



**PLGBC**  
Polish Green Building Council



# SUSTAINABLE WAREHOUSES



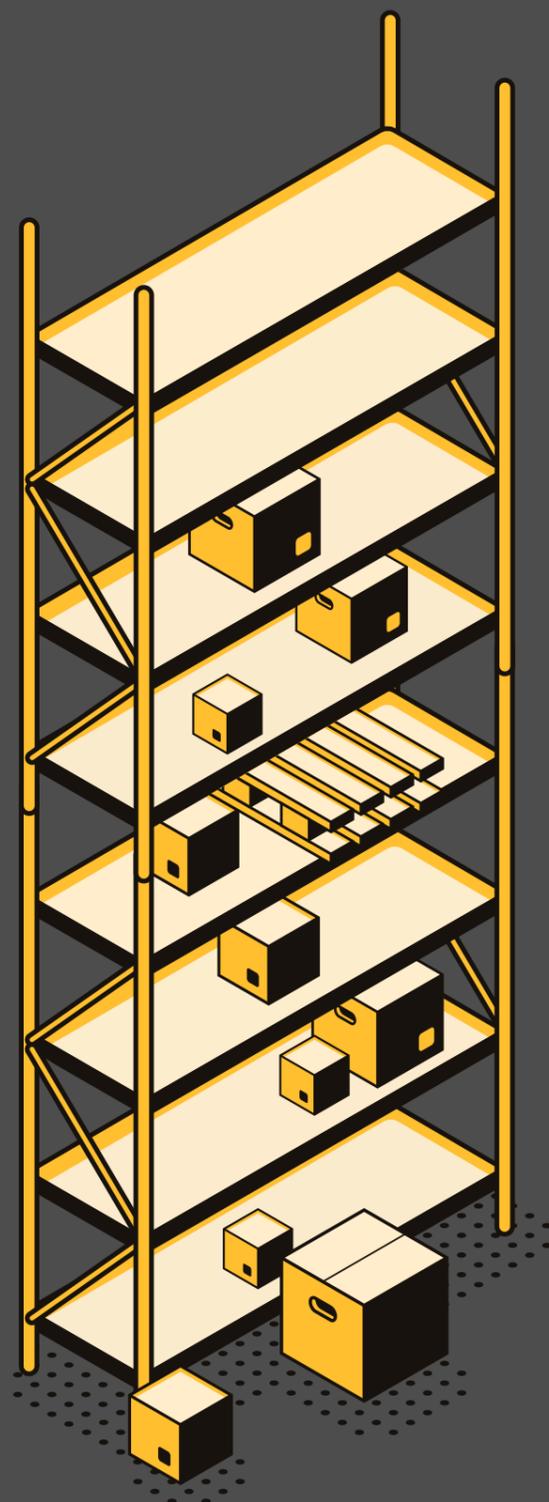
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The organisation supports the creation of sustainable buildings for all by:

- halting climate change and adapting to new conditions,
- applying the principles of the circular economy,
- enhancing well-being, quality of life and the health of society,
- enhancing biodiversity.

PLGBC is part of a global community of around 70 green building councils within the World Green Building Council.

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## TAGS IN THE REPORT



case study



good to know



according to an  
expert

## Why was this report written?

The aim of this report is to promote the best green building practices currently employed in the warehouse and industrial real estate market. The way to achieve this goal is to describe and evaluate current practices on the real estate market in the context of their impact on the achievement of the climate goals of the Paris Agreement / science-based targets. It also outlines the best practices that should be implemented to improve the warehouse market in terms of sustainable construction.

## What does it set out to achieve?

The aim of the report is to examine the current situation on the market and raise awareness of the existence of the best practices and green solutions that can be applied today and their impact on the fulfilment of current and future climate obligations. Its aim is also to indicate the scale of expenditure necessary to implement green solutions (low / medium / high). The best practices will be presented using case studies from the Polish market or, if the projects on the Polish market are insufficient for achieving the report's objectives, other markets.

## Who should read it?

The report is addressed to real estate market players who are interested in green construction and intend to implement sustainable solutions in their projects and investments.

# 1.

# LOCATION AND CONTEXT



## Location - choose responsibly

Modern supply chains require a diversified warehouse portfolio. When choosing the most convenient location for a warehouse, the key factor is access to the right transport infrastructure, such as motorways and other expressways, or sea port terminals. Some tenants focus on a central location for their main warehouse. Others depend on strengthening their presence on regional markets or, for example, on the logistical advantages provided by cross-border transport. In the wake of the pandemic, which resulted in the increased importance of e-commerce and logistics services, it became clear that all formats are now popular: big-box warehouses, BTS projects and city warehouses.

So far, the architectural planning of cities has been shaped by residential, office and commercial development (in no particular order). Today, however, warehouses are also becoming an important element of the urban and suburban fabric. Developers are responsible for the quality, aesthetics and usability of these facilities, as well as for ensuring that they have a neutral impact on the surrounding environment.

The development of warehousing within urbanised areas also creates new jobs. This is important for tenants in that it is easier for them to recruit employees – including well-qualified personnel. It needs to be remembered that modern warehousing facilities are not only warehouses – they also function as offices as well as production, retail or research & development facilities.

In order to obtain attractive land for logistics parks and last-mile warehouses, developers are increasingly opting for brownfield investments in post-industrial areas. These are in line with the sustainable construction trend and form one of the most important elements of smart city development policies.

One example is 7R Park Katowice II, which is being developed on the site of the former Huta Metali Nieżelaznych Szopienice steel plant. After the remediation of the land, reducing the amount of pollution, a complex consisting of a big box warehouse and a 7R City Flex network facility with smaller modules is to be built on the site. The use of environmentally-friendly solutions for this project will minimise its carbon footprint and allow it to obtain BREEAM certification.

Another example is the reclamation of two other plots for warehouse projects: 7R Park Szczecin and 7R Park Łódź West II. The first is being built on a post-industrial site formerly owned by the shipyard. A section of this was wasteland, with old, degraded, high-emission buildings that have since been demolished. In their place, two modern, sustainable warehouse halls are being built. A similar project is taking place in Łódź, on the site of a former aggregate reloading plant. After the area was cleaned up and the old railway siding and flyover were removed, a modern, sustainable warehouse and logistics park was built.

## Brownfields attractive to investors

Post-industrial sites are usually located within cities where a decreasing amount of land is available for warehouse development. In addition, they are often located in downtown districts, i.e. that are well connected with the motorway network and usually require only the reconstruction of the existing infrastructure, without the need to connect up e.g. parts of the road network, or install long connections or expensive water supply systems – and especially fire water supply systems – or build access roads.

However, it has to be borne in mind that brownfield sites are typically degraded areas with a long history and often contaminated land and groundwater. For new development to take place there (in the industry, what are known as 'brownfield projects'), the remediation of such contaminated land is required. However, there are still more advantages than disadvantages to this type of investment.

They represent elements of a closed-loop (circular) economy, because, as Piotr Kociotek, the environmental director for Europe at Panattoni, points out, they contribute to the rational management of land, including land of a high suitability for agriculture, and to a significant reduction in the amount of waste – up to 90% is recycled.

