

SAMSUNG

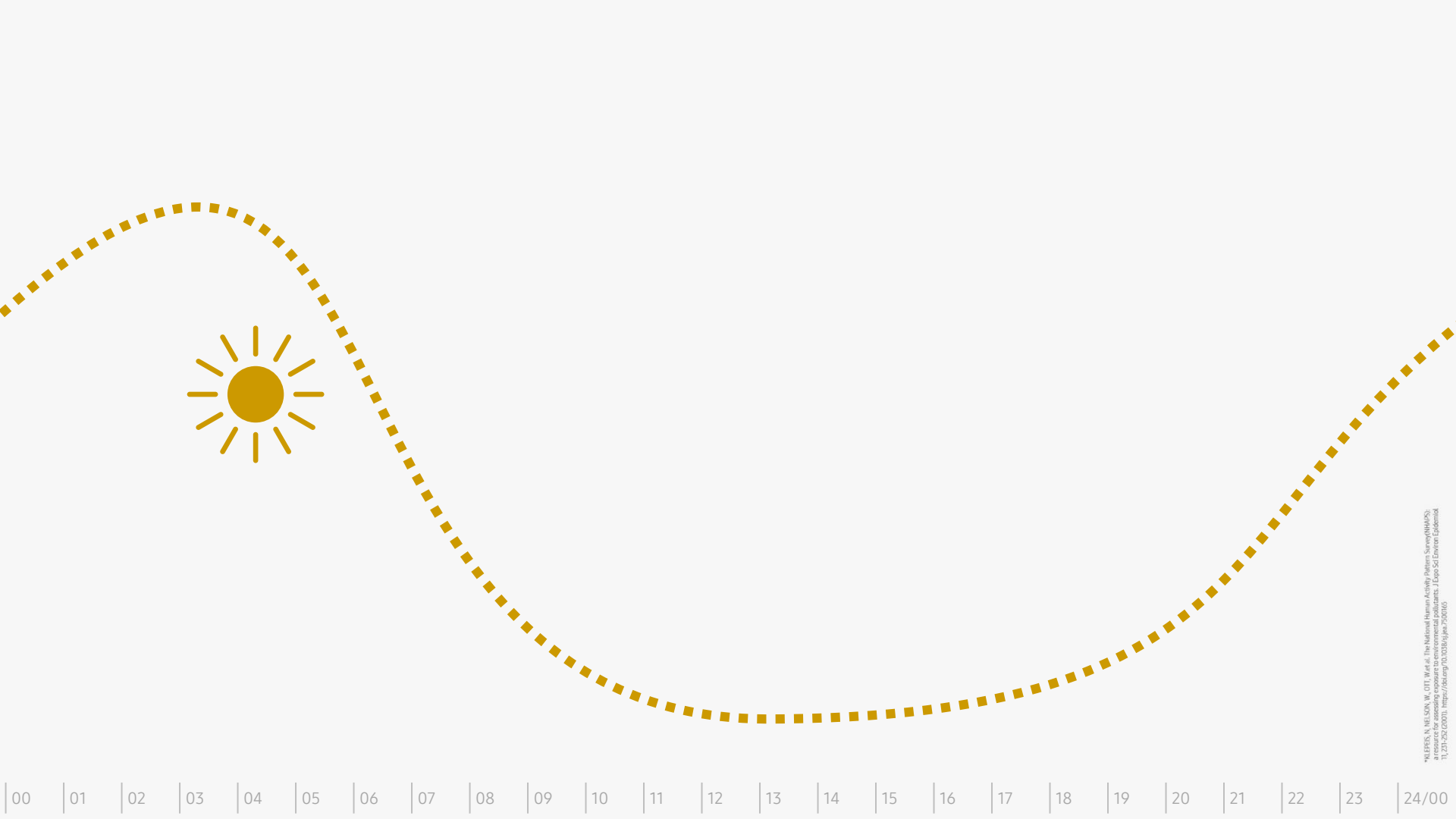
the next General Lighting

2021-03-24, Human Centric Lighting

Future Lighting Trends, ATMK

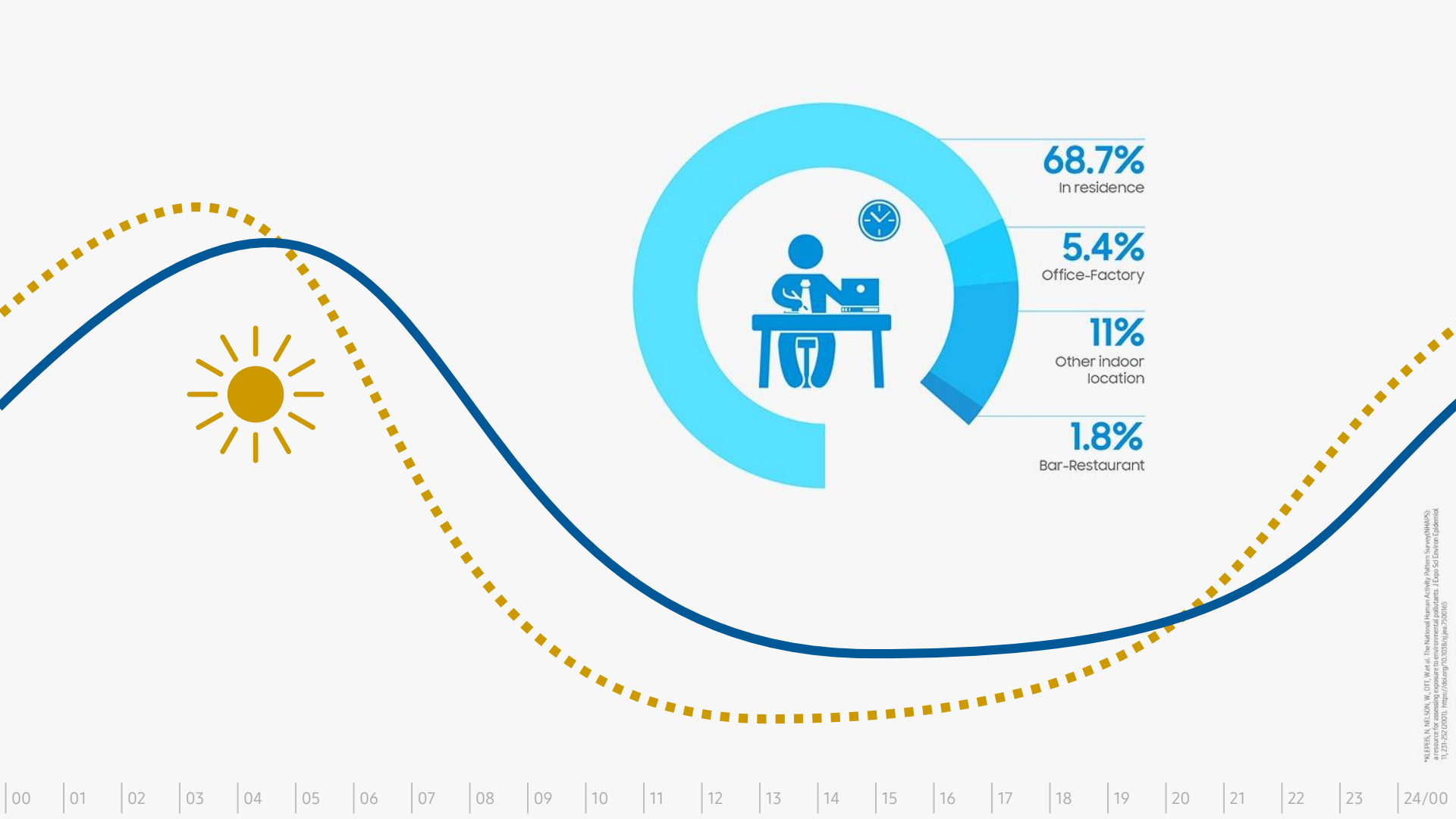


Ideal Melatonin Level over 24h



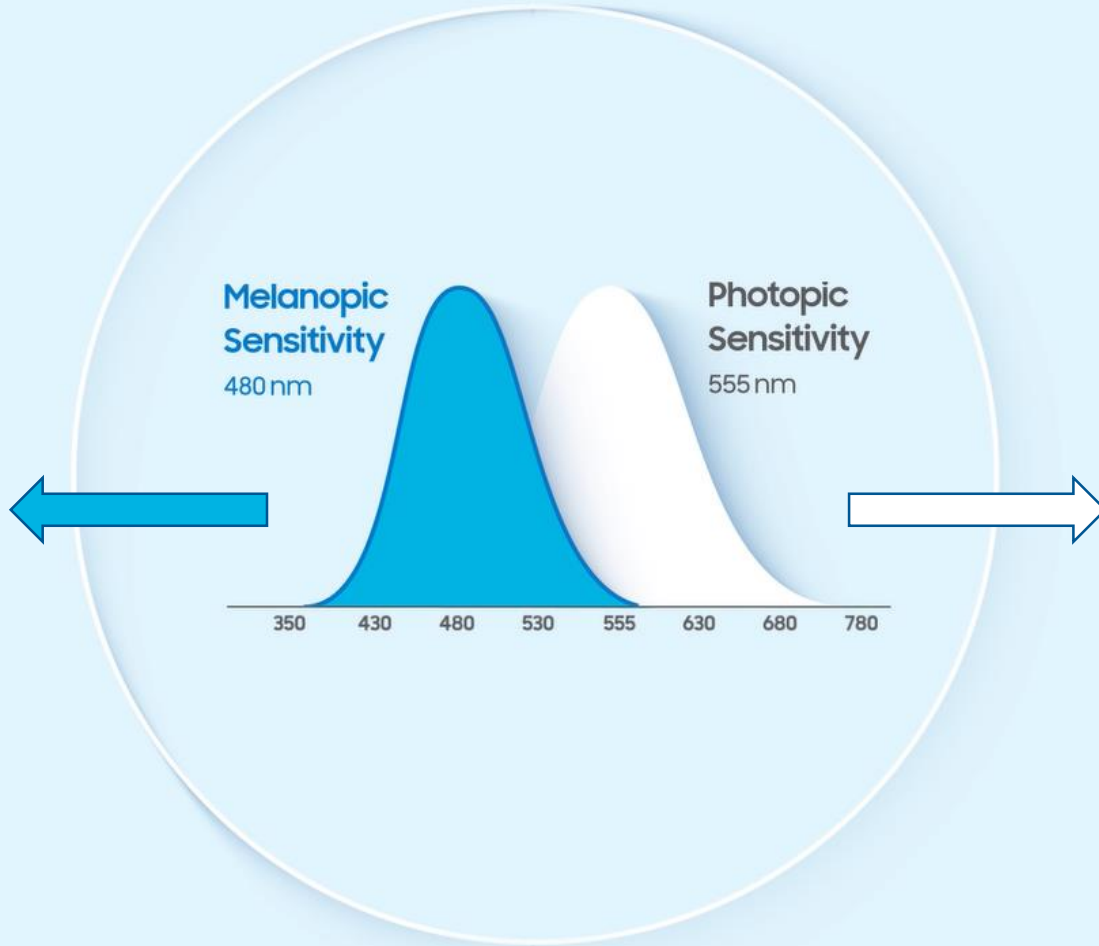
00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24/00

*MEFFRS, N., NELSON, W., OTT, W. et al. The National Human Activity Pattern Survey(NHAPS): a resource for assessing exposure to environmental pollutants. J Expo Sci Environ Epidemiol. 11, 231-254 (2001). <https://doi.org/10.1038/9407500102>



*MEFFERS, N., NELSON, W., OTT, W. et al. The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. J Expo Sci Environ Epidemiol. 11, 221-228 (2001). <https://doi.org/10.1038/9807500102>

