
Our complete approach to climate protection and the environment

LIEBHERR

Liebherr-Werk Ehingen GmbH



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The energy transition is moving forward, climate protection is on everyone's lips. And we are helping to shape the change: whether through our products, in building management or in plant traffic – there are many small and large examples of environmental protection at Liebherr in Ehingen. In addition, our products are used all over the world to preserve our environment for future generations – for example, through the construction of wind turbines.

More and more cities and regions are focussing on local emissions reduction and climate neutrality. We are also developing our business with this in mind. And one thing is certain: we all have to do our bit, whether as consumers or producers.

In our role as a company, we are faced with important decisions. We know that environmental and climate protection must not come at the expense of performance, efficiency and quality, but that these aspects must be in harmony with each other. We therefore build cranes that deliver reliable performance across a wide range of applications. Our technology diverse approach aims to fulfil customer needs and environmental requirements in the best possible way.

We view progress and innovation as evolutionary processes, which is why we are researching and developing in different directions. Whether crane functions such as ECOmode and ECOdrive for reduced fuel consumption, advances in light-weight construction or refuelling with synthetic fuels – we are embracing the future with an open approach to technology. We want to push for a maximum reduction in emissions.

In a world where climate change affects us all, taking responsibility for society and the environment is not a choice, but an obligation. Liebherr is committed to sustainable innovation and combines technology with environmental protection. Together we are shaping a future fit for our grandchildren.



Daniel Pitzer

Dr Ulrich Hamme

Christoph Kleiner

Ulrich Heusel

Environmental protection concepts – our long standing commitment

Reduced CO₂ emissions through technical progress

Climate protection at the touch of a button would be a great thing. Unfortunately, however, the technology shift from fossil-fuelled combustion engines towards sustainable, CO₂-free or at least CO₂-neutral drives is not yet in sight. And certainly not for all the various types of construction machinery. In order to develop new drive concepts, many different skills are required.

Lightweight construction

The progress we have made in terms of lightweight designs is an important point. Today, we achieve at least the same performance from a crane which weighs significantly less than previously. An example of this is that our current 5-axle LTM 1250-5.1 crane can hoist loads which, just a few years ago, had to be handled by the 6-axle LTM 1250-6.1. This means that a crane weighing 60 tonnes rather than 72 tonnes now drives to the site (with a maximum ballast of 148 rather than 169.5 tonnes).

LTM 1250-6.1



2005–2015



LTM 1250-5.1

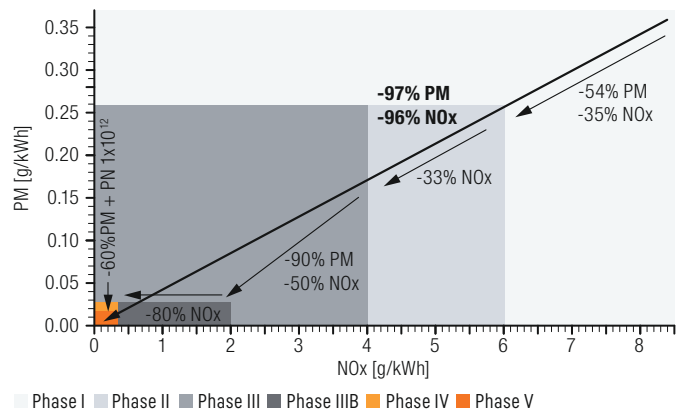


since 2016

Within just ten years we have reduced the weight of the LTM 1250 by around 15 per cent. This results in a corresponding reduction in fuel consumption and CO₂ emissions while the crane is on the road and on site. This reduction for a 250-tonne crane also applies to all other crane models. Furthermore, these savings can be extrapolated to a time period of 30 years – representing an extremely significant reduction in the volume of CO₂ emissions!

Engine exhaust stages

Liebherr has been building its own diesel engines for 40 years. In recent years, enormous progress has been made with regard to exhaust emissions (incrementally, in response to ever stricter legal requirements). For example, emissions of particulate matter (PM) and nitrogen oxides (NOx) have been gradually reduced by over 95 per cent over the last 20 years.



Emissions of particulate matter (PM) and nitrogen oxides (NOx) have been reduced by over 95 per cent in increments over the last few years.

ECOMode and ECOdrive

We launched ECOMode and ECOdrive around ten years ago. When operating the superstructure, ECOMode ensures up to ten per cent less fuel consumption and reduced noise emissions. The optimum speed is calculated to achieve this. ECOdrive makes efficient use of torque on the road and reduces fuel consumption by around five per cent when driving.

