
Groundbreaking

The latest from Liebherr Mining

1 | 2023

LIEBHERR





Dear readers

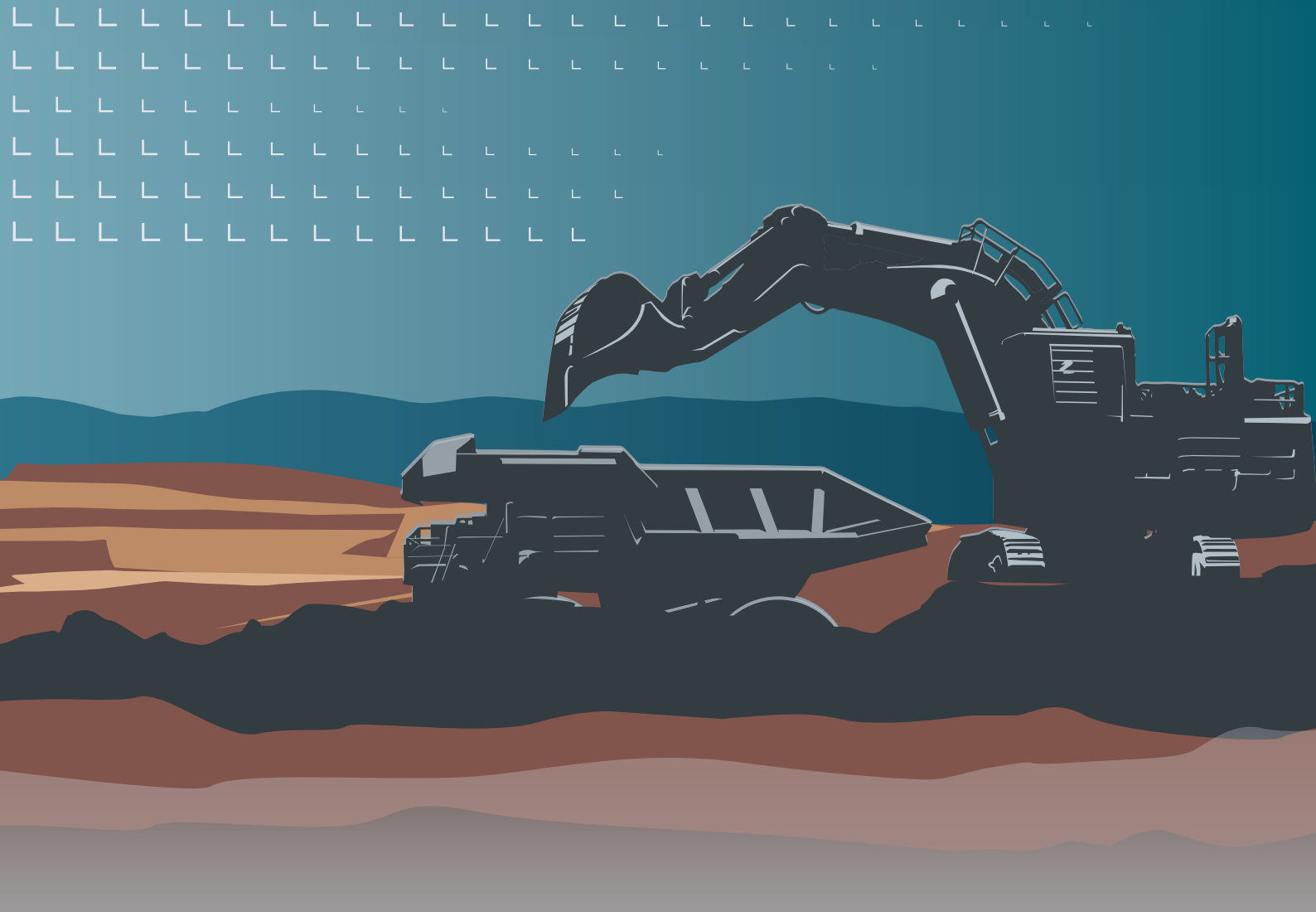
Welcome to the very first edition of *Groundbreaking*, Liebherr Mining's new magazine!

The idea to create this magazine came from a desire to find new and better ways of communicating with customers, employees, and everyone interested in the world of Liebherr Mining. Each year, Liebherr Mining undertakes important work both with and for our customers and our industry. This magazine celebrates the successes that come from this work and the people that made them possible.

In this magazine you will discover stories about the hardworking individuals of Liebherr Mining who work in many different roles. And along the way you will learn a bit more about our amazing products.

We hope you dig this magazine and look forward to sharing more exciting news with you in the future.

Until next time!



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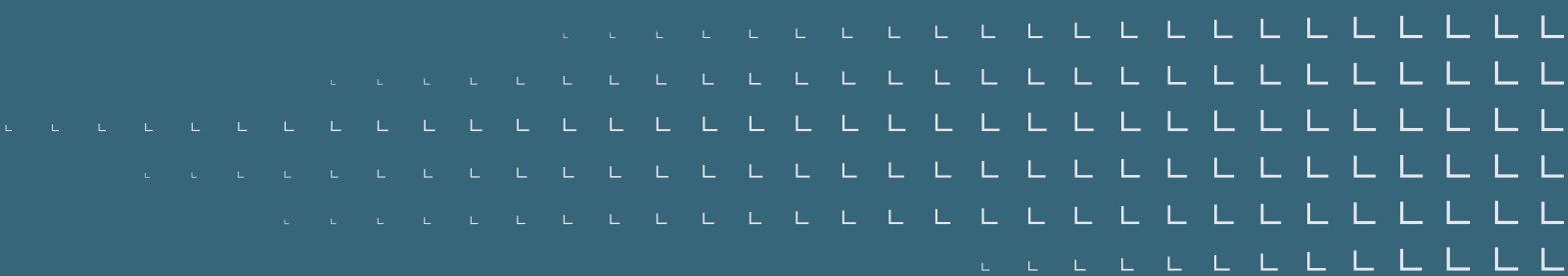
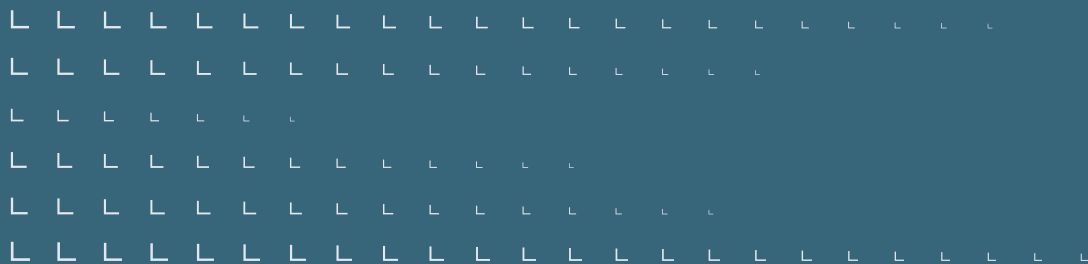
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The latest scoop

Key updates from Liebherr Mining



A transformative time in mining

Interview with the Liebherr Mining Board of Management

The global mining industry is navigating its way through a period of rapid transformation. Growing demand for digitalisation within the sector as well as the challenges of operating in an increasingly environmentally conscious world means that key industry operators have needed to take swift action to adapt and respond to the shifting landscape.



From left to right: Dr. Jörg Lukowski, Francis Maechling, Oliver Weiss, and Michael Arndt.

We spoke with the Liebherr Mining Board of Management to discuss how they are working towards delivering the solutions of tomorrow to our customers today, through current and upcoming product and service offerings.

Dr. Jörg Lukowski – Sales & Marketing
Mr. Michael Arndt – Customer Service & Quality
Mr. Francis Maechling – Finance & Administration
Mr. Oliver Weiss – R&D, Engineering, & Manufacturing

It has been an interesting few years for the mining industry. What are some of the main challenges facing the industry as a result?

Jörg: As an industry, mining faces a number of challenges today, with more to come over the next few years. However, the industry as a whole has shown incredible resilience in being able to manage the excitement of the last two years, with an international pandemic, increased energy costs, and supply chain constraints. Healthy commodity prices and good financial results over the last two years has left the industry in good shape to meet these challenges and those expected to emerge.

One of the biggest challenges for the mining sector at the moment – due to significant industry growth and restructured supply chains – is meeting the ESG (environmental, social, and governance) expectations of stakeholders, investors, and communities linked to mining activities. It is becoming increasingly common for investors to base their financial decisions on a company's ESG activities. As a leading original equipment manufacturer (OEM) in mining, Liebherr must bear these challenges in mind when developing solutions for customers and partners. With mine owners and operators under increased pressure to offer low and zero emission options to meet ESG expectations, Liebherr must continue to offer high-quality and effective products to meet these expectations.

As the world moves towards a zero emission future, meeting ESG demands will become increasingly important. Building the infrastructure for a zero emission future – such as wind turbines, solar panels, and electric vehicles – will require accelerated mining of critical minerals. However, customers and investors place enormous importance on mining operations being environmentally responsible and socially conscious. As such, Liebherr's ability to offer mining machinery that reduces a customer's carbon footprint will become more and more critical in years to come.

Have these challenges changed the priorities of the mining industry?

Jörg: Recent challenges in the industry have not so much changed the priorities of mining but highlighted areas that have been growing in importance for many years. Improving ESG and zero emission technology on site has long been a priority in the industry. However, with increasing awareness of the dangers of climate change, demand for ESG and zero emission solutions has increased dramatically. This is why Liebherr launched its Zero Emission Mining Program. It is important to us that we support our customers as they adjust to the changing demands of their own customers, as well as those of mining communities and stakeholders. Particularly as mining companies are facing greater scrutiny on their Scope 1, 2, and 3 greenhouse gas (GHG) emissions. As an OEM, Liebherr plays a vital role in helping our customers reduce their Scope 1 emissions by offering low and zero emission machinery. However, Liebherr also has an influence on customers' Scope 3 emissions. When a customer purchases one of our machines, we become part of their supply chain. As such, any emissions we generate during the manufacturing of our machines therefore become part of the customer's upstream Scope 3 emissions. In reducing our own Scope 1 and 2 emissions, we can help customers to meet their Scope 3 emissions targets.

The market's focus on autonomy, digitalisation, and low and zero emission solutions is not new but events over the past few years – such as the COVID-19 pandemic and an increase in natural disasters exacerbated by climate change – have emphasised their importance. We are proud to have released solutions in these areas over the past few years, including our Autonomy and Autonomy Ready Kits and our Trolley Assist System. We believe our achievements in these areas demonstrate that Liebherr is more than qualified to provide innovative solutions to help our customers meet their current and future needs.

“It was because of our hardworking and dedicated workforce that Liebherr Mining was not only able to overcome the challenges of the past two years, but also to experience impressive financial success during this time.”

You mentioned that the market is currently focused on autonomy and autonomous solutions. Can you elaborate further on Liebherr's product offerings in this space?

Oliver: Liebherr Mining offers scalable solutions that can meet the needs of most, if not all, of our customers.

Liebherr's first fully autonomous truck is scheduled to be deployed in Australia in 2023. This project represents the final stage of validation for our Autonomy Ready, Autonomy Kit, and Complete Autonomous Haulage Solution product offerings.

We also have a number of semi-autonomous solutions. Our Bucket Filling Assistant for excavators has been deployed in several machines in different applications with significant results. Further, our newly launched semi-autonomous Assistance Systems for mining trucks – the Trolley Guidance and Crusher Guidance Systems – were validated last year with promising results. These systems also won the 2022 Mining Magazine Award in the Fleet and Equipment category.

All of our autonomous solutions, whether semi- or fully autonomous, aim to improve operator safety on site, increase productivity and efficiency, and decrease operational costs.

The past two years have been quite a volatile time for the international community. How has Liebherr Mining weathered the uncertainties that arose during this time?

Francis: Despite international challenges such as global inflation rates, international energy crises, and the war in Ukraine, Liebherr's mining product segment has performed quite strongly, continuing Liebherr Mining's history of strong financial results. In 2022, Liebherr Mining achieved a turnover of €894 million – an 8.2% increase on 2021 numbers. These results are reflective of our strength as a diversified company. Although we experienced moderate declines in Asia and Oceania, Liebherr Mining saw increased turnover and business growth in the Middle East, Africa, and the Americas.

At Liebherr Mining, we are always acutely aware that our workforce plays a crucial role in our success. This continued to be the case in 2022, despite skill shortages around the world meaning that there were sometimes struggles when looking for candidates with the right skillsets. However, Liebherr Mining – and the Liebherr Group as a whole – takes great pride in being an attractive employer for prospective employees. We offer candidates the chance to work with cutting-edge technology and equipment in a stable environment that promotes diversity and personal autonomy. Providing this environment to employees means that we can attract the best people in each and every role, resulting in the best products and services for our customers.



“We strive to maintain relationships with our customers long after their initial purchase of our products.”

It was because of our hardworking and dedicated workforce that Liebherr Mining was not only able to overcome the challenges of the past two years, but also to experience impressive financial success during this time.

With such a hardworking workforce it is no surprise that Liebherr products have a reputation for exceptional quality within the mining industry! But what processes do your staff follow to ensure the quality of Liebherr’s equipment around the world?

Michael: We have processes in place both during and after the manufacturing of our equipment to make sure that we are providing our customers with the highest quality products we can. Our product assembly processes within our factories, remanufacturing facilities, and after-market service locations all involve quality assurance checks that must be passed in order for our products to move to the next stage of manufacturing. Once products are complete and are delivered to our customers, we then have detailed quality control procedures in place so that, if any issues arise during the operation of our products, we are able to fix the issues on site as quickly and as comprehensively as we can.

Liebherr Mining’s Service Excellence Program also helps us to ensure that customers receive the same levels of service

and product quality at all of our facilities around the world. The Program’s regular assessments, audits, and inspections check that all processes and procedures are being followed in the same way and at the same high level, in all Liebherr Mining locations. The Service Excellence status of our facilities is routinely reassessed to ensure that we always maintain our high standards in all that we do. Our customers expect the best from us, and we do everything in our power to ensure that that is exactly what they get.

That all sounds very impressive! However, Liebherr Mining has a hugely diverse and extensive customer base. How do you ensure your customers receive the support they need?

Michael: Our customer support services are a crucial element of Liebherr Mining, as we strive to maintain relationships with our customers long after their initial purchase of our products. Our Digital Services portfolio is a big part of this. Our Troubleshoot Advisor and our Content Delivery Portal both allow us to deliver expert advice and technical information to our customers on demand. The Troubleshoot Advisor gives customers’ onsite technicians access to detailed instructions for troubleshooting common technical issues. The guides from the Troubleshoot Advisor can be accessed through the Content Delivery Portal, which houses all of Liebherr Mining’s technical documentation.

To further help our customers, we are also developing a Remote Service that will provide customers with expert advice from our experienced technicians in real time. This service will maximise the uptime of Liebherr mining machines in operation and ensure that respective sites are as productive as possible.

Let's pivot now to discuss zero emission mining practices. How is Liebherr Mining supporting its customers' transition to alternative drives in the short term?

Oliver: Our Zero Emission Mining Program is designed to support our customers as they embark on a transition to alternative power sources for their equipment. In 2022 we achieved the Program's first target of having low emission options for all of our mining trucks and excavators. Now, we are following our roadmap to meet our second goal of offering fossil fuel free solutions for digging, hauling, and dozing by 2030.

We have already achieved quite a few milestones in our alternative drive offerings. Our international fleet of electric excavators is continuously growing and we have sold machines on all continents. These achievements were made possible through a combination of Liebherr's decades of experience in designing and manufacturing both electric- and diesel-drive excavators, the quality of our machines, and the support provided to customers by our application specialists. This combination of expertise, high-quality products, and excellent support services has also led to significant growth in our order book for electric excavators for the next two years.

All of our mining trucks are compatible with our Trolley Assist System, providing customers with a low or zero emission solution for their sites, depending on their choice of electricity source. Liebherr actually holds two world records related to trolley solutions: the largest ultra-class truck fleet on one mine site under trolley and the longest trolley line in the world.

For customers who still rely on diesel engines, the Liebherr Power Efficiency System can help to significantly improve the fuel efficiency of their fleet. This means that customers burn less fuel while accomplishing the same amount of work, which in turn reduces their carbon footprints.

How does Liebherr Mining plan to meet its target of offering fossil fuel free solutions by 2030?

Oliver: Reducing GHG emissions is one of Liebherr Mining's primary goals. We have dedicated R&D teams in each of our factories working to develop the most effective zero emission technology for each of our product lines. As our range of low and zero emission technologies has expanded,

we have taken on more employees with specialised knowledge to ensure that our solutions are working as intended. It is also important to us that we leverage the expertise of different product segments within Liebherr. The Liebherr Group has existing in-house core competencies – across all 13 product segments – in electrification, batteries, internal combustion engines, injection systems, and alternative renewable fuels.

Our strategic partnerships are also crucial and allow us to evaluate various well-to-wheel energy approaches. Working with hydrogen expert ENGIE is helping us to understand all relevant aspects and advantages of green hydrogen and hydrogen-derived fuels. We are also working with multiple partners on electric trolley support for mining trucks as a pathway to decarbonising mining. And in 2022 we announced our partnership with Fortescue Metals Group which will result in the integration of fuel cell and battery technologies into our T 264 trucks. These innovative trucks will, after development and field testing, be made available to other customers so that they too can achieve their emission reduction targets.

Which drivetrain technologies have you identified for zero emission solutions in the long term?

Oliver: In 2022, we completed a feasibility study that took into account four potential powertrain types that represent all relevant fossil fuel free technologies for heavy mobile equipment. These included battery electric trucks with a Trolley Assist option, hydrogen fuel cell battery trucks, ammonia combustion engine trucks with electric drive, and methanol combustion engine trucks with electric drive. Simulations for each option were conducted to ensure that they would all function in a range of locations and haul profiles. The results from the study enabled us to fine-tune and confirm our long-term zero emission strategy.

Liebherr Mining is striving to become a full solutions provider to our customers. As such, as well as drivetrain technologies, we are also investigating strategies for stationary and dynamic charging and expanding our knowledge about how alternative fuel sources could work for our machines.

To help ease the transition for our customers, our design philosophy for these drivetrain technologies focuses on offering modular solutions so that customers can retrofit them into recently purchased machines, rather than needing to purchase entirely new equipment when the technology becomes available in the next few years.

