THORN
LIGHTING

DO WE NEED TO LIGHT?
NightTune: Tune-in to Nature

Todor Rachev
Insert Title Here


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DO WE NEED TO LIGHT?
NightTune: Tune-in to Nature

TOPICS

EU GREEN DEAL
Taxonomy Regulation

OBTRUSIVE LIGHT
What it is and regulation

LIGHT FOR ECOLOGY
Considerations

NIGHTTUNE
Philosophy and technology

CONCLUSION
Questions & answers

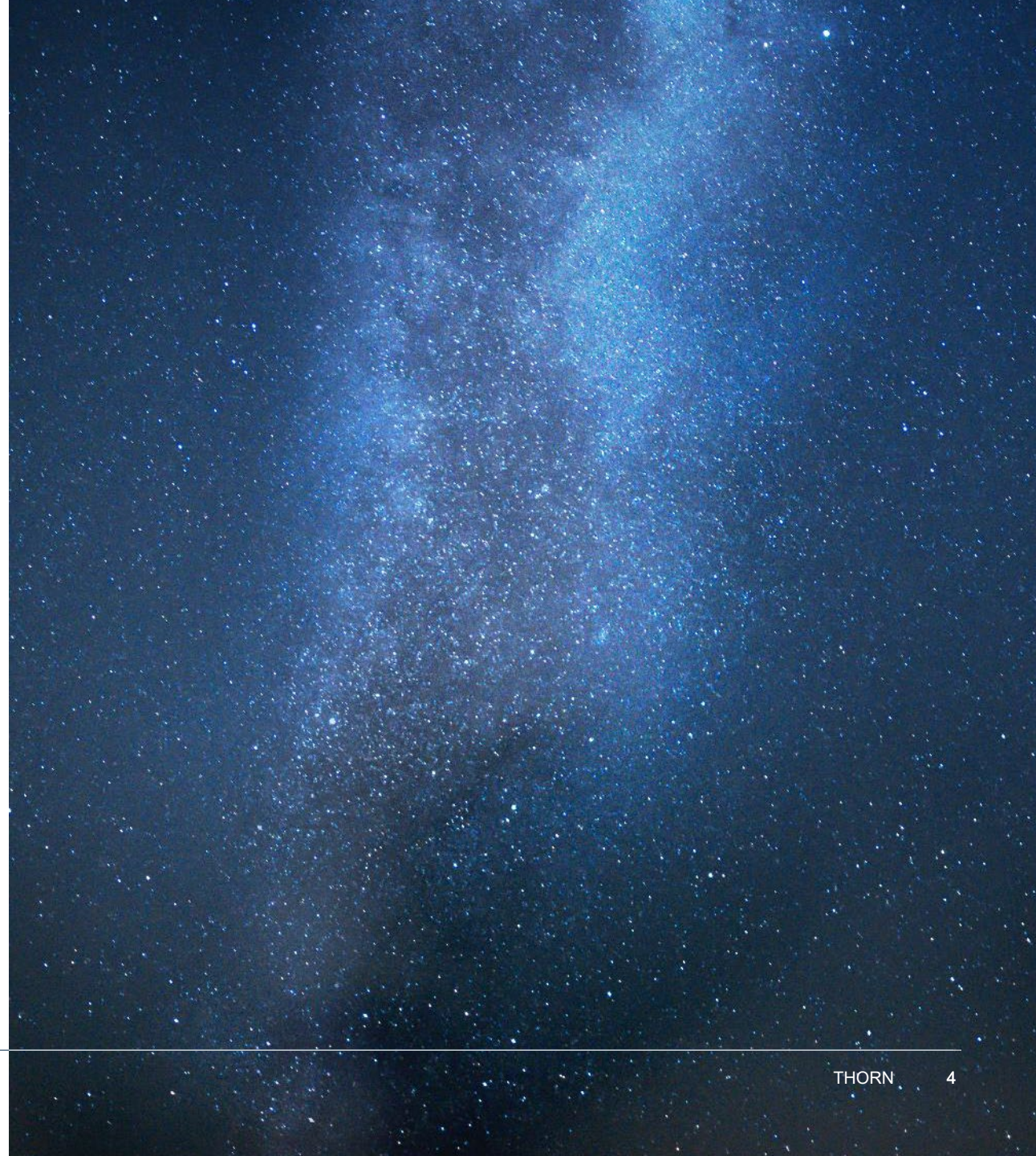
ORGANISATIONAL

NightTune: tune-in to nature

All participants are muted

Procedure for questions

- Questions can be posted via chat
- Questions are answered at the end

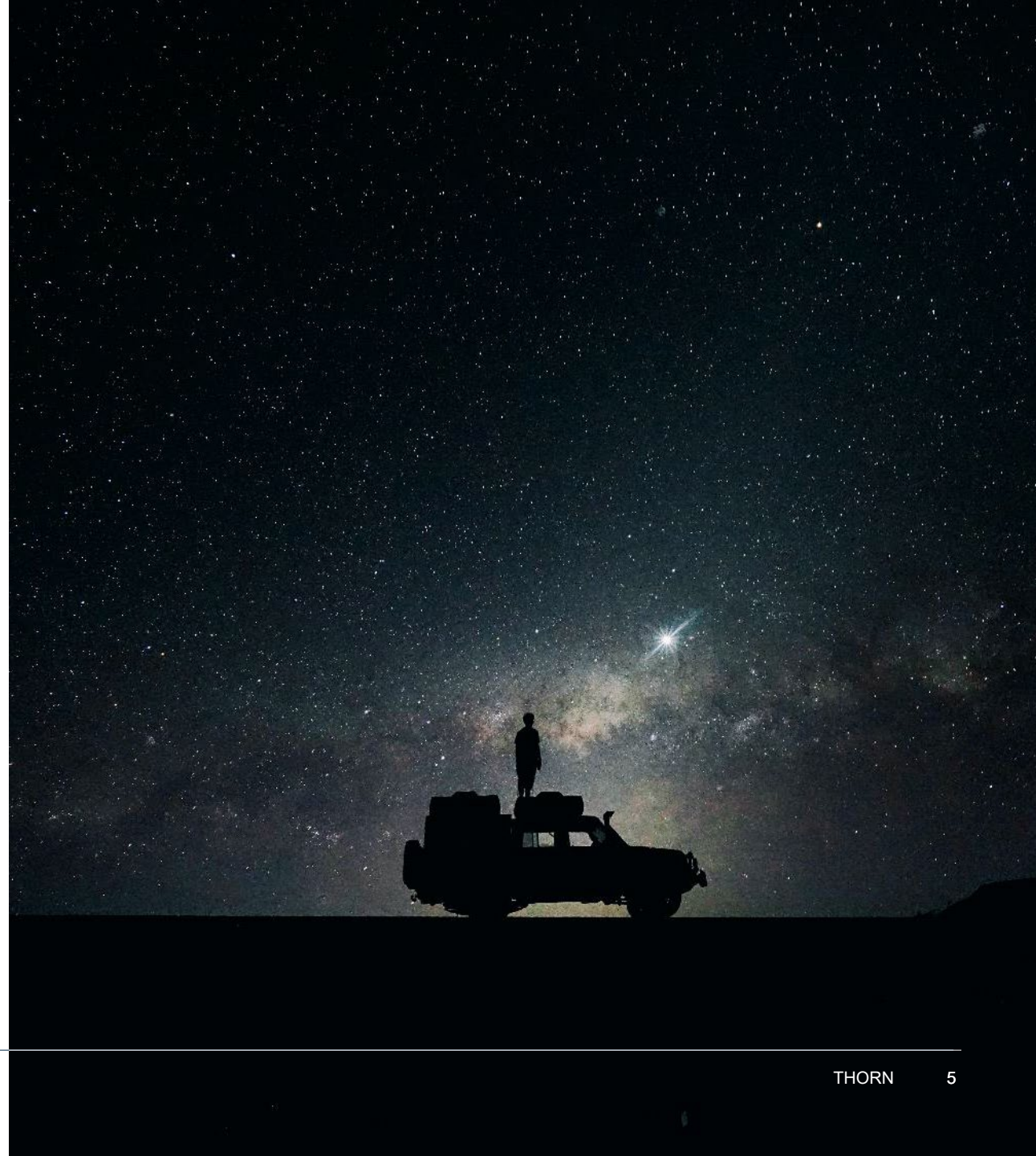


EU GREEN DEAL

Taxonomy Regulation

1.Climate change mitigation
2.Climate change adaptation
3.The sustainable use and protection of water and marine resources
4.The transition to a circular economy
5.Pollution prevention and control
6.The protection and restoration of biodiversity and ecosystems

Official Journal of the EU
(d) installation and replacement of energy efficient light sources;
Do no significant harm (‘DNSH’)



