Bat-Friendly Lighting

for a brighter future

Studies have estimated that in 2016 more than 80% of the world population and more than 99% of the U.S. and European population live under light-polluted skies. Worldwide this is up from 66% in 2001, or an increase of more than 14%.[1]

How is conventional lighting harmful to bats?

A nocturnal lifestyle is inherent to all bats. Bats are naturally exposed only to very low lighting levels produced by moonlight, starlight and low intensity twilight. They usually hide in roosts during the daytime, while fly to feeding areas or drinking sites using their established commuting routes during the night.[2] Artificial lighting disrupts the feeding patterns of bats in two ways:

1. Bats shy away from bright artificial light at night, staying inside their roosts and missing the opportunity to hunt nocturnal insects that they would normally go out to catch. Bats are avoiding light due to lightdependant predation risk;
2. Insects are drawn to bright light sources, accumulating near them, and creating a vacuum in darker places, where bats primarily hunt. Therefore, when bats get to their usual feeding areas, they find them devoid of food.

Bats being unable to hunt and feed themselves properly leads to a decrease in their reproductive ecology, such as slower growth rates and starvation of young.[3]

Why is the wellbeing of bats important to us?

Bats are a crucial part of the ecosystem, feeding on various insects and upkeeping the balance in the food chain of their local habitats. When bats are disturbed because of artificial lighting, their numbers dwindle, and the entire ecosystem loses its equilibrium. This affects both the ecosystem's nature as a whole and all species that inhabit it individually. Since bats play an essential role in pest control, seed dispersal and crop pollination, us humans can experience significant losses in agricultural industry due to damage to crops and pesticide costs.[4,5]

What VIZULO does to create a healthy environment for bats

VIZULO offers various solutions that provide a healthier night environment for bats and humans to co-exist together. These solutions are compatible with all VIZULO luminaires upon request.

1. Cinzano, P., Falchi, F. and Elvidge, C. D. (2001). The first World Atlas of the artificial night sky brightness. Monthly notices of the Royal astronomical society. 328, pp. 689-707.

2. Hutterer, R., T. Ivanova, C. Meyer-Cords & L. Rodrigues (2005): Bat migrations in Europe. A review of banding data and literature. Naturschutz und Biologische Vielvalt, Bonn 28: 162 pp.

3. Voigt, C.C., Azam, C., Dekker, J., Ferguson, J. et al. (2018). Guidelines for consideration of bats in lighting projects. EUROBATS. Publication Series No.8. ISBN 978-92-95058-40-8

4. Thomas H. Kunz,1Elizabeth Braun de Torrez, Dana Bauer, Tatyana Lobova, and Theodore H. Fleming (2011) Ecosystem services provided by bats Annals of the New York Academy of Sciences 1223(1):1-38 DOI:10.1111/j.1749-6632.2011.06004.x

5. Justin G. Boyles, Paul M. Cryan, Gary F. McCracken, Thomas H. Kunz Economic (2011) Importance of Bats in Agriculture Science 332(6025):41-2 DOI:10.1126/science.1201366

Bat friendly lighting

Vizulo bat friendly lighting projects in The Netherlands:

- Sportparkdreef, Valkenswaard
- Mgr.Smetsstraat, Valkenswaard
- Technology Base, Enschede

Here is how it works:

Bats are sensitive to bright light, especially the green and blue component of it. Warm toned light with lower correlated colour temperature (CCT), as well as red and amber light, causes noticeably less disturbance to bats, since their retinas barely absorb wavelengths longer than 590 nm.[6] This kind of light also does not attract insects as strongly as blue and white light does.[7] This ensures that insects are present in their usual habitats, reducing the vacuum effect that prevents bats from feeding.

As opposed to bats, humans perform better when the light colour is cooler.[8] When the colour temperature of light decreases, it is harder for humans to discern details, and their reaction time to visual triggers increases.

Using a smart, Zhaga socket-controlled system that detects human presence, the colour temperature of VIZULO luminaires can be changed from bat-friendly tones to the human-oriented ones (3000 K or 4000 K). Once human presence is no longer detected, the lighting goes back to bat-friendly tones, keeping in mind bat wellbeing. The smart system can be programmed to automatically turn on and off depending on the biological rhythms of the local bats. You may also opt-out of the dual-colour option and keep a constant bat-friendly light if you wish to further minimize disturbing the bats in your area.

Additionally, VIZULO offers a wide array of optical lenses and light cutters to focus the light only where it is needed and avoid unnecessary illumination of potential bat habitats.

VIZULO provides three different kinds of bat-friendly lightning, depending on the specifics of the project:

Bat Fan

This solution was developed by VIZULO for illuminating sites with maximal value placed on bat comfort. It utilizes red colour lighting, to which bats are proven to be least sensitive.[9] In this way, minimal disturbance to bats is achieved. We recommend using this solution together with the integrated dual-colour technology with smart control, since pure red light is not ideal for human visual comfort and spatial orientation.

6. Feller KD, Lagerholm S, Clubwala R, Silver MT, Haughey D, Ryan JM, Loew ER, Deutschlander ME, Kenyon KL. Characterization of photoreceptor cell types in the little brown bat Myotis lucifugus (Vespertilionidae). Comp Biochem Physiol B Biochem Mol Biol. 2009 Dec;154(4):412-8. doi: 10.1016/j.cbpb.2009.08.006.

7. van Grunsven, R.H.A., Donners, M., Boekee, K. et al. Spectral composition of light sources and insect phototaxis, with an evaluation of existing spectral response models. J Insect Conserv 18, 225–231 (2014). https://doi.org/10.1007/s10841-014-9633-9

8. Smith MR, Revell VL, Eastman CI (2009) Phase advancing the human circadian clock with blue-enriched polychromatic light. Sleep Medicine 10: 287–294.

9. Spoelstra K, van Grunsven RHA, Ramakers JJC, Ferguson KB, Raap T, Donners M, Veenendaal EM, Visser ME. 2017 Response of bats to light with different spectra: light-shy and agile bat presence is affected by white and green, but not red light. Proc. R. Soc. B 284: 20170075. http://dx.doi.org/10.1098/rspb.2017.0075

Bat Friend

This solution features amber coloured lighting that is slightly more disturbing for bats (due to the amber spectral emission peak being closer to blue), yet more friendly to human eyes. We recommend implementing this solution if you wish to maintain balance between being friendly to both humans and bats.

Bat Associate

This solution provides a warm toned polychromatic illumination (1800 K) that is relatively comfortable to human eyes, while keeping the wellbeing of bats in mind. This solution is more energy efficient than using amber light yet provides more disturbance to bats.

	Bat Fan *red light*	**Bat Friend** *amber light*	**Bat Associate** *1800 K light*
Relative energy efficiency	+30%	+0%	+15%
Comfort to humans	Low	Medium	Medium
Comfort for bats	High	Medium	Low
Necessity for dual-CCT smart control system	High	Medium	Medium

Please note that we **do not recommend** using this solution along highways and busy roads as, according to studies, red, amber and warm-toned lighting increases the time it takes for humans to react, causing potentially hazardous situations while driving at high speed.

VIZULO draws its inspiration from nature in all its shapes and forms. Help us keep the natural environment diverse and friendly to all its inhabitants!

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