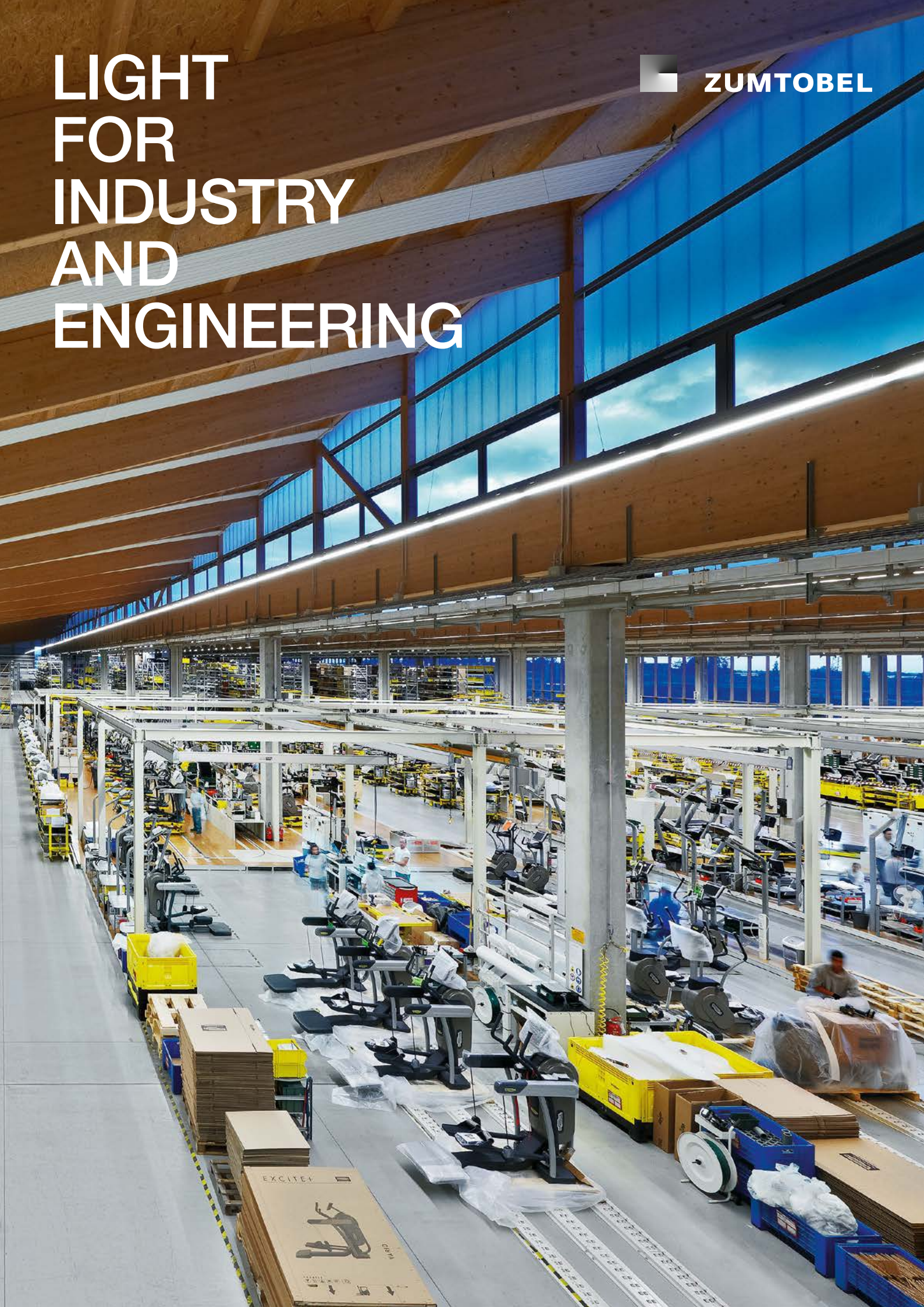


# LIGHT FOR INDUSTRY AND ENGINEERING



ZUMTOBEL





**Light for industry and engineering**

High productivity is essentially dependent on a company's employees. The right lighting at the workplace helps to enhance staff members' performance and motivation as well as their sense of well-being – this applies to shift workers in large industrial bays as well as to specific manufacturing areas. Used properly, an advanced lighting solution helps to optimise conditions at workstations in manufacturing bays, increasing motivation and preventing fatigue and, thus, industrial accidents. Based on many years of experience and on-going research, we are aware of the effects and application options of light in industrial areas, and this allows us to provide our customers with professional advice. Using customised solutions and modular product ranges we ensure that perfect lighting is provided for all rooms and areas, at any time. As energy efficiency and sustainability are the order of the day, we are increasingly using concepts that combine daylight and artificial lighting. Our wide range of products for industry and engineering includes luminaires and intelligent control system that allow for integral solutions by a single supplier.

Zumtobel. The Light.

# Applications



Tryckfolket, Malmö | SE



A. Locker Konfekt GmbH, Heinfels | AT



Nike Europe, Vorst-Laakdal | BE



Škoda Auto factory in Mladá Boleslav | CZ





## References

Alpla Werke, Hard, AT / APAG Parkhaus Aachen, DE / Apipharma, Zagreb, HR / ASDA, Doncaster, GB / ASEAG Verkehrsbetriebe Aachen, DE / AU Optronics factory, Trencin, SK / Bauarena Volketswil, CH / Bosch Rexroth Pasching, AT / Dhollandia factory Predmier, SK / Engel Werke, St. Valentin, AT / Fernheizkraftwerk Klausen, IT / Ferrari Classiche, Maranello, IT / Fiat Kragujevac, RS / Flextronics, Althofen, AT / Freitag Taschen, Zurich, CH / Garage Delorge VW-Audi-Seat-Skoda, Sint-Truiden, BE / Güterverkehrszentrum Ingolstadt, DE / Haberkorn Ulmer, Leonding, AT / Hawle, Freilassing, DE / Hörmann Austria, Dobl, AT / Hugo Boss Shoes & Accessories Italia SpA, Morovalle, IT / IWT Innovative Water Technology GmbH, Lienz, AT / La Baita, Caselle Torinese, IT / Liebherr Baumaschinen AG, Reiden, CH / Loacker Konfekt GmbH, Heinfels, AT / Mondelēz Belgium Biscuits Production NV, Herentals, BE / Migros Verteilerbetrieb AG Neuendorf, CH / Nike Logistikzentrum, Laakdal, BE / Parker Hannifin, Bielefeld, DE / Rema Holzindustrie, Eben im Pongau, AT / Risse + Wilke Kaltband GmbH & Co., Iserlohn, DE / Rolls-Royce Motor Cars LTD., Goodwood, GB / RSD Electronic, Naturno, IT / Rupp Käserei, Lochau, AT / Salewa Headquarters, Bolzano, IT / SBB Serviceanlage Oberwinterthur, CH / Scania Parts Logistics, Opglabbeek, BE / Schletter Leichtmetallbau GmbH, Kirchdorf, DE / Siloking, Mayer Maschinenbaugesellschaft mbH, Tittmoning, DE / Škoda Auto factory, Mladá Boleslav, CZ / Storenmaterial AG, Geroldswil, CH / TechnoAlpin AG, Bolzano, IT / Technogym, Cesena, IT / Tryckfolket, Malmö, SE / Voestalpine, Krieglach, AT / Vonlanthen Holzbau AG, Schmitten, CH / ZF-Getriebe, Saarbrücken, DE



**Photo on front cover: Technogym SpA, Cesena | IT**

Architects: Studio Antonio Citterio & Partners, Milan | IT

Lighting solution: The production bay is characterised by a large amount of daylight. The TECTON continuous-row lighting system, controlled by LUXMATE LITENET, adds the amount of artificial light as required. The integrated emergency lighting increases system reliability.

Other products: PERLUCE diffuser luminaire, MELLOW LIGHT recessed luminaire, PANOS downlight, RAIN moisture proof batten luminaire, ONLITE ARTSIGN escape sign luminaire





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## Requirements on lighting

### Light for industry and engineering



#### Efficiency

Sustainable production technologies are becoming increasingly important in almost all industries worldwide. Companies are putting in place measures to increase resource and energy efficiency and also to optimise production processes, procedures and energy sources. Industrial applications have huge potential in environmental and economic terms and when it comes to human factors. There is often external pressure as well: many industrial buildings need to be modernised to meet applicable energy requirements.

- Reduced CO<sub>2</sub> emissions
- Lower energy costs
- Less maintenance



#### Flexibility

Increasing automation brings fast, precise workflows, and the requirements placed on activities that involve demanding craftsmanship are becoming more exacting. A space needs to cater for a variety of usage scenarios and requirements in order to take both these aspects into account. Different ceiling heights, temperatures and degrees of automation demand functional flexibility. Not only that, industrial architecture and the image that industry seeks to project are witnessing radical change. Transparency is a sign of a company's strength when it comes to public relations. Cleanliness and innovation are inner values of the future.

- Flexibility in use
- Expandable as desired
- Easy-to-use control





## Productivity

Economic conditions demand production increases, more efficient workflows, improved organisational structures, technological progress and as few faults as possible. Productivity is a long-established concept but is only now giving rise to a complete rethink in many industries. Nowadays, more capital and labour are being invested in optimising productivity from the ground up. To accomplish this, working environments, working conditions and processes are being redefined.

- Fewer days lost to illness
- Lower error rates
- Shorter production times



## Reliability

Whereas in some industrial enterprises extreme temperatures, humidity and vibration represent major challenges, in other companies extreme precision or conscientious attention to hygiene is the order of the day. The measures to ensure maximum reliability are as different as the industrial facilities themselves. The lighting should work at all times regardless of environmental influences, including during power cuts. Reliable emergency lighting prevents disorientation and shows the escape routes to the open air.