OBTRUSIVE LIGHT

OBTRUSIVE LIGHT

There are 3 categories of obtrusive light

SKY GLOW

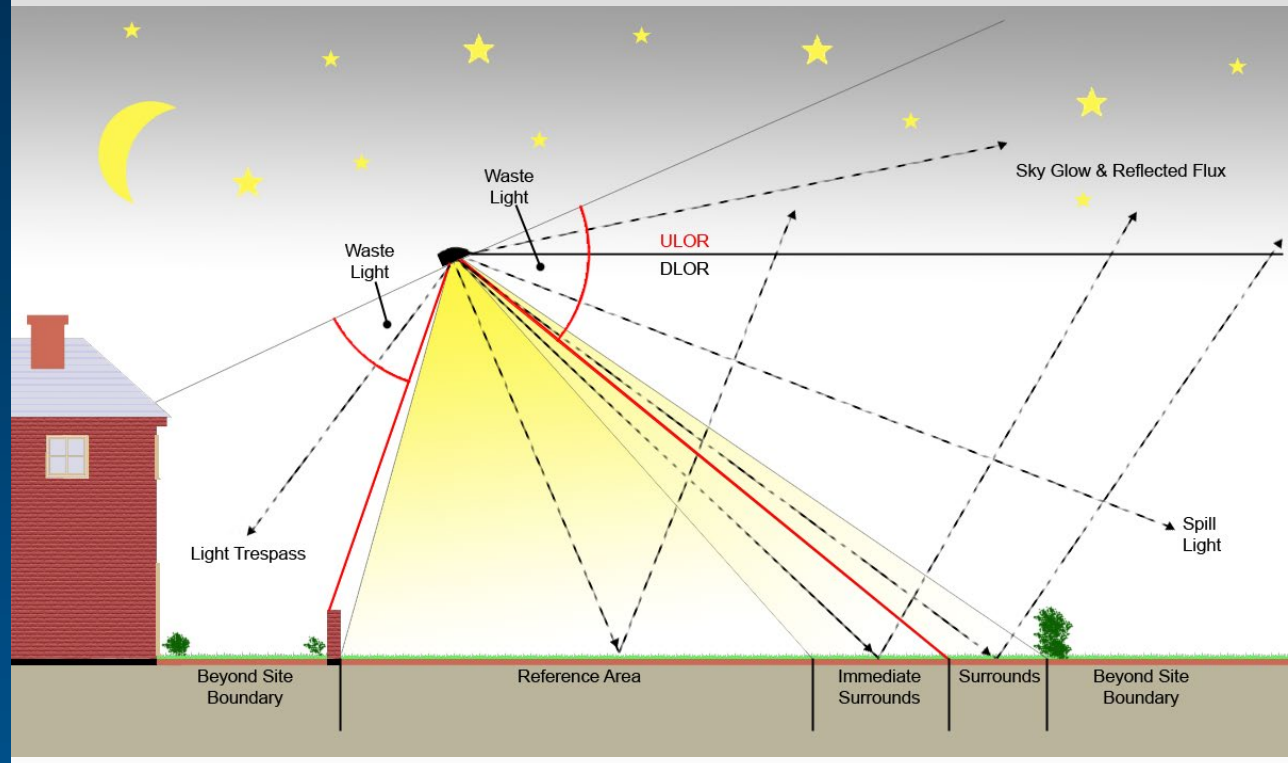
light that contributes to the brightening of the sky

LIGHT TRESPASS

light that spills onto surrounding properties, and the direct viewing of bright luminaires from normal viewing directions causing annoyance distraction or discomfort

SPILL LIGHT

light emitted by an installation that falls outside the boundaries of the property for which it was intended



OBTRUSIVE LIGHT

Requirements are defined in CIE 150

They are based upon the environmental zone the area to be lit is in.

Table 1 – Environmental lighting zones

Zone	Lighting Environment	Examples
E0	Intrinsically dark	UNESCO Starlight Reserves, IDA Dark Sky Parks, Major optical observatories
E1	Dark	Relatively uninhabited rural areas
E2	Low district brightness	Sparsely inhabited rural areas
E3	Medium district brightness	Well inhabited rural and urban settlements
E4	High district brightness	Town and city centres and other commercial areas
NOTE	Regardless of the level of urban development, the recommendations for Environmental Zone 1 or 0, should be followed for all locations within 100 km of a major optical astronomy observatory. Regardless of the level of urban development, the recommendations for Environmental Zone 2 (or better) should be followed for locations within 30 km of an operating urban optical astronomy observatory, and for locations between 100 km and 300 km from a major optical astronomy observatory.	

OBTRUSIVE LIGHT

Requirements are defined in CIE 150

CIE 150 includes a large amount of information on issues and mitigation strategies.

Table 8 – Possible effects on spill light from changes to the installation parameters

Parameter	Dimension	Advantages	Disadvantages	Influence on design	Comments
Mounting height	Greater	-Less spill light -Simplified shielding -Less glare from luminaires (see comment)	-More conspicuous by day	-Narrower beams -Tighter beam control -More downward aiming	-Higher mounting implies more conspicuity but allows better control of spill light -Mounting height may be determined by lighting requirements, e.g. in relevant Standards, or vertical illuminance component required for the application -The listed advantages and disadvantages are reversed for Type C cut-off floodlights that incorporate a pre-set aiming angle, i.e. with no means of adjusting the beam
	Smaller	Less conspicuous by day	-More spill light -More difficult to shield -More glare from luminaires (see comment)	-Smaller lamps -Wider beams -More upward aiming	
Set back	Greater		-More spill light -More difficult to shield	-Narrower beams -More outward or higher aiming	Set back may be determined by physical constraints, requirements for unobstructed views, safety to users
	Smaller	-Less spill light -Simplified shielding		-Wider beams -More inward or lower aiming	
Luminous flux output (per luminaire)	Greater	-Greater efficiency	-More spill light	-Requires higher mounting or set back -Fewer luminaires -Reduces control	Flux output should be selected to match beam distribution availability to allow efficient and controlled design
	Smaller		-Less efficiency	-More luminaires -Increases control	
Beam type and distribution	Controlled (narrow beam or sharp cut-off)	-Controls spill light -Reduces need for shielding	-May need more luminaires to light the area	-Permits light to be well directed	Beam classification does not necessarily determine spill light control or shielding of high lamp luminances
	Uncontrolled (wide beam)		-Reduces light containment -Difficult to shield	-Limited directional control of light	
Distance to adjoining property	Greater	-Reduces effect of spill light -Simplifies shielding -Isolates installation from adjoining properties		-Less effect on adjoining property	Greater distances from lighted area to property line simplifies containment of spill light
	Smaller		-Increases spill light -Makes shielding more difficult	-Increases need for good light control	
Vertical aiming angle	High		-More spill light -Lamp more visible -Difficult to shield	-High vertical illuminance contribution	High aiming angles generally not recommended due to difficulty in controlling spill light
	Low	-Less spill light -Lamp less visible -Simplified shielding		-High horizontal illuminances -Low vertical illuminances -Simplifies control of spill light	
NOTE	In this table consideration is generally given to the effect of changing one parameter at a time. In practice, it is possible to compensate for the variation of one parameter by changing another simultaneously. For example by increasing set back and mounting height together, aiming angles may be kept constant.				

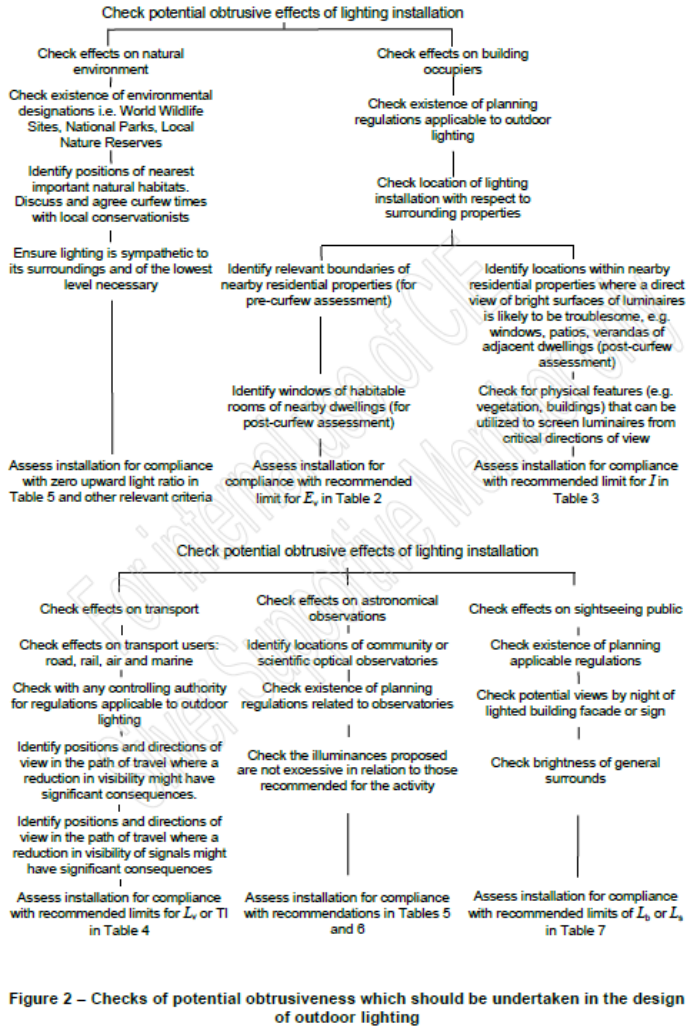


Figure 2 – Checks of potential obtrusiveness which should be undertaken in the design of outdoor lighting

LIGHT FOR ECOLOGY

THE EFFECTS OF LIGHT

Our urban life-style

Humanity is increasingly living a lifestyle removed from the natural world and rhythms.

Buildings and structures in urban areas impact the flows of light and air and remove contact with plant and animal life.

Urban areas create heat islands and localised environments.

Technology impacts many aspects of life including air quality.

