

Sustainable and Energy Saving Lighting in Star Park Rhön



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Wasserkuppe:

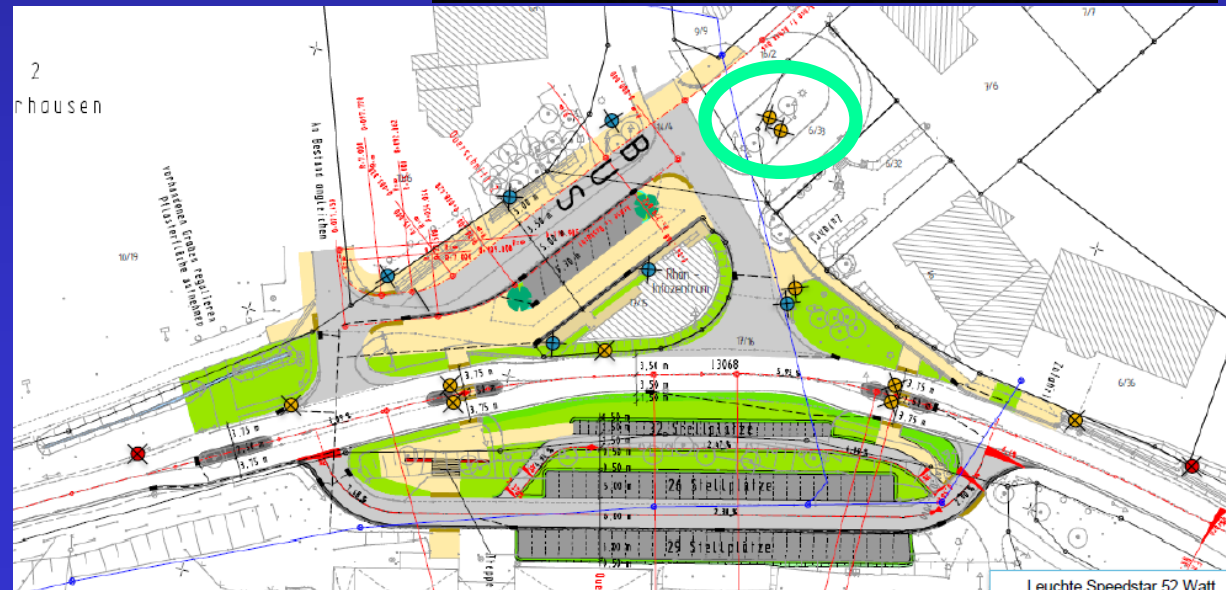
- highest mountain (alt. 950 m) in German state Hesse
- famous for gliders
- US military terrain after WWII
- in UNESCO MAB Biosphere Reserve Rhön
- touristic development: 800,000 -> 1,200,000 tourists/year
- development of parking facilities
- improved lighting for security



Original situation:

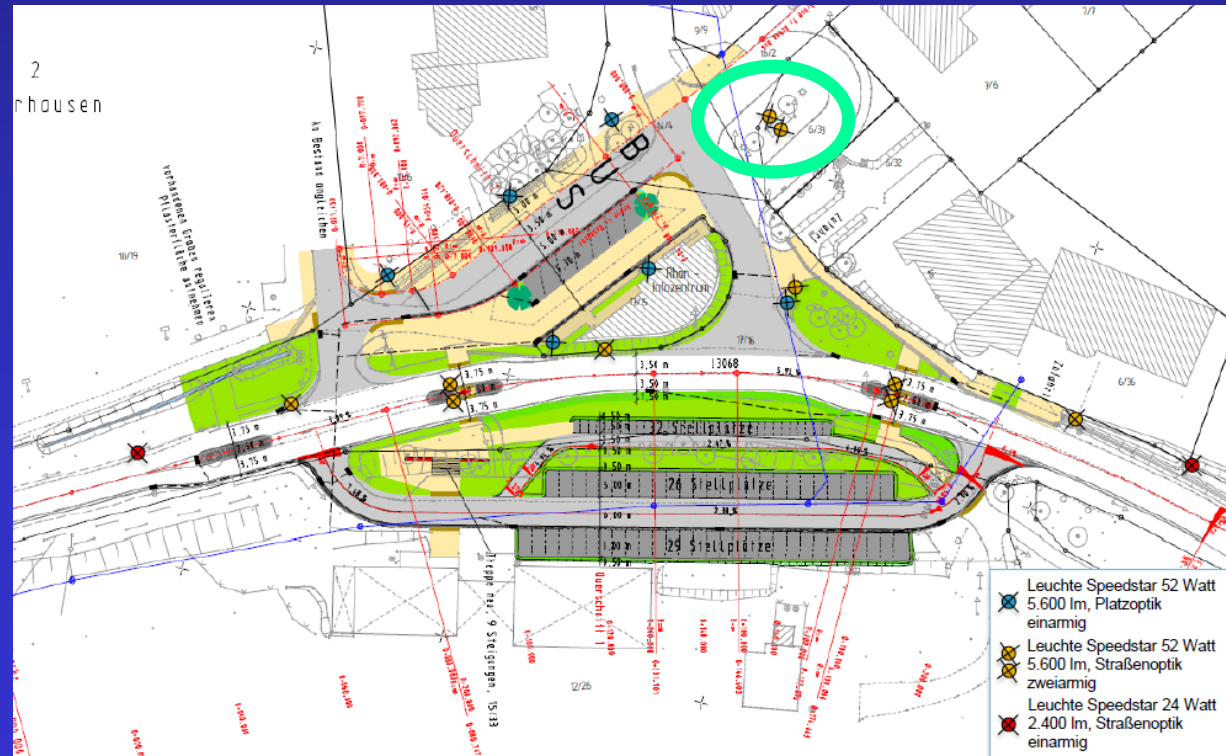
only bus stop illuminated:

- installed power: $4 \times 125 \text{ W} = 500 \text{ W HQL}$
- power consumption:
2 000 kWh (1 200 kg CO₂)



Initial ("conventional") planning:

- total luminaires: 18 (2 x 24W/2400lm, 16 x 52W/5600lm)
- total luminous flux: 94 400 lm
- installed power: 880 W
- power consumption: 3 696 kWh (full night)
planned: **2 565 kWh** (reduction to 50% 22:30 – 5:30)
- LED $\leq 3\,000\text{ K}$
- full cut-off (G6)



International Dark Sky Reserve Rhön

- designated in 2014 by International Dark Sky Association IDA
- lighting guidelines:
 - full cut-off luminaires
 - reduced blue spectral parts
 - reduced luminous flux
 - adaptive lighting according to needs
 - not only energy efficient!
- new tender, no blue light content:
 - yellow filters
 - (pc) amber LEDs
 - reduction during night



reduced blue spectral parts

- less glare
- reduced attraction of insects
- less scattering in atmosphere
- better transmission with haze and fog
- less influence on circadian rhythm



reduced colour recognition:

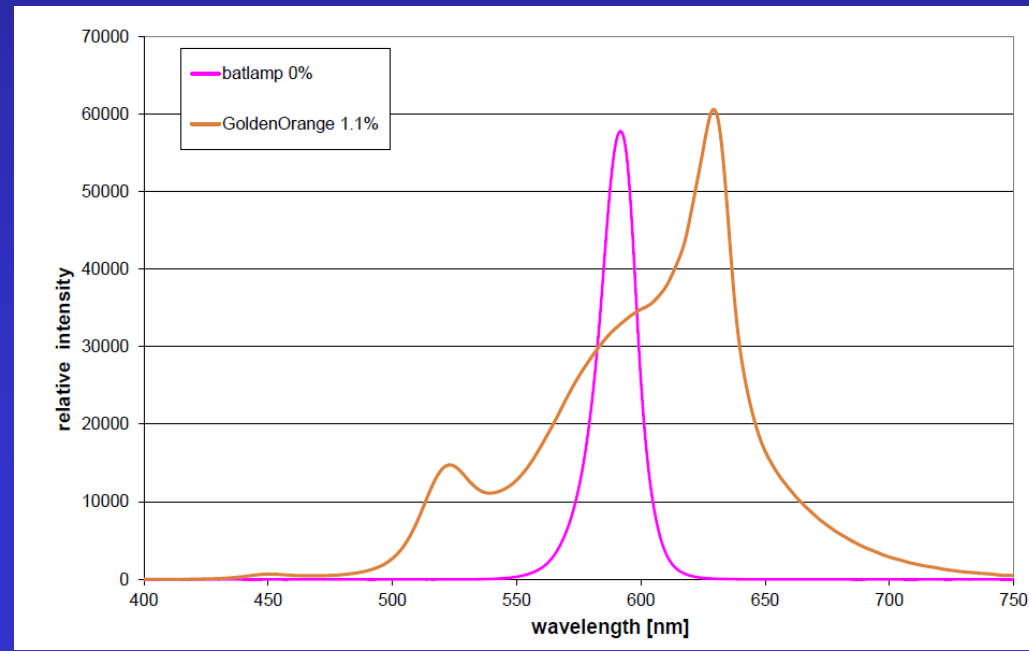
- addition of some colours: GoldenOrange