Working towards a more sustainable future

Over the past few years, the decarbonisation of mining activities has become a primary focus for the entire mining industry. In fact, the most recent mining outlook reports have stated that concerns about the environmental and social impacts of mining have eclipsed commodity prices as the sector's primary concern. This change reflects the current attitudes of the international community. In 2015, 196 countries adopted the Paris Agreement at COP 21. The Paris Agreement is a legally binding treaty focused on climate change and the reduction of greenhouse gas (GHG) emissions. The main objective of the Paris Agreement is to cap global warming at less than 2 °C (3.6 °F), with 1.5 °C (2.7 °F) the ultimate target. Achieving this goal will require the global cooperation of both the public and private sectors.



Liebherr takes its environmental responsibilities incredibly seriously and considers contributing to the decarbonisation of the mining industry as one of its obligations as an original equipment manufacturer (OEM).

“Liebherr Mining has already embarked on our path towards decarbonisation so that we can hand over a world with a future to our children. As an OEM, we have all required competencies and it is our responsibility to push, drive, and realise decarbonisation,” said Oliver Weiss, Executive Vice President of R&D, Engineering, and Manufacturing for Liebherr Mining.

To support these efforts, Liebherr announced its Zero Emission Mining Program at MINExpo 2021, pledging to offer low GHG emission solutions for all trucks and excavators by 2022 and fossil fuel free solutions for most applications by 2030.

Liebherr is exploring many different pathways to meet its zero emission targets. These pathways include conducting investigations into future zero emission technologies, updating its equipment offerings, and partnering with major players in the industry to develop zero emission solutions for the wider mining industry. Liebherr would like to share its projects and achievements in the zero emission space with customers to demonstrate its dedication to decarbonising the mining industry.

Agnostic and upgradable: The Liebherr Mining approach

To ensure the success and longevity of Liebherr’s zero emission plans, the company conducted a feasibility study to investigate the viability of a variety of zero emission technologies that could be used as complements to its mining equipment. The study, which was finalised in early 2022, examined four drivetrain technologies that represent potential relevant technologies for large mining machines: battery electrification, including trolley solutions and the ability to undertake stationary or dynamic charging; ammonia internal combustion engines; methanol internal combustion engines; and fuel cell electrification, utilising a hydrogen fuel cell/battery hybrid in a truck running on a trolley line or using dynamic charging.

The feasibility study ran simulations of these four drivetrain technologies in a number of different scenarios, including how each would work in different locations and in a range of haul profiles. Predictions for 2030 were also used in these simulations – including forecasts of alternative fuel prices provided by alternative fuel expert ENGIE – to determine the workability of the proposed technologies and their associated costs.

“Thanks to the Liebherr Zero Emission Mining feasibility study we were able to define a clear and strong zero emission strategy and roadmap,” said Dr.-Ing. Isabelle Ays, Head of Zero Emissions for Liebherr Mining. “We were able to define all zero emission projects which, if implemented, will lead us to certain success.”



A closer look at COP

The COP, or the Conference of Parties, is the predominant decision-making body of the United Nations Framework Convention on Climate Change, commonly referred to as the “Convention”. The primary goal of the Convention is to prevent perilous human influence and interference with the climate.

Since the Convention came into force in 1994, it has been ratified by 198 countries. These 198 countries are referred to as Parties to the Convention and each one is represented at each COP meeting. During these meetings, the COP reviews the impacts of actions taken by each Party in their efforts to meet the Convention’s primary goal and evaluate how much progress is being made. It is from these meetings that well-known international climate action treaties, such as the Kyoto Protocol of COP 3 and the Paris Agreement of COP 21, are adopted.

COP meetings take place annually, unless circumstances lead the Parties to decide otherwise. For example, COP 26 was originally due to take place in 2020, but due to the COVID-19 pandemic, it was postponed until 2021.

The next COP, COP 28, is to be held from late November to early December 2023 in the United Arab Emirates.



The results of this study, coupled with Liebherr's understanding of its customers and the wider mining industry, have paved the way for the beginning of a number of different zero emission mining projects within Liebherr and many of these are well underway. Each of these projects will help Liebherr to meet its target of offering zero emission mining equipment by 2030.

Tools of the trade

In recent years, Liebherr has provided updates for its range of digging, loading, and hauling products so that these machines can help customers to meet the low and zero emission technology requirements of today, while also being prepared for the zero emission technologies of the future.

Lining up for trolley power

Liebherr has offered trolley solutions for its range of mining trucks since 2016 through its Trolley Assist System. This system allows customers to power diesel-electric trucks by connecting them to overhead electric powerlines.

"We have recognised that, in the future, electricity will continue to be the cheapest alternative to today's diesel. For this reason, every mine should try to use as much electricity as possible," said Ays. "Dynamic charging with trolley overhead lines offers an optimal way to use electricity without interrupting the mining process.

Also, future Liebherr trucks with zero emission drives will have this Trolley Assist option so that our customers can keep their energy costs as low as possible."

Trolley solutions are usually installed on the up-grade section of a haul route as this is when the most energy is consumed by the machines. When trucks are operating under the Trolley Assist System, they can achieve higher speed on grade and faster acceleration which can in turn lead to increased productivity, decreased energy costs per tonne, and a reduced carbon footprint of the mine.

Today, Liebherr's global fleet of trucks that operate on the Trolley Assist System exceeds 50 machines spread across Panama, Zambia, and Austria, with further units to be commissioned for a new site in South America in 2023. Customers prefer Liebherr's mining trucks for trolley solutions because of the company's semi-autonomous Assistance System offerings for these machines. The range consists of the Crusher Guidance System, which helps operators to reverse safely into crushers; and the Trolley Guidance System, which helps trucks to connect and disconnect from the trolley line while also helping the truck to maintain a consistent travel path.

30 years of E-xperience with electric excavators

Liebherr has offered electric-drive excavators to its customers for over 30 years. Over that time, Liebherr has been able to develop electric digging solutions that can significantly reduce a customer's GHG emissions.

"We develop our mining machines in a modular way so that we can constantly upgrade or retrofit them with alternative drives. Our excavators are no exception to this philosophy. In Australia, for example, we retrofitted an R 9400 diesel excavator produced in 2010 with an electric drivetrain, turning it into an R 9400 E," explained Weiss.

The rate of GHG emissions reduction that customers receive from using an electric-drive excavator on site will differ depending on the characteristics of the mine site where it is being used. However, if customers are able to power their sites with electricity from renewable sources, these excavators become a zero emission solution for their mine.

As electric excavators must be connected to their power source throughout operation, ensuring the mobility of these machines was a priority for Liebherr. Thus, Liebherr leveraged its decades of experience to develop the cable reeler system for its entire range of mining excavators. The cable reeler can be integrated into the undercarriage of an excavator to provide up to 300 metres of autonomous cable reeling without reducing the machine's ground clearance. This solution helps operators to manage the excavator's cable while the machine is in operation, which not only improves the mobility of the machine but increases the safety of those working alongside it.

The powerhouse of mining

Liebherr's D98 engine series is designed specifically for mining applications. With its modular design, this engine can be used in equipment produced by Liebherr and by other OEMs. When designing these engines, Liebherr took advantage of every opportunity to reduce GHG emissions. One such opportunity was including selective catalytic reduction (SCR) in the design of the D98 engine to comply with the latest emission regulations. SCR is an active emissions control system that reduces the nitrogen oxides (NOx) produced by the engine to near zero. A chemical reaction within the system converts NOx to nitrogen, water, and minute amounts of carbon dioxide (CO₂) before running the transformed gases through a particulate filter and emitting them from the exhaust pipe.

Despite being originally designed as a diesel engine, the D98 series can also work with certain alternative fuels. Due to the engine's larger volume displacement, the D98 series can use synthetic renewable fuels such as hydrotreated vegetable oil and up to 10% biodiesel. The D98 series is also being used as the basis for developing internal combustion engines that can operate using other kinds of alternative fuels, with multiple factories from within the Liebherr Group participating in different projects.

At the Bauma 2022 exhibition, Liebherr demonstrated its expertise in hydrogen engines by winning the Bauma Innovation Award in the climate protection category for its first hydrogen-powered excavator, powered by Liebherr's H966 hydrogen engine. Liebherr began developing hydrogen combustion engines in 2019 and now, following the H966 engine's success at Bauma, Liebherr is further exploring the capabilities of these engines with ammonia. Testing this fuel source in an internal combustion engine is expected in early 2023.



Partners in success

Liebherr has also entered strategic partnerships with customers and industry experts alike to explore options for the development of zero emission solutions that can be offered to customers in the future.

Fortescue Metals Group

Liebherr's partnership with Fortescue Metals Group (FMG) was announced in June 2022. The collaboration between these two companies will focus on the delivery of zero emission mining trucks to the wider mining industry. Liebherr will work closely with two FMG businesses – Fortescue Future Industries and WAE – to install battery technology into the T 264 mining truck.

“This project provides us with an excellent opportunity to accelerate the integration of alternative drive systems into our mining equipment, supporting our vision and strategy to offer zero emission machines with the most suitable drive technologies in the future. Along the way, we will support our customers in choosing technology options from our wide range of products that are most suitable to them,” said Weiss.

The process of integrating these zero emission technologies into the T 264 will take approximately two years, with supply of these fossil fuel free machines commencing once the development phase had concluded.

Trolley solutions

Over the past few years, Liebherr has partnered with a number of trolley service and infrastructure suppliers to be able to offer customers the best possible trolley solutions for their specific site requirements. Working with a variety of suppliers has helped Liebherr to provide customers with the best performance option for their sites at the lowest cost. The first trolley system defined through the collaboration between customer, Liebherr Mining, and trolley service and infrastructure suppliers will be deployed in 2024 to a customer in South America.

“Liebherr has, and will continue to build up, know-how for dynamic and stationary charging. Our application engineers use specific simulation software to identify the optimal trolley system design for each customer. All elements – such as potential locations to place trolley line hardware, length of lines, ramp design, and other important elements – will be looked at to optimise cost, maximise production, and minimise total emissions. This information results in clear recommendations for the best trolley system, based customers' mine layouts,” said Weiss.

Weiss is also aware of the challenges that customers can face when including zero emission technologies in their mining practices.

“Zero emission technology is new to our customers and can require some adjustments on their part. But if this technology is used correctly, emissions will be reduced while optimising both energy consumption and total cost of ownership,” said Weiss.



Meeting Paris objectives

The Paris Agreement of 2015 was the first time that Parties to the Convention agreed to take ambitious steps to both combat climate change and to adapt to the effects of a warming world. To do this, Parties are expected to submit their nationally determined contributions (NDCs) to the Coalition of Parties (COP) every five years. These NDCs encompass the Parties' goals, policies, and proposals for reducing greenhouse gas (GHG) emissions and for adapting to the current effects of climate change.

For international efforts to continue to be impactful, Parties must present more ambitious NDCs every five years to ensure continued progression towards the ultimate goals of the Paris Agreement. Each of the Parties' NDCs are documented in a registry that is maintained by UN Climate Change.

Since the Paris Agreement came into effect, zero emission solutions have become competitive in a range of sectors that collectively represent 25% of global GHG emissions.



“As we convert our products to zero emission, we will offer our customers additional advisory services. These services aim to assist our customers by providing specific know-how so that they can make the best use of Liebherr’s mining solutions and get the maximum performance out of their machines. As a result, customers’ mining processes and performance will be improved through optimal use of our technology products,” Weiss continued.

ENGIE

At MINExpo 2021, Liebherr and ENGIE announced their partnership to research different pathways to fossil fuel free mining solutions. Specifically, the two companies have been evaluating the workability of different renewable energies – with a focus on hydrogen and hydrogen-derived fuels such as ammonia – to be used in well-to-wheel solutions for the mining industry.

Part of this collaborative effort involved ENGIE supporting Liebherr during its feasibility study investigating the most effective zero emission technologies for mining equipment. The information gained from this study has been crucial as Liebherr works towards offering zero emission mining solutions by 2030.

“We have teamed up with ENGIE so we can work together to reduce our customers’ risks when investing in zero emission mining equipment. Liebherr Mining can guarantee the performance of our machines while ENGIE guarantees the availability of the fuel,” said Weiss. “With the support of both companies, customers can be sure that they have a full solution as well as transparency about the well-to-wheel emissions and energy costs associated with their chosen solution for reaching their zero emission targets.”

Looking ahead

“Our series of zero emission mining projects contribute to different layers of our decarbonisation approach, including consulting, development, deployment, and support. Our goal is to provide a Liebherr zero emission mining solution, thereby simplifying the transition process for our customers while facilitating their progression to zero emission mining,” explained Ays.

When discussing the future of Liebherr’s zero emission solutions, Weiss reflected on how Liebherr’s current technology offerings can help customers both now and in the future.

“The energy and powertrain agnostic approach of the Liebherr Group, combined with all Liebherr in-house core competencies and the significant level of vertical integration in our mining products, enables us to identify and realise the best solutions for open-pit mining machines. The combination of today’s proven low and zero emission products with our zero emission mining development roadmap for future solutions, makes us very confident that we will meet the requirements of our customers,” said Weiss.

United for a zero emission future

In June 2022, Fortescue Metals Group (FMG) and Liebherr announced they were entering a partnership with the aim of developing and supplying fossil fuel free mining trucks. The two companies will work together to integrate zero emission powertrain technologies – being developed by Fortescue Future Industries (FFI) and WAE – into Liebherr’s T 264 240 tonne mining truck.

The partnership between FMG and Liebherr will play a key role in the zero emission targets of both companies. Liebherr first announced its zero emission targets at MINExpo 2021, where the company unveiled its Zero Emission Mining Program. The initial goal of this program was for Liebherr to be able to offer its customers low or zero emission options for its full range of mining trucks and excavators. Liebherr successfully met this goal in 2022. Following this recent success, Liebherr is setting its sights on meeting its next zero emission goal: offering completely fossil fuel free mining equipment for hauling, digging, and dozing by 2030.



Who is FMG?

Fortescue Metals Group, or FMG, was established in 2003 and is situated in Western Australia. FMG is primarily an iron ore company and has three mining hubs in the Pilbara region of Western Australia: Chichester, Solomon, and Western. FMG boasts the fastest heavy haul railway in the world, which connects each of its three hubs to the Herb Elliot Port and Judith Street Harbour towage facility.

Today, FMG ships more than 180 million tonnes of iron ore to its customers per year, with over 1.7 billion tonnes distributed since 2008.



Signing ceremony between Liebherr and FMG at Liebherr-Mining Equipment Colmar SAS, France.

“This partnership with Fortescue will draw from Liebherr’s industry-leading equipment and technology, as well as Fortescue Future Industries’ expertise in decarbonised technologies, to deliver zero emission mining,” said Dr. h.c. Willi Liebherr, President of the Administrative Board of Liebherr-International.

Working together for decarbonisation

Liebherr’s 2030 zero emission target offers a perfect complement to FMG’s 2030 goal of transitioning its mining fleet from diesel engines to fossil fuel free power.

“The signing of this contract with Liebherr marks a significant step in the delivery of our industry-leading

decarbonisation target to achieve net zero Scope 1 and 2 emissions by 2030,” said Elizabeth Gaines, Non-Executive Director of FMG.

FMG is one of the lowest cost producers of iron ore in the mining industry. In 2020, FMG established its green energy and resources company, FFI as part of its long-term business plan to achieve carbon neutrality in its Scope 1 and Scope 2 emissions by 2030. FMG’s collaboration with Liebherr will be crucial in achieving this target.

Leveraging Tier 1 expertise

The partnership between Liebherr and FMG will take advantage of Liebherr’s extensive experience as an original

equipment manufacturer (OEM) and Fortescue’s cutting-edge low and zero emission technology. The expertise of both companies will be used to integrate battery-electric and fuel cell systems – technology developed by FMG companies WAE and FFI – into Liebherr’s T 264 mining truck. The development and integration of this technology into the T 264 will take place over a two-year period.

As part of this joint enterprise, FMG intends to purchase of a total of 120 T 264 mining trucks that will be built to include FMG’s zero emission power systems. These trucks represent close to 45% of FMG’s current fleet of mining trucks.



Who is FFI?

Fortescue Future Industries (FFI) operates within FMG and is the company’s green energy arm. FFI is committed to developing technologies that will help hard-to-decarbonise industries, such as mining, reduce their carbon emissions. The company aims to accomplish this through a variety of renewable energy projects, such as green hydrogen and green ammonia production. Further, FFI is also responsible for finding ways to decarbonise FMG by 2030.

Exciting times ahead

The phased supply of these machines is expected to take place once the development period has concluded, with the first zero emission trucks to be operating on FMG mine sites by 2025. Once these trucks are fully operational, the two companies will make the T 264 with zero emission powertrain available for the wider market to purchase.

“A mining product that will be developed through a close partnership of two Tier 1 companies, including access to the latest zero emission technology, will create an immense industry opportunity and demand,” said Dr. Jörg Lukowski, Executive Vice President of Sales and Marketing for Liebherr Mining.

To celebrate the partnership between Liebherr and FMG, representatives of both companies visited Liebherr-Mining Equipment Colmar SAS, France, in June 2022 and then travelled on to Liebherr-Mining Equipment Newport News Co. in the USA the following month. During the festivities, both parties expressed enthusiasm and excitement for their partnership and the work they will undertake together.



Meeting between FMG, WAE, and Liebherr officials at Liebherr-Mining Equipment Colmar SAS, France.

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Who is WAE?

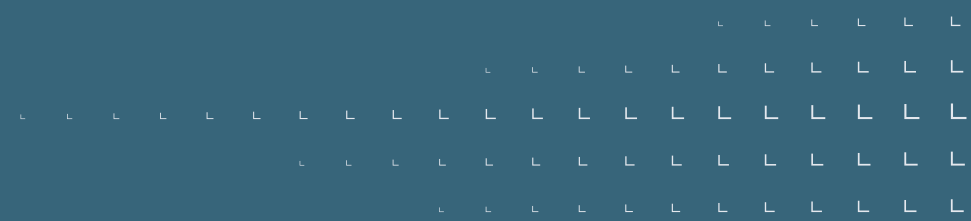
WAE came into being as Williams Grand Prix Engineering, the business supporting the Williams F1 team. In 2010, the company began to diversify its interests and it wasn't long until WAE became an industry leader in the fields of electrification and energy storage.

WAE applies its innovation and expertise to a diverse range of industries including motorsport, aerospace, defence, off highway, and rail.



