SUSTAINABILITY

CONVENTIONAL UNDERGROUND CAR PARKS VS. WÖHR PARKING SYSTEMS

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INTRODUCTION

The fight against climate change will be decided on the construction site.

The concept of sustainability is becoming increasingly important in today's world, as we grapple with the challenges of climate change and scarce resources. Individuals and companies need to be aware of how their activities affect the environment and look for opportunities to design, live, and build in a more environmentally friendly way. We are confident that car parking systems from WÖHR can play a key role in driving forward sustainability, especially in the construction sector. The pressure to use urban spaces more efficiently while minimizing the ecological footprint has driven the development of sustainable car parking systems.

With our products and actions, we want to make a decisive contribution to making tomorrow's cities smarter, more efficient, and more sustainable.

SUSTAINABILITY AND CAR PARKING SYSTEMS

Sustainability is already inherent in the very concept of a car parking system. Even the very earliest parking systems saved a great deal of space and materials with their ingenious approach to parking vehicles.To this day, they offer an efficient solution to the parking problem in urban areas and have numerous advantages compared to conventional underground car parks:

Efficient use of space
Car parking systems from WÖHR make optimal use of the space available by stacking vehicles vertically. As a result, they take up less space than a conventional underground car park.

Packing more cars into a smaller area frees up vital space for housing, green areas, or social meeting places. This offers outstanding added value, especially in urban areas where space is at a premium.

Green areas with trees and plants in particular have a significant beneficial impact on the quality of life in urban areas, by acting as the »green lungs« of the city and improving the air quality and climate.

Energy efficiency
During the construction phase, a lot less earth is excavated and a lot less material is used. The fact that less earth needs to be excavated and moved generates considerable savings. Because more cars are packed into a smaller space, a great deal of the material normally required becomes superfluous, which offers enormous potential for savings in production and transportation.

Furthermore, conventional multistory underground car parks also require more installations, which all consume energy during the operation phase. All of this means that car parking systems have a smaller carbon footprint than conventional underground car parks.

Conservation of resources
The use of WÖHR car parking systems as opposed to conventional underground car parks reduces the consumption of materials and resources since fewer building materials are required to construct the WÖHR systems. One reason for this is that the WÖHR systems require fewer levels than conventional underground parking solutions. In particular, they require far less reinforced concrete, which is very resource-intensive to produce and difficult to recycle. This reduces the ecological footprint of the construction project and minimizes the use of limited resources.

Reduction of CO_2 emissions
In contrast to conventional underground car parks, considerable savings on emissions are achieved during the construction phase because, for example, less excavation is required, and fewer trucks are needed to remove the rubble and earth.

And because less material is used in the construction project, a sizable proportion of emissions are avoided in the transportation and production of materials.

Once the parking system is in use, the amount of traffic resulting from drivers searching for parking spaces in urban areas is reduced. Thanks to the parking systems, there are plenty of parking spaces, so drivers don't have to search for long. This also helps to reduce CO2 emissions and improve air quality. According to Germany's ADAC automobile association (March 24, 2022), 30% to 40% of traffic in inner cities is caused by drivers looking for parking spots.

Promotion of electromobility
Car parking systems from WÖHR can be specially designed to facilitate the integration of electric vehicles. By providing charging stations and special parking spaces for electric vehicles, they can promote electromobility and support the transition to more environmentally friendly means of transportation.

In the expansion of the e-charging infrastructure, they can be a crucial element for convenient charging.

CONVENTIONAL UNDERGROUND CAR PARKS VS. PARKING SYSTEMS: A COMPARISON

We would now like to compare conventional underground car parks and parking solutions with our car parking systems and highlight the differences in terms of area and volume consumption as well as material use, energy expenditure, emissions, and costs.

We will compare two approaches (a conventional solution and one that uses parking systems) with the same or similar conditions and prerequisites. Taking the same plot of land and the same number of parking spaces as our starting point, we will create the best possible design for each approach and compare the two.

As a basis for the comparison, we will use a fictitious plot of land for an apartment building that is approximately 33 meters long and 19 meters wide. The total construction area is around 640 square meters.