- Long service life guaranteed
- Damage-resistant regardless of the environment
- Responsible course of action

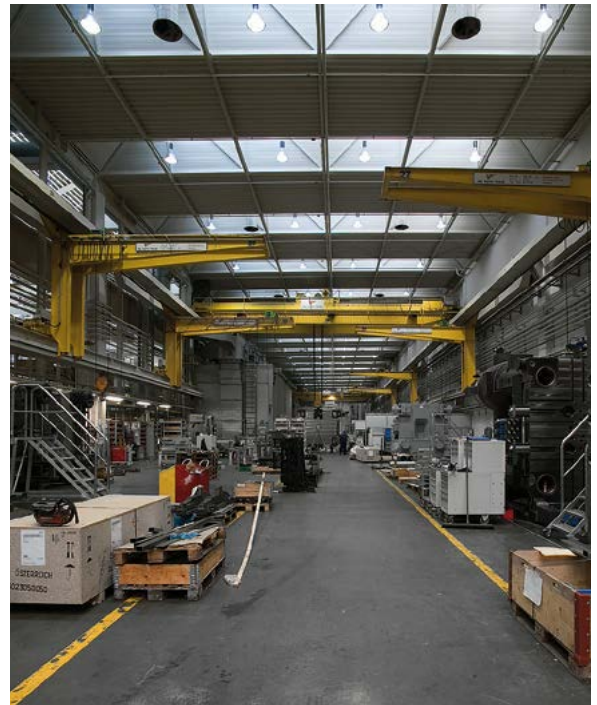
# Calculating the potential

## Lighting analysis tool for industry and engineering

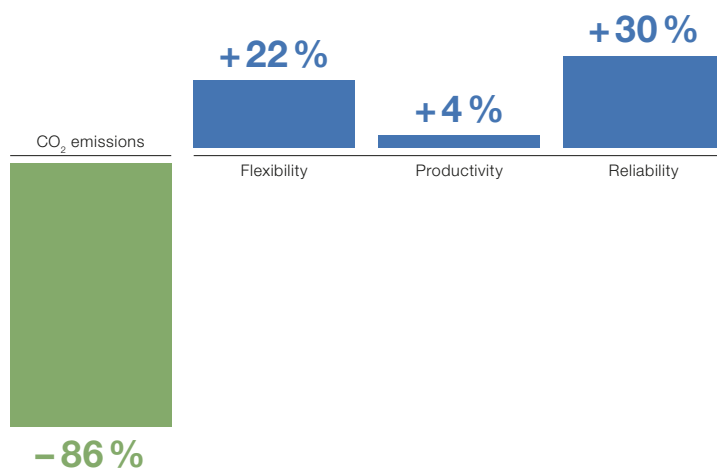
The lighting in many industrial facilities is not state-of-the-art. However, employees are still expected to give their best, which under the given circumstances can be either impossible or else very difficult. With innovative luminaires and a professional lighting control system, however, lighting can become a factor that adds value. The best light for industry is:

- **Light that consumes fewer resources but provides higher output**
- **Light that responds to changes**
- **Light that improves an individual's performance and enhances their wellbeing**
- **Light that works safely and reliably for many years**

With the Zumtobel lighting analysis tool, you can see in a few minutes the potential that a new lighting system would open up for you. The analysis results are concrete numbers that answer pertinent questions about energy consumption or CO<sub>2</sub> emissions, such as "How much can I save?", "Where do the savings come from?", or "What potential does a lighting control system have?" The second area of the analysis refers to the flexibility of the lighting. "Where would it be advantageous to respond flexibly to varying requirements, visual activities or occupancy times?" The third level is that of productivity. Increases can be achieved, particularly in areas where repetitive manual work is performed. Factors such as the wellbeing and sleep quality of employees are just as relevant as the speed at which tasks are performed. These are influenced by the proper selection of light colour and by dynamisation of the lighting. The fourth point to consider is the potential for reliability compared to the existing system. You will be shown the percentage by which reliability can be increased by lighting that takes account of specific environmental conditions and carries on operating even in emergencies.



High bay lighting installed over seven years ago is often lacking in illuminance, uniformity and energy efficiency.



The Zumtobel lighting analysis tool will evaluate your current lighting situation and calculate the potential for refurbishing the lighting in the four core areas: CO<sub>2</sub> and cost efficiencies, flexibility, productivity and reliability.

You can perform the calculation on-line at the Zumtobel website at any time. It only takes a couple of minutes to fill it in, and the results are displayed directly on-line and also output as a comprehensive PDF document.

[zumtobel.com/industrialighting](https://zumtobel.com/industrialighting)





#### Engel Werke, St. Valentin | AT

Electrical installations: G. Klampfer Elektroanlagen GmbH, Leonding | AT

Lighting solution: The skylights allow a large amount of daylight to enter the bay. The illuminance levels of the VALUEA IP 50 high bay luminaire on TECTON trunking can be reduced as required, controlled by LUXMATE LITENET.



Step one: record the core data for the project and area of application.



Step two: enter the data on the existing lighting system and technologies employed.



Step three: define the zones, their dimensions, visual tasks and ambient conditions.



The result: you will immediately be given a clear overview of the potential of a new lighting system. The PDF version contains all the interesting details as well.

## Efficiency

“At EnBW EnergyWatchers we have made it our mission to help small and medium-sized enterprises save energy costs. We are efficiency professionals and are able to tap into potential savings in companies and help them make savings while also benefiting from public funding. We need capable, dependable partners by our side in order to be able to improve customers’ competitiveness in this way. Zumtobel’s unique lighting expertise enables us to implement our ideas when it comes to efficient lighting. This allows our customers to cut their long-term energy costs while also protecting the environment.”



**Melanie Bunke**  
Executive Board, EnBW EnergyWatchers GmbH | DE





#### **IWT Innovative Water Technology GmbH, Lienz | AT**

Electrical consultants: Elektro Green, Lienz | AT

Lighting solution: The modern industrial building is characterised by a high daylight influx. Combining this with the ZX2 flexible lighting system means that employees benefit from high lighting quality while the system saves energy at the same time.

Other products: CLARIS louvre luminaires, ONLITE emergency lighting system

The introduction of Green Building labels and energy conservation regulations is adding to the requirements that are part of identifying and reducing the energy consumption of buildings. Industrial enterprises are required to take measures designed to conserve resources and optimise their energy budget.

Lighting makes a vital contribution towards energy efficiency. The proper use of lamps and ballasts in luminaires, optimised luminaire efficiency and intelligent operation are all a big step in the right direction. There is huge scope for lighting refurbishment projects in industry. Many industrial plants need to be modernised to meet applicable energy requirements. Modernisation also provides the opportunity to upgrade the quality of lighting. Beside environmental and economic factors, ergonomics is the third pillar of sustainability. Ergonomics involves optimising production workflows and processes and configuring them to add value.

Companies want to assume responsibility and make customers aware they are sustainable companies. Just like using renewable energy sources, modern lighting underscores the sustainable and innovative nature of a company.

# 1 Efficiency

## Cutting CO<sub>2</sub> emissions

- **Saving energy is not simply a matter of cutting electricity costs, it also means optimising a company's CO<sub>2</sub> budget**
- **Industrial plants can make a significant contribution towards helping the country in which they are located achieve a successful CO<sub>2</sub> balance**
- **CO<sub>2</sub> certificates spell out the fact that an entrepreneur is conscious of his or her responsibilities**



### **Salewa Headquarters in Bolzano | IT**

Architecture: Cino Zucchi Architetti and Park Associati, Milan | IT

Electrical consultants: Energytech, P.I. Gabriele Frasnelli, Bolzano | IT

Lighting solution: In addition to various standard products for industrial applications, the IBLA office luminaire was developed for the Salewa headquarters. Its design and colour match the architecture and also meet the strict energy requirements, with the result that the project was awarded the KlimaHaus (ClimateHouse) certificate.

Other products: MELLOW LIGHT recessed luminaire, SLOTLIGHT II light line, TECTON Slimline continuous-row lighting system, LINARIA batten luminaire, PERLUCE recessed luminaire, LIVIANO spotlight, ONDARIA circular luminaire

Photo: Oskar Da Ritz

### **Key energy-balance data:**

**CO<sub>2</sub> saving: 330 tonnes per year**

Large industrial enterprises that benefit from fixed basic electricity rates and low recurrent electricity costs have less of a battle with energy costs but do account for a significant proportion of CO<sub>2</sub> emissions. Worldwide targets are being transposed into national laws that stipulate cuts in CO<sub>2</sub> emissions. CO<sub>2</sub> certificates quantify the contribution that a firm is making towards environmental protection. Companies are increasingly trying to achieve Green Building certification. Labels such as LEED, BREEAM, DGNB, ÖGNI, KlimaHaus, HQE, Minergie, BCA Green Mark, CASBEE and GreenStar are used to rate the overall energy efficiency of a building. Last but not least, such certification also provides a marketing tool that allows companies to position themselves as sustainable enterprises.

Refurbishing old installations provides huge scope for cutting CO<sub>2</sub> emissions. Many lighting systems in industrial buildings are not up to current standards. Modernising a lighting solution can quickly save large amounts of CO<sub>2</sub> and energy, and this means that investment costs are ultimately amortised more quickly. This produces not just energy savings, but cash savings as well.

The bulk of the CO<sub>2</sub> emission accounted for by a luminaire is the CO<sub>2</sub> that is emitted while it is in service. When a luminaire is in use, efficient light sources, advanced ballasts, optimised reflectors and optics and intelligent lighting control systems reduce actual energy consumption. Zumtobel sets great store by sustainability during the manufacture of luminaires in order to ensure they have an optimal overall energy balance: this starts with choosing the right materials, includes process efficiency and transport, right through to disposal. As proof of sustainability, an Environmental Product Declaration (EPD) is provided for every Zumtobel product. This life cycle assessment is in accordance with European standards for Green Building certification.





**Risse + Wilke Kaltband GmbH & Co., Iserlohn | DE**

Lighting solution: Uniform and occasionally reduced lighting level using VALUEA high bay reflector luminaires dimmed by the DIMLITE lighting management system.

**Recommended products**

VALUEA | high bay reflector luminaire

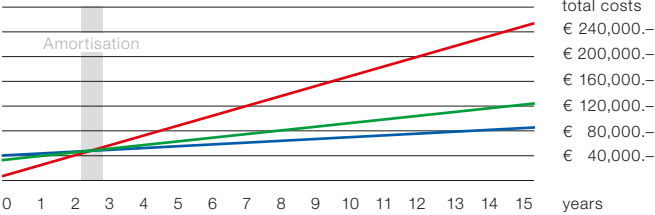
PST presence detector | lighting management system





# 1 Efficiency

Reducing energy consumption



**Calculation example**  
Investing in a lighting solution using GRAFT high bay LED luminaires rather than metal halide lamps (HIE) pays for itself within two to three years.

Power consumption per square metre per year is cut by 55% using modern LED technology. An additional presence-based and daylight-based control system for the bay with a sawtooth roof reduces energy consumption to a striking 78%.

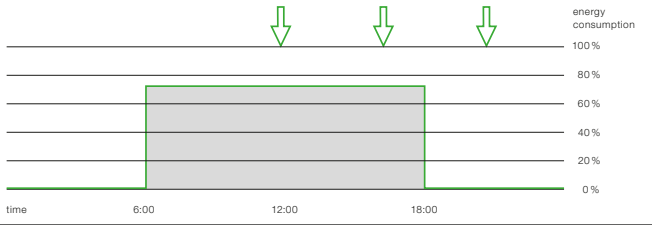
Energy consumption per year			
HIE (existing)	42 x	400 W	70 kWh/m²a
GRAFT LED	35 x	280 W	32 kWh/m²a
GRAFT LED	35 x	280 W	15 kWh/m²a
with daylight-based and presence-based control			





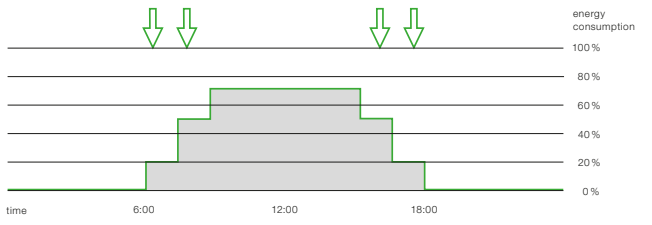
luminaires and light sources

Saving energy starts with the right selection of luminaires and light sources. The use of luminaires fitted with advanced electronic control gear with a dimming function reduces energy consumption by some 25%.