Liebherr Mining at Bauma

News and highlights from the Bauma 2022 exhibition



Bauma in a snapshot

3,200+



exhibitors from
60 countries

A total of **200,000 m²** hall space and
414,000 m²
outdoor space

495,000+

visitors from more than **200** countries

100

outdoor Liebherr exhibits

Liebherr's **outdoor booth** spanned

15,000 m²

A focus on
digitalisation
and
sustainability

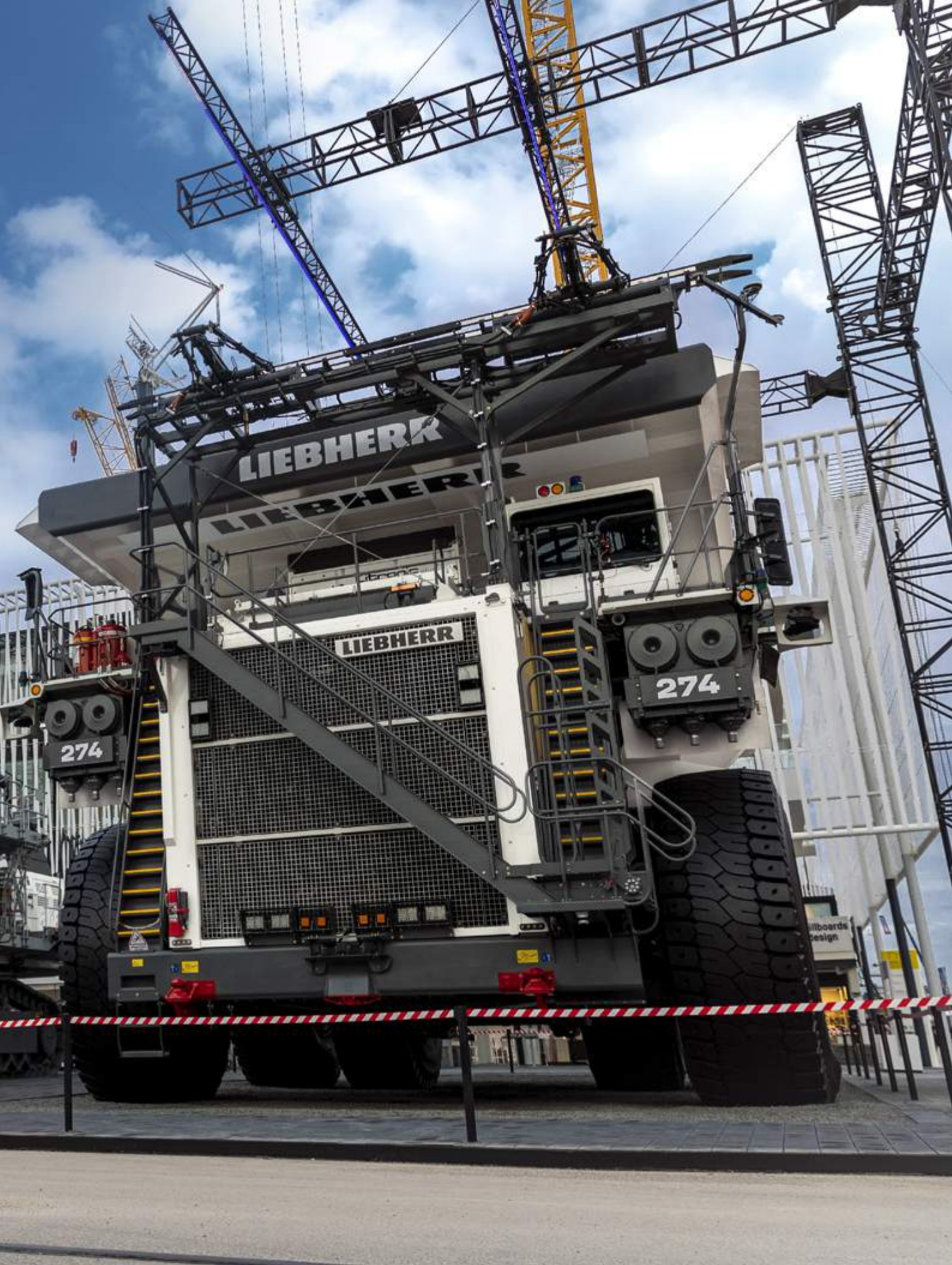


Electrified giants

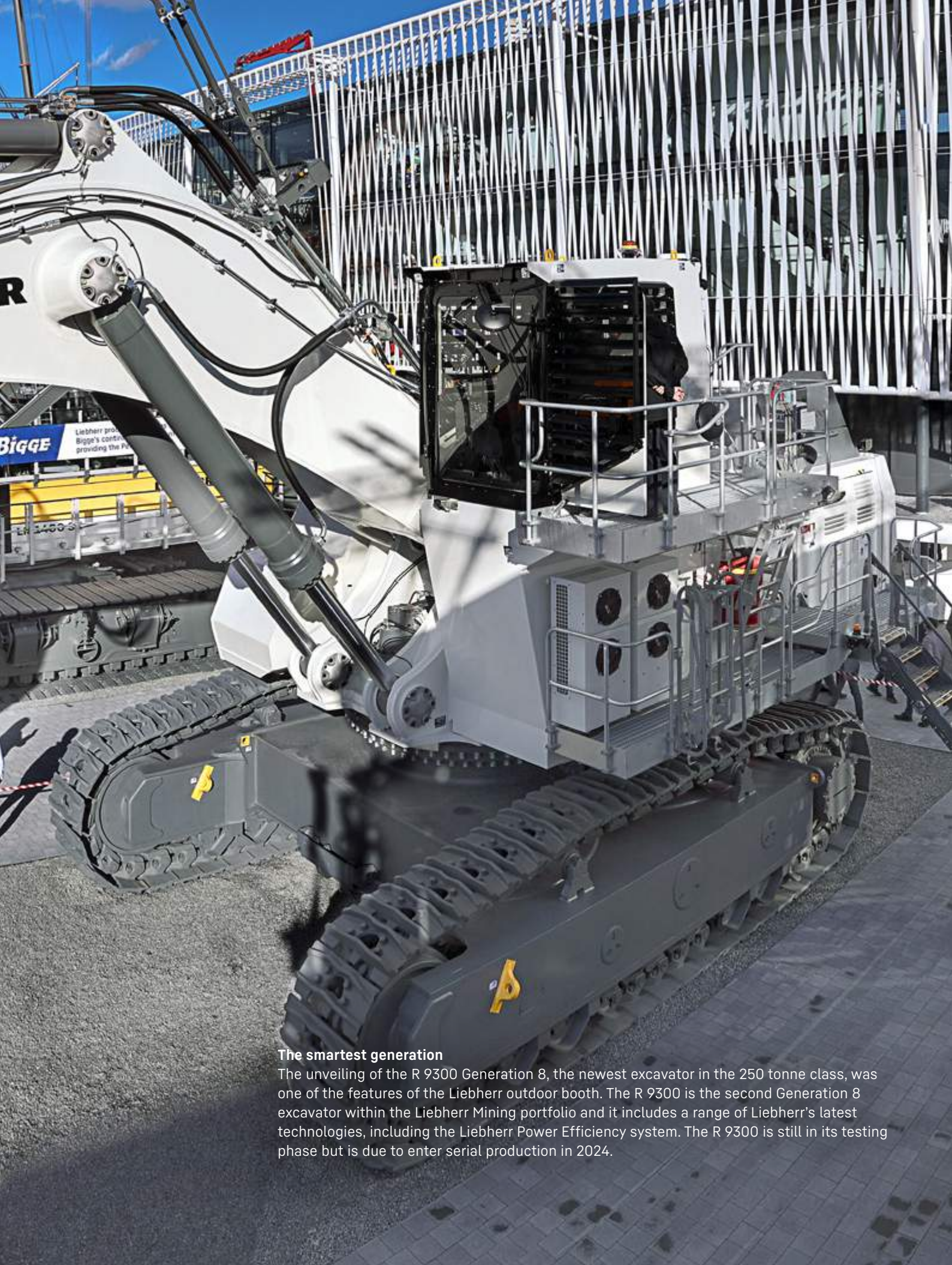
Liebherr's latest mining truck, the T 274, was in pride of place in the Liebherr pavilion at Bauma. The T 274 was something to behold, connected to an interactive Trolley Assist System display. Visitors to the Liebherr booth could watch the Trolley Assist System in action during the daily demonstrations and learn about the T 274's and Liebherr Mining's journey to zero emission mining.

The T 274 offers customers the largest payload in its class, faster cycle times, low fuel consumption, low cost per tonne, and increased production rates. Not to mention, this truck can be adapted to suit a wide range of applications, with options for high altitudes, cold climates, autonomy, and noise sensitive areas.









The smartest generation

The unveiling of the R 9300 Generation 8, the newest excavator in the 250 tonne class, was one of the features of the Liebherr outdoor booth. The R 9300 is the second Generation 8 excavator within the Liebherr Mining portfolio and it includes a range of Liebherr's latest technologies, including the Liebherr Power Efficiency system. The R 9300 is still in its testing phase but is due to enter serial production in 2024.

Exploring the latest technology

At the Liebherr Mining technology pavilion, customers were able to explore Liebherr's most cutting-edge technology, products, and solutions. Customers using the virtual mine touchscreen display within the pavilion could experience even more of Liebherr's innovations.

Visitors to the pavilion also had the chance to experience Liebherr's Assistance Systems from the operator's seat of the R 9800 using virtual reality.

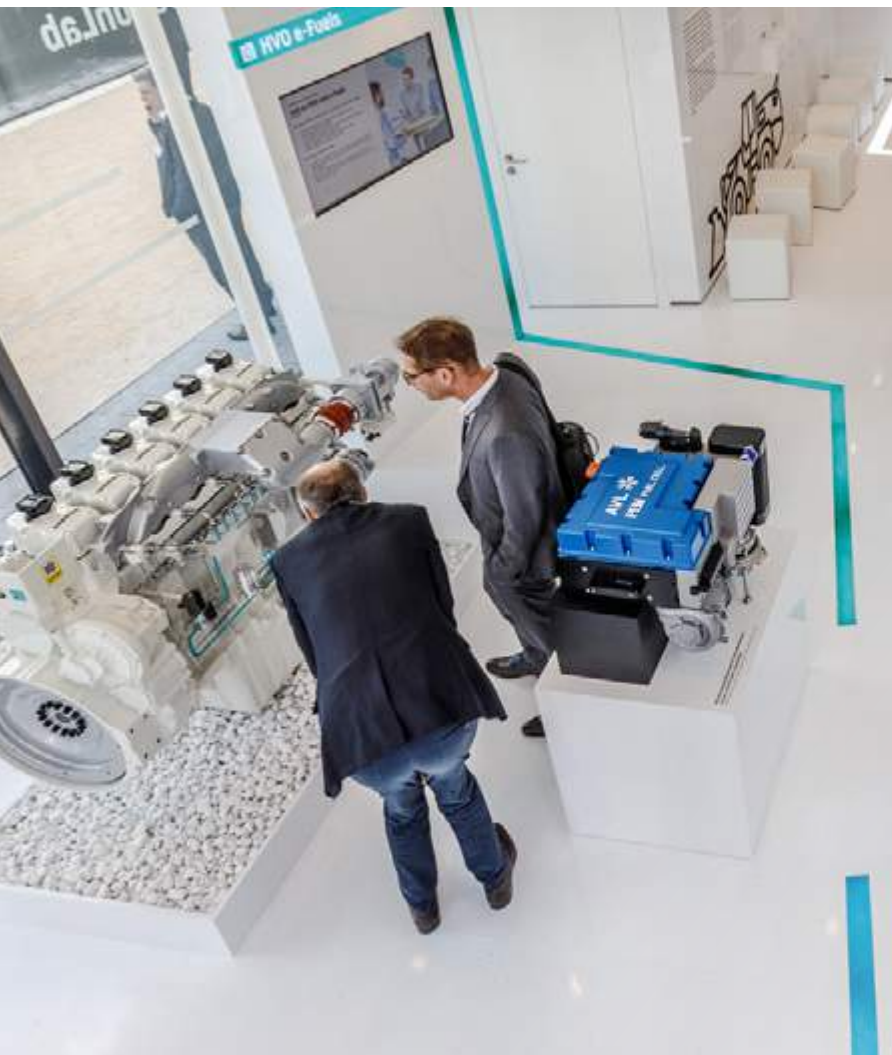


9300
IEBHERR



Award-winning innovation

Liebherr's first hydrogen powered crawler excavator, the R 9XX H₂, was awarded the Bauma Innovation Award in the climate protection category. The R 9XX H₂ is powered by an H966 hydrogen engine and emits 70% less CO₂ during its lifecycle than its traditionally powered counterpart. And when on site, the R 9XX H₂ emits almost no CO₂ at all! This reduction of emissions is accomplished without sacrificing any of the power or strength of its diesel equivalent. This excavator, suited for use under extreme temperatures, shock, and high-dust conditions, may prove to be a robust solution for both earthworks and quarrying in the future.



Showcasing current and future technologies

At the Liebherr InnovationLab, customers could walk among physical exhibits, models, short films, and presentations to see the results of Liebherr's work in developing efficient and carbon neutral technologies. The highlights of the InnovationLab included the H966, a hydrogen powered combustion engine; a hologram of an e-drive; and displays that featured a fuel cell system and a high-voltage battery.

Monnis and Liebherr finalise substantial supply contract

During the 2022 Bauma exhibition, Monnis – the dealer for Liebherr’s mining and earthmoving equipment in Mongolia – and Liebherr confirmed a significant supply deal. This deal will see Liebherr deliver 17 units of dozers and excavators to Monnis’ long-term customer Erdenes Tavan Tolgoi (ETT) throughout 2023 and 2024.



Monnis International (Monnis) was founded after signing a distributorship agreement with Nissan Motors Co. in 1998. Although Monnis began life as an automotive dealer, the company quickly diversified to cover a wide range of industries – including the mining sector – and in 2002 the company became an official Liebherr dealer. Today, Monnis is one of the largest companies in Mongolia.

This most recent supply contract is for a total of 17 Liebherr mining machines, comprised of eight excavators – three R 9250s, two R 9400s, and three R 9600s – and nine PR 776 G6 dozers. These machines are to be delivered to the Tavan Tolgoi coal mine, which is operated by one of Monnis’ longstanding customers ETT, a state-owned mining company in Mongolia.

To ensure the fast and reliable delivery of after-sales services for Liebherr machinery, Monnis opened its Gobi branch in 2011, located approximately four kilometres from the Tavan Tolgoi coal mine. With the opening of this branch, those working with Liebherr equipment have access to spare parts, highly trained technicians, and a range of Liebherr mining products to meet the needs of any scenario that may arise on site.

The new Liebherr excavators and dozers will support the existing Liebherr machinery on site, which includes two R 9200s and one R 9350.

WAE and Liebherr pay tribute to their joint zero emission work

Representatives from WAE and Liebherr came together at Bauma 2022 to pay tribute to their work developing zero emission solutions for the mining sector.

The foundation for the relationship between WAE and Liebherr was laid in March 2022, when Fortescue Metals Group (FMG) acquired WAE as part of their journey to becoming an international renewable resource company. As part of FMG, WAE – an industry leader in the electrification and energy storage sectors – is working to support Fortescue Future Industries (FFI) – FMG’s green energy enterprise – in its work in battery technology.

Partners for the future

In June 2022, FMG and Liebherr announced they were forming a partnership, with the intention of developing and supplying zero emission mining trucks as a step towards decarbonising the mining sector. Key to this partnership is Liebherr’s ability to work in conjunction with WAE and FFI to develop battery-electric and fuel cell systems that will be integrated into Liebherr’s T 264 mining trucks. WAE’s extensive expertise in developing energy storage solutions for a wide range of sectors will be crucial in ensuring that this project becomes a success.

Dave Rawlins, WAE’s Head of Engineering Technology said, “We are delighted to be working on a strategic partnership with Liebherr to integrate zero emission drive systems into Liebherr products. This partnership will enable customers, including FMG, to move towards net zero emissions through delivery and management of drive solutions across the complete product lifecycle.”

The importance of teamwork

Bryant Ward, Managing Director of Liebherr Mining Equipment Newport News Co., also spoke about the partnership between WAE and Liebherr. “Working with the WAE team has been a fantastic experience. The WAE and Liebherr teams work very well together and truly operate as one. The partnership helps to rapidly expand our development capabilities and accelerate bringing products to market. Also, bringing the electrical energy specialists together with the truck specialists enables us to produce a high-quality and high-performance product for the mining industry.”

Liebherr’s partnership with both WAE and FMG became a key part of Liebherr’s Zero Emission Mining Program. Liebherr’s trolley trucks and electric-drive excavators already provide low and zero emission solutions for customers. However, Liebherr is continuing to work within its Zero Emission Mining Program so that it can provide complete zero emission mining solutions for dozing, loading, and hauling – free of fossil fuels – by 2030.

Liebherr is working with Tier 1 companies like WAE and FMG to meet its 2030 deadline and provide solutions that will lead the industry in both technological innovation and cost efficiency.





Positive reception from stakeholders

While at Bauma, Ward discussed Liebherr's efforts in the zero emission space with customers and professionals within the mining industry. "The response from customers at Bauma was tremendously positive. I personally received several comments from customers and industry peers that Liebherr has an advanced and clear strategy for moving forward with zero emission mining products."

Supply of the zero emission mining trucks being developed by Liebherr, WAE, and FFI is expected to commence after the conclusion of a two-year joint development period between the three companies. There is already significant interest from other mining companies in the solutions that FFI, WAE, and Liebherr are developing.

Once the initial field deliveries of the zero emission T 264 trucks have been made to FMG, it is intended to offer these products to more customers.

Karunia and Liebherr commemorate their partnership

PT Karunia Armada Indonesia (Karunia) – a Liebherr Indonesia customer – met with Liebherr officials at Bauma 2022 to commemorate their partnership throughout the development and validation process for the new R 9300 Generation 8 mining excavator. Based on the R 9300's excellent productivity on site, Karunia has purchased an additional four units of the excavator, to be delivered from late 2023 to early 2024.



The R 9300 was unveiled to the public for the first time at Bauma 2022. However, Karunia had been operating one unit of the R 9300 since September 2022. Throughout the operation of this excavator, Karunia provided Liebherr with valuable insight into the overall performance of the R 9300 as well as the functionality of the new, more advanced, Liebherr Mining technologies fitted into the machine. These new technologies provide increased operational efficiency, reduced fuel consumption and greenhouse gas emissions, and higher levels of operator safety and comfort.