Continuous optimisation and helpful tips for crane operation



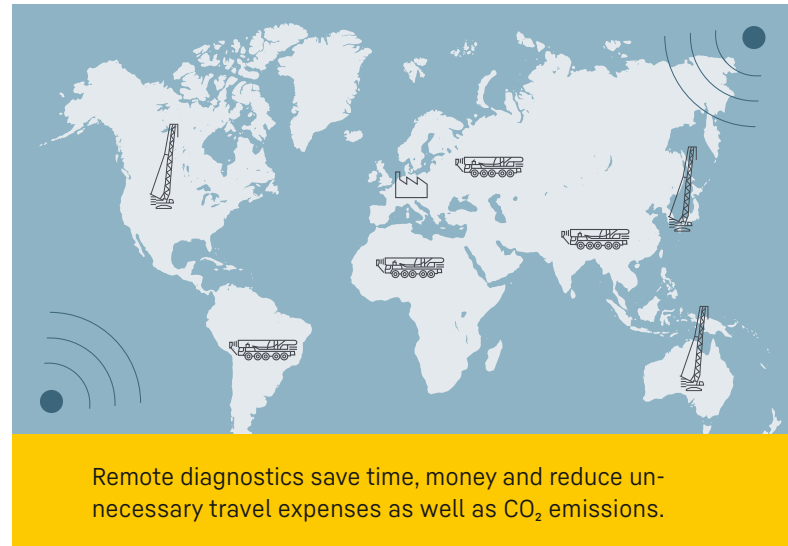
Remember to switch off of the motor during lifting pauses

The motor can be easily switched off using the specially developed motor stop button in the crane cab, but the controls will remain active. This saves fuel and thus reduces CO₂ emissions.



No travel expenses, no fuel consumption

Is the error light blinking? Instead of sending a technician to the site, a service representative connects to the crane control via the mobile phone network. Targeted fault diagnosis through remote diagnostics increases the crane's uptime. Furthermore, it saves time, money and reduces travel expenses.



Use organic hydraulic oil

Our organic hydraulic oil is an ash-free, biodegradable, high-performance hydraulic fluid. It is particularly suitable for use in environmentally sensitive areas.



Ensure optimum tyre pressures

Improved rolling friction minimises fuel consumption and thus reduces CO₂ emissions.

By the way, we offer a tyre pressure monitoring system for our LICCON3 cranes to make it easy to monitor the optimum tyre pressures.



Use HVO instead of diesel

The higher the proportion of HVO in the fuel mixture, the greater the CO₂ reduction. To achieve the maximum possible CO₂ reduction, the crane must be powered permanently using pure HVO.



Open to diverse technology: drivetrains and alternative fuels

The key to reducing greenhouse gas emissions lies in electricity generated from renewable sources. This is the basis for climate-neutral e-drives, and for the production of eFuels and green hydrogen.

Many of our cranes, which are needed to enable the energy transition, are designed for high power requirements and continuous operation, and are therefore based on a fossil-fuel drivetrain. As this makes them significant CO₂ emitters, we have accelerated the development of low-emission and emission-free technologies in our product range and made considerable progress in this area.

Indeed, perhaps it is not the engines which require modification, but rather the fuels. Perhaps we do not need to make too many changes to the drivetrains, but should simply use different fuels in them. The biggest challenge is storing fuel on a crane. Currently, of course, we have a diesel tank for this purpose. If other forms of propulsion are used, for example based on hydrogen, the relevant special features such as weight, volume and temperature must be taken into account.

Liebherr is involved in the **eFuel alliance** – together with over 135 members – which works to promote the production and broad acceptance of eFuels as an alternative, climate-neutral fuel.



