

The MissionZero Copper Mine (Desktop Study)

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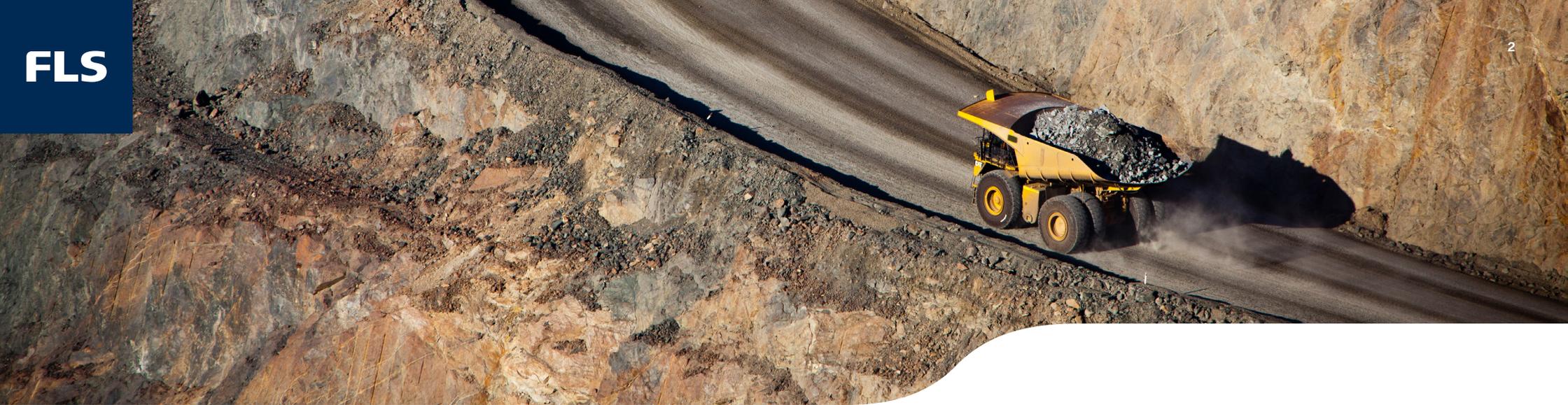
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Abstract

The mining industry is crucial to the global economy and green transition. However, its activities come with significant environmental challenges. The processing of ores consumes large amounts of energy and water, contributing to global greenhouse gas emissions and straining local water supplies. FLS launched the MissionZero Mine sustainable mineral processing initiative to address these issues. This initiative aims to accelerate the development of the most efficient processing flowsheets and equipment to significantly lower emissions, water consumption, and energy use. This paper

discusses two MissionZero Mine copper flowsheets of the future, both focused on reducing energy consumption in copper concentrate production. Introducing these flowsheets into the mining industry will require collaboration between copper miners, research institutes, universities, and governments. There is some precedent for cooperative action here: the Copper Mark certification programme provides a voluntary framework addressing copper mines' performance across various environmental, social, and governance (ESG) criteria and guiding mines toward compliance with the UN

Sustainable Development Goals (SDGs). It currently covers 38% of global copper mine output. Building on such existing schemes offers a potential way forward to deliver required improvements in environmental performance and meet international climate change commitments. By embracing sustainable practices and investing in new technologies, the mining industry can reduce its environmental impact, improve efficiency, and inspire a more sustainable future for all.



Introduction

The copper mining industry contributes significantly to the global economy, employing more than one million people and adding USD144 billion to the global economy (International Copper Association, no date). It is also a cornerstone of the green transition (Pickens, Joannides and Laul, 2022), but its activities have environmental consequences. Ore processing consumes much energy and water, contributing to global greenhouse gas (GHG) emissions and straining local water supplies. More than 50% of current copper production is already concentrated in areas of water stress (de Oliveria Bredariol, 2022), while climate change is expected to cause more frequent droughts and floods (Rodell and Li, 2023), altering the water supply to mining sites and disrupting operations and heightening the potential for water conflict between mines and local communities (Blais, 2024).

Exacerbating these challenges, demand for copper is expected to rise by 275% to 350% by 2050 (Elshkaki et al., 2016). Primary global copper production is not keeping pace

(International Copper Research Group, 2024), highlighting the need for innovative practices that enable the industry to meet growing demand in an environmentally responsible way.

The copper industry is already taking some collaborative action to address these challenges. International Copper Association (ICA) members—among whom are some of the largest producers of refined copper—have committed to reducing their Scope 1 and 2 carbon emissions by 30% to 40% by 2030 and by 70% to 80% by 2040 (Keltie, 2023). Meanwhile, the global Copper Mark certification programme is a voluntary framework that assesses copper mines' performance across environmental, social, and governance (ESG) criteria and guides mines toward compliance with UN Sustainable Development Goals (SDGs). By meeting these standards, copper mines can demonstrate their commitment to environmentally responsible mining practices; however, it currently covers only 38% of global copper mine output (Copper Mark, 2024).



FLS launched the MissionZero Mine initiative in 2021 to support the mining industry in its green transition. At its core, the MissionZero Mine is a sustainable mineral processing programme that aims to develop the most efficient processing equipment and flowsheets to reduce the mining industry's energy use, water consumption, and GHG emissions. The programme specifically focuses on accelerating innovation in these three key areas to provide mineral processing equipment for lithium, gold, iron ore, and copper mines of the future. The programme focuses on the entire flowsheet, emphasising areas where there is significant potential, e.g., maximising water recovery, lowering tailings risk and footprint, and improving energy efficiency in grinding.

This paper introduces two MissionZero Mine flowsheets that aim to reduce energy consumption in copper concentration production. The study examines the effect of various grinding, digital, and flotation technologies on energy reduction, compared

to a conventional SAG and ball mill circuit (SABC) with forced air flotation, at a desk-top level. The first flowsheet analyses the impact of incorporating FLS' latest and most efficient technologies into a wet copper concentrator flowsheet. The study starts at the crushing stage with an Eccentric Roll Crusher (ERC®). It then integrates the Load IQ™ mill load optimisation system to the SAG Mill circuit and introduces the use of high-pressure grinding rolls (HPGR) with a ball mill for grinding, followed by the HPGR Pro upgrade. Subsequently, the ball mill is replaced with a vertical-stirred FLSmith® Tower Mill (FTM), followed by coarseAIR™ Coarse Particle Flotation, and finally replaces conventional flotation cells with the Reflux™ Flotation Cell (RFC™). The aim was to identify the optimal combination of technologies for reducing the overall energy consumption of the full flowsheet. The second flowsheet examines a more radical alternative, transitioning to dry grinding using finish grinding with either a vertical roller mill (VRM) or HGPR with air classification, thereby

achieving a further reduction in energy consumption and hence GHG emissions. Both flowsheets incorporate other supporting technologies, such as the Rail-Running Conveyor and ore sorting.