**Non-visual
Effects**

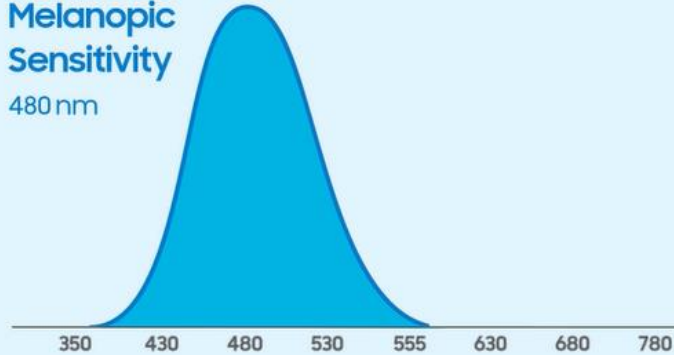


**Visual
Effect**

**melanopic flux
is crucial for
activation &
concentration**

**Melanopic
Sensitivity**

480 nm

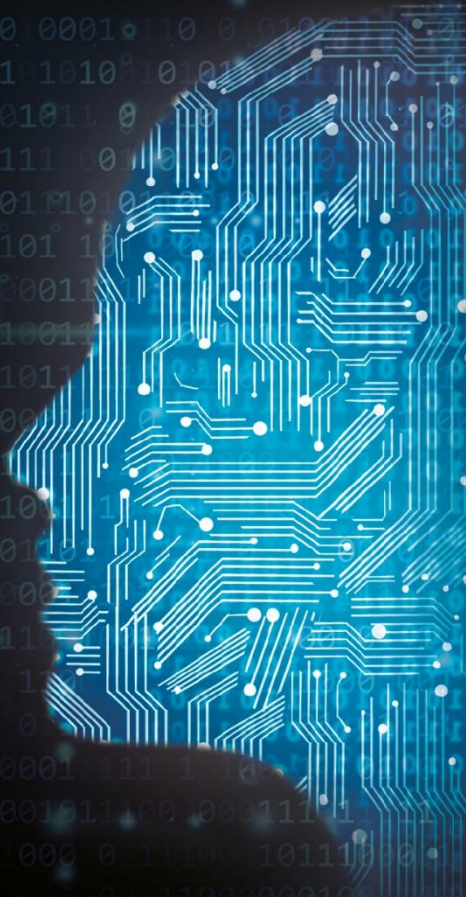


SAMSUNG

4000K, 5000K or 6500K?

500lux, 1000lux or more?

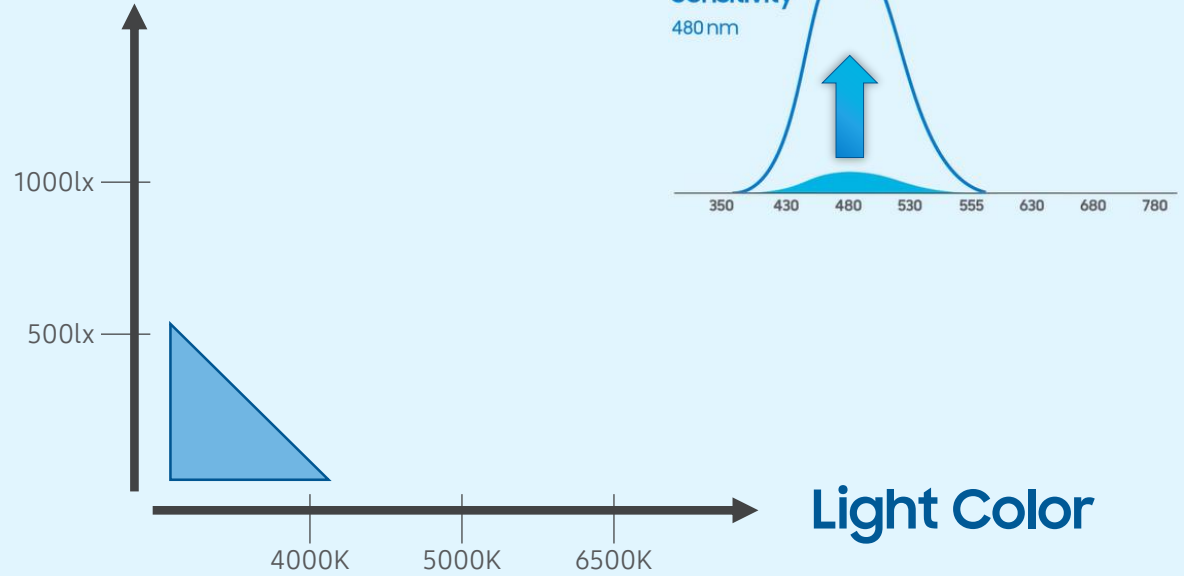
How to improve lighting for daytime?



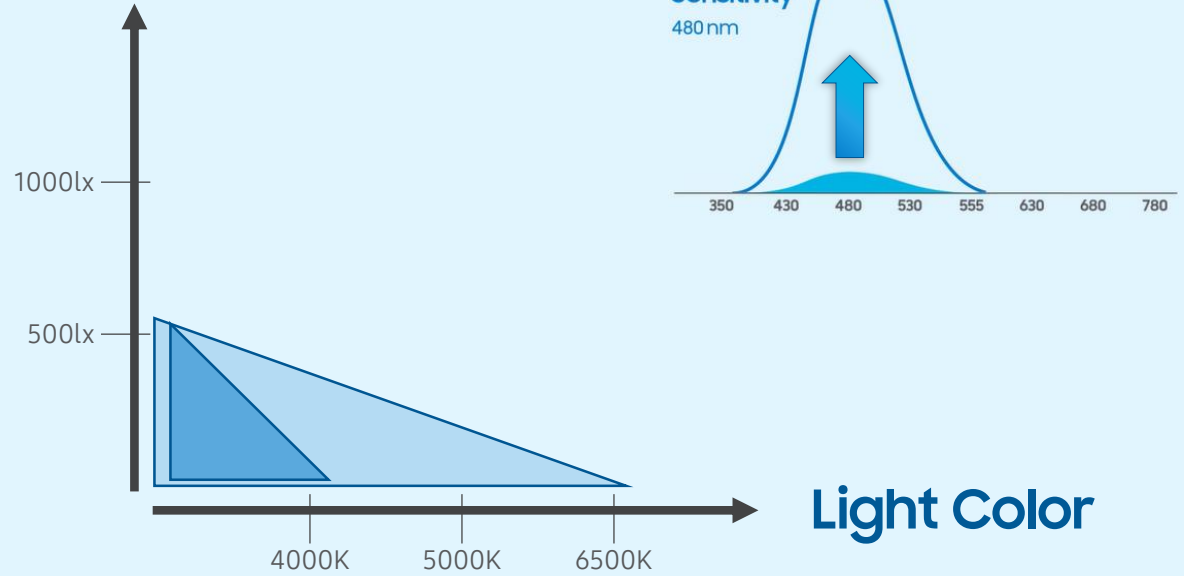
Norms of Lighting on Productivity

Researchers	Subjects	Results	URL
U.S. Department Energy (2017)	Classrooms at middle school (in Carrollton, a northern suburb of Dallas, USA)	Enhanced overall learning ability	https://www.energy.gov/sites/prod/files/2017/10/f37/2017_gateway_tuning-classroom_0.pdf
Department of Industrial Design, KAIST (2016)	2 Classrooms at elementary school (Republic of Korea)	Improved test scores at 6500K	https://www.osapublishing.org/oe/fulltext.cfm?uri=oe-24-10-A907&id=340246
The University of Mississippi The University of Texas, Austin (2012)	84 people aged from 7 to 8 (4 public school classrooms at south central region, USA)	Enhanced reading fluency at 6500K	https://journals.sagepub.com/doi/full/10.1177/2158244012445585
University of Twente, Enschede The Philips Lighting (2012)	89 elementary school students (The Netherlands)	Better learning ability at bright and blue enriched CCT	https://journals.sagepub.com/doi/abs/10.1177/1477153512446099
The society of light and lighting (2016)	94 Federal government workers (USA)	Improved vitality, energy levels and lower sleepiness	https://www.researchgate.net/publication/322346542_Circadian-effective_light_and_its_impact_on_alertness_in_office_workers