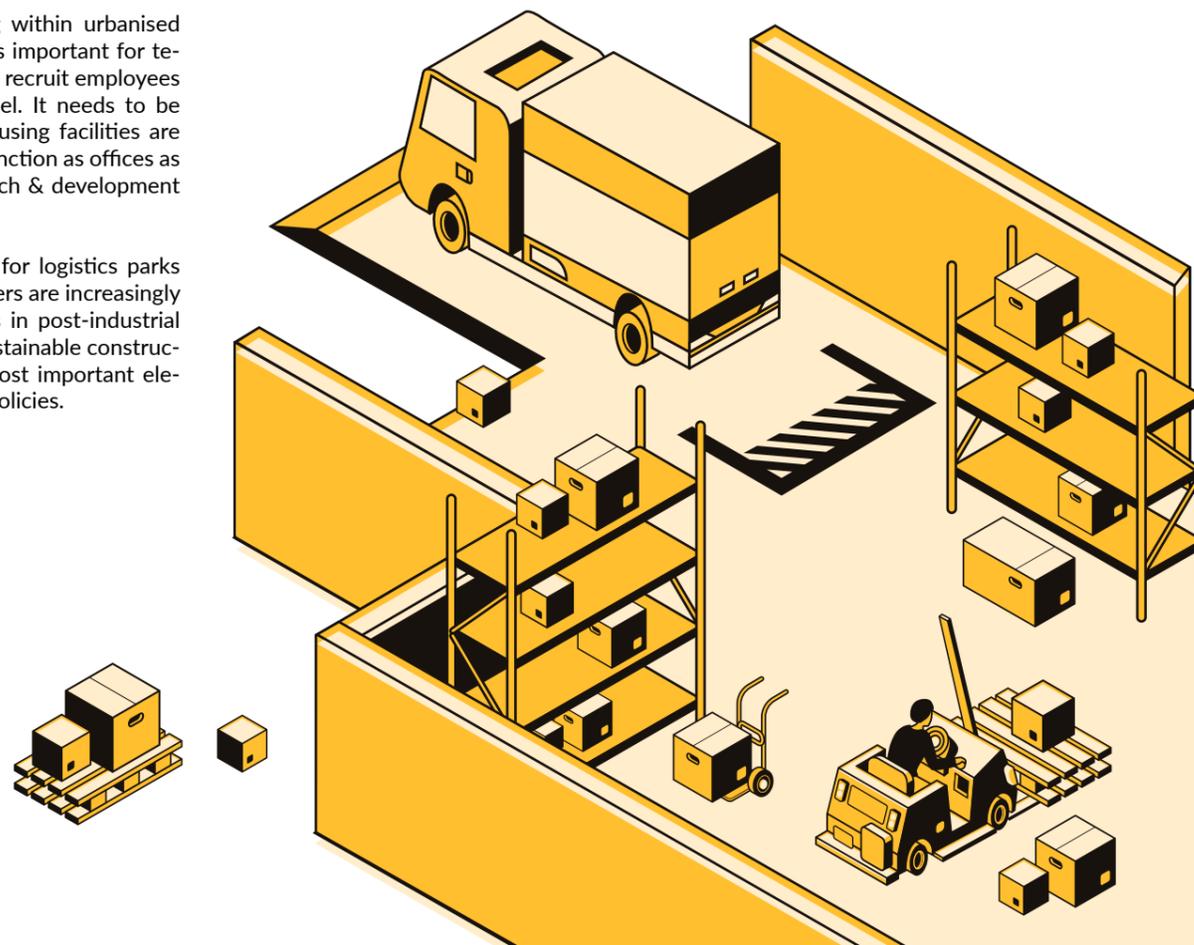
Demolition materials are treated as semi-finished products and reused at the construction stage or in other processes – such as the concrete, which is processed and used for the foundation work.

Brownfield projects can also restore the local area's biodiversity. One example of such good practice can be found with Panattoni Park Sosnowiec I, which was built on a post-industrial site, and thanks to the efforts of the teams working on the project, it was awarded the first BREEAM International New Construction Excellent rating on the industrial real estate market.

The investment was carried out in an area of low ecological value, but care was taken to preserve and improve its biodiversity, conserve resources, as well as for the health and well-being of its eventual users. On over 30% of the plot, green areas have been created – lawns and grassy areas, which are of exceptional importance for the local ecosystem, as the project has been built on the site of the former sand pit.

Another interesting example is the demolition of an old concrete production plant in Kraków's Nowa Huta district, which Panattoni is carrying out to make way for the construction of its City Logistics Kraków I park. Before the work could begin, the industrial history of the area was researched and soil and water samples were taken to gauge the degree of contamination. The entire reinforced concrete structure of the dismantled cement plant is to be recycled – the steel is being recovered and sent to the smelter as scrap, while the concrete is being crushed and processed into aggregate, to be added to the construction materials used for the new complex.

Post-industrial sites should, in the first place, be designated in the development plans of municipalities or cities as areas intended for revitalisation. A holistic urban analysis of this form allows for the effective and efficient management of the subsequent design work and remediation activities.



# 2.

# ACCESSIBILITY AND TRANSPORTATION

## Sustainable transport initiatives by socially engaged companies

In the case of logistics parks, external transport as the term is generally understood is an aspect that the investor should consider especially carefully at the investment planning stage, with particular reference to the location of the parks.

For facilities located in or in the immediate vicinity of cities, existing public transport networks are usually already operational and allow workers easy access. It is important, particularly in the context of multi-criteria certification, that the investor provides adequate access via footpaths between the logistics park and the nearest public transport stop.

The situation is slightly different when it comes to logistics parks located further away from cities. They are generally built in areas selected in terms of logistics factors, rather than in terms of public transport and employee access. Due to the fact that most of the employees of such facilities are people living in the vicinity of the park, the car remains one of the main ways of accessing it. The investor must therefore provide an adequate number of parking spaces for the park's employees.

Another means of transport suitable for employees living in the vicinity of the park, which is graded in multi-criteria certifications, is the bicycle. The investor, by providing bicycle stands and extensive hygiene and sanitary facilities for cyclists, can encourage employees to use this healthy and sustainable means of transport. Here, attention should be paid to the appropriate location of bicycle racks, which should be close to the entrance to the plant, as well as to the provision of repair points, and to ensure that the racks have roofs.

Currently, multi-criteria certification systems also cover the safety aspects related to this area, i.e. the accessibility of the facility from existing bicycle paths, or their development as part of a logistics investment. This makes sense in the context of the heavy traffic load on the access roads to the plant, as bicycle traffic on the roads is not recommended.

Shuttlebuses provided by the park manager are another common solution for transporting employees between the park and a convenient public transport interchange. Departure times and the frequency of the buses should be agreed on by the manager with the tenants to ensure they are in line with the shifts that employees work. Another good practice is for the investor to consult with the local authorities, preferably as early as the investment planning stage, so that

a bus service can be provided that runs to and from the logistics park at a suitable frequency. In such cases, it is common for the park's owner to co-finance these additional bus routes. This kind of investment, to a large extent, enables potential employees to reach their workplace and makes it easier for tenants to find the right staff. In both cases described above, the investor should provide bus stops, including in the park, in ideal locations.

In the case of larger logistics parks, especially those where one tenant is located in several halls, it is extremely important to ensure adequate transport links inside the park. Such local transport should be considered at the design stage, because it can sometimes require changes in site development conditions, while the tenants themselves have an increasing need for their employees not to waste time unnecessarily moving around the park. Another increasingly popular form of transport is the use of electric scooters, which, however, requires providing suitable facilities (ideally-located stands with charging points) as well separate paths for designated for scooters to ensure safe movement around the park for everyone.

Until recently, all electric vehicles were considered something of a novelty, but due to the technological progress in this area, including increased battery power and driving ranges, reduced charging times and lower costs, we can now speak of there being an electromobility revolution underway.

More and more companies representing various sectors of the economy are supporting initiatives related to environmental protection. In this way, they can improve their image, but also meet the expectations of employees and customers. Examples of such eco-friendly activities include car charging stations, bicycle parking, eco-driving courses for employees, and business trips involving the use of carsharing.