While the conventional underground car park has the same surface area as the parking system, it needs to have a second level with a second ramp to create the same number of parking spaces.

In general, the volume of a conventional underground car park is significantly larger than the volume of a solution that uses parking systems.

The first level is 3.3 m deep, and each additional level is another 2.4 m deep. The first level of an underground car park must be at least 3.3 meters under the ground to accommodate technical installations such as ventilation systems, fire extinguishing systems, and storage space for other equipment that may be needed. These systems are necessary to ensure the safety and functionality of the underground car park.

*All dimensions are based on the 2023 recommendations for parking facilities (EAR 23) issued by the German Road and Transportation Research Association (FGSV).

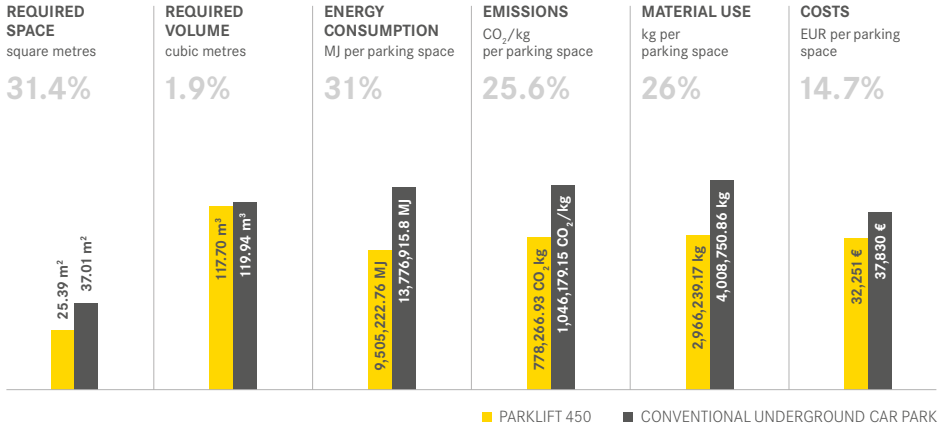
Parklift 450

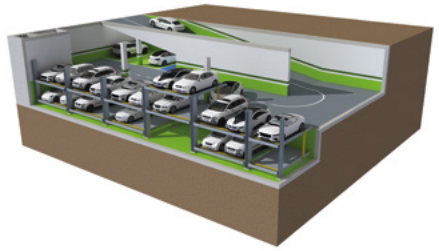
The Parklift 450 parking system is designed for independent parking of two cars on top of each other. To enable independent parking, the Parklift 450 requires enough space for three levels as the platforms have to move up and down.

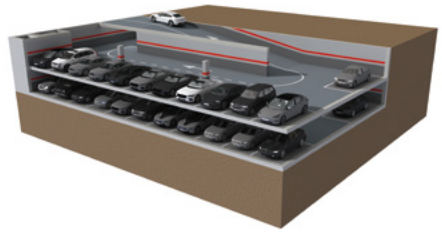
Surface area: width 19.05 m x length 33.70 m, approx. 642 m²
Underground levels: 2
Parking spaces in Parklift: 24

Parking spaces in conventional underground car park: 27
Parking space in parking system: Length 5.50 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m

*However, part of the pit has to be dug deeper (4.2 m). This deeper section extends over the entire length of 33 meters and is approx. 6 meters wide and 7 meters deep to accommodate the »Parklift 450.« A total of 24 parking spaces are located in this area.