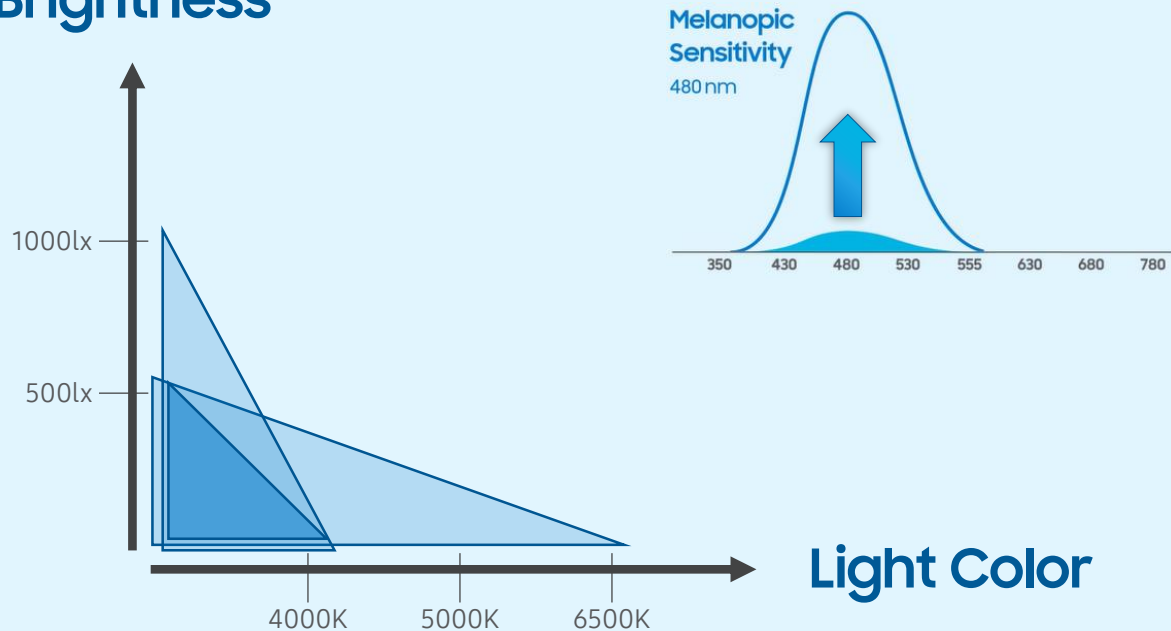
Brightness



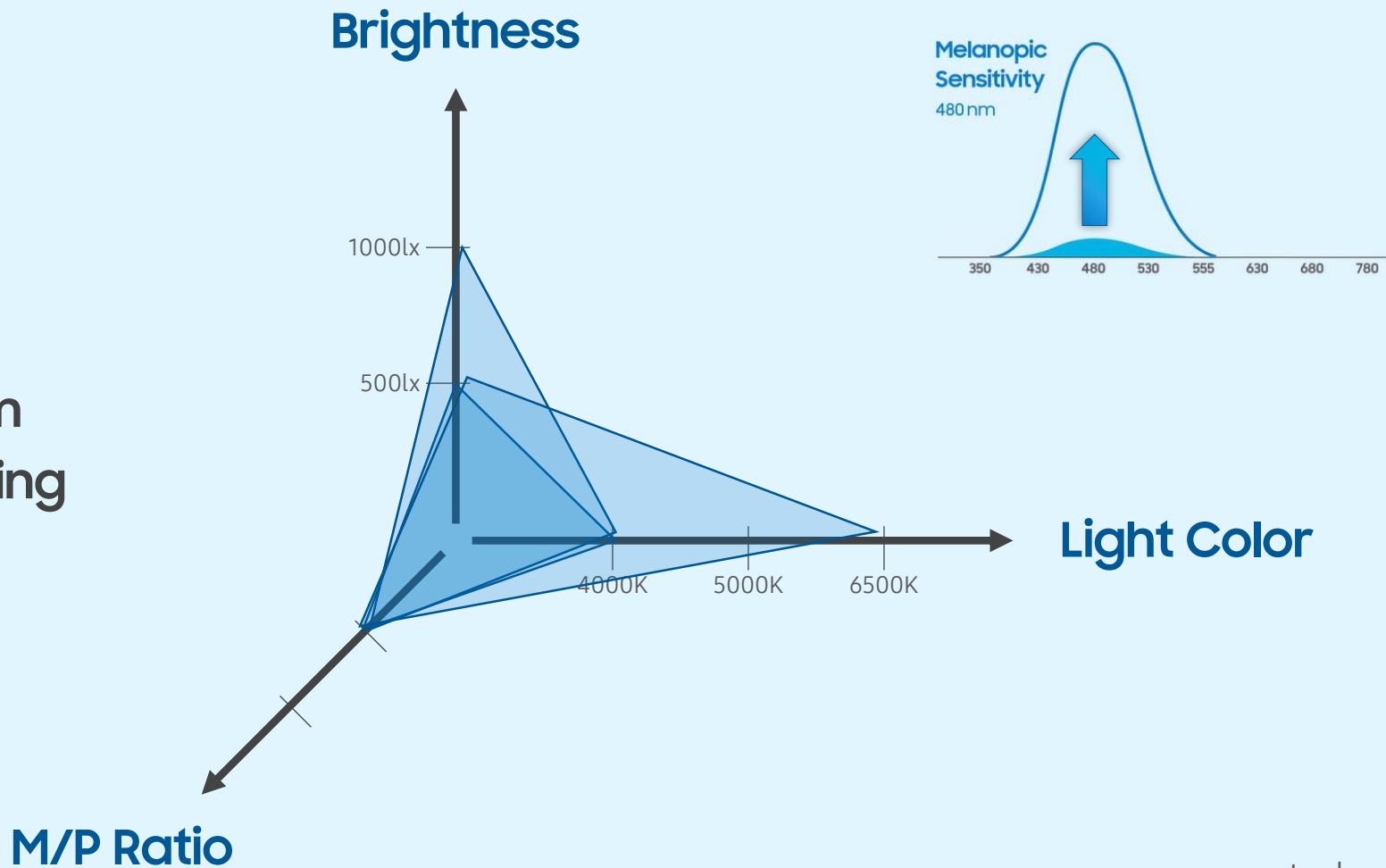
Brightness



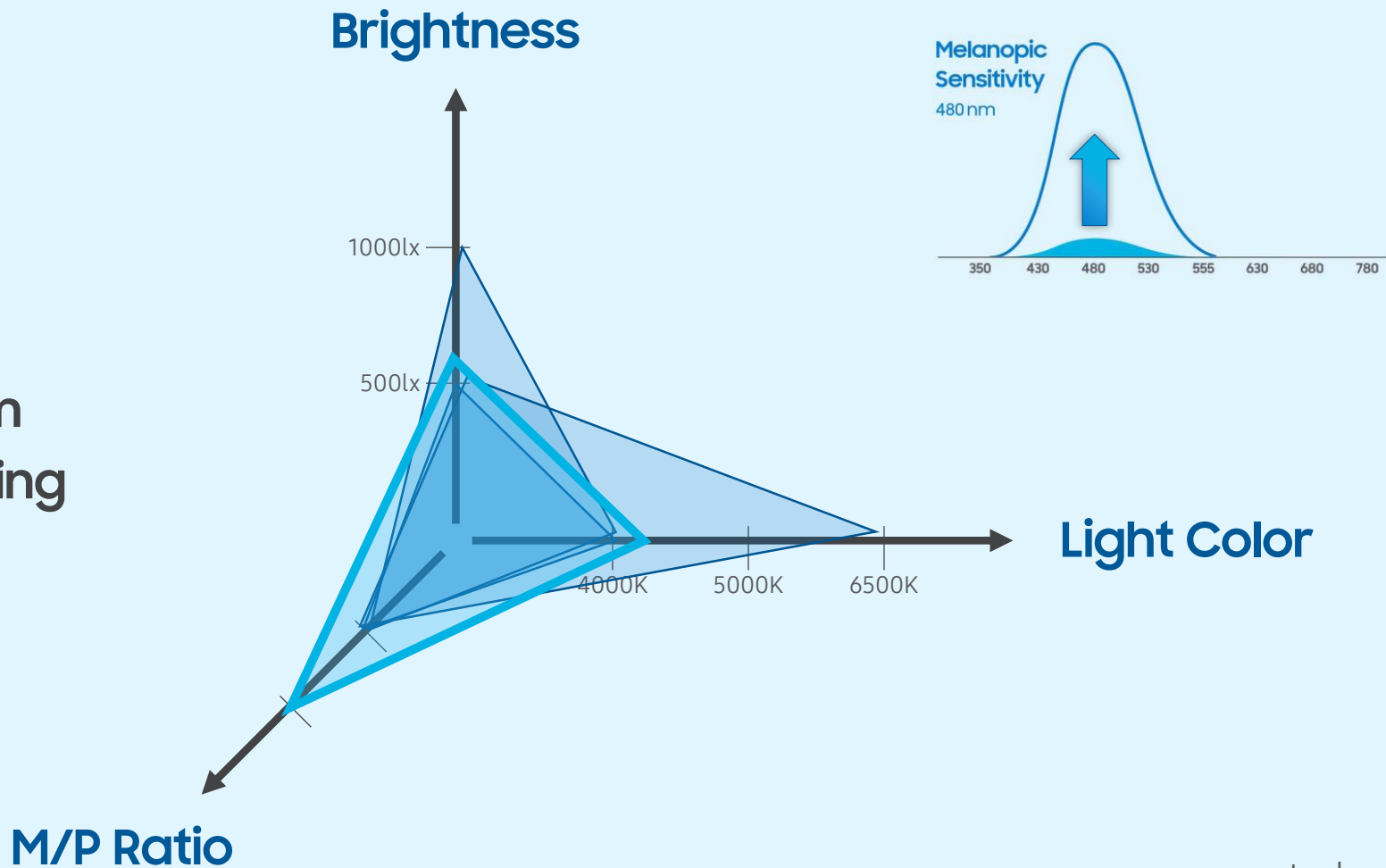
Brightness



Adding Spectrum Engineering



Adding Spectrum Engineering



Same CCT, Same Lux, Same Lighting?