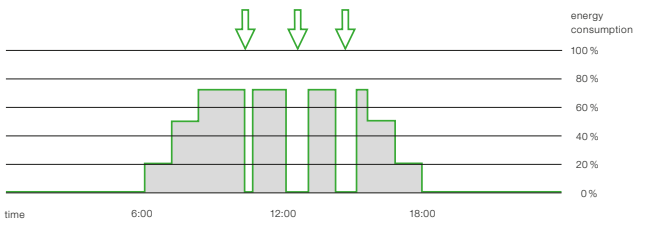
time-based management

The right light at the right time: individual on-times can be defined in the LUXMATE LITENET central building calendar for the entire year, for example, and open up potential savings of between 20 and 40%.



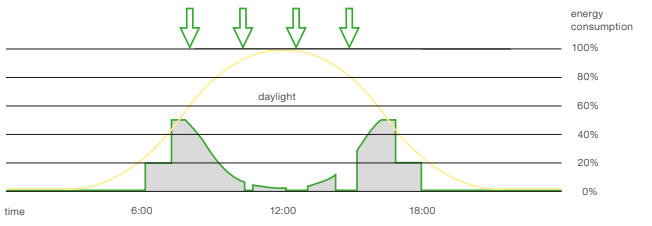
presence detectors

Lighting that is only switched on when it is actually needed is the most frugal of all. Correctly positioned and properly functioning presence detectors help to cut energy consumption by 20 to 40%.



daylight

The most efficient lighting is of course natural daylight, the intelligent use of which can save up to 75% of lighting energy. This free daylight influx can still be utilised even if both sunshading and glare protection are employed. Properly coordinated control of lighting and blinds reduces the cooling load of a building while improving lighting quality.



**Scania Parts Logistics, Opglabbeek | BE**  
Architects: Helsen & Van Com Architekten, Hasselt | BE  
Technology & energy consultants: Archimedes n. V., Keerbergen | BE  
Lighting solution: The warehouse areas are not continuously occupied. The lighting is therefore reduced and energy saved when they are not being used. The TECTON continuous-row lighting system is controlled by the TECTON PST presence detector.  
Other products: ONLITE RESCLITE emergency luminaire

# ecocalc

Comparing various lighting concepts, calculating total costs and payback times: ecoCALC design software makes it possible to check out the sustainability of lighting solutions and refurbishment projects quickly.



# 1 Efficiency

## Use of daylight

- Extra energy consumption due to long operating hours can be balanced out by efficient technology and lighting control
- Maximising energy savings means combining all the potentials together: energy-saving luminaires and light sources, customized time-based management, presence detectors and the use of free daylight
- The result is a lasting reduction in costs and CO<sub>2</sub> over many years.

Energy requirements in industry are often extremely high due to long operating and production hours – and this includes lighting too: high bay lighting in particular requires large lumen packages. Constantly rising energy prices provide an additional incentive to save energy.

Even the choice of light source has a huge impact on energy consumption. Powerful fluorescent lamps combined with high efficiency reflectors consume significantly less energy than metal halide lamps. Advanced LEDs are used in situations where they can play to their strengths – an individually manageable and controllable light source that has a long service life and is largely maintenance free. The switch to electronic ballasts marks another milestone.

Intelligent lighting management achieves the greatest possible energy efficiency. Daylight is used as a natural light source and supplemented with artificial light in order to maintain a constant lighting level during working hours. Increasing automation is creating more and more zones and areas where people do not work at all or which are visited only for occasional inspections. Lighting management with a corridor function adjusts brightness down to a minimum level at such times and only switches back up to full lighting levels when movement is detected.

Recommended products

GRAFT | high bay LED luminaire



TECTON PST presence detector for installation at greater heights | lighting management system

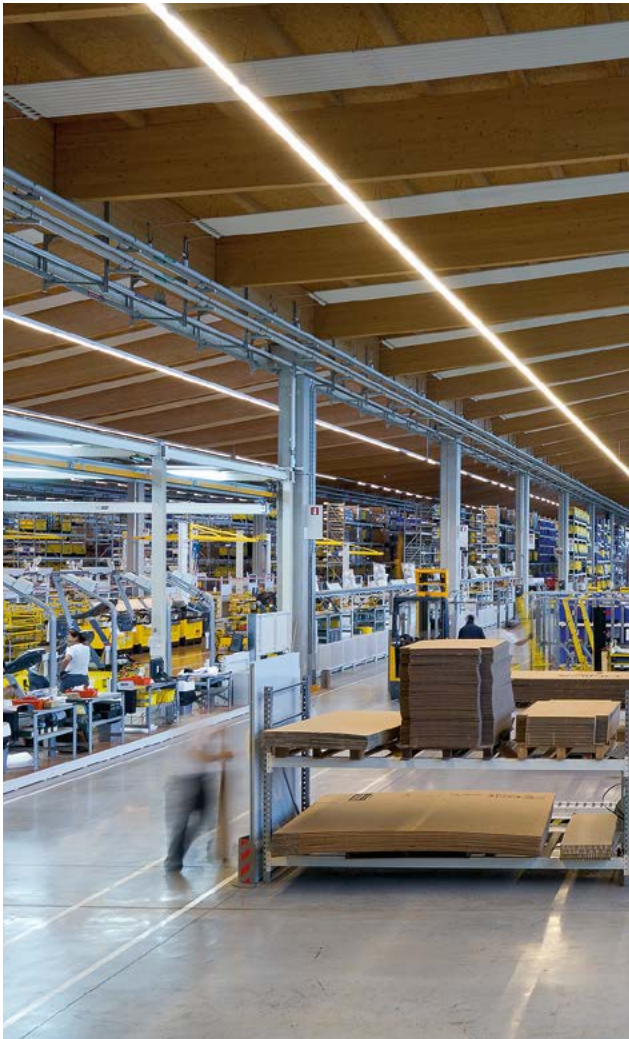


- Sightlines into manufacturing workshops and workflows differentiate and position a company
- Extensive glazed surfaces provide a reference to outward reality but also require architecture-related lighting
- Contemporary lighting solutions enhance the image of both the architect and the company as a brand

Industrial buildings are increasingly turning into architectural high-lights. Design, sustainability and quality are factors that companies use to shape their image. Large glazed areas that delineate a building are being used on an increasing scale.

Glass has two advantages, firstly it allows the use of daylight in order to cut the need for artificial lighting and hence and secondly, glazed surfaces provide fascinating glimpses into a company. Production and employees become visible. Clear styling, bright working environments and neatly zoned task areas improve the image of a company. This affirmation of innovation is visually underpinned by LED solutions. Light shines out from inside a building when it is dark outside. An architectural effect can be achieved through appropriate lighting design.

Industrial buildings that do not have sweeping daylight lit surfaces can communicate with the public through façade lighting. Visible from afar, façade lighting makes a building enhance a company's image and, among other things, offers the option of raising brand awareness by using corporate identity colours and motifs. Brightly lit vertical surfaces give passers-by a sense of security.



Recommended products

LUXMATE LITENET | lighting management system



LUXMATE external daylight sensor | sensor

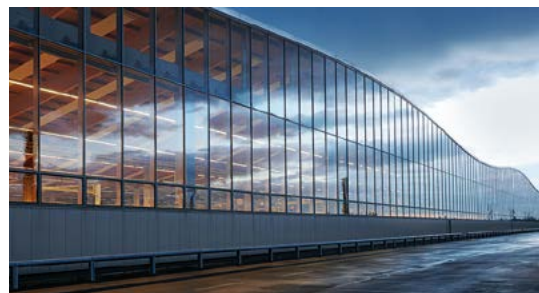






#### Technogym SpA, Cesena | IT

Architecture: Studio Antonio Citterio & Partners, Milan | IT  
 Lighting solution: Ambient lighting provided by TECTON is controlled by LUXMATE LITENET on the basis of the generous amount of daylight entering the building. The emergency lighting is integrated, which gives a uniform appearance.  
 Other products: PERLUCE diffuser luminaire, MELLOW LIGHT recessed luminaire, PANOS downlight, RAIN moisture proof batten luminaire, ONLITE ARTSIGN escape sign luminaire



Fitness equipment is manufactured and stored in Techogym's 11 m high production bay and warehouse building. The switchable T26 luminaires were replaced over an area of more than 20,000 m<sup>2</sup> by a TECTON T16 continuous-row system with LITENET daylight-based and presence-based control. This has considerably increased the lighting system's efficiency, and the investment will pay for itself within 2 years, thanks to reduced energy and maintenance costs. Over the next 20 years, the system will save more than 3,800 tonnes of CO<sub>2</sub>.

Other benefits: dimmability and presence-based control allow illuminance levels to be perfectly matched to the relevant activity. As much of the work is manual, productivity is considerably increased by the availability of natural light at the workstations. The lighting system is made even more reliable thanks to the luminaires' long service life and the emergency lighting system.

The potential savings and improvements were calculated using the on-line lighting analysis tool. [zumtobel.com/industrialighting](http://zumtobel.com/industrialighting)

CO<sub>2</sub> emissions



– 68 %

+ 22 %



Flexibility

+ 20 %



Productivity

+ 10 %



Reliability

# 1 Efficiency

## Replacing lighting systems

- **Refurbishing an out-of-date lighting solution has a positive impact on energy consumption, working atmosphere and operating costs**
- **Modern lighting solutions reduce expenditure on maintenance and improve lighting quality**
- **LED lighting and lighting control systems are an investment in the future**

There is a higher than average proportion of ageing buildings in industry. They consume many times the energy they actually need because of outdated technologies. Even if extensive renovation is not feasible, operating costs can be cut significantly by just refurbishing the lighting. Added value in terms of quality is reflected in a brighter environment: employees in particular benefit from this thanks to better visual conditions, a pleasant working atmosphere and the improved quality of the entire workplace.

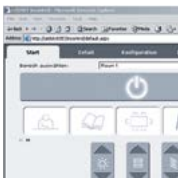
The changeover from T26 lamps with conventional ballasts to T16 fluorescent lamps with electronic ballasts represents real technical progress. LEDs take a step into the future. Switchover is especially easy with TECTON because the new LED optics are 100% compatible with the entire product line. Old T16 and T26 modules can be replaced by new LED luminaires without the use of any tool, and existing trunking and wiring can therefore continue to be used.

Changing over to LEDs involves a relatively high initial investment but pays for itself in the long term thanks to maintenance and energy cost savings and the improvements it brings for employees.

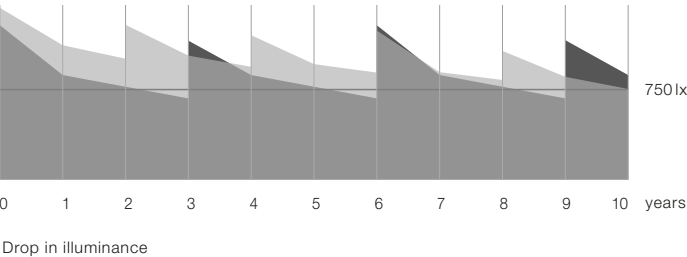
### Recommended products

TECTON LED | continuous-row luminaire

LUXMATE LITENET | lighting management system



**Bosch Rexroth, Pasching | AT**  
Before the lighting was refurbished, employees complained of excessively low illuminance levels, multiple shadows and strobing



**T16 versus LED**  
Conventional lighting for manufacturing areas is a T16 continuous-row system. If, however, the decision is made to opt for a TECTON LED Wide Beam continuous-row system, it is not just lighting quality that improves markedly: T16 luminaires require time-consuming cleaning of lamps and reflectors and replacement of all light sources once every three years whereas continuous-row LED systems are simply wiped down once every two years. Because there is no need to replace light sources, maintenance costs are 68% lower. Over a ten-year period, the total cost of the continuous-row LED system is actually 10% less than that of T16 lighting.