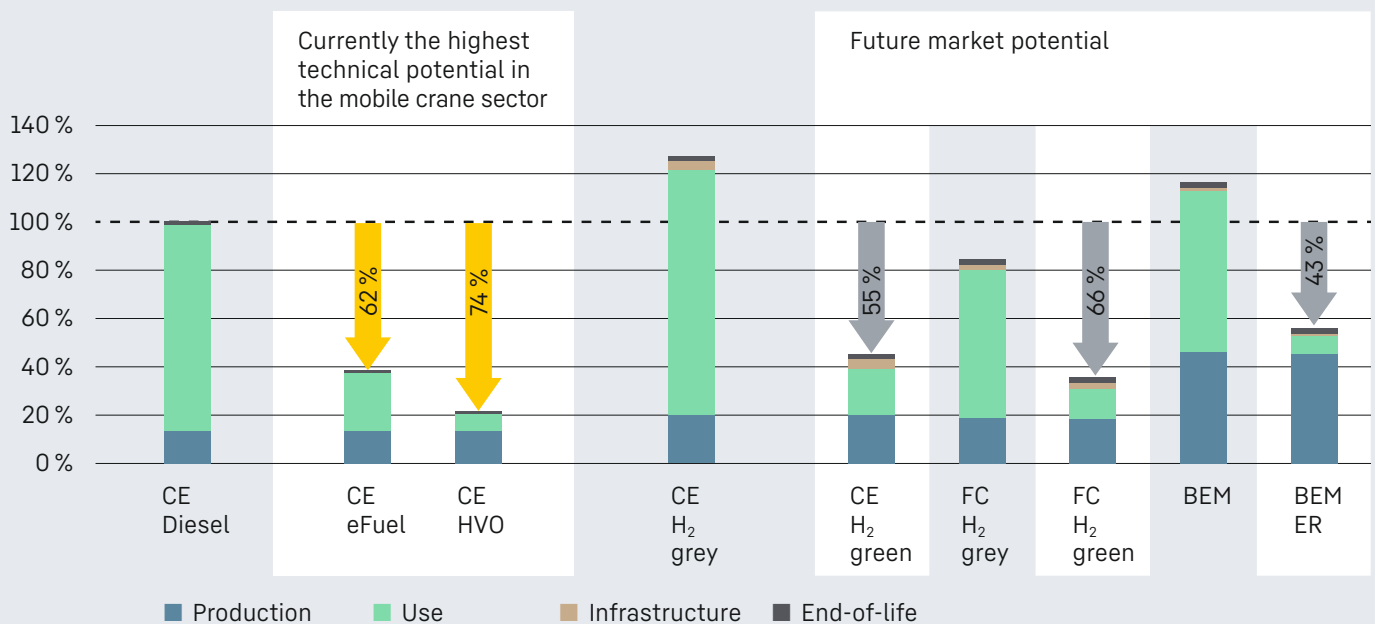


“In order to properly assess alternative drives for mobile cranes from an ecological perspective, the entire life cycle must be analysed.”

Dr Ulrich Hamme
Managing Director Design and Development

Based on an LTM 1160-5.2, we compared different drive types in terms of CO₂ emissions over the entire life cycle. An internal combustion engine fuelled with diesel (B7) served as a reference point. The analysis has shown that we are currently achieving the greatest CO₂ savings with HVO. However, the use of eFuels can also make a significant contribution to reducing emissions. In a fictitious future scenario based on green hydrogen, emissions could be reduced by far more than half. The situation is similar with a fuel cell drive. And with a battery-electric drive – based on 100 per cent green electricity – CO₂ emissions can be reduced by over 40 per cent. But even if this electricity mix were possible today, HVO is currently the best option for our mobile cranes.

Comparison: CO₂ emissions by various types of power unit (example: LTM 1160-5.2)



CE = combustion engine, FC = fuel cell and electric motor, BEM = battery and electric motor, ER = electricity from renewable energies

We are HVO-ready



Hydrogenated vegetable oils (HVO) are an exciting alternative to fossil diesel. These are plant based oils which can be converted into hydrocarbons by adding hydrogen. They are mainly produced from vegetable oils and other edible waste oils. So waste oil becomes fuel! As it is possible to adjust the oil's properties fairly accurately, the fuel can be used in various mixtures and even in a pure form. Its use will significantly reduce greenhouse gas emissions.

We also find these fuels extremely promising because we manufacture extremely durable mobile and crawler cranes. Therefore, if Germany and the EU continue to reduce their emission limits in the next few years, older machines with diesel engines will not simply have to be scrapped. On the contrary, in Asia, Africa and South America, these machines will continue to operate for many years, which will also have a positive impact in terms of climate change.

Regardless of whether and how quickly we can equip more machines with engines that reduce CO₂ emissions, the further development of fuels based on hydrogenated vegetable oils or synthetic fuels from renewable energy

sources can make a valuable contribution to reducing global emissions of greenhouse gases. At present, it is simply not possible to make the process any faster or more effective than through the use of HVO!

Highlight

For a 5-axle mobile crane, **CO₂ emissions are reduced by 74 per cent** compared to diesel fuel if pure HVO is used on a permanently basis, assuming that the entire life of the crane, including its production, is taken into account – i.e. “cradle to grave”.