Exceeding expectations

The R 9300 is currently being used to remove and load overburden on site and to load coal into 100 tonne mining trucks. This new excavator is capable of filling trucks of this size in a total of four passes.

“The performance of the R 9300 surpasses our expectations by far. All the newly installed features have definitely supported us in achieving continuous and peak productivity targets!” enthused Nahdi Asfahani, Karunia’s Director of Plant and Supply Chain.

Karunia is a mining contractor headquartered in Balikpapan, East Kalimantan. Karunia was established in 1993 and started its operations by offering construction services and the supply and rental of heavy equipment. As part of these core activities, Karunia has carried out several infrastructure projects around the mining concessions of PT Bayan Resources Tbk (Bayan). In 2011, Karunia was given the opportunity to expand its services within the mining business when Bayan offered an initial contract for the Tabang mine site in East Borneo, Indonesia.

A relationship built on honesty

Liebherr cemented its relationship with Karunia in late 2021, with the handing over of an R 9100 mining excavator at the Tabang mine.

Christian Bombenger, the Managing Director of Liebherr Indonesia, said of the partnership, “We appreciate the tremendous level of trust and transparency that has prevailed in our relationship from the get-go. Our companies communicate incredibly well at all levels and we always find innovative solutions to further improve our partnership over time.”

Karunia has expressed its great satisfaction with the performance of other Liebherr products already in operation on site. These products include the R 9100 and R 9200 mining excavators and the PR 776 G6 mining dozer. In fact, as a result of the performance of these machines, Karunia has purchased additional units of these models, bringing the total number of its Liebherr fleet to over 20.

“We have experienced high levels of professionalism, commitment, excellent communication, and effectiveness with Liebherr Indonesia. These values are clearly what we also see as essential for a lasting relationship,” commented Achmad Asfia, President Director and Owner of Karunia.

New opportunities for the future

The recent partnership between Liebherr Indonesia and Karunia represents new opportunities for Liebherr Mining as a whole.

“This new partnership allows us to once again demonstrate both the consistency we are known for in the market, but also to deliver superb and promising new perspectives for our future sustainable growth in Indonesia,” said Max Muench, General Manager of Sales and Marketing for Liebherr Indonesia.

The R 9300 mining excavator is still currently within the validation stage but will enter serial production in 2024.

Learn more about the R 9300!

Looking forward with Serbia Zijin Copper Doo

During the 2022 Bauma exhibition, Serbia Zijin Copper Doo, Liebherr-Mining Equipment Colmar SAS, and representatives of Liebherr management came together for an in-depth discussion about how the two companies can work together more strategically in the future for the benefit of both Serbia Zijin Copper Doo and Zijin Mining Group as a whole.

Zijin Mining Group is an international mining company involved in the exploration, development, engineering, and technological research of gold, zinc, lithium, copper, and other mineral resources. The company has projects spread across 15 of China's provinces and in 13 countries including Argentina, Australia, the Democratic Republic of the Congo, and Colombia.

First impressions

In 2018, Zijin Mining Group acquired the RTB Bor Group of Serbia, the sole producer of copper, gold, and silver in Serbia. Once the acquisition was finalised, RTB Bor Group changed its name to Serbia Zijin Copper Doo. After the initial adjustment period came to an end, the company restarted production in 2019. It was at the end of this same year that Liebherr Mining and Serbia Zijin Copper Doo began their business partnership. Liebherr China and the teams from Liebherr-Mining Equipment Colmar SAS and Liebherr-Export AG in Switzerland travelled to Bor in Serbia to introduce themselves and to discuss the ways Liebherr Mining could help Serbia Zijin Copper Doo to reach its business goals. Based on these initial discussions, Serbia Zijin Copper Doo purchased its first unit of Liebherr Mining equipment – an R 9400 E – in July of 2020. The impressive productivity and reliability of this machine – along with the excellent onsite support provided by Liebherr – led Serbia Zijin Copper Doo to purchase a second unit of the R 9400 E just two months after the first.

Hard-working and efficient

Today, these machines work diligently for Serbia Zijin Copper Doo, with the first unit of the R 9400 E reaching the milestone of 12,700 working hours. These two machines – plus the addition of an R 9350 E in July 2021 – have allowed Serbia Zijin Copper Doo to demonstrate to the rest of Zijin Mining Group that large excavators do have a place in a copper mine and can provide mine operators with remarkable levels of efficiency.

“The R 9350 E and the two R 9400 Es are working quite well. Daily production for the R 9400 E is around 60,000 tonnes per day, 25% higher than competitive models at the same jobsite,” says the management team of Serbia Zijin Copper Doo. “We are planning to add an additional two units on site.”

Zijin Mining Group's high praise of the performance, reliability, and onsite support that Liebherr Mining can provide to its customers has helped to build Liebherr's reputation within the mining industry in China. And because Zijin Mining Group is a market leader within the Chinese mining industry, other businesses will look at the results that these large excavators can provide and see that Liebherr's range of large excavators can also work well for their mining endeavours.

Planning for the future

Given the success of the partnership between Zijin Mining Group and Liebherr to date, it will be exciting to see how much more these two mining powerhouses can achieve together in the future!

“Zijin Mining has some new mining projects in Suriname and Eritrea, providing us with more chances to cooperate with Liebherr,” says the customer.



LIEBHERR

T 274 E

See you in 2025!



Relive the magic of Bauma 2022 here!



LIEBHERR

site

ATTORNEY

Mining rock stars

Our amazing people and achievements



Women in mining

The mining industry is working to diversify its workforce to transform a previously male-dominated industry into one that embraces diversity of people and thought. Gender parity in the workplace has been proven to not only improve company culture, but also to have a positive impact on a business' bottom line and its long-term value. The mining industry – alongside its leading bodies, companies, and contractors – are all implementing initiatives to rebrand the industry as one that is diverse, inclusive, and contributes positively to the community.

Liebherr Mining celebrates the many talented and determined women that work with us every day. We've taken the opportunity to get to know some of our international workforce by chatting to them about why they chose a career in mining.



Emilie Bazo
Application Engineer, Liebherr-Mining Equipment Colmar SAS
Began with Liebherr in 2019



Alicia Nelwan
Field Service Technician, Liebherr Indonesia
Began with Liebherr in 2022



Samantha Carter
3rd Year Plant Mechanic Apprentice, Liebherr-Australia
Began with Liebherr in 2019

What attracted you to a career in the mining industry?

Samantha: Working in the mining industry was something I had always wanted to do, mainly because sitting at a computer all day wasn't something that intrigued me. I like the fact that if you work in the mines there are so many opportunities and avenues to better yourself and your career.

Alicia: I believe that the mining industry has excellent prospects for a career, both domestically and abroad. In addition, the challenges and experiences offered by this industry intrigues me to explore it. Life in this industry is very challenging, so I wish to be able to grow into a strong person both physically and mentally.

Emilie: I started working in the mining industry mainly by chance. I had no special vocation for it. In France – and in other European countries – we are not surrounded by a mining culture like the USA or Australia. I had barely even heard of mining before starting to work in this industry. Today I can say that I really enjoy working in the mining industry because it is very diversified. I like the gigantic side of the things: the machines, the mine sites, and the scale of the projects.

What is your role, and how did you get to where you are today?

Samantha: I am a third-year plant mechanic apprentice. How did I get here? Well, when I was working at KFC, I scrolled on Seek [an online employment marketplace] to see which apprenticeships were out there. Liebherr was looking for first-year apprentices. I clicked the link to apply and a few weeks later I had the job. Now three years down the track I'm a female apprentice on a contract out at a customer site – Mangoola – on a heavy crew, working on a whole bunch of different machines.

Alicia: My current position is a field service technician. The main duty of this position is to provide services in the form of repair and maintenance of units on site. I graduated from St. Petersburg State Transport University with a major in mechanical engineering, specialising in railway rolling stock. I got to my position after going through the selection process held by Liebherr Indonesia.

Emilie: I work as an application engineer for Liebherr Mining. I cover Africa, Europe, and Asia. My job consists of providing sales support to promote the performance of our machines. I make sure the customer is buying the right machine for their needs to ensure user satisfaction. For machines already in operation, my job is to ensure that the machine is used correctly: checking operating techniques, set-up, organisation of the loading area, operational efficiency (load/haul and best truck match), and operating conditions.

It is a consulting role to build up loyalty and to ensure satisfaction and future sales. Mining machines are used very intensively, and renewals are frequent (every 5 to 10 years depending on the size of the machine), which is why it is important to always be present in this very competitive industry.

What's the best part about working for Liebherr?

Samantha: The best part would have to be the people you work with on a daily basis. They're all amazing people who are more than willing to teach me everything I need to know. I'm constantly learning and working in a team that works so well together.

Alicia: For me, the best parts of working for Liebherr are the opportunity to learn, develop my skills, and collaborate with my peers who are proficient in their fields. Other than that, the working environment and its people are extremely welcoming and encouraging. As a new recruit, I managed to gain tremendous knowledge from my seniors.

Emilie: Liebherr as a group is very well perceived in the industry, which is enjoyable in your everyday work! Also, working for a family-owned company with strong values has become essential for me. Compared to other companies I have worked for I can really feel the impact of these values on all employees and on the quality of our products as well.

Why are you passionate about your work in this industry?

Samantha: I am contributing to the reason a digger [excavator] or truck is up and running. You're getting up close and watching how everything works. You never stop learning in this industry. It's something I could never get bored doing.

Alicia: What makes me passionate about working in this industry is that there are constant challenges and new developments that drive me to be more competent.

Emilie: I like the fact that every project is unique. Every time I am involved in a new mining project, I have to understand the essence of it and what the customer's expectations and limitations are. I never do the same thing twice and I really appreciate it. I like that we participate in the extraction of raw materials that are used in many other industries. They are resources that we all need. In my work, I try to help customers to do their job in the best possible way by optimising all resources, processes, and means. I feel more comfortable having our machines do the extraction work rather than having people with bad tools doing this work with high risks.

Do you feel like you're positively contributing to the company, industry, and your wider community?

Samantha: In this industry, you're always contributing to the business, whether that be in administration, the planning stages, or the parts department/warehouse. Being on the tools, you're contributing to the controls that get put in place to keep yourself and other workers around you safe. I am part of a team that puts the bits together to build a machine and also executes the way a shutdown or a build has been planned. I am part of a business where you're always working on a team that has a lot of different ideas and thoughts to make things work, or to make things better for the community – and the mining industry is its own community. So yes, I do feel as if I make a positive contribution to the company and the wider community.

Alicia: Yes. I always try to do my utmost in every responsibility given to me. I believe that every contribution, no matter how small, can have a positive impact on my surroundings.

Emilie: Of course! The experience I acquired in my previous jobs has helped me to bring new skills to Liebherr. My position didn't exist before and I'm very proud to facilitate the work of the sales teams. My work strengthens the sales arguments for our machines. This role provides real internal expertise that usually has to be outsourced. For new product developments, especially for the new zero emission mining topics, my field experience really benefits the engineering teams. Every day I am able to give feedback on our products and I work closely with our marketing department to create job reports that will be helpful for other sites.

How do you think women in the mining industry add a different perspective to the workplace and positively influence the success of the business?

Samantha: Having women in mining adds diversity to the industry. Women think a lot differently to men which gives the mining industry a lot more different perspectives about how things are done.

Alicia: The presence of women in the mining industry certainly provides a different perspective from what has existed before. The appearance of women can make the image of tough women better known to the public.

Emilie: In my opinion, professionalism and commitment are not gender related. However, having variety of different profiles is an asset for the workplace. I regret the fact that I don't meet a lot of women who hold a position in sales or after-sales in our industry. For my job, what is required are observational skills, a critical and analytical mind, and curiosity; all skills that women and men have equally.

I feel that women underestimate themselves; they think they are not capable of doing this kind of work.

What advice do you have for women considering a career in the mining industry?

Samantha: Don't be scared, go for it. You won't know until you try and give it your all.

Alicia: I strongly support women who want to pursue a career in the mining industry. But I also believe that every woman has her own specialties and deserves to work according to her passion, be it in the mining industry or any other industry. Be sure to have positive motivation when working so that any difficulties encountered can be overcome with enthusiasm and sincerity.

Emilie: Do not hesitate! We all have the abilities and strength to do the same job as a man. Do not underestimate yourself and don't get overwhelmed. I am convinced that more representation of women could help to change mentalities. In general, women should take up all the technical professions that exist and not just in the mining industry. I would like to see more women in management too, to lead the way.

Women in mining around the world

Recent estimates suggest that women make up approximately 8–17% of the global mining workforce. Women hold a vast range of roles within mining, from operational to technical to managerial. However, women are more likely to hold support roles in areas such as administration and marketing.

Global efforts are being made across a range of industries – including mining – to increase the number of women in leadership roles. In 2017, leading social impact organisation Parity.Org launched the international ParityPledge for women.

Companies who sign this pledge make a public commitment to interview at least one qualified female candidate for every vacant Vice President, C-Suite, and Board position. In the first 18 months of the ParityPledge, 73% of the organisations that signed the pledge added at least one woman to their executive staff and 56% added at least one woman to their board of directors.



Twenty-five years. One iconic machine. A generation of stories.

When the R 9600 was launched in 2021 it took its place as Liebherr's signature 600 tonne class excavator. However, the journey that led to the creation of this incredible machine spans decades and multiple continents. And that journey began with the 600 tonne icon that started it all: the Liebherr R 996.



The early years

The R 996 was groundbreaking – no pun intended – when it entered the market over 25 years ago. First introduced in 1996, the R 996 was Liebherr's largest and most advanced excavator at the time and had an operating weight of 530 tonnes. The operating weight remained unchanged for several years until structural enhancements – produced in the name of continuous improvement – increased the excavator's operating weight to 670 tonnes. This remained the R 996's operating weight for the rest of its life.

The difference between working on the R 996 and Liebherr's next largest excavator – the R 994-200 series – was considerable. To begin with, the R 994-200 series had an operational weight of only 230 tonnes, which was over 400 tonnes smaller than that of the R 996! To engage with the R 996, all staff who worked with the excavator – whether in assembly, maintenance, or operation – needed to have a thorough understanding of this machine.

George Barturen – the Senior Product Manager for Excavators and Assistance Systems at Liebherr-Mining

Equipment Colmar SAS – has been part of Liebherr Mining for over 30 years and experienced first-hand the complexity of working with the R 996. At the time, Barturen was a technician and worked to assemble the very first R 996. He would then go on to supervise R 996 machine assemblies throughout Australasia.

“Coming from a 230 tonne R 994 to then assemble the R 996 was a distinctly different proposition in so many ways,” explained Barturen. “New processes had to be established and implemented during the projects to ensure that the high standard of safety was maintained, project timelines optimised, and costs reduced.”

“One cost reduction initiative was the development and introduction of a hydraulic powerpack unit, allowing for the assembled undercarriage to be propelled into position under the suspended and complete uppercarriage – that was a game changer” said Barturen. “This innovation simplified and accelerated the assembly process with smaller capacity mobile cranes.”

“The technology within the hydraulic and electrical systems and the circuits was new age on the R 996,” he continued. “This meant that training was integral to success, both for Liebherr technicians and our customers.”

The larger size of the R 996 also presented Liebherr's design engineers with a wide range of challenges. The huge dimensions of the new excavator presented fresh obstacles that were eventually overcome. For example, the 350 kilogram bottom roller used in the R 994-200 series needed to be altered to support the weight of the R 996. Eventually, the design engineers devised a bottom roller for the R 996 that initially weighed 900 kilograms but was more recently adjusted to weigh 1.6 tonnes. Innovations such as the newer, more robust bottom roller could only be created based on the actual experience of working with this massive machine on site and valuable feedback from operators in the field.

In 2009, the R 996 received further upgrades and evolved into a newer version: the R 996B. The evolution to the B version included new swing drives and motors, revised track pads, a new mainframe upper structure, shorter boom, increased bucket capacity, and over 200 modifications to the machine base.

“It was a very busy time in the late 1990s and early 2000s,” said Barturen. “Valued feedback from our customers, as well as our field observations of the R 996 working in various applications and commodities, ultimately led to the upgrades we implemented on the machine. Continuous improvement is something that we pride ourselves on at Liebherr, and nowhere is this clearer than with the evolution of the R 996 into the R 996B.”

A reputation well earned

The R 996 is well known within the international mining industry and has a reputation among customers for reliability, durability, and performance. But the most distinctive feature of the R 996 is, of course, the right-hand side operator cabin.

Most excavators have the operator cabin on the left-hand side of the machine. However, Liebherr chose a more innovative path and placed it on the right-hand side to improve safety for operators when double side loading with the face shovel attachment. Despite initial uncertainty among operators, many grew fond of the R 996 and its unique cabin placement. However, Liebherr’s continuous drive to improve its products led to the decision to move the cab back to the left-hand side on the new R 9600.

Matt Charley – Technical Support Advisor for Liebherr-Australia – has worked with many R 996 excavators in his more than 25 years with the company, including with some of the very first machines. He has already noticed that operators familiar with the R 996 have become sentimental about the era of the R 996 drawing to a close.

“A lot of operators have gotten their start with an R 996 over the years,” said Charley. “They still talk about what that machine can do. You rarely hear stories like that of other OEM [original equipment manufacturer] machines. The R 996 is legendary.”



An Australian icon

Although “born” in Europe, Australia is the adopted home of the R 996. The country has been home to 111 R 996 machines over the years – 68% of all manufactured units. The Australian fleet included the very first R 996, commissioned in March 1996.

“The initial impressions back in 1996 were of the sheer size of the machine,” recalled Barturen. “Not only the components we were assembling, but the overall size of the machine when you stood alongside it. The loading cycle time of such a large machine was equally as impressive. I recall operators at all sites in the early years trying – and succeeding – to set global milestones of productivity with the machine.”

Charley was also heavily involved in many of the first R 996 excavators in Australia and tells the story of a locally famous excavator, known as “109”.

“109 was exceptionally well travelled for a machine,” recalled Charley. “After arriving in Australia, this excavator was first put to work at a gold mine in the Northern Territory, then was sent to a diamond mine in Western Australia, a coal mine in Queensland, a gold mine in New South Wales, and finally overseas to a coal mine in Indonesia. It was an impressive career for one piece of mining equipment!”