### 40% lower annual energy consumption

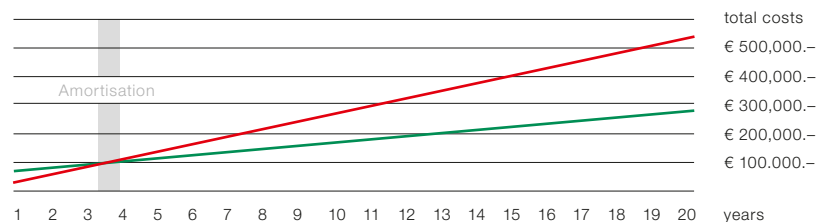
- 128.6 kWh/m² T16 continuous-row luminaire 1/80 W
- 76.8 kWh/m² TECTON LED WIDE BEAM 63 W





#### Bosch Rexroth, Pasching | AT

Architecture: Atelier Hauptplatz,  
Dipl.Ing. Ricardo Baumgarten, Linz | AT  
Lighting solution: As part of the refurbishment,  
a change was made to efficient TECTON T16  
lighting. Energy consumption was further  
reduced on the basis of daylight by LUXMATE  
LITENET. The lighting solution was rounded off  
by the ONLITE emergency lighting system.



#### After refurbishment

The flexible TECTON trunking system ensures bright ambient lighting and comfortable working conditions. A lighting control system adjusts the artificial lighting depending on the amount of daylight that enters through the skylights. This enables Bosch Rexroth to save up to 22,240 kWh of electricity per year. Its investment will be amortised in less than 4 years.

#### 38% lower annual energy consumption

— 22.27 kWh/m<sup>2</sup> Existing lighting installation  
— 13.87 kWh/m<sup>2</sup> New lighting solution using TECTON 2/49 W with LUXMATE LITENET lighting control system and ONLITE emergency lighting system



## Flexibility

“The lighting played a major role in the design of our new company headquarters. Zumtobel has managed to perfectly meet our requirements in terms of superior lighting in a variety of rooms. Zumtobel has turned out to be an indispensable partner, supplying a professional and energy-efficient lighting solution for the single-person offices, the conference room and manufacturing through to components assembly.”



**Erich Gummerer**  
CEO TechnoAlpin AG, Bolzano | IT



#### Freitag Taschen, Zurich | CH

Lighting solution: Various different production areas and operations are best served by various different lighting types, in this specific instance by the CHIARO moisture-proof luminaire and the surface-mounted COPA high bay luminaire.

Other products: TECTON and ZE continuous-row systems

Photo: Roland Tännler

Industrial applications are extremely diverse and cover numerous different areas. The requirements placed on lighting and task area functionality are just as varied as the areas themselves. Different ceiling heights, temperatures and working conditions underline this diversity, which calls for highly flexible lighting solutions that preserve a look that is as consistent as possible.

Driven by the demand for high output and productivity, high-speed, precision automated work processes are becoming increasingly important. This makes visual tasks at manual, inspection and test workstations more difficult, components are getting smaller, movements of the hand must be more accurate and are performed under controlled conditions.

As well as workflows, architecture is also changing. Modernness, innovation and sustainability must be apparent to the customer and reinforce a brand image. Transparent architecture steers people's gaze towards production. Lighting can underscore the sustainable, innovative nature of a business.

## 2 Flexibility

### Preserving individuality

- **Visual requirements specific to individual operations are ideally met by variable light focussed on the task area.**
- **Rising efficiency and increased automation are making new demands on lighting**
- **Good light caters for people's individual requirements, visual tasks and eyesight**

Many companies are optimising resources and costs by introducing more efficient processes and new work structures. The workplace and work tasks are being impacted by greater automation. Machine inspections and quality inspections require high lighting levels, well-balanced shadow detail and – where colours are checked – very good colour rendering. The light must also offer a certain amount of flexibility in manufacturing plants with unknown or changing production processes that are becoming increasingly more variable. Different operations impose different lighting quality requirements. Lighting that is as uniform as possible and sets of luminaires that are controlled in groups can quickly be adjusted to meet new requirements and zoning. Task area-related lighting is implemented by the control system. The second principle is that the individual needs of each employee must be met. At a time of demographic change, this is an especially interesting issue. Older people need and benefit from relatively higher illuminance. The solution are concepts that allow intervention in dimmable lighting groups or additional individual luminaires for workstations. These improve user acceptance, visual performance and hence motivation, too.

LED product ranges offer the advantage of a variety of beam patterns while retaining a consistent appearance. For instance, various lenses are used to meet different requirements in the case of the TECTON continuous-row lighting system. This means it is no longer necessary to use reflectors to direct light.



#### **Nike Europe, Vorst-Laakdal | BE**

Architecture: Signum NV, Sint Denijs-Westrem | BE

Lighting solution: Different operations demand different lighting concepts. For example, the production bay is illuminated by the TECTON continuous-row lighting system, while other areas are equipped with the MELLOW LIGHT recessed luminaire or the CLARIS II pendant luminaire.

Other products: PANOS downlight, LEDOS recessed floor luminaire

#### **Recommended products**

CHIARO LED | moisture-proof luminaire

LUXMATE | presence detector







#### Rema Holzindustrie, Eben im Pongau | AT

Lighting design: Elektrotechnik Kontriner, Bischofshofen | AT

Lighting solution: The TECTON continuous-row lighting system provides high-quality lighting for every visual task – from inspection work through to warehousing. The emergency lighting system incorporating an ONLITE local SB128 controller ensures safety in an emergency.



Inspecting  
1,000 lx



Grinding  
750 lx



Machining  
500 lx



Planing  
300 lx



Drying  
50 lx

The visual requirements vary with the operation in question. In the woodworking industry, these range from very demanding requirements for grinding or inspecting (750 and 1,000 lux respectively) through demanding work on woodworking machines (500 lux) to general visual tasks at the planing bench (300 lux) and the less demanding ones for automatic drying or plywood manufacture (50 lux).

## 2 Flexibility

### Changing structures

- **The flexibility requirements on lighting increase with shorter product cycles and increasing product diversity**
- **The big benefit of lighting management systems: there is no need to change the lighting installation, the adjustment is done by computer**
- **Well-trained Zumtobel service personnel take care of design, commissioning and also maintenance if required**

Is the lighting still supposed to come on automatically at the right time although the working hours vary? Is the plan to retrofit one area with a daylight-based control system? Do the new assembly operations require a constant 750 lux instead of 500 lux? A professional lighting control system can implement changes like this with a few clicks of a mouse. Do you want to combine or change groups of luminaires? Add or replace groups of luminaires? The flexible DALI addressing system in Zumtobel lighting control systems allows structures to be easily changed. Organic growth is also possible: LUXMATE covers all sizes, from just a few luminaires to over 10,000 automated output actuators. Scalability is always possible, and many functions can be implemented without automation components.

LUXMATE control systems incorporate many components and functions that have been used successfully in industrial applications for many years. The range extends from simple DALI or DSI control systems with adjustable lighting scenes, presence detectors and daylight sensors to open maximum-function lighting management systems with interfaces to BACnet, OPC or TCP/IP.

#### Recommended products

DIMLITE | lighting management



LUXMATE LITENET | lighting management system



#### **Mondelēz Belgium Biscuits Production NV, Herentals | BE**

Electrical installations: WELEC elektro techniek  
n.v., Westerlo | BE

Lighting solution: The TECTON continuous-row  
system provides uniform and efficient lighting in  
the production bay. The quantity of light at each  
workstation is adjusted individually via simple  
control points.

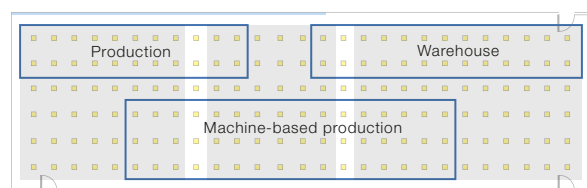
Other products: FEC louver luminaires,  
central LUXMATE LITENET daylight-based  
control system





#### Improving safety

Automatic checks and function tests, unambiguous error messages and defined emergency operating features are distinctive aspects of LUXMATE and guarantee a high level of safety.



□ Zone Plan A

■ Zone Plan B

#### System grouping

The flexibility of a LUXMATE lighting solution gives you the option of dividing up or merging rooms any way you like. For instance, several single-person offices with a corridor (left) can be transformed into a team office (centre) or a conference room (right).



## 2 Flexibility

### Coping with long distances

- **The trend is for higher bays with high visual requirements**
- **Linear solutions with fluorescent lamps and innovative high bay LED luminaires provide impressive uniform illumination with dimmability and controllability.**
- **LED solutions boast a long service life, full output in cold environments, and the capability for integration into emergency lighting systems**

As bays become increasingly higher, the visual tasks become more and more diverse and above all, more demanding. Manual work, machine-based production and warehousing are all accommodated under one roof. This requires high illuminance levels with high-quality spot lighting from considerable heights, combined with the ability in high bays to respond rapidly and flexibly to changes in the equipment layout. A trunking system combined with lighting control offers maximum lighting flexibility, allowing luminaires to be repositioned and individually adjusted at the touch of a button.

In many industrial and engineering applications, linear light sources such as fluorescent lamps are the cornerstone of a rational lighting solution, in view of the room heights involved. Continuous-row systems have numerous positive features in their favour: task levels are uniformly lit, luminaires are dimmable and can also be integrated into emergency lighting systems thanks to their starting performance. Beyond a certain room height, however, linear light sources begin to reach their limits. Higher luminous flux levels are needed.

#### **Hörmann Austria Ges.mbH., Dobl | AT**

Architecture: Wannenmacher + Möller GmbH, Bielefeld | DE

Lighting solution: Adapted to the various ambient conditions, the TECTON continuous-row lighting system illuminates the general use areas and the warehouse, while the SCUBA and PERLUCE moisture-proof luminaires light the more sensitive areas.

LUXMATE BASIC provides the control function on the basis of daylight. Emergency lighting provided by the ONLITE central battery together with ECOSIGN and COMSIGN escape sign luminaires shows the benefits of an integral lighting solution.

Other products: LIGHT FIELDS pendant luminaire, FD downlight, MIRAL and MIREL louver luminaires



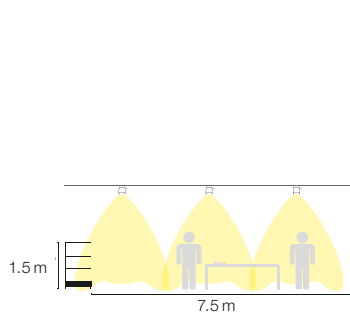
Zumtobel has developed the GRAFT high bay LED luminaire as an efficient replacement for the widely used high bay reflector luminaires with high pressure discharge lamps. With a luminous power up to 28,000 lumens, it combines innovative lens technology for precise narrow-beam or square light distribution. Luminous fields that do not overlap create significant extra uniformity and efficiency for any lighting solution. Fewer luminaires are required, significantly reducing investment costs – irrespective of whether they are used in warehouses, manufacturing facilities or workshops.