Implementing these new flowsheets and technologies into the global mining industry will require collaboration between copper mines, research institutes, universities, and governments. The Copper Mark demonstrates a willingness on the part of the industry to cooperate. Building on such existing schemes offers a potential way forward to deliver required improvements in environmental performance and meet international climate change commitments. The goal is the establishment of consumption and production patterns that support global climate change mitigation efforts and meet SDGs, balancing economic and social progress with environmental protection to ensure a more sustainable future for future generations.





Literature review and benchmarking

Copper production accounts for 0.2% of global GHG emissions (International Copper Association, 2023). However, innovative mineral processing technologies, such as those highlighted by the MissionZero Mine programme, can significantly reduce energy consumption and GHG emissions (Norgate and Haque, 2010). Comminution is the most energy-intensive step in processing plants, regardless of configuration, with data from over 400 copper mines showing an average energy intensity of about 25 GJ/t of copper produced (engeco, 2021). Overall, comminution consumes between 30% and 40% of the total energy consumed in copper mining

(**Table 1**), accounting for about 0.2% of global electricity consumption.

The situation is set to become more challenging as copper miners face declining ore grades and depths. Energy costs of milling/flotation operations have been found to increase significantly as ore grades decline. Ore grades of 0.5%, 0.4%, and 0.3%, extracted at a depth of 300 m, consume 60 MJ/kg, 127 MJ/kg, and 447 MJ/kg, respectively, to obtain a 30%+ copper concentrate at underground mines, and 52 MJ/kg, 95 MJ/kg, and 255 MJ/kg, respectively, at surface mines (Koppelaar and Koppelaar, 2016).

Table 1. Benchmarking of comminution energy consumption for a surface copper mine (after Ballentine and Powell, 2024).

Operation	% Mine Site Energy Consumption
Drilling	2%
Blasting	12%
Loading and hauling	44%
Crushing and grinding	35%
Flotation	5%
Thickening and filtration	2%

Traditional grinding methods, such as semi-autogenous grinding (SAG) and ball mills, are particularly inefficient when processing low-grade, harder, and more competent ores (Foggianto and Chandramohan, 2024). In contrast, HPGR's are more energy-efficient for medium and hard ores, leading to lower energy consumption and operating costs (Ballantyne et al., 2023; Vanderbeek et al., 2006). HPGR grinding also causes microcracking in the material, making subsequent ball milling more efficient by up to 10%. Lower wear rates, maintenance costs, reduced water use, and lower GHG emissions further contribute to the HPGR advantage. At the same time, its modular design allows for easy integration and scalability, making HPGR a versatile and flexible option for optimising grinding circuits.

Coarse particle flotation is another technology expected to deliver significant benefits within the MissionZero Mine flowsheets. The shift to a coarser cut point impacts cyclone and milling circuit operations, requiring cyclones to handle larger particles and milling circuits to be configured for a coarser feed. Mill capacity and power adjustments are necessary to process varying feed sizes while maintaining consistent product quality. Coarse particle flotation aims to improve operational efficiency by reducing recirculating loads and managing larger particle sizes earlier in the process, reducing grinding energy consumption, mass flows into flotation, and mass flows of flotation underflow.

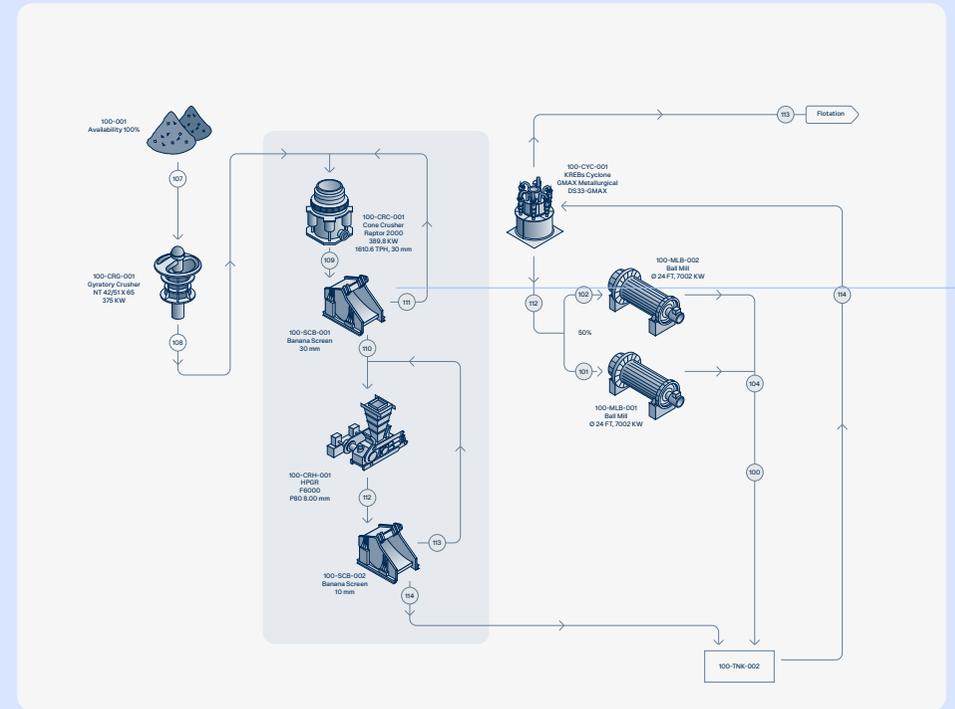


Figure 2. Simulation flowsheet of an HPGR replacing a SAG-pebble crusher circuit

Table 2 shows simulation results comparing cyclone and milling circuit performance in conventional flotation (F80=200 um) and coarse flotation (F80=400 um) while Table 3 shows the power draw of various grinding and flotation flowsheet configurations.

Table 2. Comparison of normal and coarse flotation with a cut point of 400 um.

Parameter	Normal Flotation	Coarse Flotation
Cyclone		
Feed Capacity (tph)	2450	2065
Recirculating Load (%)	96	65
Slurry Flow Rate (tph)	2473	2088
Pressure Drop (kPa)	10	10
Feed Overflow (tph)	1250	1250
Feed Underflow (tph)	1200	815
Ball Mill		
Nominal Capacity (tph)	600	407
Motor Power (kW)	9482	7002
Feed Size F80 (um)	6574	8718
Product P80 (um)	165	400

Table 3. shows the power draw of various grinding and flotation flowsheet configurations.

