



NACHHALTIG



Sustainable buildings

Design, build, operate
for a promising future

Editorial



Dear Readers,

Buildings are the backbone of our economy. In our corner of the world, modern homes and workplaces are simply unimaginable without secure buildings with the right specifications. We lay the foundations that give our clients just that, creating buildings for people, mobility and goods. But bringing these buildings to life consumes considerable resources.

We accept the huge amount of responsibility that we have in our work and embrace the opportunities that this brings with it. As a family-run business, we always keep the big, long-term picture in mind.

We do our utmost to make our buildings sustainable throughout their entire life cycle. This is nothing new for us. Building with industrially prefabricated system components, which in turn enable us to prevent waste, is an essential part of who we are. Our buildings are designed to be efficient and fit for the future, and they consume far fewer resources during development than buildings built using conventional construction methods.

They are also designed to be particularly energy efficient in operation. In the following chapters, we will tell you all about how GOLDBECK constructs and operates buildings sustainably and how we also ensure more sustainability in the revitalization of existing buildings.

Are we perfect? No. We need to go even further – and that is our objective. That's why our development team strives daily to bring many more bright ideas to life and make our products even more sustainable. The latest sustainability standards give us guidance as we forge our own path ahead to a sustainable future.

Jörg-Uwe Goldbeck



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Everyday sustainability

01



Everyday sustainability

Why GOLDBECK takes the long view

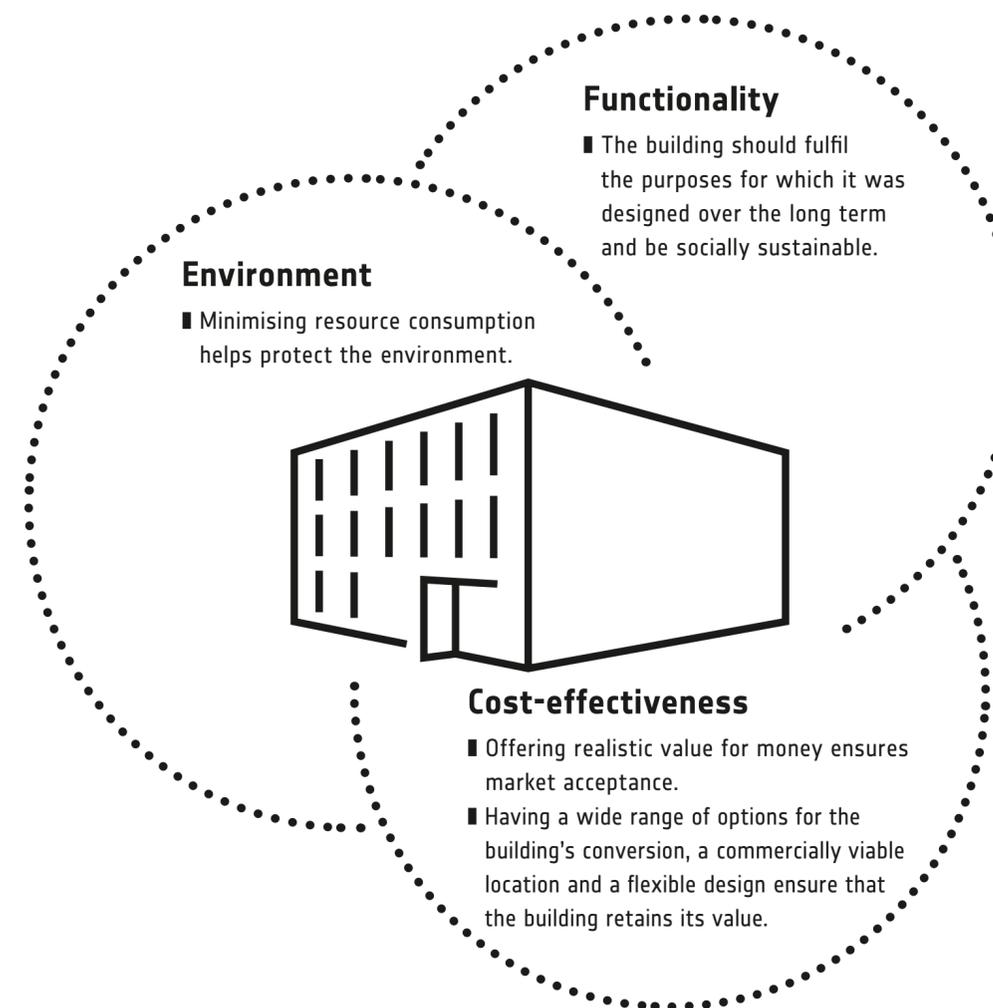
When you think of sustainability, you automatically think of a product's environmental impact – how many resources are consumed to make it and use it? How much CO₂ is emitted throughout its life cycle? How else does it impact the environment? It goes without saying, then, that the environment is integral to sustainability. But to be genuinely and objectively sustainable, products need to do so much more. They need to be functional (i.e. designed to fulfil their intended purposes), while meeting social sustainability criteria to support the comfort and well-being of building users through temperature, acoustics, lighting and high-quality interior and exterior design. They must be cost-effective, meaning it should be possible to construct them for a client-friendly price.

If you fail to consider one of these factors, or only give it limited attention, then the sustainable product is unlikely to have a realistic chance at being implemented widely. It may end up being nothing more than a prototype.

That's why we consider cost-effectiveness another essential factor in creating sustainable buildings. It is a key benchmark that we measure ourselves against to ensure that our solutions give clients real long-term added value while minimising our environmental footprint. To be objectively regarded as sustainable in this context, a product's components and entire life cycle need to be taken into consideration.

A snapshot of a product's impact is not enough to be deemed sustainable – at least not in the way that we see sustainability.

GOLDBECK conducts extensive research and development to ensure that our system solutions incorporate a balanced mix of all aspects, enabling us to construct highly sustainable buildings for our clients – now and for many years to come. This is a major undertaking, but we can safely say that our engineers have always strived to develop solutions that work well in a wide range of applications, so we are well prepared for the challenge.



Sustainable construction

02



Sustainable construction

How we do what we do

A system makes all the difference

As the saying goes, 'Nothing is more powerful than an idea whose time has come.' But what if some ideas are always more powerful than others? We believe that systematic modular construction is this kind of idea. GOLDBECK has been successfully using this concept for decades, and now it is gaining a new significance in today's context. That's because it not only creates certainty around costs and deadlines, but it also helps boost sustainability – and sustainability is now more critical than ever.

Focus on individual factors or take a holistic approach?

Of course, you could assess the sustainability of every single piece of building work during construction. Check the environmental footprint of all the materials used. Adapt all of the building's technology to be energy efficient. And then once the building is completed, it will be made from lots of individual sustainable components. But would that be enough? No, because a sustainable building should be more than the sum of its parts, and the best possible result can only be achieved with a perfectly balanced combination of different factors.

That's why we see buildings as complex products, think in terms of processes and – since we consider ourselves a technology company – use a smart construction system.

Now and into the future: The importance of the life cycle

We take into account a building's use, demolition and material recycling during its design stage. A GOLDBECK building must perform well on all these levels throughout its entire life cycle. That's why we harness the power of the most effective approach to boost our sustainability performance: systematic construction. It may make construction even more complex, but it also turns this complexity to its advantage. It uses a meticulously structured network with a carefully coordinated infrastructure. It encompasses our production facilities, the design of our system components, precisely defined processes, digital and technical solutions, assembly and logistics. At GOLDBECK, this is all integrated under one roof, and no other construction company harnesses such synergies like we do.

This helps us to be resource-efficient, for instance when we design components that use materials efficiently.

This kind of system is not created overnight. It is the result of ongoing efforts to reflect on and engage deeply with the topic of construction. This means automatically incorporating all of the latest findings and innovations into the system, leaving nothing to chance. By defining our ideal fundamental principles in advance, we have freedom to rethink conventions and make our product and service strategy sustainable.

“**Sustainable construction isn't about simplifying complexities; It's about harnessing them. We're doing just that with our smart system.**”

Jan-Hendrik Goldbeck,
Managing Partner

Design – sustainable from the outset

We lay the key groundwork for a building project during its very intense, albeit short draft and design stage. Most of the decisions taken at this point are firm – they are not altered later in the project, at least not without high costs. This initial phase of the project at GOLDBECK results in a unique, optimised and sustainable building design, combining eco-friendly solutions, functionality and cost-effectiveness over the building's entire life cycle.

Systematic and individual needs assessment

We attach great importance to analysing our clients' needs and wishes systematically, in detail and at an early stage. Our sales engineers work with them to flesh out their vision and then translate it into architectural specifications.

New build or renovation?

Many projects start with the question: Should an old existing property be renovated, or should we build from scratch? GOLDBECK gives its clients comprehensive advice to help with this decision, including financial support options. And our advice is impartial, as we also offer construction for existing properties. Discover more on page 33.





