

PHILIPS

COSMOPOLIS

Benefits of White Light



Road and Urban Lighting

Marc Janssens
Sr Product Manager HID Turnhout



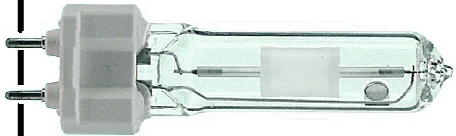
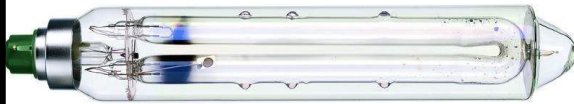
How lamp light affects our lives

- Functional requirement
 - Traffic safety
 - Meeting lighting norms
 - Energy efficiency
- Experience requirements
 - Social safety
 - Security
 - Ambience
 - Spectacle

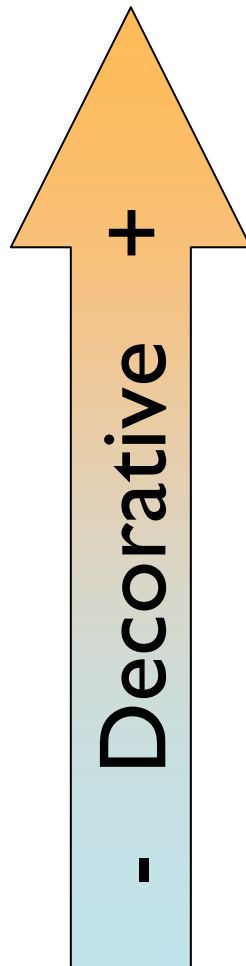
Optimized
balance



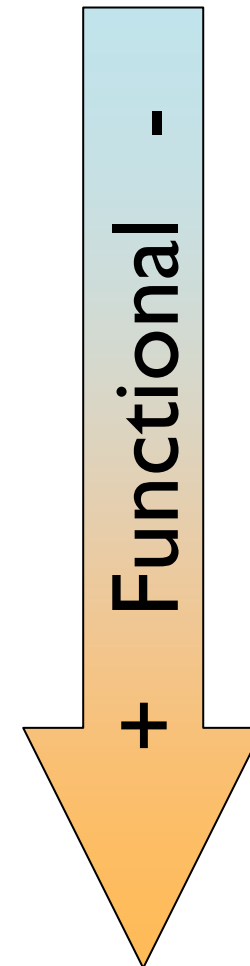
Lamps types used for road/residential lighting

MASTERColour CDM-T 35-250W 	MASTER SON-T PIA Plus 50-600W 	MASTER CosmoWhite CPO 45-140W 
HPL-N / HPL Comfort 50-400W 	MASTER SON PIA Plus 50-400W 	MASTER CityWhite CDO-TT & ET 70-250W 
MASTER SOX(-E) 18-180W 	MASTER QL 55-165W 	MASTER PL-L / PL-T 24-80W / 32-42W 

Lamp characteristics relevant for road lighting



- Colour temperature T_c (Kelvin)
- Colour rendering index R_a
- Light output (lumen) *)
- Lamp efficacy (lumen/Watt) *)
- Lamp life (hours) *)
- *): influence costs

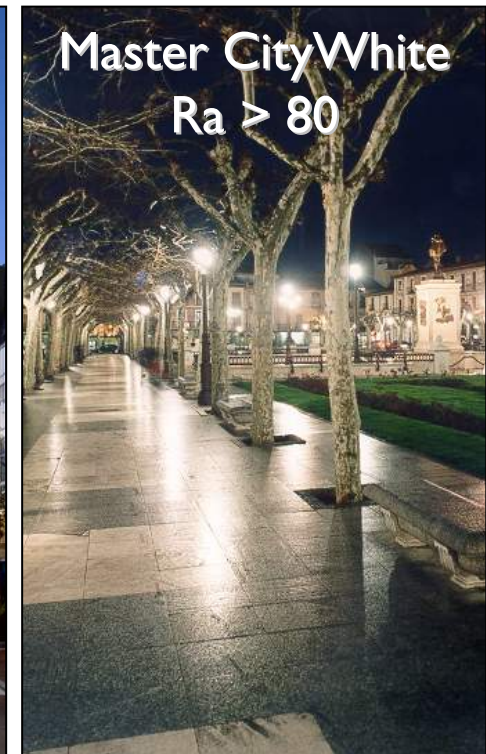
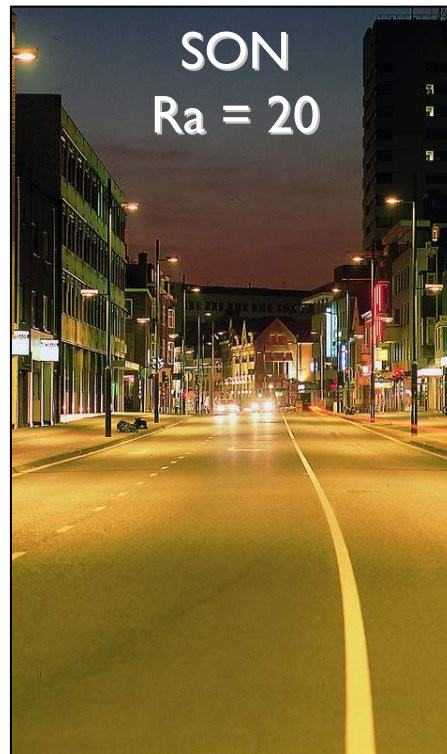


Lamp characteristics relevant for road lighting

Colour rendering

Functional outdoor lighting: no demand

Residential lighting: as natural as possible



Research - white light

- Perceived brightness higher under white lighting at low (road) lighting levels.
- Provides a better perceived safety and ambience.
- Better orientation and quicker identification of people and surroundings.