Farewell but not forgotten

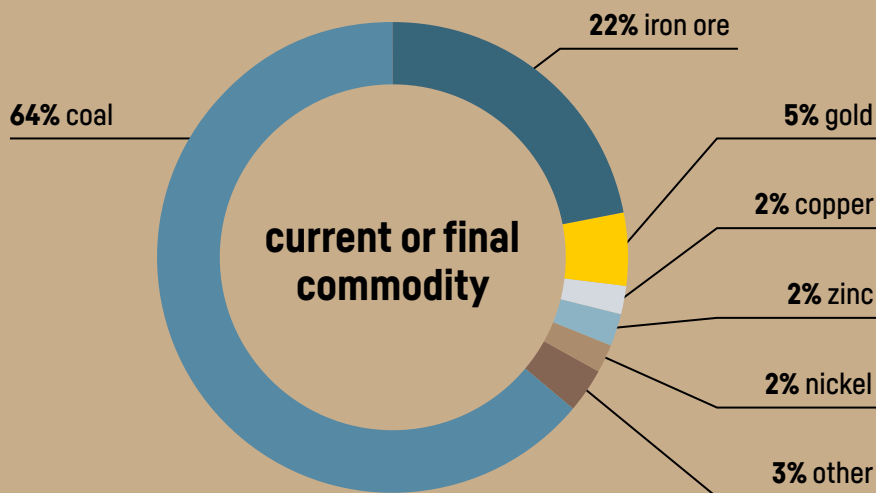
The R 996 and R 996B may not be in production anymore, but this is not yet the end of the road for these customer and operator favourites. These machines have an expected service life of ten years and Liebherr is dedicated to the continued support of the equipment for their entire expected lifespan. Liebherr also offers maintenance services and retrofit upgrade options for mining equipment, helping customers to make the most of their investments. In 2021, one machine in Indonesia achieved the milestone of 140,000 operational hours thanks to these services!

Although the R 996 and R 996B will be missed by Liebherr and by customers alike, Liebherr Mining and its global affiliates are excited to show the world what the R 9600 – the new star of the 600 tonne excavator class – can do.



**Learn more about
the new R 9600**

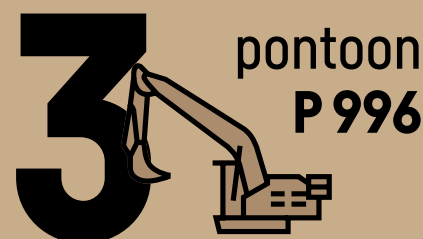
R 996 in numbers



25 years

of manufacturing
from **1996** to **2021**

99% of R 996 and R 996B exceeded their theoretical **60,000 hour design life**, with some units surpassing **120,000 hours SMU** (service metre units) and **one** holding a record of over **140,000 hours**



11,373,000+

recorded working hours which equates to **1,300+** years and increasing



R 996 still in operation

78% backhoe configuration, **22%** face shovel configuration

167

total number of R 996 and R 996B
manufactured

Liebherr Indonesia: 25 years of excellence

PT Liebherr Indonesia Perkasa (Liebherr Indonesia) turned 25 in 2022. The company was founded in 1997 on the Indonesian island of Borneo, in Balikpapan. Since then, Liebherr Indonesia has been a local representative for Liebherr Group's mining equipment, maritime cranes, crawler cranes, and deep foundation equipment. Liebherr Indonesia also offers a wide range of services such as component remanufacturing, key component fabrication, and several innovative field service solutions.

Since its founding in 1997, Liebherr Indonesia has supplied and supported customers with more than 360 Liebherr machines. Over 170 of these excavators and dozers are still operating today, with Liebherr Indonesia offering its services and support for these machines to 12 customers across 25 mine sites. As of early 2023, Liebherr Indonesia's workforce exceeded 500 employees and it is these hardworking people that ensure that customers' Liebherr equipment is always performing as it should.

Liebherr Indonesia has been providing its component remanufacturing and key component fabrication services since it first opened its doors. The goal was to be able to offer customers local after-sales assistance so that support could be provided in a timely and efficient manner. Over the years, the remanufacturing and fabrication facility has been through significant developments. Each year, site assessments are carried out to ensure that production and safety standards are maintained at an excellent level. To maximise the company's compliance with the Liebherr Group's operational standards, the pricing system at the remanufacturing and fabrication facility was upgraded in 2010. Previously, customers were provided prices for remanufacturing and fabrication based on a "strip and quote" system. However, in 2010 this system changed to a fixed price process, where components are priced per level. This upgrade helped to enhance the quality of services Liebherr Indonesia offers to its customers.



**Liebherr
Indonesia
through
the years**

1997

Branch office opened in Sangatta, East Borneo.

A long-term partner for success

Aside from the supply of its proven products and services, Liebherr Indonesia strives to work closely with its customers and business partners, creating relationships built on loyalty and fairness. To help maintain these close working relationships with customers, Liebherr Indonesia not only concentrates on its operational activities, but also aims to remain a reliable and accessible business partner. To become more accessible for customers, the company officially moved its headquarters to Jakarta – the capital city of Indonesia – in 2021. Liebherr Indonesia's geographical proximity to customers and business partners means that official gatherings are now more convenient for all parties.

“We are committed to sustaining and further strengthening our customer base, while simultaneously delivering our innovative and cost-saving solutions,” said Max Muench, General Manager of Sales and Marketing for Liebherr Indonesia “In the near future, we also intend to diversify and further support other business areas, such as the steadily growing local nickel industry.”

Maintaining service accessibility

To further maintain Liebherr Indonesia's accessibility for customers, the construction of a new branch in Tanjung, South Kalimantan, has recently begun. This branch will focus on maintaining operations close to customers in the province. Services in this area will be further developed and streamlined to better support customers through a more efficient supply of spare parts and by having increased numbers of Liebherr staff on hand.

“This is one of several proactive approaches the company has taken to support ongoing operations in the main mining area in Indonesia. This will also enable the company to effectively provide a broader range of services,” Erich Sundah, Liebherr Indonesia's Assistant General Manager, explained.

Focusing on employee safety

For the past 25 years, Liebherr Indonesia has relied on its capable and loyal employees to provide the high-quality services that customers and business partners have come to expect from the company. As such, creating a healthy and safe work environment for these employees is a priority for Liebherr Indonesia. A comprehensive behaviour-focused safety plan has been rigorously implemented to ensure the safety and security of Liebherr staff during the company's operations.



1998

Fabrication department opened.

2011

Remanufacturing department opened.
Branch office opened in Tanjung, South Borneo.

2019

Hose production began.

2021

Brand office and upgraded warehouse established in West Sumbawa, West Nusa Tenggara.

Dream big. Work hard. Make it happen.

As the first woman to drive the biggest mining truck in Panama, and an instructor for the Liebherr T 284, Nancy Lazo shows her colleagues how it's done.



Meet Nancy and the trucks she works with every day!

A dream come true

About three storeys high and capable of loading the equivalent of 26 school buses – no, this isn't a riddle but rather a Liebherr T 284 truck, the workplace of Panamanian miner Nancy Lazo. The young woman standing before us at the site of Cobre Panamá has an impressive record: she was one of the first women in Panama to sit in the driver's seat of a Liebherr T 284. Today, she also trains her mostly male colleagues how to operate the colossal mining trucks.

"I am very proud to be the first female heavy equipment operator here in Panama. It is one of my greatest successes," Lazo says.

For some, becoming a woman in mining – a field still dominated by men – as well as an instructor might seem an unusual career choice. For Nancy Lazo, it is where her passions have taken her.

"It all started when I saw the machinery being taken to the mine," she explains.

After attending courses at INADEH – the National Institute of Professional Training for Human Development – Lazo was hired by First Quantum Minerals (FQML), proprietor of Cobre Panamá. Starting as an operator, she soon began to drive bigger machines and finally became the operator of the biggest mining truck in Panama. In 2018 she was given the opportunity to extend her field to become an instructor.

"It was obvious from the start that Nancy had a lot of determination. She was very clear about what she wanted to do, which was operating the biggest trucks in the world," says Edwin Salazar, Mining Production Manager at Cobre Panamá. "But we could see early on that she had great talent for passing on what she had learned. That's a rare gift because you may be a very good operator, but that does not mean you're a good teacher," he adds.

For Lazo, joining the instructors meant fulfilling another dream. "Both my parents are teachers and I had always wanted to become one too," she says.

Working in a male-dominated industry

The fact that she would have to instruct mostly male colleagues was not a daunting task for Lazo.

"My colleagues always treated me with respect," she says. "That did not change when I started training them. Sure, our interactions might be less relaxed when I'm teaching but that is because I sometimes have to call them to attention, it's not because they are challenging me."

Something similar happened to one of Lazo's female colleagues, Ladyn Correa, the only female electrical technician working on the trucks.

"There is a lot of respect in the team. They respect my position and my work. I work shoulder to shoulder with them," explained Correa.

Still, with gender roles as they are, both of their paths were not without challenges.

"I am very proud to be the first female heavy equipment operator here in Panama. It is one of my greatest successes."

"Sometimes it was difficult to really become part of a group that used to think heavy equipment is only for men. There were situations where I felt I had to give it more and keep trying and trying to be accepted and also to do well," Lazo explains.

Today, however, she feels most of her colleagues are proud of her progress and are happy to be taught by her. And this is well deserved.

"She's one of our top instructors for the ultra-class T 284 Liebherr trucks," confirms Salazar.

Mastering control of the giants

For Lazo, the fascination of driving and training in a fully-loaded 600 tonne truck hasn't worn off.

"I love it!" she exclaims.

Most of her time is spent teaching the theoretical background of driving.

"But whenever I'm in one of the DTU [Detachable Towing Unit] trucks with one of my students or when I operate them myself, I still feel just as excited as I did the first time," Lazo adds.

Small wonder as every day may pose a new challenge.

"The coolest part is that you can never be certain what is going to happen. Here in Panama the weather is very volatile, and we often have to handle the equipment in extreme conditions," she explains, "and that's not easy at all and takes a lot of concentration. But to me it is the most beautiful part, because there is always something new, something different in these trucks on a daily basis".

Family matters

Mother to a teenage son, Nancy Lazo is glad that the equipment she works with is becoming more sustainable. Family in general, and the strong women surrounding her in particular, play an important role in her life.

“My mom is my motivation, my pillar. She is the person who always pushes me forward and does not let me fall. And my grandmother, who sadly is no longer with us, always took care of me. Her memory is also what drives me because she was one of the people who believed that I could not achieve this dream.”

“The memory of my grandmother is also what drives me because she didn’t believe that I could achieve this dream.”

Her mother also was the one who taught her how to drive a car when she was only 16 years old. “My dad just didn’t have the patience,” Lazo laughs.

Being away from her family over extended periods of time is the only downside of her job – a situation that was exacerbated by the COVID-19 pandemic.

“For the past five years I have had to leave home many times which is difficult because my son is still growing up. Luckily, my parents are there to support us,” she adds. “Sometimes I feel a bit torn between home and the mine where I’m able to do such fascinating work.”

Dream team for the future

Since Liebherr Mining offers a range of future-ready solutions, it was the first choice for FQML, the proprietor of Cobre Panamá.

“We are a company at the forefront of technology and that’s why we chose Liebherr technology,” explains Salazar.

FQML is convinced there is no better match for Cobre Panamá in terms of productivity, efficiency, and sustainability. The support offered by Liebherr is a further selling point.

“We had to make a number of adaptations when we received the trucks in order to integrate them. All those challenges were overcome and the fleet is running perfectly today,” Salazar continues.

To date, the collaboration has been so successful that a further eight T 284 trucks have been ordered for the mine.

“We are a world leader in copper exports. And in order to be a world leader, we have to work with state-of-the-art technology,” says Salazar. “That’s why we wanted to work with Liebherr, because we know that they also work with state-of-the-art technology.”



Did you know...?

Early on, women had been extensively involved in mining in different parts of the world. However, by the end of the 18th century during industrialisation, women were gradually excluded from mining. By 1934, a report to the International Labour Conference stated that “the employment of women underground in mines no longer exists, or is dying out, within the metropolitan territories of the States Members of the International Labour Organization”. Today, we see a paradigm shift as the benefits of greater inclusion of women and diversity in mining are increasingly recognised. This is fuelled in part by evidence that gender-inclusive workplaces produce more balanced group dynamics and reduce wear and tear on equipment.



About Cobre Panamá

Cobre Panamá is a copper mine owned by First Quantum Minerals (FQML), a world leader in mining. It is the largest private investment project in the history of Panama at \$6.7 billion. It celebrated its first ore on February 18, 2019 and its first shipment on June 14, 2019.

The benefits of Cobre Panamá’s operations are tangible since, even before production began, the company contributed \$118 million in worker–employer contributions to the Panamanian Social Security Fund; \$66.5 million to the sustainable development of the communities of Donoso, Omar Torrijos, and La Pintada; \$53 million to the country’s environmental conservation; payments to more than 1,850 Panamanian companies; and more than \$17 million in training for Panamanian personnel. According to a report prepared by INDESA, more than 39,000 jobs in the country depend – directly or indirectly – on Cobre Panamá’s operations.

Contributing to zero emission mining

Liebherr’s innovative solutions enable customers to fulfil their goals in reducing CO₂ emissions. Enrique Fals, who works in product support for Liebherr, has been monitoring the Cobre Panamá fleet in order to provide feedback and ensure maintenance work is done according to the manual. As he works on site, he has direct insight into the effectiveness of the system.

“The data we have gathered here shows two important things have been achieved. Firstly, that we are able to significantly reduce pollution given that we can save about 91% of fuel. Secondly, the truck can go faster when connected to the Trolley Assist System. Normally a loaded truck has a speed of 13 kilometres per hour but with the Trolley Assist System the speed of a loaded truck uphill can be up to 22 kilometres per hour,” explained Fals.

Both factors improve the duty cycle of the trucks, enabling mining companies to maximise their return on investment and to meet production targets with fewer trucks, or in shorter time frames.

Learn how Liebherr is contributing to zero emission mining at Cobre Panamá.



World’s largest 360 tonne trolley truck fleet

If one is as in love with operating heavy machinery as Nancy Lazo, Cobre Panamá is the place to be. With 38 Liebherr T 284s and a further 8 already ordered, FQML operates the largest ultra-class truck trolley fleet in the world. The T 284 also happens to be one of the largest mining trucks in the industry, standing at eight metres tall. If you stand in front of this behemoth, your head might *just* reach the bumper.



Five facts about application engineering

At Liebherr Mining, we strive to ensure that the products that you buy from us are going to serve you, your staff, and your site to the best of their ability. To do this, we rely heavily on our application engineers. These hardworking individuals endeavour to provide tailored solutions for our customers so that the machines and products delivered to site will provide the results that they are looking for. But who are our application engineers? How are they able to provide this tailored advice? And what are some of their other responsibilities?

Here are five facts you may not have known about Liebherr Mining's application engineers:

1 There are three application engineers working in Liebherr Mining's application engineering team.

Each of our application engineers oversees a different international region. There is one who looks after North and South America, another who manages the Oceania region (which includes Australia, New Zealand, Polynesia, Melanesia, and Micronesia), and yet another who is responsible for Africa, Europe, and Asia. Together, our application engineers have a combined 19 years of experience in the mining industry and 36 years of experience in engineering!

2 Application engineers run simulations to see which configuration of products will work best for a customer's site.

The best solution for one customer may be quite different from that of another customer. As such, our application engineers use simulations to review the impacts of a wide range of variables within a mine site to optimise your operations so that you can achieve the desired outcomes for your projects. These simulations can be used to consider how different fleet arrangements, fuel types, energy sources, and haul routes can best meet your emission reduction and production targets.



3 Application engineers help customers get the most out of their machines.

It is important to us that we deliver on the promises we make to our customers. So, our application engineers undertake data analyses, production studies, and site assessments to check that our machines are providing the productivity and energy efficiencies that we said they would.

Our application engineers can also make recommendations for best operational practices – including work area set-up and loading styles – to optimise and improve fleet performance. These recommendations will have the added benefit of improving the reliability and durability of your machines.

4 Application engineers create job reports.

The information included in our job reports highlight the capabilities of our products when working in different mines around the world. Most recently, these reports have been used to demonstrate the impacts that our products – machinery and technology offerings alike – have had on our customers' site efficiency. To calculate the impact of our products, application engineers conduct onsite evaluations and collect performance data generated by our equipment. They then run calculations based on this information to reveal the ways in which our products meet the demands of their environments. The results of these calculations form the basis of our job reports. These reports are then shared with our customers to show what Liebherr products can really do!

5 Application engineers can provide recommendations to customers while on site.

Our application engineers travel extensively within their regions, often making several trips per year to visit our valued customers. During each site visit, these engineers expand their expertise as they work alongside our customers on sites with different geologies, commodities, and operating styles. Understanding how the differences between sites can impact site operations means our application engineers are able to provide precise recommendations to our customers.

While visiting our customers' sites, application engineers will make detailed observations about their operations and will also review the efficacy of our products. Based on the data collected, our application engineers can make recommendations on ways that equipment performance can be improved. How would installing a trolley line on site impact fleet output and greenhouse gas emissions? An application engineer can tell you!

Read one of our latest job reports!





Liebherr-Australia reaches 600 bucket milestone

In October 2022, Liebherr-Australia's fabrication workshop manufactured its 600th excavator bucket just three years after achieving its 500th bucket milestone in 2019. Located in Liebherr-Australia's head office complex in Adelaide, South Australia, this workshop manufactures buckets for Liebherr's entire excavator range.



Liebherr-Australia first began manufacturing excavator buckets in 1995, with a 16 cubic metre bucket for the R 994-200. By comparison, the 600th bucket is enormous, measuring 47.5 cubic metres. This milestone bucket is to be fitted to the largest of Liebherr's excavators, the R 9800. The difference between the first and 600th bucket speaks to Liebherr-Australia's ability to build buckets ranging from 8 cubic metres to 50 cubic metres, with some of these buckets achieving a maximum capacity of 100 tonnes.

The fabrication team responsible for creating these buckets is composed of more than 45 Liebherr-trained boilermakers and welders, supported by expert welding inspectors and engineers to ensure that each bucket is of the highest quality.

"We're incredibly proud of our team here in Adelaide," said Dale Clayton, the General Manager of Production,

Mining, for Liebherr-Australia. "The growth of our business over the past few years has been remarkable and our capacity to meet this growing demand keeps improving."