This is where LEDs score highly with a service life of 50,000 hours. Over the same period, a high-intensity discharge lamp would need

to be replaced approximately four times. What is more, an LED can be continuously dimmed and this makes it possible to fully exploit the potential savings offered by presence and daylight-based control systems. The very good starting behaviour of LEDs makes them suitable for use in integrated emergency lighting systems. LEDs are also an ideal lighting source in cold ambient temperatures. The light output of fluorescent lamps is adversely affected by below-zero temperatures whereas the luminous flux of LEDs remains constant.

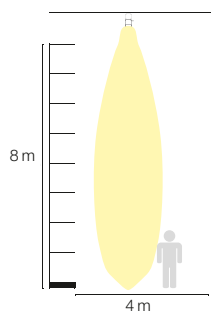
#### Recommended products

TECTON LED | continuous-row luminaire



#### TECTON LED Wide Beam

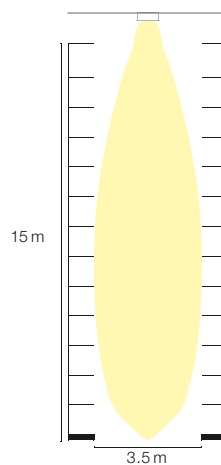
- In production areas, emphasis is placed on uniform illumination of surfaces.
- Machines and manufacturing areas can be planned and used independently of the lighting solution. This allows flexible production concepts without any need for action as far as luminaire positioning is concerned.



#### TECTON LED Narrow Beam

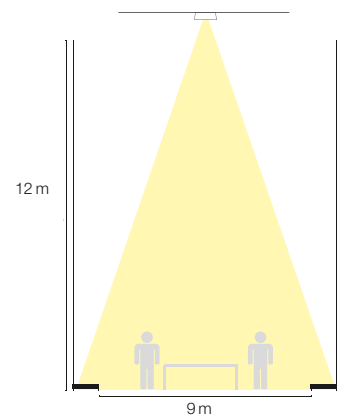
- Illuminance levels have been optimised for medium and high racking; the focus is on aisle areas.
- A specially designed and installed solution will provide uniform illumination of aisle areas and shelf surfaces.

GRAFT | high bay LED luminaire



#### GRAFT Narrow Beam

- Light distribution and illuminance levels are optimised for the efficient and uniform lighting of long and high shelf rows.
- As a distinctly narrow-beam solution, it uses the spacing between one LED luminaire and the next to full effect. The spacing can be up to 15 m when installed at a height of 15 m.



#### GRAFT Wide Beam

- Perfect beam pattern for high bay uses with production areas where people have to work reliably and with concentration.
- The light from the LED high bay luminaire has well-controlled glare and is uniquely efficient and uniform. This is made possible by a lighting cone that is shaped like a pyramid with a square base.



## 2 Flexibility

Holistic planning



**Schletter Leichtmetallbau GmbH, Kirchdorf | DE**

Electrical consultants: Elektro Seidinger GmbH,  
Bachmehring | DE

Lighting solution: Transparency from the office to the  
production bay – the TECTON continuous-row luminaire  
and its balanced brightness level put the idea into an  
impressive solution.



- **Different applications that make different demands on lighting are mixed up in industrial buildings**
- **Taking into account circulation routes, workflows and areas of activity throughout an entire building makes orientation easier**
- **A lighting solution and lighting control system that take a cross-building approach use light in a targeted manner, thus reducing expenditure on energy**

#### Recommended products

PANOS INFINITY | LED downlight



LIGHT FIELDS LED | recessed luminaire



Industrial applications are strikingly diverse; they range from manufacturing workshops and warehouses, underground car parks and offices through to test and inspection workstations. The more disparate the requirements, the more important it is to obtain a lighting solution from a single source. Zumtobel can supply the right lighting components for every location and every area of activity – sometimes from within a single luminaire product line – in order to solve different visual tasks while maintaining a consistent design. Zumtobel lighting solutions provide flexibility to adapt to on-going changes by grouping luminaires together and the ability to dim them, thus adjusting lighting levels. Systems that are controlled by a single lighting control system reap the benefit of integrated control and numerous operating and maintenance synergies.

Integrated lighting concepts for industrial buildings involve considering architecture and usage circumstances separately. Zumtobel's extensive product portfolio includes lighting solutions for every application area: from lighting for offices and conference rooms through to underground car parks and from wide-area lighting using downlights through to façade lighting.



## Productivity

“Production work often involves shift work. Nowadays it is taken for granted that shift work has a negative impact on the risk of accidents and sleep quality. Room lighting can have a positive effect, especially in times when work-related stress is increasing due to an arrhythmic lifestyle. A “productive” lighting solution meets both visual and biological needs. Such lighting solutions often include a lighting control system that varies the intensity of light and light colour based on specific working hours and shift models.”



**Markus Canazei**  
Bartenbach LichtLabor GmbH, Aldrans | AT



### **RSD-electronic GmbH, Naturns | IT**

Architects: Dr. Walter Dietl, Schländers | IT

Electrical consultants: Studio ingegneri

Dr. Fleischmann & Dr. Janser, Laces | IT

Lighting solution: Light Fields and CAREENA recessed LED luminaires ensure the necessary lighting quality and high illuminance levels for precision work.

Other products: PANOS INFINITY LED downlights, SLOTLIGHT II light line, ELEE A pendant luminaire, SCUBA moisture-proof luminaire, RESCLITE LED emergency luminaire, ARTSIGN escape sign luminaire with central monitoring

In today's society, more and more information is being processed even more quickly. Human productivity is predicated on absorbing content quickly. Striving for extra output leads to continuously more efficient workflows, changing organisational structures and altered underlying conditions. Light makes it possible to cope with visual tasks effortlessly without making mistakes. Poor visual conditions hamper work, make people feel ill at ease, reduce productivity and lead to mistakes and accidents. Conversely, good visual conditions create an atmosphere in which workers feel at ease, which boosts motivation, aids concentration and makes them more productive. Improvements in lighting quality result in demonstrable reductions in error-proneness.

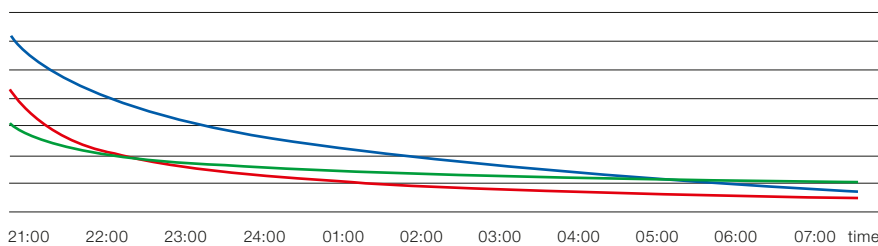
Employees have to cope with fatigue in situations where shifts are worked from early in the morning until late at night or in the case of round-the-clock working. This strain can be minimised by a lighting solution that delivers the right amount of light, good direction of light and light colour that are optimum at the appropriate time.



### 3 Productivity

#### Researching the effects of light

**What influence does dynamic lighting have on the well-being of employees who work shifts? To answer this question, Zumtobel relies on scientific research, either directly in the field or in the laboratory. The study results show that dynamic light has a demonstrably positive effect on productivity by reducing physiological strain and improving performance. As a less costly alternative, high-frequency dynamic lighting can increase activity and reduce the stress factor.**



A detailed analysis of night-time activity levels shows that static ambient lighting during working hours (blue line) results in significantly poorer sleep quality. Dynamic lighting (red and green lines) shows significantly calmer night-time activity levels.

#### Effects of dynamic lighting scenarios

Many people who work early morning shifts in industry complain about poor sleep and are unable to work at maximum productivity, as both performance and regeneration are demanded at the “wrong” time. Zumtobel initiated a field research project at the Flextronics electronics company to demonstrate that lighting solutions with dynamically controlled illuminance levels and colour temperatures successfully counter this phenomenon and that significant productivity increases are possible. The results:

- Dynamic room lighting conditions significantly improve sleep quality and have a positive impact on the wellbeing of workers during and after shift work.
- The average time for performing the work tasks fell significantly during the winter months compared to the standard time.

#### Effects of short-frequency dynamic lighting

To test the new research and to find a less costly alternative to biological light direction, Zumtobel, in conjunction with the Bartenbach Lighting Laboratory, gave a number of test subjects the task of constructing simple and complicated pre-set shapes with Lego bricks. Unlike previous studies, the control system did not follow a 24-hour rhythm but used shorter stimulation frequencies, oriented to the breathing and blood pressure rhythms of human biology. The results showed that:

- Breathing light with illuminance changes from 500 to 680 lux every 10 seconds is less tiring and more interesting and stimulating. The test subjects were more active in the early evening and slept more soundly at night.
- Light increased at an hourly frequency from 500 to 2,000 lux in a saw-tooth pattern reduced the physiological reactions to stress.

**Flextronics, Althofen | AT**

Lighting solution: TECTON continuous-row lighting system,  
LUXMATE EMOTION lighting management system





### 3 Productivity

Optimising visual performance



#### **Ferrari S.p.A., Maranello | IT**

Architects: Prospazio, Modena | IT

Lighting design: Arch. Francesca Nasi, Carpi | IT

Lighting solution: High illuminance levels reduce error rates and reveal details more clearly. At Ferrari a TECTON continuous-row LED system provides a high level of lighting at 1,000 lux with good colour rendering. The light is dimmed on the basis of daylight by a LUXMATE DAYLIGHT lighting control system.

#### **Recommended products**

TECTON LED | continuous-row luminaire

LUXMATE EMOTION |  
lighting management system





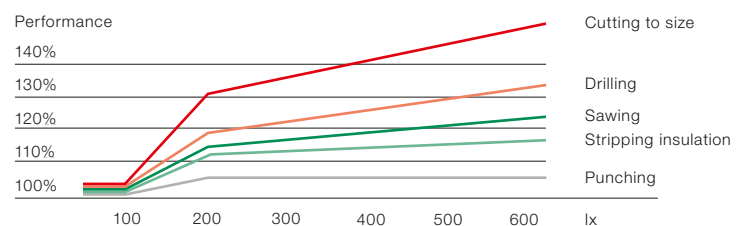


- **Lighting design concentrates on accomplishing visual tasks without making mistakes**
- **Smaller details are more visible with high illuminance levels, and the number of accidents decreases**
- **Pleasant distribution of luminance levels in a space, and a balanced mix of directional and diffuse light enhance visual comfort**

Light has a major impact on the performance of employees and on the frequency of errors and accidents in the workplace. Making it possible to cope effortlessly with visual tasks is therefore the first consideration when it comes to lighting design. An adequate lighting level is required in order to be able to concentrate on work and remain motivated. In addition, high illuminance has a positive effect on commitment, error rates and the risk of accidents. A pleasant room atmosphere is obtained through a combination of direct and indirect light, vertical illuminance or a zonal lighting solution. Visual comfort is obtained as a result of the human eye having to accommodate less often when switching from viewing the work task to viewing the room. Other consequences: employees feel at ease, are motivated and identify with their workplace.