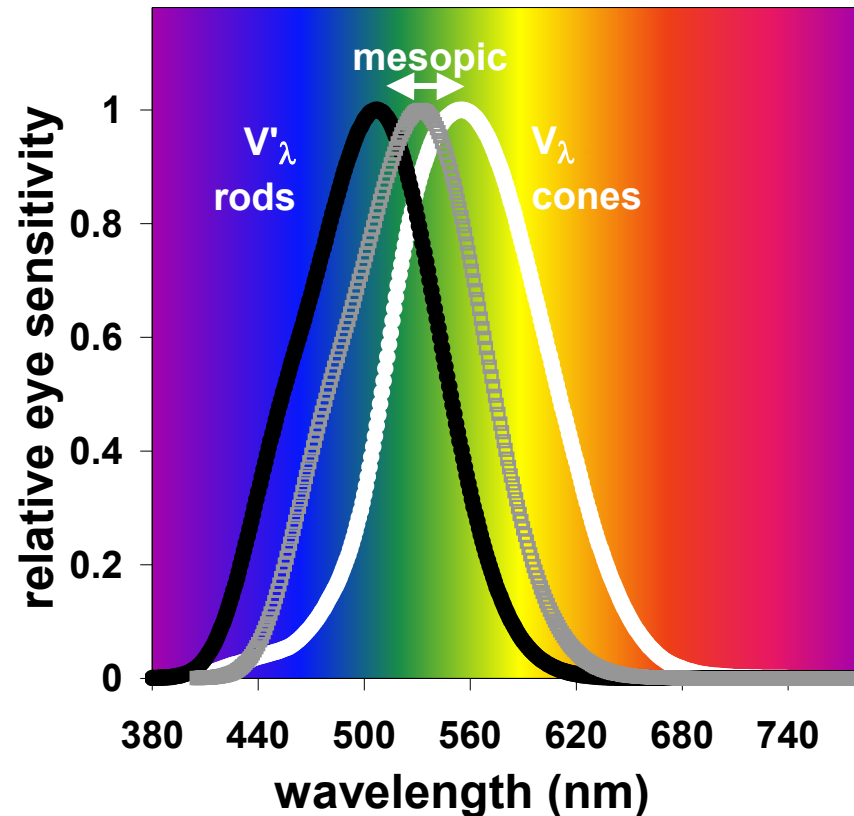


Redbridge, UK, before



Redbridge, UK, after installation of CosmoWhite (Philips)

Spectral Sensitivity of the human eye

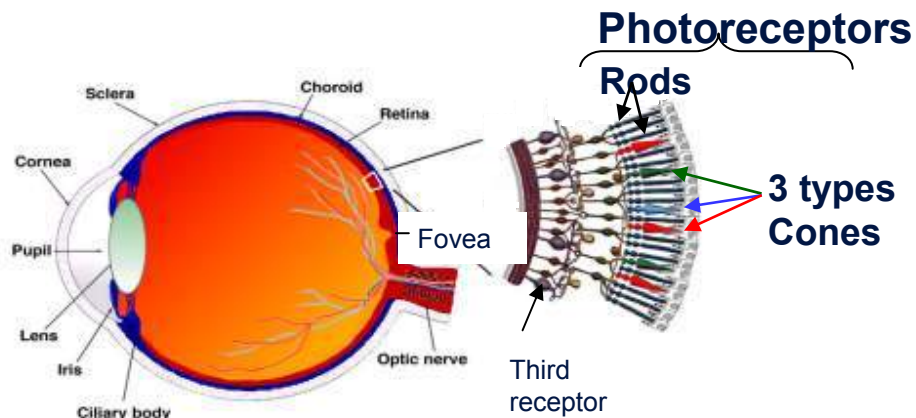


- **Cones**
enable us to see colors

Sensitivity peak cones:
 $I_{\text{maxcones}} \sim 555\text{nm}$, yellowish
- **Rods**
enable us to see in the dark and peripherally

Sensitivity peak rods:
 $I_{\text{maxrods}} \sim 507\text{nm}$, bluish

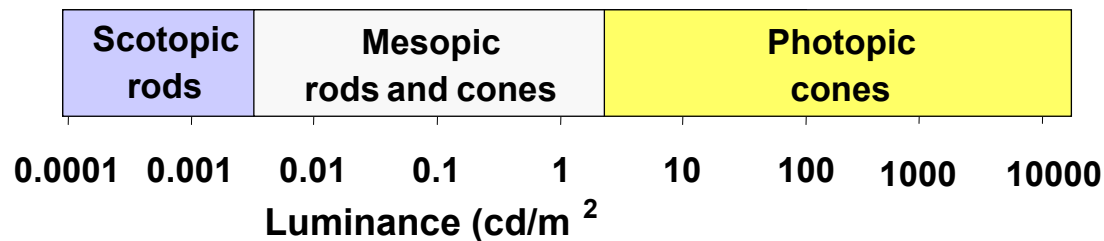
Visual System: Spectral Sensitivity of the human eye



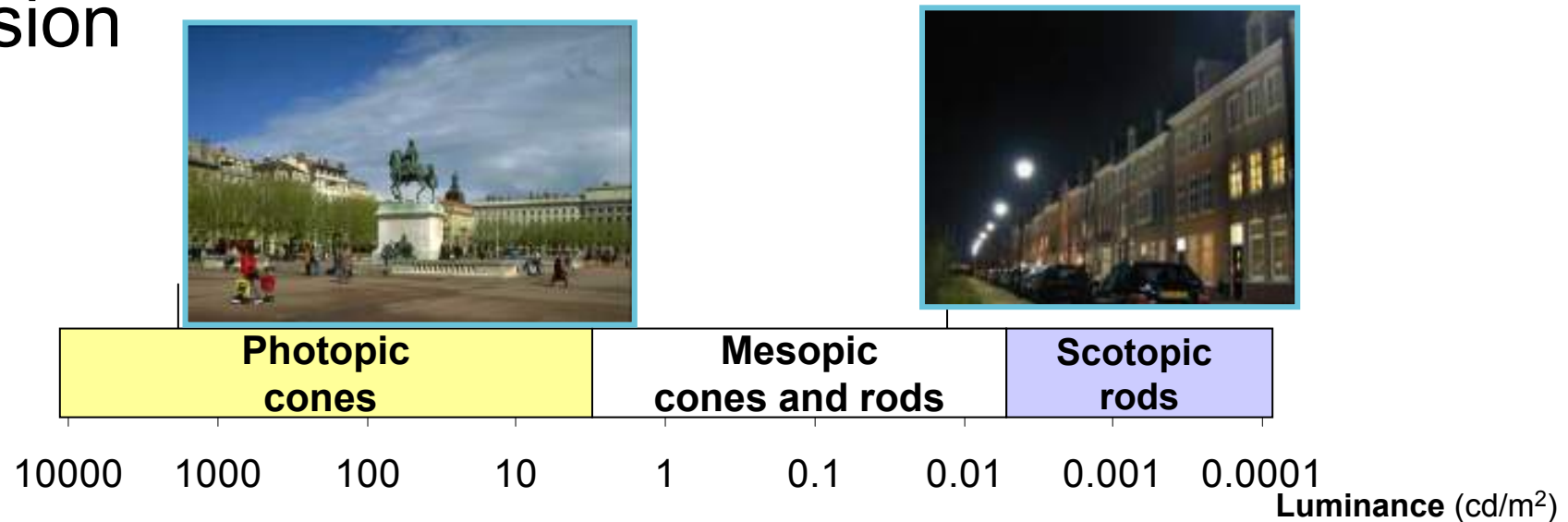
Photopic:
Cones are sensitive
Higher light levels

Scotopic :
Rods are sensitive
Extreme low light levels

Mesopic:
Mixed Rods/Cones
“night time” light levels



Day and Night Vision – Photopic and Mesopic Vision



At low lighting levels

- Eye sensitivity changes as rods contribute to vision
BUT → Light output calculated based on photopic lumens!!!

