

Nové vědecké poznatky o vlivu umělého osvětlování

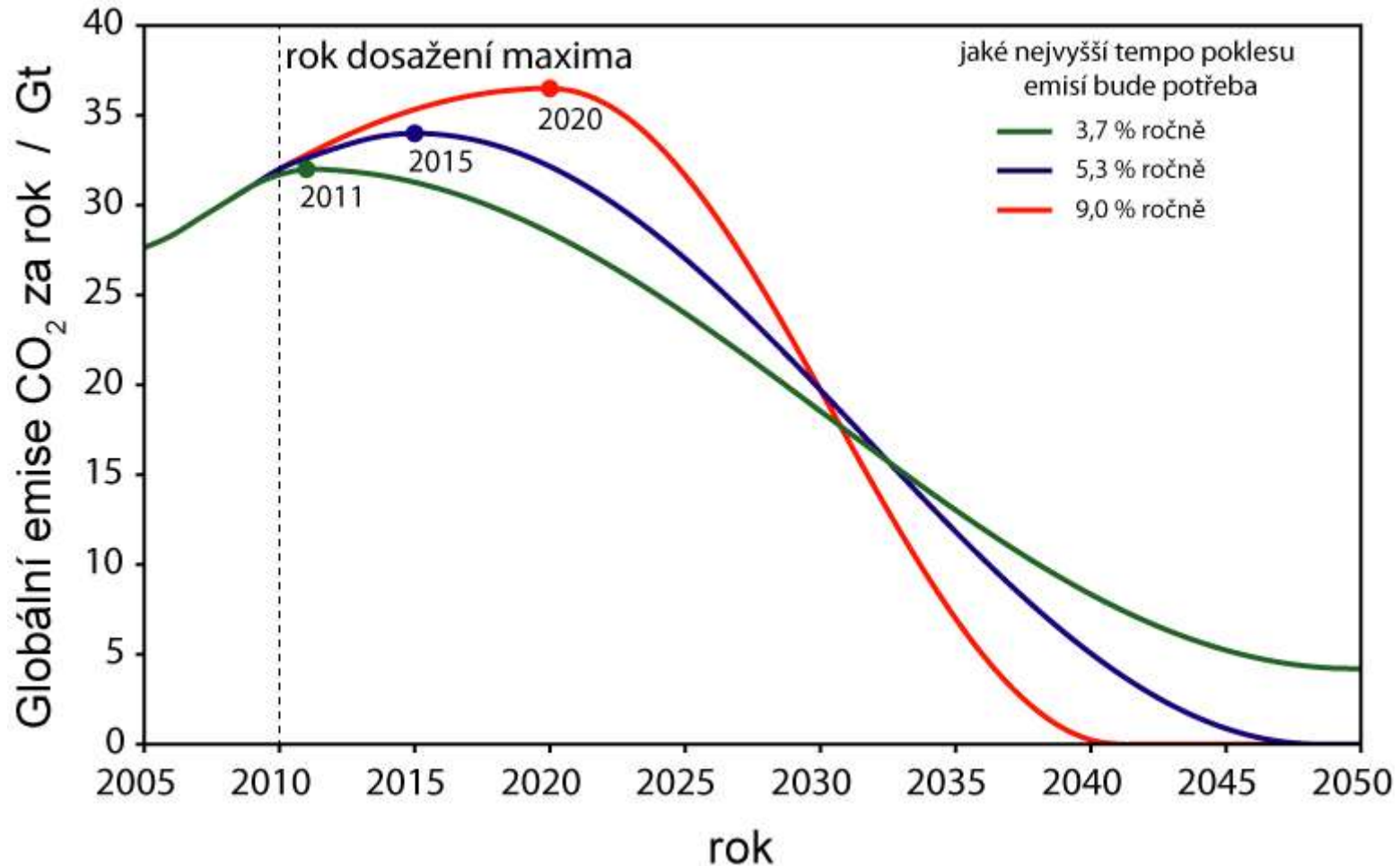