Cooperation:

- Landkreis (county) Fulda
- City Gersfeld
- Police
- RhönEnergie Fulda

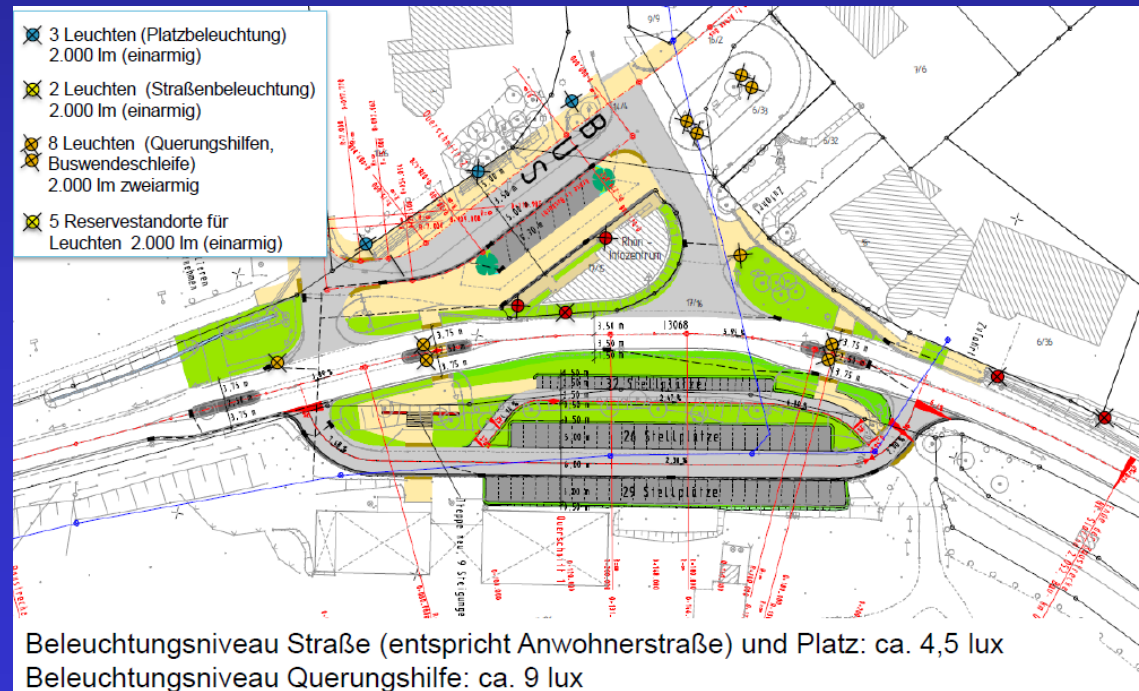


Harald Bardenhagen



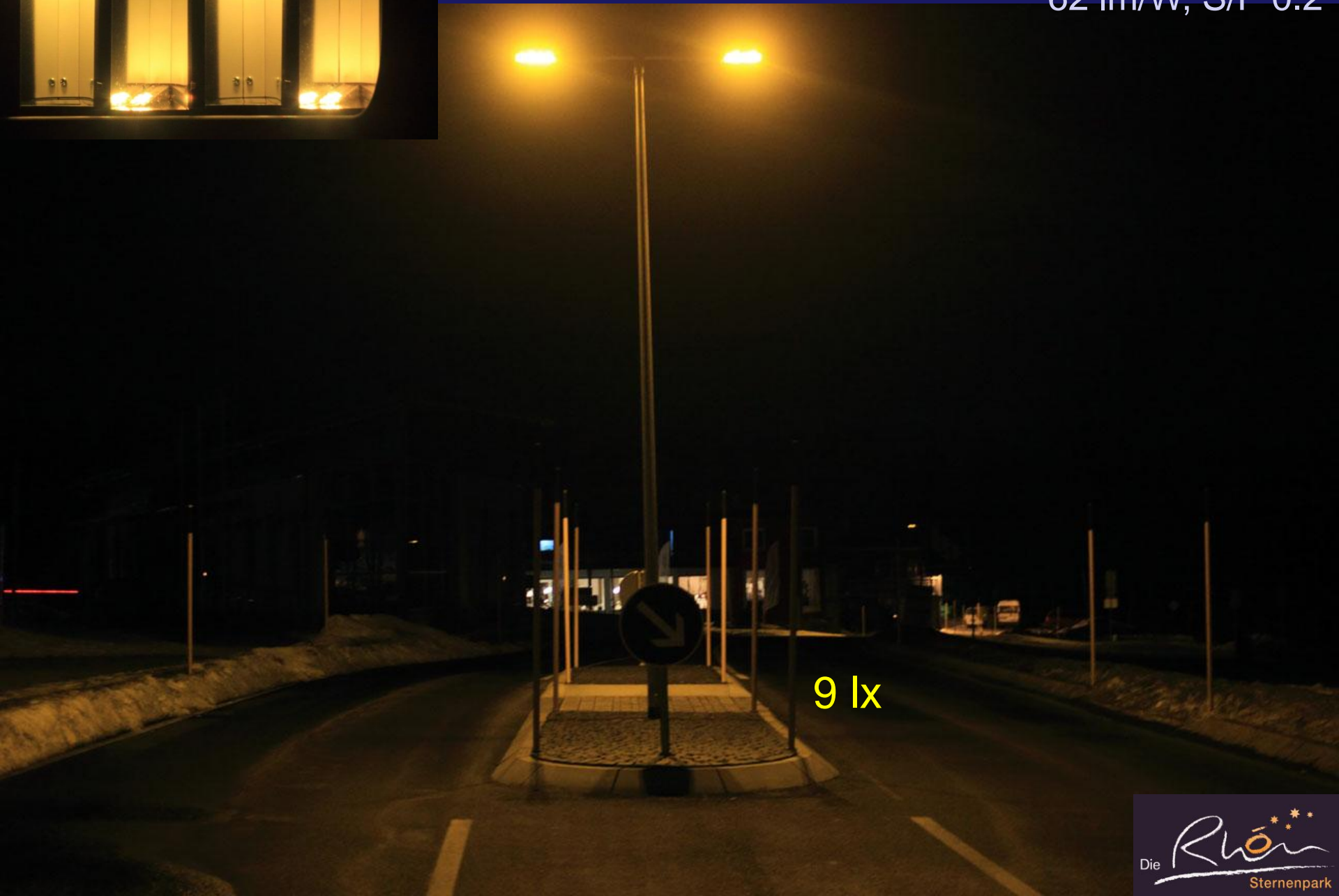
Revised planning:

- total luminaires: 13 (-5), ULOR = 0%
- total luminous flux: 26 000 lm (26 %)
- installed power: 429 W (49 %)
- power consumption: 1 802 kWh (full night)
- 10 Batlamp (amber LED) and 3 GoldenOrange (mix) 1 800 K



Batlamp (amber LED)

62 lm/W, S/P 0.2



9 lx

GoldenOrange (mix amber/red/green/ww)