Flowsheet	HPGR with Coarse Flotation	HPGR with Fine Flotation	SAG mill with Coarse Flotation	SAG mill with Fine Flotation
HPGR power draw	8127 kW	8127 kW		
Ball mill power draw	5182 kW x 2	7368 kW x 2	7002 kW x 2	9482 kW x 2
SAG mill power draw			9236 kW	9236 kW
Total grinding power draw	18,381 kW	22,863 kW	23,240 kW	28,088 kW



Grinding circuit simulation

FLS Cycad is a comprehensive design tool for simulating and balancing comminution circuits. It is based on FLS products and generic equipment models (such as vibrating screens) and provides robust modelling capabilities for various flowsheet configurations. FLS equipment models are based on historical full-scale data from customer operating sites and laboratory data from scaled machines.

This paper uses a simulated hard rock copper ore plant with a design capacity of 60,000 tpd (**Table 4**) to provide a baseline for comparison with the MissionZero Mine flowsheets. The Cycad simulation allows optimisation of the main comminution equipment (crushers, SAG and ball mills) using detailed settings for feed parameters and unit configurations. Simulation results help enhance process performance and product quality by allowing the selection of different equipment configurations and adjusting equipment settings based on particle size distribution (PSD) and power consumption data.

Table 4. Plant data from a hard rock copper ore. The data is used to set simulations.

Process Data	Value	Material Data	Value
Ore Type	Copper ore	Specific Gravity	2.75 m ³ /t
Design Capacity	60,000 tpd	Bulk Density	1.64 t/m ³
ROM PSD	0-1000 mm (assumption)	Moisture	1.8%
Top Size	1000 mm	UCS (Uniaxial Compressive Strength)	150 MPa (assumed)
A80	537 mm	CWi (Crushing Work Index)	25 kWh/t
Primary Crusher	Eccentric Roll Crusher (ERC)	Ai (Abrasion Index)	0.13 g
P95 Primary	< 127 mm (optimum tbc)	BWi (Bond Work Index)	24.0 kWh/t
Secondary Crusher	Cone Crusher	RWi (Rod Mill Work Index)	25.0 kWh/t
PSD Secondary	24 – 38 mm	Axb	28
HPGR Product	< 6 mm (4 mm)	DWi (Drop Weight Index)	9.9
Ball Mill Product	165 µm	Specific Gravity	2.75 m ³ /t
Operating Time Crushing Plant	80%	Bulk Density	1.64 t/m ³
Operating Time Milling + Flotation	93%	Moisture	1.8%

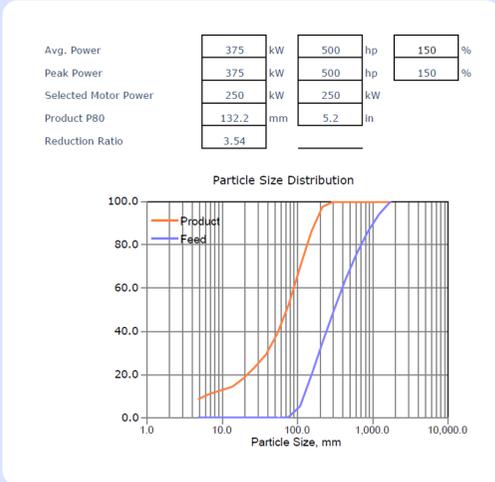


Figure 6a. Baseline simulation results: gyratory crusher.

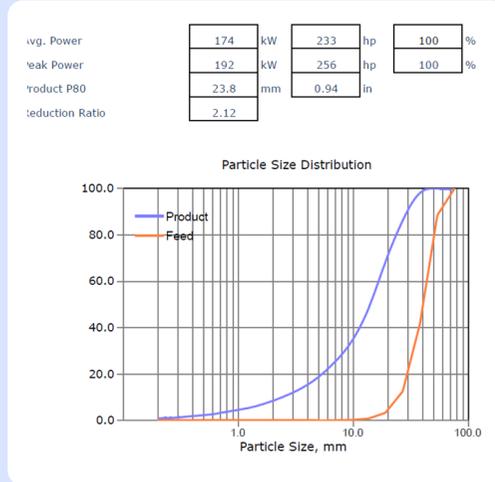


Figure 6b. Baseline simulation results: pebble crusher.

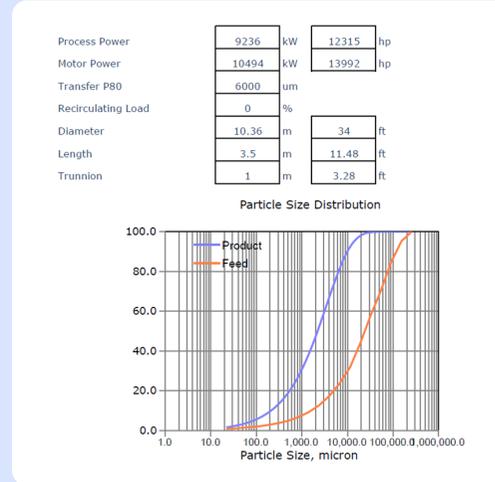


Figure 6c. Baseline simulation results: SAG mill.

PSD and power data can be used to enhance process performance and product quality by adjusting equipment settings such as crusher gap, mill speed, and cyclone configurations. Power consumption can be optimised by analysing power parameters relative to the PSD. Comparing feed and product PSDs helps evaluate crusher, mill, and cyclone efficiency.

Table 5. Mass flow and power consumption for each unit in the baseline flowsheet.

Equipment	Calculated Power Consumption (kW)	Solid Mass Flow (tph)
Gyratory Crusher	375	536
Ball Mill 1	9436	600
Ball Mill 2	9436	600
SAG Mill	9236	1250
Cone Crusher	174	312
Cyclone		1250

Figures 6a-e present the Cycad simulation for each piece of equipment included in the baseline flowsheet, showing machine parameters, process PSD, power estimation, and mass flows.