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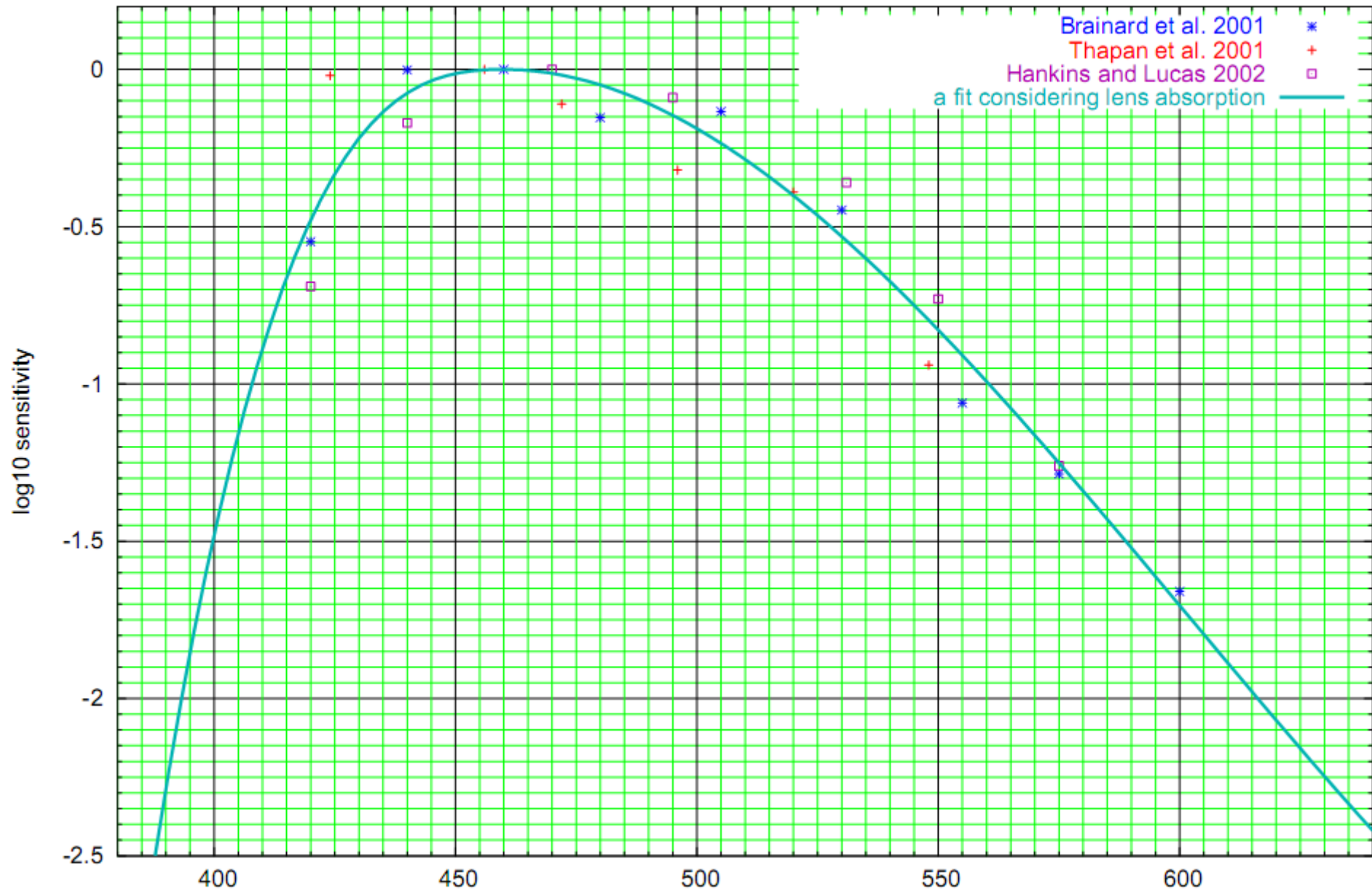
Svícení spotřebovává elektřinu



