Lighting solutions for the balance between the environment, energy and the individual.

Zumtobel defines Balanced Lighting solutions as those which combine superior quality and maximum efficiency, and offers practically relevant assessment methods, design tips and reference projects in order to implement such solutions.
The individual and energy

The earth’s fragile ecosystem deserves our full attention. Its equilibrium has been disturbed, and our climate is changing. A greenhouse gas, carbon dioxide (CO₂), is the prime cause of this change. Calls for a significant reduction in energy consumption have been made in many languages, at both private and government-organised events. The declarations of intent in the Kyoto Protocol and the follow-up conference in Bali have at last been set out in concrete targets and standards. Saving energy is economically and socially important. The International Energy Agency (IEA) reckons that lighting accounts for 19% of worldwide electricity consumption. The contribution that an energy solution can make to climate protection is correspondingly significant. Zumtobel has developed the HUMANERGY BALANCE concept in order to assume its share of responsibility for energy consumption, and to take another step towards energy efficiency combined with outstanding levels of quality. Because people need light. Like a staple food, good light gives us vitality and security and is a basic prerequisite of life in economic and societal terms. Poor lighting, on the other hand, can have a negative impact on our health, job performance and sense of well-being.

HUMANERGY BALANCE is inspired by nature: beneficial light which offers infinite variety seemingly effortlessly. The HUMANERGY BALANCE concept is scientifically underpinned by extensive research into the effects of light and how to quantify quality and efficiency. Real-life reference projects and practical design tips help users implement balanced lighting solutions.
HUMANERGY BALANCE
Lighting solutions which strike a balance between environment, energy and the individual

HUMANERGY BALANCE defines light as a tool which caters for human needs as effectively as possible but minimises environmental pollution. Lighting is intended to foster our sense of well-being and create perfect conditions for enhancing productivity, satisfaction and health. To achieve these objectives, Zumtobel sets great store by a well-balanced blend of ecology and economy, economics and science, together with its sense of responsibility and the spirit of its customers, partners and employees when it comes to adopting new approaches and giving priority to innovative solutions.

Three aspects – lighting concept, luminaire and lighting management – are crucial in the effort to achieve maximum efficiency. The lighting concept deals with issues such as the ideal location of the luminaires, their number and their characteristics. In the case of the actual luminaire, apart from its design, it is above all the light source and control gear which decisively influence energy consumption. Compared with conventional standard lighting, intelligently controlled lighting solutions use up to 80% less energy. Illuminance levels are automatically controlled depending on the amount of daylight available and signals from presence detectors.

Visual requirements relate to the visual task which must be fulfilled properly with the right lighting quality. Illumination and colours have effects at an emotional level. Light has a biological effect because colour and changes in light influence human biological rhythms.

Three effects are considered from the very outset in order to assess the quality of light holistically: the visual, emotional and biological functions of light. Visual requirements relate to the visual task which must be fulfilled properly with the right lighting quality. Illumination and colours have effects at an emotional level. Light has a biological effect because colour and changes in light influence human biological rhythms.

Light to wake up to: soft light and warm light colours are a gentle way to start a busy work day.

Midday light: midday is characterised by exceptionally high light intensities with relatively strong blue components.

Light when day is done: muted ambient light with warmer components combined with accent lighting is typical of nightfall.
A balanced lighting composition includes several lighting components.
All good things come in threes
The three components of a good lighting solution

Light for visual functions
People need a minimum level of light in order to perform visual tasks and identify objects. This level varies greatly depending on the particular application area. The visual demands made by an office are different to those of a retail area, and discussions require different lighting qualities than working at a PC. For many areas and activities, these basic visual requirements are summarised in standards and recommendations concerning brightness, uniformity, glare limitation, colour and contrast rendition.

Light which has an emotional effect
Relaxing or working, stimulating or calming: the various ways in which light can be used to evoke emotions matches the whole gamut of human emotions. For instance, a room is much more inviting if light is used to attractively illuminate the vertical surfaces and objects in the room. Colours also produce significant effects.

Light which has a biological effect
Nature provides the perfect model for using light to achieve biological changes. Daylight has left its imprint on humans. The succession of light and darkness is reflected in our waking and sleeping patterns and hence our circadian rhythms. A light spectrum with sufficient blue components inhibits the production of melatonin, and has a favourable effect on alertness and readiness for action in the morning and early afternoon. Warm colours in the evening interfere with melatonin production and favour relaxation.

Tone makes music. Tone is the material from which musicians fashion their compositions. The character of a composition is determined by its key. Similarly, good workplace lighting provides the basis for a high-quality lighting solution by ensuring visual functionality. Workstations are illuminated by direct lighting from ceiling-mounted luminaires in the office area shown above.