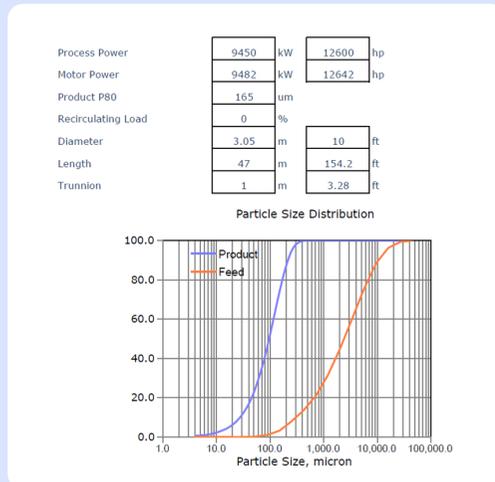


Figure 6d. Baseline simulation results: ball mill

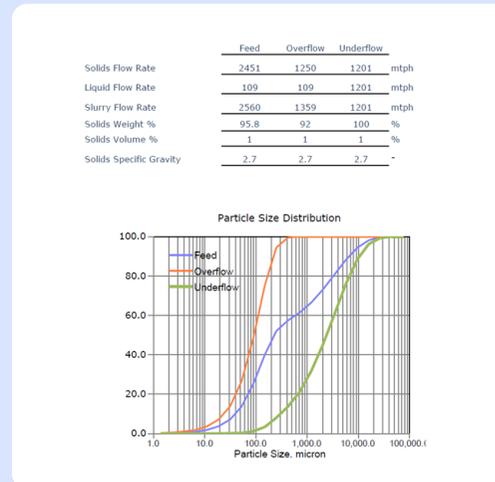


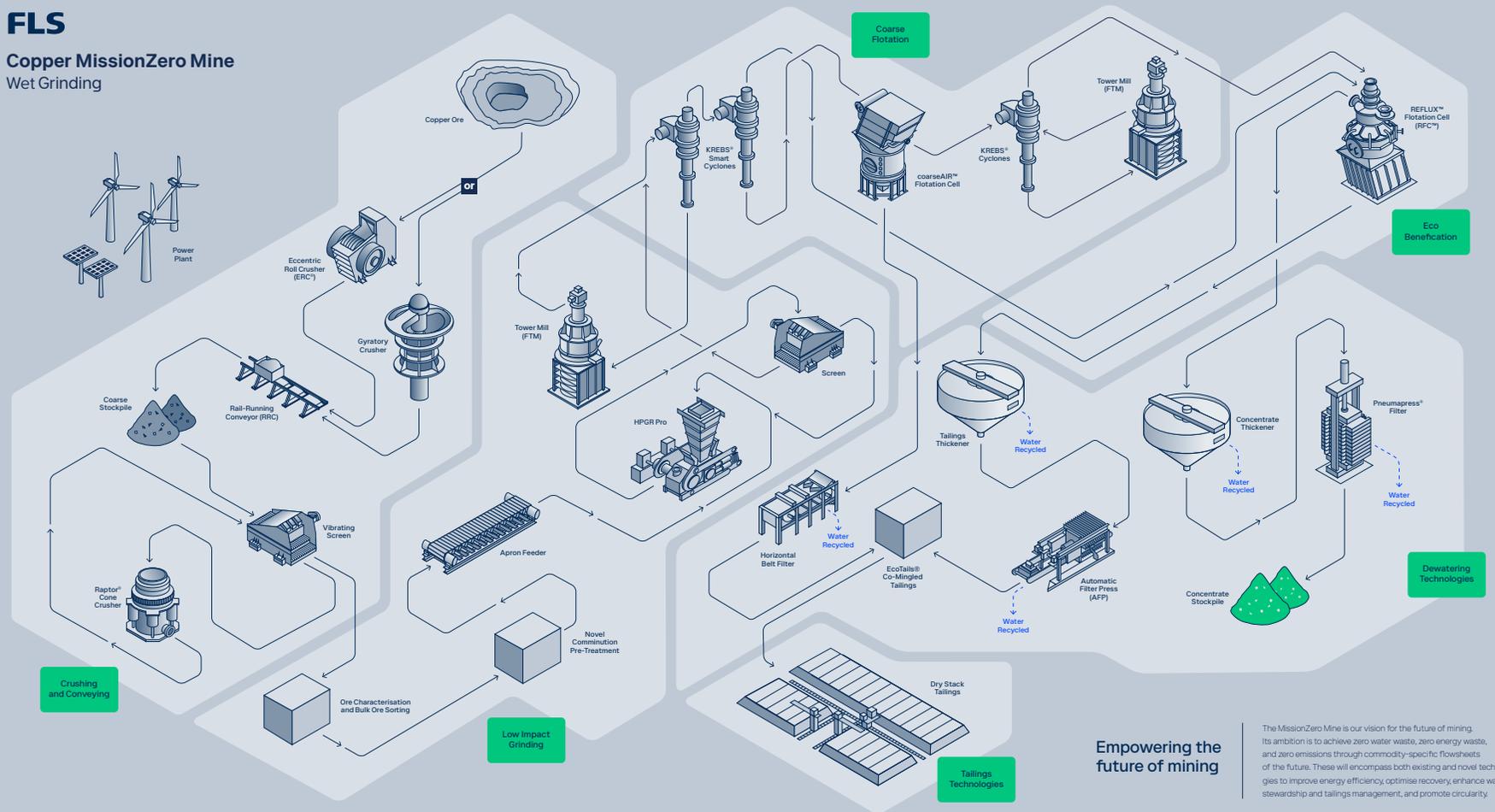
Figure 6e. Baseline simulation results: cyclone.

MissionZero Mine flowsheet 1: wet grinding

The first MissionZero Mine flowsheet to be simulated was a wet grinding process (Figure 7). The most efficient flowsheet comprised a Rail-Running Conveyor, with ERC-HPGR Pro-FTM grinding circuit, and coarseAIR Coarse Particle Flotation and RFC. This flowsheet demonstrated potential total energy savings of 40% against the baseline (Figure 8).

FLS

Copper MissionZero Mine
Wet Grinding



Empowering the future of mining

The MissionZero Mine is our vision for the future of mining. Its ambition is to achieve zero water waste, zero energy waste, and zero emissions through commodity-specific flowsheets of the future. These will encompass both existing and novel technologies to improve energy efficiency, optimise recovery, enhance water stewardship and tailings management, and promote circularity.

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Figure 7. MissionZero Mine copper wet grinding flowsheet.