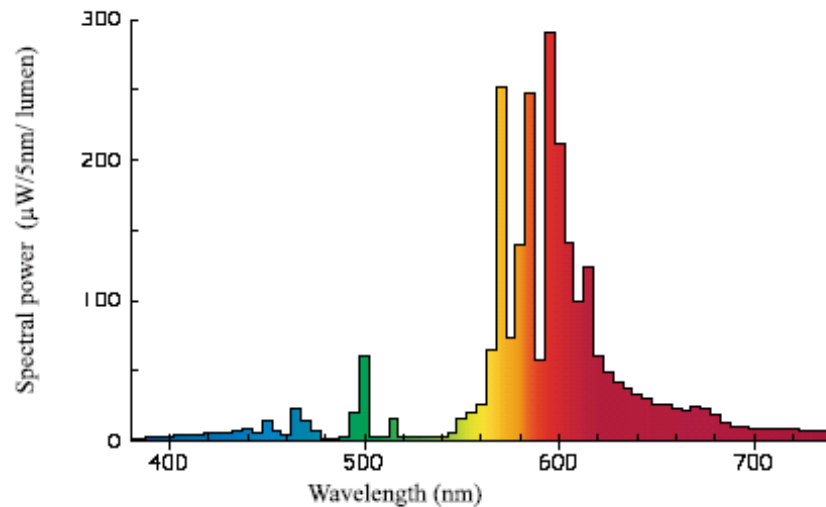
Light sources tuned to human visual performance at low lighting levels

- ✓ improve visibility & people's feeling of safety and comfort
- ✓ enable use of lower levels, save energy & reduce CO₂ emissions

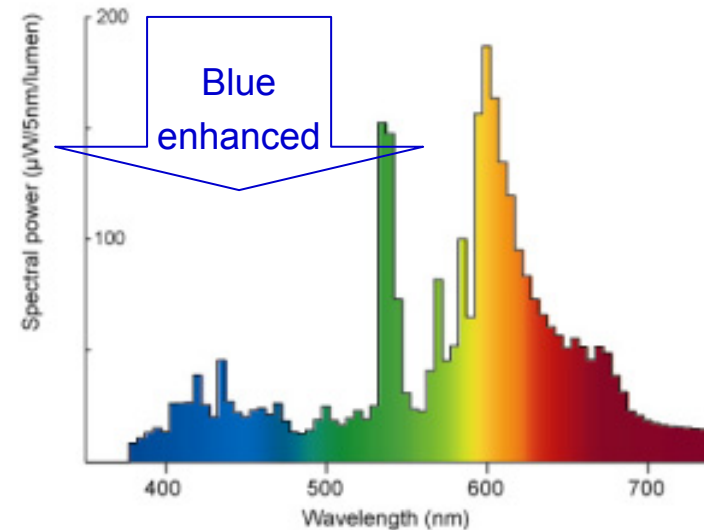
Visibility at mesopic light levels

Sources with more blue emission can be more effective at low light levels

Yellow: HPS- Technology



White: CDM / CDO / CPO-
Technology



Effect of lamp spectrum on:

People's Perception and Performance at Night

- Perception of safety
- Perception of brightness
- Facial recognition
- Color distinction and identification

Conventional (yellow SON) vs new (white) technology

United Kingdom Roadlighting Norms

BS 5489-1 and BS EN 13201-2: 2003

Subsidiary Roads – residential roads, footpaths and cycleways

Lighting Classes for motorways and traffic routes

Crime Rate	Ra Value	Lighting Class						= road classification
		Low Traffic Flow		Normal Traffic Flow		High Traffic Flow		
		E1/E2	E3/E4	E1/E2	E3/E4	E1/E2	E3/E4	
Low	Ra < 60	S5	S4	S4	S3	S3	S2	
	Ra ≥ 60	S6	S5	S5	S4	S4	S3	
Moderate	Ra < 60	S4	S3	S3	S2	-	S1	
	Ra ≥ 60	S5	S4	S4	S3	-	S2	
High	Ra < 60	S2	S2	S2	S1	-	S1	
	Ra ≥ 60	S3	S3	S3	S2	-	S2	

S Class lighting levels



Class	Horizontal Illuminance		
	$\bar{E}$ in Lux (min. maintained)	$\bar{E}$ in Lux (max. maintained)	E_{min} in Lux (maintained)
S1	15	22.5	5
S2	10	15	3
S3	7.5	11.25	1.5
S4	5	7.5	1
S5	3	4.5	0.6
S6	2	3	0.6
S7	Performance not defined		

Outdoor lighting

□ System of the future



Cosmopolis: , CosmoWhite



- Total system solution
- Extremely efficient/energy saving
- Environment- friendly
- Compact – New Architecture

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CosmoPolis



Gear



Lamps



**System
Development**

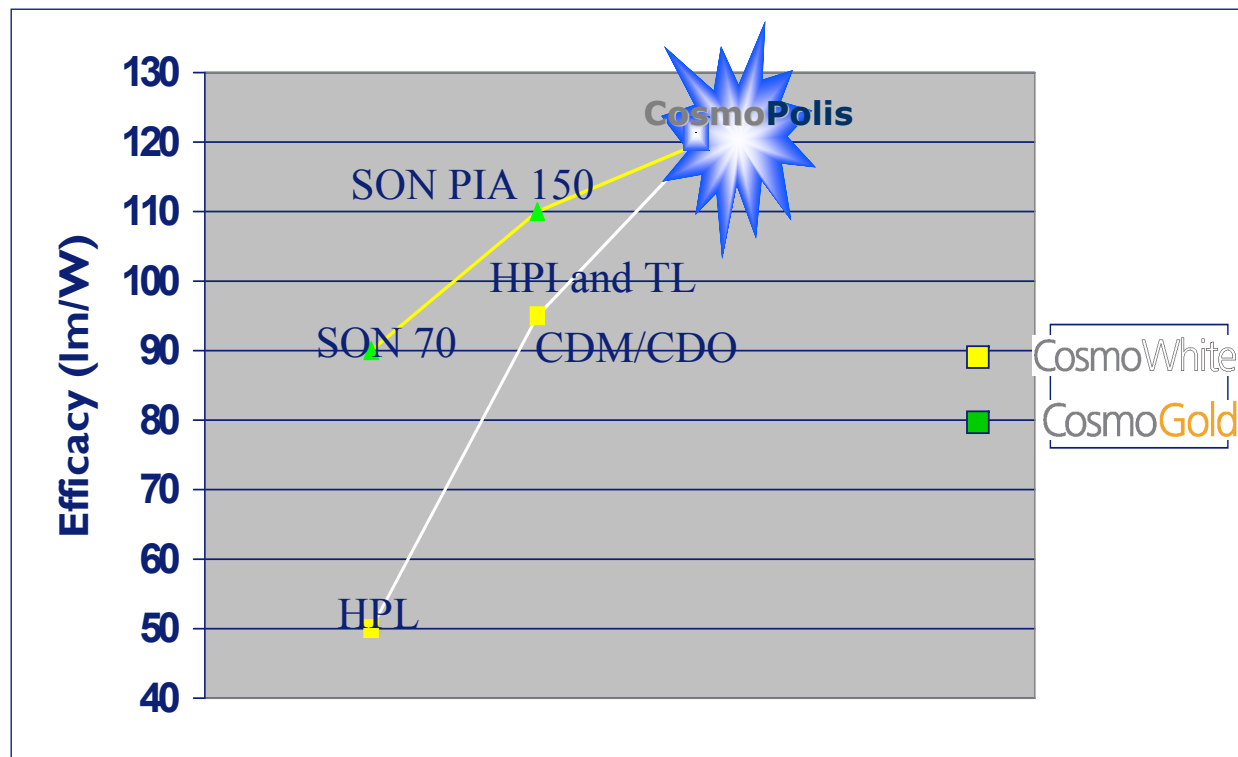
Main benefits

- High system efficacy for energy saving and low cost of ownership
- Compactness offers optimisation in design of optics and luminaires
- Best optical efficiency for greater spacing and thus lower investment
- Long service lifetime lamps and exceptional high gear lifetime
- Stand alone dimming gear LumiStep (2008)
- Official Green Flagship product to minimise environmental impact and CO₂ emission
- Philips CosmoWhite: colour quality