Integrated Design

At GOLDBECK, all the key design specialists and experts work in house, enabling our design team to work together at the same time and across disciplines. This allows us to check interdependencies and various scenarios swiftly and reliably. Our design process is systematic, making it efficient, quick and precise. At GOLDBECK, everything that is hidden is systematised, and everything that is on show is individualised. This means we don't have to keep reinventing the wheel. Instead we can draw on tried and tested, resource-efficient solutions and swiftly deliver the best solutions for each project.

Energy and Sustainability team as part of Integrated Design

Experts from our Energy and Sustainability team are included in the Integrated Design process at GOLDBECK. They ensure that sustainability and energy efficiency are embedded in the design process. They draw up concepts that take into account the entire life cycle of a building and incorporate all of the key factors:

- Thermal modelling
- Operational costs analysis
- Profitability calculations
- Funding options support
- In-house power supply
- Carbon assessment
- Sustainability certificates

We've got everything covered: How GOLDBECK develops a custom, optimised energy concept for your building

Kick-off meeting

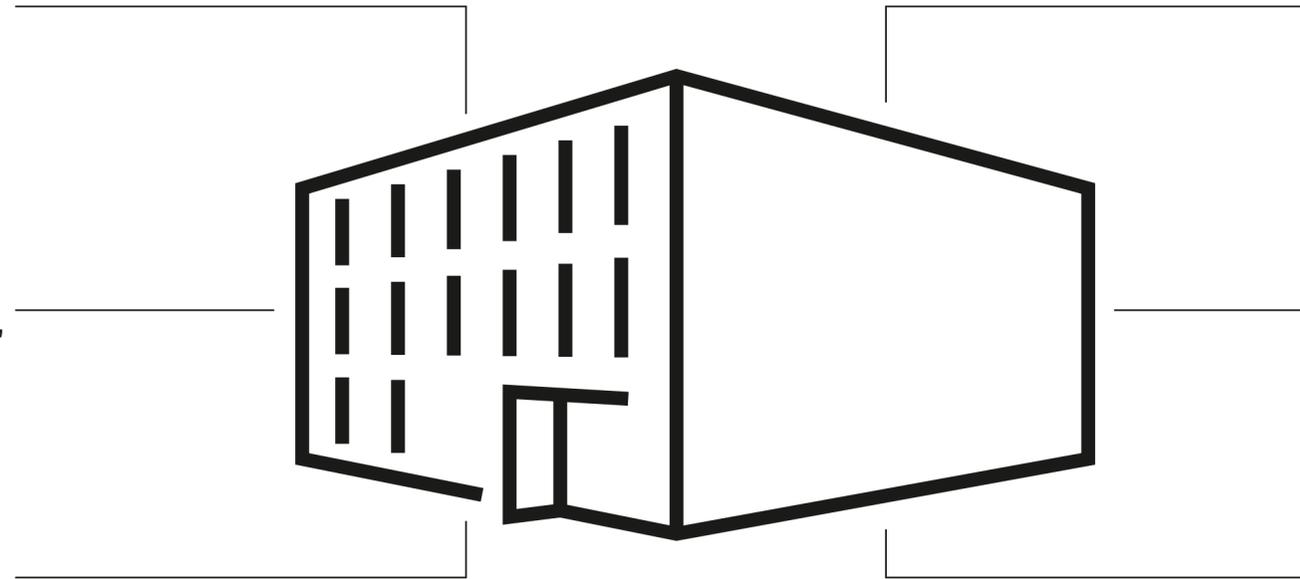
We ask you the relevant questions and clarify the initial parameters regarding location, space requirements and usage specifications as well as your own needs and ideas.

Energy consulting

We ensure that all regulatory requirements are adhered to, from designing right through to constructing the building, and we prepare the energy certification.

Energy concept

We find out everything we need to know about energy consumption and supply/demand to draw up the building's energy concept. We use our simulation tool GEOS to calculate the cost-effectiveness of alternative energy supply systems for office buildings, focusing on passive and regenerative energies in particular. The user costs forecast then factors in the maintenance and cleaning costs of such energy systems.



Certification

BREEAM, LEED, WELL – whichever certification system you choose, your assessment process is in expert hands with us.

Funding support

We help you secure funding and give you support with your application.

Simulations

We optimise the systems engineering for heating and cooling using building simulations, inputting the building's location, orientation, occupancy, window area ratio and many other details.

Outcome:

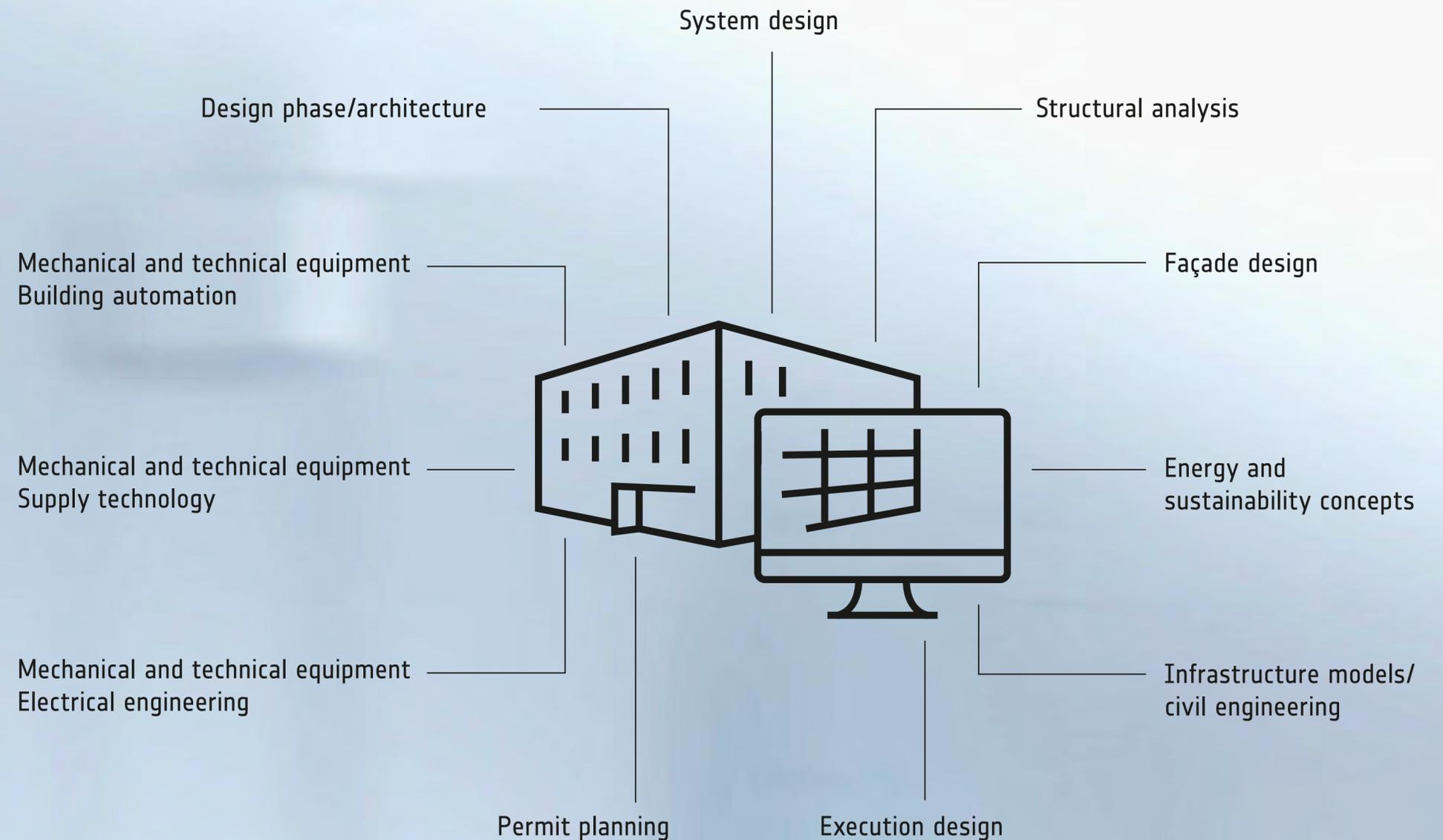
A sustainable building perfectly tailored to user requirements with low operating costs.

Digital design

GOLDBECK uses Building Information Modelling (BIM) for almost all of its projects. Digital design methods enable our design specialists to work together in an agile way. They streamline processes and enable them to run in tandem, as well as creating transparency and preventing costly errors, ensuring quality and cost-effectiveness. BIM means there are fewer corrections, thereby saving resources.

Technical model data is used directly on the construction site using BIM 360 software. By being able to access models and plans directly on site, queries can be solved straightaway and details can be passed on to subcontractors. The software supports site managers in their day-to-day project management, helping analyse data and digitalising most of the work that was previously paper based.