Warehouse developers are now seeing the potential of supplementing their existing infrastructure with electric car charging stations. Such facilities allow goods logistics to be based on the use of zero-emission vehicles and is an incentive for tenants, customers or partners to use electric cars.



Another interesting, and clearly environmentally-friendly, approach is to encourage carpooling. This can be promoted by, for example, designating places for such vehicles closest to the entrance to the building or by using marketing materials (posters, leaflets). There are also carpooling mobile apps available on the market, which makes it much easier for carpoolers to contact each other. The benefits of this system are manifold – the financial savings generated by a group of people travelling in one vehicle to a single destination, the reduced need for paved surfaces, but above all, the reduction in the amount of fuel consumed and CO<sub>2</sub> produced.

The use of photovoltaics or other renewable energy sources to supply the charging stations for electric and hybrid cars or scooters also reduces the amount of greenhouse gas emissions into the local eco-system. Other approaches include ensuring high levels of biodiversity and creating pedestrian walkways to allow employees to walk out of sections used by motor vehicles and through landscaped areas with some shelter from the sun, so that the walk between the car and the workplace is a form of relaxation. Employers have already noted that providing such high quality of life conditions, not only in the workplace, but also for every aspect of the employees' daily duties, increases their work efficiency.

Such features are already increasingly becoming a requirement for current and potential tenants, and so care for the environment through such activities is now becoming the norm on the warehouse real estate market.

To ensure greener transport through the use of electric cars, attention needs to be paid to where the energy for charging such a vehicle comes from. The goal of fully sustainable transport can only be achieved if the energy for charging the car comes from renewable energy sources!



# 3.

# ENVIRONMENTAL IMPACT

## Light pollution

Light itself is a positive phenomenon, but artificial lighting can have the undesirable effect of polluting the night sky. In order to minimise this problem, we can first of all design buildings according to the following guidelines:

- the use of lighting fixtures that do not radiate light upwards or onto neighbouring properties or areas. Flat instead of convex lampshades;
- providing lights with a minimum usable but standard luminosity;
- compliance with the standard permitted maximum values (PN-EN 12464-2: 2014) related to:
  - > the proportion of luminous flux emitted to the upper-half of the space (the so-called ULOR index, or UpwardLightOutput ratio),
  - > the luminosity permitted in terms of impacting neighbouring residential buildings,
  - > the luminosity of lighting beamed in undesirable directions,
  - > the luminosity of elevations and advertisements;
- providing control and zoning of outdoor lighting, i.e. with dimming and timer options, and installing motion and presence sensors.



## What can we prevent?

Light pollution has a significant impact on the environment and health – and humans are no exception to this. Excessive lighting disrupts the biological clocks of humans, plants and animals, leading to – among other problems – disturbed asleep and reduced sleep quality, headaches, stress and other conditions. It also disrupts the growing seasons for plants as well as the spatial orientation and behaviour of animals.

In France, new standards for outdoor lighting were introduced in 2020, in order to completely abolish light radiation above the horizontal line of the light fitting, to improve the colour of the lighting to a warmer tone (3000K – the colour of the sunset), and to minimise the use of artificial night lighting, which should have a positive influence on both local residents who are exposed to the light at night as well as the local fauna.



## The impact of noise on the local community and natural environment

Nuisance noise is noise that is so excessive or that causes such a disturbance that it can have a negative impact on people's health or quality of life. During the design and construction phases of buildings, the noise profile of the area, the local topography and the location of the buildings need to be taken into account. Their orientation and design should be strategically planned to minimise the potential impact of disturbance and noise, both within the building and that caused by the building.

Ensuring that a building has the right acoustics is an issue that has many variables, so it often requires the input of an expert at the design stage and special supervision during the purchasing and construction work. The results are worth the extra effort, because acoustic comfort cannot be overestimated.

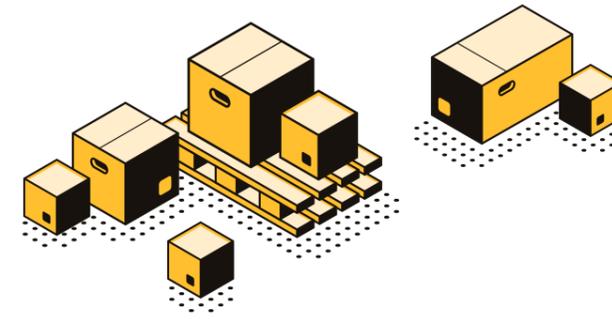
According to BREEAM INC 2016 criteria, in rooms intended for leisure or individual work, the permissible sound level cannot exceed 40dB. For multi-person offices, the maximum sound level is 40-50dB, while in meeting rooms it is 35-40dB, while the appropriate reverberation time should also be ensured.

Internal installations should be designed so that their maximum sound level is 5dB below the permissible sound level in a given room.

The appropriate level of acoustic insulation of the external partitions should be determined in relation to the level of external noise and the permissible sound level in the room.

The acoustic insulation of internal partitions should meet the requirements of the PN-EN ISO 717-1 standard.

BREEAM INC 2016 certification includes a noise reduction credit for the impact on nearby residential areas. The requirements take into account the difference between the existing background noise level and the background noise level when the noise sources of the new building are included, stipulating that they should be not more than 5dB during the daytime and 3dB at night.



The LEED v4 and v4.1 certification schemes allow for a pilot loan to be taken out for reducing the noise generated by a new investment. Noise tests should be performed in one location for 24 hours. The maximum noise level of a project located close to residential buildings cannot exceed a background noise level of 60dB and the average noise level cannot exceed 45dB.

For projects that are not near residential buildings, the day-night noise level limit (Ldn), or the equivalent noise level in a specific area, is 60dB (CNEL).

The standards listed above can be achieved by applying best practices, such as:

- adjusting the acoustic insulation of partitions to external and internal conditions;
- the use of vibration isolation solutions;
- providing installation passages through partitions that do not reduce the acoustic insulation of these partitions, e.g. passages in sleeves sealed by filling them with mineral wool with a permanently elastic mass;
- the use of acoustic silencers for intake and exhaust vents;
- turning off or reducing the power of devices at night;
- the use of acoustic screens of an appropriate height and with sound absorption qualities.

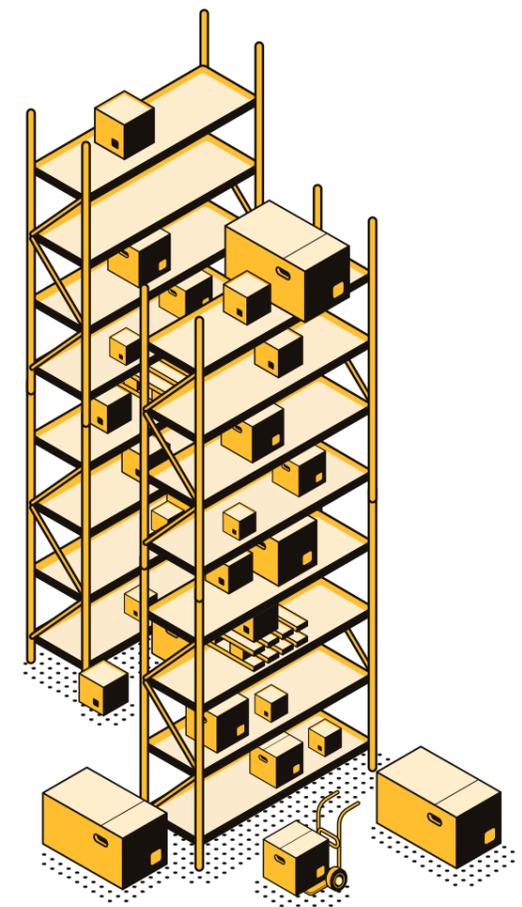
## What can we prevent?