Benefit One

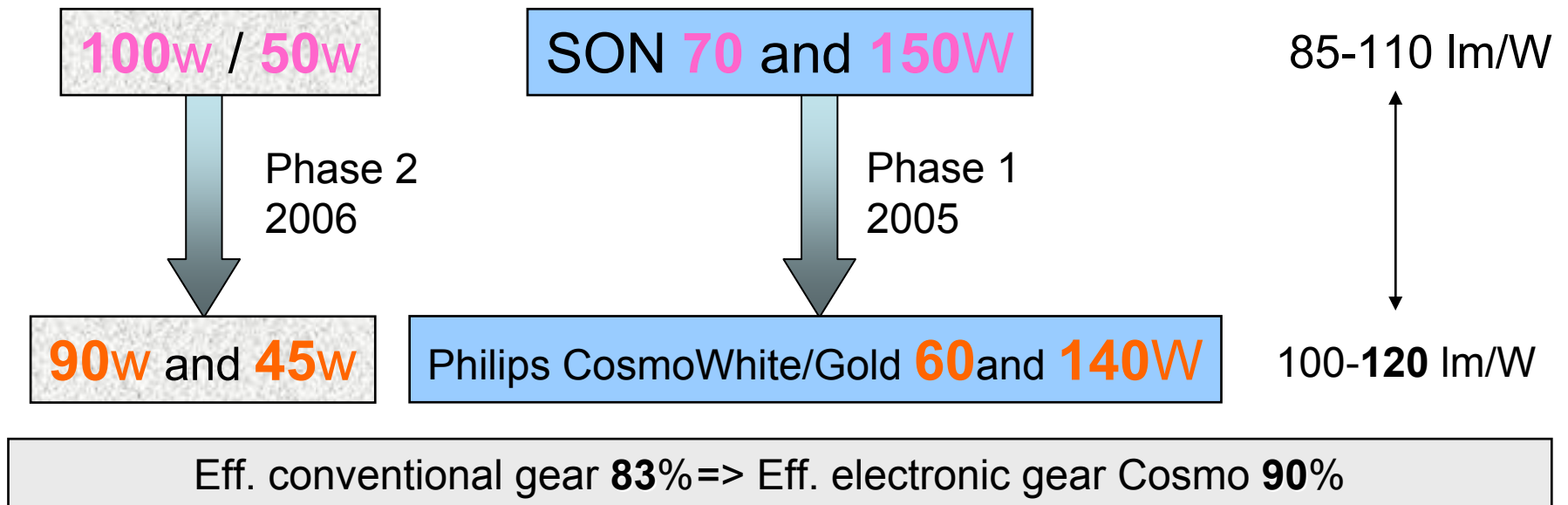
CosmoPolis = Revolutionary
Highest efficacy



Benefit 1: High system efficiency

High efficient lamps and gear:

- best system efficiencies
- translated into lower power consumption



Benefit 2: Compactness

- white and yellow light in similar compact size
- single component small size electronics: -50% to conventional
- design freedom for optics and luminaires

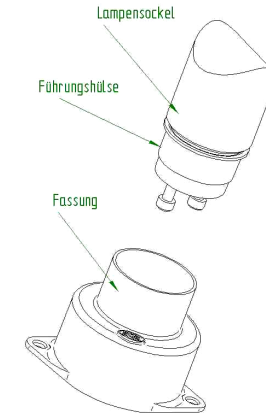
Same diameter as CDM-T, 25mm longer



Benefit 3: Best optical efficiency

Improved optical quality:

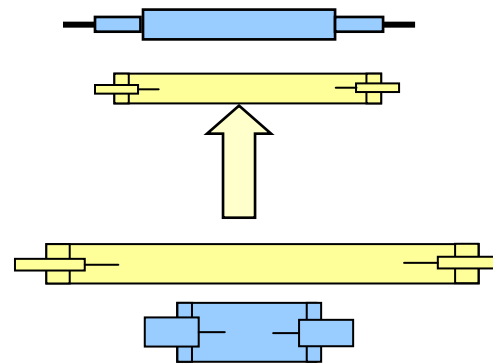
- Optimal burner Aspect Ratio
- Optimal burner positioning via new base
- Consistent burner position, even after relamping



CosmoWhite => A.R.
1:5

SON => 1:8

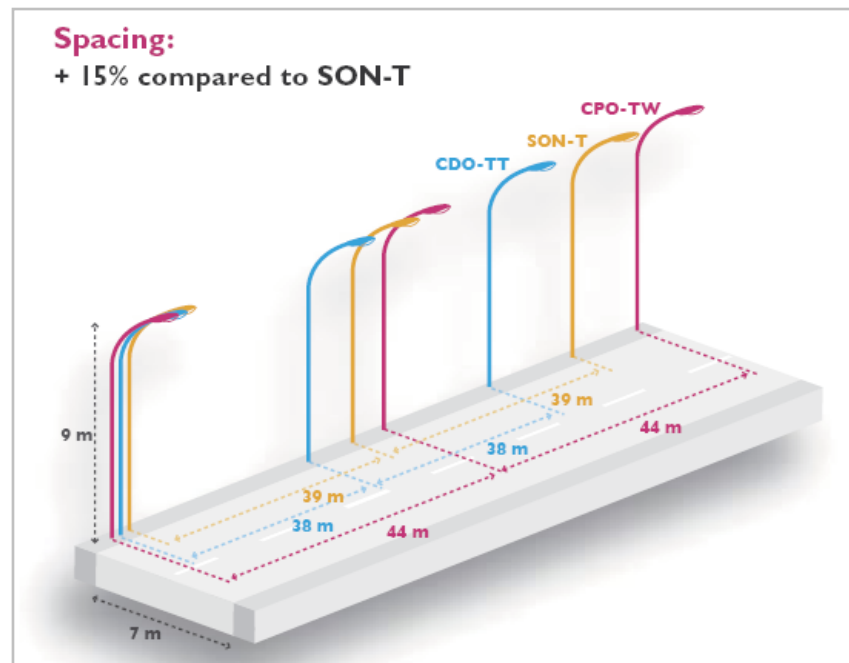
CDM => 1:1.5



The optimal AR for road lighting optic is 1:5

Benefit 3: Best optical efficiency

Upto 15% more spacing On average



Benefit 4: Lifetime

Service Lifetime 3 yrs (Philips CosmoWhite)