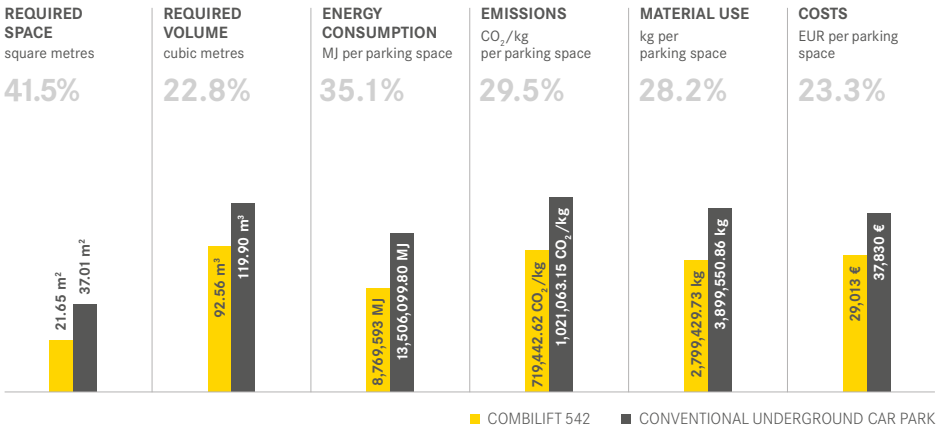


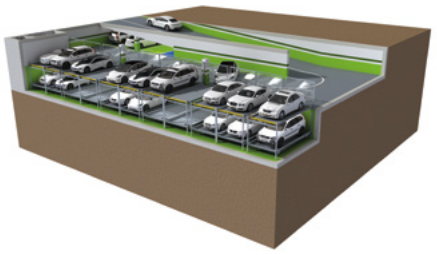


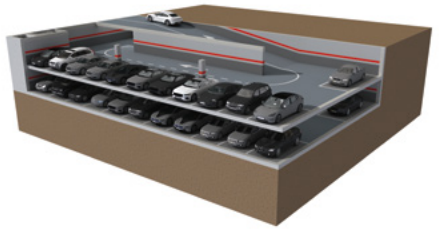
Combilift 542

In the »Combilift 542« system, vehicles are stored in a highly compact way by raising, lowering, and sliding the parking platforms sideways and can still be parked independently.

Surface area: Width 19.05 m x length 33.70 m, approx. 642 m²
Underground levels: 2
Parking spaces in Combilift: 25
Parking spaces in conventional underground car park: 27
Parking space in parking system:
Length 5.70 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m





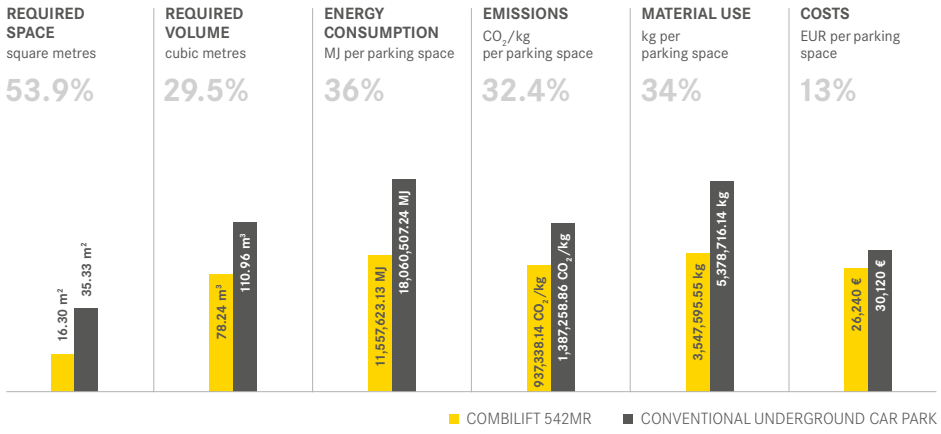


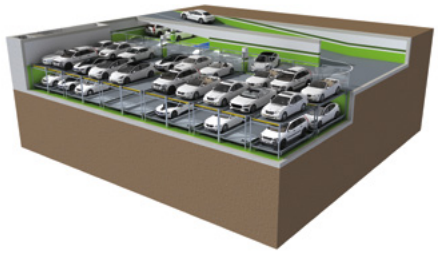
Combilift 542MR

In the »Combilift 542MR« system, vehicles are stored in a highly compact way by raising, lowering, and sliding the parking platforms sideways and can still be parked independently.

Thanks to the multi-row (»MR«) function, the systems and vehicles can be arranged in multiple rows. The flexible MR sliding platform acts as a bridge and provides access to the rear row of the parking system.