Diesel B7
|
-74% CO₂
↓
HVO

“We have made our entire mobile and crawler crane fleet HVO-ready. Our cranes have already undergone extensive testing and trials.”

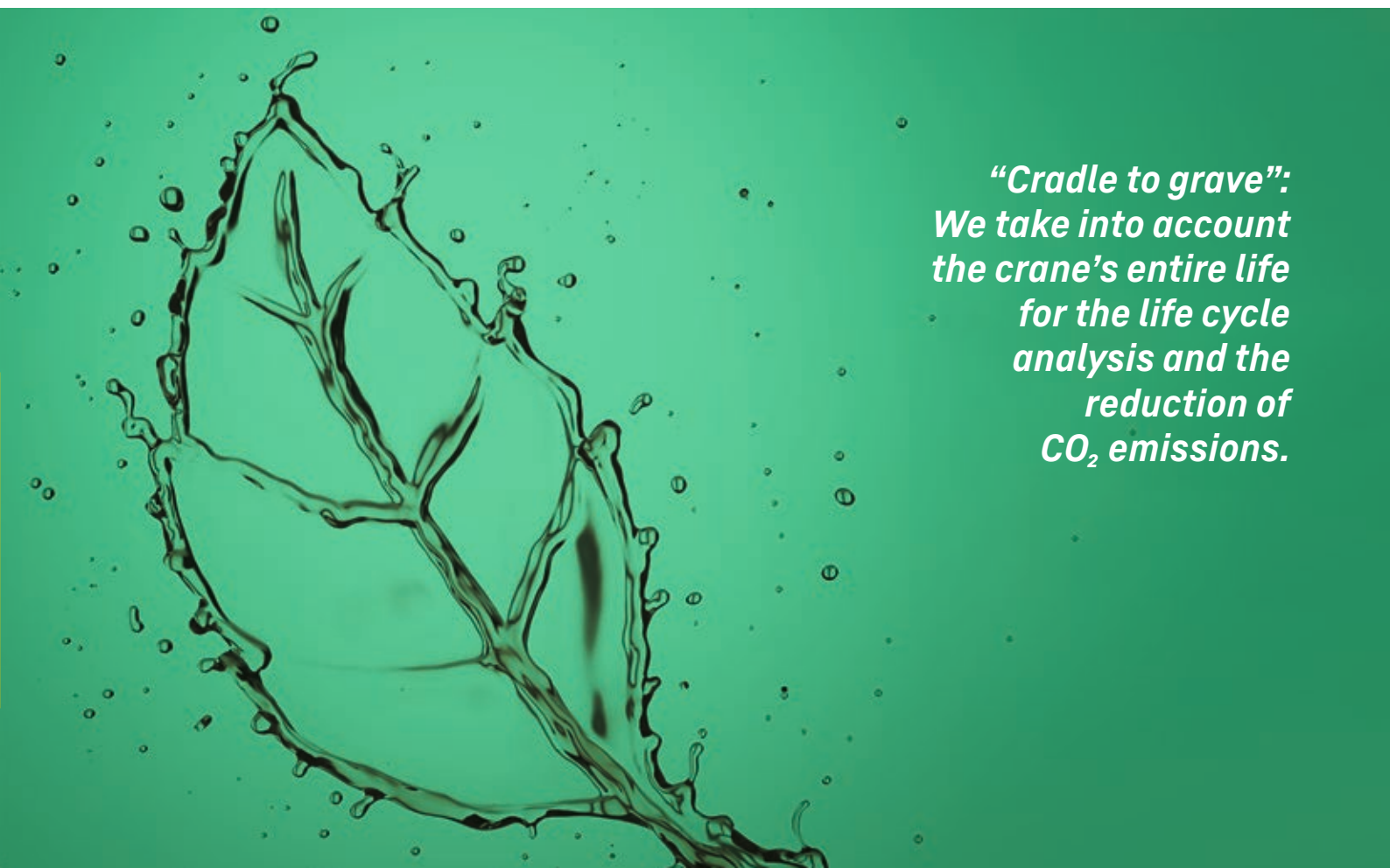
Phillip Federle
Head of Crane Vehicles Department



To make HVO or other synthetic fuels attractive for our customers, they must be available nationwide and in plentiful quantities at filling stations, as is the case today with diesel. This will not be possible overnight. But we are making a start.

As an aside, since September 2021, we have been fuelling our mobile and crawler cranes at the Liebherr plant in Ehingen exclusively with pure HVO. This is used for the crane acceptance procedure and test drives as well as the first tank of fuel before delivery.