Composers use different note lengths, chords and sequences to bring their musical pieces to life. Indirect light full of effects breathes life into a lighting solution. The picture above shows how lighting using several spotlights and the indirect component of the ceiling-mounted luminaires exerts its emotional effect.

Musicians use individual climaxes to bring their works of art to a finish. Listeners are enthralled by masterfully modulated arrangements. The right time of day is a decisive aspect of the biological effectiveness of a lighting solution: in this office room, walls and ceilings are brightened up by strong cold white light in order to stabilise the circadian rhythm.
Using VIVALDI, the various components of a lighting installation have been combined to provide a stimulating lighting scene.
VIVALDI
Now anyone can use light like a composer

Balanced lighting solutions have the impressive ability to unite three components of light into a single overall entity. Zumtobel has developed special software to make it easier to handle a matter as complex as light: VIVALDI.

VIVALDI is used to compose light and breathe fresh life into hitherto static lighting design. Dynamic lighting scenarios and their effect on people and architecture can be experienced interactively on a screen. VIVALDI can be operated simply, almost playfully, and has an impressive look and feel: lighting scenes can be produced by lighting calculation programs or can be retrieved from the reference library at the click of a mouse. Individual scenarios are placed alongside each other on timelines so that lighting can be optimised over the course of the day – keeping an eye on energy efficiency at the same time. VIVALDI calculates both actual consumption as well as resulting CO₂ emissions. This way, dynamic lighting is made visibly perceptible in a novel manner, which gets across the added value of high-quality lighting solutions at every stage of the sales process, whilst also spelling out the potential savings which can be made by using intelligently controlled lighting solutions.

For more detailed information and reference designs, please visit www.zumtobel.com/vivaldi
MELLOW LIGHT IV, 2LIGHT, 2LIGHT MINI and PANOS downlights as well as the LUXMATE lighting management system are used in the training and seminar rooms at the Clarion Hotel in Stockholm, Sweden, providing perfect light for any scenario.
**ELI and LENI**

Assessing lighting quality and energy efficiency

Zumtobel, encouraged and supported by intensive research activities, has made lighting quality measurable for the first time ever. The Ergonomic Lighting Indicator (ELI) now makes it possible to express lighting quality, in all its diversity, in figures, showing a total of five aspects of quality: visual performance, vista, visual comfort, vitality and empowerment are shown in a spider chart which comprises five axes. This assessment system makes it possible to make even complex design parameters apparent at a glance. Quality criteria and assessment methods were developed in close cooperation with Professor Christoph Schierz of the University of Technology (TU) in Ilmenau, Germany. These were used to produce simplified questionnaires regarding practical day-to-day work. Zumtobel’s practical calculation and assessment tools allow very good estimation within a few minutes.

The Lighting Energy Numeric Indicator (LENI) is defined in the European standard for the estimation of energy requirements (EN 15193). National standards and guidelines are based on LENI, which quantifies annual energy consumption per square metre. Besides the installed load, daily usage times and stand-by consumption are also factored in. Together with indicators for heating, air-conditioning, ventilation and hot water production, it is used to calculate the total energy demand of a building.

The ELI-LENI calculator is the perfect tool to quickly calculate ELI’s and LENI’s. This program, which is available from Zumtobel, speeds up calculation, simplifies assessment and delivers numeric results as well as graphical diagrams in just a few minutes – the ELI-LENI seal of quality.

The planning and design handbook contains further background information, references and detailed information about every stage of the HUMANERGY BALANCE design process.
Shelves backlight in colour create strong emotional accents at Müller Jewellers in Oberstdorf, Germany. For visual identification of the items, recessed downlights have been installed in the showcases; pendant luminaires above the counters show jewellery in the right light.
Check it out yourself!
Design tips ensure fast, accurate ELI and LENI results

Lighting quality is objectively assessed by using questionnaires which Zumtobel provides in printed form and, in simplified form, stored in the ELI-LENI calculator. Check it out yourself! A preliminary estimate based on gut instinct often produces an ELI spider chart which is very similar to that obtained by more detailed assessment. Simply give a score from 1 (not applicable) to 5 (completely applicable) and enter it on the chart.

A **Visual performance:** takes into account traditional lighting quality criteria and assesses how well tasks can be performed or goods can be identified.
B **Vista:** grades how the lighting solution is experienced and what impression it leaves.
C **Visual comfort:** estimates how pleasant viewing conditions in the room are.
D **Vitality:** grades the positive influence of the lighting on the human biological clock.
E **Empowerment:** assesses lighting control and how well lighting adapts itself to individual needs.

Stick with your instinct! Simply enter the scores on the axes in question and draw a line to connect them. Your ELI spider chart is done.