Surface area: Width 224.85 m x length 33.70 m, approx. 837 m²
Underground levels: 2
Parking spaces in Combilift: 46
Parking spaces in conventional underground car park: 39
Parking space in parking system:
Length 5.70 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m



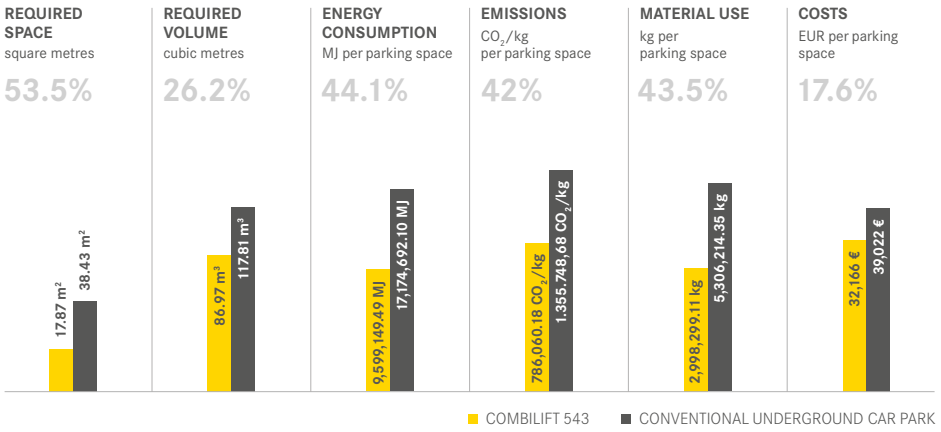


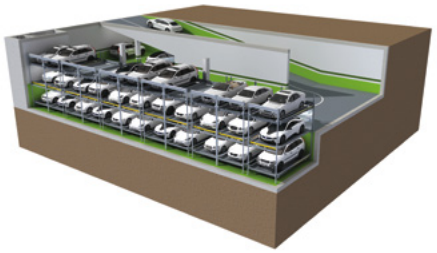
Combilift 543

In the »Combilift 543« system, vehicles are stored in a highly compact way by raising, lowering, and sliding the parking platforms sideways and can still be parked independently.

The Combilift 543 offers parking spaces on three levels with only one driving aisle.

Surface area: Width 19.25 m x length 33.70 m, approx. 649 m²
Underground levels: 3
Parking spaces in Combilift: 34
Parking spaces in conventional underground car park: 39
Parking space in parking system: Length 5.70 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m



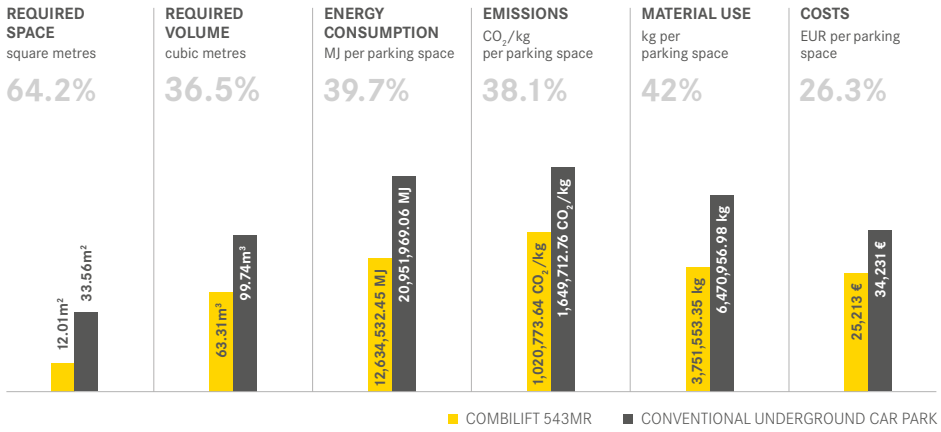


Combilift 543MR

In the »Combilift 543MR« system, vehicles are stored in a highly compact way by raising, lowering, and sliding the parking platforms sideways and can still be parked independently on three levels.

Thanks to the multi-row (»MR«) function, the systems and vehicles can be arranged in multiple rows. The flexible MR sliding platform acts as a bridge and provides access to the rear row of the parking system.