***“Cradle to grave”:
We take into account
the crane’s entire life
for the life cycle
analysis and the
reduction of
CO₂ emissions.***



Zero emissions, full power

The new version of the LTC 1050-3.1 features an additional electric motor to power the crane functions.



Electric motor

Customer benefits, working practice and economy go hand-in-hand with global and local environmental protection. We have developed a new version of our compact crane – the LTC 1050-3.1E – to reduce greenhouse gas emissions and thus meet the “Local Zero Emission” requirements, especially in cities.

As an all-rounder, this crane still has a conventional combustion engine, which can be fuelled with HVO or diesel on the road. This also applies to crane operation. Alternatively, its additional electric motor for crane operation enables emission-free working, for example inside buildings. For this solution, an additional common gear assembly was installed between the transmission and the pumps. The electric motor was flange-mounted to this.

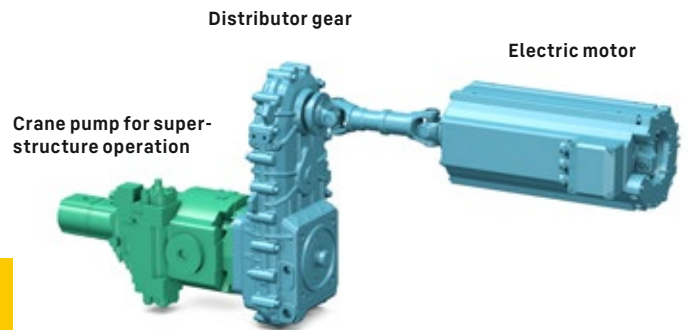
Whether using its emission-free electric motor or its combustion engine to ensure smooth crane operation, all familiar functions remain the same. A 125 A connection is required for the LTC 1050-3.1E to reach maximum performance.

The LTC 1050-3.1E draws the electricity needed for crane operation directly from the site. Alternatively, it can also be connected to a stand-alone power source, for example a battery-based energy storage system such as the Liduro Power Port from Liebherr.

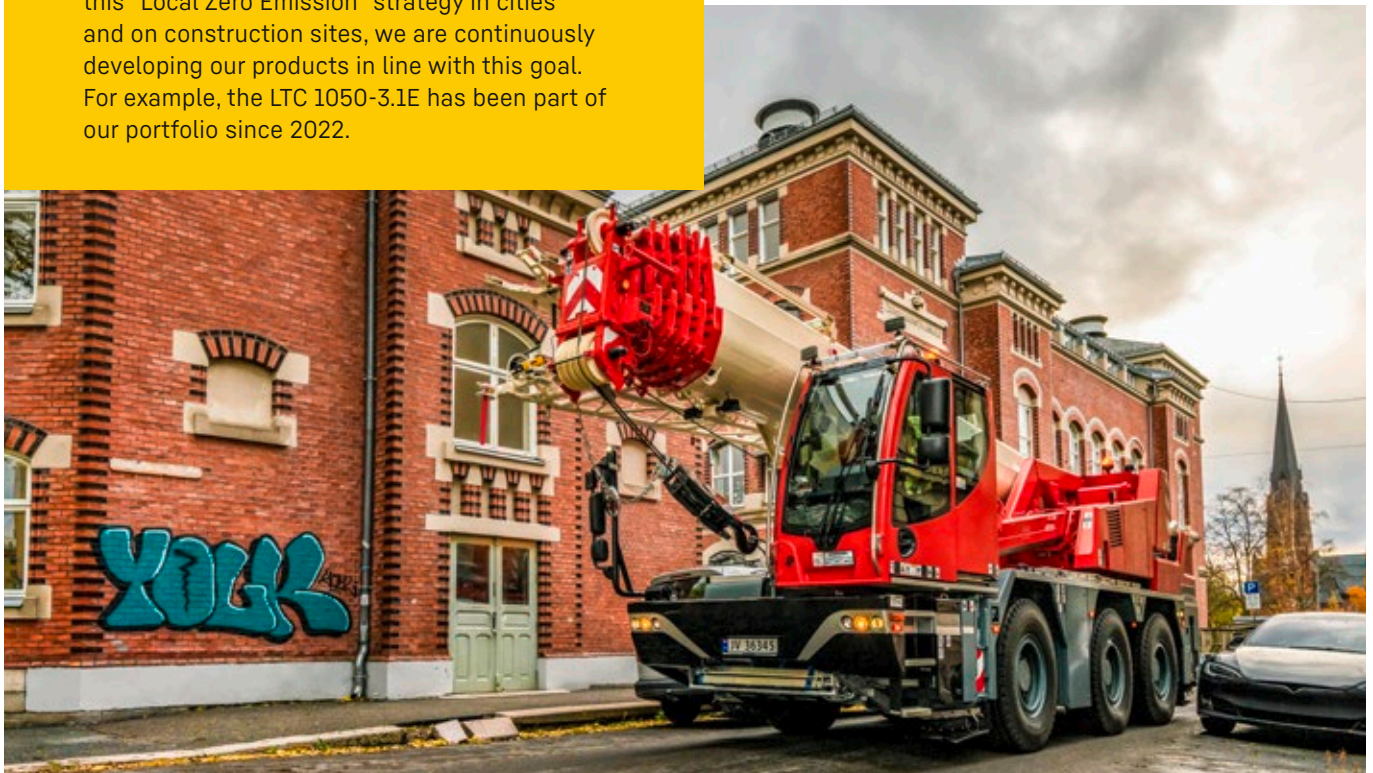
Via this solution, we ensure that the hybrid LTC 1050-3.1E can continue to be used as a flexible and economical “world crane” at all locations.