Modern buildings and materials impact lighting quality, quantity and spectrum.

Artificial lighting is part of this fracture between the natural and man-made worlds.

OUTDOOR LIGHTING

Impact on man and nature

In a paper

Impact of outdoor lighting on man and nature

The Health Council of the Netherlands (2000) it was observed that

“Stress occurs if something is at stake that is important at the time for an individual's well-being in terms of important objectives and values”

Therefore an individual may experience stress, and over time an impact on health, from a disturbance of the environment by artificial light during the evening and night, depending upon how much the person considers this to be a nuisance.

Exposure to other stress factors in the environment may combine to increase the indirect effect of artificial lighting.

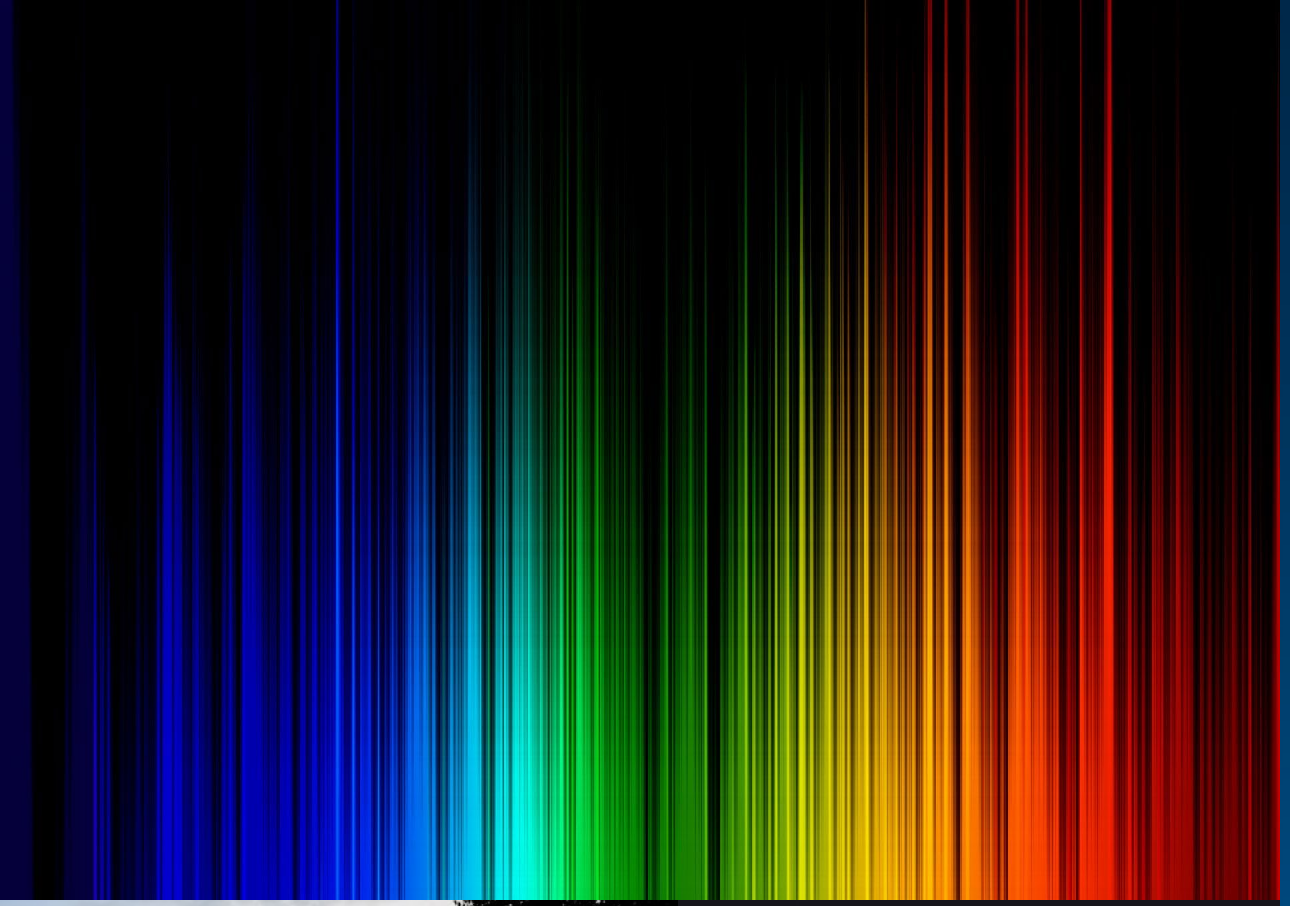
STRESS FACTOR

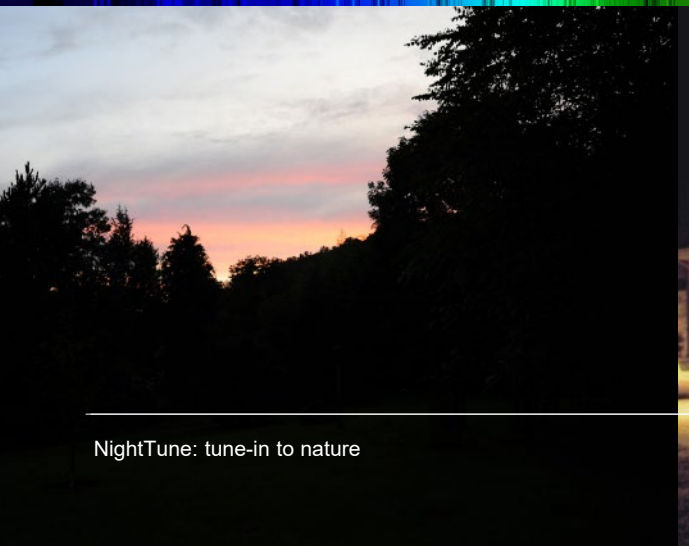
Research

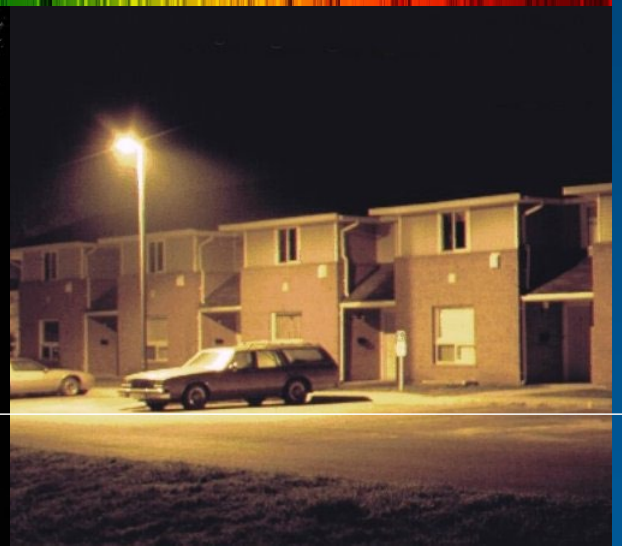
In research in the Netherlands on nuisance caused by environmental factors...

40% of respondents complained on noise
2% of respondents on light from car headlamps
2% of respondents on street lighting and outdoor lighting combined

The stress factor was noise and not particularly light.







LIGHTING STRATEGIES

Light at night

When considering light at night 5 main strategies should be considered*

Prevent areas from being artificially lit,
Limit the duration of lighting,
Reduce the impact of obtrusive light,
Change the intensity of lighting,
Change the spectrum of lighting.

Each of these strategies will have differing impacts of people and ecology.

**Reducing the ecological consequences of night-time light pollution: options and developments*

Kevin J. Gaston, Thomas W. Davies, Jonathan Bennie and John Hopkins

Journal of Applied Ecology 2012, 49, 1256-1266. British Ecological Society

DO WE NEED TO LIGHT?