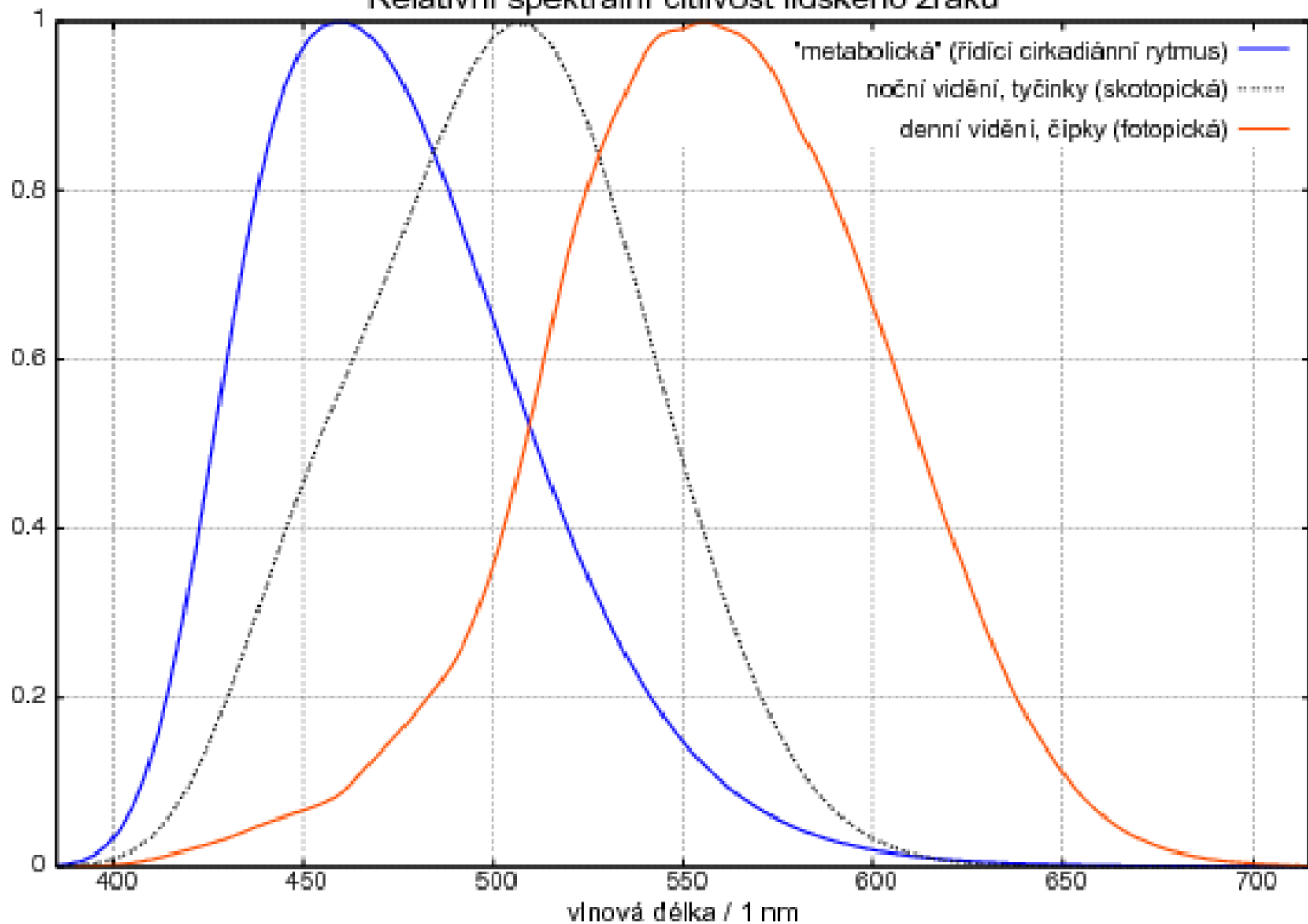
Příklady globálních emisních trajektorií takových, aby se úhrnné emise CO₂ za časové období 2010–2050 rovnaly 750 Gt (1 Gt C = 3,67 Gt CO₂). S touto hodnotou dosahuje pravděpodobnost omezení globálního oteplování na maximálně 2 °C hodnoty 67 %. (Kodaňská diagnóza, obr. 22)