meaning >90% survivors and >80% lumen maintenance

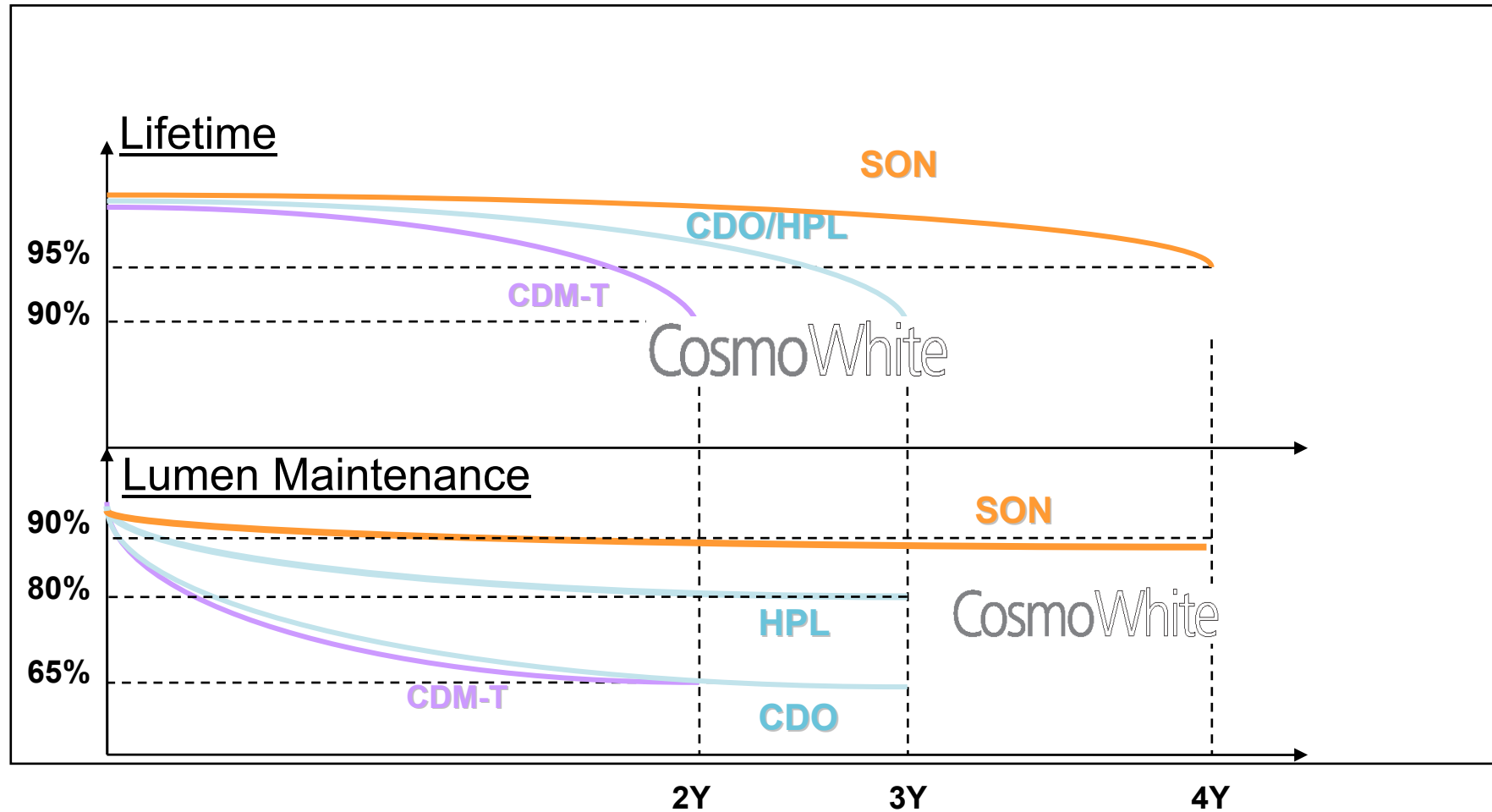
References :

CDM-T	: 2 years service life
CDO-TT	: 3 years 90% survivors / 60% lumen maintenance
HPL	: 3 years 90% survivors / 60% lumen maintenance
SON PIA	: > 4 years service lifetime

Philips CosmoPolis HID-PV Xtreme gear: 60,000 hrs lifetime

(95% survivors) = outdoor long-life heavy-duty specification

Target Specification



CosmoWhite : Range

CPOT –W 45 W – 60W – 140 W

Lamp range	Light Output	Lamp base	Lamp Voltage	Colour Temperature	Colour Rendering Index	Service Lifetime	Lumen Maintenance at Service Lifetime	Order code
	(lm)		(V)	(K)*	(Ra)	(h)		EOC 8711500...
Philips MASTER CosmoWhite 45W/628	4,300	PGZ 12	230	2600 - 2850	60	12,000	80%	21119415
Philips MASTER CosmoWhite 60W/728	6,850	PGZ 12	230	2600 - 2850	65	12,000	80%	20851415
Philips MASTER CosmoWhite 90W/728	10,450	PGZ 12	230	2600 - 2850	65	12,000	80%	21121715
Philips MASTER CosmoWhite 140W/728	16,500	PGZ 12	230	2600 - 2850	65	12,000	80%	20853815

*Lamps are optimised for horizontal use, although they can be operated in all positions.

Colour temperature and colour rendering are position dependent (corresponding data are for vertical/horizontal position)

CosmoPolis

Official Green Flagship of Philips Lighting



- **Energy efficient**
 100-120 lm/w (lamps)
>92% efficacy (gear)
- **Low on hazardous materials**
 low mercury, no lead
- **Low weight and miniature size**
 low on material use
low on packaging material
- **Power Factor**
constant at > 0.98



Why Philips CosmoPolis Electronics ?