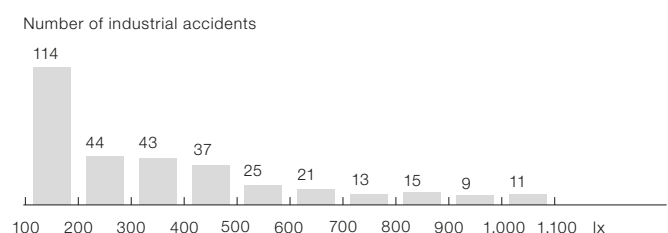
#### A higher illuminance level increases performance

Source: Ilmenau Technical University: "Nutzen einer besseren Beleuchtung", (Benefits of improved lighting), Abschlussbericht (Final Report), Gall, Völker.



#### Higher illuminance levels reduce the number of industrial accidents

Source: Ilmenau Technical University: "Nutzen einer besseren Beleuchtung", (Benefits of improved lighting), Abschlussbericht (Final Report), Gall, Völker.



### 3 Productivity

Supporting biological rhythms



#### **Ferag AG, Hinwil | CH**

Lighting solution: With a large daylight influx, work on conveyor and processing systems takes far less effort – like working in the open air. If there is a lack of daylight, the TECTON continuous-row lighting system steps in to replace it with perfectly uniform lighting. The lighting is controlled by the DIMLITE multifunctional 2-channel lighting control system.



- **Light affects an individual's natural circadian rhythms and prevents fatigue**
- **Light with short-wave blue spectral components stimulates, while warm white light has a relaxing effect**
- **Light whose colour temperature changes dynamically has a positive influence on people's health**

Besides its visual and emotional effects, the biological effect of light is also important. Colour temperatures affect mood. The warm white spectrum has a relaxing effect and increases an individual's wellbeing. Cool white light, on the other hand, is stimulating. The motors for this are the blue short-wave light components. Biologically perfect lighting is variable and makes full use of the available possibilities at any given time. Judiciously used illuminance levels and light colours synchronise human circadian rhythms on a long-term basis, and this has a positive effect on health.

This is particularly relevant in the case of night shift working when employees' normal day-night rhythms can be disrupted by atypical working hours. Shift work and its associated night-time lighting have a tiring effect on people. Nevertheless, people can be helped by the provision of biologically effective light, depending on the nature and duration of the shift work. Various dynamic light variation concepts pursue different objectives: a change in colour temperature can stimulate or relax workers in the short term. It is also possible to exert a long-term positive effect on sleep patterns and health. Biological lighting also has the ability to synchronise or shift the natural human circadian rhythm in the long term. With alternating day and night shifts, synchronisation is achieved by using colour temperatures that follow the natural changes in daylight. However, in the case of permanent night shift working it is better to adapt the rhythm. This is done by using a high proportion of blue at high illuminance levels at the beginning.

#### Recommended products

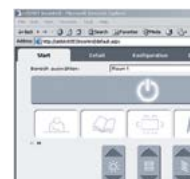
TECTON LED 6,500 K |  
continuous-row luminaire

LUXMATE LITENET |  
lighting management system



#### Flextronics, Althofen | AT

Lighting solution: As part of the research project described on page 36, a TECTON continuous-row lighting system was installed, controlled by a LUXMATE EMOTION lighting management system, in order to prove the effects of dynamic lighting on shift workers.



### 3 Productivity

#### Daylight as a model

- **Natural daylight has very special qualities and everyone perceives it as being pleasant.**
- **Cool white lighting in an interior enhances the natural effect of light and avoids mixed-lighting situations.**
- **Cool white LED luminaires combine visual comfort with almost unparalleled efficiency.**

Large amounts of daylight are available in a steadily increasing number of industrial bays. The large glass façades have a symbolic significance as well as a lighting aspect. Allowing outsiders an untrammelled view into a building symbolises a high degree of transparency and emphasises a high awareness of quality.

Employees in the bays find the natural daylight particularly pleasant. Their wellbeing and potential for stimulation is a second important argument, after energy efficiency, for using daylight as intensively as possible. The colour temperature of sunlight varies – with the exception of the very early morning and late evening hours – between 5,000 and 6,000 K. Artificial cool white light emulates this and so avoids mixed lighting situations with different colour temperatures from daylight and artificial light. Another benefit: cool white is perceived subjectively as being brighter and is regarded by employees in a positive way.

#### Recommended products

GRAFT 6,500 K | high bay LED luminaire



SCUBA 6,500 K | moisture-proof diffuser luminaire





**Alpla Werke, Hard | AT**

Lighting solution: The plastics manufacturer has been using luminaires with cool white 6,500 K lamps for many years, achieving an almost seamless transition between outdoors and the production bay. This concept was implemented in the latest lighting refurbishment with the 6,500 K TECTON continuous-row LED system for greater efficiency and higher lighting quality.



### 3 Productivity

Intelligent control



**Mondelēz Belgium Biscuits Production NV, Herentals | BE**

Lighting solution: The TECTON continuous-row lighting system meets the high requirements in the production and warehousing areas on reliability at various ambient temperatures while ensuring food hygiene. The central LUXMATE LITENET control system decreases the lighting on the basis of daylight and the presence of staff, thereby saving energy and prolonging the service life of the lighting solution.

Other products: FEC louvre luminaires for offices

**Recommended products**

TECTON LED | continuous-row luminaire

LUXMATE LITENET timeline editor | lighting management system



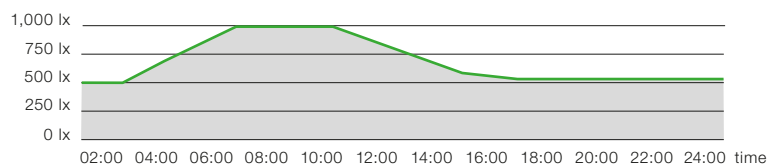
- **Light for people that promotes both wellbeing and motivation can only really be achieved by using a lighting control system**
- **Timelines are used to implement a wide variety of individual project requirements**
- **Graphic editors are simple to use and are an important tool in utilising the advantages of dynamic lighting in in everyday situations**

To promote an individual's wellbeing and productivity in industrial plants effectively, light is needed that meets human requirements as unobtrusively as possible. The key to this is varying the quantity and colour of the light. Employees working in shifts frequency suffer from problems with health and poor quality of sleep. Lighting plays a central role here, and precisely when and how the lighting is used is of great importance.

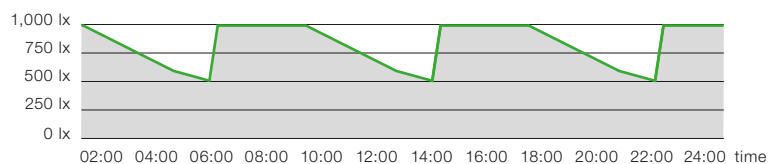
A lighting control system combines the various components of a lighting solution and puts the requirements on the biological effects of light into practice. In addition to standard automation features such as daylight-based or presence-based control, a dynamic lighting system can also offer individual timer settings. The graphic editor makes it easy for the user to define the illuminance level and light colour at any time of day or night. Zumtobel systems include predefined timelines as an aid that can be adapted very easily to local conditions.

#### Concept for biologically effective light

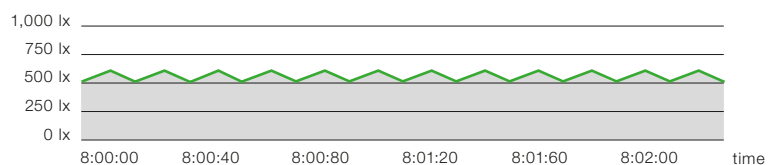
If employees often have to change between day and night shifts: high luminous intensity at the start of working hours stabilises the circadian rhythm.



For permanent night-shift working: high illuminance levels (or high colour temperatures) at the beginning of each shift help people to adjust to the working hours.



For more activity and less fatigue: breathing light with illuminance changes from 500 to 680 lux every 10 seconds.



## Reliability

“In industry, the requirements in terms of lighting for workstations have increased over the past years. Optimal lighting today is characterised by customised innovative lighting technology integrating the amount of daylight available. The proper arrangement of luminaires, as well as the efficiency and cost-effectiveness of luminaires and lamps play an essential role in this respect. The choice of luminaires depends on ambient conditions – difficult at times –, such as room height, ambient temperature and dirt load. In order to provide for easy cleaning of the luminaires and smooth replacement of lamps, we attach great importance to good accessibility and easy handling.”



**Heribert Czarnetzki**  
Master Electrician Otto Fuchs KG, Meinerzhagen | DE





**Mondelēz Belgium Biscuits Production NV, Herentals | BE**

Lighting solution: The TECTON continuous-row lighting system meets the high requirements in the production and warehousing areas on reliability at various ambient temperatures while ensuring food hygiene. The central LUXMATE LITENET control system decreases the lighting on the basis of daylight and the presence of workers, thereby saving energy and prolonging the service life of the lighting solution.

Other products: FEC louvre luminaires for offices

Working hours can be long in many industrial enterprises, often extending over two or three shifts. This entails long periods of operation, including for lighting. The requirements for a long service life are therefore highly relevant in industry, where the lighting should not fail or be merely satisfactory in operation after five years. An LED solution is therefore advisable on the grounds of the higher expected service life alone. The dimmability offered as standard with LED luminaires and its associated reduced periods of operation also has the effect of extending their service life.

Ambient and operating conditions play an important role in the selection of the best possible lighting solution. Very high or very low temperatures have a significantly negative effect on the efficiency of various light sources. Humidity, dirt or chemical particles also call for a correspondingly resistant luminaire housing. A sealed luminaire with the appropriate IP rating ensures that no foreign bodies enter the luminaire. Lighting is necessary not just to ensure industrial safety and reliability; it is also responsible for showing employees the route to safety in emergencies.

## 4 Reliability

### Increasing toughness

- **Bright environments with bright vertical surfaces make it possible to take in an entire room at a glance, thus creating a feeling of greater safety**
- **Environmental influences dictate the protection rating of a luminaire**
- **Explosion-proof luminaires ensure safety in industrial locations where harmful dust or gases are liable to occur**

Dark areas create a feeling of insecurity; employees and visitors feel safer in a room that is consistently bright. Ideally, the entire room can be taken in at a glance. This is ensured by bright rooms that have bright vertical surfaces; glare and excessively high or low illuminance levels can be distracting.

Moisture-proof luminaires afford long-term protection and good efficiency in harsh environments. They are extremely resistant to dust, moisture, chemicals, mechanical stresses and extreme ambient temperatures. Zumtobel uses various materials and degrees of protection to meet specific challenges.

When planning a project, any expected environmental influences and the luminaires suitable for the application must be clarified exactly. Explosive atmospheres in industry are an often underestimated hazard. Mixtures of gas and air or dust can lead to an explosion and cause immense injury to people and damage to equipment. Gas explosions are an issue in the chemical industry in particular. Sawdust, fodder, food, plastic and carbon dust can cause dust explosions. As a potential ignition source, luminaires for hazardous locations must not cause ignition in an explosive atmosphere – Zumtobel supplies luminaires that are suitable for Zones 1/21 and 2/22 in accordance with the ATEX directive.