LENI is calculated on the basis of the specifications in EN 15193. This standard contains a quick method. Once a building or room type has been selected, the calculator automatically inserts standard factors obtained from standard tables. The following simplification applies:

\[
\frac{(P_n \times t \times F_D \times F_O \times F_C)}{A}
\]

To perform calculations using the ELI-LENI calculator, simply enter the following parameters:
- Quantity, installed load and stand-by load of luminaires \(P_n\)
- Luminaire usage times \(t\)
- Factors for daylight-based control \(F_D\), presence control \(F_O\) and maintenance control \(F_C\)

Even given minimal details, the ELI-LENI calculator calculates consumption per annum per square metre \((\text{kWh}/\text{m}^2\ \text{a})\) and displays it in the LENI diagram.

Download the ELI-LENI calculator from [www.zumtobel.com/humanergybalance/eli_leni_calculator](http://www.zumtobel.com/humanergybalance/eli_leni_calculator)
DEGW is a leading consultancy for workplace design. The company develops integral office organisation solutions. It has implemented one such exemplary solution in its German head office in Munich. Flexible workstations and screened focus boxes are set centre stage using SLOTLIGHT light lines, 2LIGHT MINI, PANOS Q downlights, TECTON lighting coves and LIGHT FIELDS clusters controlled by EMOTION touch panels.
Light for working
Meeting human needs and minimising environmental impact

In any situation where people’s productivity and health are a prime concern, lighting must create perfect conditions for concentrating on work. Inadequate lighting increases the risk of accidents and causes loss of concentration, headaches and fatigue in many cases. Despite this, out-of-date lighting systems which provide deficient lighting quality and poor light output ratios are still in use in many workspaces. Apart from using effective technologies, it is above all lighting management which makes a significant contribution towards energy efficiency: by seamlessly integrating daylight and allowing automation using timers or presence detectors.

Light for visual functions
Optimum light for working is bright, focused onto the task area and appropriate to the relevant activity carried out. People can only work productively at full efficiency where light meets all the quality criteria for the visual task in question.

Light which has an emotional effect
Walls and objects are illuminated, preferably with warm white light, to produce room light which is full of atmosphere. Colour and changes in colour have a strong emotional effect.

Light which has a biological effect
Apart from as much daylight as possible, temporarily high light levels and cold white light colours in particular, when used at the right time, stimulate activity, for example using a wallwasher.

REFERENCE EXAMPLES FOR BALANCE

Generously-sized glass frontages and skylights allow plenty of daylight to enter Strobl Bau’s shop floor in Weiz, Austria. If illuminance drops below the required 500 lux at the workstations, the COPA high-bay reflector luminaires switch on automatically. When work is done, the LUXMATE lighting management system switches on energy-saving night-time lighting.

Great importance was attached to a high-quality lighting solution in order to create an attractive environment for social work students in the new building of the Benediktbeuern University of Applied Sciences (Germany). PANOS Q downlights provide pleasant ambient brightness while suspended indirect/direct luminaires deliver comfortable light for reading and working near bookshelves and at workstations.

The lighting concept at the Herne dialysis centre in Germany focuses on the patient. ACTIVE LIGHT WALLS are used in waiting areas and MELLOW LIGHT IV is used in treatment rooms in order to make the patient’s stay as brief and restful as possible. The colour and intensity of both these forms of lighting can be adjusted – by both the patient and the energy-saving LUXMATE PROFESSIONAL lighting management system.
The extravagant styling of the Side Hotel in Hamburg (Germany) is accentuated by remarkable lighting scenarios. Lighting was incorporated into furniture and room shapes as part of the architecture. Atmospheric lighting scenes using various colour set-ups are available at the press of a button.
Light for enjoyment
Impressive effects without indulging in excess

Where the emphasis is on producing an experience, lighting primarily concerns itself with providing sensational centre-stage settings for interiors, products or works of art. This calls for a blend of fascination and a comfortable feeling, a mix of creativity and artlessness, of lighting quality and energy efficiency. This reaches its zenith thanks to intelligent lighting management. Changing lighting sceneries, light colours and control based on daylight, presence and time of day ensure that energy is used responsibly.

Light for visual functions
Light’s first task is to show off goods and objects to optimum effect. To achieve this, accent lighting must be coordinated with the characteristics of the objects which are set centre stage, and it must also produce ideal working conditions for staff.

Light which has an emotional effect
The art of using lighting effects involves producing variations of light and dark, emphasising the interior design and exploiting the effect of colours.

Light which has a biological effect
Human biorhythms are pre-programmed to cope with change. Ambient lighting can, just like daylight, provide the pointers which our biological clocks need.

Natural daylight enters through striking skylights at the “Bergoase” spa at the Tschuggen Grand Hotel in Arosa (Switzerland). PANOS downlights combined with luminaires concealed in coves produce a cozy, warm white room atmosphere with a ceiling in changing blue. The pools are impressively illuminated by halogen spotlights.