Surface area: Width 24.85 m x length 33.70 m, approx. 837 m²
Underground levels: 3
Parking spaces in Combilift: 67
Parking spaces in conventional underground car park: 60
Parking space in parking system: Length 5.70 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m

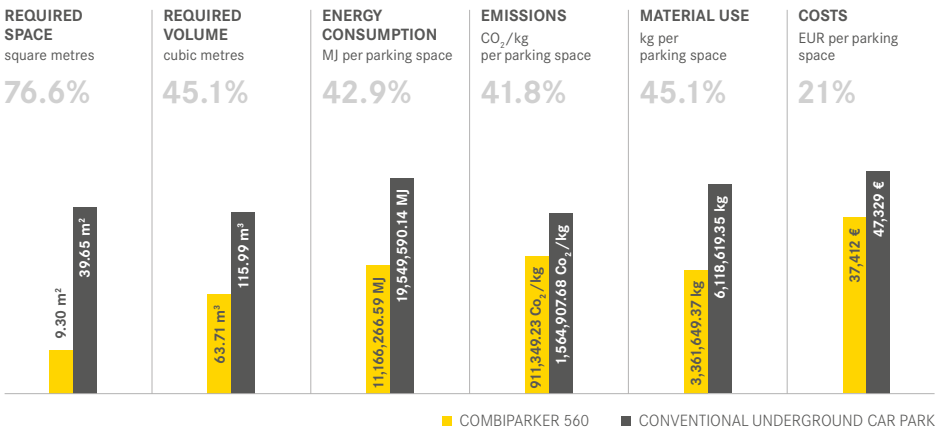


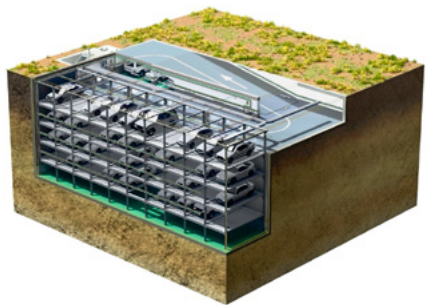
Combiparker 560

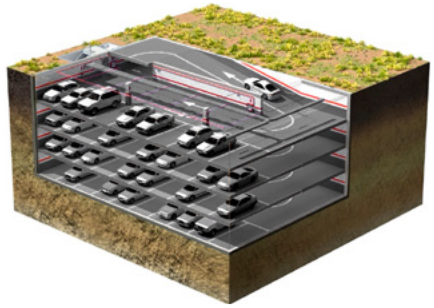
The »Combiparker 560« is similar to the Combilift and also makes it possible to store vehicles in a highly compact way by raising, lowering, and sliding the parking platforms sideways.

Thanks to a special technology, however, the Combiparker 560 can park cars on up to five levels – with only one access level.

Surface area: Width 19.25 m x length 33.70 m, approx. 650 m²
Underground levels: 5
Parking spaces in Combiparker: 58
Parking spaces in conventional underground car park: 63
Parking space in parking system: Length 6 m, width 2.70 m, height 2.05 m
Parking space in conventional underground car park: Length 5.20 m, width 2.65 m







SAMPLE CALCULATION: EFFICIENCY THROUGH PARKING SYSTEMS

Opting for a parking system instead of a conventional underground car park leads to considerable savings in terms of materials and labor. These savings in turn lead to a significant reduction in time and costs as well as lower interest charges. By integrating a parking system, the excavation can be completed around a third faster than with the conventional underground garage construction method. This allows construction work on the building above to begin earlier. While work is being carried out on the building above, the parking system can be installed below at a comfortable pace. This parallel working method leads to significantly lower construction time costs.

Sample calculation in detail

	Conventional underground car park	Parking system
Total costs	EUR 12 million	EUR 11.25 million
Average credit costs (50%)	EUR 6 million	EUR 5.625 million
Construction time	16 months	14 months
Interest rate	4%	4%
Calculation of interest	Interest = EUR 6,000,000 * 0.04 * 1.33 ≈ EUR 319,200	Interest = EUR 5,625,000 * 0.04 * 1.17 = EUR 263,250.00
Difference	EUR 319,200 - EUR 263,250 = EUR 55,950 → saving approx. 17.53%	

By opting for the parking system, the construction time can be shortened by two months and the interest costs reduced by more than EUR 55,950. These savings are of particular interest to property developers, as they lead to a significant improvement in the profitability and efficiency of the construction project.