#### Scania Parts Logistics, Opglabbeek | BE

Architects: Helsen & Van Com Architekten, Hasselt | BE  
Technology & energy consultants: Archimedes n. V., Keerbergen | BE  
Lighting solution: The TECTON continuous-row lighting system is controlled by TECTON PST sensors on the basis of the presence of users. RESCLITE luminaire is incorporated in the system.



#### Recommended products

TUBILUX LED | tubular LED luminaire

KXB 2 LED | explosion-proof luminaire





**APAG Parkhaus Aachen | DE**

Operator: Energieversorgungs- und Verkehrsgesellschaft Aachen | DE  
 Lighting solution: There are no dark areas in this multi-storey car park. The dimmable SCUBA LED IP 65 moisture-proof luminaire is controlled on the basis of the presence of visitors and consequently offers them a uniform and comfortable lighting situation at any time of day.



## 4 Reliability

Maintaining cleanliness



### **Pasticceria La Baita srl, Caselle Torinese | IT**

Lighting solution: The high requirements on cleanliness and purity are reliably met by the TECTON continuous-row lighting system. The ONLITE RESCLITE emergency luminaire is incorporated in the system.

#### **Recommended products**

SCUBA LED |  
moisture-proof diffuser luminaire

CLEAN LED | clean-room luminaire





- **Cleanliness and hygiene are promoted by bright, low-maintenance, easy-to-clean lighting systems**
- **Cleanliness during manufacture is becoming more important as increasing demands are placed on product quality**
- **Difficult visual tasks such as precision inspections or wiring are made easier by good lighting and a clean environment**

The many arguments in favour of bright, clean lighting are matched by Zumtobel's versatile range of luminaires that offer as few surfaces as possible on which dirt can settle. Cleaning is more efficient, first impressions are great and product quality improves. Besides degrees of protection and associated resistance to impact by chemicals, dust or extreme temperatures, Zumtobel relies on smooth surfaces and no loose parts.

Zumtobel relies on good to very good colour rendering in order to ensure that products or ingredients in the food processing industry can be assessed correctly. Relevant guidelines laid down, for instance, by International Food Standards (IFS) and the British Retail Consortium (BRC) set minimum standards and flag up areas where there is room for improvement when guidelines are revised on an annual basis. All versions of the SCUBA moisture-proof luminaire have achieved certification according to the IFS Standard by an independent testing authority. TÜV Rheinland LGA Products GmbH has certified SCUBA and the TUBILUX tubular luminaire as being particularly suitable for use in the food processing industry. This certification attests to the fact that the luminaire is shatter-proof, contains no glass, has an enclosed light source, and no splinters can get into the food product if the lamp breaks. This provides proof of food-safe design. The Hazard Analysis and Critical Control Points (HACCP) method is used to determine risks to the safety of food and actively reduce them. Choosing the right lighting in terms of safety, protection, maintenance and efficiency helps the food processing industry achieve these goals.

Production under controlled conditions opens up the possibility of new, more effective and more accurate methods. Various organisations and standards such as Good Manufacturing Practice (GMP), the Food and Drug Administration (FDA) and the German Medicinal Product Law set out specific recommendations for equipping clean-rooms. Among other items, this includes luminaires with IP 65 protection that are suitable for use in rooms with positive or negative pressures. Other specifications relate to ability to withstand cleaning agents and disinfectants and low particle emission behaviour. Installation flush with the ceiling or surface mounting may also be required depending on the construction of the ceiling and the particular application area.

#### **A. Loacker Konfekt GmbH, Heinfels | AT**

Architecture: Lienz architect partnership | AT

Lighting solution: The SCUBA moisture-proof luminaire, installed on TECTON trunking, withstands the demanding ambient conditions.

Other products: MELLOW LIGHT recessed luminaire





## 4 Reliability

Simplifying maintenance

### Freitag Bags, Zurich | CH

Lighting solution: Various production areas and operations are best served by various lighting types, in this specific instance by the CHIARO moisture-proof luminaire and the surface-mounted COPA high bay luminaire.

Other products: TECTON and ZE continuous-row systems

Photo: Roland Tännler







- **Maintenance is a crucial factor in high bays and in situations where luminaires are hard to access**
- **State-of-the-art LED solutions have the advantage of long service lives**
- **In contrast, LED retrofit lamps often involve excessive compromises when it comes to lighting quality, technical safety and energy efficiency**

Zumtobel's product portfolio features particularly low-maintenance units that have a long service life, and it meets industrial requirements: many luminaires in high bays are difficult to access; maintenance and frequent relamping are therefore very expensive. Reducing the need for maintenance also means less frequent disruption of manufacturing processes. With an average service life of 50,000 hours and a guaranteed end-of-life luminous flux in excess of 70%, LED luminaires are virtually maintenance free for long periods of time. Even cleaning is particularly easy thanks to the compact design sizes that are achievable by combining LED light sources, battens and optics. Another benefit of LEDs is the fact that they limit the visible light spectrum. LED light is free from ultraviolet and infrared radiation and does not harm even plastics that fade easily.



The temptation to modernise old fluorescent lamps by fitting LED tubular lamps is huge, but caution is required. Many LED retrofits are not compatible with the technical lighting and electrical requirements of a luminaire. As the LED retrofit and luminaire were not tested as a single unit, confirmations for marks of conformity have to be applied for again after upgrading, and the firm which carried out conversion will be held liable in the event of any damage or claim. The reflector and optic in a Zumtobel luminaire are precisely matched to the fluorescent lamp, and upgrading to a LED tubular lamp results in a markedly different beam pattern. The specified luminous intensity curve can no longer be guaranteed and the photometric calculations used to determine illuminance and glare are no longer valid. The primary attraction of retrofit solutions is the fact that they consume less electricity than fluorescent lamps of the same length. This initial attraction soon fades, however, when one realises that LED retrofits emit roughly 50% less light than most LED and fluorescent lamps.

#### Recommended products

METRUM | continuous-row system

ONLITE RESCLITE | emergency luminaire



## 4 Reliability

### Increasing safety in emergencies

- **LED emergency luminaires with extra protection tailor-made for industry and especially for high ceilings**
- **Wide selection of escape sign luminaires with low-cost all-round models for industry**
- **Flexible and modular emergency lighting**

Environmental conditions can sometimes be extremely harsh in industry. Zumtobel offers escape sign and emergency luminaires with IP 42, IP 54 and IP 65 protection to make sure that the escape routes are reliably illuminated in an emergency despite harsh conditions – these products are well protected against dust and water. High bays pose additional challenges for emergency luminaires. RESCLITE High Ceilings escape route luminaires and anti-panic spots guarantee reliable orientation even from a height of 7 to 20 metres. The spacing between LED luminaires can be up to 21 metres. The combination of IP 65 and a central supply makes the luminaires practically maintenance-free.

Sturdy low-cost LED luminaires like CROSSIGN are characterised by high toughness, ease of installation and perfect lighting technology. Two ERI spots on the underside give the escape sign luminaires the qualities of an emergency luminaire. This means that thanks to the latest LED technology, a saving is made not only in electricity but also in the number of luminaires.

The logical reply to the continuous reduction in power of LED emergency and escape sign luminaires on the supply side is the first TÜV-certified central battery. eBox meets all the requirements for central and group battery systems under EN 50171 and can be used in both very small and in major projects. Its high reliability starts with easy installation and wizard-led commissioning, continues with an easy-to-use web browser user interface and culminates in a permanent display of the expected battery life. If SUB stations are used, the fire load on the building is reduced by 70%.

#### Recommended products

ONLITE RESCLITE for greater heights |  
LED emergency luminaires



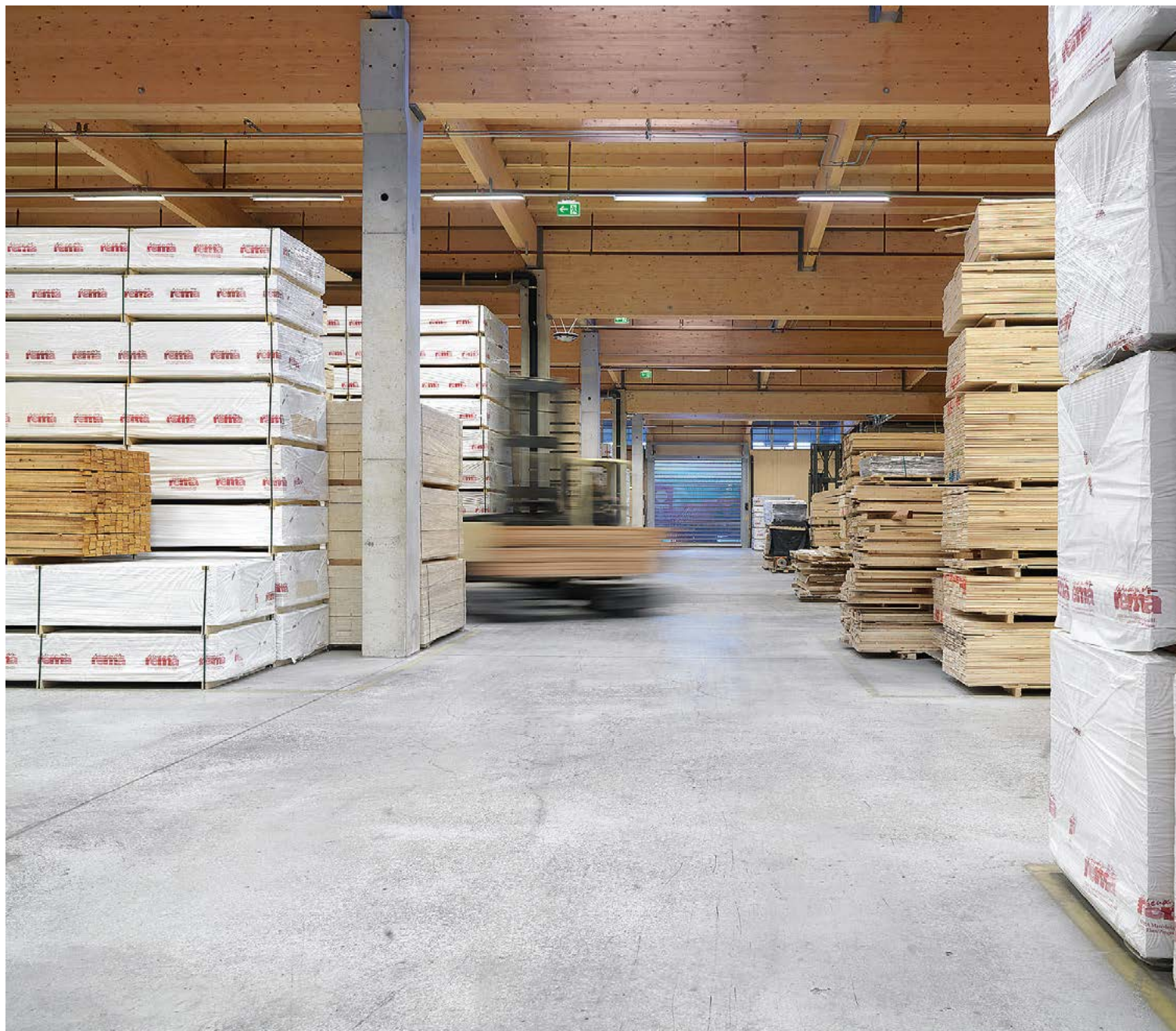
CROSSIGN 160/110 |  
escape sign luminaires



ONLITE CENTRAL eBox | emergency lighting supply system







**Rema Holzindustrie, Eben im Pongau | AT**

Lighting design: Elektrotechnik Kontriner, Bischofshofen | AT

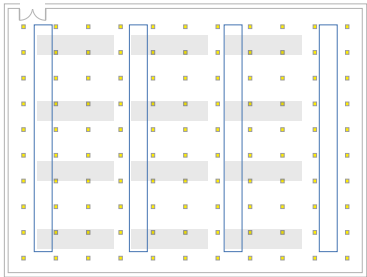
Lighting solution: The ONLITE ECOSIGN escape sign luminaire is controlled by the ONLITE local SB128 controller.