Improved system performance

- Lamp and gear developed simultaneously and **tuned as a system**
- Outdoor **Extreme Life** and Heavy Duty specification
- Operates both **Class I and Class II** luminaires
- No disturbance to environment due to **EMC/EMI compliance**
- Protected against :
 - **Peek-voltage**
 - **End of lamp life**

Reasons to believe Xtreme Lifetime

PrimaVision Xtreme Life CosmoPolis

Resistant to Vibration

- Potting, fixing internal components
- Strong housing construction
- Connector with spring construction (no screws)



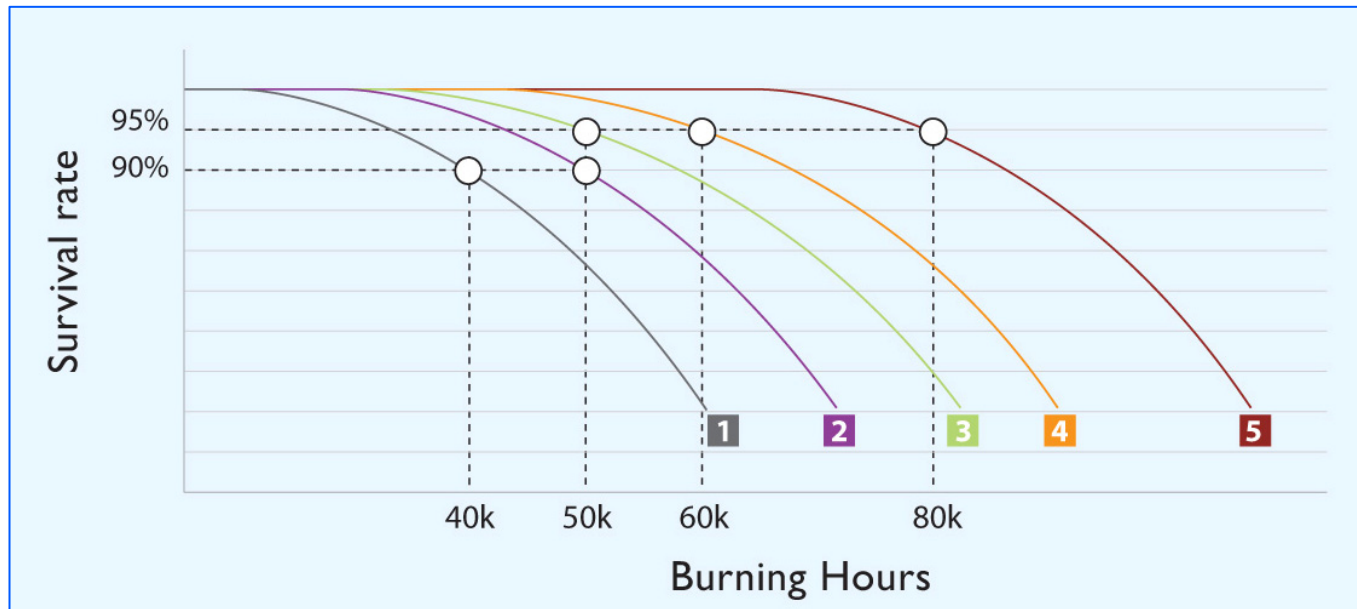
Protected against moisture, insects and other contaminations

- Fully potted, no penetration

Electrical robustness

- Lightning protection 10kV
- Designed and tested to withstand short circuit to ground on the lamp terminals

Overview Lifetimes Electronics

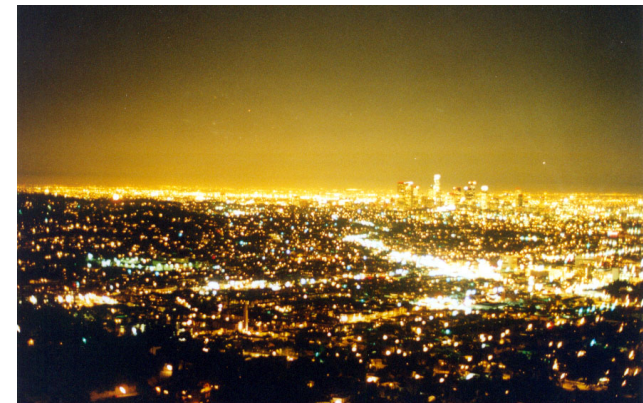


- 1 indoor specification
- 2 outdoor specification 'previous'
- 3 outdoor specification LED
- 4 outdoor specification CosmoPolis / outdoor target specification 2005-2008
- 5 target specification CosmoPolis $\geq$ 2008

Market trends



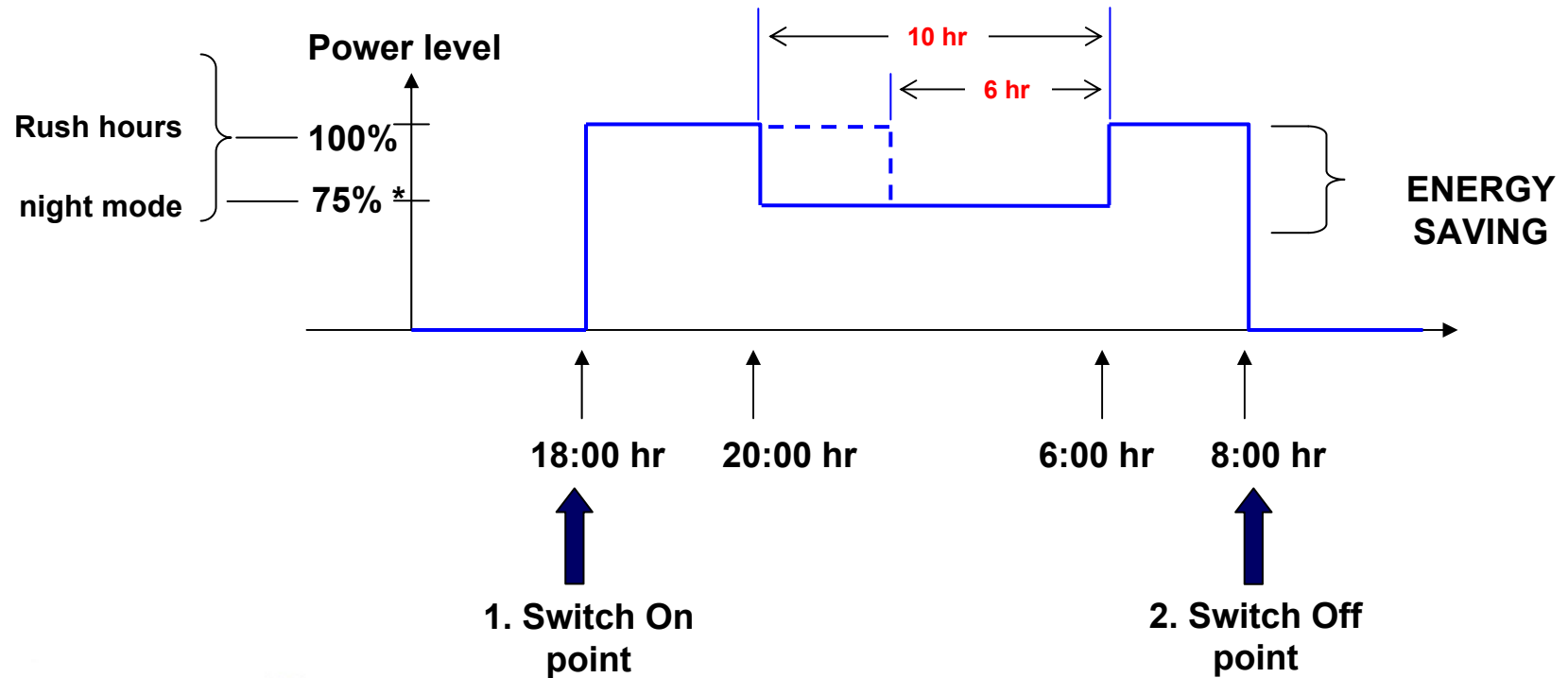
- Need to lower **energy-use** and **CO₂ emission**
- Tendency available control and management systems are **expensive** and **not so easy to maintain**
- Clear need for an easy and **standalone dimming** system