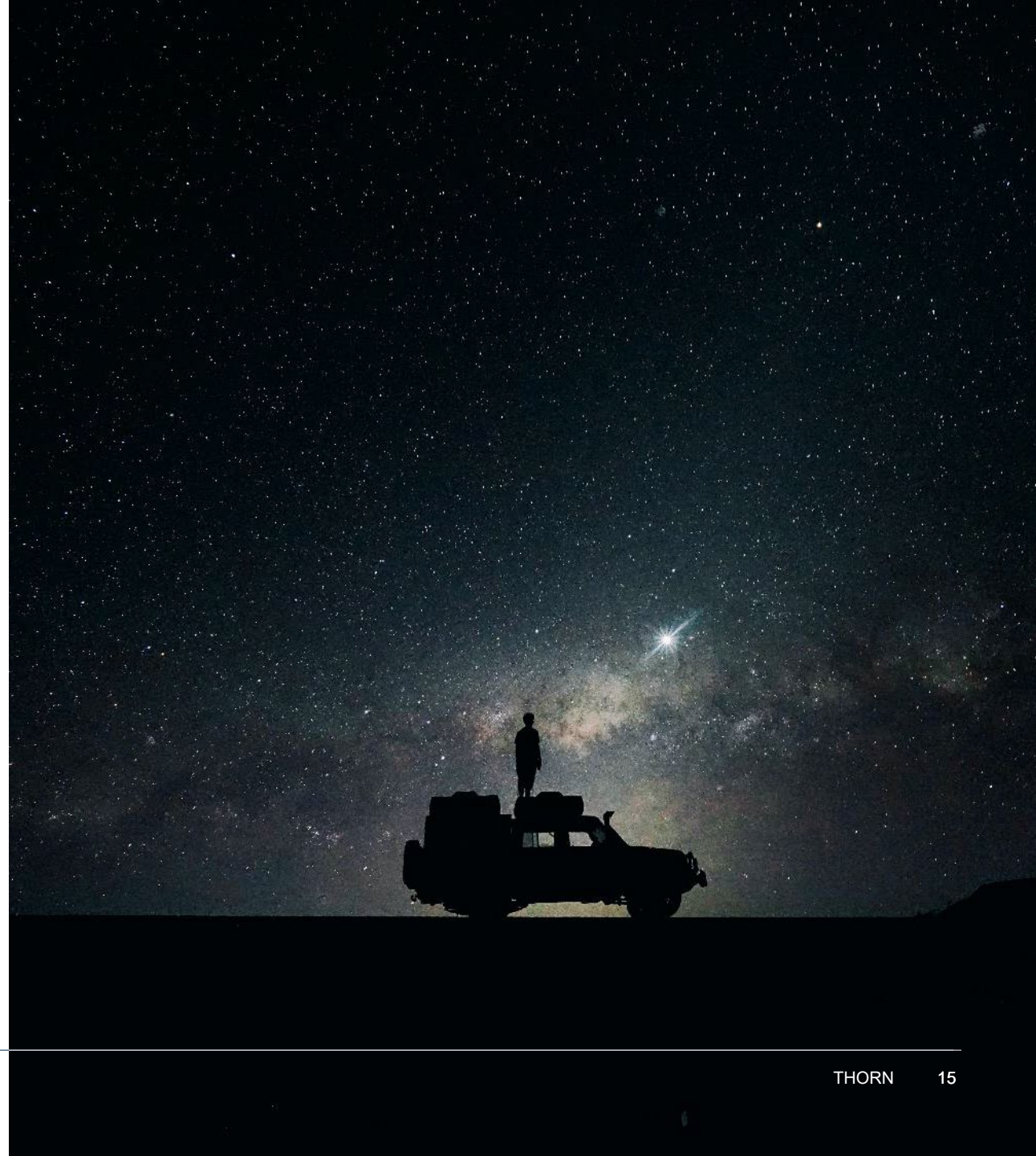
Prevent areas from being artificially lit

There is little information as to the size of unlit area and light intensity below which an area is effectively unlit in ecological terms.

Thresholds are likely to vary by species.

It will create oases of dark for organisms that do not disperse or migrate over large distances.

Diffuse illumination from urban sky-glow may impact over distances of tens or hundreds of kilometres.



DUSK AND DAWN

Limit the duration of lighting

Those hours when lighting is most important to humans

the hours immediately after dusk,

the hours immediately before dawn,

are also those at which it has the most significant impact on many other organisms, including people.

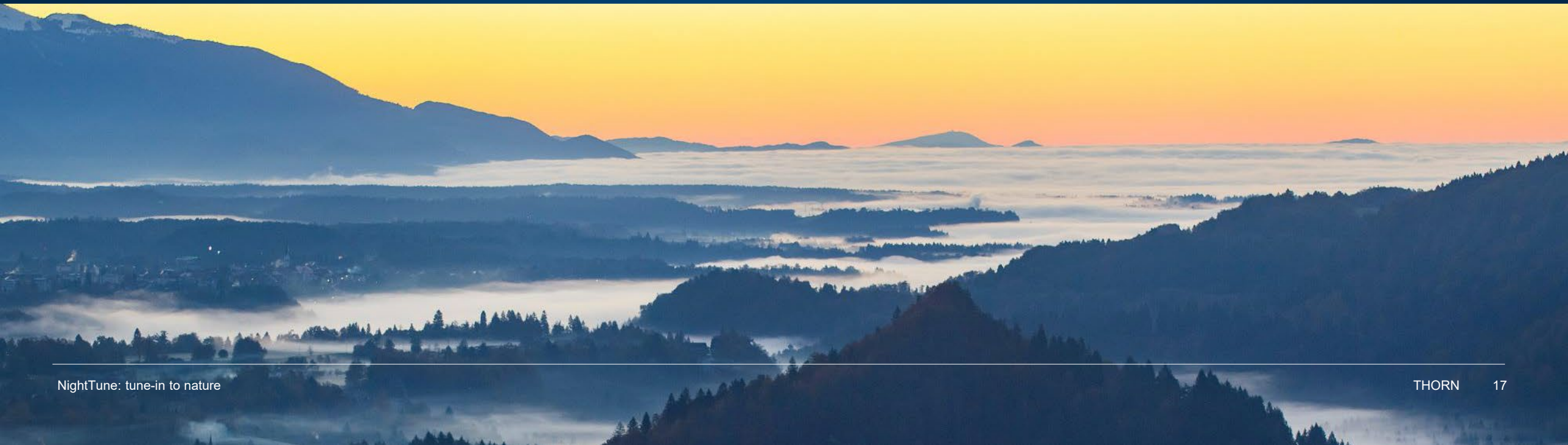
DUSK AND DAWN

Limit the duration of lighting

The majority of activity by nocturnal and twilight active organisms tends to occur during these hours.

Many species time the stages of their life cycle through the detection of day length
such as bud burst, flowering, dormancy and leaf abscission in plants, and reproduction, migration and diapause in animals.

Any physiological impacts may continue to be disrupted by light curfews.



SKY-GLOW

Reduce the impact of obtrusive light

Blue-rich light sources produce more sky-glow in the vicinity of light sources than an equivalent intensity of yellow-rich lighting.

Sky glow impacts may still be observed 100 – 200km distant from an urban area in observatories.

Specific ecological effects may be affected unequally by diffuse atmospheric light pollution at different wavelengths

THE MOONLIGHT

Change the intensity of the lighting

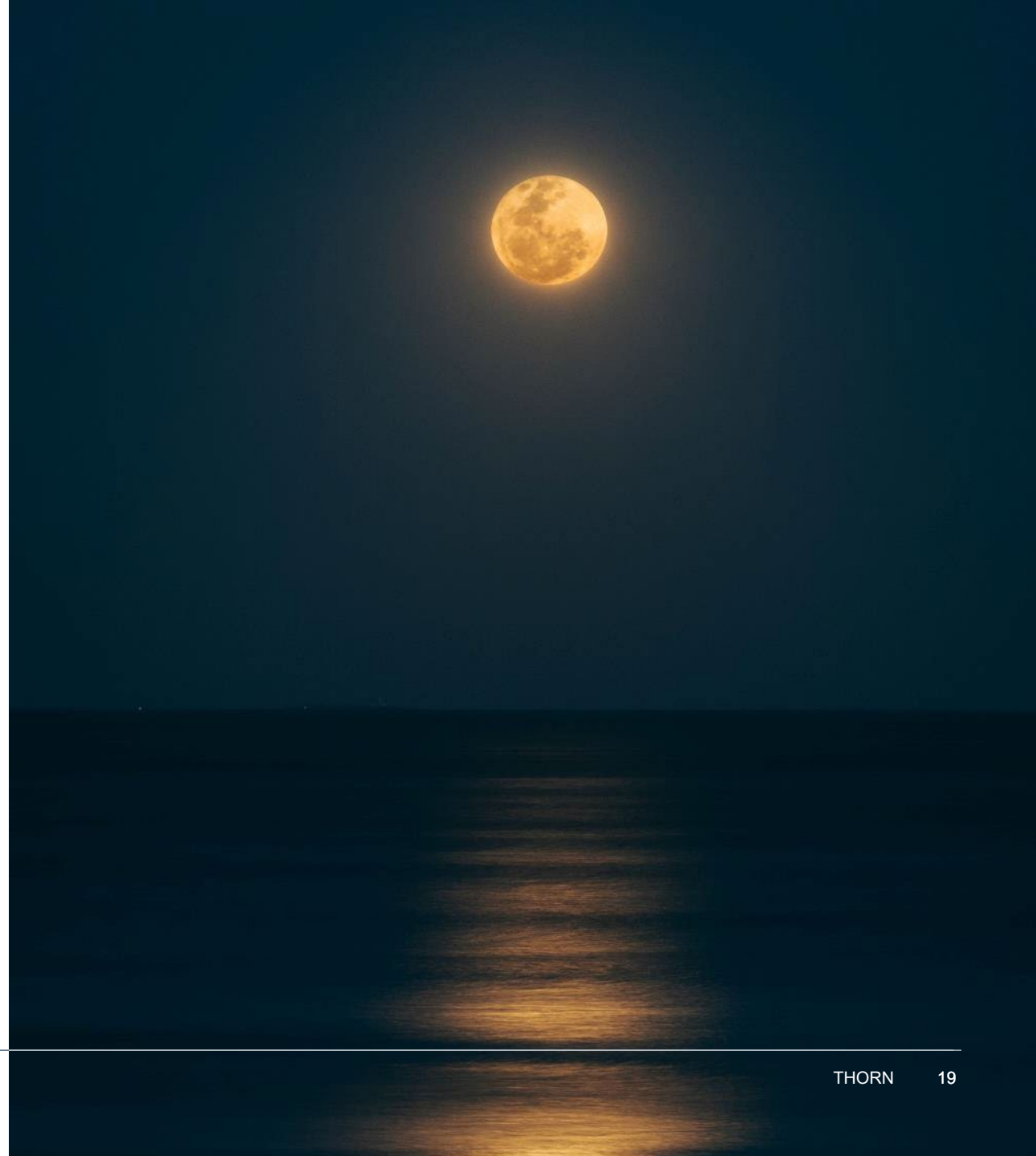
In the absence of artificial light

- full moonlight under clear skies gives an illumination of ~ 0.1–0.3 lux,
- a clear starry sky ~ 0.001 lux,
- an overcast night sky ~ 0.00003–0.0001 lux

Typical street lighting gives rise to street-level illumination of between 5 and 15 lux.