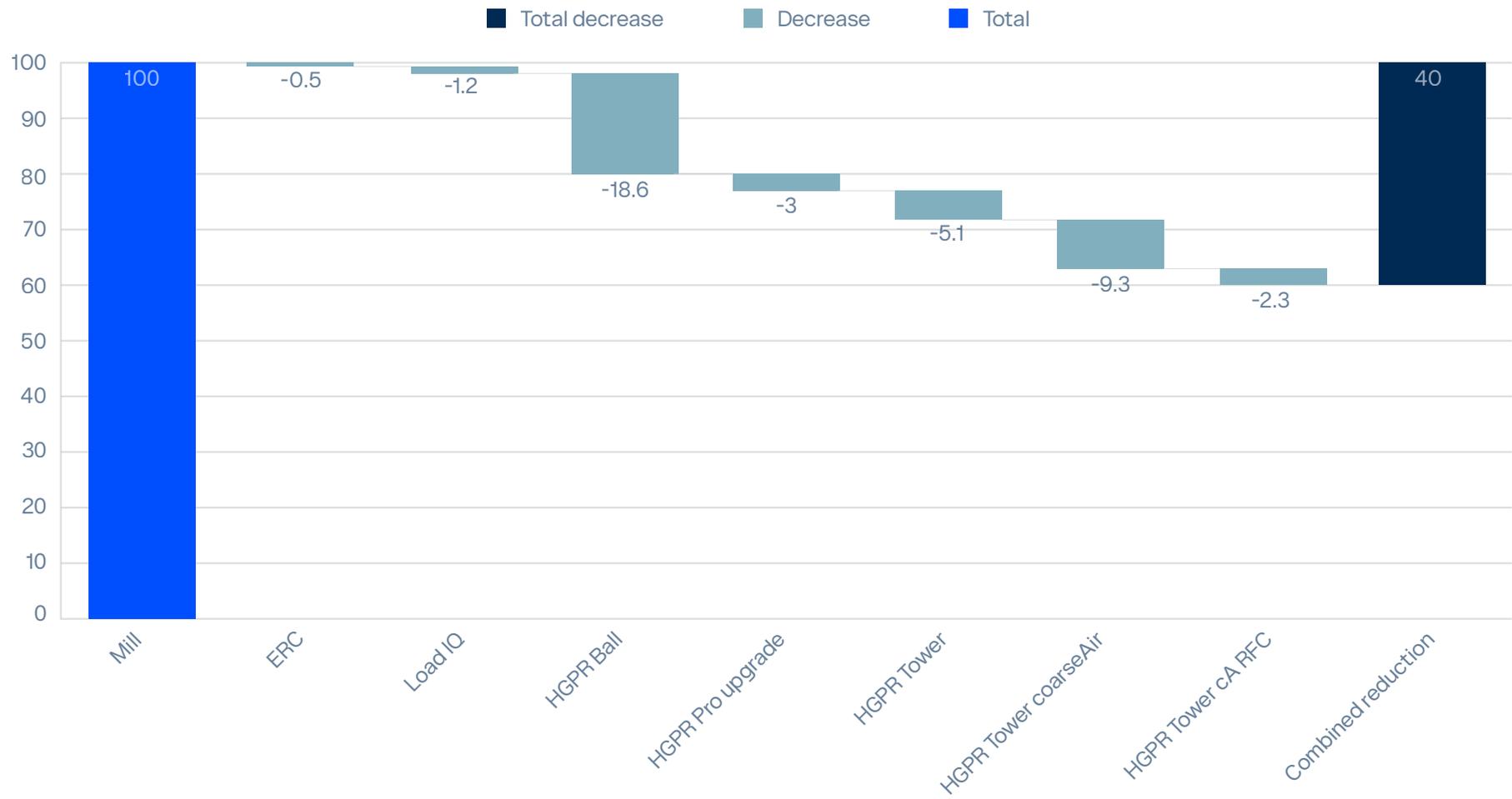
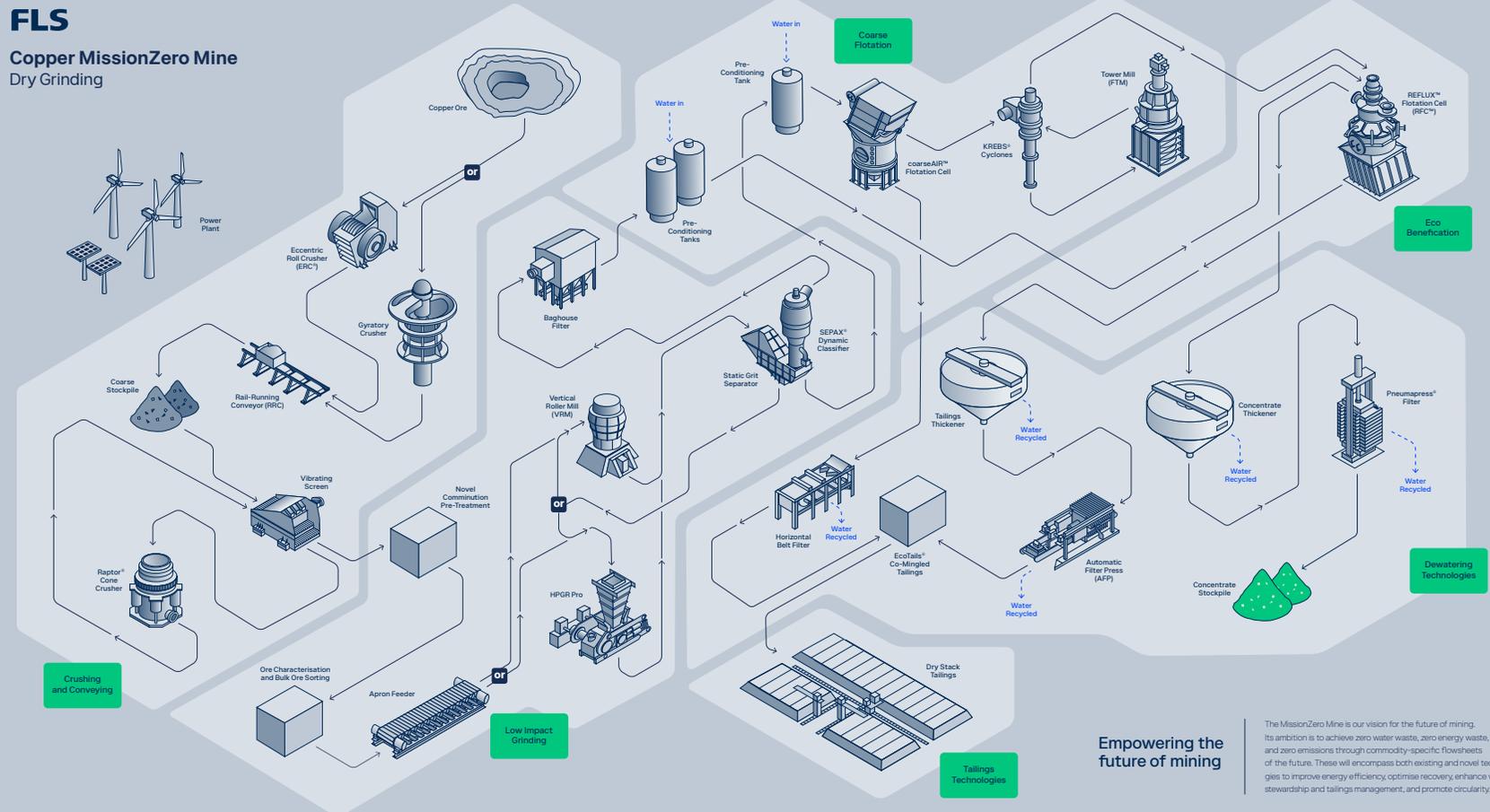


Figure 8. Potential energy improvements available in the MissionZero Mine wet grinding flowsheet.

