energy efficiencies.

One of the key outcomes of this strategy was a group wide review of the company's operational comminution circuits as they reflect heavy power consumption figures and at certain mines more energy is being utilised to grind the ore more finely to improve our metal recovery.

Up to 83% of processing plant energy usage is attributed to comminution energy, equating to 28% of a site's greenhouse gas emissions. Optimisation of comminution circuits, efficiency improvements and changes in the mine-to-mill ratio (blasting/crushing/comminution/classification circuits) are key focus areas to reduce energy consumption.

We have set quick win targets to reduce power consumption by 5% with associated GHG reductions, and to reduce grinding media consumption by 5%. In parallel, modelling of the comminution circuits will pin-point future opportunities along the fragmentation chain, equipment limitations and recirculating loads by comparing actual to theoretical performance.

The most tangible benefit of Gold Fields' association with CEEC, of which we are a founding financial sponsor, will be in using the organisation as a technical resource for comminution efficiency programmes, benchmarking and standardisation in KPI measurements. The access to CEEC's library of technical information specifically targeted at comminution efficiency is also extremely beneficial, as is the network of CEEC member companies which can provide peer support and assistance. The CEEC has also attracted a series of consultants and academics, which could be used in future programmes."

Nick Holland
Chief Executive Officer,
Gold Fields Ltd.

Contact CEEC: **www.ceecthefuture.org or sarah.boucaut@gmail.com**

Centre launched for sustainable comminution

Anglo American is committed to developing and maintaining sustainable competence in comminution through the Anglo American Centre for Sustainable Comminution, launched at the Julius Kruttschnitt Mineral Research Centre (JKMRC), Sustainable Minerals Institute (SMI), The University of Queensland (UQ), Brisbane on 22 November 2012. The Centre is a Platinum and Technology Development initiative.

The Centre will benefit both industry and academia; advancing research in key areas of comminution as well as developing a pipeline of comminution expertise and talent. A Global Comminution Collaborative (GCC) will be coordinated by the Centre. The GCC will comprise a community of university experts and milling practitioners, effecting knowledge and technology transfer to operations and projects in the design, commissioning and optimisation of production and energy efficiency of comminution circuits.

From left, Prof Alan Lawson Pro Vice Chancellor (Research and International) UQ; Nick Barlow Head of Resource Development and Operational Excellence at Anglo American; Prof Chris Moran, Director of the Sustainable Minerals Institute, UQ.

Anglo American's commitment extends beyond the GCC, as the resulting expertise will also be of benefit to the larger mining industry.

''We are in a vulnerable situation,'' says Jeremy Mann: Head of Geosciences, Process & SD, Technology Development. ''There is a lack of sustainable expertise to conduct the design and operational reviews required in one of the key, most capital intensive, processing areas of our operations.''

Five academic centres of excellence in comminution exist globally, each with their own area of expertise:

- JKMRC, Sustainable Minerals Institute, The University of Queensland, Australia: renowned for ore characterisation, process modelling and simulation, with the flagship products of the JK Drop Weight Tester and JKSimMet simulator being used extensively for industrial design and optimisation studies.
- Centre for Minerals Research (CMR), Dept of Chemical Engineering, University of Cape Town, South Africa: a hub of comminution expertise in Africa, with specialist skills in cyclone classification and run-of-mine ball mills (RoM mills) with state of the art modelling capability in these units. The CMR is also associated with the PEPT facility that conducts fundamental studies of the mechanical environment in comminution devices – underpinning mechanistic model development.
- Chalmers Rock Processing Research, Product and Production Development, Chalmers University of Technology, Sweden: expertise in dynamic process modelling and design of dry crushing circuits and process control.
- Dept. of Mining Engineering, Mineral Processing Division, Hacettepe University, Turkey: extensive experience in dry grinding and classification, with specialist skills in HPGR, vertical roller mill and air classifier technology.
- LTM (Laboratory of Mineral Technology), Dept. of Metallurgical and Materials Engineering, Universidade Federal do Rio de Janeiro, Brazil: specialist skills in mechanistic mill modelling, ore strength characterisation and physical separation.

CEEC advocates worldwide

Advocates have been established around the world to support CEEC's mission to accelerate knowledge transfer in the area of alternative comminution strategies.

Located in Peru, Chile, South Africa, Canada and Sweden, these comminution leaders play a critical role in sharing CEEC's resources with their communities, making public presentations on behalf of CEEC and providing valuable views to the CEEC Board.

The CEEC Advocates are: Rob McIvor Metcom Technologies; Laurie Reemeyer AMEC Americas; Levi Guzman Moly-Cop® Adesur S.A.; Peter Amelunxen Consultora Amelunxen Mineral Engineering Ltda; Chris Rule Anglo Platinum, and Christian Ottergren Sandvik Mining and Construction Sverige AB.

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