Your benefits:

- Maximum reduction in CO₂ emissions in crane operation (CO₂ emission-free crane operation with electric motor)
- Up to 65 per cent lower noise emissions during crane operation using the electric motor
- Full performance with a 125 A power supply, reduced performance with 63 A
- Use of HVO possible
- Power supply possible via power storage system / battery packs (for example Liduro Power Port)
- Maximum flexibility by quickly changing between diesel-hydraulic and electro-hydraulic power



More and more cities and regions are aiming to reduce local emissions to zero in addition to achieving climate neutrality. In the spirit of this “Local Zero Emission” strategy in cities and on construction sites, we are continuously developing our products in line with this goal. For example, the LTC 1050-3.1E has been part of our portfolio since 2022.



Shaping the future through green concepts



Battery

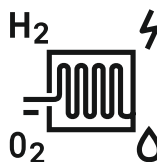
We are also taking a very close look at the development of battery electric drives as part of our “technology-diverse” approach. We have pooled the required technological skills within the Liebherr Group at a “Battery Competence Centre”. This ensures that we are always at the cutting edge of development throughout the entire group of companies.

As the amount of energy in lithium-ion batteries is very small in relation to their volume and weight, and the technology available today offers no potential for universal installation in all-electric mobile and crawler cranes, we are focusing on alternative storage solutions. Instead of drawing power from the grid, external battery packs could also be used as wired power supplies for smaller mobile cranes. Perhaps in the future, the demand for “Local Zero Emission” could also be met for larger cranes through such buffer battery storage systems – for example, the Liduro Power Port developed by our sister company in Biberach.

H₂ Hydrogen

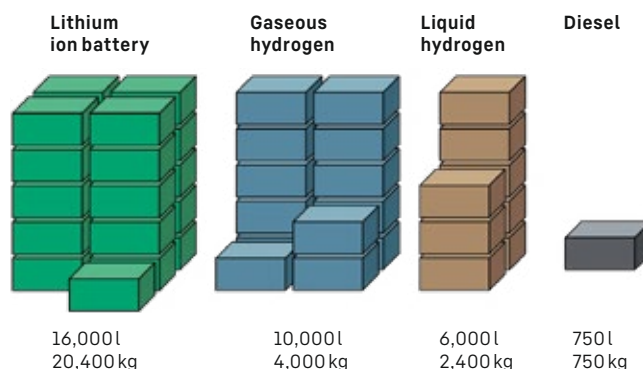
A hydrogen internal combustion engine would actually increase total emissions if we used the hydrogen that is available today, since it is normally produced using natural gas. This makes it a questionable choice from an ecological point of view. So let's imagine the following future scenario: With green hydrogen, we can cut emissions by well over half. A fuel cell gives similar results due to the fact that it uses hydrogen as the fuel. However, this scenario highlights the greater efficiency of this technology.

It remains to be seen whether hydrogen engines have a future or whether hybrid hydrogen engines are a sustainable drive concept. Many concrete and promising approaches are being explored. We remain technology-diverse and consistently monitor the market readiness of new motor developments, as well as their potential adaptations for use in mobile cranes.