Building Information Modelling (BIM)



Kinder to the environment with our system

Comparing two construction methods

Which has the better CO₂ performance – a conventional reinforced concrete building or a modular one made from system components? We teamed up with independent experts to find out and used a typical office building as a reference. What is noticeable at first glance is that systematic construction uses less concrete than a conventional construction: precast concrete components are much more intricate than traditional concrete structures – and their performance is identical. But we wanted to delve into the details.

The question

Which construction method has a better CO₂ footprint, both in terms of its manufacture and its demolition and potential for recycling? What's more, how much CO₂ does GOLDBECK save by constructing a typical office building using modular construction compared to conventional construction methods?

The assignment

One of GOLDBECK's previous projects went under the microscope, and software was used to compare our construction methods with conventional ones. The construction materials used for the shell were the main focus. Several factors were analysed: raw material extraction, transport from supplier to our production facilities, component manufacture, waste management and disposal, and the potential for recovering, repurposing and recycling the materials. To ensure that our research was independent and impartial, we enlisted the services of an external engineering firm to carry out the calculations for the conventionally constructed reference building. The environmental performance of both constructions was then calculated using GaBi and LEGEP – standard software for life cycle assessments.

Our test subject

The 'Cube' in Engen, Konstanz, Germany – a office building close to the A81 motorway that we constructed for our client Sachs Engineering. In brief: it spans six floors and 3,800 square metres, and it houses a mix of offices, conference rooms and social spaces, plus a bistro and an industrial building area on the ground floor. It gets the name 'Cube' from the uniform length of its edges and symmetrical cubature – a signature GOLDBECK office building. We gave the experts our design documents to kick off the comparison process.



The scope

The main differences between modular and conventional construction methods are to be found in their shells. As a result, the testing looked at external and internal walls, intermediate ceilings, the roof, foundations, internal and external columns, floor slabs, the stairway and staircase. The concrete and reinforcement data for the Cube were calculated based on its design documents. Our environmental management system provided the figures for the factory production stages for external wall elements and ribbed slabs, including electrical and thermal energy consumption and waste generated during production (sewage sludge and concrete).

The result

The scale of the differences is immense. Using GOLDBECK Construction Systems to construct the building saved over 135 tonnes CO₂. That's more than a million kilometres in car trips and over 22 per cent lower than carbon emissions generated by conventional construction methods. It corresponds to a saving of almost 36 kg CO₂ per square metre.

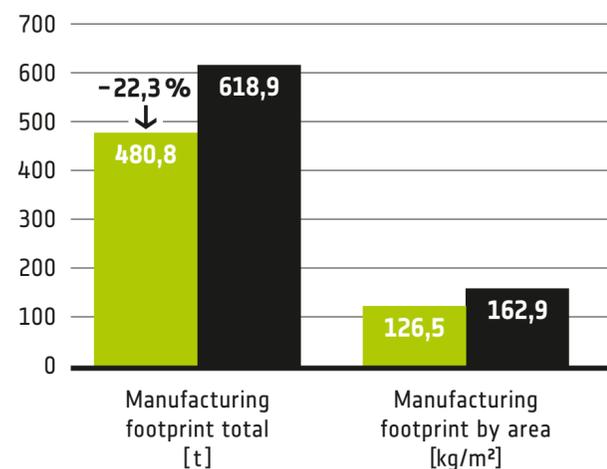
And when you take into account demolition and recycling potential alongside the manufacturing results, the materials used in the GOLDBECK construction method also help save more than 25 per cent in harmful carbon emissions. Over the full period, 41.5 kg CO₂ per square metre are saved compared to the results for conventional construction methods.

The explanation

Precast system components are much slimmer than site concrete as they can be made using concrete of higher strength classes. System construction methods also lead to long-term optimisation: only that which is structurally necessary is constructed. In addition, we use cement in which we have partially replaced its usual energy-intensive cement clinker with energy-saving aggregates. We use CEM II whenever production calls for it. This grade of cement contains 20 to 25 per cent less cement clinker, enabling us to avoid carbon emissions. What's more, the steel we use is largely secondary steel, which emits less CO₂ than primary steel.

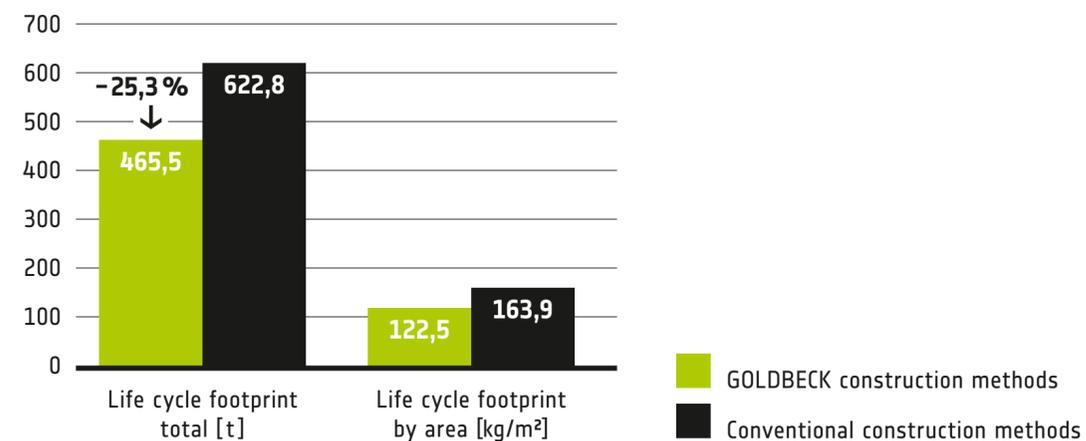
Manufacturing footprint

CO₂ emissions by method



Manufacturing and demolition combined footprint

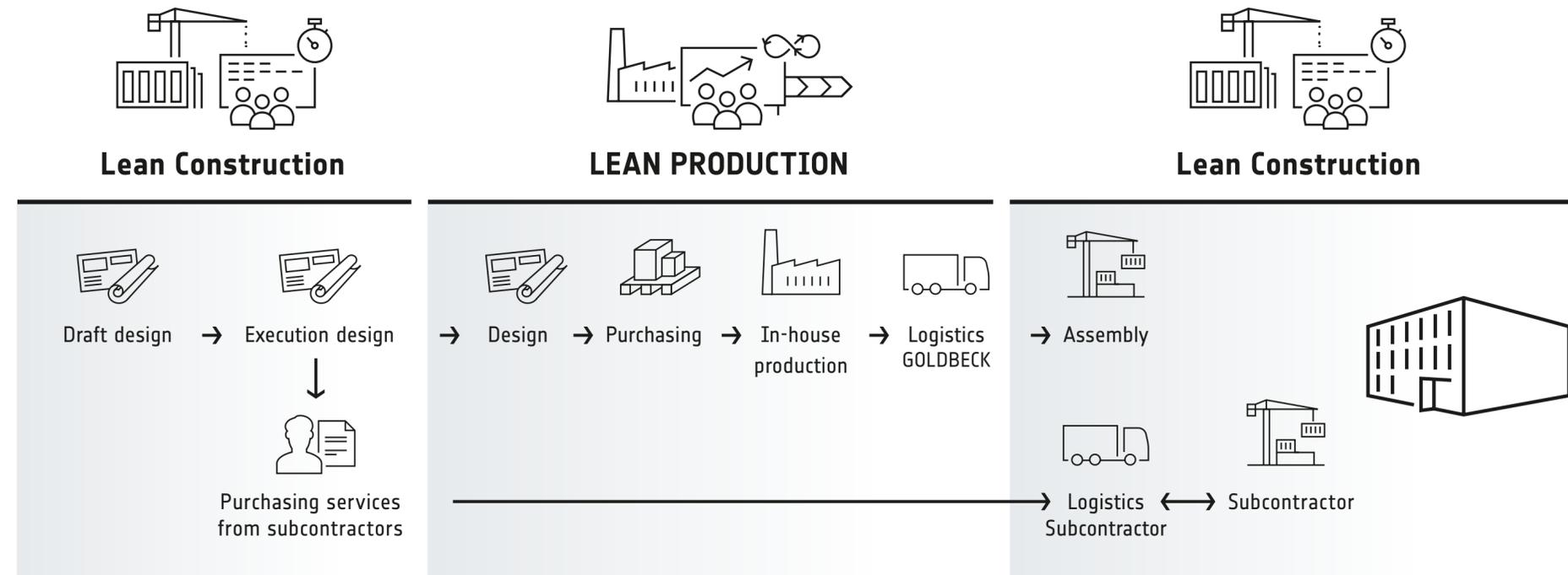
CO₂ emissions by method



Legend:
■ GOLDBECK construction methods
■ Conventional construction methods

LEAN@GOLDBECK

Possibly the most direct way of being sustainable is to prevent waste. This is where LEAD@GOLDBECK comes in. Our strategy covers two areas of application: 'Lean Construction' and 'Lean Production'. Key aspects to both of them are customer focus, employee engagement and continual efforts to improve (CIP).