More than 300 TEMPURA spotlights in the early Classicist style Zeughaus in Mannheim (Germany) ensure perfect conditions for connoisseurs to appreciate works of art. User-adjustable LED spotlights protect precious exhibits against heat and UV radiation. Each spotlight has a precisely adjustable colour temperature to cater specifically for the characteristics of the various exhibits. Narrow SLOTLIGHT light lines provide ambient light which is full of atmosphere.

Bright ambient lighting by PANOS downlights reassures hesitant customers and extends a friendly invitation to enter the Ross pharmacy in Hanover, Germany. Spotlights direct the customer’s gaze toward shelves and the items on display. Indirect accent lighting on the columns punctuates the matter-of-fact, cool ambience.
Zumtobel is the internationally leading supplier of integral lighting solutions for a wide variety of applications in professional interior lighting:

- Industry and engineering
- Offices and communication
- Education and science
- Presentation and retail
- Hotel and wellness
- Art and culture
- Health and care
- Sport and leisure
- Transit areas and parking
- Orientation and safety

We provide unique customer benefit by integrating technology, design, emotion and energy efficiency. Under the Humanergy Balance concept, we combine the best possible ergonomic lighting quality for people’s well-being with the responsible use of energy resources.

The company’s own sales organizations 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.

Corporate goal: 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.
United Kingdom
Zumtobel Lighting Ltd.
Unit 4 - The Argent Centre,
Pump Lane
London
Hayes/Middlesex UB3 3BL
T +44/(0)20 8589 1800
F +44/(0)20 8785 0000
M enquiriesuk@zumtobel.com
www.zumtobel.co.uk

United Arab Emirates
Zumtobel Lighting GmbH
Dubai Airport Free Zone,
3rd East Wing, 4th Floor, Office 413
PO Box 54620
Dubai
T +971/(4) 214 9845
F +971/(4) 214 9501

Poland
Zumtobel Lighting GmbH Sp.z.o.o.
Przedstawicielstwo w Polsce
ul. Narbutta 46/48
02-541 Warszawa
T +48/(22) 856 7431
F +48/(22) 856 7432
www.zumtobel.pl

USA and Canada
Zumtobel Lighting Inc.
Location Highland
3300 Route 9W
Highland, New York 1258-2630
T +1/(845) 691 62 62
F +1/(845) 691 62 89
www.zumtobel.us
www.zumtobel.ca

Slovenia and Croatia
Zumtobel Licht d.o.o.
Dunajska cesta 159
1000 Ljubljana
T +386/(1) 56 09 820
F +386/(1) 56 09 866
M bzi.lv@zumtobel.si
www.zumtobel.si

Australia and New Zealand
Zumtobel Lighting Pty Ltd
333 Pacific Highway
North Sydney, NSW 2060
T +61/(2) 8913 5000
F +61/(2) 8913 5001
M info@zumtobel.com.au
www.zumtobel.com.au

Sweden
Zumtobel Belysning
Birger Jarlsatan 57
113 56 Stockholm
T +46/(0)8 26 26 50
F +46/(0)8 26 56 05
M info.se@zumtobel.com
www.zumtobel.se

Russia
Zumtobel Lighting GmbH
Official Representative Office
Skakovaya Str. 17
Bld, No 1, Office 1104
125040 Moscow
T +7/(495) 945 36 33
F +7/(495) 945 16 94
www.zumtobel.ru

Czech Republic and
Slovak Republic
Zumtobel Lighting s.r.o.
Jankovcova 2
170 00 Praha
T +420/(2) 66 762 200
F +420/(2) 66 762 201
M praha@zumtobel.com
www.zumtobel.cz

Poland
Zumtobel Lighting GmbH Sp.z.o.o.
Przedstawicielstwo w Polsce
ul. Narbutta 46/48
02-541 Warszawa
T +48/(22) 856 7431
F +48/(22) 856 7432
www.zumtobel.pl
**VIVALDI**
Design software information

www.zumtobel.com/vivaldi
Detailed information on the application options and operation of the VIVALDI design software, plus a reference library.

**HUMANERGY BALANCE**
Detailed information and design aids

www.zumtobel.com/humanergybalance
This site provides an overview of the contents and objectives of the HUMANERGY BALANCE concept – from scientific research fundamentals through to application-specific references.

**ELI-LENI calculator for downloading**
www.zumtobel.com/humanergybalance/eli_leni_calculator
The ELI-LENI calculator is the perfect tool for quickly calculating ELI and LENI and for implementing an ELI-LENI quality seal.

**ELI questionnaires for downloading**
www.zumtobel.com/humanergybalance
Questionnaires for quickly identifying the qualitative requirements of a planned or existing lighting solution and for its evaluation.
HUMANERGY
BALANCE

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