Conclusion

Car parking systems offer numerous advantages over conventional underground car parks, from both an environmental and an economic perspective. Thanks to their space-saving design, they significantly reduce land use, which helps to conserve green spaces and minimize the degree of soil sealing in urban areas. They are also often cheaper to build due to the more efficient use of space.

Another significant environmental benefit is the reduction in CO_2 emissions. Car parking systems minimize the need for long access ramps and large driving surface and therefore require less concrete and steel – materials that are very energy-intensive and environmentally damaging to produce. In the operating phase, CO_2 emissions are also reduced due to shorter searches for a parking space, as traffic caused by drivers looking for a parking space is significantly reduced, and traffic flow is improved.

From a financial perspective, car parking systems offer potential savings thanks to their modular design, as time (and related costs) can be saved during construction. In addition, by increasing the parking density in the parking space, almost the same number of vehicles can be parked on fewer levels. This is important because underground building activities become increasingly expensive with each additional level.

Overall, it is clear that car parking systems are not only a more sustainable alternative, but also economically more advantageous.

*Information text on the individual parameters considered in the calculation

Energy expenditure
- Excavator (EURO6) for excavation work: 0.00062 MJ/kg
- Reinforced concrete (concrete foundation, concrete level, concrete ceiling, ramp, masonry): 2.48 MJ/kg
- Wall coverings: 7.98 MJ/kg
- Waterproofing: 97.00 MJ/kg
- Car park ventilation: 71.89 MJ/kg
- Fire protection: 41.49 MJ/kg
- Electrical installations: 75.30 MJ/kg
- Parking system: 25.42 MJ/kg

Material use
- Excavator for excavation work
- Reinforced concrete (concrete foundation, concrete level, concrete ceiling, ramp, masonry)
- Wall coverings
- Waterproofing
- Underground car park installations
- Parking system including assembly

Emissions
Excavation pit:
- Excavation/excavator: 0.00005 kg CO_2/kg
- Reinforced concrete (concrete foundation, concrete level, concrete ceiling, ramp, masonry): 0.23 kg CO_2/kg
- Wall coverings: 0.37 kg CO_2/kg
- Waterproofing: 3.00 kg CO_2/kg
- Car park ventilation: 2.45 kg CO_2/kg
- Fire protection: 4.71 kg CO_2/kg
- Electrical installations: 2.43 kg CO_2/kg
- Parking system: 1.72 kg CO_2/kg

Costs:
Approx. costs/m² for conventional parking
1st level = EUR 800/m²
2nd level = EUR 1,000/m²
3rd level = EUR 1,200/m²

Detailed comparison report for two excavation pits
1. Introduction: The objective of this report is to carry out a detailed comparison between two excavations, analyzing the excavation and transportation processes. The first case involves an excavation pit with a volume of 3,605 m³, while the second case involves an excavation pit with a volume of 4,379 m³. The goal is to identify the differences in excavation time, transportation time, CO_2 emissions, and savings between the two scenarios.
2. Methodology: The data for this report comes from various sources, including industry standards, manufacturer specifications, and values obtained in practice. The calculations are based on this data and on standardized formulas and assumptions that are widely used in the construction industry.
3. Excavation process: In the excavation process, an excavator is used to remove the earth from the excavation pit. The excavator has a capacity of 2 m³ of earth per shovel lift. The excavation time depends on the number of shovel lifts required.

ADVANTAGES FOR PROJECT DEVELOPERS

Advantages of WÖHR car parking systems

Economic benefits
The use of WÖHR car parking systems is associated with lasting economic benefits. These include savings on construction costs, lower operating costs, and a higher return on investment for the property due to the efficient use of the available space.

Environmentally friendly image
At a time when environmental awareness is playing an increasingly important role, the integration of sustainable parking solutions can help to improve the reputation of a construction project and the companies involved.