GOLDBECK Lean Construction

Standardising construction processes, workflows and components is firmly embedded in our corporate DNA and forms part of our lean principle of 'Jidoka' (automated quality assurance). The aim of this approach is to detect errors and discrepancies quickly to ensure quality and prevent unplanned follow-up work, extra transport, duplication of work and material wastage. An agile Kanban board is one of the standardised project processes and tools that help us to do this. We are already putting the second lean principle 'Just in Time' into action at some construction sites using the 'Takt planning and control' method. The content of subcontractors' work packages is coordinated and harmonised, making for a smooth, seamless construction process on site from one Takt zone to the next. This not only minimises stress and ensures a good working relationship, but it also ensures resource-efficient construction.

GOLDBECK Lean Production

As we apply the Lean Production principle in our plants and use a system to manufacture and pre-assemble our components, there is relatively little waste at our production facilities and construction sites. We use resources efficiently and avoid waste. Our methods range from shop floor management to process standardisation and cover many practical aspects. For instance, we take waste metal generated during production and use it to create attachment solutions. And thanks to serial production, we re-use our formwork over and over instead of discarding it after one use.

Equipment, production and construction materials

Optimised components

We design our system components to match their intended purpose perfectly. As a result, of this and our prefabrication methods, we can build much more precisely than with site concrete, so we only use the amount of material that is actually needed. Additional materials are kept to a minimum as components are always manufactured under the same optimised conditions in our plants.

To demonstrate how effective our approach is, here is an example: external walls and ceilings in office buildings are the largest contributors to construction-related CO₂ emissions, producing 68 per cent of them. In contrast to conventional construction methods, however, we save almost a quarter of CO₂ emissions in the manufacturing process for typical office buildings. We calculated this in a recent case study (see page 13).

Another example can be found in the different column manufacturing methods. When using site concrete for instance, columns are manufactured with the same diameter throughout their entire length. But thanks to industrial prefabrication, we have a different solution at GOLDBECK – our columns are slimmer in the middle. Their performance is the same, but the amount of material saved is considerable, and it makes transporting them much more efficient logistically.

Dual functionality also creates sustainable efficiencies. Our car park slabs are a good example of this. They are both load bearing and inherently water-resistant, which is representative of how many of our other dual-function system components work.

This special functionality is made possible by the combination of special concrete developed by GOLDBECK and our unique manufacturing methods. We cast the concrete slabs at our plant using special vibrating tables. The vibration densely compacts the concrete on the base in particular. This base is then placed topside when it is installed in the multi-storey car park, and it is resistant to temperature changes, frost, de-icing salt and oil without needing any other coating. There is nothing else like it in the construction industry.

Sustainability in production

Sustainability plays a key role in our plants, too. We act sustainably at all levels, from installing photovoltaic systems on the roofs of industrial buildings to recycling water in the production of precast concrete components and applying waste-cutting lean methods. And we continually strive to develop even more sustainable solutions.

Not a single gram over:
A concrete component in the making
at the GOLDBECK Hamm site.



Recyclability and the principle of reusing

Sustainability can only realistically be assessed if the entire life cycle of a material is taken into account, from its creation to its reuse. If you take a holistic view and apply 'life cycle thinking' to this, you are using a principle that is apparent in nature. There is no such thing as waste in nature – every substance has a use and is recycled.

Just like biological cycles in which nothing is lost, we also aim to keep our raw materials in use. As a result, we usually opt for recycled materials. The key determining factor in whether a material can be reused is its purity. Any substances joined together in some way need to be easily separable to ensure cost efficiency. That's why we use mechanical connectors for our system components wherever possible so that they can be easily detached during demolition. We select construction materials and assemblies that we can preferably continue using, reuse elsewhere, or separate into constituent parts either to recycle or, at the very least, dispose of individually.

What this means is that we avoid using composite materials, bonding agents and fillers by, for instance, designing and manufacturing with high precision. Façade elements and steel columns can be easily detached from one another, and any sealed-in connections can be removed using a normal prying tool. This means that even concrete components can be separated from one another. Steel and aluminium can be melted down: both are almost 100 per cent recyclable and don't lose their properties when they are melted down.

Luckily, producing secondary aluminium only requires five per cent of the energy that is needed to produce primary aluminium, and it comes with just five per cent of the emissions. Recycling steel produces similar results.

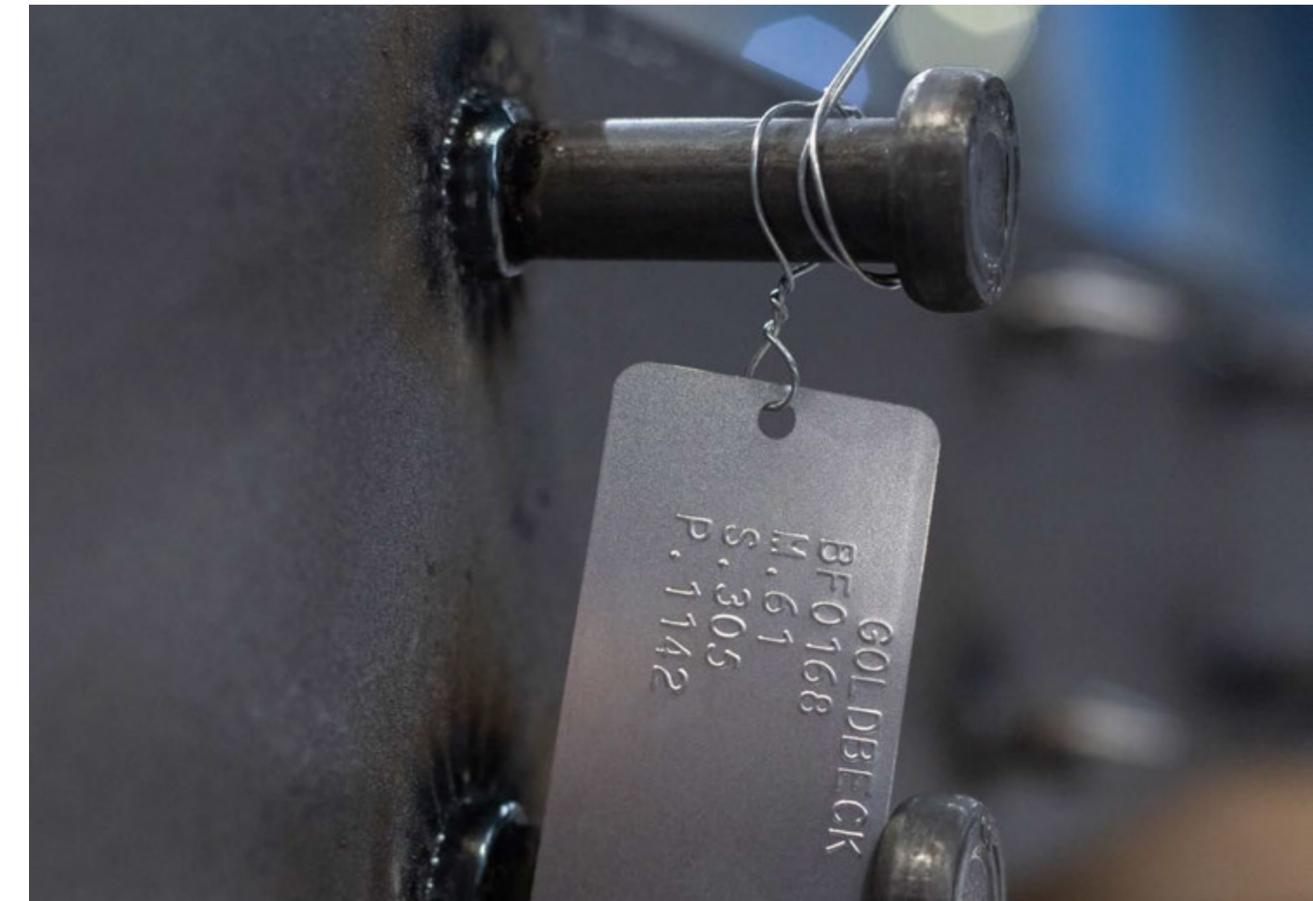
Low-emission construction materials

Some construction materials pollute the soil, air and water, posing a risk to humans, animals and the environment. In addition, shells are being made increasingly thicker to improve the energy efficiency of buildings, but this reduces natural air flow. As a result, the concentration of harmful substances indoors can increase considerably,

so the choice of construction materials is key to ensuring a healthy indoor environment. Low-emission construction materials add to a building's sustainability credentials without compromising on quality. We make sure that only low-emission construction materials are used to comply with requirements for building certifications. These materials meet the highest quality standards (level 4) of the German Sustainable Building Council (DGNB).