5000K, 500 lux lighting at the room.

Do you see any difference between two pictures?



Picture A

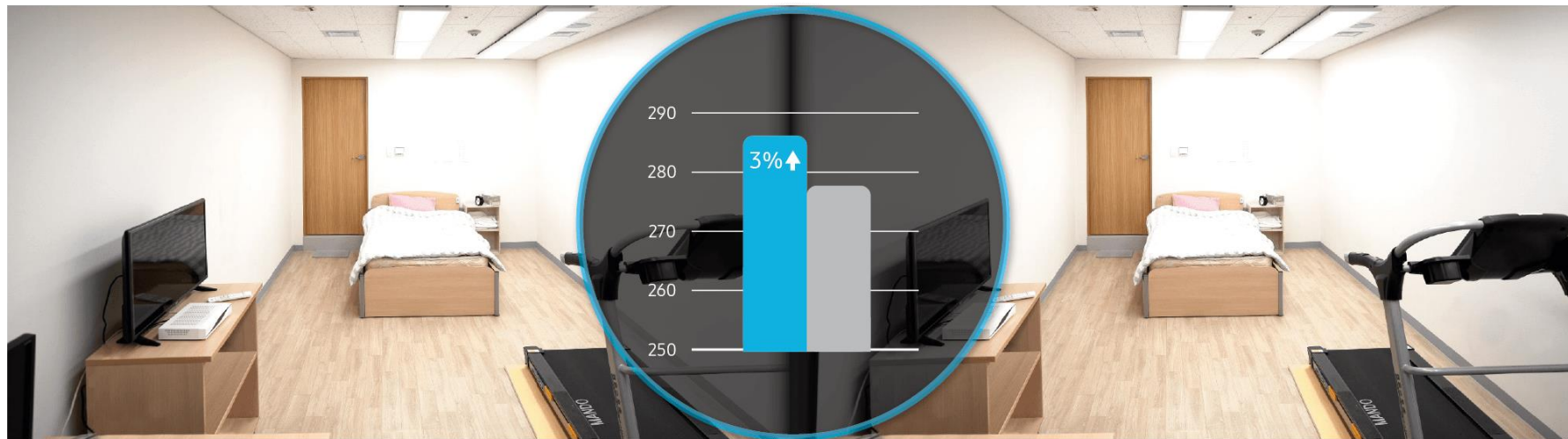


Picture B

Same CCT, Same Lux, Same Lighting?

Clinical test reveals different results on concentration level between subject groups.

Why?