Noise pollution can potentially contribute to tension, anxiety, decreased performance and productivity, hearing problems, high blood pressure, stress levels and psychological damage. Its wider effects can include:

- economic impact, such as reduced property values and employee productivity;
- social impacts, such as sickness or absenteeism;
- vibrations caused by certain sound waves that can damage the structure of buildings.

For many years, Panattoni has had an environmental approach in its projects, aimed at minimising their impact on the natural environment. In line with the standard adopted by the company in 2021 to always meet the requirements of BREEAM certification at the 'Excellent' level, the developer has widened the scope of such measures. One is to undergo a CO<sub>2</sub> emission analysis of each of its building's life-cycles prior to their construction.

As Emilia Dębowska, the sustainability director at Panattoni, explains: "At the design phase, we take into account the emissions that will be generated by the construction materials used. When selecting these, we set out to stay in line with the EMS (Environmental Management Systems) group's environmental certificates, such as EPDs (e.g. for the doors, insulation, drywalls), FSCs (for the structure and legality of the timber used for this), as well as the ISO 14001 of the manufacturer (e.g. concrete poles, insulation). We also carry out a life-cycle assessment, in which we calculate the total carbon footprint of a project over its entire life cycle."



# 4.

# ENERGY EFFICIENCY

## Enhanced lighting

The lighting in warehouses, due to the specific nature of such buildings, is energy-intensive. Energy consumption can be significantly reduced, and thus CO<sub>2</sub> emissions, by using LED lighting, positioned in suitable places and through lighting control. LED lighting is several times more efficient (with lumen streams of as little as 1 Watt) compared to traditional sources, while also requiring less material in its production, having a longer life, the possibility of directing the light stream and trouble-free control. Lighting control can also be used to reduce energy consumption through the appropriate use of motion and light sensors in combination.

**When the energy models are calculated for warehouse facilities, total energy savings using LED lighting and lighting control systems can be achieved of up to 80% compared to standard methods.**

The lighting in warehouses is installed in elevated parts of the building. Therefore, high-power lighting fixtures are used to ensure adequate illumination. An additional consideration is that employees work in the storage space often in two or even three shifts.

To reduce energy consumption and CO<sub>2</sub> emissions, use:

### 1. LED lighting

- greater energy efficiency (lumens per Watt) compared to traditional lighting, which means that fewer bulbs are needed;
- longer life (3-5 times) compared to traditional lighting, thus reducing waste and effort in replacing the lights;
- the option of directing the light with lenses, through which the light can be focused;
- the option of trouble-free control of the LEDs, which extends their life and increases their efficiency.

### 2. Lighting control

- centralised, wired systems in which each light and its fitting are individually controlled;
- changes to the settings using the management software, thanks to which the lighting can be adapted for new tenants or new requirements – with no additional work;
- sensors for high-ceilinged rooms – high-bay type halls;
- the use of light sensors in buildings with skylights – energy savings of approx. 30%;
- the use of motion sensors in the inter-rack lanes – energy savings of approx. 30%;
- the use of timers for switching the lights on and off;
- savings from avoiding the over-illumination of the buildings – of approx. 15%;
- optimised combinations of the above – for the example, in a warehouse that after optimisation generates 50% savings, the ROI was 2 years (with a 75% warehouse section and a 25% logistics, unloading and loading section);
- the option of adding monitoring and energy consumption functions to the system.

**Energy efficiency is defined as the ratio of the obtained value of the useful effect on a given facility, technical device or installation, in typical conditions of their use or operation, to the amount of energy consumption by this facility, technical device or installation, or as a result of the service performed that is necessary to achieve this effect.**

Due to their size and cubic capacity, warehouse buildings require a significant amount of primary energy for heating, cooling, lighting and the operation of technical systems. Whereas, as the developers and contractors of these facilities, we have no influence on the energy consumption of the building's systems, we do for the building's own needs.

As a conscious and responsible contractor, we can contribute to a reduction of CO<sub>2</sub> emissions into the atmosphere by offering tenants and investors various methods of increasing energy efficiency.

To improve energy efficiency, three areas should be considered:

### 1. The building envelope:

- the insulation of partitions,
- the tightness of the building.

### 2. Building equipment that reduces the demand for utilities:

- the use of energy-saving and primary energy-saving heating and air-conditioning systems;
- the use of energy-saving lighting systems;
- the use of control systems in order to provide the most efficient use of the installed systems.

### 3. Building equipment that enables the use of renewable energy and the reuse of resources:

- the use of rainwater recovery systems;
- the use of photovoltaic systems to partially meet the demand for electricity;
- the use of heat recovery systems for installations using hot water, e.g. for cleaning vehicles;
- the use of skylights with a rigid tube to provide natural light in rooms separated or much lower than the halls;
- the use of innovative trigeneration systems.

The energy efficiency of industrial facilities should be considered at the design stage and should include the functional conditions of the plot, its location and design of the shape of the building. This is crucial for achieving the maximum energy efficiency of individual zones, especially for glazed offices. Therefore, we should avoid undesirable light exposure for the office units and allow the body of the building to have an irregular outline, for the creation of natural partitions.

Drawing up a detailed approach for buildings is another step that should be given equal weight to energy modelling, e.g. in accordance with BRE standards.

It is worthwhile using building management systems – both simpler and more advanced versions, such as building automation BMS, to provide efficient energy management. Thanks to the use of comprehensive energy calculation and monitoring systems (with a greater number of meters), it is possible to separate out not only the main systems in halls and offices, but in the case of the latter, to separate the lighting from the ventilation, thanks to which the building manager has the ability to accurately monitor and identify increases in energy consumption.

Heat recovery systems can feature the use of innovative technological devices, e.g. recuperation in the air handling units in offices. Thanks to these, up to 80% of heat can be recovered.

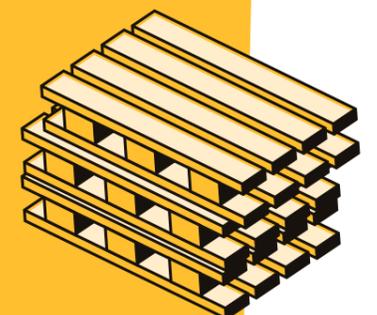
The tightness of facilities and the insulation of thermal bridges are also important.

Most class A warehouse buildings are fitted with LED lighting, and some are additionally enhanced with dynamic control systems.

**As Emilia Dębowska comments: "This solution allows the lighting intensity to be adjusted according to the levels of natural light penetration, for example, through the skylights."**

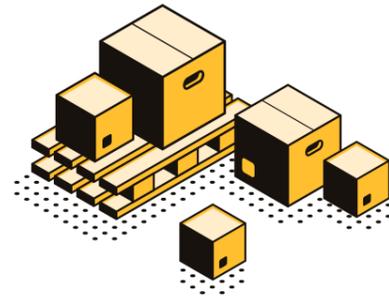
Buildings equipped with solar panels for heating the water and photovoltaic installations are also appearing on the market – e.g. the photovoltaic installations in Panattoni Park Bydgoszcz III.

Combining solutions leads to savings of 50% in energy consumption and a reduction in power consumption by up to 60% – according to Panattoni.