Flexibility and innovation
These systems offer customized solutions for various requirements and can be adapted to the specific needs of a project. This enables property developers to offer innovative and forward-looking solutions.

Cost efficiency
The shorter construction time and material savings mean that costs can be reduced during the construction phase. WÖHR car parking systems can also achieve long-term savings through optimal space utilization and lower energy consumption.

Attractiveness to end users
WÖHR car parking systems offer a modern, sustainable and innovative solution to the parking space problem in urban areas. The user-friendliness and convenience of such systems can make the entire construction project more attractive.

Sustainability certifications
The integration of WÖHR car parking systems into construction projects can help the projects to achieve sustainability certifications such as LEED or BREEAM. This in turn can make it easier to market the project and attract potential investors.

Future viability
In view of growing urbanization and the need to use urban spaces more efficiently, car parking systems represent a viable solution for the future. Property developers who adopt this technology at an early stage can position themselves as pioneers and secure lasting success.

Conclusion

The integration of car parking systems from WÖHR into construction projects offers numerous advantages in terms of sustainability, efficiency, and future viability. This innovative technology enables property developers to make urban spaces more livable and environmentally friendly by providing a sustainable solution to the parking space problem in towns and cities.

With their efficient use of space and energy, conservation of resources, and promotion of electromobility, WÖHR's car parking systems actively contribute to the promotion of sustainability.

SUSTAINABILITY AT WÖHR

WÖHR's contribution to sustainability

As a leading provider of car parking systems, WÖHR actively contributes to the promotion of sustainability:

Research and development
WÖHR continuously invests in research and development in order to develop innovative and energy-efficient parking solutions, not only for cars but also for bicycles, that support sustainability goals.

Product design
WÖHR's products are designed with sustainability aspects in mind, such as the use of environmentally friendly materials, energy-efficient technologies and the integration of electromobility infrastructure.

For example, WÖHR car parking systems are produced with a zinc-aluminum alloy, which offers the same level of surface protection as hot-dip galvanizing but yields energy savings of 70% in production.

Consulting and support
WÖHR offers comprehensive advice and support for property developers, architects, and designers to develop and implement sustainable parking solutions to suit individual requirements.

Environmentally friendly site
At the company site in Friolzheim, WÖHR uses 100% green electricity in production processes and regularly carries out energy-oriented refurbishments in and on the production and administration buildings.

In addition, several e-charging stations have been installed in the car parks and the majority of company cars have been replaced by electric vehicles.

Contribution of WÖHR products to sustainable development

WÖHR products contribute to sustainable development in several ways:

Decarbonization of mobility
By reducing traffic volumes and promoting efficient parking solutions, car parking systems from WÖHR contribute to the decarbonization of mobility.

Urban planning and development
The integration of car parking systems into urban development projects enables the sustainable use of urban space and promotes a livable environment for residents. In addition, parking more cars in a smaller space makes more space available for housing as well as green areas with trees and plants, which have a positive impact on the inner-city climate.

Modular design and flexibility
The modular design and flexibility of car parking systems enable cities to adapt to changing conditions, whether due to population growth, new mobility trends or changing urban planning requirements. This contributes to the long-term sustainability and resilience of cities.

Social integration
The reduction in the space required for parking creates new social spaces and meeting places for people and provides residents with an environment worth living in.

Economic stimuli
The implementation of car parking systems can boost the local economy by attracting investment in infrastructure and enhancing the appeal of business and residential areas. This in turn can create jobs and promote economic development.

Better mobility planning
It could also be interesting to consider the long-term effects of car parking systems, including their impact on traffic flow, city centers, and residents' quality of life, over a longer period of time. Relocating on-street parking spaces to denser mobility hubs means that streetscapes can be reorganized. In addition, the number of drivers searching for a parking space is reduced, which improves traffic flow and prevents accidents.

The integration of cycle lanes where on-street parking used to be can increase the safety of cyclists in traffic.

SUSTAINABILITY CERTIFICATES

EPD product certificate

Our Parklift 450 was the first parking system to receive an EPD (Environmental Product Declaration) certificate.