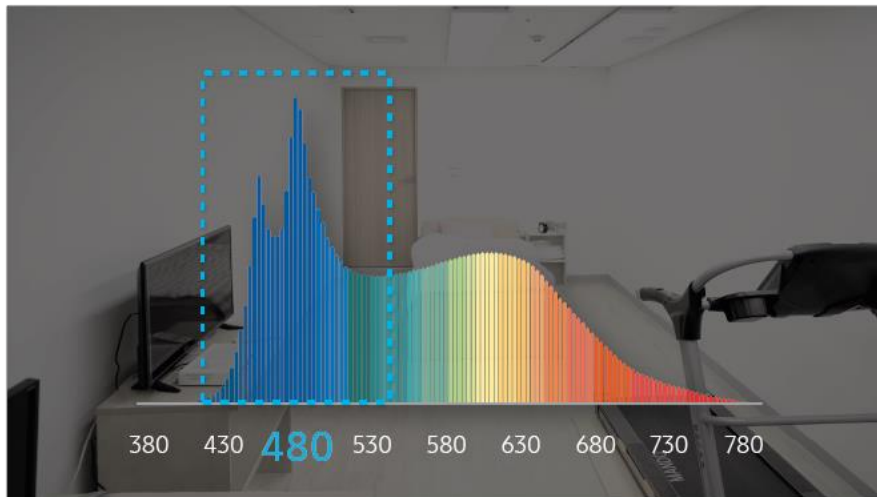
Picture A

Picture B

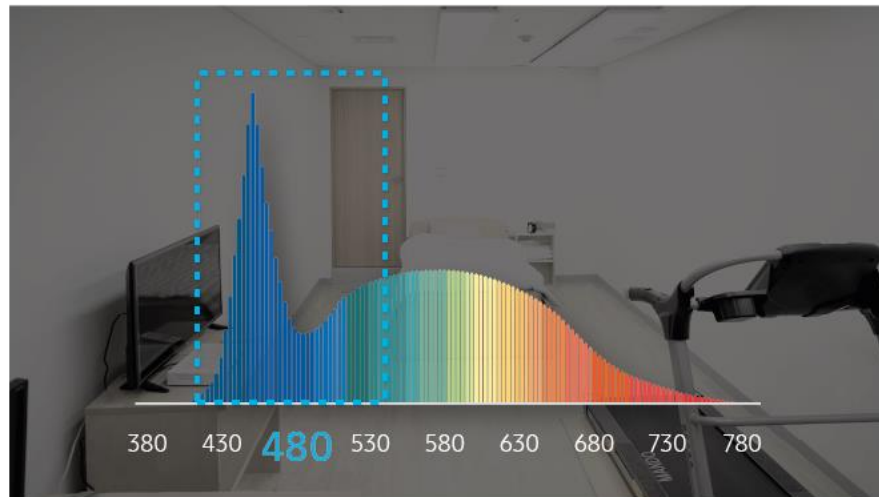
What You See Is Not Everything

The lightings look indistinguishable to the eyes.