MissionZero Mine flowsheet 2: dry grinding

Most of the comminution processes in the mining industry are wet. However, there are several successful dry grinding examples in various mining and industrial mineral applications. Many of these examples are based on ball milling. More advanced dry grinding technologies, VRMs and HPGR, are state of the art in some industries. Both technologies show a higher energy efficiency than ball mill systems (Burchardt, 2016; Burchardt and Brandhoff, 2014).

With this background, the second MissionZero Mine flowsheet to be simulated was a dry grinding process (Figure 9). The most efficient dry grinding flowsheet uses an ERC-VRM/HPGR Pro-FTM comminution circuit with coarseAIR Coarse Particle Flotation and RFC. This flowsheet demonstrated potential total energy savings of 60% against the baseline (Figure 10). Further advantages can be expected from introducing dry beneficiation solutions to replace flotation processes.



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Figure 9. MissionZero Mine copper dry grinding flowsheet.

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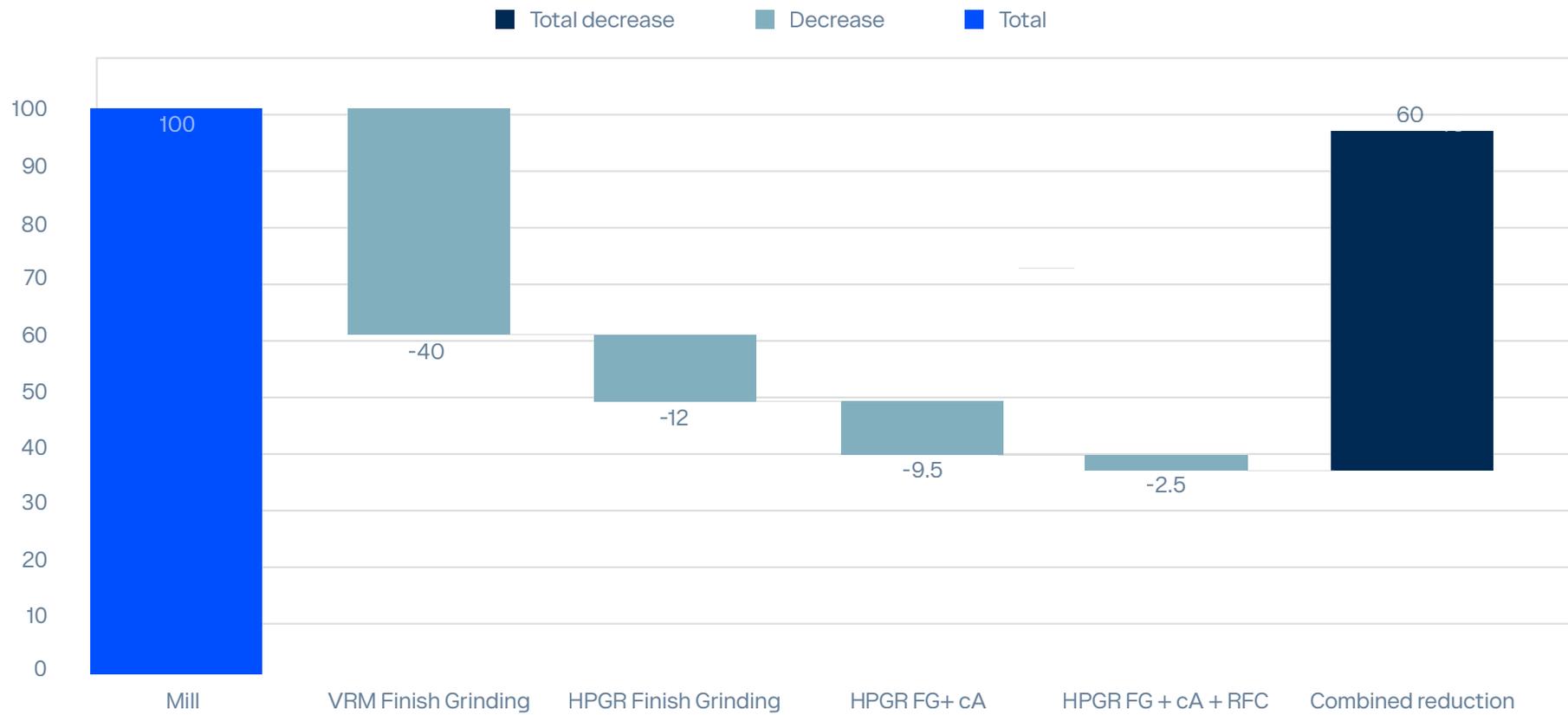


Figure 10. Potential energy improvements available in the MissionZero Mine dry grinding flowsheet.

Description of equipment included in MissionZero Mine flowsheets

Rail-Running Conveyor

The Rail-Running Conveyor (RRC) was developed in partnership with the University of Newcastle, Australia, and launched in 2020. It combines proven technologies to deliver greater efficiency and route adaptability than traditional conveyors. Its high curvability makes it an attractive replacement for truck-based haulage in surface mining operations. Indeed, as a viable replacement for truck haulage, the RRC can enable significant GHG reductions (FLSmidth, 2020).

The RRC wheel-on-rail transport mode delivers 30% to 80% lower operating energy consumption than conventional conveyors for typical applications. The result is a 20% to 90% reduction in carbon footprint (inc. embodied carbon). This is thanks to its efficiency, with calculated losses less than half of those published for other wheel-on-rail haulage modes, including heavy-haul rail and friction-drive light rail (Dugdale and Wheeler, 2021).

These energy savings are significant even in the context of a mine's total process energy. The baseline 60,000 tpd surface mine consumes about 28,700kW in the processing circuit (Table 3). Implementing a 5km RRC instead of conventional trough conveyors for haulage from the pit to the process plant would save about 1000kW (3.4%) for a relatively modest haulage

tonnage of 3000 tph (Dugdale and Wheeler, 2021).

In this case, the RRC reduces losses by about 0.065 kWh per ton-km compared to an FLS high-efficiency trough conveyor. However, many modern copper mines require higher tonnages and longer haulage distances, resulting in much higher savings of 3000kW to 4000kW when selecting the RRC. Indeed, studies have shown power savings over conventional conveyors in high-tonnage haulages over tens of kilometres to be in the order of total energy consumed in the comminution circuit (Dugdale and Wheeler, 2021).

The RRC also lowers embodied energy inputs required in manufacturing/construction compared to traditional conveyors in the following ways (Dugdale and Wheeler, 2021):

- Lower drive requirements reduce the amount of copper, semiconductors, and aluminium needed for construction and rubber and steel for belts and belt replacements.
- 30% to 90% lower belt tensions allow tighter vertical and horizontal curves, reducing the need for earthworks and civil construction.
- Reduced forces on structures and foundations lower the steel needed in drive stations/ elevated sections and the amount of concrete/ steel in foundations.