Svícení snižuje produkci melatoninu

Action spectrum of melatonin suppression by light"



Relativní spektrální citlivost lidského zraku



Noční osvětlování a nádory

Stevens, R.G. Electric power use and breast cancer: a hypothesis. *Am. J. Epidemiol.* **125**, 556 (1987).

Stevens, R.G. Light-at-night, circadian disruption and breast cancer: assessment of existing evidence. *International Journal of Epidemiology* **38**, 963-970 (2009):

Background Breast cancer incidence is increasing globally for largely unknown reasons. The possibility that a portion of the breast cancer burden might be explained by the introduction and increasing use of electricity to light the night was suggested >20 years ago.

Methods The theory is based on nocturnal light-induced disruption of circadian rhythms, notably reduction of melatonin synthesis. It has formed the basis for a series of predictions including that non-day shift work would increase risk, blind women would be at lower risk, long sleep duration would lower risk and community nighttime light level would co-distribute with breast cancer incidence on the population level.

Results Accumulation of epidemiological evidence has accelerated in recent years, reflected in an International Agency for Research on Cancer (IARC) classification of shift work as a probable human carcinogen (2A). There is also a strong rodent model in support of the light-at-night (LAN) idea.

Conclusion

If a consensus eventually emerges that LAN does increase risk, then the mechanisms for the effect are important to elucidate for intervention and mitigation. The basic understanding of phototransduction for the circadian system, and of the molecular genetics of circadian rhythm generation are both advancing rapidly, and will provide for the development of lighting technologies at home and at work that minimize circadian disruption, while maintaining visual efficiency and aesthetics. In the interim, there are strategies now available to reduce the potential for circadian disruption, which include

- extending the daily dark period,
- appreciate nocturnal awakening in the dark,
- using dim red light for nighttime necessities,
- and unless recommended by a physician, not taking melatonin tablets.

Epidemiologické doklady

Kloog, I., Haim, A., Stevens, R.G., Barchana, M. & Portnov, B.A.
Light at Night Co-distributes with Incident Breast but not Lung Cancer in the Female Population of Israel.
Chronobiology International **25**, 65-81 (2008).

Kloog, I., Haim, A., Stevens, R.G. & Portnov, B.A.
Global Co-Distribution of Light at Night (LAN) and Cancers of Prostate, Colon, and Lung in Men.
Chronobiology International **26**, 108-125 (2009).

Kloog, I., Portnov, B.A., Rennert, H.S. & Haim, A.
Does the Modern Urbanized Sleeping Habitat Pose a Breast Cancer Risk?
Chronobiol Int **28**, 76-80 (2011)

Due to its disruptive effects on circadian rhythms and sleep deprivation at night, shiftworking is currently recognized as a risk factor for breast cancer (BC). As revealed by the present analysis based on a comparative case-control study of 1679 women, exposure to light-at-night (LAN) in the “sleeping habitat” is significantly associated with BC risk (odds ratio [OR]=1.220, 95% confidence interval [CI]=1.118–1.311; $p<.001$), controlling for education, ethnicity, fertility, and alcohol consumption. The novelty of the present research is that, to the best of the authors' knowledge, it is the first study to have identified an unequivocal positive association between bedroom-light intensity and BC risk. Thus, according to the results of the present study, not only should artificial light exposure in the working environment be considered as a potential risk factor for BC, but also LAN in the “sleeping habitat.”