Our designers take their lead from a regularly updated database of certified low-emission construction materials. Their corresponding product specifications, technical data sheets, safety data sheets, environmental product declarations and manufacturer's declarations are compiled in a separate system. The database currently contains entries for over 800 low-emission construction materials.

We include specific requirements regarding materials in our tender specifications to ensure that subcontractors use only low-emission construction materials for a DGNB certification. This commits subcontractors to following the quality requirements set and declaring all construction products and materials when planning the works. To prove that subcontractors are adhering to specifications, they submit data sheets regarding all of their construction materials for GOLDBECK to check. The team of sustainability experts checks the materials in question. Only once they have given authorisation may the low-emission construction materials be used. If a material doesn't meet quality level 4 standards, an alternative product will be recommended.



Timber

As a renewable raw material, timber is a popular solution in the discussion about sustainable construction. It stores carbon and is incredibly versatile. However, the use of timber should be given careful consideration: as a general rule, pure natural wood is not used in industrial construction. Only under a fifth of a conventional wood frame construction is made from the natural material itself. The rest of the construction elements – some 80 per cent – is made from plaster, sealants and adhesives, meaning that they cannot be completely separated during demolition.

So, it is clear to us that construction materials need to be separable, and their environmental impact needs to be transparent. What's more, wood needs to be similar to steel and concrete in terms of functionality and cost-effectiveness, including availability, maintenance requirements, recycling potential and life cycle assessment. It is important to select construction materials based on the project. That's why we offer timber as an optional material that the client can choose for the supporting structure in industrial buildings and as part of the façade. We source the trusses from certified and audited manufacturers, and we maintain our system parameters, such as grid, bay width and roof pitch.

It may surprise you to learn that wood can be a useful and cost-effective material for fire protection reasons. It may be flammable, but it burns slowly and, most importantly, evenly. Burning wood develops a charred surface, providing an extra layer of protection that slows down the burning. This means that we can accurately predict how timber construction elements will behave structurally in a fire.

Facts and figures about building with steel, aluminium and timber

Using aluminium

without releasing carbon

95%

Recycling rate

Up to 95 per cent of aluminium can be recycled, and recycling only requires five per cent of the energy originally needed to produce it.

Manufacturing aluminium releases relatively large amounts of CO₂, but once it is in use it doesn't emit any CO₂, unlike timber, which regularly needs to be retreated.

Carbon footprint

Wood and aluminium-framed windows have almost exactly the same carbon footprint.



Wood composite

Only 17 per cent of timber composite materials used in a wood frame construction, for example, are actually wood. The rest is a mix of insulation, plasterboard and waterproofing material that are hard to separate.

Service life

If wood is burned or sent to landfill at the end of its service life, the carbon originally stored in the wood will be released back into the atmosphere.



Optimising energy use early on

We determine the best options for energy efficiency in buildings and furnishings during the conception design phase, using the following two methods:

GEOS – transparency through digitalisation

GEOS is the perfect example of how digitalisation in the construction industry creates sustainability potential. The **GOLDBECK Energy Optimisation System** calculates the best energy scenario for a particular building in a matter of seconds. To do so, the software takes into account the investment, consumption and operating costs as well as the building's carbon footprint and user comfort.

It therefore delivers a result that far exceeds anything a person could calculate due to the sheer number of different possible combinations: a comparative view of all possible, appropriate energy systems. Graphs give us a clear overview of all the alternatives. We then select the most interesting to compare in a reference scenario. This service is unique in the construction industry, and the accuracy of its results can easily keep pace with similar complex and time-consuming individual simulations. What's more, it doesn't cost clients a penny – with GOLDBECK, they receive the quick comparison check as part of the package. We developed GEOS in partnership with the Fraunhofer Institute for Industrial Mathematics (ITWM) and regularly deploy it for designing office and school buildings.

Simulations

We optimise the systems engineering for heating and cooling using building simulations, inputting the building's location, orientation, occupancy, window area ratio and many other details. Virtual building models that clients can 'walk around' using VR headsets make it easier for them to make definitive decisions at an early stage. This reduces the need for changes to be made later, thereby keeping resource consumption low. Compared to GEOS, the simulation is even more accurate, albeit more costly. That's why we only use it if just a few variations need to be compared very closely with one another.



With GEOS we were finalists in the Smart Renewable Energy category at the 2019 edition of The Smarter E Awards. GEOS was also deemed a Best Practice Innovation in the 2020 innovation report by the ZIA German Property Federation.

Which power generation systems can GEOS simulate?



- Heating boiler
- District heating
- Heat pumps
 - Air-to-water
 - Ground source
 - Water-to-water
 - Gas powered
- Combined heat and power plant
- Variable refrigerant flow
- Hybrid variable refrigerant flow
- Pellet boiler



- Water chiller
- Split system air conditioning
- District cooling
- Heat pumps
 - Air-to-water
 - Ground source
 - Water-to-water
 - Gas powered
- Sorption cooling
 - Adsorption cooling
 - Absorption cooling
- Variable refrigerant flow



- Photovoltaic
- Battery storage
- Combined heat and power plant

Digitalisation & innovation

At GOLDBECK, we don't rest on our laurels – that's just part of who we are. The concept of innovation is therefore firmly embedded in all relevant divisions, from Process Management to IT and Production. The IPS division – Innovations, Products and Systems – brings together some of GOLDBECK's development units. Our Innovation team includes innovation managers and development engineers, whose work centres around strategic product development while applying sustainability criteria. They analyse social, sector and market trends to inspire their product development plans.

They cover several areas of activity: smart building, the relationship between building and service, and sustainable material development. They scout out new technologies, assess them in pilot projects and create promising potential solutions with the best prospects of becoming products before colleagues in product development take them on.

We are the first German construction company to found a Tech & Innovation Hub in Silicon Valley, where we work with renowned partner organisations as well as Stanford University. In Germany, we have teamed up with the Karlsruhe Institute of Technology (KIT) to do pioneering work in the field of artificial intelligence in the construction industry.

We see our identity as being more of a technology company than a construction one. We use technology to become more efficient and sustainable, from automated production processes and the use of drones, 3D scans and VR, to digital design using Building Information Modelling.



Robot dog Spot created by Boston Dynamics has a 3D laser scanner on its back and has been deployed at GOLDBECK construction sites in Germany as part of a test run.



GOLDBECK employee car park in Hirschberg

Carbon concrete example

Car park slabs made from carbon concrete are the latest development from our materials researchers. With these system components, a carbon fibre mesh replaces the usual steel reinforcement, making the construction elements slimmer and more lightweight and saving 20 per cent in materials. Using fewer materials also means improving the carbon footprint, including in transport. What's more, the material's special properties extend the life of the car park as carbon doesn't corrode, for instance. GOLDBECK completed a pilot project during the construction of our employee car park in Hirschberg in 2019, successfully replacing the steel in the load-bearing reinforcement with the carbon mesh. The ongoing process to obtain national approval from the German Institute for Construction Technology (DIBt) will lay the groundwork for the component's volume production – a real groundbreaking achievement!

Smart building example

Smart buildings are fitted with sensors that are connected to and communicate with the building's mechanical and electrical systems. The purpose of this is to compare the current and target conditions and automatically manage and optimise the environment based on the user's requirements. As a result, the building's energy consumption can be considerably reduced, for instance, as unoccupied rooms are not unnecessarily heated, the lights are automatically controlled and analyses of room usage help space to be used more efficiently. We are currently running a pilot project at our Gateway Gardens site in Frankfurt.

The sensors used in this pilot project provide data on room occupancy, temperature, noise levels, humidity and air quality. They provide the basis for cloud-based data collection in which data from GOLDBECK buildings is compiled and analysed. This data then helps inform our product development. We are already integrating smart components for system and room automation in our buildings, which significantly boost energy efficiency.

GOLDBECK Gateway
Gardens site, Frankfurt
am Main



Certification



BREEAM®

With our in-house sustainability experts and advisory professionals we will handle building certification schemes whatever the requirement BREEAM, DGNB or LEED.

DGNB pre-certified building systems

We not only build systematically, but our design team also works to specific systematised standards, which meet the requirements of the Gold certification awarded by the German Sustainable Building Council (DGNB) for warehouses and office buildings. This automatically gives our building systems pre-certification from the DGNB for very sustainable construction and operation. Once the building is completed, this pre-certification will make the process for full certification much easier.

GOLDBECK is currently the only company in Germany offering this level of standards for office buildings – around ten per cent of all DGNB certificates awarded have gone to GOLDBECK buildings. We are currently working on multiple certification for multi-storey car parks after our employee car park in Hirschberg was the first multi-storey car park ever to receive Gold certification at the 2019 EXPO REAL trade fair. DGNB multiple certificates are also planned for schools and factory buildings. As a member of DGNB, GOLDBECK supports the organisation's efforts to achieve greater sustainability in the construction industry.