As part of the certification process, an analysis of the entire life cycle was carried out. This identified a high sustainability potential, primarily due to the long service life of the system and high recyclability of the materials used (95% recycling). Additional certification processes for Combilift and Parking Platform are set to take place by the end of 2024.

Projects with environmental certificates
Some outstanding projects implemented with WÖHR parking systems have also received high LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method) ratings.

BREEAM – WÖHR Multiparker 740
Calle Montalbán, Madrid – Live in a Work of Art

BREEAM »Very Good« certification
Sustainable densification of parking space during restoration project

LEED – WÖHR Parklift 462 & 463
Apolonio Morales, Madrid – the most sustainable building in Europe at the time

LEED Green Building Rating System – Platinum

WÖHR Combilift 551
UP Berlin, Berlin – revitalization of a department store giant

LEED »Gold« certification

WÖHR Combiparker 560
Falckenberg Ensamble, Munich – from car park monolith to neighborhood in the heart of Munich

Aiming for LEED »GOLD« certification

Photo: WÖHR + BAUER

OBJECTIVES

Global goals for sustainable development

Agenda 2030 aims to achieve socially, economically and ecologically sustainable development all around the world by 2030. To this end, the global community has agreed on 17 Sustainable Development Goals (SDGs).

These goals encompass all aspects of sustainability and are designed to help address the most pressing challenges of our time, such as poverty, inequality, climate change and environmental degradation. This is not only about improving living conditions in developing countries but also about sustainable development in industrialized countries.

Implementing these SDGs requires collaboration among all stakeholders at global, national and local levels. Enterprises play an important role and can make a significant contribution to achieving the goals through their commitment and innovations.

We are aware of our responsibilities as a company and are committed to promoting the SDGs in our business operations and beyond. We know that we can only ensure a sustainable future for ourselves and future generations if we all pull together.

In the following four areas in particular, our know-how and experience enable us to present innovative solutions for sustainable mobility and help meet the challenges of the future.

GREEN PARKING

ZIELE FÜR NACHHALTIGE ENTWICKLUNG

9 Industry, innovation and infrastructure

A growing number of people is moving to cities, and urbanization is progressing unabated. As a result, in future most of the world's traffic will be within a comparatively tiny portion of the Earth's surface. Our parking systems help to utilize urban space more efficiently and overcome traffic problems in densely populated regions. We offer bespoke solutions for limited space requirements and help improve traffic flow and avoid congestion with our technology, enabling commuters, residents and visitors to reach their destination conveniently while also avoiding stress.

We are constantly committed to sustainable urban development and thus contribute to improving the quality of life in cities.

11 Sustainable cities and communities

Creating green spaces is a key issue for the city of the future committed to sustainability. We at WÖHR contribute not only by creating additional parking space but also by preserving existing green spaces and housing. One example of this is shifting parking spaces underground. In this way, we create space and at the same time contribute to a greener cityscape. Our mission is about transforming cities and making them fit for the future.

Our products support the mobility transition and help create a sustainable and green city in which people enjoy living and working.

12 Sustainable consumption and production

We are aware of the importance of sustainability for the future of our planet and are committed to using its limited resources more responsibly and offering sustainable solutions to our customers. We are constantly committed to optimizing our production processes and products in terms of resource efficiency and sustainability. Our environmentally friendly parking systems are designed for long life and energy efficiency.

Our Parklift 450 was the first parking system in the world to come with an environmental product declaration (EPD), which documents a product's entire life cycle and ecological footprint. At our company headquarters in Friolzheim, we already rely 100% on renewable energies and are actively engaged in working for a greener future.

13 Climate protection measures

Our products have always been designed to be environmentally friendly and offer numerous advantages over conventional parking solutions. By consuming fewer resources during production and installation, they help reduce environmental impact. When in operation, they also produce significantly lower CO_2 emissions and thus help to improve air quality in cities. Searching for parking spaces is a major factor in inner-city emissions and can be minimized by our intelligent parking systems. With our commitment as a pioneer in the field of net-zero cities, we want to help reduce environmental pollution and improve the quality of life in cities.

WE COMPACT PARKING SPACES.
WE ENABLE LIVING SPACES.

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