Emergency lighting requires (minimum)

- 1 lux on an escape route,
- 0.5 lux in and open area,
- 1 lux for safety lighting.



LIGHT LEVELS AT NIGHT

Change the intensity of the lighting

Flowering has been observed to be delayed and promoted, and vegetative growth enhanced amongst a wide range of ornamental plant species at ~ 10 lux.

Earlier initiation of morning song by American robins occurs at <4 lux.

The benefit of reducing light intensity for the ecology of animals in the local environment rests largely on their sensitivity to light.

Dimming artificial light within the range at which humans can still retain sufficient visual acuity is unlikely to eliminate any effect on the vision of nocturnal animals.

LED LIGHTING

Change the intensity of the lighting

With careful planning, the development of directional LED lighting has the potential to provide a much more uniform, intermediate level of illumination.

While peak light levels are much lower directly beneath these lamps, there is a loss of dark refuges between street lights.

Such dark patches between lights allow light-avoiding animals to cross linear lit features such as roads or footpaths.

LIGHT AT NIGHT

Change the spectrum of the lighting

Light at night from street lighting may impact the human circadian system.

Light at night from street lighting may impact the local animal and plant ecology.

Lighting technologies that emit a narrow spectrum of light are likely to have less ecological impact compared with broader spectrum or ‘whiter’ light sources.

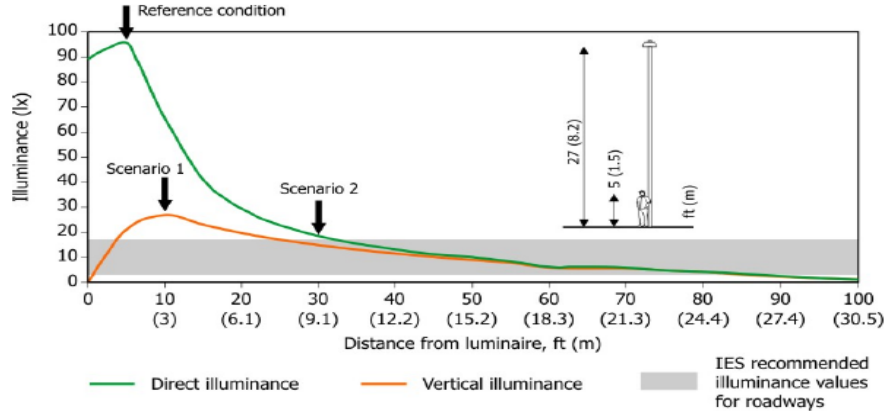
Light sources that emit broader spectra overlap with the absorbance range of more visual pigments, which enables organisms to perceive a greater range of the colours in their environment.

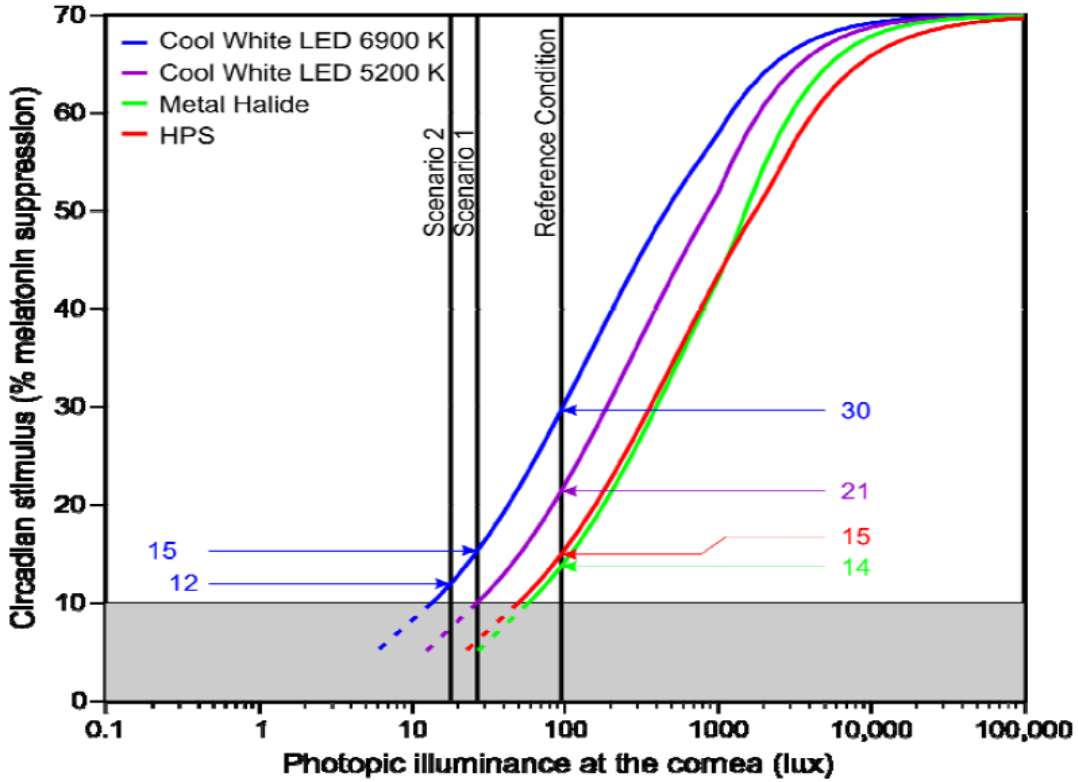
CIRCADIAN STIMULUS

Change the spectrum of the lighting

Based upon a conservative threshold of a 30-minute exposure to 30 lx on the eye for a white light source[1]

3 out of 4 light sources examined would not meaningfully stimulate the circadian system after 1 hour exposure[2]

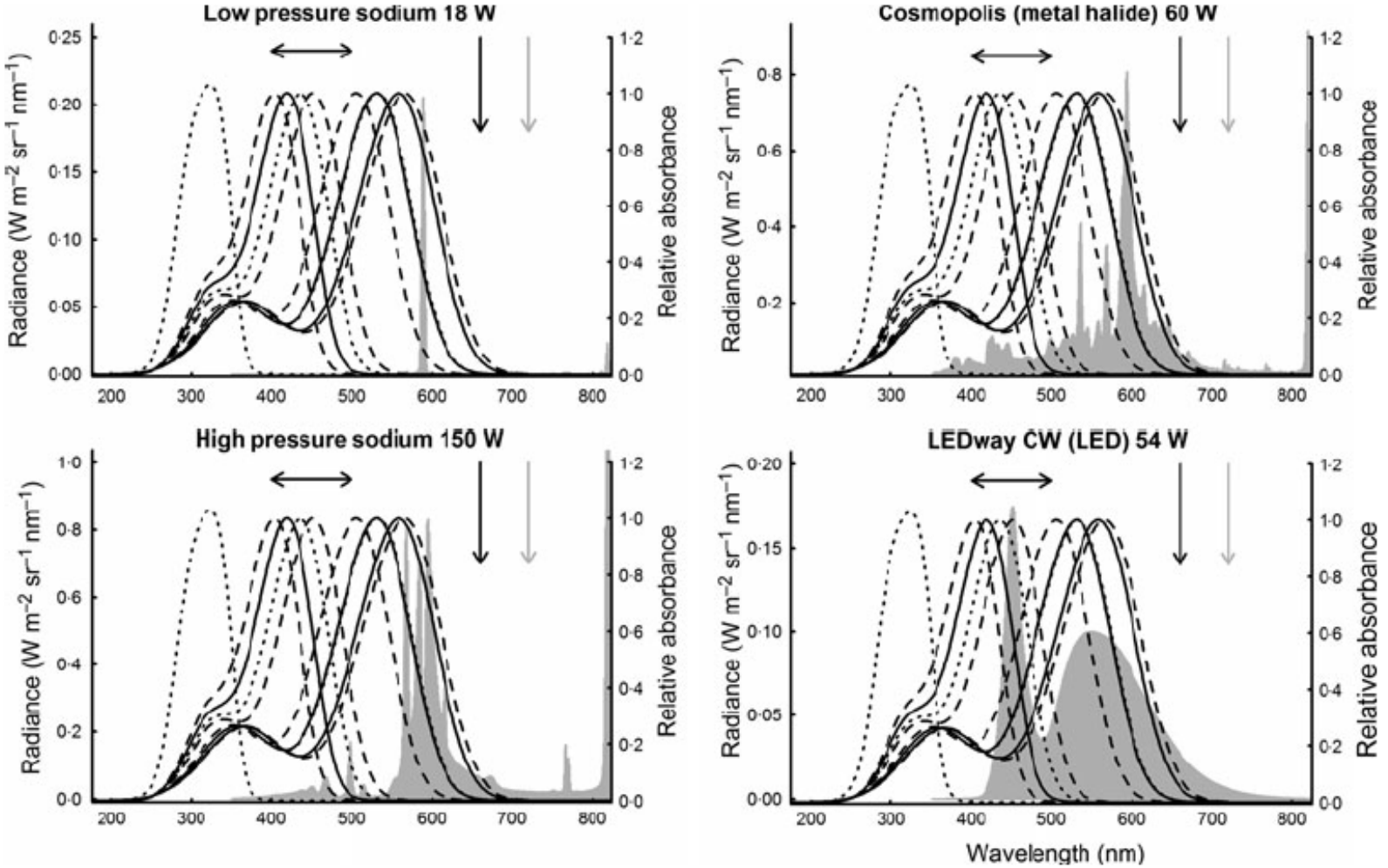




1. *Does architectural lighting contribute to breast cancer? Journal of Carcinogenesis 5(1):20. 2006*
2. *The potential of outdoor lighting for stimulating the human circadian system ASSIST*