# 5.

# THE INTERIOR



### Energy efficiency in warehouses

According to the World Economic Forum's data, buildings are responsible for 40% of global energy consumption and a third of greenhouse gas emissions. Warehouses are one of the main links in supply chains. Therefore, developers and their tenants are looking for ways of achieving climate neutrality goals in their projects. The ambition of the sector is to achieve total energy self-sufficiency in the future, based as much as possible on renewable energy and, in the case of logistics operators, on electric vehicle fleets. The level of energy consumption during warehouse operations can be minimised through energy efficiency management systems in the building and constructing them in ways that prevent, for example, heat loss.

Panattoni's strategy for reducing its carbon footprint has been implemented through an energy-saving policy – the developer has achieved savings of 50% in terms of energy consumption while reducing power consumption to 60% of the base value.

When it comes to energy efficiency, the company places particular emphasis on solutions for increasing the energy efficiency of buildings. These include minimising heat loss by improving the thermotechnical properties of the building's structure, energy-saving windows, energy-saving lighting systems inside the building and in adjacent areas, and intelligent energy measurement systems (featuring the remote reading of all energy meters, enabling constant control and possible improvements in the event of over-calculating the power consumption), and the use of BMS and HVAC systems in the office sections. The facilities are to be powered exclusively by renewable energy.

### Real benefits

7R's research shows that for a facility with an area of 20,000 sqm that has photovoltaic panels, increased wall and roof insulation, LED lighting and an energy management system, energy consumption is reduced by up to 50%. In the same building, water savings of up to 2,400 litres per day can also be generated, thanks to the use of a grey water system, appropriate rainwater management as well as consumption and leakage control.

The developer has analysed the real benefits of the sustainability solutions that it offers to its clients.

Chargers for electric cars, as well as planting vegetation, flower meadows and green roofs, can reduce CO<sub>2</sub> emissions by approx. 381 tonnes per year. From the point of view of the tenants of the building, it is also important that such green solutions have an impact on the well-being of their employees. Green surroundings, relaxation zones, outdoor furniture and bicycle infrastructure increase the efficiency of employees by up to 20%.

### Customised solutions

There are already commercial properties in Poland that do not need external energy to function. One example is BWI Group's research and development centre, which has been fitted with a trigeneration system. The gas-fired unit produces the energy needed to power, heat, cool and ventilate the building. This is the first implementation of this type of technology in an office and laboratory facility carried out by 7R. „Previously, similar systems were used only in industrial or waste incineration plants, which shows how crucial it is for reducing the carbon footprint of real estate to utilise existing technology and local energy management systems.”

### Smart design for the well-being users

Care for the health and well-being of a building's users is among the best practices employed by responsible developers and investors. In order for employees to feel good inside industrial facilities, the cooperation of several design teams dedicated to smart design is needed at many levels – starting from the location itself, through to the interior and the workplace.

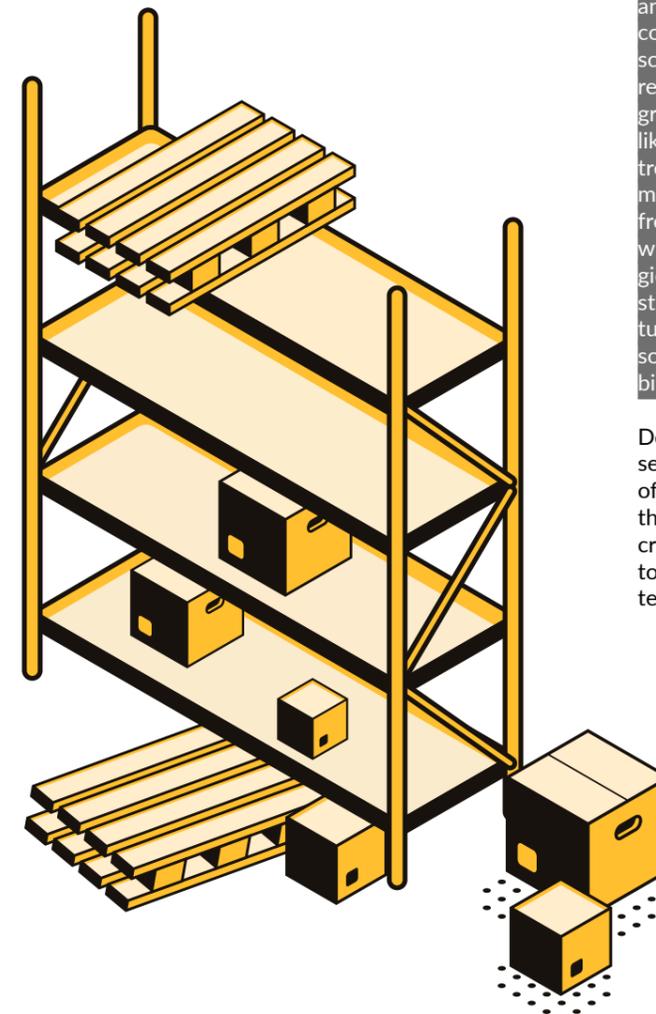
When designing the office space within a building, the orientation of the project itself should be taken into account, on the one hand, to ensure access to daylight, and on the other, to avoid such effects as glare or excessive sunlight.

In order to provide an optimum intensity of natural light over the entire area, the depth of the rooms should not exceed 7m (exceeding Polish legal standards). It is good practice to use light breakers, e.g. as part of the structure of the building itself or through the use of adequate blinds. In addition, it is worth providing openable windows so that employees have access to fresh air.

It is also important to use materials with reduced levels of organic compounds in accordance with the ISO 1600-9 standard and, at the end of the construction work, to check the level of volatile compounds throughout the building in a laboratory.

The next step, according to developers, is the introduction of biophilic design to buildings' interiors – not only in the office sections, but also in the warehouses. It is worth noting, however, that they are already betting on a green approach – and not only figuratively, but also literally. The 'Go Earthwise with Panattoni' policy assumes the creation of four main zones: an entrance, as a showcase for tenants; an entrance constituting a green gate to the office section; landscaping; and a relaxation zone. Each performs a different task and therefore has a different character – the greenery in each of Panattoni's developments looks like a zoned but informal English garden with native trees, irregular shrubs and large expanses of flower meadow and landscaped lawns. Green areas requiring frequent mowing have been deliberately dispensed with. In place of short, evenly trimmed lawns, ecological meadows are now created, which maintain moisture, prevent soil erosion, reduce the air temperature, act as significant producers of oxygen and absorbers of carbon dioxide, while additionally ensuring biodiversity.

Developers and investors in the industrial real estate sector are also working on improving the availability of office space for all potential users, especially for those with disabilities. Therefore, it is becoming increasingly common for the elevators in office sections to be adapted for the blind, with notices ('Braille plates') fitted for the visually impaired or the blind.



Material optimisation during the development process is made possible by maintaining transparency when it comes to accessing information. In addition, the growing importance of third-party verified certificates has raised the awareness among building materials manufacturers of the environmental impact of buildings.

The role of investors and general contractors now involves ensuring that producers are aware of existing certificates for materials.

Much depends on the markets that are supplied. Producers that distribute their goods to several markets or globally are in a better position to do all this, because Poland is still not among the leaders in the field of certification.

Projects that undergo sustainable construction certification are driving these changes. Points in the material category can be earned by opting for a carefully supervised product selection process to ensure that there are enough products with the required documentation. The requirements are rather high, however.

#### The impact of the production process on the environment

The use of the right construction building materials is included in the scoring of multi-criteria certification systems in terms of their environmental impact and transparency. Such an analysis can be provided by such certificates and declarations as independently verified EPDs, C2Cs and HPDs, or statements about the content of recycled raw materials and the location of their extraction and production in relation to the location of the investment.