The Philips answer is **LumiStep**

- A **one-component** system for easy installation and reliable operation
- Offers to CosmoPolis additional **energy saving** during night
- **No additional control** equipment needed
- **Install** and **forget**
- Fulfil future demand to **lower energy-use**

CosmoPolis LumiStep 60W

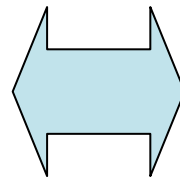


Reference-points are the switch-on and switch-off time, these points will change over the seasons and start en stop dimming moments will

* Full LumiStep : freedom in settings ; dimming to max 60 % in Power

Testimonials

HPS - SON



Cosmopolis

HPM - HPL



Germany : Vechta



- Old installation and Mercury vapour lamp of 125W each;
- Replacement with new Koffer² with Cosmo-R140 optic new CosmoPolis 60W (white) system;
- Spacing remains the same: only the luminaire have been changed.

HPL 125W Old - New CPOT 60W



	Old inst.	New inst.	Savings
Luminaire	Competition	Koffer ² 70 GB	
Quantity/km	28 pcs	28 pcs	
Lamp	1 x HPL 125W	1 x CPO-TW 60W	
Light output	6 300 lm	6 850 lm	+ 9%
System wattage	157 W	67 W	+ 138%
Average luminance L_{ave}	0,24 cd/m ²	0,57 cd/m ²	+ 96%
Average illuminance E_{ave}	4,50 lx	8,80 lx	+19
Colour rendering Ra	46	65	+ 73%
General uniformity U_o	0,33	0,57	+ 155%
Longitudinal uniformity U_l	0,22	0,56	- 57%
Energy consumption/km	4,396 kWh/km	1,876 kWh/km	1 512,00 €
Energy cost/year/km	2 638 €	1 126 €	
Energy consumption/year/km	17 584 kWh	7 504 kWh	
CO ₂ /year/km	7,07 t	3,02 t	4,05 t

More light...with better quality... can lead to money savings...
...and better care for the environment

Benefits



- For the end-user (driver, pedestrian, inhabitant...)
 - More light per lighting point;
 - Better light quality (better colour rendering, better uniformity...)
- For the municipality
 - Better total cost of ownership due to energy savings
 - Less “energy cost increase” dependency;
- For the environment
 - No more hazardous substances (Mercury)
 - CO₂ emissions reduced by 57% !

Comparison in-situ



Amateur photoshots with automatic digital still camera. Same camera with automatic settings for both pictures. Same hour.



CO² Tool calculation

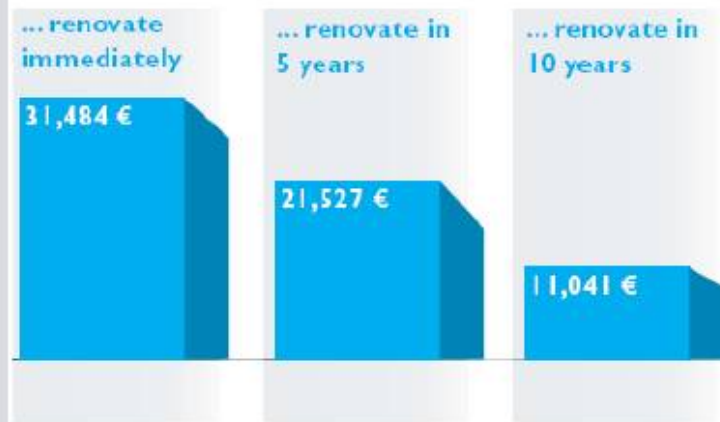


Vechta: a profitable investment



Vechta renovation of an old installation with Koffer²

This is how much you can save if you ...



Compare:

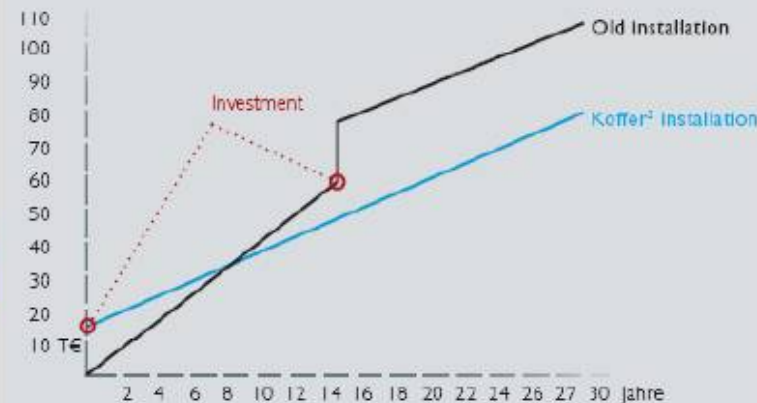
The calculation is based on a luminaire lifetime of 30 years. The old installation in this example is 15 years old and will have to be renovated in 15 years at the latest. The Koffer² luminaire starts to pay for itself in the calculation shown after 8.5 years, 6.5 years ahead of the planned renovation. The longer renovation is put off, the greater the reduction in potential savings due to the higher operating costs of the old installation.

Fact:

The longer the investment is put off, the higher the cost of the installation over the 30-year operating period.

Comparison of operating costs

Length of the installation: 1 km; operating hours: 4,000; spacing between 2 luminaires: 30 m; price per kWh: 0.15 euros; inflation rate: 1%; arithmetical interest rate: 4%



	Koffer² installation	Old installation
Age of the installation	-	15 years
Remaining life	30 years	15 years
Lamp	CPO-TW 60W	HPL-N 125W
Investment costs	14,339 euros (immediately)	16,927 euros (in 15 years)*
Maintenance costs	25,857 euros	26,331 euros
Energy costs	39,000 euros	67,421 euros
Overall costs	79,196 euros	110,680 euros
Saving	31,484 euros	

* invested in the Koffer² installation described

In our calculated example a number of factors have been taken into account that have not been identified in the above scenario. Other factors, the overall effect of which is negligible, have not been included in the calculation for the sake of clarity.

South Tyneside, UK - SON replaced by CPOT



Lamp: Philips CosmoWhite 60W

Luminaire: Iridium Philips

Location: South Tyneside, UK

Porto, Portugal



Lamp: Philips CosmoWhite 140W

Luminaire: Zapio

Location: Porto, Portugal

Somosaguas (Madrid), Spain



Lamp: Philips CosmoWhite 140W

Luminaire: Modena, Philips/Mazda

Location: Somosaguas (Madrid), Spain

"We are very satisfied indeed. The lighting complies with our strict aesthetic requirements. The white light is closer to natural vision, which increases the feeling of safety and the quality of life for local inhabitants as well as increasing property values in the area."

