



# IMPROVING MILL PRODUCTIVITY

HOW EFFECTIVE BLASTING CAN REDUCE ENERGY  
CONSUMPTION AND TOTAL MINING COSTS



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Crushing and grinding ore in the mill (comminution) can be a significant cost to your operation, both in terms of dollars and energy consumption. Optimising rock fragmentation through blasting can deliver consistently sized rock to the mill for processing, improving your bottom line.



Figure 1 Total mine processing costs.

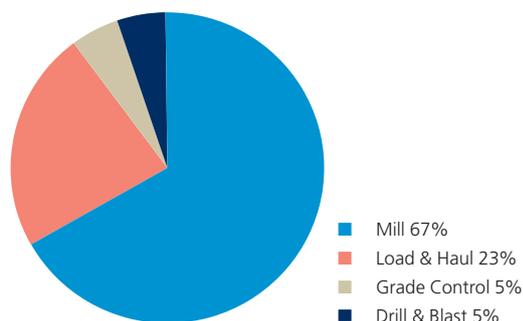


Figure 2 Total energy consumption.

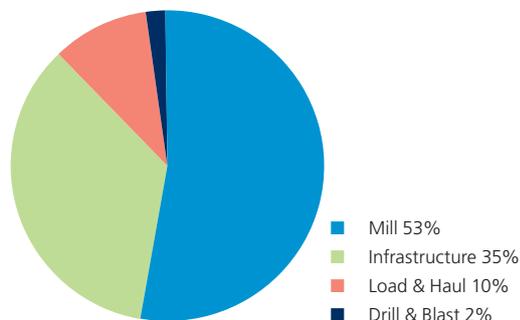
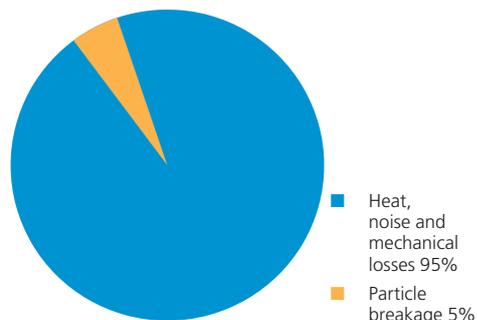


Figure 3 Energy use within the mill.



## THE COSTS OF COMMINUTION

Comminution is, on average, the highest point of energy consumption in mineral extraction. Studies have shown that it can account for up to 67% of total mine processing costs<sup>1</sup> (Figure 1) and can consume up to 53% of total energy in a mining operation<sup>1</sup> (Figure 2).

Additionally, comminution is inherently inefficient, with up to 95% of energy consumed by heat, noise and mechanical losses<sup>1</sup> (Figure 3). Only 5% of the energy consumed is actually used to break the rock. That's like expending the energy to run a 100 metre race but only travelling 5 metres.

### But there is a better way.

It is now widely accepted that chemical energy used in blasting is more efficient for rock breakage than comminution. With its relatively low cost and energy efficient profile, blasting can provide significant opportunities to deliver cost and energy reductions.

Through effective blasting you can improve the productivity of your mill, making you more competitive and reducing your environmental impact.

1. Powell, M. 2012, Energy Efficient Liberation and Comminution Research, CSRP.

## EFFECTIVE BLASTING CAN IMPROVE MILL PRODUCTIVITY

Occurring early in the mining process, blasting has the potential to effect all downstream processes with the value flowing through to load, haul, crushing and grinding processes.

The key is optimising fragmentation, delivering a consistent size of rock to the mill for processing.

By focusing on fragmentation through effective blasting, operations stand to benefit from:

- increased throughput,
- reduced production costs,
- potential reduction in capital costs,
- lower greenhouse gas emissions per tonne, and
- improved social license to operate.

By optimising fragmentation, our customers have seen improvements to their bottom line in the tens of millions of dollars annually. Even small increases in mill throughput and total mine production can result in significant financial benefits.

# US\$ 26.4 MILLION/ANNUM

**DEMONSTRATED BENEFIT  
TO A METAL CUSTOMER  
IN LATIN AMERICA  
THROUGH INCREASED  
THROUGHPUT AND REDUCED  
ENERGY CONSUMPTION.**

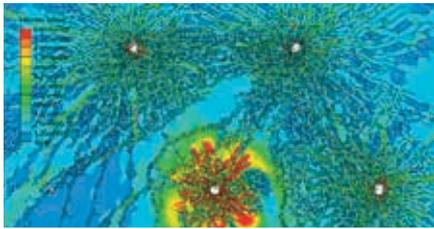
## CASE STUDIES IN BRIEF

- 1** Reducing the 80% passing size of the feed from 150 mm to 80 mm improved mill throughput at a base metal mine by around 40%.
- 2** In a copper mine, increasing the fraction of ore passing 25 mm from 18% to 45% increased plant throughput by 6.5% and reduced specific energy consumption by 4.6%.
- 3** In a side-by-side comparison with conventional blasting, a high powder factor blasting technique called "Ultra High Intensity Blasting" increased the fraction passing 25 mm from 35% to 56%.



## ENABLERS OF EFFECTIVE BLASTING FOR MILL PRODUCTIVITY

Drawing on a broad range of products, services, delivery systems, design and in-field technologies, we tailor blasts to optimise fragmentation for our customers' milling operations.



### ADVANCED BLAST MODELING

- Orica's class leading modeling tools allow detailed blast analysis and comparison of options.
- Advanced modeling analyses fragmentation, movement, damage, vibration, airblast and flyrock.



### BLAST DESIGN SOFTWARE

- SHOTPlus™ 5 is used to design, analyse and optimise blast initiation.
- SHOTPlus™ 5 can be enhanced by in-field technologies like DIPPlus™, allowing for 'actual' to be compared to 'design'.



### ON-BENCH LOADING SERVICES

- On-bench services provide high efficiency to maximise broken stocks and optimise fragmentation through best in class people, delivery systems and in-field technologies.
- Services: Down the Hole, Total Loading Service and Blast Quality Service.



### ADVANCED BLASTING SERVICES

- Advanced Blasting Services provide outcomes to agreed specifications for customers, with Orica managing all stages of planning, design, execution, post-blast measurement and analysis.
- Services: Rock to Specification, Mine to Plant, Mine to Leach.



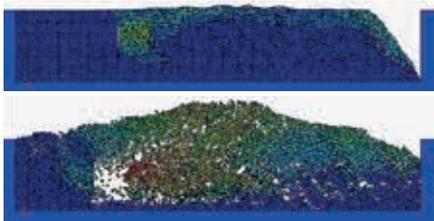
### BULK SYSTEMS

- High energy and detonation pressure explosives Fortis Extra™ and Vistis™/Vistan™ allow greater energy in the blast for improved fragmentation.
- Low energy explosives such as Flexigel™ allow shorter stemming and better collar fragmentation.



### ELECTRONIC BLASTING SYSTEMS

- Orica's electronic blasting systems provide industry leading timing accuracy and flexibility.
- Tailored application of fast timing provides a multiplier effect through colliding energy wave fronts, promoting fragmentation.



### SPECIALIST BLASTING TECHNIQUES

- Orica's specialist blasting techniques use EBS timing and sophisticated designs to maximise the effects of explosive energy to promote improved fragmentation.
- Techniques: Ultra High Intensity Blasting, Dual Layer Blasting and Ore Pre-conditioning.



### POST-BLAST MEASUREMENT TOOLS

- Fragmentation measurement is a core measure to improving mill productivity.
- PowerSieve™ is used for manual fragmentation image capture while Binocular Vision Systems are used for fragmentation measurement and analysis.

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