Eccentric Roll Crusher

The ERC is designed to offer improved efficiency, energy consumption, and flexibility in hard rock crushing applications. Its compact, simple, and robust design is 20% to 50% smaller than other primary crushing technologies, helping reduce CAPEX by up to 10%. Thanks to an integrated grizzly screen, throughput capacity is up to 20% higher than a gyratory/jaw crusher with a separate grizzly at the same product size.

The ERC's specific power consumption is 0.08-0.2kWh/t (40%) lower than that of a gyratory/jaw crusher in the same application

(Szczelina, P., Koch, T., and Papajewski, N., 2021). It also offers a higher reduction ratio (1:10) and a wider CSS range (50-300mm). A fully automatic gap adjustment system compensates for wear, ensuring optimum crushing performance is maintained throughout the liner's lifetime. It also automatically releases tramp metals to avoid excessive wear and premature liner replacement.

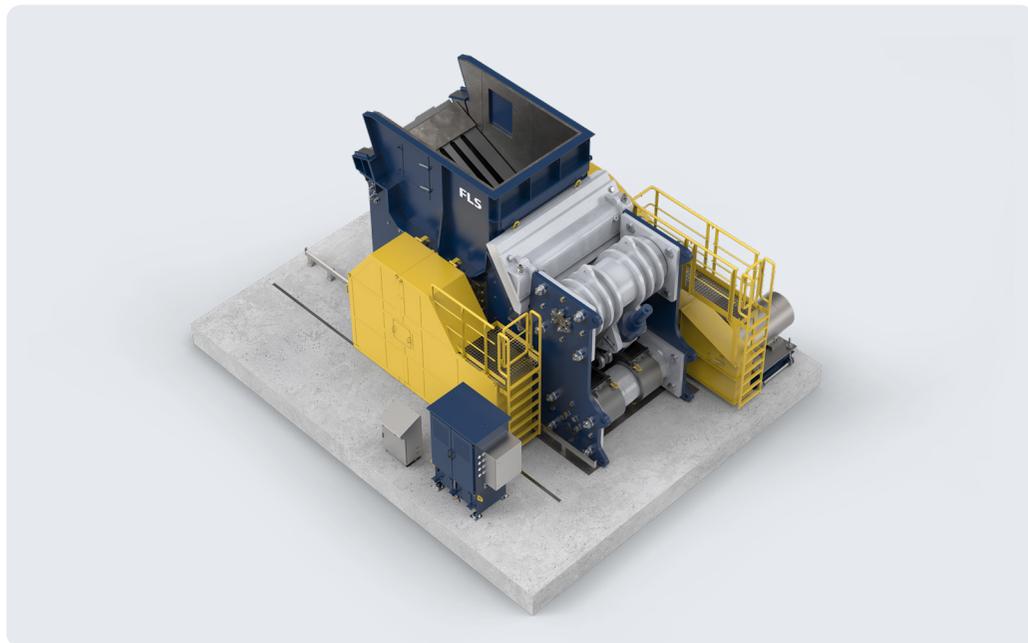
Due to its unique crusher chamber design and operation modes, the ERC can create more fines than other primary crushing solutions.

LoadIQ™ mill load optimisation

Smart mill load technologies, such as the LoadIQ™ system, use smart sensors to measure volumetric filling and ore trajectory in real-time. These readings are combined with ore type and liner profile data to determine the optimum mill load. Operating parameters are then adjusted automatically as operating conditions change. Typical throughput increases of up to 6% have been demonstrated.

By operating at optimum load, energy consumption is reduced while operating stability is increased. The system also prevents

overloading of the mill, reducing the risk of excessive liner wear or damage and extending wear life with a subsequent reduction in maintenance costs and downtime.



High-pressure grinding rolls

HPGR grinding technology has been used in the cement industry since the early 1980s, improving product quality and reducing energy and wear-part consumption. Tungsten carbide stud development enabled the use of HPGR in the mining industry to grind competent, low-grade medium to hard ores (Rodriguez, V.A., et al, 2024). HPGRs have a proven track record in reducing energy consumption for grinding by up to 25% in mining when processing hard, low-grade ores compared to SAG-ball mill circuits (SABC). FLS leads the HPGR market with more than 160 references worldwide. FLS has also developed the HPGR Pro upgrade, which extends the benefits of HPGR technology

in the mining industry. Side-by-side performance trials at a customer site showed up to a 15% reduction in specific power consumption and up to a 24% higher specific throughput compared to standard HPGR designs. With the HPGR Pro, the same throughput can be achieved at lower power draws and roll speed with an optimised pressure profile across the roll width due to rotating side plates (RSP) technology (Mackert et al., 2023). RSP technology reduces roll wear, increases roll life, and is expected to achieve up to 30% longer roll life at the same throughput. The lower power draw and motor speed will also likely extend motor component life.

Vertical roller mills (VRM)

VRMs have become the dominant grinding tool in the cement industry, supplanting multi-compartment ball mills and roller presses due to their ability to dry, grind, and separate the final product in one (vertical) mill body. This eliminates the need to transfer fine materials between other grinding units and the air separator.

Additionally, VRMs have proven highly energy efficient when compared to traditional ball milling circuits (by as much as 50%). This grinding efficiency makes VRM technology attractive to the mining industry as a lower-energy, dry-grinding alternative to traditional wet-grinding processes. Typical savings include

>20% lower energy consumption. Requirements for procuring, storing, and charging horizontal grinding mills with grinding media also often require a plant-within-the-plant to be built, operated, and maintained. Eliminating this reduces operating costs by ~50% while reducing downstream metal contamination and grinding media manufacturing emissions.

The VRM's air separators are highly efficient and can be configured to deliver a steeper product curve with reduced ultrafine particles, enhancing downstream flotation performance.



FLSmidth Tower Mill (FTM)

Featuring a central agitator screw as the only moving part in contact with the slurry and grinding media, the FTM reduces particle size by attrition. This lowers energy consumption for fine-grinding minerals by 25% to 50% compared to traditional horizontal ball mills for the same feed and product size (Source). The vertical

arrangement allows internal classification of the feed material, which keeps coarser particles within the grinding media while allowing fines to exit the mill. It also consumes 25% less grinding media while delivering optimum PSD.



Coarse particle flotation

Coarse particle flotation technologies, such as the coarseAIR™ system from FLSmidth, reduce the grinding required to liberate the ore completely. This delivers up to 30% lower energy consumption per tonne of throughput in the grinding circuit while increasing mill capacity by more than 25% (Smith et al., 2023). Coarser

particle size in tailings also improves water drainage, improving the safety and sustainability of tailings management (Johnson et al., 2022).