WAVELENGTHS OF LIGHT

Different intensities



Curved lines indicate absorbance curves for
Solid– Human
Dashed – Rock pigeon
Dotted – European Honey Bee

Vertical arrows indicate absorbance peaks for phytochrome in plants
Black - phytochrome a
Grey - phytochrome b

Horizontal arrows indicate absorbance range of cryptochrome in plants and animals

LIGHTING SYSTEMS

Study in the Tirol region, Austria

	HQI TS	HCI TT	HCI EIP	NAV T 70W	LED 6000K	LED 3000K	Summe
Blattodea	1	1	1	3	3	3	22
Coleoptera	486	427	277	137	135	117	1579
Dermaptera	2	0	0	0	0	0	2
Diptera	103	109	75	50	53	36	426
Diptera klein	2820	3400	1830	1650	750	421	10871
Ephemeroptera	13	14	10	12	5	7	61
Heteroptera	298	242	126	93	73	46	878
Auchenorrhyncha	46	38	17	117	17	14	249
Sternorrhyncha	108	282	129	84	29	14	646
Hymenoptera	227	819	206	171	88	42	1553
Lepidoptera	1249	1160	740	494	127	107	3877
Neuroptera	69	38	17	11	2	2	139
Plecoptera	108	99	107	84	50	28	476
Psocoptera	52	63	35	26	13	11	200
Rhaphidioptera	3	0	1	0	1	0	5
Trichoptera	12	6	6	1	2	0	27
Summe	5597	6698	3577	2933	1348	848	21001

Anlockwirkung moderner Leuchtmittel auf nachtaktive Insekten - Ergebnisse einer Feldstudie in Tirol
Kooperationsprojekt Tiroler Landesumweltanwaltschaft & Tiroler Landesmuseen Betriebsgesellschaft m.b.H.

CONSIDERATIONS

Does lack of good lighting ever make you …

It's the New Dark Age as street lights are switched off
Daily Telegraph 17 February 2019

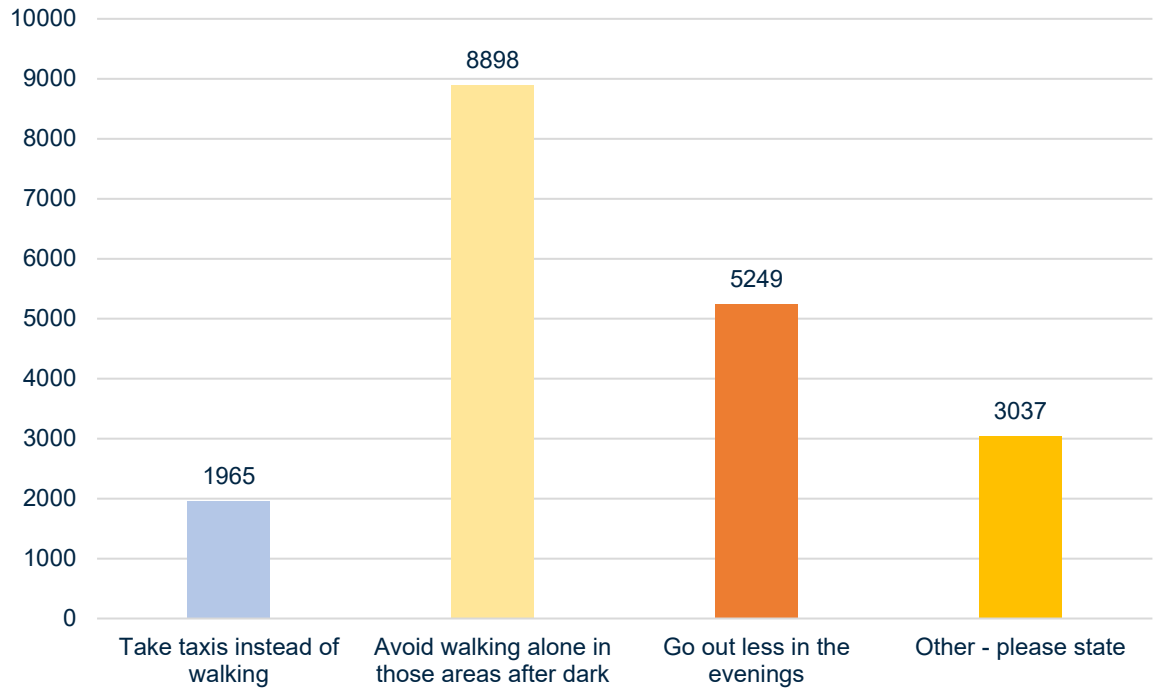
Turning off lights save councils £15m 'but costs lives'
The Times 20 February 2019

Street lights switch-off could be reversed
CoventryLive 22 March 2018

Lincolnshire council u-turns on 10pm street lights black out
The Lincolnite 8 June 2016

The people scared to go out at night due to Blaenau Gwent's disappearing street lights
WalesOnline 10 December 2018

Residents: 'Our street lights have been turned off - and it's so dark we're scared to leave home'
HullLive 24 October 2018



Does lack of good lighting ever make you…
Street Lighting & Perceptions of Safety Survey 2013
Suzy lamplugh trust

NIGHTTUNE PHILOSOPHY

VISUAL ORIENTATION

NightTune: tune-in to nature

People orientate themselves mainly with their eyes. About 80% of all information we take in is visual.

LIGHT IS THE PREREQUISITE FOR VISION

Light generates:

Brightness

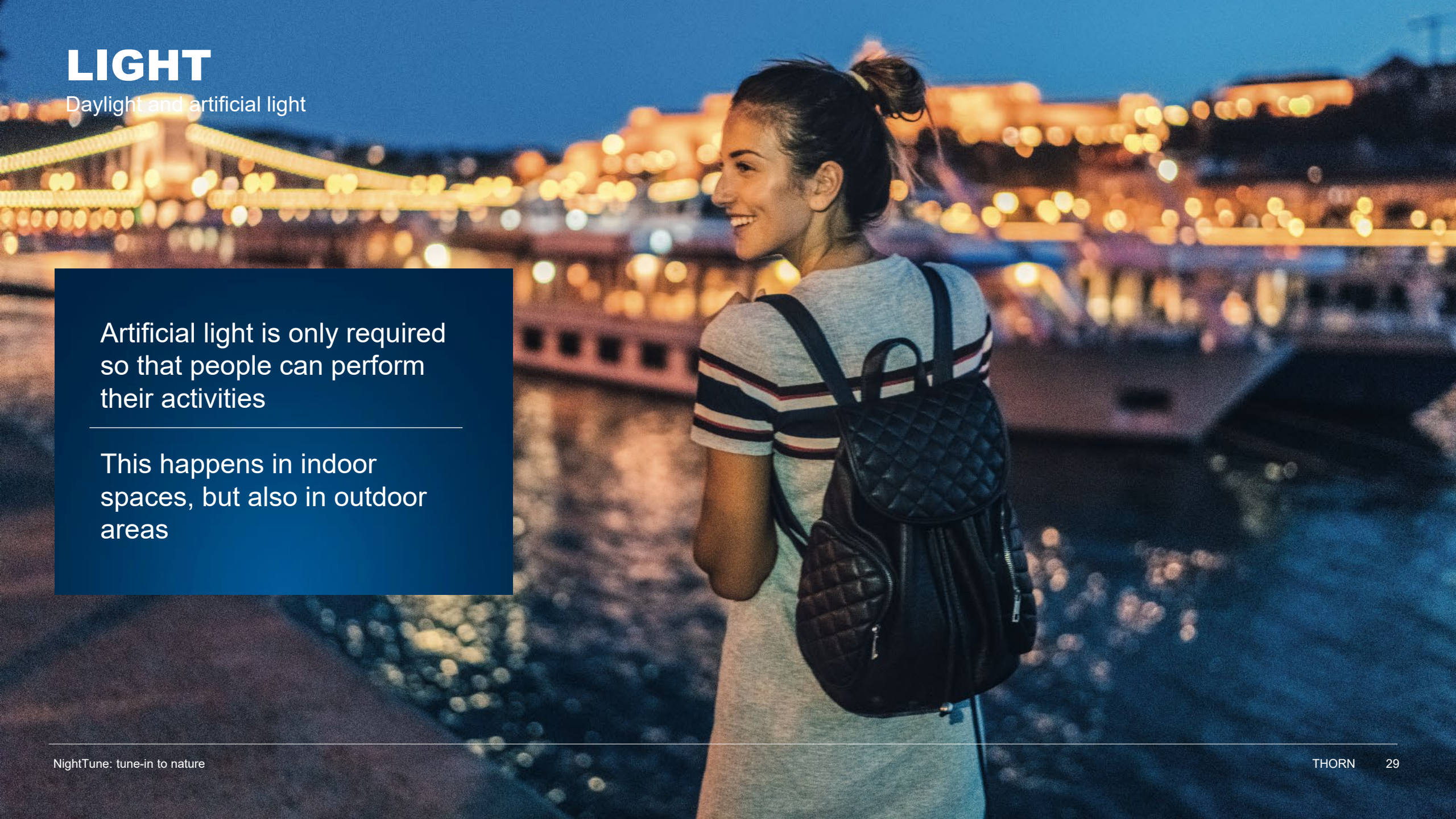
Contrasts

Colour

Human beings developed within 5-7 million years under natural light and ALL our sensory cells have developed with it!