LEED, BREEAM and other environmental standards

We are also happy to give our clients expert support on their way to obtaining any other sustainability certificates. Whichever you choose, we will handle the process for you with our extensive experience and knowledge.

Component catalogue

The Sustainability team draws up a project-specific component catalogue for building certifications. It serves as evidence that low-emission construction materials have been used and looks at the full layer structure of all construction elements, including all additives such as adhesives and primers. This tailor-made catalogue also provides information about where within the construction the materials have been used. This is not only important for quality assurance during construction, but it is also useful for defect rectification, renovation and building maintenance. As a result, a component catalogue can play a key role in ensuring a building's long-term usability and value retention.



On the construction site

Local partner companies

More often than not we work with local partners on our construction sites. This ensures travel distances are kept short, thereby reducing transport-related CO₂ emissions. We also use power from renewable energy sources whenever we can.

Recycling

When we run projects that require old buildings to be torn down, we recycle the demolition waste as far as possible and feed it back into the construction process wherever it is suitable to do so.

A GOLDBECK project in Wenden shows us a good example of this practice. Around 15,000 cubic metres of demolition waste were broken up, processed for recycling and completely reintegrated into the construction. This recycled rubble from the old building was used to construct all the supporting layers under the buildings and traffic areas. We reused the floor slabs, foundations and masonry from inside the building, as well as asphalt from the old traffic areas. A partner consulting firm takes samples and chemically analyses the recycled material, while agreement is sought from the local water authorities to approve its use.

Cut and fill

Cut and fill is when excess ground material from one place can be reused at another site. We deploy drones with laser scanners at our construction sites to minimise the need for transport. These drones fly over the plot of land and take detailed measurements. This gives us reliable data enabling us to cut and fill the earth to create level foundations, while keeping transport costs, noise and emissions to a minimum.

Just-in-Sequence

We use Just-in-Time and Just-in-Sequence models to organise our deliveries. This means that construction elements are delivered in the order that they are used for assembly, enabling us to minimise construction site noise and traffic. Our seasoned assembly experts play a key role here. They assemble buildings at an incredible rate, helping to keep construction times to a minimum.

Experts on site

We also put our lean concepts into practice at our construction sites. After all, their golden rule is to take a holistic view of all our processes, from design all the way through to execution. Our site managers are usually on site every day, meaning they are in contact with everyone involved in the construction and can swiftly take action to remedy faults. This means that they are right there to ensure that we stay on schedule and uphold quality standards.



Sustainable Buildings

03



Sustainable Buildings

Looking ahead: how we construct buildings for the future

We gave a lot of space over to the 'Sustainable construction' chapter, and rightly so. It provides answers to the 'How?' and makes our construction method transparent. This chapter is intended to answer the 'What?' and specifically looks at our products. They are a manifestation of our construction method, making them inherently more sustainable than conventionally constructed buildings. And what's more, it gives our clients many more options for increasing the sustainability of their new office building, industrial building or multi-storey car park. There is an abundance of tools that can be combined in different ways. At the heart of it all is an energy-optimised shell combined with efficient building services. There is also a comprehensive range of options for fittings and furnishings. But most importantly, aspects such as carbon neutrality and resource conservation must be taken into account during the conception design phase as this is the point when decisions are made that affect the property's entire life cycle. It is up to the clients themselves how 'green' their building will be.



Certified

Industrial buildings built with the GOLDBECK system can be certified with LEED, BREEAM or DGNB Gold or Platinum.



Seamless approval procedure

We are familiar with local authorities' requirements and will get you through the approval procedure swiftly and reliably by being proactive and making provision for environmental aspects early on in the project planning.



CO₂ concept

If requested, we can draw up a specific concept to ensure that the building is carbon neutral in operation and that CO₂ emissions are offset during construction by implementing measures to avoid, reduce and offset them. The latter can be achieved through high-quality solutions such as using photovoltaics and geothermal energy or certified carbon offset projects.



In tune with nature

The GOLDBECK biodiversity strategy aims to increase the variety of species around its buildings by providing bird houses, bug hotels, wild flower grasslands and semi-natural ponds, for instance.

Industrial Buildings



At GOLDBECK, we don't see sustainability and cost-effectiveness as contradictions in industrial building construction. We design, build and operate pioneering business parks and logistics, factory and cold storage buildings, and we do so with quick turnarounds, energy efficiency and, if requested, carbon neutrality. We have all components covered, from energy-optimised shells and efficient building technology to nature-based external facilities. It is up to you, the client, how much we make your building a 'sustainable industrial building'. From photovoltaic installations on the roof and green façades, to tanks for recycling rainwater and charging points for electric cars and bikes – different options give you the freedom to determine just how sustainable you want your property to be and achieve a perfect balance between cost-effectiveness and functionality.



TTI, Inc., Maisach



ESM Industrial Building 5 | Heppenheim

Best practice for a sustainable energy supply: The perfect planning and utilisation of the roof area for photovoltaic systems enable the vibration specialists ESM to manufacture almost exclusively with green electricity. In addition, the waste heat from the machinery is used to heat the offices. And if that's not enough, heating can also be provided by geothermal energy. The industrial buildings are particularly well insulated, and the office building has been completed to passive standards.