74 lm/W, S/P 0.8

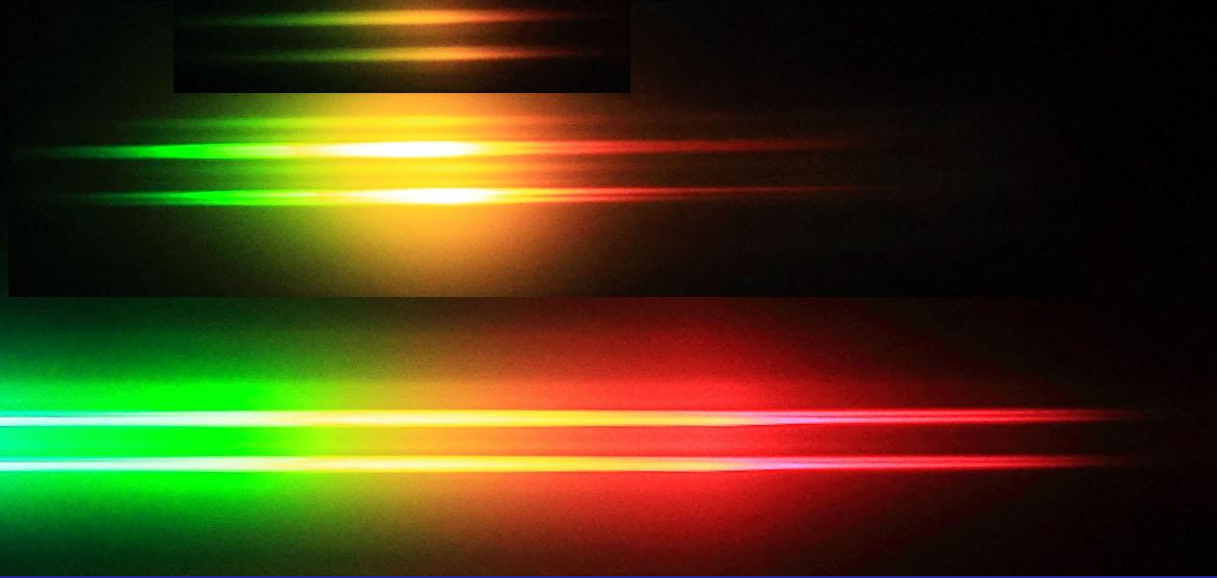


6 lx

Spectra

Batlamp

Golden Orange



white

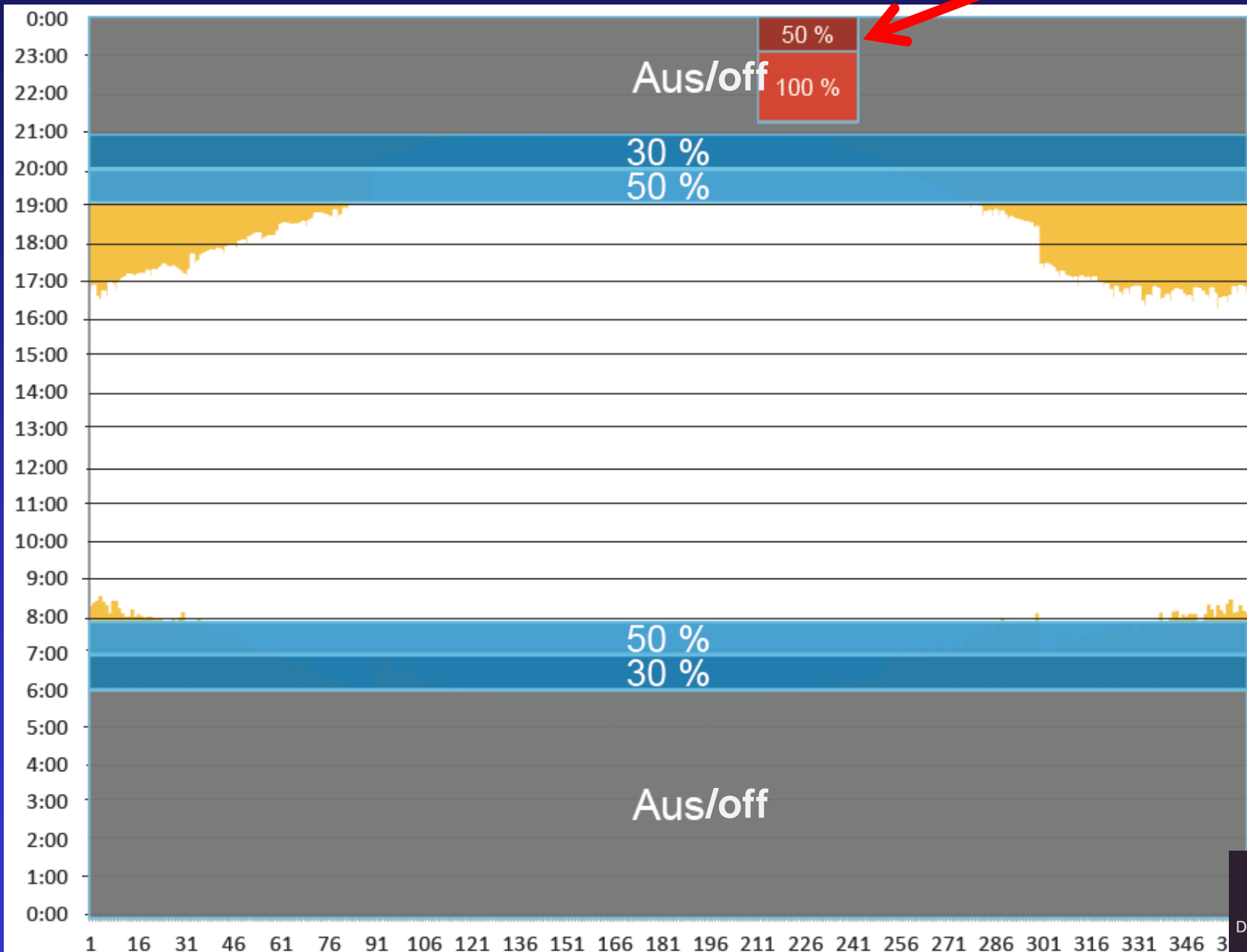
GoldenOrange

Batlamp



Adaptive lighting!

only occasionally
for special events!



electric power consumption: 324 kWh (3 696/2 565 kWh)
(8.8% against full night, 12.6% against reduced use)
sustainable environmental friendly lighting
with reduced energy consumption!

3000 K lighting in Rhön communities
German firms now offer (pc)amber LED!





Thank you!