LIGHT

Daylight and artificial light



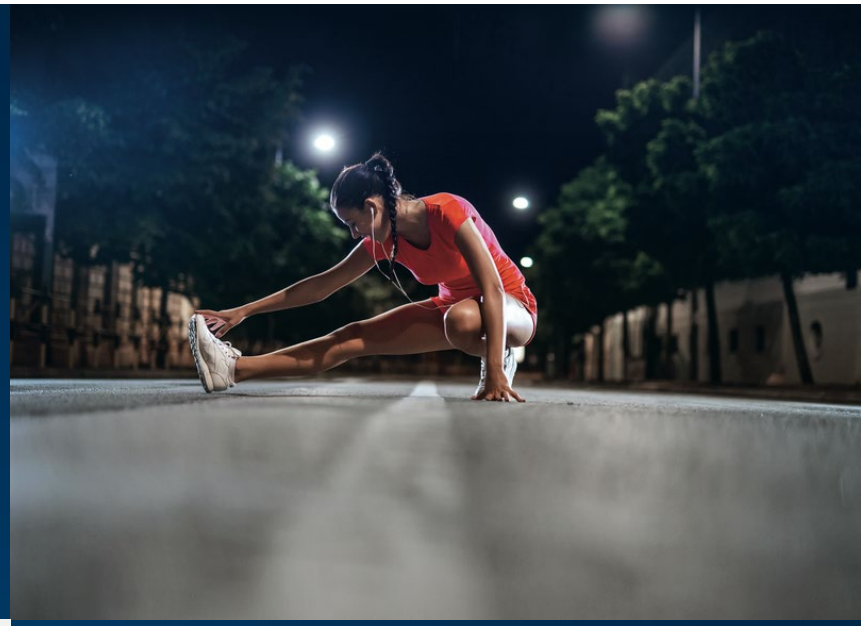
Artificial light is only required so that people can perform their activities

This happens in indoor spaces, but also in outdoor areas

OUR IDEA

WE CONTROL OUR LIGHTING

We can control our lighting intelligently and adapt it to the user needs and the nocturnal ecosystems.



WE CAN DO MORE

We can do more than just "SMART" City or "intelligent" lighting.

WE CREATE IDENTITY THROUGH LIGHT

Lighting ensures that people perform their visual tasks, creates identity and provides a feeling of safety to explore cities at night.

NIGHTTUNE

Environmental design of light

We minimise light pollution because no light is emitted upwards. We dim the light during the night. And we have the option of using particularly warm colour temperatures to protect the ecosystem at night.

With the NightTune technology, light colour and luminous flux can be directly adapted to the individual needs of people and nature during the course of the night.

ENVIRONMENTAL PROTECTION WITH NIGHTTUNE TECHNOLOGY

DAYLIGHT

The best light

Daylight is the best light for us as human beings.

But sometimes it is not enough.

With our current knowledge about light, we can reconcile human needs and the protection of nature.

That is what drove us to create NightTune.