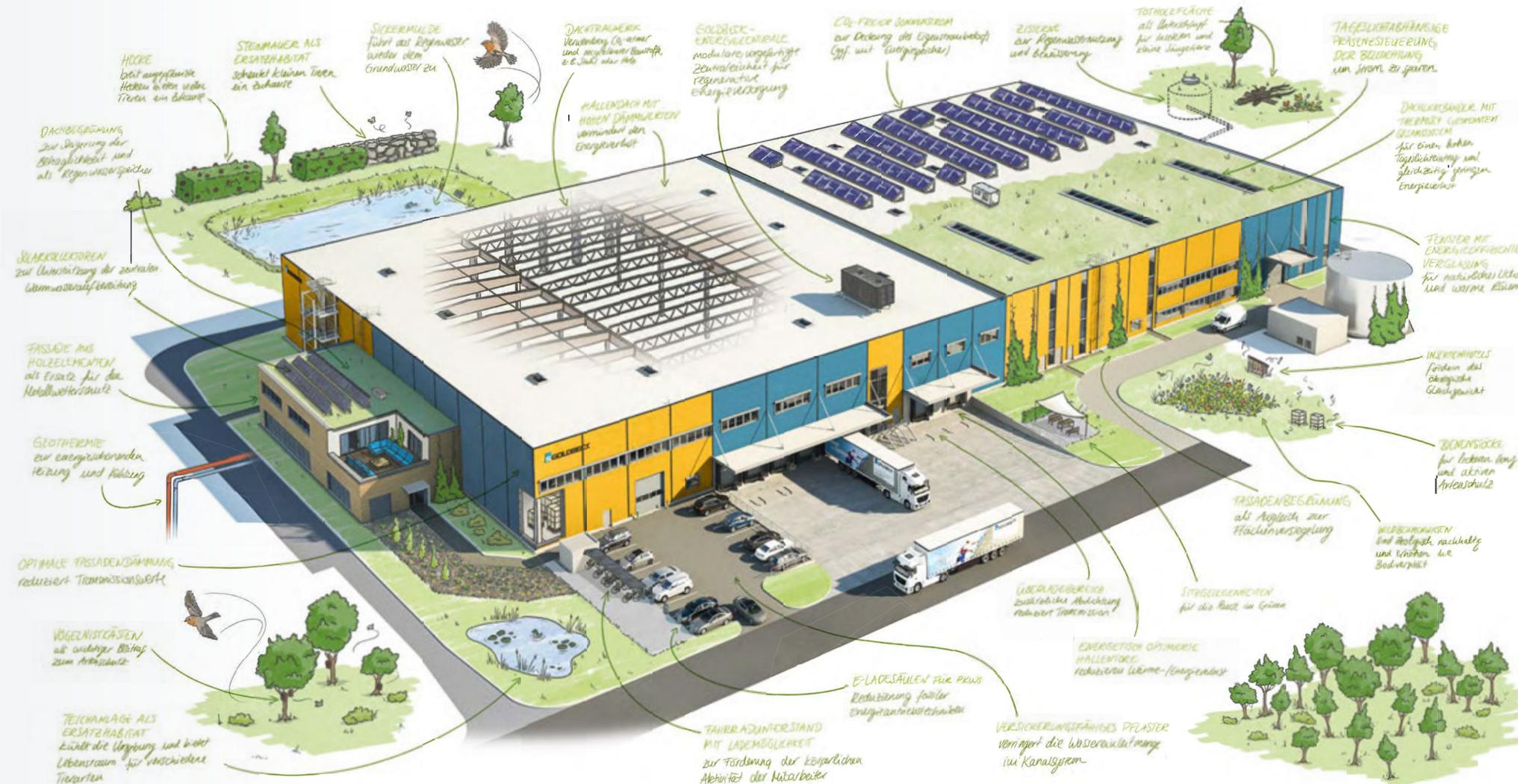
Sustainability with a system

Add-on modules that enhance the sustainable industrial building

Green Premium

Green Premium Plus

Carbon neutrality (use)	Design for carbon-reduced use	Design for carbon-neutral use
Carbon footprint (construction)	Calculating the carbon footprint of the construction according to the GOLDBECK standard analysis	Calculating the carbon footprint of the construction according to the GOLDBECK standard analysis plus concept to offset CO ₂ by certified means
Construction materials	Use of low-carbon and recyclable materials for the support structure B. steel truss beams or wooden trusses]	Use of low-carbon and recyclable materials for the support structure B. steel truss beams or wooden trusses) and the shell
Photovoltaic system	Fittings for rooftop PV systems	Rooftop PV systems
Office heating and hot water generation	Using ambient heat B. heat pumps]	Using solar energy in combination with ambient heat
Electric charging stations	Charging points for electric cars	Charging points for electric cars including billing system
Lighting control	Presence control	Responsive to daylight, controlled by smart presence sensors
Roof greening	Roof greening for office extensions, outbuildings and bicycle shelters	Roof greening on the entire property
Façade greening	Façade greening in small sections (outbuildings, bicycle shelters, etc.)	Green façades on all parts of the factory façade
Green outdoor area/habitat replacement	Planting and seating in the outdoor area	Plants and seating in the outdoor area, as well as the installation of beehives, bug hotels, bird houses or ponds
Rainwater	Rainwater French drains using retention basins	Tanks for harvesting rainwater to use for outdoor irrigation plus French drain basin
Certification of sustainability	DGNB Gold certification	DGNB Platinum, LEED or BREEAM certification
Promotion of energy standards	KfW 55 targeted	KfW 40 targeted



Office buildings



We also combine energy-optimised shells with efficient building technology systems for our office buildings, and regenerative energies can be included on request. It is up to you, the client, how 'green' we make your office building. We will complete your office building in compliance with any energy standards you wish. What's more, we always take a holistic approach to energy efficiency in office buildings, taking into account their entire life cycle. The making of a green building starts with the construction method: the GOLDBECK construction system saves resources and reduces the building's carbon footprint.

Ortwin Goldbeck Forum,
Bielefeld



Energy monitoring

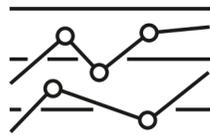
Reliable energy consumption data is key to managing a building's energy efficiency. This is where our monitoring system comes in. It records data on the consumption of energy and materials and makes it available for analysis. As a result, a property's energy use is transparent throughout its entire life cycle, providing the perfect basis for optimising its energy efficiency. A warning feature immediately alerts the user to any unusual data so that they can take swift action.

Benefits at a glance



Installation

Hardware is delivered and installed for you



Data capture

Energy data (min. 5 years)



Round-the-clock
Access data any time through the online portal



Mechanical and electrical systems

How warm is warm enough? And how warm is too warm? At GOLDBECK, the mechanical and electrical (M&E) building services are also systematic to achieve the perfect balance between sustainability and comfort. This creates the perfect conditions for ensuring energy is generated, distributed and used efficiently. There are huge benefits to having the building and its technical systems supplied by the same provider, whose construction system also enables the two to integrate seamlessly – both are perfectly coordinated with one another as a result. Interfaces can communicate directly and quickly. And most importantly, the system ensures that sustainability is factored into building services right from the outset.

At GOLDBECK, the Sustainability team also gets involved with selecting the type of heat generation system. They usually choose heat pumps that use regenerative energy from the air, water or earth, significantly reducing CO₂ emissions in the process compared to other heating system. Geothermal systems also have the benefit of making excess warmth from the summer available for use in winter, while it can use cold stored from winter for cooling in summer. Combined with the GOLDBECK Energy Floor – an extremely efficient surface heating and cooling system – these solutions become very sustainable. The energy floor and ducts are part of the construction system, so they are delivered to the site in precisely the right configuration for the project. This means there are no offcuts and raw materials don't go to waste.

There are also other options for energy supply systems: GOLDBECK helps with the integration, planning and configuration of photovoltaic systems. We have even implemented standardised sustainable processes for this too. Once energy has been generated, it remains with the building using heat recuperation systems (e.g. in ventilation systems), which reduces the building's energy footprint. External shutter systems are also part of the system design and are available as a prefabricated building component. They are used to keep heat out, or only let it into the building to a specific degree. One bonus of using prefabricated components is that it eliminates large quantities of packaging waste on construction sites.

System automation

Technical systems for heating and cooling as well as ventilation systems are fitted with communications technology throughout. Central system automation is a standardised, basic service for GOLDBECK office buildings, allowing all components to interact seamlessly. It captures and processes all of the system's data and uses it to create control mechanisms. As a smart, integrated complete system, it also ensures that the building can be operated sustainably and with energy efficiency.

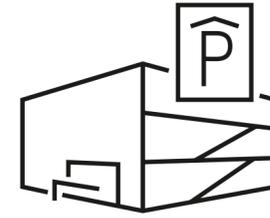


GOLDBECK energy centre using a modular system

Room automation

Room automation brings the M&E systems' smart controls to every room. For instance, it adjusts the lighting depending on the level of daylight, changes the sun protection to match the amount of sunlight exposure and alters the air change rate depending to the room's air quality. The room automation technology captures specific data from the individual systems in user-definable room units, so it can control the systems in a sustainable way that improves energy efficiency and saves resources.

Multi-storey car parks



The future of mobility is also the future of parking. e-Mobility is the big topic of the day, and policymakers are playing a decisive role in moving it forward. The rising number of electric cars and plug-in hybrids on the road means we need a reliable charging infrastructure that becomes more widespread as they do. Concepts such as self-driving cars and automatic parking need to be factored into the design of traffic and parking areas today so that they can serve the needs of tomorrow.

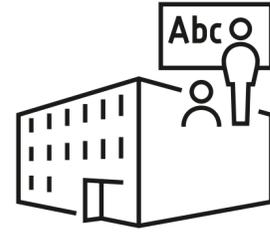
We see multi-storey car parks as the refuelling stations of the future, turning parking time into charging time. To accommodate the rapid developments in charging technology, we are developing future-ready solutions that expand as the demand increases – the perfect symbiosis of building and technology. Such as combining a photovoltaic system on the car park's roof with charging points available at the parking bays. This can be expanded, and depending on demand, a sophisticated energy and charging management system can be added with practicable billing systems, all in compliance with Germany's measurement and calibration law (Eichrecht). The entire technical system and power supply data for these facilities come together in one central control room, which is a bonus from a maintenance point of view.

Our mobility ideas extend far beyond parking spaces – we are teaming up with partner companies to design and operate mobility hubs for the traffic infrastructure of tomorrow, such as cargo bikes to hire, car sharing services and e-scooters that can be booked with a user-friendly mobility app. Such initiatives also integrate local public transport.

Multi-storey
car park at Tübingen
University Hospital



School buildings



No other building type has users who are as concerned about sustainability than those in a school building. This is where future generations are educated and shaped. It is where key foundations for our future are laid, which will be defined to a large extent by efforts to combat climate change.

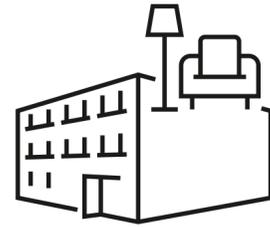
GOLDBECK school buildings take this into account, such as in the construction and building services, which can be configured to meet energy efficiency and passive house standards. We deploy our GEOS tool for schools too. We use it to calculate the best energy scenario for a specific school building (see page 18).

There are also various tools that we can use to improve the building's sustainability level, such as choosing construction materials and insulation with different sustainability ratings, which our experts can easily give advice on. Usually the custom configuration directly leads to obtaining certification, such as from the DGNB. GOLDBECK school buildings also achieve top marks for sustainability at user level. Our sophisticated room plans are highly flexible, catering to the growing requirements around comfort and personalised, interdisciplinary learning. And it doesn't stop at the school gates either: outdoor 'green classrooms' can be added to the design right from the outset. This turns the school into a place to learn surrounded by nature, a place to live side-by-side harmoniously and build strong relationships with others.

The training centre for health professionals in Erding has been built to passive house standards and features a wood façade.