The deliberate selection of products with such declarations allows for the optimisation of solutions with more favourable environmental parameters, which are currently calculated for certified investments as part of their Life Cycle Assessments.

"Many of our partners have such certificates. On the other hand, those who are only in the early stages of adopting their CSR policies and their plans to decarbonise production are very eager to obtain certificates when entering into joint investments. It is very satisfying to see how, thanks to such joint efforts and cooperation, the market is being transformed before our very eyes," says Katarzyna Krześniak of NG Concept.

#### Indoor air quality

Another separate issue is the content and emission of volatile organic compounds (VOCs). Reducing their cumulative emissions in rooms has a positive impact on the efficiency of users' work and their well-being, so it is worth taking a closer look at the scope of the finishing work.

International producers are again taking the lead in this respect. Due to the specific requirements for testing, the optimal way to ensure compliance with certification requirements is to obtain specific certificates recognised by building certification bodies (e.g. EMICODE EC1+).

There seem to be many certified products available on our market. The problem is the availability of relevant data. The vast majority of manufacturers do not provide tests on their websites, so the only way to confirm the existence of such documentation is to contact the manufacturer each time. There are also no publicly accessible databases where the investor could select products with acceptable VOC test results.

#### Where are we heading

The transparency of the production and composition of construction products is but one stage in more ambitious plans to increase the efficiency of processes and complete the production cycle using resources that are already available on the market. In this way, waste can be reduced (ideally to zero) as well as the extraction of new raw materials.

This process is designed with circularity and energy efficiency in mind:

##### 1. Transparency

Information about products and the optimisation of their selection during the development process is possible while maintaining transparency in accessing information. Additionally, the growing importance of third-party verified certificates raises awareness of the environmental impact of buildings.

The choice of EPD Type III products can be combined with optimisation and better environmental performance (LCA). Information on the content of ingredients (e.g. on HPD and Declare labels) makes it easier to care for the health and well-being of users.

##### 2. Material efficiency

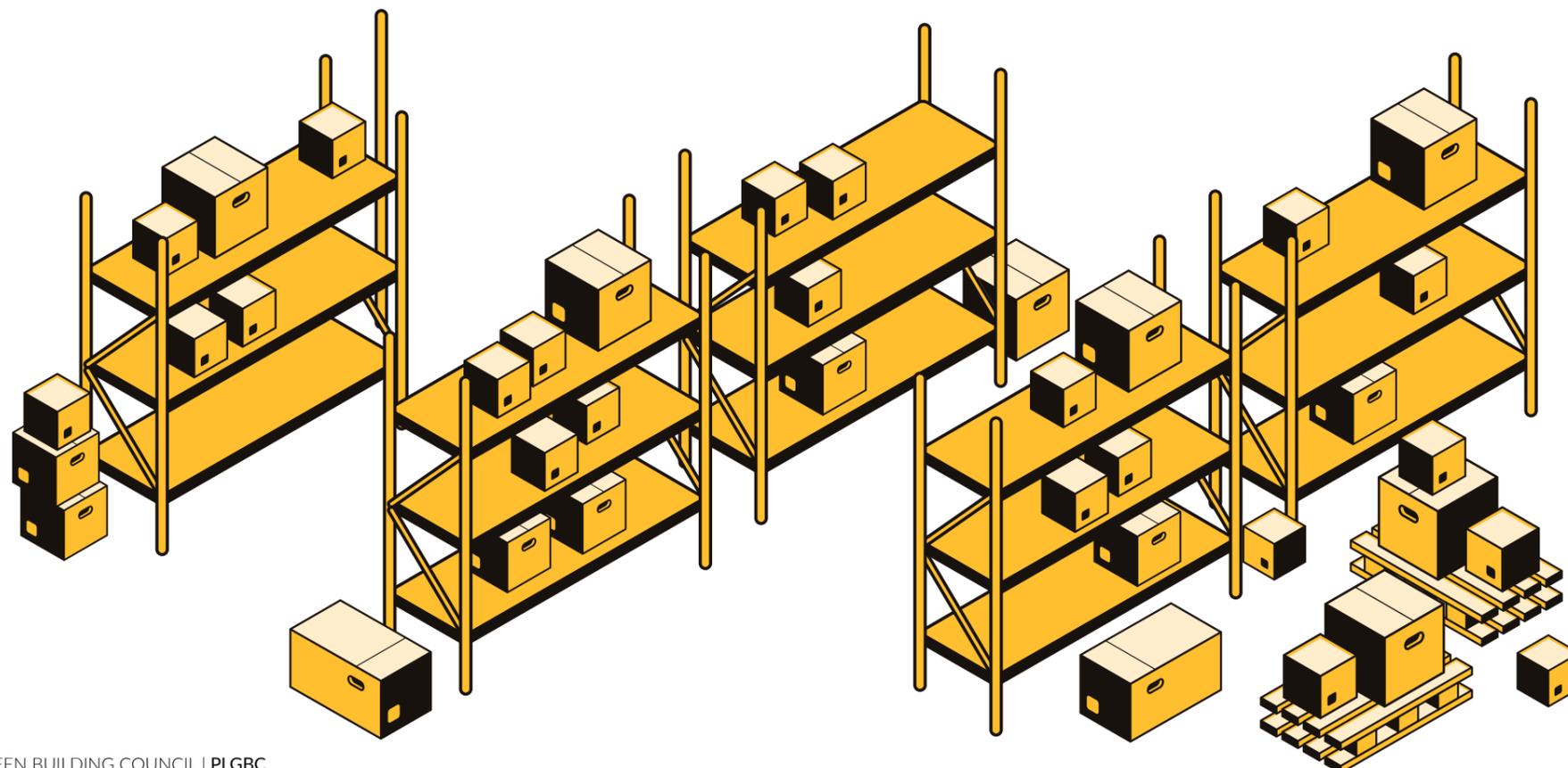
The functions and parameters of products in warehouse facilities are important. This requires choosing the most environmentally-friendly products without compromising the structural stability, durability or longevity of the building.

##### 3. Market analysis:

- construction products,
- declarations,
- certificates within certain product groups

##### 4. Sustainable construction process:

- an appropriate selection and optimisation of orders,
- required transport,
- energy consumption,
- reducing the environmental impact,
- conserving existing natural elements,
- waste management,
- consideration for local residents.



**A sustainable construction process is a well-planned process**

Ensuring a sustainable construction process is an extremely important step in the creation of buildings that are friendly to the environment, their users and local communities. This is a complex process and requires the efficient cooperation of all its participants – from the PT investors, the designers in each sector, the suppliers of materials and manufacturing systems, the contractors, through to the tenants and their teams that maintain the buildings. Excellent cooperation, however, brings tangible results.

From the perspective of a general contractor implementing sustainable development principles for a project, organising the construction process in such a way as to minimise its negative impact on the environment is one of the key challenges. In order to work as efficiently as possible and at the same time respect natural resources, it is necessary to select materials and technology that guarantee the highest quality of construction and that are environmentally-friendly at the same time. It is extremely important to optimise what is ordered, by carefully calculating the amount of materials necessary and their dimensions. All of this minimises the amount of waste.

Transforming design processes through BIM data management minimises the discrepancy between computational and actual requirements to less than 1%. This is ostensibly a huge step forward in reducing construction waste.

Another important feature of a sustainable construction process is the waste management. According to Polish law, all the waste created on a construction site must be disposed of. Through segregation, up to 95% of the waste can be recycled. The profitability of in-site or off-site segregation should be calculated individually for each project.