# Specimen solution for a production bay

## Lighting analysis

Electronic components are produced, packed and stored in an area of 1,200 square metres in this specimen bay. The height of the space is six metres, and daylight enters along a window frontage on one side and through skylights. The bay was lit by HID reflector luminaires prior to refurbishment. The comparison with a lighting solution using VALUEA T16 high bay reflector luminaires and another LED lighting solution with GRAFT and LUXMATE LITENET clearly shows the potential of an innovate lighting solution.



HID high bay luminaire (existing) with RAB reflector

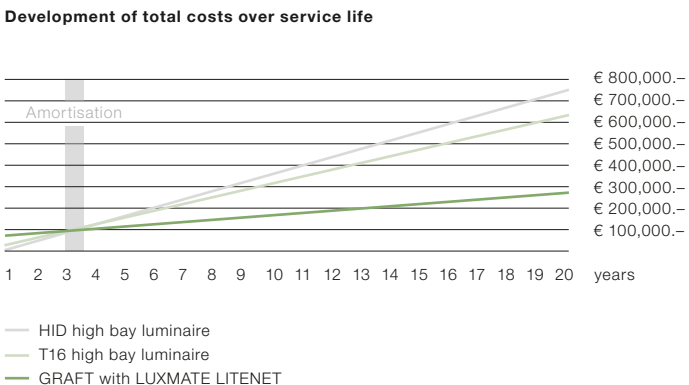
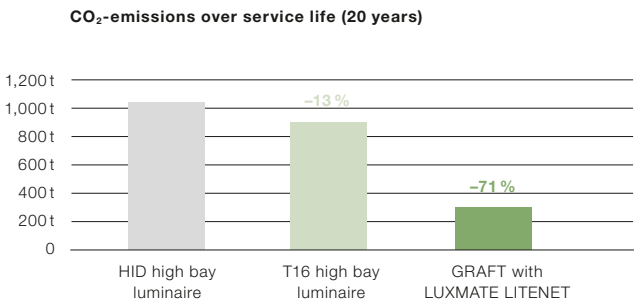


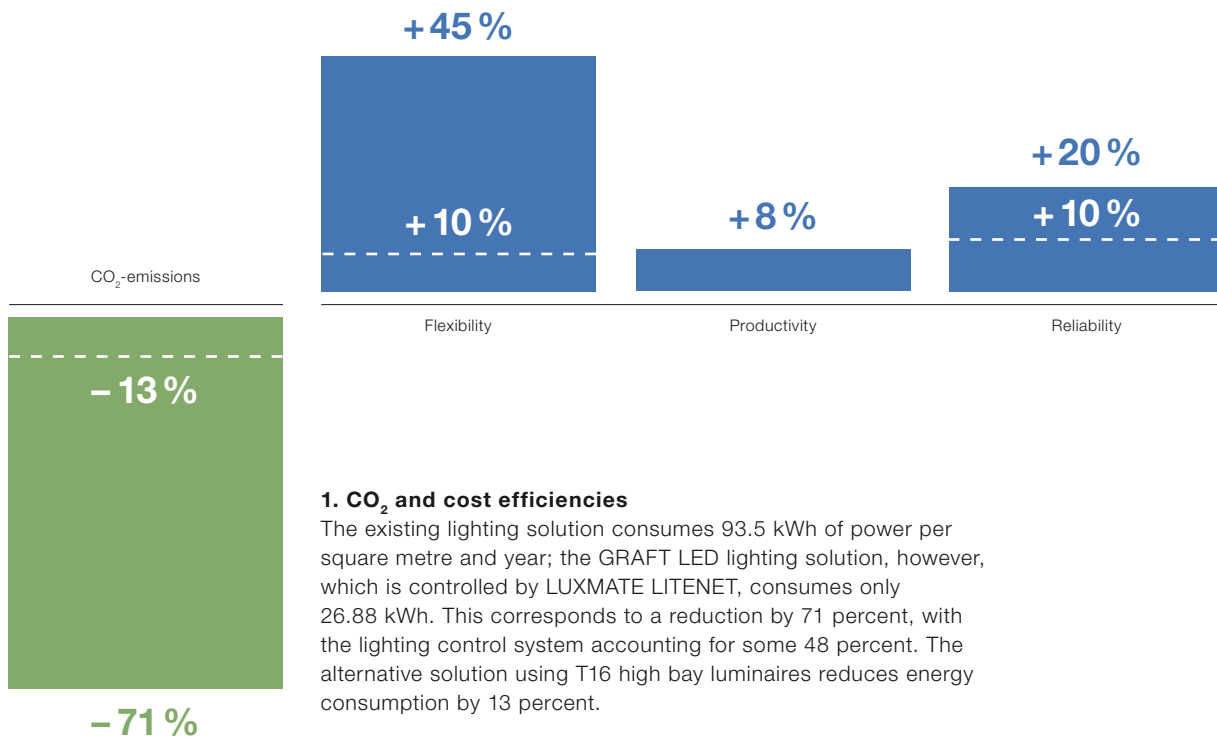
T16 high bay luminaire



GRAFT 330 WB with LUXMATE LITENET lighting control system

	HID	T16	LED
Light source	HID	T16	LED
Installed load	250 W	216 W	140 W
Number of luminaires	90 off	99 off	110 off
Luminous flux	19,000lm	17,800lm	12,600lm
Luminaire efficiency	76lm/W	82lm/W	90lm/W, 4,000 K, Ra80
Benefits		<ul style="list-style-type: none"><li>• Low total installed load</li></ul>	<ul style="list-style-type: none"><li>• Low installed load</li><li>• Low maintenance</li><li>• Dimmable</li><li>• Daylight integration</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>• High energy consumption</li><li>• High maintenance</li><li>• Low efficiency</li></ul>		





### 1. CO<sub>2</sub> and cost efficiencies

The existing lighting solution consumes 93.5 kWh of power per square metre and year; the GRAFT LED lighting solution, however, which is controlled by LUXMATE LITENET, consumes only 26.88 kWh. This corresponds to a reduction by 71 percent, with the lighting control system accounting for some 48 percent. The alternative solution using T16 high bay luminaires reduces energy consumption by 13 percent.

### 2. Flexibility

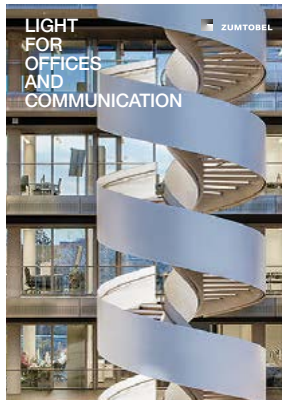
The illuminance level is 750 lux throughout the bay, designed to meet the very demanding visual tasks in the production area. The ability to reduce the lighting level to 300 lux at the packing station and to 150 lux in the finished goods warehouse reduces unnecessary energy consumption and provides flexibility.

### 3. Productivity

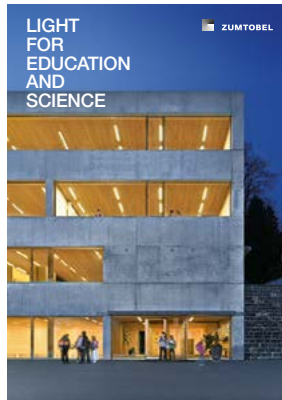
The lower the illuminance level of ambient lighting, the higher its factor for additional motivation. By increasing the lighting level by 12 percent in the warehouse, by 10 percent at the packing station and by 5 percent in the production area, productivity is increased by an average 8 percent.

### 4. Reliability

The fact that the luminous flux of a GRAFT luminaire does not decrease even in case of high temperatures below the bay's ceiling makes the lighting all the more reliable. Another important aspect is the high bay LED luminaire's low failure rate, which results in less frequent downtimes and lower maintenance costs.



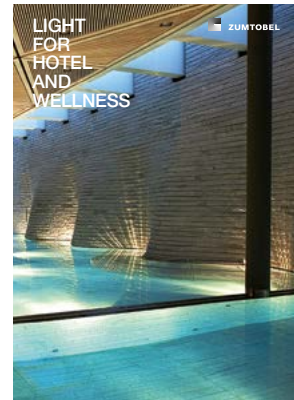
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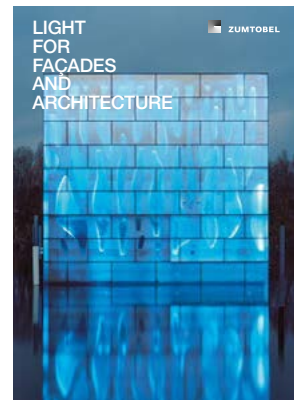
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**Zumtobel is the internationally leading supplier of integral lighting solutions for professional interior and exterior lighting applications.**

- Offices and Communication
- Education and Science
- Presentation and Retail
- Hotel and Wellness
- Art and Culture
- Health and Care
- Industry and Engineering
- Façades and Architecture

We provide unique customer benefits by integrating technology, design, emotion and energy efficiency. Under the Humanergy Balance concept, we combine the best possible ergonomic lighting quality for an individual's well-being with the responsible use of energy resources. The company's own sales organisations in twenty countries, as well as commercial agencies in fifty other countries, form an international network of experts and design partners providing professional lighting consulting, design assistance and comprehensive services.

#### Lighting and sustainability

In line with our corporate philosophy *"We want to use light to create worlds of experience, make work easier and improve communications and safety while remaining fully aware of our responsibility to the environment"*, Zumtobel offers energy-efficient high-quality products, while at the same time making sure that our production processes based on the considerate use of resources are environmentally compatible.

[zumtobel.com/sustainability](http://zumtobel.com/sustainability)



#### Top quality – with a five-year guarantee.

As a globally leading luminaire manufacturer, Zumtobel provides a five year manufacturer's guarantee on all Zumtobel branded products subject to registration within 90 days from the invoice date and in accordance with the terms of guarantee at [zumtobel.com/guarantee](http://zumtobel.com/guarantee).

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Technical data was correct at time of going to press.

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# ZUMTOBEL



Track and spots



Modular lighting systems



Downlights



Recessed luminaires



Surface-mounted and pendant luminaires



Free-standing and wall-mounted luminaires



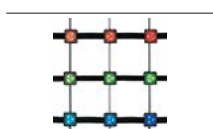
Continuous-row systems and individual batten luminaires



High-bay luminaires and floodlight reflector systems



Luminaires with extra protection



Façade, media and outdoor luminaires



Lighting management system



Emergency lighting



Medical supply systems

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