Gooley, J.J. et al. **Exposure to Room Light before Bedtime Suppresses Melatonin Onset and Shortens Melatonin Duration in Humans.** *J Clin Endocrinol Metab* (2010).doi:10.1210/jc.2010-2098

Millions of individuals habitually expose themselves to room light in the hours before bedtime, yet the effects of this behavior on melatonin signaling are not well recognized. Objective: We tested the hypothesis that exposure to room light in the late evening suppresses the onset of melatonin synthesis and shortens the duration of melatonin production. Design: In a retrospective analysis, we compared daily melatonin profiles in individuals living in room light (<200 lux) vs. dim light (<3 lux). Patients: Healthy volunteers (n = 116, 18-30 yr) were recruited from the general population to participate in one of two studies. Setting: Participants lived in a General Clinical Research Center for at least five consecutive days. Intervention: Individuals were exposed to room light or dim light in the 8 h preceding bedtime. Outcome Measures: Melatonin duration, onset and offset, suppression, and phase angle of entrainment were determined. Results: Compared with dim light, exposure to room light before bedtime suppressed melatonin, resulting in a later melatonin onset in 99.0% of individuals and shortening melatonin duration by about 90 min. Also, exposure to room light during the usual hours of sleep suppressed melatonin by greater than 50% in most (85%) trials. **Conclusions:** These findings indicate that room light exerts a profound suppressive effect on melatonin levels and shortens the body's internal representation of night duration. Hence, chronically exposing oneself to electrical lighting in the late evening disrupts melatonin signaling and could therefore potentially impact sleep, thermoregulation, blood pressure, and glucose homeostasis.

Tři druhy osvětlení, aby neškodilo zdraví

- doplnění či náhrada denního světla: bílé, silné
- slabé žluté od západu Slunce do jeho východu: pro práci, na čtení
- velmi slabé bílé pro noční orientaci: obdoba měsíčního svitu

Dopady nedbalého venkovního svícení (2003, tisíc osob z celé ČR)

- poruchy spánku u statisíců osob, působené venkovním osvětlením jako jednou ze dvou hlavních subjektivně udávaných příčin
- nežádoucí, nedostatečně potlačené světlo do ložnic, postihující dalšího třičtvrtě milionu lidí
- potřebu nočního zatemňování ložnic, které jako dostatečně účinné používají další dva miliony osob

**Praktický závěr: umělý příspěvek k osvětlení
oken nesmí přesáhnout 0.1 lx**

Tma jako biologický imperativ nejen pro lidi

Longcore, T. & Rich, C. *Ecological Consequences of Artificial Night Lighting*. (Island Press: Washington, D.C., 2006).
<www.urbanwildlands.org>

Longcore, T. & Rich, C. Ecological light pollution. *Frontiers in Ecology and the Environment* **2**, 191-198 (2004). Český překlad **Ekologické světelné znečištění**,
http://amper.ped.muni.cz/noc/vyber_textu/ekologie.pdf

C. Aubrecht, M. Stojan-Dolar, A. de Sherbinin, M. Jaiteh, T. Longcore, and C. Elvidge (2010)

Lighting governance for protected areas and beyond – Identifying the urgent need for sustainable management of artificial light at night

<http://www.earthzine.org/category/sections/ecosystems/>

Zákony pomáhají – pokud zakazují svícení vodorovně a výše

Falchi, F. Campaign of sky brightness and extinction measurements using a portable CCD camera. *Monthly Notices of the Royal Astronomical Society* (2010)