Fuel cell

Fuel cell power units are not really suitable for mobile cranes, which experience very uneven stresses and high load collectives. Hydrogen engines may therefore be more interesting. The lack of clarity overall is still so great that it is not currently possible to define any realistic targets. One of the core problems is storing the energy source on a crane. In current crane designs, there is not enough weight or volume available for hydrogen in gaseous form or for liquid hydrogen, which must be cooled to very low temperatures.



Volume requirement and weight of medium including tank for various types of power unit, using the LTM 1160-5.2 as an example.



*Interplay of sustainable solutions:
The MK 88-4.1, the Liduro Power
Port and the LTC 1050-3.1E.*



Durable and valuable

Used cranes from the manufacturer

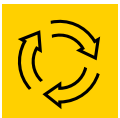
We offer an all-round sustainable solution across all industries with our used cranes. From 30-tonne machines on tyres to large crawler cranes, we are also present in this market with our complete product range. Regardless of where in the world a repurchased used Liebherr crane was last used, it is always first checked at a Liebherr repair centre and its condition is documented before it is sold again.

The customers themselves decide whether and to what extent the used cranes are repaired. The cranes that come to us for reconditioning are between two and 20 years old. Thanks to their high quality, the availability of spare parts and the service we offer on site, they have a considerable resale value – even after decades.



“Quickly available and of proven quality, our cranes are also a sustainable solution for the construction industry.”

Bernd Rechtsteiner
Head of Sales Used Cranes



Reman

Conserve resources with Reman

In order to get our cranes up and running again as quickly as possible, even if a component fails, our remanufacturing programme provides the option to recondition defective parts to OEM quality and reuse them as an inexpensive alternative to new components. Compared to recycling, i.e. the energy-intensive conversion of old goods into raw materials, remanufacturing focuses on the efficient restoration of as many components as possible. This value-added cycle conserves resources and reduces costs. In addition, remanufacturing enables us to guarantee high availability of stocked replacement parts, and thus reliably cover spare parts requirements in times of raw material shortages.

What the future holds

No energy transition without Liebherr cranes

More and more wind farms are being built around the world, both onshore and offshore. Whether loading monopiles at the harbour or erecting wind turbines, our economical and powerful mobile cranes are playing a key role in the energy transition. They are precisely tailored to the needs of the wind power industry and have proven themselves for decades.

To meet the challenge of increasingly powerful turbines and taller towers, we are offering optimised cranes and new boom systems with exceptionally high load capacities.

With a view to future generations, we are investing in innovations that offer benefits both for our customers and the environment.



Environmental protection in and around our plant



At our locations in Ehingen, we have analysed all vehicles that make up the plant traffic. With only a few exceptions, we have been refuelling them exclusively with HVO since September 2021. This enables us to eliminate 6,500 tonnes of CO₂ on our factory premises every year. Since January 2022, we have also been exclusively sourcing green electricity from European wind farms – with the corresponding certification. The electricity from the grid is supplemented by 2.7 megawatts from the photovoltaic systems that have been installed on four buildings at the plant to date. This is yet another milestone on the road to CO₂ neutrality.

Shuttle, app and carpooling

Another aspect of the energy transition that we are tackling at our Liebherr plant is mobility management. One of the challenges is to accommodate the increasing number of employees within a limited parking area. But commuter traffic also plays a role, especially during rush hour. In order to make transport more environmentally friendly, socially acceptable and efficient, we are currently rolling out our employee mobility strategy. With Mobility+, we are working on everything from shuttle services to carpooling to reduce private transport. We are gradually converting the company's vehicle fleet to e-mobility.



“We design new buildings at least to the KfW 55 standard as a matter of principle.”