More than buckets

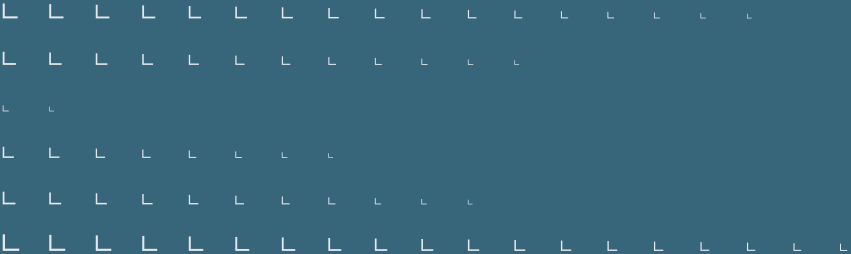
Liebherr-Australia has been the sole supplier of original fit excavator buckets for the region for quite some time. However, the fabrication workshop is also known as a reliable manufacturer of second fit buckets within the local market. Liebherr's excavator buckets have been optimised to work with Liebherr excavators in harsh operating conditions. As such, customers choose these buckets to ensure that they are getting the best possible performance out of their equipment. While many of the manufactured buckets remain in Australia, the fabrication workshop has also sent buckets to countries all over the world, including Indonesia, Ghana, and Chile.

The expertise and workmanship of the Adelaide team is not just limited to manufacturing excavator buckets. The fabrication workshop also provides fabrication and repair services for the structural components required for the entire Liebherr range of mining trucks, dozers, and excavators. To complete this work, the fabrication team relies on a mixture of its own in-house specialists – such as its highly experienced welding supervisors and inspectors – and Liebherr Mining's international factory engineering team.

As Liebherr-Australia has a large customer base, the Adelaide workshop has a strong order book for its high-quality Australian-made buckets, suggesting that Liebherr-Australia will meet its next manufacturing milestone sooner rather than later.

On the ground

Our mining solutions in action all around the world



First R 9150 E backhoe delivered to Xinjiang China

On 21 July 2022, Liebherr China delivered the very first R 9150 E backhoe excavator to the Xinjiang region of China. The customer – Xinjiang Mingyang – is the largest mining contractor in the area and produces 120 million cubic metres of material per year, which includes overburden and both thermal and chemical coal. Xinjiang Mingyang has put the excavator to work in the Zhundong South open-pit coal mine.

The Zhundong South open-pit coal mine is located in the Dajing mining area, within the Zhundong coalfield of Qitai county, Xinjiang. The mine is currently under a contract that states 50 million cubic metres of overburden will be stripped, loaded, and hauled from the site between 2021 and 2030. As such, it was vital that Xinjiang Mingyang chose the right tools to help them to meet this obligation.







Meeting customers' needs

Xinjiang Mingyang first became interested in electric-drive excavators in general – and the R 9150 E in particular – in early 2021. The Xinjiang region, much like the rest of China, has been feeling the effects of diesel shortages since 2021. These shortages have resulted in fuel rations and sky-high fuel costs, both of which have a significant impact on the productivity and prosperity of a mine site. As such, Xinjiang Mingyang became interested in the R 9150 E as a way to reduce both its mine's reliance on diesel and its operational costs.

However, changing aspects of how a mine operates is never easy. Every customer and their respective mine sites have unique needs and concerns that must be addressed to ensure that the customer has found the solution that works best for them. Liebherr Mining strives to provide customers with personalised solutions as they embark on their decarbonisation journeys. For Xinjiang Mingyang, this process involved working closely with the staff of Liebherr China for over 12 months to determine how best to ensure the continued success of the Zhundong South open-pit coal mine. At the end of this process, the customer decided that the R 9150 E – with its cable management capabilities, the largest capacity bucket in its class, and significantly reduced fuel expenses – was the best fit for its purposes.

Trailblazing technology

Xinjiang Mingyang's choice to invest in the R 9150 E makes the company a trailblazer in many ways. It is expected that electric-drive backhoe excavators in the 150 tonne class will be the most used loading equipment in the Xinjiang market within the next three to five years. Most operators in this area already use backhoe excavators – albeit with diesel engines – and so are already familiar with this kind of machinery.

Further, electric-drive excavators will help mine operators to reduce costs for their machinery. Based on the current prices of diesel and electricity in the Xinjiang region, customers using the R 9150 E can benefit from an over 80% reduction in energy costs. In addition, electric-drive excavators have lower maintenance costs than their diesel-drive counterparts. As electric-drive excavators like the R 9150 E do not have an internal combustion engine, there is no need to replace items such as engine oil filters, air filters, or engine oil. In fact, the R 9150 E does not use engine oil at all. Moreover, electric-drive excavators do not require the same maintenance and overhaul checks as diesel-drive excavators. Therefore, less labour is required to keep an electric-drive excavator in peak condition than what is needed for a diesel engine, translating into lower costs for the customer.

Since the R 9150 E arrived at the Zhundong South open-pit coal mine, Xinjiang Mingyang has started to feel the benefits of this electric-drive excavator. The machine has already served more than 1,500 working hours, averaging 600 working hours per month since its arrival in July 2022. The customer has been so impressed with the performance of the R 9150 E that they are currently in negotiations with Liebherr China for the purchase of an additional three or four units.



Liebherr and Thies join forces to strengthen presence in the Americas

Throughout 2022, Liebherr Mining supported its long-term partner Thies – a global mining services provider – as the company began expanding its presence in the Americas. Eleven T 264 trucks were supplied to Thies in total, divided between two mine sites: one in Chile and one in the USA. Liebherr worked closely with Thies to ensure that the supplied trucks met the unique needs of each of these mine sites.

Thies began its operations in the Americas in 2015, when it was awarded a services agreement for the Encuentro open-pit copper mine in Chile. Since this time, Thies has solidified its reputation as a reliable mine services provider in the region.

Increasing efficiencies in Chile

In June 2022, Liebherr delivered five of the eleven T 264 mining trucks for Thies to Encuentro, the same copper mine in northern Chile that marked Thies' first foray into the South American market.

Watch a T 264 being built on site in Chile!

“South America is essential to Thies’s long-term growth and building our diversification into commodities such as copper and gold,” said Darrell White, Thies’s Executive General Manager Americas. “As we continue to build our presence in the Americas, we’re continually looking for innovative ways to provide solutions for our clients that deliver safety, sustainability, and productivity benefits. Liebherr’s T 264s boost our fleet numbers and provide our clients with the opportunity to increase production capacity.”

These mining trucks will help to increase the productivity and efficiency of Encuentro mine with their payload of 240 tonnes, high speed on grade, incredibly fast cycle times, and the best power-to-payload ratio in their class. The T 264s also deliver increased operator safety with an ergonomically designed cab, maximum visibility during operation, and protection against both roll-over and falling objects. Further, these trucks are designed so that zero emission technology can be retrofitted into the machines, thus future-proofing Thies’s investment in this equipment.

Arriving in the USA

Thies was awarded its first contract within the USA not long after establishing its first permanent office in the country in early 2021. In order for Thies to fulfil its contractual obligations, it needed to supply its customer with six of Liebherr’s T 264 trucks. The collaboration between Liebherr and Thies to meet this customer’s expectations marked the first time the two companies have conducted joint business in the USA in their partnership of over 30 years.

“Liebherr was honoured to be chosen as the partner for Thies’s launch in the USA,” said Shane Kuhlmeier, Divisional Director of Mining for Liebherr USA.

Liebherr and Thies ensured that the six trucks could operate at high altitudes without derating, which involved the inclusion of heated dump bodies and additional fuel and engine heaters.

“The unique application, coupled with the difficult operating conditions, allowed for Liebherr to exercise all of its capabilities to deliver a reliable product on time for this project,” Kuhlmeier said.

With the help of its Newport News truck factory, Liebherr was able to deliver all six of the T 264 to Thies ahead of schedule, demonstrating the original equipment manufacturer’s commitment to meeting customer needs.

As Thies seeks to continue expanding its operations in North America, Liebherr will offer its longstanding customer dedicated support services and best-in-class assets. These services will ensure that the Liebherr equipment delivered to Thies will continue to provide a high level of productivity and efficiency to the service provider’s customers.

“As Thies expands in America, we will be right there with them providing high-quality solutions that deliver on our commitments to the mining industry,” explained Kuhlmeier.



Learn more about Liebherr and Thies’s collaboration in the USA.

R 9400 helping restore native lands



In the northwest of New Mexico, a Liebherr R 9400 mining excavator with the nickname “Bherr Claw” has been crucial to mine reclamation operations at the Navajo surface mine located within the Navajo Nation. The Navajo Nation is the largest Native American tribal nation – both in landmass and population – in the USA and its land spans three states: Arizona, Utah, and New Mexico.





The Navajo mine is owned and operated by the Navajo Transitional Energy Company (NTEC). NTEC acquired the Navajo mine from BHP Group in 2013. Officials of the Navajo Nation made this decision to protect jobs, maintain revenue, and support local economies for the Diné, also known as the Navajo people. When NTEC acquired the mine, it also inherited a significant amount of un-reclaimed mining land; land that had not yet been restored for its original purpose after the mines had become exhausted. NTEC takes its reclamation responsibility incredibly seriously and has committed to reclaim well over 84 million cubic metres of material. Reclamation of this un-reclaimed land began in 2017 and is expected to be completed by 2031.

A force to be reckoned with

Bherr Claw – NTEC’s R 9400 mining excavator – has been essential for reclamation efforts at the Navajo mine since the machine’s delivery in 2019. The 345.50 tonne excavator was the first piece of Liebherr equipment that NTEC owned outright. It is set up in a backhoe configuration and has been digging channels and doing regrade work in the mine pits. Bherr Claw is currently working in an area of the mine that NTEC has voluntarily committed to reclaim, to ensure the land is restored to its highest environmental status.



NTEC’s commitment to reclamation is the driving force behind the company’s annual increase in the amount of land it restores and Bherr Claw has helped to dramatically increase the efficiency of this process. The R 9400 is scheduled for over 80 hours per week to handle blasted sandstone spoiled by draglines and the machine plays a crucial role in helping restore the land to a sustainable and stable condition.

“The large excavator makes the job easier. We can move more yards than we can with a single loader [wheel loader], and we’re able to load more yards more efficiently into the bed of a truck,” said Viridon Yazzie, Reclamation Manager for NTEC.

Going above and beyond

Today, the Navajo mine is a mine-mouth operation, providing over four million tonnes of sub-bituminous coal to Four Corners Power Plant. However, before the land was used for mining it was primarily used for livestock, cattle, and sheep while also providing habitation for local wildlife. Restoring the area so the mining land can be used for these purposes once again is a high priority for NTEC and the company has already exceeded its expected restoration requirements. Navajo mine was built in an area that was 60% badlands – arid terrain with little to no vegetation growth. Because of this, there were fewer restoration expectations placed on NTEC, given the inhospitable nature of the original land. But NTEC is determined to leave these mining lands in the same – or better – condition than when they were developed.



Liebherr, NTEC, and Navajo mine have established a strong working relationship built on trust and an understanding of both NTEC's and the mine's mission to do things in the right way and to operate safely and efficiently.

"The Liebherr Group provides good responses to occasional issues with the machine and understands the criticality of this machine to our operations and NTEC's commitment to reclamation," said Yazzie.

A powerful reputation

One of the main reasons that NTEC decided to purchase the R 9400 was the Tier 4 engine. Tier 4 is an emissions standard set by the Environmental Protection Agency in the USA that aims to dramatically reduce the amount of particulate matter and nitrogen oxides being emitted by off-highway diesel engines.

However, another reason the R 9400 was chosen was because of its reputation for high performance. The excavator has been designed to offer the best force distribution and digging and lifting forces within its class. When NTEC operators were working to reclaim areas of dragline spoils, they realised that they needed a machine like the R 9400 to handle the tough materials buried within the land. Liebherr Claw has proven its reliability in the years since it was commissioned and NTEC remains sure that the reliability and high performance of the R 9400 will continue, allowing for Navajo mine to continue its impressive reclamation efforts.

R 9200 working hard in India

The National Mineral Development Corporation (NMDC) – India's largest single producer of iron ore – has increased its mining fleet with the purchase of two new R 9200 mining excavators. These two new excavators are part of NMDC's plan to boost production at its Donimalai mining complex.

NMDC has been a part of India's mining sector for 64 years. Since its incorporation as a Government of India public enterprise in 1958, NMDC has amassed some impressive titles. The company is India's largest iron ore producer, the tenth largest iron ore producer in the world, and one of the lowest cost producers of iron ore internationally. Collectively, NMDC produces 35 million tonnes of iron ore per year, with 20% of this material coming from the Donimalai mining complex. NMDC hopes to increase iron ore production across all of its mines to 100 million tonnes per year by 2030. The addition of two R 9200s to these mines will help NMDC to achieve this goal with the excavators' class-leading bucket capacity and peak fuel efficiency.

The Donimalai mining complex was commissioned in 1977 and is located in the southern state of Karnataka. The two mines within the Donimalai complex – Donimalai and Kumaraswamy – cover more than 597 hectares of land. The complex gets its name from the inverted boat shape of the mines' topography. In Kannada – the local language of the area – “doni” means boat and “malai” means hill. To accommodate the terrain within the Donimalai complex, both R 9200 excavators were fitted with extra heavy-duty buckets.



Arrival of Liebherr in Ontario



In 2022, Liebherr-Canada delivered two dozers – a PR 776 G6 and a PR 766 G8 – to Magino, a gold mine operated by Argonaut Gold. The delivery of these two dozers also represents the first Liebherr equipment to arrive in Eastern Canada.

Argonaut Gold is a company involved in the exploration, mine development, and production of gold and gold ore. The Magino property lies 40 kilometres to the northeast of Wawa in Ontario and spans over 2,200 hectares. Argonaut acquired Magino in late 2012 and in December 2017 a feasibility study demonstrated that open-pit mining was possible on the site. Construction of the mine began in January 2020.

Liebherr-Canada is proud to assist Argonaut Gold with this project.

“When the opportunity arose to work with Argonaut Gold on the Magino project, it was quickly and unanimously agreed they were a strategic partner for Liebherr-Canada. We are thrilled to be providing our exceptional dozer products and our world-class service to this transformational project and cannot wait to see the tracks hit the ground,” said Tom Juric, Divisional Director, Mining, for Liebherr-Canada.

Rock stars of Magino

Since the two dozers were commissioned in 2022, they have been supporting the existing Argonaut fleet. These dozers have been responsible for the removal of waste rock and the tidying up of the areas where the trucks wait to be loaded. To be effective in these tasks, the dozers needed to be supplied in high-drive configuration. Magino is full of granitic rocks that are difficult to penetrate. Working with such material can increase the amount of daily wear and tear that the dozers sustain. To extend the lifespan of the dozers' componentry while working in these conditions, the elevated sprocket in the high-drive configuration keeps the dozers' drive systems away from the rocks and their related debris. Liebherr is only one of two original equipment manufacturers (OEMs) that offer the high-drive configuration for mining dozers.

Providing low and zero emission solutions

Both the PR 776 G6 and the PR 766 G8 also have the added benefit of reducing the fuel requirements and greenhouse gas (GHG) emissions of the Magino site. The hydrostatic drivetrain used in both models sustains a steadier rpm rate than other kinds of drivetrains and so provides 20% more fuel efficiency than dozers built by other OEMs.

Moreover, the engines in both dozers have been built to Tier 4 emissions standards, which will help Argonaut to meet its emission reduction targets.

“Due to the efficiency of the Liebherr hydrostatic drive transmission system, Argonaut can reduce its carbon footprint up to 20% compared to competitors while remaining equally productive,” said Dominic Bergeron, Regional Sales Representative, Mining, for Liebherr-Canada. The dozer engines also have the benefit of being able to run on hydrotreated vegetable oil, which can reduce GHG emissions by approximately 90%. The availability of this option will help to future-proof these machines so that they can meet emission reduction targets of the future.

Improving everyday operations

The design of the dozers also impresses the operators who work with these machines every day. Operators have described the PR 776 G6 and PR 766 G8 as easy to manoeuvre and quiet and comfortable to operate, while also having impressive pushing power.

Two more units of the PR 766 G8 are scheduled to be delivered to Magino in the summers of 2023 and 2024. With gold production set to begin in April 2023, these two dozers will arrive just in time to help Argonaut with this new phase of mining.



Cementing Liebherr's success in Colombia

In August 2021, Liebherr Colombia assembled an R 9100 excavator for a new customer that is a market leader within the Colombian cement and concrete sector.

The excavator began operating in a quarry located on the Caribbean coast and has been working hard for the customer ever since. This R 9100 excavator represented one of Liebherr Colombia's most important assemblies, having beaten tough competition from other original equipment manufacturers for this new customer. The assembly of the R 9100 was led by Liebherr Colombia's After-Sales Manager of Mining, David Kligman, supported by a team of technicians with vast experience in the assembly of these excavators.

The success of the assembly of the R 9100 in combination with the strength of its performance at this particular quarry has led the customer to commission another of these excavators, which was scheduled to be delivered at the end of 2022. Liebherr Colombia believes these R 9100s will continue support Liebherr's strong reputation for small mining excavators in quarry mine terrain.



David Kligman of Liebherr Colombia proudly standing in front of the new R 9100.

Constantly striving for excellence

In the name of constant innovation, Baosteel decided to upgrade one of its R 9350 E excavators – purchased in 2008 – not once but twice. All in the name of efficiency, safety, and optimal performance.

Continual innovation is one of the core tenets of the Liebherr Group. As such, it is no wonder that Liebherr's customers often endeavour to meet this same goal. Baosteel – a Liebherr China customer located in China's Inner Mongolia region – is one such customer. As one of the most competitive and modernised iron and steel companies in China, Baosteel is no stranger to innovation and the need to constantly improve its modes of operation. Luckily, Liebherr China has been a willing partner in Baosteel's journey since 2008.





Partners for more than ten years

Throughout 2008 and 2009, Baosteel purchased five R 9350 E electric-drive excavators in face shovel configuration from Liebherr China as its way of increasing productivity, decreasing costs, and reducing greenhouse gas emissions. Since their delivery to the Barun mine – which produces both iron and rare earth ore – each of these excavators has accumulated in excess of 50,000 working hours with one unit clocking up an impressive 60,000 working hours. Baosteel credits these excavators – tasked with the digging and loading of both iron ore and overburden – with its progress over the past decade.

“Liebherr R 9350 E is the main workforce in the Baosteel Barun mine and has contributed a lot in the past years,” said the equipment manager of the Barun mine. “Especially as the pit is digging deeper and deeper, the mine area is becoming narrow. It is difficult for a large-sized machine – like a rope shovel – to move and operate [in the mine area].”