For residential buildings



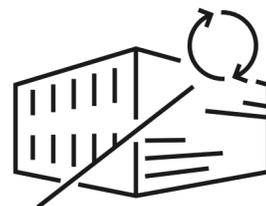
Constructing high-quality residential buildings in a sustainable and cost-effective manner can be a particular challenge if they also need to meet the criteria to be eligible for housing grants. This is where the benefits of our construction system really shine, and on several levels – environmental, economic and social. Thanks to its robust construction method, GOLDBECK residential buildings are long lasting and provide good noise protection, which is particularly important when so many people live under one roof. Strong designs ensure the building has a small land footprint, while smart floor plans make the most of the available space and offer a good quality of living for all ages. Clients can request for our buildings to be made accessible and wheel-chair friendly, too.

Like our other building types, we equip our clients with a range of options that they can use to boost the level of sustainability in their property. At the start of every project we conduct a comprehensive energy consultation. Our residential building standard meets KfW 55 requirements, but we can also build to KfW 40 efficiency standards. Triple-glazed windows with recyclable PVC frames and ventilation are included. Green roofs and photovoltaic systems are also options. We can also design and construct nature-based external facilities, with optional EV charging points, on request. A special feature of our residential buildings are the prefabricated bathrooms, which we fully assemble in the factory with tiling and plumbed-in fixtures and fittings, and then we install them in the building as modular components. Doing it this way speeds up the already quick construction phase and adds to the building's assuredly high quality.

GOLDBECK residential building in the Milbertshofen-Am Hart district of Munich [visualisation]



Existing building refurbishment



Preserving value(s)

Existing buildings often have the advantage of a prime location, thereby contributing considerably to a company's success. Such buildings can also be worth renovating, particularly in regard to sustainability aspects. Our specialists provide advice on the basis of extensive analyses and reliably predict whether or not a building can continue to meet a client's requirements in the future. They prepare a utilisation concept that is adapted to the company's current needs, restructuring building spaces and incorporating possible state or regional subsidies. The latest technology helps answer the question as to which parts of the building can be retained. A survey via 3D scan, often carried out by a drone, provides a precise and highly reliable basis for planning. This allows for the cost-effective, significant extension of the life of a building – with all the positive implications this has for environmental protection and resource efficiency. After all, working with existing buildings means using existing infrastructures – such as streets, ducts and wiring – which avoids additional land sealing and conserves resources for producing and supplying construction elements.

If the existing shell can continue to be used, this substantially reduces the ecological footprint of the building being refurbished. Energy-optimised buildings – whether industrial buildings, office buildings or school buildings – have a reduced level of energy consumption. If the building uses renewable energies, this further reduces its CO₂ emissions significantly. Smart solutions and efficient mechanical and electrical equipment provide additional possibilities

for conserving energy. Moreover, existing buildings can also be certified – for instance, with DGNB certificates for renovations and for buildings in operation. This makes positive environmental impacts objectively visible and contributes to a company's favourable image.

GOLDBECK's principle of "construction with a system" also applies to existing building refurbishment. We use tried and tested solutions for recurring challenges, our own construction elements, and clearly defined and proven design and construction processes. Our specialists provide you with impartial advice on all aspects of construction.

- Using space efficiently and intelligently
- Conserving resources
- Increasing value
- Reducing CO₂ emissions
- Benefitting from subsidies
- Recycling construction materials
- Using brownfield construction

Sample calculation

Numbers sometimes say more than words. With this in mind, we used a specific example on page 13 to show you that our construction system generates 25 per cent less CO₂ – both in the construction and the dismantling – compared to conventional construction with reinforced concrete. With existing buildings, the shell is largely preserved; as a result, CO₂ emissions are only generated from the facade, extension and technical building equipment. In our specific example, the renovation of an existing building is shown to save more than 50 per cent in CO₂ emissions compared to a new build.

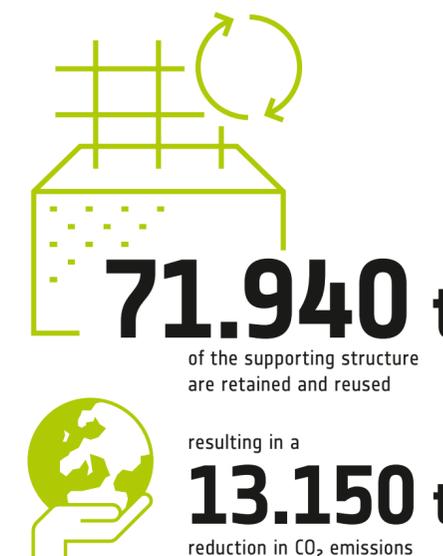
Comparison of CO₂ emissions

by area



- Refurbishment of existing building (continued use of solid shell, but new facade, interior design and M&E equipment)
- Conventional new-build

CO₂ emissions are approx. **51 %** less than for a conventional new-build*



Analysis based on a typical reference office building. Deviations are possible.

* GOLDBECK existing building refurbishment, financial year 2021/22

Existing building refurbishment

Sustainability is not completed when the building is. On the contrary – there are key tools you can use in operating the building to boost energy efficiency and save water, gas and electricity. Up to 80 per cent of the energy life cycle costs are operating costs. Luckily, energy-efficient building operation is factored in as early on as the design stage at GOLDBECK.

We tailor the building's M&E and automation systems to how the client will use the spaces, and we also handle the commissioning and calibration of the building services. A state-of-the-art building is like a complex organism with a myriad of interacting parts to take into account, and their functionalities are not always self-explanatory. You won't be left to deal with it on your own, however. You will have a regular contact who will handle it all for you. You can also submit any queries through our client portal at any time as we offer a 24/7 technical support service.

Best Practice made by GOLDBECK: our Hirschberg site was awarded the DGNB Gold certification in September 2020 in recognition of the solutions that enable the office and administration buildings to be operated sustainably.

Commissioning a building with GOLDBECK:

- Calibrating the M&E systems
- Briefing users
- Monitoring user habits and resource consumption
- Readjusting the building services to ensure that they are set up for optimal operation

We also give you support beyond commissioning – our Facility Services take into account a property's long-term value retention, cost-effectiveness and sustainability.

Our 'Energy Adviser' is a little booklet for clients and users, giving them top tips on how to use their building efficiently and sustainably. We tailor the 'Energy Adviser' brochure to every project.

Our strengths



Extensive
technical expertise



Many services
provided in house



Smart
services



Quick
response



Outlook – our journey to a sustainable future

04

A modern, multi-story office building with a glass facade and a landscaped courtyard featuring a pond and greenery. The building has a prominent glass entrance and is surrounded by lush greenery and a small pond. The sky is clear and blue.

Outlook – our journey to a sustainable future

For us, sustainability is about always looking further ahead, constantly seeking out new solutions and developing strategies fit for the future. This way we can make our company and the buildings that we construct and operate even more resource and environmentally friendly. We factor in ESG (environmental, social and governance) criteria, which set the scope for our holistic, sustainable corporate development.

We gladly rise to the challenge

Building, using, renovating and demolishing buildings use a great deal of resources and as a result have a significant impact on our environment. GOLDBECK is fully aware of the responsibility that this entails, so we have set ourselves the objective of making our business as sustainable as possible while maintaining cost-effectiveness.

This is reflected in our sustainability strategy. We have already started incorporating many sustainability aspects in our design, production and construction processes, applying them to the raw materials we use and thus embedding them in our products and services. And since they are already in use, we are continually improving them too. We are also setting ourselves ambitious targets for the future.

We are committed to continuously improving our environmental protection and performance beyond the official requirements, laws and regulations. To achieve this, we are harnessing innovative methods and state-of-the-art technologies while fostering the exchange of knowledge.

Clear goals

A key component of our sustainability strategy is the steady decarbonisation of our business activities in order to achieve our global climate protection goals. In doing so, we consistently follow the principle of prioritising avoidance over reduction, and reduction over offsetting. As a positive contribution, starting in the 2023/24 financial year, we will offset CO2 emissions that have been unavoidable in our business operations up to now with carefully reviewed climate protection projects.

We are also continuing to work hard on making comprehensive improvements to the life cycle assessments of our products using the cradle-to-cradle concept. We will achieve this by continuing to check where our raw materials are sourced and how many resources they consume, as well as how well our products can be dismantled and recycled. We will then use this information to improve our environmental performance. Our aim is to use more recycled and even more sustainable, resource-efficient raw materials without compromising on quality or our products' high standards.

Careful analysis

We remain prudent and continuously assess the environmental impact of our business so that we can advance towards greater sustainability with purpose and focus. To do so, we draw on outside expertise, such as when we run comparisons on our construction methods with conventional ones. We also regularly review our goals and adapt them to the latest findings.

Strong community

It is especially important to us that our employees come with us on this journey. Successful environmental protection is only possible when everyone in the company does their bit. That's why we involve every employee in the process and encourage them to act with consideration for the environment in every part of the company. Our actions are transparent, and we welcome open, practical dialogue with our employees and business partners.

Building excellence

We will use a variety of measures to achieve tangible and measurable results, and these will help us to reach our goal of developing our company in an eco-friendly and cost-effective way. Our 'building excellence' motto will guide us on this journey.



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