WITH MORE THAN 90 YEARS EXPERIENCE IN LIGHTING WITH THORN


NIGHTTUNE
FOR WELLBEING


NIGHTTUNE
FOR SAFETY


NIGHTTUNE
FOR THE NOCTURNAL
BIODIVERSITY

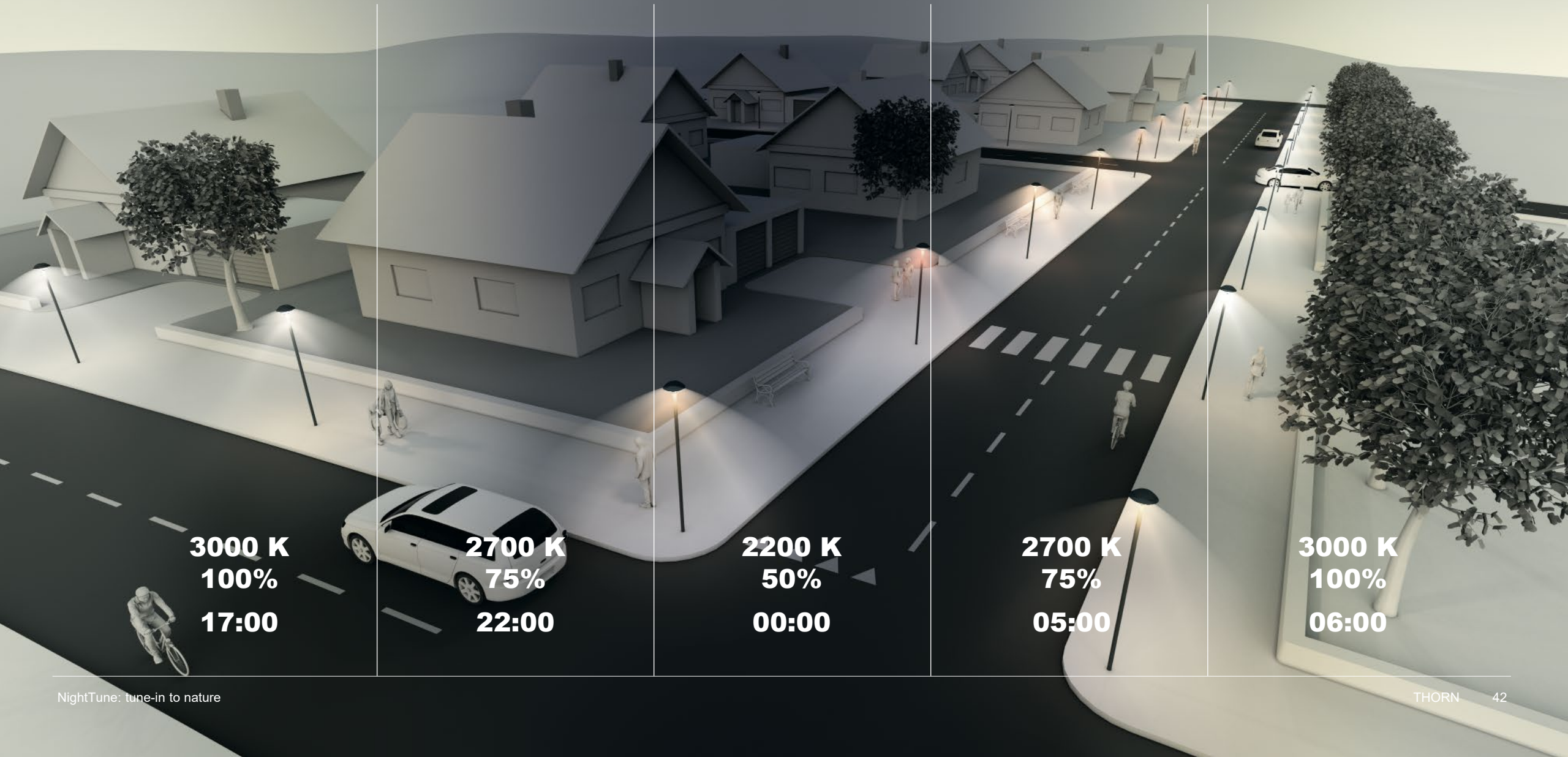
NIGHTTUNE TECHNOLOGY

VERSATILITY AND VISUAL COMFORT,

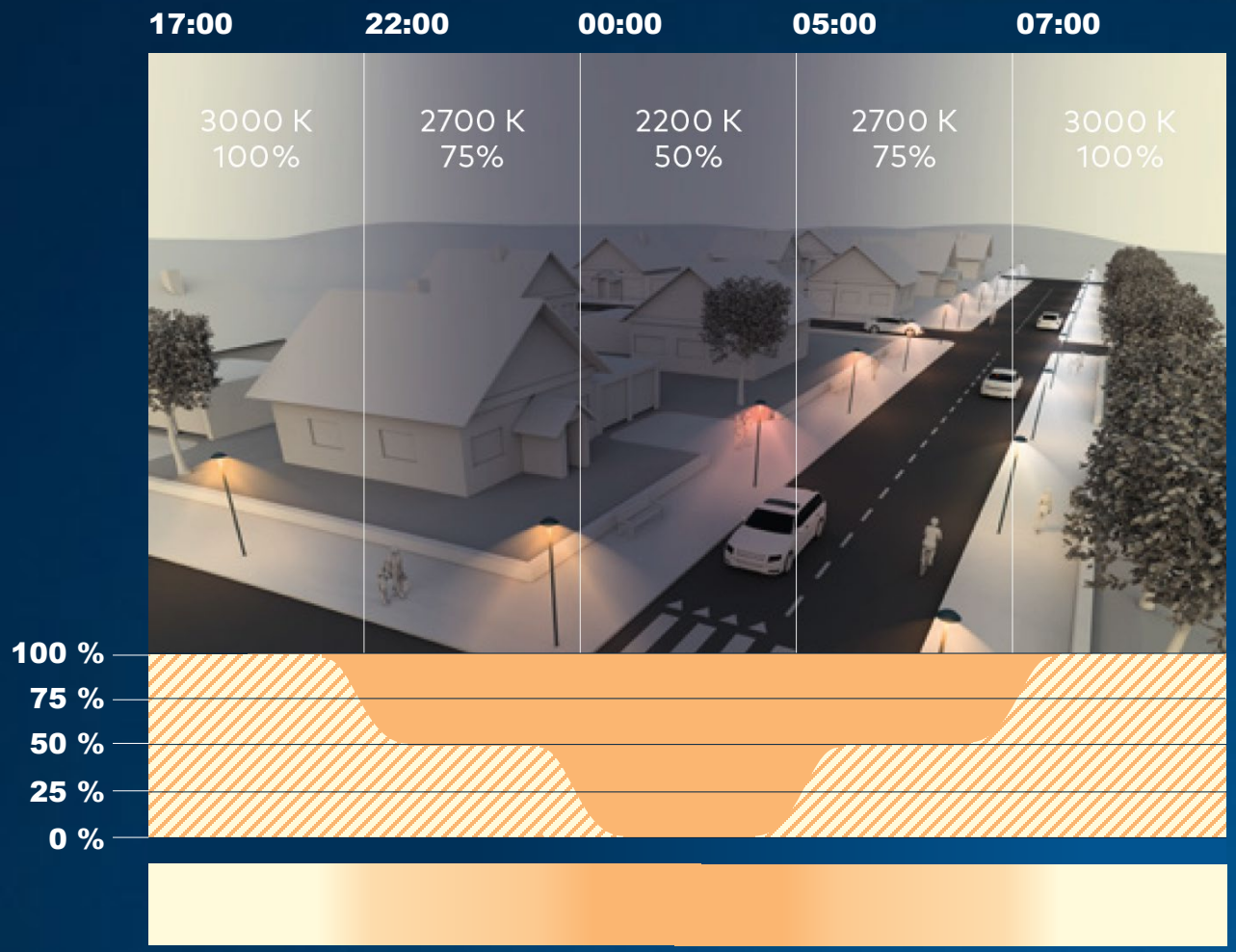
driven by optical excellence

LIVING TOGETHER

Once most people are indoors, nature can return to the city



NIGHTTUNE



Plurio Indirect – a perfect mixing of 2 LED colour temperatures with reflector optics

Use case example:

2200K	Channel 1:	Always on 100 %
4000K	Channel 2:	Dimming
2200K 3000K	Result:	Changing colour temp. and luminous flux adj.

PLURIO LED

Visual comfort, precision, adaptability


ORIGINAL

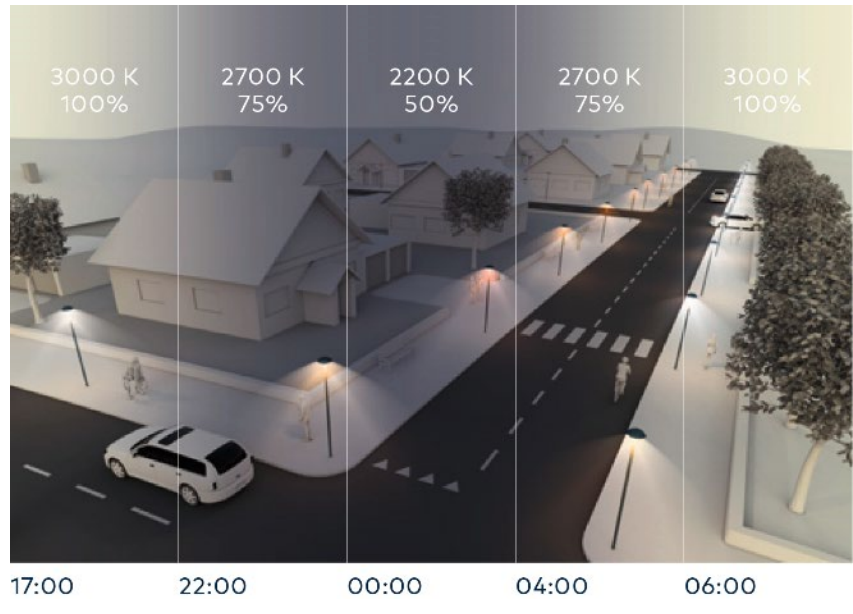

ROUND


DISC


FLAT

GROUND-BREAKING OPTICAL TECHNOLOGY

The Plurio family is designed to provide both direct and indirect illumination, while maintaining consistency in aesthetic appearance and light quality.



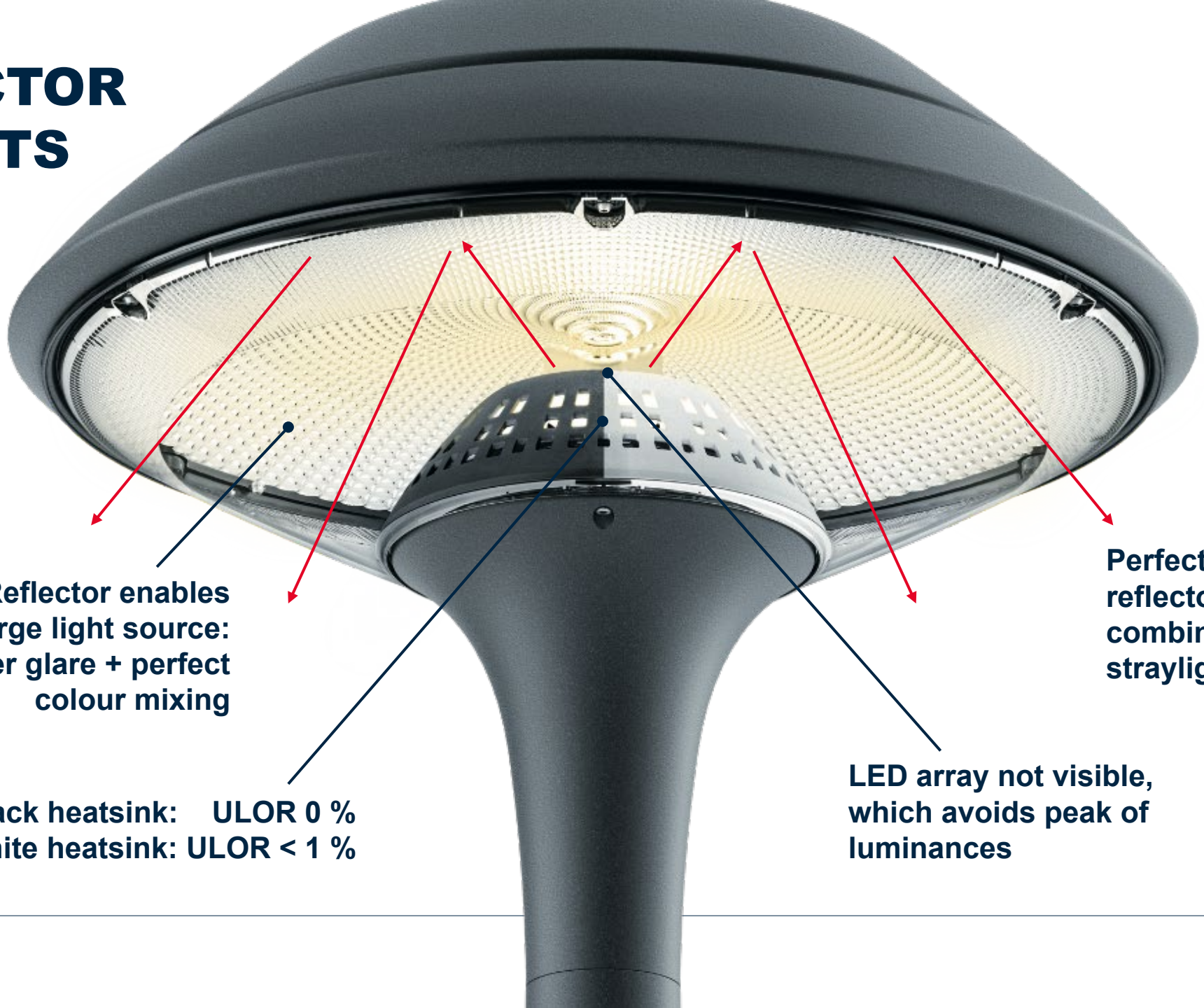
AESTHETIC VERSATILITY

With Plurio, designers can select the most appropriate design to integrate with any urban space. Four different variants provide the freedom to perfectly integrate the lighting system into the built environment, both by night and by day.

LIGHT DISTRIBUTION

Plurio minimises light pollution, with zero upward light emission. It also comes with a wide variety of colour temperature options, including warm tones to respect the nocturnal ecosystem. Plurio is equipped with Thorn's NightTune technology.

REFLECTOR BENEFITS



Reflector enables large light source: lower glare + perfect colour mixing

Perfectly calculated reflector – PCB – combination avoids straylight

Black heatsink: ULOR 0 %
White heatsink: ULOR < 1 %

LED array not visible, which avoids peak of luminances


NIGHTTUNE

CONCLUSION

Questions & Answers


THORN
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GET IN TOUCH

www.thornlighting.com

WE
MAKE
LIGHT
WORK