Adapting to change

As the shape of the Barun mine has changed over the years, Baosteel needed to investigate ways of updating its operating techniques to better reflect the nature of the site. In 2020 – after a decade of working with the R 9350 E fleet as it was – Baosteel decided to change one of its units from face shovel to backhoe configuration. Because of the topography of the Barun mine, the backhoe version of the R 9350 E allowed operators to work more efficiently from day to day.

“Designed in compact size compared to others, Liebherr electric-drive excavators can move flexibly and freely even in restricted working areas, which is a big advantage for us,” continued Barun mine’s equipment manager.

The latest in operator safety

While having the best machinery for a job is important, these machines cannot run without dedicated operators in the driver's seat. As operators and other site employees are crucial to the success of a mine, it is vital that they are kept safe. To better protect its valuable employees, Baosteel made a second upgrade to the R 9350 E backhoe excavator in 2021: the company installed a Liebherr cable reeler. The cable reeler – when installed on an electric-drive excavator – allows the power cable trailing behind the machine to automatically start reeling once the machine has begun to reverse. It is an elegant solution for mines where excavators need to be repositioned. The autonomous nature of the reeler helps to increase the safety of all personnel on site.

Preparing for the future

In the name of continuous innovation and improvement, Baosteel plans to monitor the performance of this updated R 9350 E and explore how it differs from the four face shovel units still on site. The data gained from this investigation will help the customer with future machine purchases and mine planning.

“In the future, more of the work done by rope shovels will be replaced by Liebherr electric-drive excavators as rope shovels are too large and extremely difficult to move and travel,” the equipment manager of Barun mine said.

Making the switch from rope shovel to electric-drive excavators will also be hugely beneficial for Baosteel's energy costs over the next few years. At present, electricity is an economical and stable energy source in China, whereas the supply of diesel fluctuates and prices have sky-rocketed in recent months. If these trends continue, engaging one R 9350 E on a mine site could save Baosteel six million yuan in annual energy costs.

Liebherr China is excited to see how it can next help Baosteel to achieve its goals so that its success in Inner Mongolia can continue.







First R 9100 arrives in Colombia

Despite the challenges that 2020 would pose for the world, the year started very well for Liebherr Colombia. The first R 9100 mining excavator to land in Colombia was delivered to new client Ingeniería de Vías – a prestigious company in the Colombian construction sector – to work in its quarry La Libertad. La Libertad is in Samacá, a small town in the Colombian department of Boyacá. The quarry produces base and sub-base materials that can be used in the construction of roads and bridges and can also be combined with asphalt.

Despite the challenges caused by the COVID-19 pandemic – and thanks to the great teamwork of everyone at Liebherr Colombia – the machine was delivered to Ingeniería de Vías in August 2020. However, the journey was not without its challenges and a backup plan was needed due to the travel restrictions in force at the time. To ensure that both the excavator and the team to assemble it could still get to La Libertad, the Liebherr Group needed permission from the Colombian Minister for Transport to travel to site in two trucks. Once this voyage had been authorised, the journey to La Libertad took a total of 15 hours.

Exceptional customer service

Liebherr Colombia also wished to enlist the help of an expert with over 30 years of experience in the field of excavator operation to help the customer with its operator training. This was so Liebherr could provide Ingeniería de Vías with the best possible customer service. However, due to the excavator's remote location

and restrictions for air travel, the expert, Ivan Carreño, had to travel more than 16 hours by land – from Barranquilla to Samacá – to reach La Libertad.

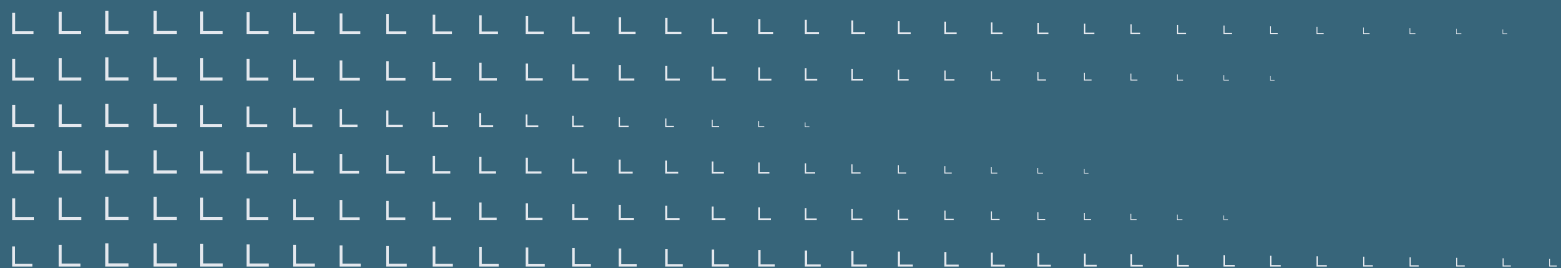
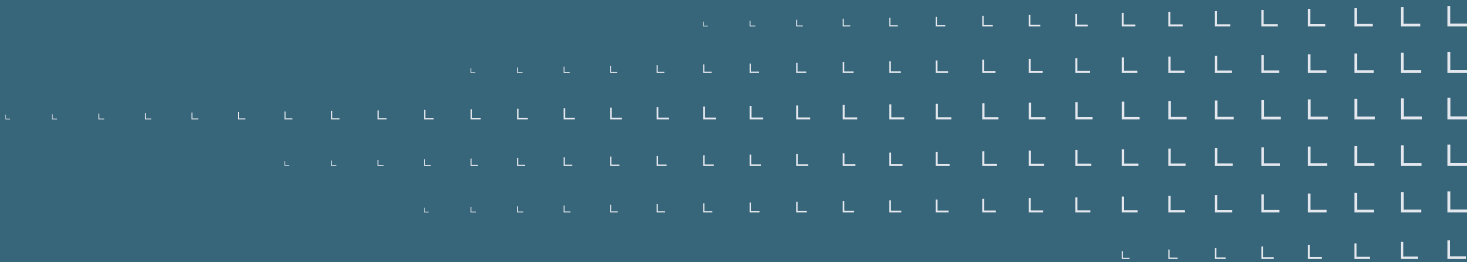
The R 9100 was supplied to Ingeniería de Vías with the ripper attachment, to assist with moving the extremely hard and abrasive rock on site so the machines could extract the base and sub-base material.

The productivity and efficiency Liebherr delivers to its customers has been demonstrated in all of Liebherr Colombia's interactions with Ingeniería de Vías. The personnel of Ingeniería de Vías have expressed their delight with Liebherr Colombia's service at all levels, as well as with the performance of the R 9100.

This project proves to the Colombian market the value of this type of excavator for the extraction of commodities other than coal, including aggregate quarries.

Product spotlight

An in-depth exploration of Liebherr
Mining solutions



Technical spotlight: Assistance Systems for mining trucks

At MINExpo 2021, Liebherr launched a new range of semi-autonomous Assistance Systems for its mining truck portfolio. These systems included the Trolley Guidance System and the Crusher Guidance System and were designed to increase operator safety, productivity, fuel efficiency, and to protect customers' machines from unnecessary damage. At the 2022 Bauma exhibition, both Assistance Systems were showcased inside the Liebherr Mining technology pavilion so that visitors could take a closer look at this new technology in action.

Site infrastructure

For these Assistance Systems to work on a mine site, they need to leverage a site's existing Global Navigation Satellite System Real-Time Kinematic (GNSS RTK) base station technology. Both systems rely on high-precision GNSS units to perform their respective functionalities. GNSS units use the location correction information collected from the base station to calculate the precise position of trucks on site with centimetre-level accuracy. This level of accuracy is crucial when trucks weighing hundreds of tonnes perform delicate manoeuvres such as connecting to a thin trolley line in the right place or reversing into a narrow, fixed structure.

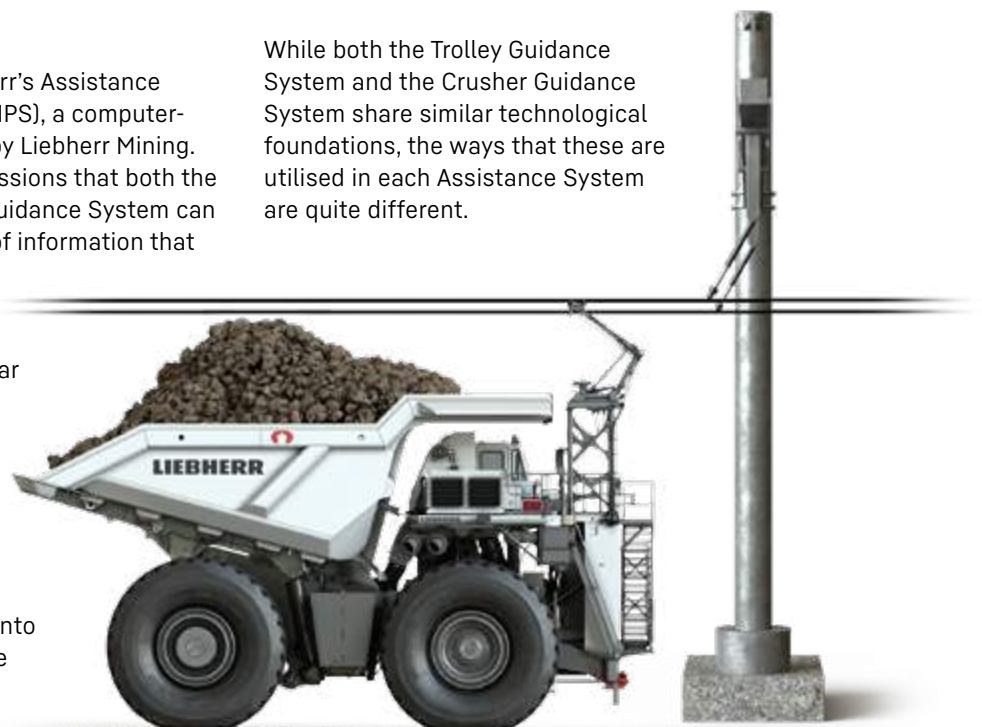
Planning missions

A valuable component of both of Liebherr's Assistance Systems is Mission Planner Software (MPS), a computer-based software developed and owned by Liebherr Mining. The MPS allows customers to create missions that both the Trolley Guidance System and Crusher Guidance System can then execute. A mission is a collection of information that dictates where a truck can travel on site as well as which areas of the mine site require the Assistance Systems to perform particular functions. These functions can include raising a truck's pantograph or sending a notification to the operator to take their hands off the steering wheel.

The MPS allows for survey images of a customer's site to be directly imported into the program. The customer can then use these images to accurately map out locations where the missions for each

Assistance System will be carried out. After the customer has created these missions and included all relevant information – such as speed limits for path segments and where trucks need to connect to the trolley line – details are then packaged together and sent to Liebherr's cloud platform. Once the details are saved within the cloud platform, the mission information can be retrieved by a certified Liebherr technician and loaded onto the truck. These original missions will remain installed in the trucks for as long as they have an Assistance System installed. If these missions need to be altered, customers need to ensure that the yearly maintenance fee has been renewed in order to update the system data.

While both the Trolley Guidance System and the Crusher Guidance System share similar technological foundations, the ways that these are utilised in each Assistance System are quite different.



Trolley Guidance System

To understand how the Trolley Guidance System (TGS) works, it is important to first know what a trolley system is. A trolley system is a power delivery system that allows mining trucks to use electricity from fixed electrical infrastructure as their power source, rather than using a diesel combustion engine. The trucks connect to the trolley line via a pantograph and collect the energy needed to move the machines via this connection. However, it can be difficult for operators to connect successfully to the trolley line, given the small size of the target. Moreover, it can be difficult for operators to maintain a consistent travel path while connected to the trolley.

This is where the TGS can help.

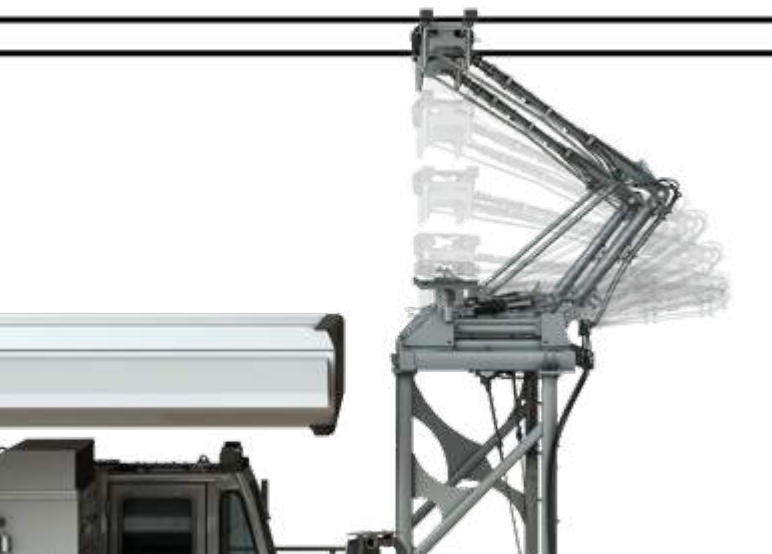
The TGS leverages a mine site's existing GNSS RTK base station and radio frequency identification (RFID) technology to identify the right time to automatically raise and lower the trucks' pantographs and to steer trucks while connected to the trolley line. The onboard GNSS unit stores the location data of the trolley line and compares this to the position of the trucks. The TGS will then make steering corrections to keep the trucks aligned with the trolley line. The RFID technology is a secondary system that helps to control the pantograph and its connection to the trolley line. Once the system has been installed, the customer can create trolley guidance missions using a combination of the imported site survey imagery, landmarks known to the survey team, and the trucks' overall operating area. The MPS allows the customer to designate different areas of the mine site as signifiers for when the TGS needs to take certain actions. Within the software, the customer can highlight which area on site is the "operation area" for the TGS and thus, when this system needs to come online. Inside that area, the customer can nominate the



"hands off area" for when the system needs to notify the operator – via audible chime and visual cues on the TGS screen – to remove their hands from the steering wheel. This is when the TGS will take control of the truck and guide it to the appointed "starting area", where the system will raise the pantograph to connect to the trolley line. The truck will then steer itself along the trolley line in the operating area until it reaches the place that the customer has designated the "ending area". Here, the system will automatically disconnect the pantograph from the trolley line and alert the operator that it is time to take control of the truck once more.

Customers can allocate alternate access points along the designated trolley path to accommodate times when the operator needs to disconnect their truck from the trolley. For example, if the path is blocked due to a stalled truck or spillage, the operator can deactivate the TGS, travel around the blockage, and can reactivate the TGS at a predetermined alternate access point. Alternate access points can also be used in instances where trucks need to enter the trolley line from an intersection within the line.

The TGS can maximise trucks' time under trolley by ensuring that they are connected to the line properly and can automatically follow the trolley line's path. This results in a reduction of the fuel consumed by the trucks. Further, the TGS can help to reduce the pressure on operators to keep the trucks perfectly in line with the trolley, thus ensuring increased efficiency and decreased operator stress and fatigue.



Crusher Guidance System

The Crusher Guidance System (CGS) helps operators to successfully reverse their mining trucks into a fixed, and often narrow, structure such as a crusher. To do this, the system relies on a foundation of high precision GNSS and ultrasonic technologies to reverse trucks safely and accurately into these tight spaces. The GNSS provides the guidance system with the exact geospatial location of the relevant trucks. The ultrasonic technology is a secondary system that ensures that the trucks stop in the right place to safely dump their loads into the crusher.

After the CGS has been installed, the customer can use the MPS to map out the pathway the trucks will need to take to reverse into the crusher safely. If needed, the customer can map out multiple unique crusher missions within the MPS, each with its own designated travel path and specific speed characteristics.

Within the map of their site in the MPS, the customer can nominate the “operating area” which will determine the scope of the CGS’ influence. Within this area, the customer will also designate the “staging area”, which is where the CGS is activated. From this area, the customer will then plot out the reversal path that trucks need to follow to reverse safely into the crusher. When operators enter the area and navigate onto the path, they will be notified via audible chime and visual cues to remove their hands from the wheel as the CGS will then be in control.

The reversal pathway is comprised of two sections: the forward motion and the reversal motion. The forward motion is when the system is steering the trucks so they are properly aligned with the crusher. Once this motion has concluded, operators will need to put the trucks in reverse

so that the reversal motion can begin. Towards the end of the reversal motion, the CGS will alert operators – via audible chime and visual cues – when the guidance system has completed the mission successfully. After completion, operators will be advised to place the truck in neutral and set the handbrake. The CGS will then advise via visual indicator that it is fine to dump the trucks’ load.

Using the CGS helps to reduce the risk that the trucks may be damaged during the reversal process while also decreasing cycle times. This in turn will allow for increased productivity on site and reduced stress for the operators.

Installation and integration

Liebherr’s Trolley Guidance System and Crusher Guidance System are available for the T 264, T 274, and T 284 mining trucks and have been extensively field tested to ensure their efficacy when used in customers’ mining fleets. Both of these Assistance Systems are designed to serve as individual solutions to specific inefficiencies within a mine or to serve as a combined solution for multiple mine challenges.

Liebherr’s Assistance Systems can be retrofitted into trucks that are already operating on site. And if a truck already has one of these Assistance Systems installed, a second one can be installed later in the life of the machine. An additional kit can be provided with the harnesses and sensors necessary for the new system to work alongside the system already installed.

This impressive technology is ready to be integrated into Liebherr mining trucks to ensure that customers can make the most out of their equipment while also ensuring the safety and wellbeing of their staff.



**Proven design.
New format.**



Five quick questions about the T 274 with Derek Alband



We sat down with Derek Alband, General Manager of International Sales for Mining Trucks at Liebherr Mining Equipment Newport News Co. to learn more about Liebherr's latest mining truck.

1 What features make the T 274 the best in its class?

The T 274 is a true 305 tonne mining truck offering the largest payload capacity in its class, moving more tonnes each hauling cycle than the competition. The T 274 is powered by the most powerful engine in its class – 2,720 kilowatts – and by the Liebherr Litronic Plus AC drive system. The T 274's engine and drive system, combined with the truck's advanced hydraulic design and fast cycle times, means that this machine can move more material in less time.