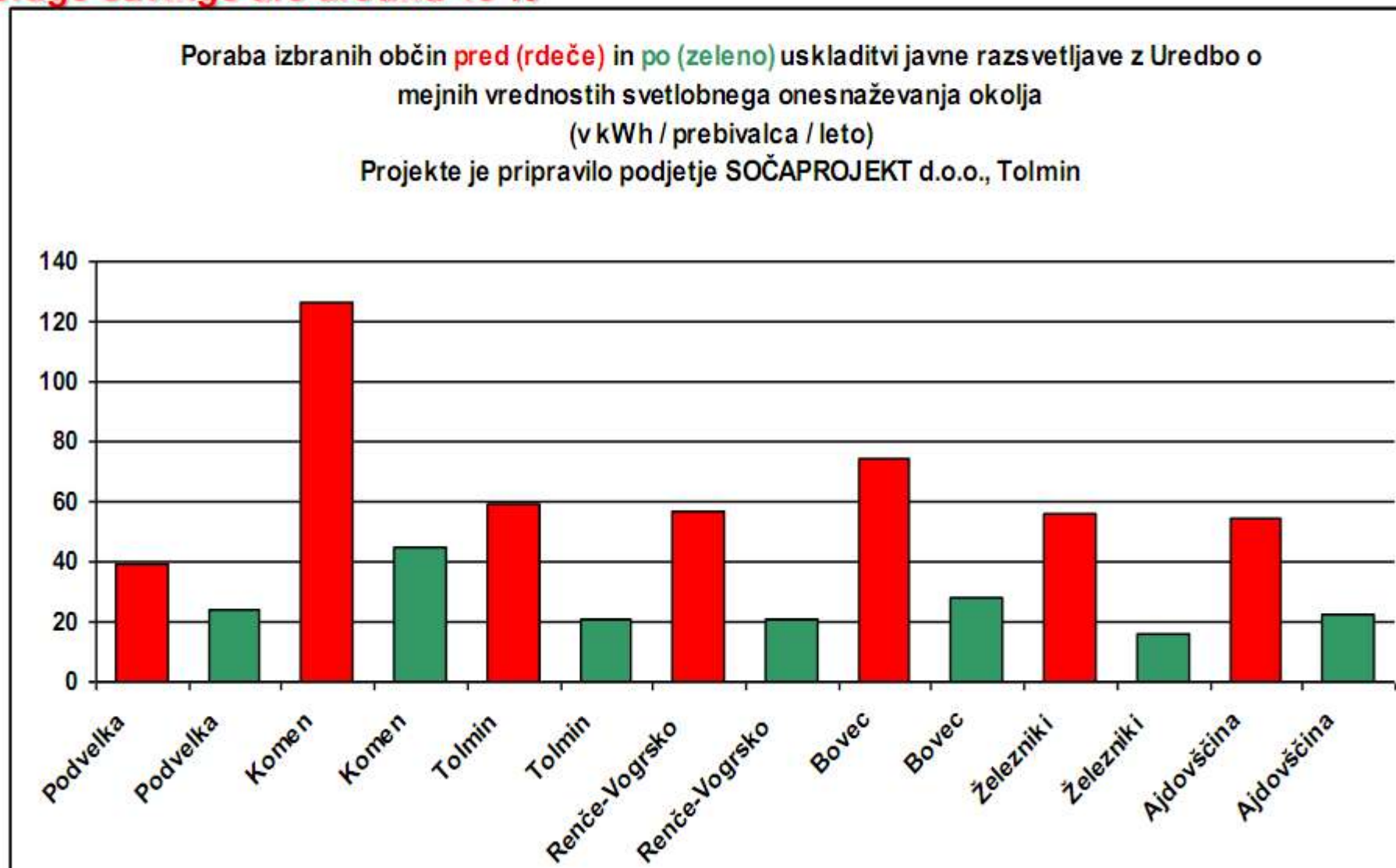
(Jas oblohy tam již nestoupá; vliv přímého světla ze svítidel je stále dominantní)

Mohár, A. *Slovene Light Pollution Legislation – 3 Years of Positive Changes*. (2010).

<http://www.darkskyparks.org/docs/Lastovo2010_Mohar.pdf>

Energy savings in communities in Slovenia in kWh/person/year:
red (kWh/person/year before reconstruction),
green after reconstruction according to Slovene LP Law

Average savings are around 40 %



Světlo a CO₂

Oba polutanty byly kdysi považované za neškodné, ba myšlenka, že jde o polutanty, nikoho nenapadla.

Oba jsou ale zásadním nebezpečím pro lidstvo.

Je na čase začít jejich emise radikálně snižovat.
Má to jen samé výhody.

Světlo je dobrý sluha, ale nečekaně zlý pán!