Nevertheless, the fundamental element of light, **the spectra were different.**

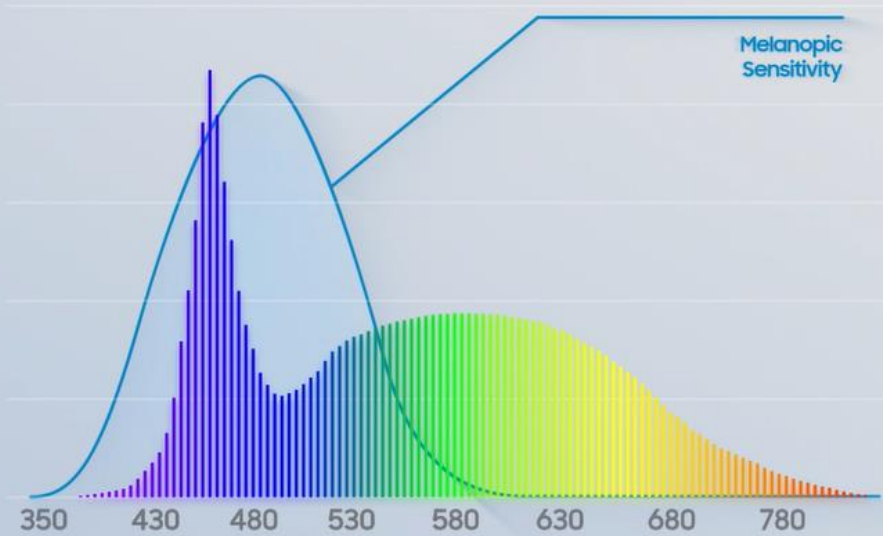


5000K, 500 lux of Samsung's LM302N DAY

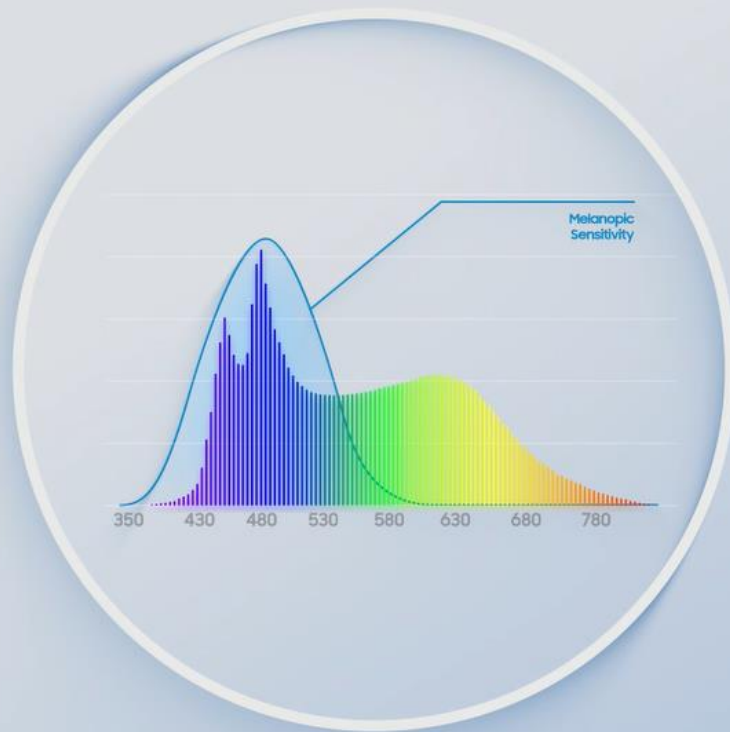


5000K, 500 lux of Conventional Mid-power LED

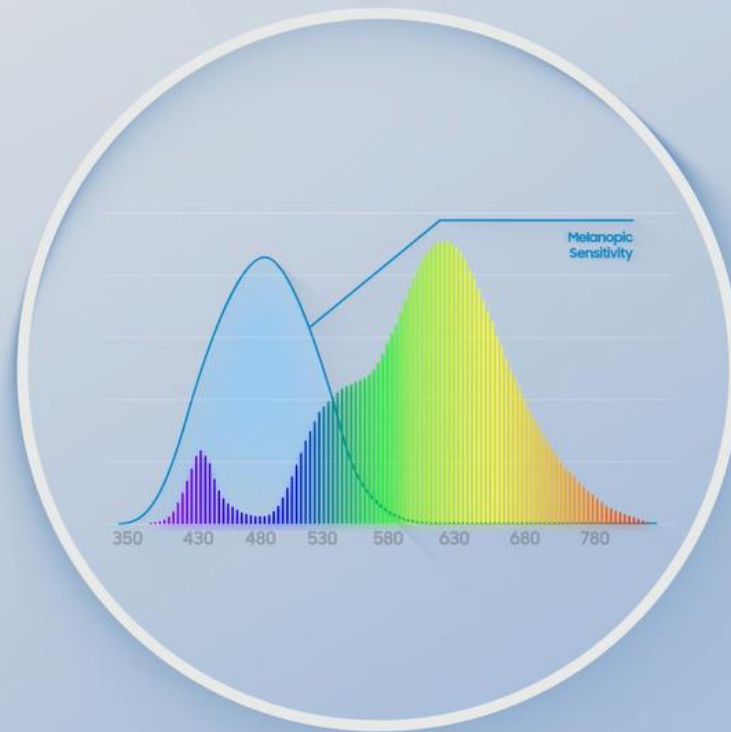
Conventional White LED



For the Energetic Moments

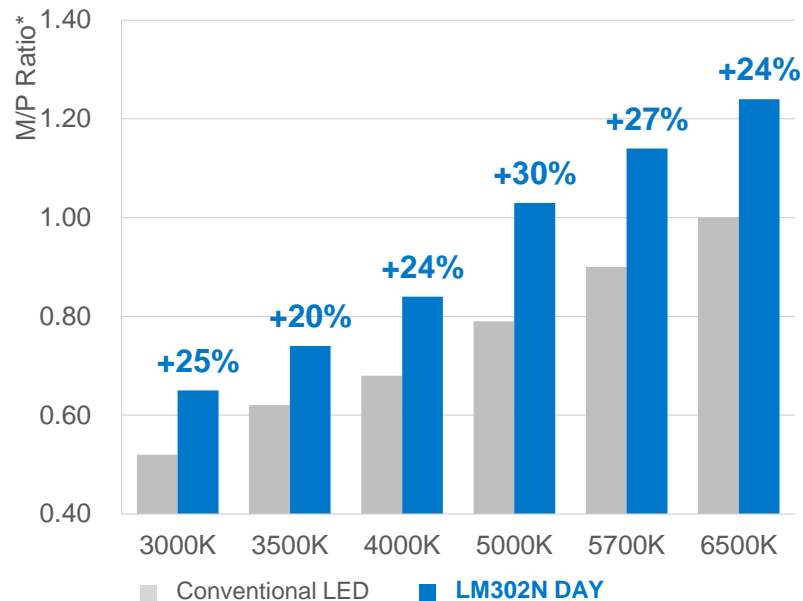
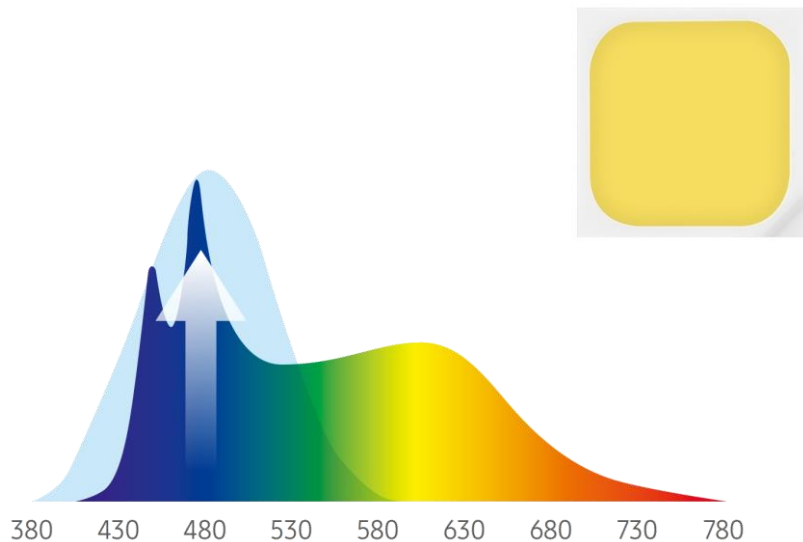