Spokesman at the Pozuelo de Alarcón town hall in Madrid

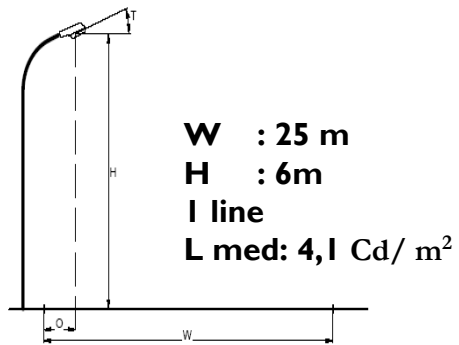
Somosaguas (Madrid), Spain



Somosaguas' energy costs, and therefore CO2 emissions, have been cut by 47%.

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Somosaguas 2nd phase: Spain



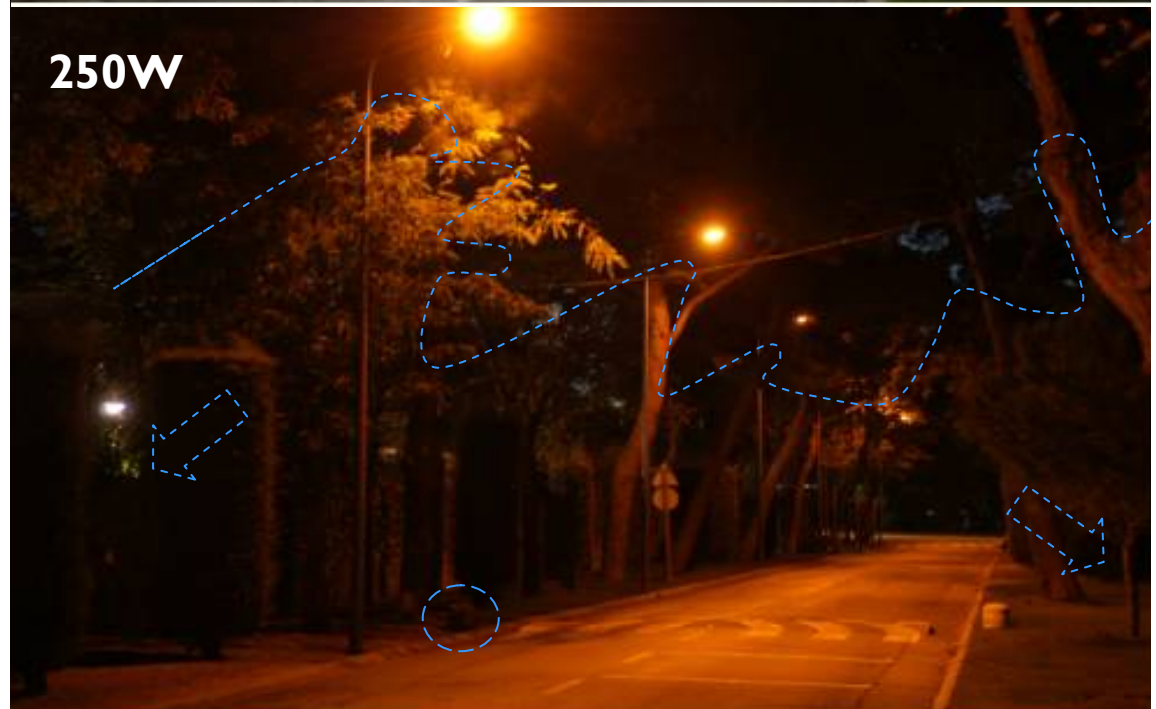
Proyect

- Area residencial
- 300 systems
- Modena SGP68I
- CPO-TW 140W

140W



250W



Brussels, Belgium



Lamp: Philips CosmoWhite 60W

Luminaire: Metronomis Cambridge, Philips Luminaires

Location: Goffinlaan in St.-Agatha-Berchem, Brussels, Belgium

"MASTER CosmoWhite has a better light output and at the same time a lower energy consumption. We did not need a 70W but only a 60W lamps, with negligible losses in the gear. Furthermore the lifetime was a clear advantage."

Marc Baeten, technical supervisor

Brussels, Belgium



White light for better colour rendering and greater safety for road users.

Antwerp, Belgium (Leien)



Lamp: Philips CosmoWhite 60W – 140W

Luminaire: Neos, Schröder

Location: Leien, Antwerp, Belgium

“The use of white light is a growing trend in urban environments. Thanks to CosmoWhite we not only have the white light, but also a considerable energy saving of 22%.”

Rudy de Bock, public lighting department Antwerp

Antwerp, Belgium (Berchem)



Lamp: Philips CosmoWhite 140W

Luminaire: Selux

Location: Antwerp, Berchem station square, Belgium

Turnhout, Belgium



Lamp: Philips CosmoWhite 60W

Luminaire: Belgica Schröder

Location: Turnhout, Belgium

Coevorden, The Netherlands



Lamp: Philips CosmoWhite 60W

Luminaire: Metronomis Porto, Philips Luminaires

Location: Coevorden, The Netherlands

Milan, Italy



Lamp: Philips CosmoWhite 60W

Luminaire: MiniMilewide, Philips

Location: Milan, Italy

An-yang city, Korea



Lamp: Philips CosmoWhite 140W

Luminaire: MiniMilewide, Philips

Location: An-yang city, Korea

Romania ; Boekarest



Lamp: Philips CosmoWhite 140W

Luminaire: Hestia Schröder

Location: Romania

France;

FLERS (61)



Luminaires Philips Milewide + MASTER CosmoWhite 140W

Lamp: Philips CosmoWhite 140W

Luminaire: Milewide

Location: Flers

France ;



Lamp: Philips CosmoWhite 140W

Luminaire: Modena

Location: IFS

Germany ; Böblingen



Lamp: Philips CosmoWhite 60W

Luminaire: koffer

Location: Böblingen

Germany ; Böblingen

	Old installation	Redeveloped installation	
Luminaire type	Koffer 70	Koffer ² 70 GB	
Lamp type	2xHPL 80W	1xCPO-TW60W	
Lamp luminous flux	7400 lm	6850 lm	-7%
System power	179 W	65 W	
Medium luminance	0,27 cd/m ²	0,32 cd/m ²	19%
Total uniformity U ₀	0,25	0,40	60%
Longitudinal uniformity U _l	0,61	0,54	-11%
Threshold rise TI	12,1%	9,4%	
Sidewalk near to mast E _m (E _{min})	6,45 lx (1,56 lx)	4,41 lx (1,31 lx)	(
Sidewalk afar from mast E _m (E _{min})	0,93 lx (0,74 lx)	1,97 lx (1,0 lx)	
Power input	5,594 kW/km	2,031 kW/km	-64%
Specific power input	20,718 kW/km/cd/m ²	6,348 kW/km/cd/m ²	-69%
Energy consumption/Year*km(*)	15.383 kW	8.125 kW	-47%
CO ₂ /Year*km(*)	6,18 t	3,27 t	-47%

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sense and simplicity