Waste can also be segregated off-site. Regardless of the method chosen by the general contractor, the percentage of recovered materials should be specified in the contract with the waste processor. Construction waste is not recycled unless this has been stipulated by the contracting authority. Why? Because it is more expensive than landfilling.

A separate but altogether necessary step is the recovery of materials from construction waste. The competencies and willingness to segregate waste possessed by construction teams still leave a lot to be desired.

The key is to clarify the scope they have to act in this way in terms of their cooperation and to consistently enforce requirements. This is always a challenge and requires a great deal of effort, but the results are well worth it.

Good construction practice plans can also be considered as an additional commitment by investors to the sustainable construction process. These often cover issues such as dealing with the pollution during construction, the speed of movement around the construction site, the elimination of exhaust emissions during unloading, and so on. It would seem that for larger investments these are simply what is required by the relevant environmental permit, but it is still not a practice that is universally adhered to, and therefore this approach requires special attention and sensitivity.

The most important factor, however, is to have a sincere commitment and conviction about the need to do this work through educating the construction management to the right level. It is impossible to carry out sustainable development as an 'overlay' onto the old construction process – i.e. onto traditional approaches to carrying out the work. The knowledge of the people directly managing the construction site should provide sufficient tools for them to talk freely with producers and contractors, which should be the driving force behind the changes that we want to see on our construction sites. The ratio of the level of awareness and understanding of the need to implement sustainable development to the results of such efforts is directly proportional.

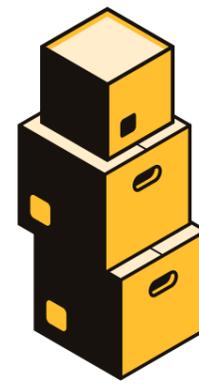
With a view to reducing CO<sub>2</sub> emissions, it is worth cooperating with subcontractors based as close to the development site as possible. The situation is similar with building materials – it is best to obtain them from warehouses located near construction sites. Keeping records of the consumption of water, energy, waste and the transportation of materials provides an accurate picture of actual needs and allow activities to be optimised, as well as for other possible projects.

A responsible construction management process also involves conserving nature and minimising activities that have an adverse impact on the environment, such as generating dust, noise or surface water contamination. To avoid disruption to ecosystems and to protect plantings, existing trees need to be preserved. New natural flora should be planted in line with analyses carried out by landscape architects and green suppliers.



# 7.

## MANAGING THE DESIGN PROCESS



In Poland, there is about 1,800 m<sup>3</sup> of water/year per capita, while during droughts the figure drops below 1,000 m<sup>3</sup>/year/person. Taking this into account, our country is among those most at risk of water shortages. The average amount of water per capita across Europe is 2.5 times greater – approx. 4,500 m<sup>3</sup>/year<sup>1</sup>.

### Low water retention and water saving

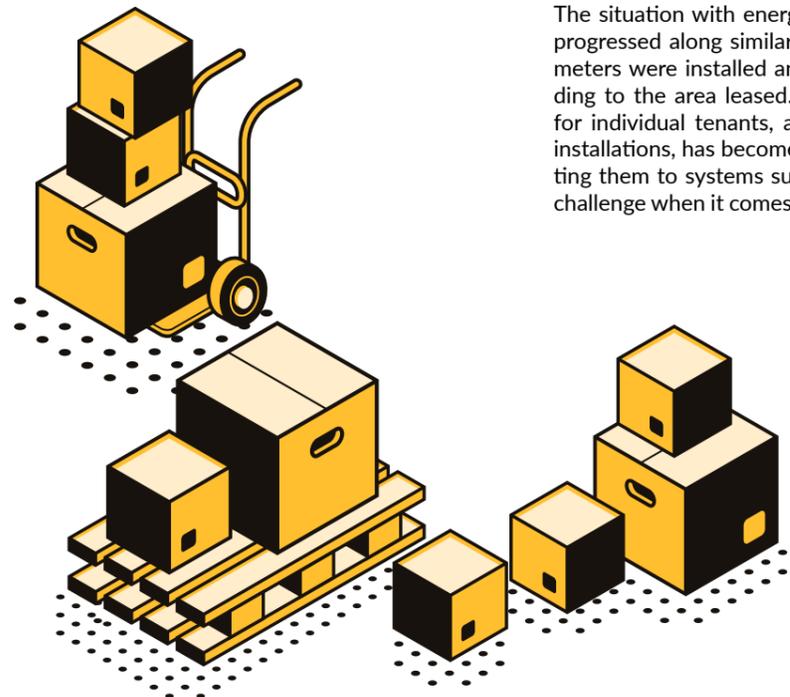
The management of rainwater in logistics parks is essential for the local water situation, due to the large areas that parks tend to cover. The discharge of rainwater from these sites into rainwater sewage systems or watercourses may cause significant issues – on the one hand, affecting the local water balance and contributing to flooding and inundation, and on the other, damaging the goods stored. Therefore, it is important that developments of this type take into account the possibility of managing water on one's own premises by:

- collecting rainwater and using it for watering greenery and cleaning roads and pavements,
- the use of rainwater for flushing toilets,
- the use of rainwater for cleaning vehicles,
- if utility water cannot be used, sustainable systems based on various techniques of rainwater drainage can be used instead, including:
  - > rain gardens that collect water from sealed areas in order to drain and use it for irrigating vegetation. This technique is especially effective around parking areas and roads. Carefully selected vegetation and filtering layers help to purify the water and discharge it to deeper layers of the soil as well as to evaporate it. The efficiency of such gardens is about 40% greater than traditional green areas;
  - > retention basins, ditches or small ponds that collect larger amounts of water and slowly drain and evaporate it. Plants that intensify this process can also be cultivated;
  - > infiltration through barrels/tanks/drainage boxes. These have the advantage of possibly being installed under hardened, impermeable areas, if the soil conditions permit this;
  - > green roofs and green walls. By increasing the biologically active surface, the amount of water discharged into offsite areas can be significantly reduced;

- > the use of permeable pavement instead of completely hardened impermeable materials. It is especially worthwhile laying such surfaces in the parking or pedestrian areas. Currently, there are not only geogrids / eco-grids or gravel available, but also other new types of water-permeable surfaces (e.g. HanzaWay).

Another method for conserving water resources is to reduce the water consumption in sanitary facilities, through:

- the use of water-saving or water-free devices (e.g. waterless urinals);
- grey water recycling for e.g. toilet flushing;
- avoiding watering plants by planting vegetation that only requires natural rainfall or that can be watered through the use of rainwater drip irrigation systems with humidity and rain sensors and zoning (to adjust the level of watering to the needs of the plants in a given zone).



### Multi-criteria approach to investments

When the first green certificates, BREEAM and LEED, were introduced to Poland in 2009, many of the solutions they proposed seemed ill-suited for Polish conditions, its societal needs and the technical knowledge of local investors and project teams. Assessors and consultants have struggled to convince investors of the wisdom of adopting certain solutions, and explanations of the value of certain technical solutions have often been questioned by engineers. This was due to a lack of experience and the required knowledge among investment and technical teams.

The most visible example of changes to the approach towards development has been the inclusion of facilities for cyclists. Just a decade ago, it was unimaginable that in Poland there would be enough people willing to commute using this means of transport, and therefore it would not be necessary to provide roofed, safe stands and sanitary facilities, such as cabinets, showers and changing rooms. Now, virtually all projects include such amenities, regardless of whether they are certified or not, and no one questions their value.