Faster flotation: the REFLUX Flotation Cell

The RFC is designed to accelerate flotation kinetics, thereby reducing energy consumption. Trials have demonstrated required residency times of just three to four minutes, compared to 31 minutes in conventional flotation plants, with a 1% to 3% increase in recovery possible at equal or slightly improved grade (EIT, 2024). Thus, the number of RFCs needed for any given

application is substantially lower than that of conventional flotation cells to achieve similar performance. Through extensive on-site testing over the past two years, RFC flotation has been shown to reduce energy consumption in copper circuits by 27% in the flotation section of the plant (Table 6, Figure 11) (EIT, 2024; FLSmidth, 2024).

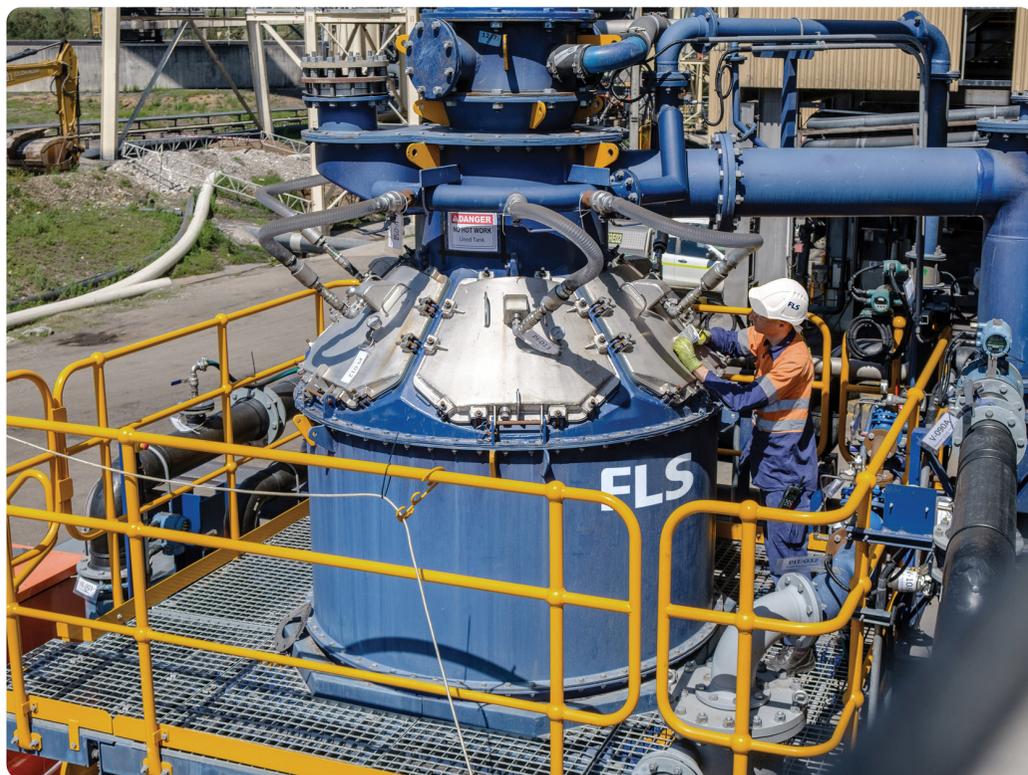


Table 6. Comparison of total energy consumption of RFC and conventional flotation technologies.

Parameters	RFC	Conventional flotation	% reduction with RFC
Size	2.35m dia. x 7m	48 m3	NA
Footprint (m2) of steel	109	325	66%
Quantity	3	7	57%
Air Requirement (m3/h)	937	2700	65%
Air Supply Power (kW)	75	150	50%
Flotation Direct Power (kW)	0	315	100%
Wash water Requirement (m3/h)	468	0	0%
Wash water Pump Power (kW)	76	0	0%
Pump Power (kW) (Feed & UF)	189	0	0%
Total Power	340	465	27%

Conclusion

The MissionZero Mine Programme offers a robust framework for mitigating the environmental impact of copper mining by integrating advanced mineral processing technologies. The preliminary desktop findings indicate that the proposed copper flowsheets, which incorporate FLS's latest grinding and flotation technologies, have the potential to significantly reduce energy consumption and hence greenhouse gas emissions.

The first flowsheet, featuring HPGR and the FTM, demonstrates a potential reduction in energy consumption of up to 30% compared to conventional SABC. The integration of coarseAir Coarse Particle Flotation and RFC technologies further enhances energy savings, achieving up to a 40% reduction for the entire flowsheet. It is important to note that these energy savings are specific to the hard ore used in this desktop study, and different Bond Work Index (BWi) values may yield different results.

The second flowsheet explores dry grinding, achieving even greater energy reductions. This approach lowers energy consumption by up to 52% compared to conventional SABC, with

additional savings of up to 60% when coarseAir Coarse Particle Flotation and RFC technologies are included. Again, these findings are particular to the specific hard ore used in the study, and results may vary with different BWi values and equipment selection may be different.

These results are derived from FLS Cycad simulations, internal data, and published research, validated through a comprehensive desktop study, and highlight the effectiveness of advanced technologies in minimising copper mining's environmental impact. FLS's forthcoming in-depth test work and engineering programme at the FLS Materials Testing and Research Centre will further substantiate these findings and refine the proposed flowsheets for optimal energy equipment selection for hard copper ores with a Bond Work Index (BWi) of 24.0 kWh/t.

FLS has identified the HPGR-FTM as a near-term efficient method for reducing energy use in copper concentrate production for hard ores. However, its efficiency depends on the ore type and PSD required for liberation, making it essential to evaluate ore characteristics when

selecting an optimal processing flowsheet. SABC and HPGR-ball circuits can also be effective for specific ores, alongside mechanical flotation cells, depending on the specific mineralogy and liberation size of the mine site being evaluated. The longer-term energy strategy involves developing dry grinding and separation flowsheets that work effectively and in tandem with downstream processing. Technologies such as HPGR finish grinding, VRM dry grinding, and dry classification circuits are being evaluated at pilot scale to determine their true potential to reduce energy in copper concentrate production while maintaining productivity and cost-effectiveness across the entire copper concentrate flowsheet.

Ongoing research is aimed at validating the discussed flowsheets at pilot scale and developing engineering studies to enable the new flowsheets to be widely adopted to empower the future of mining.

The study underscores the critical role collaboration has in implementing new technologies into a conservative market. For significant progress to be made in energy

reduction in copper concentrate production, the industry needs copper mines, research institutions, universities, OEMs such as FLS, and government bodies to work together to implement these innovative technologies. The Copper Mark certification programme shows such collaboration is possible. By leveraging such existing efforts and sustainable practices, the mining industry can achieve substantial improvements in environmental performance and contribute meaningfully to global climate change mitigation efforts.

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