2 How does the T 274 contribute to Liebherr's vision for low and zero emission mining?

Not only does the T 274 have excellent fuel efficiency to begin with, but it is available with a Tier 4 engine and with the Liebherr D9816 engine, which is now compatible with hydrotreated vegetable oil. The T 274 can also be used on trolley – like our other Liebherr trucks – with our Trolley Assist System. Trolley systems are an existing solution for our customers on the road to low carbon and zero emission mining.

Liebherr has an impressive track record with trolley technology and actually holds two trolley world records: the world's largest ultra-class trolley truck fleet, made up of more than 50 T 284 trucks; and the world's longest trolley line, measuring five kilometres.

3 Is the T 274 equipped for automation?

Liebherr's vision for machine automation follows our philosophy of open and interoperable autonomy platforms. We want to give our customers the freedom to choose their preferred combinations of equipment, onboard autonomous solutions, and central control platforms. Our open protocol – included in all of our mining trucks – allows these machines to integrate with our own Liebherr autonomous solutions or with third-party solutions. The benefit of the Liebherr autonomous solution is that ours includes the latest generation perception system and onboard robotics and so is less dependent on site infrastructure and centralised supervisory systems.

4 What about what's inside the truck? What sets the T 274 apart from similar models?

All Liebherr equipment follows our vertical integration approach, making use of the expertise and developments of different Liebherr product segments so that our equipment can always reach its full potential. The T 274 is no different and is now available with the Liebherr D9816 engine. The ability to integrate Liebherr engines into Liebherr trucks means that we can provide a complete Liebherr powertrain for all of our mining trucks, including the T 274, as well as a single point of contact for our customers. Another benefit of the T 274 is that its frame and drive systems are the same as those used in the T 284 truck, which has a higher payload capacity than the T 274. Because the T 274 carries a lighter payload than the T 284, the frame and drive systems should have a much longer design life than other trucks in this class.

5 Will data-driven insights and analytics be available for the T 274, and other Liebherr trucks, like they are with the Liebherr excavators?

Assistance Systems and Onboard Analytics are also available for Liebherr trucks. These will help operators during their daily activities and provide the mine with machine insight in order to optimise the availability of the truck. We have released two unique Assistance Systems: our Crusher Guidance System and our Trolley Guidance System. Both are semi-autonomous products that automate a portion of the operator's role. The Crusher Guidance System aids operators as they reverse into a crusher. The Trolley Guidance System supports operators with getting on, staying on, and disengaging from a trolley line. We will continue to expand both our Assistance Systems and Onboard Analytics for Liebherr trucks – alongside the products developed for excavators – with comprehensive suites that support manned and unmanned operations. These suites will eventually include products such as onboard Operational Excellence, Operational Awareness, Asset Health, and Operational Analytics.

A new perspective on mining

Liebherr tower cranes – with their ability to withstand extreme temperatures, high-speed winds, and high altitudes – are perfect for the often harsh conditions of a mine site. Tower cranes can even be used in earthquake prone areas! The masts of tower cranes can flex back and forth to absorb the kinetic energy produced by an earthquake, allowing the machines to withstand these natural disasters.

Tower cranes can be installed to build key mining structures like flotation cells and crushers and then left in place to maintain those structures for over 30 years! The main advantage of these cranes over other forms of lifting machinery is their reach, which allows these machines to service a considerable area of a mine site.

And news of the benefits of Liebherr tower cranes is spreading.

Demand for higher capacity towers cranes on mine sites has increased dramatically in the past decade. Ten years ago, the biggest tower crane in a mine was 630 metre tonnes. Now, Liebherr has tenders in place for tower cranes as large as 4,000 metre tonnes!

Liebherr's tower cranes can offer reductions in operational costs, spare parts consumption, and energy use. Not to mention, these cranes can cover two cycles with just the one machine. No wonder these machines have shown themselves to be the most economical choice for construction and maintenance on a mine site when compared to other machinery used for the same tasks!





Discover the new PR 766 G8!

Liebherr's latest mining dozer, the PR 766 G8, made its sales debut at the 2022 Bauma exhibition. As one of its latest product offerings, Liebherr Mining wanted to share some of the dozer's most interesting features.

1 The PR 766 G8 is available in high drive.

Liebherr is one of only two original equipment manufacturers that offers hydraulic dozers in high drive – a running gear particularly well-suited to heavy-duty mining applications. The elevation of the final drive makes high drive the optimal choice for the rocky terrain of many mine sites. The raised position of the final set of gears in the drivetrain protects the mechanisms from the dirt and damage that harsh terrains may cause. Further, keeping the final drive at a distance from the terrain helps to reduce wear on the bearing bushes and sprockets.

Another benefit of high drive is that the guide wheels and track rollers help the running gear to better adjust to the terrain by absorbing the increased shock on these mechanisms and maintaining excellent track chain traction.

2 The PR 766 G8 is the only dozer with hydrostatic drive in the 50 tonne class.

Machines using hydrostatic drive can help customers to reduce both their fuel and maintenance costs. In the PR 766 G8, the hydrostatic drive can maintain the engine at a constant speed of ~1,600 rpm by synchronising the drive components and Liebherr's intelligent engine management system. This constant engine speed helps the engine to only burn fuel that is absolutely necessary and so this increases the fuel efficiency of these dozers by 20%.

The hydrostatic drive also replaces high-wear items such as clutches, service brakes, and manual transmissions with a configuration of flexible hoses, hydraulic pumps, and motors. Because the components of hydrostatic drive are essentially wear free, they are uniquely suited to working in harsh conditions and require little to no maintenance. This reduces the maintenance costs of the PR 766 G8 as well as the downtime of the dozer.

3 The PR 766 G8 is fitted with maximum ECOmomy.

As this dozer is part of the latest generation of mining equipment, the ECO function comes standard. This function allows operators to alternate between high performance and maximum economy driving options, depending on the task and terrain at hand. The ability to choose between these two options can help customers to increase their fuel savings when the dozer is working in light to medium applications.

4 The PR 766 G8 offers increased operator safety and comfort.

The updated design of the PR 766 G8 means that operators have increased visibility from all directions. The rounded edges, sloping sides, panoramic glazing, and minimal cab profile provides an uninterrupted view of the surrounding terrain, ripper, and blade to increase the safety of those working on and around this machine. The work area of the PR 766 G8 is also illuminated by LED lights to increase visibility in situations where light is limited, for example during night shifts or inclement weather.

To ensure operator comfort, the workstation in the PR 766 G8 is arranged so that operators can set the controls for the traction drive, blade, and ripper to be as ergonomic for their personal needs as possible. The joystick used within the workstation has also been designed for ergonomics, and provides operators with the most comfortable hand position during operation.





The world of Liebherr

A taste of the wider world of the Liebherr Group



Components

CO₂-free drive in off-road use

Construction sites at high altitudes, and/or those that have dusty air or strong shocks and vibrations, push electrically powered construction machines and cranes to their limits. This is where hydrogen internal combustion engines (ICE) make it possible to work without CO₂ and achieve goals in line with the 2015 Paris Agreement – even for heavy-duty applications. At Bauma 2022, Liebherr's latest hydrogen engine celebrated its world premiere in the R 9XX H₂ crawler excavator.

Hydrogen (H₂) is a very special type of fuel. It is the most abundant chemical element in the universe and has a high energy density. Therefore, hydrogen represents great hope on the road to reducing global greenhouse gas emissions. It is an energy source definitely worth investigating. And that's exactly what the engine development team at Liebherr-Components is doing in the Swiss town of Bulle. At Test Bench 54 for diesel and H₂ engines, the team led by Dr. Bouzid Seba, Head of Combustion Engine Pre-development, has carried out the company's latest project: a hydrogen ICE with direct H₂ injection. The hydrogen ICE was installed onto the test platform and connected to a tangle of cables, strings, and hoses that continuously send data about the engine's operating conditions, emissions, and performance to the control station.

Hydrogen from renewable energy sources has long been seen as a beacon of hope for a carbon-neutral energy supply.

"Again and again, hydrogen seemed to be on the verge of a breakthrough as an infinite source of energy, only to disappear again into oblivion," explains Seba. However, the tables have turned, leading to a reassessment in the politics surrounding hydrogen as an energy source, especially in the construction machinery market.

"Wherever batteries or fuel cells reach their limits, hydrogen ICEs can be the solution. This is primarily the case in applications where the engine is exposed to strong vibrations or where there is a lot of dust and dirt. This mainly concerns mobile construction machinery like crawler excavators, but also heavy-duty vehicles."

The engine engineering team in Bulle is currently examining different injection and combustion technologies for hydrogen ICEs. Liebherr's decades of experience with diesel and gas engines helps to boost their development. The mechanics, crankshafts, bearings, and turbochargers do not have to be developed from scratch, a fact that greatly shortens the time prior to intensive field testing.

This experience becomes particularly obvious in the latest cooperation between Liebherr Machines Bulle SA and Liebherr-France SAS in Colmar for the development of the R 9XX H₂, a 50 tonne crawler excavator equipped with the hydrogen ICE. Henrik Weitze, Project Manager at Liebherr-France SAS, has worked closely with Seba's team for many years. Weitze sees the newly-designed hydrogen ICE for the R 9XX H₂ as predestined for use on construction sites at extremely high temperatures, under shocks, or in the particularly dust-intensive environments typical of earthmoving or quarries.

"Like all our crawler excavators the R 9XX H₂, with its alternative drive, meets the highest quality standards under extreme conditions," explains Weitze.

Keeping this in mind, the engineering team in Colmar designed the machine with the latest Generation 8 crawler excavator technologies as the basis.

"The overall performance is in no way inferior to the diesel version, be it power output, engine dynamics, or response during dynamic load changes," explains Weitze. "The only difference is the refuelling process. Special infrared communication between the excavator and the filling station makes it both fast and safe."

The hydrogen ICE developed for the R 9XX H₂ in Bulle is based on port fuel injection (PFI).

"The accuracy and quantity of hydrogen injection is an essential requirement for heavy-duty ICEs," explains Seba.





“The overall performance is in no way inferior to the diesel version, be it power output, engine dynamics, or response during dynamic load changes.”

Henrik Weitze
Project Manager

Dr Bouzid Seba (left) and
Henrik Weitze (right).

“To align the performance of an H₂ engine to that of a diesel engine, the system has to be able to guarantee the different requirements in terms of flow and injection accuracy,” Seba continues. “Hydrogen gas has a low density, which requires large valve cross-sections in the injector. We were able to combine different components to control pressure and flow rates.”

Following PFI, direct H₂ injection developed by Liebherr will be tested in terms of performance in particularly dynamic heavy-duty applications.

“During our tests, we aim to gather large quantities of input data from the operating conditions of the H₂ engine,” explains Seba.

The developers can follow the engine performance in real time and make adjustments and optimisations simultaneously. Thanks to digitalisation, the speed of development is significantly faster today than even a few years ago.

“Before the engine even gets to the test bench, we can use simulations to evaluate it under different operating conditions and incorporate their effects into the engine architecture right away,” Seba continues.

Weitze thinks that Liebherr is on the right track towards making a relevant contribution to the company’s climate goals. The European Green Deal, which aims to make the European Union (EU) climate neutral by 2050, is also setting the course for the development team. As early as 2030, CO₂ emissions are to be reduced by at least 55% as compared to 1990 emissions.

“That’s a tight deadline, but we will [make it],” Weitze says. “Until then, it is important to never lose sight of the goal, even when things get tough along the way.”

The engineering team in Bulle intends to start serial production of the H₂ engine by 2025.

Striking the right tone

More and more crawler cranes and deep foundation machines from Liebherr-Werk Nenzing GmbH (Nenzing) in Austria are being made available in “unplugged versions”. These unplugged versions can be used wirelessly with a battery – with the same power as a conventional drive. Michael Flecker – Head of Sales for crawler cranes – and Sascha Bechter – Head of Sales for deep foundation machines and material handling equipment – know why both types of drive complement each other perfectly and why each has its own justification.

It can be said that Michael Flecker grew up with Liebherr crawler cranes. At the very least, they have had a massive influence on his professional life. He first came into contact with crawler cranes in 2005 when he started his career at Liebherr as an international fitter – and he has remained loyal to them ever since. Since April 2022, the Vorarlberg native has been the Head of Sales for crawler cranes in Nenzing.

Flecker has previously seen a lot of the world and was, among other things, customer service manager at Liebherr USA in Houston for several years. There he helped to build up the crawler crane product segment based on feedback from customers. He was also up close when the first unplugged crawler cranes came onto the market at the end of 2020. The Liebherr unplugged machines were launched in 2019.

“Demand for electric construction machines is particularly high among customers in northern Europe – led

In addition, they are very quiet and therefore ideal for urban areas – an advantage for both residents and construction site workers.

“Five unplugged machines are as loud as one diesel-powered machine.”

Michael Flecker
Head of Sales for crawler cranes

“Five unplugged machines are as loud as one diesel-powered machine,” Flecker explains.

The battery-powered machines achieve the same performance as the diesel versions and are identical in their operation. Another advantage of Liebherr

products is the complete package of drive concept and machine, because unlike its competitors, Liebherr offers both from a single source.

The unplugged series also strikes the right tone with new customers.

“Many customers choose our battery-powered machines because they believe in the technology and want to be the first to use it in their market,” explains Flecker. “In some countries, this is actually a distinct competitive advantage.”

However, even though unplugged construction machines have many advantages, they are not best suited for every use or application. That’s why all unplugged units in Nenzing remain available with conventional drives.

by the Scandinavian countries and Great Britain, which are pioneers in the field of zero emissions,” Flecker explains. In the meantime, Liebherr’s unplugged machines are available in many other countries, for instance Germany, France, and the USA. Cities such as Oslo, for example, have clearly defined climate targets. By

2030, CO₂ emissions there are to be reduced by 95% compared with 2009 levels. This means that as early as 2025, only emission-free construction machinery will be used in urban areas.

A clear advantage of the unplugged series is that the battery-powered units do not cause CO₂ emissions on the construction site.



Sascha Bechter (left) and Michael Flecker (right).



“Together with the customer, we decide individually which drive technology is right for the customer, the construction site, and the application.”

Sascha Bechter

Head of Sales for deep foundation machines and material handling equipment

“Together with the customer, we decide individually which drive technology is right for the customer, the construction site, and the application,” adds Bechter. The 48-year-old is a true Liebherr veteran. He started his career at Liebherr more than 30 years ago as an operational electrician in Nenzing, before being drawn to Liebherr’s international companies in the USA, Great Britain, Italy, and Singapore for many years.

“I have never worked for any company other than Liebherr,” says Bechter.

That’s why he knows Liebherr construction machines and their applications in the field particularly well – and can judge which drive type suits which customer. Construction sites in rural or remote areas, for example, are typical applications where conventional drives are more suitable.

This is because these places do not usually have the infrastructure needed for electric machines. Diesel-powered machines are sometimes also more suitable in the early stages of a construction project or for short-term assignments, because the necessary charging infrastructure for the electric motors is often not available when a construction site is first set up. Flecker and Bechter agree that all types of drive have their justification. That’s why Liebherr takes an open approach to technology, where every customer gets what is best suited to them and their construction site.

2019

With the LB 16 unplugged, Liebherr introduces the world’s first large drilling rig with a battery-electric drive.

2020

World premiere: Liebherr launches the first battery-powered crawler cranes: the LR 1200.1 unplugged and LR 1250.1 unplugged.

2022

Another product area from Nenzing is electrified with the LRH 200 unplugged and LRH 100.1 unplugged piling rigs.

Highlights from other product segments



Gear technology and automation systems

Liebherr Academy's "Gear Technology" goes digital

Everyone is talking about digital learning, but Liebherr is doing it. Training courses on topics related to gear cutting technology now also take place as interactive live online training courses. Participants can connect from anywhere and – if required – can also receive virtual training on the modern, fully equipped machines in Liebherr-Verzahntechnik's Machine Training Centre. During the training session, the trainer can display the controls and the workspace of the machines via several cameras. Because the training sessions are conducted with smaller learning groups, interactive learning dialogue with the trainers is easier to facilitate.

Maritime cranes

New mobile harbour crane product line

The Liebherr mobile harbour crane series is gearing up for the future. The new LHM is equipped with additional digital features, even greater efficiency, and a modern design. A new crane control system, extended sensor integration, and digital information transmission enable future assistance and semi-automatic systems. In addition, the Liebherr Pactronic hybrid system and the cab were improved according to customer needs.



Aerospace

First complex 3D printing for Airbus

Liebherr-Aerospace began serial production of 3D-printed parts in 2019. After the 3D-printed proximity sensor bracket for the nose landing gear of the A350 was successfully certified and delivered, Airbus and Liebherr have decided to launch a more complex component for the same aircraft: the lower cargo door actuator and valve. The complex valve is manufactured using additive layer manufacturing. This is evidence of the joint commitment of both companies to introducing pioneering innovations.

Transportation systems

New air-free brake system for Siemens

In close cooperation with Siemens Mobility, Liebherr has developed a compact, closed, electro-hydraulic brake actuator. It contains all the components necessary to build up and release the brake force as well as those required for local control and all components meet the highest safety requirements. Siemens Mobility is implementing the new brake technology for the first time in the “X-Wagen” metro project in Vienna, Austria. This means that the company Wiener Linien – Vienna’s public transport operator – is the first transit authority in the world to benefit from this brake system for both in conventional operation with drivers, as well as on the new, fully automated U5 line.



Hotels

Expansion of the Löwen Hotel Montafon

Since March 2022, extensive construction work has been underway at the Löwen Hotel Montafon in Schruns, Austria, where an extension is being built. “Haus Montafon” offers twenty-three additional rooms, an expanded gastronomy area, and four conference rooms with a breathtaking backdrop and will be gradually put into operation by the beginning of 2023. But the highlight of the expansion awaits in the basement. The “Löwengrube” will be reopening its doors in a cosy setting with a dapper, snug atmosphere. From 1974 to 2003, the legendary dance hall was known far beyond the country’s borders: Udo Jürgens opened the club with Greek wine and the young Falco also rocked the whole of Schruns in the Löwengrube.

Refrigerators and freezers

The BluRoX revolution

In 2022, Liebherr-Hausgeräte introduced its new and unique vacuum perlite technology, BluRoX. BluRoX technology makes it possible to manufacture freezers in the top energy efficiency classes for the first time. Perlite is a volcanic rock that is used to stabilise the vacuum body. It is also recyclable and can be reused without major processing. Since January 2023, the FNb 5056 hybrid device – the door of which is equipped with the patented BluRoX technology – has marked the start of this revolution. It will be the first device of its kind in the world to bear the “B” efficiency class rating according to the EU energy labelling legislation.



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