The situation with energy and water sub-meters has progressed along similar lines. In the past, only basic meters were installed and tenants were billed according to the area leased. But today, installing meters for individual tenants, as well as larger devices and installations, has become the norm, although connecting them to systems such as BMS or EBMS is still a challenge when it comes to some warehouse projects.

Water-efficient sanitary facilities and devices are one of the biggest changes that can be noticed in buildings today. Several years ago, the installation of low water flow taps or of 4 / 2l flushing cisterns were regarded as unpractical, given the lack of suitable products on the market, and even if some were available, they were ineffective. Today, producers have filled this market niche, and low water consumption has been supplemented with innovative technical systems to achieve the desired effect. The monitoring of water leaks, along with the installation of electromagnetic shut-off valves in water systems to eliminate small spills and drip irrigation systems, are nowadays becoming increasingly commonplace in warehouse facilities, and are also a 'must have' in the office market. Also, the vegetation around the buildings or that forms an internal part of them is no longer the same as it was years ago. This now represents an important structural feature, both for the biodiversity of the surrounding area and for the well-being of the buildings' users. It is selected by specialists and species conservation consultants, to create valuable fauna and flora habitats or to improve the health of the people who work in these buildings. Flower meadows, butterfly habitats and apiaries are now common features of most of the logistics centres being developed.

Thanks to the certification systems, the working conditions on construction sites and the contractors' responsibilities towards the natural environment during the construction work have improved significantly. Waste segregation, providing showers and social facilities, and consideration for local residents are also practices that have become established and will continue to change the way in which facilities in Poland are built.



<sup>1</sup> <https://ungc.org.pl/info/zasoby-wodne-polsce/>

# PROPTech IN THE SERVICE OF THE ENVIRONMENT

## Proptech for the environment

Developers are endeavouring to be flexible in adapting to the challenges generated by how supply chains are evolving. The processes inside warehouse are becoming increasingly automated and digitised. The goal of improving work efficiency goes hand-in-hand with sustainability. Hence the importance of proptech. On the one hand, this increases the utility of buildings; while on the other, it reduces their emissions – limiting their carbon footprint and optimising the costs related to their operations. Investment in new technology improves the quality of warehouse operations and increases customer satisfaction.

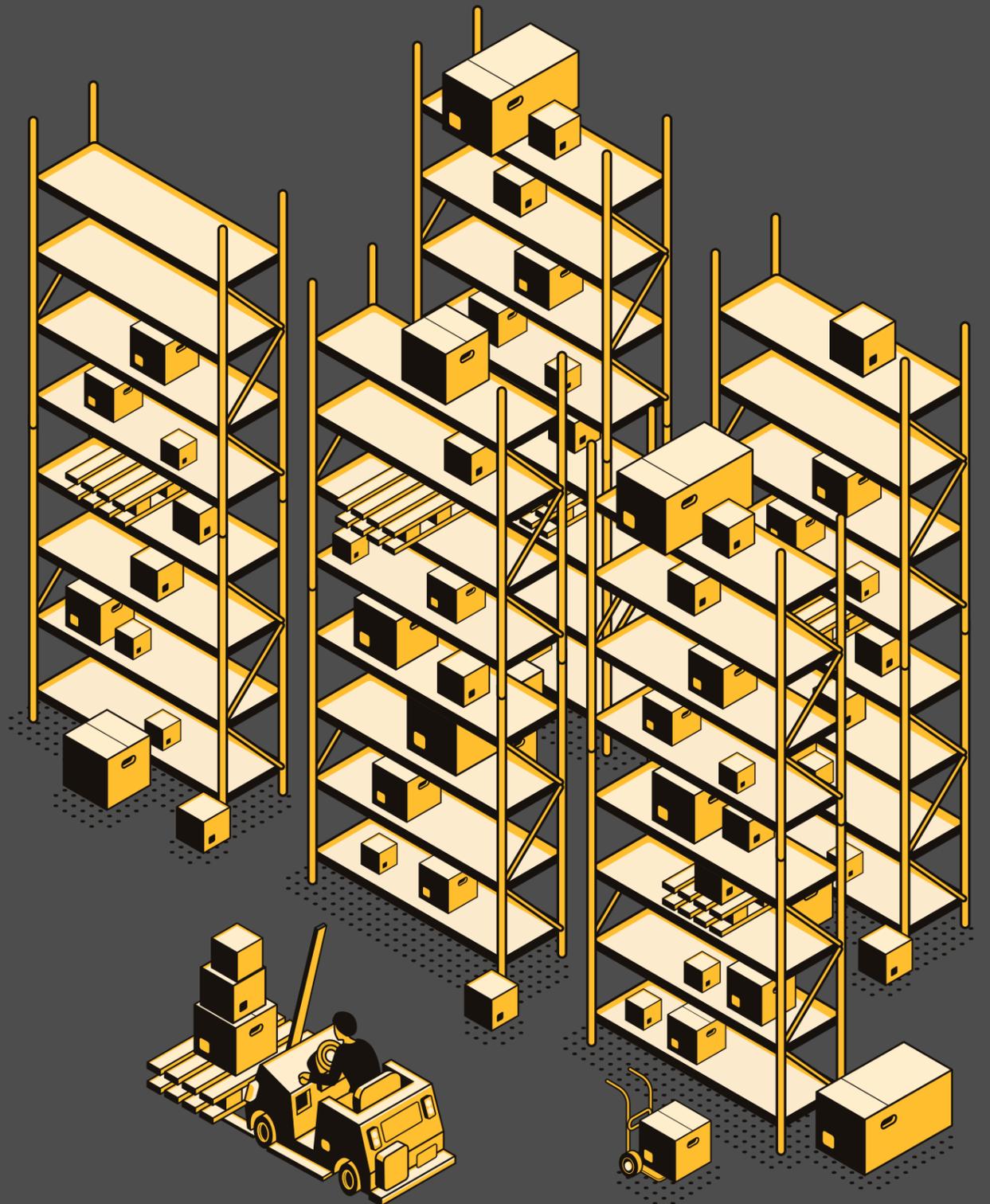
## Operations logistics management

Tenants are opting to employ automation and robotics to improve the operations inside their warehouses. Automatic sorters now scan products via their QR codes or through the use of 'cobots' – cooperating robots that complete the shipment on their own. For everything to run smoothly, the building must be adapted for process automation.

One example is the BTS project that 7R has completed for HultaforsGroup. This was one of the first class A warehouses in Poland to use the Autostore system. The storage method uses the Cube Storage concept, which involves robots storing goods containers very tightly, right next to each other, forming a completely compact body. As a result, this can increase the capacity of the warehouse space by up to four times. The robots pick up the containers and deliver them to the places where picking, replenishment and the validation of stock occurs. High bay warehouses can increase the efficiency of the space used through such solutions. These systems will be put into practice, among other locations, in Żabka Polska's distribution centre, which is being built by 7R in Radzymin.

## Building efficiency management

Operations can be supervised by systems that can process huge amounts of data – by using a Warehouse Management System. Its task is to monitor and manage the warehouse's operations. Many Proptech systems utilise the Internet of Things. This can be used to integrate the lighting control systems so that the light intensity is automatically altered, to monitor the media consumption, and to manage the entire building – i.e. through a BMS platform. New technology can also be used to enhance the safety and security of a building, such as through the use of 'intelligent roofs'. This is a system that helps to prevent overloads due to heavy rain or snowfall as well as for carrying out renovation and assembly work. Sensors installed under the roof can gauge the current stress load on the structure and – in emergency situations – alert the building's manager to the potential risk from this. For 7R, this solution was employed, among other parks, at 7R Park Gdańsk II and 7R Park Kielce.





# PLGBC

Polish Green Building Council

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