Jürgen Abele
 Manager for Industrial Services and Construction

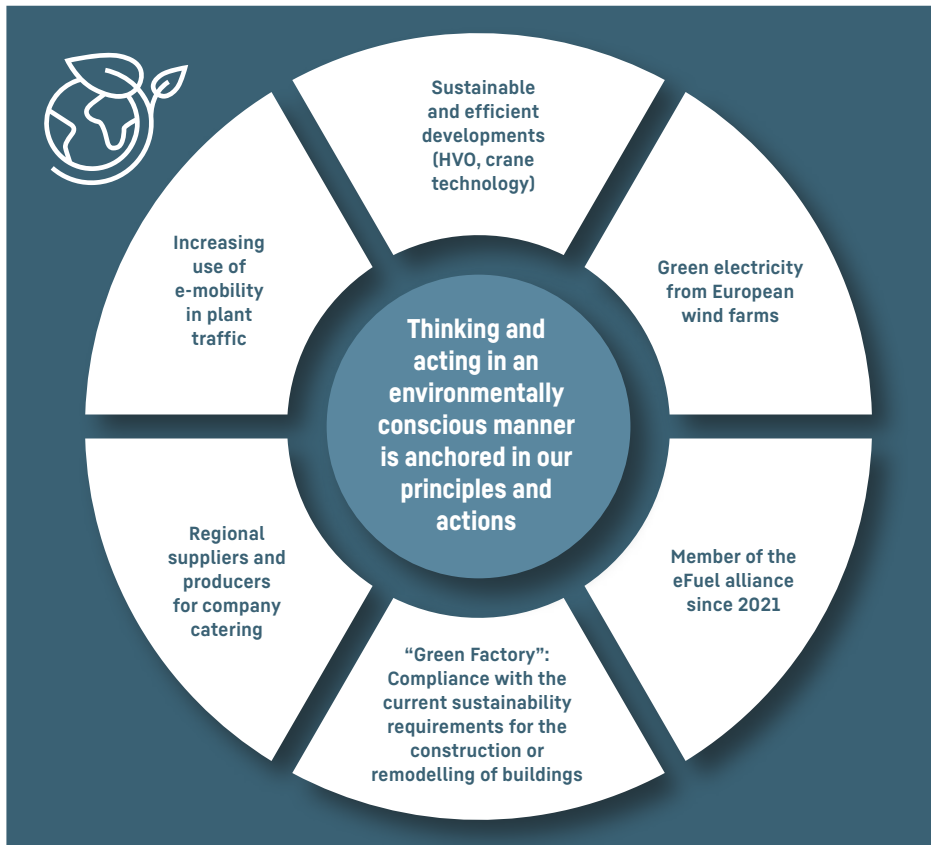
Energy management

As a matter of principle, we construct new buildings – such as our repair branch in Berg – at least to the KfW 55 standard (an indication for energy-efficient houses which require only 55 per cent of the energy of a conventional new building). Additionally, one third of the building’s 12,000-square-metre roof has been planted with greenery. Another third, which is reserved for photovoltaics, is occupied by a 742 kW peak system. And the last third consists of skylights to deliver natural light into the building and reduce the need for artificial lighting.

Regional procurement wins

Whether it’s components for our crane production or supplies for our company catering, we prioritise regional sourcing and short supply chains wherever possible. Whether steel cables from Memmingen, winches from Sigmaringen or cylinders from Oberopfingen, around 140 active suppliers with a total of around 6,000 employees manufacture products for us in Germany and other European countries.

And to provide our employees with a balanced and healthy selection of meals, our canteen at the Ehingen site, for example, prepares around 1,500 meals daily – at lunchtime alone. It has been awarded two lions by the “Schmeck den Süden” network for offering at least six dishes made from ingredients sourced from Baden-Württemberg.



Corporate Responsibility – our strategy



Corporate Responsibility

As part of a globally active family business, we bear a significant responsibility towards wider society and the environment. We are convinced that we can only be successful in the long term if we act in a sustainable and future-focused manner. For us, the term “future-focused” doesn’t just describe a period of five or ten years, but means also keeping an eye on the well-being of the next generation and the generation after that.

The Liebherr Group has developed a comprehensive Corporate Responsibility strategy in order to meet this requirement also in the future. It is designed to promote sustainable and responsible behaviour in all areas of our business activities. In this way, we can help tackle environmental issues and support the communities in

which we live and work. This will ultimately contribute to the long-term success of our company. At the same time, it is also an obligatory task that we have to face as a family business.

Alongside our vision of being an economically, ecologically and socially sustainable family business, our mission statement defines the implementation of our vision based on the following key areas of action:

- Products and services
- Environment and energy
- Employees and society
- Sustainable economic activity

The Corporate Responsibility Policy of the Liebherr Group summarises the understanding of responsibility towards people and the environment. It applies to all Liebherr companies worldwide and defines the Group's goals and commitments in the following areas:

- Responsibility for health, safety and the environment
- Social responsibility
- Sustainable economic activity

Liebherr aligns itself with the ten principles of the United Nations Global Compact regarding human rights, labour standards, the environment, anti-corruption legislation, as well as the Sustainable Development Goals of the United Nations. As a globally active group of companies, Liebherr makes this a reality in a variety of ways.

Our vision of Corporate Responsibility

We aim to be an economically, ecologically and socially sustainable family business that convinces its customers with innovative solutions for challenging tasks – and improves the quality of life of present and future generations through technological progress and responsible behaviour.