For the Relaxing Moments



LM302N DAY: Higher M/P Ratio with Cyan-rich Spectral Composition

The higher M/P ratio*, the higher MEDI** and energizing effect

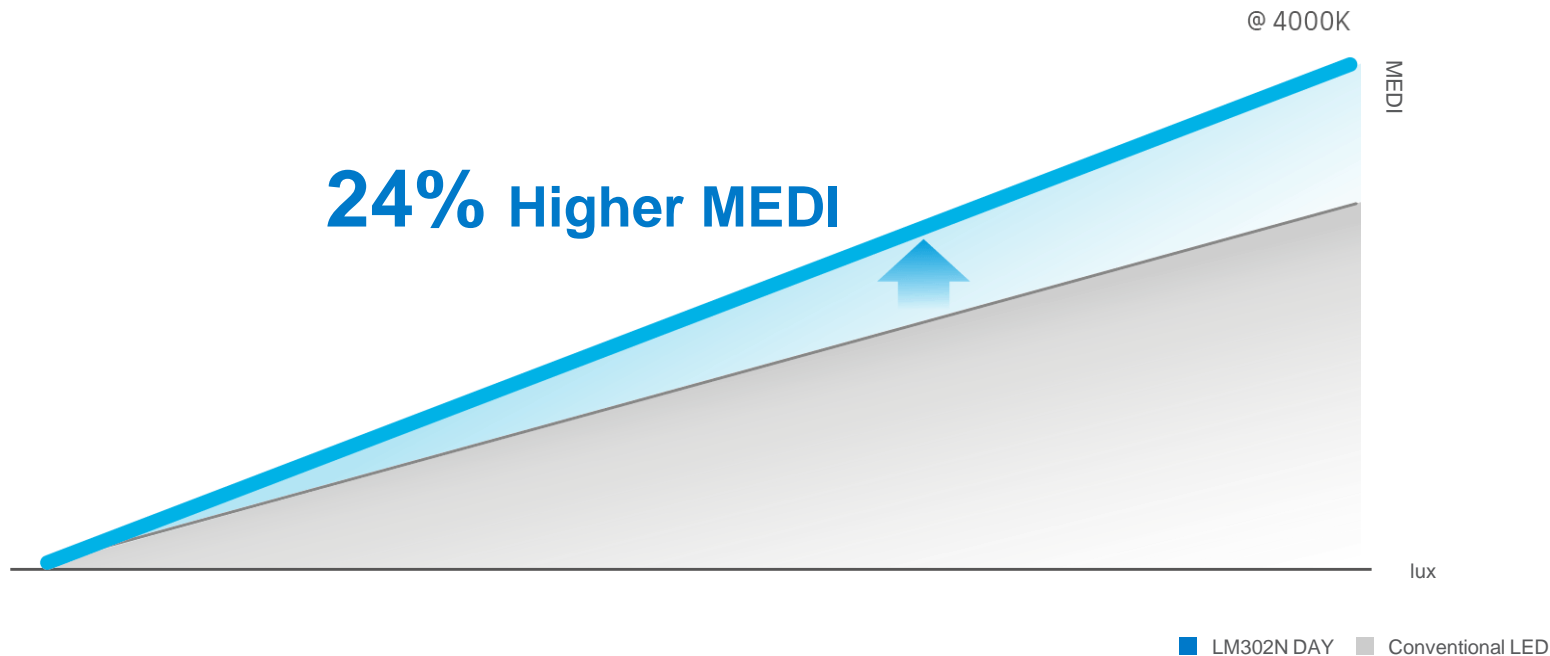


* M/P Ratio (Melanopic/Photopic Ratio)

** MEDI (Melanopic Equivalent Daylight Illuminance)

Same Appearance, Higher MEDI

Higher effects on productivity without changing appearance of lighting

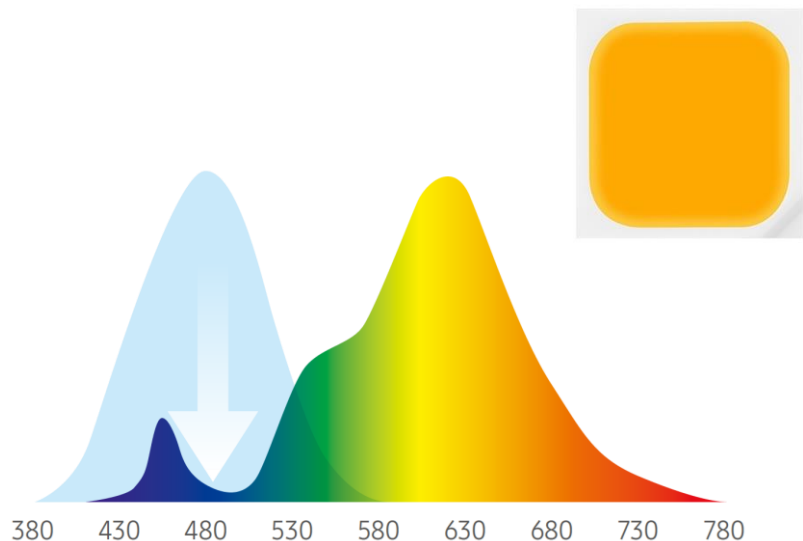


Every place with the right light for concentration



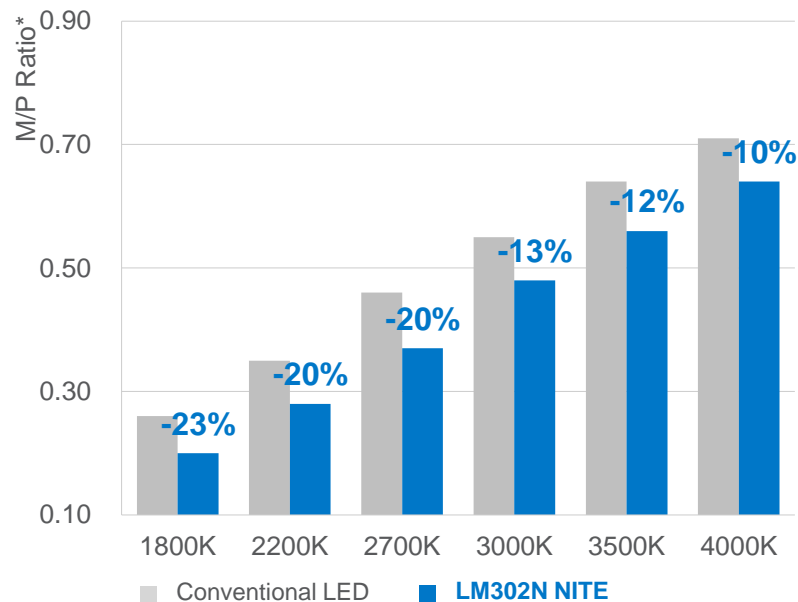
LM302N NITE: Lower M/P Ratio with Cyan-gap

Lower M/P Ratio by directly controlling cyan enhances melatonin secretion levels



* M/P Ratio (Melanopic/Photopic Ratio)

** MEDI (Melanopic Equivalent Daylight Illuminance)

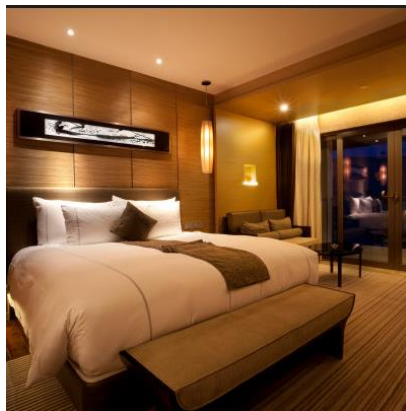


* M/P Ratio: Melanopic/Photopic Ratio

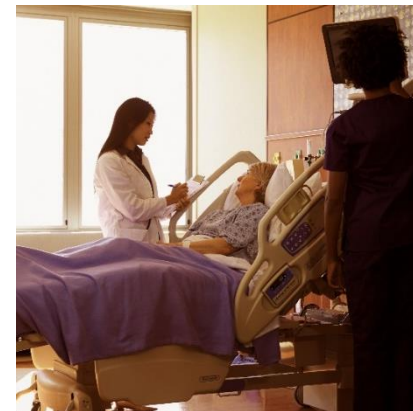
Every place with the right light for relaxing



Residential



Hospitality



Medical & Care

HCL must become General Lighting

There are key considerations in human-centric lighting to being a practical lighting

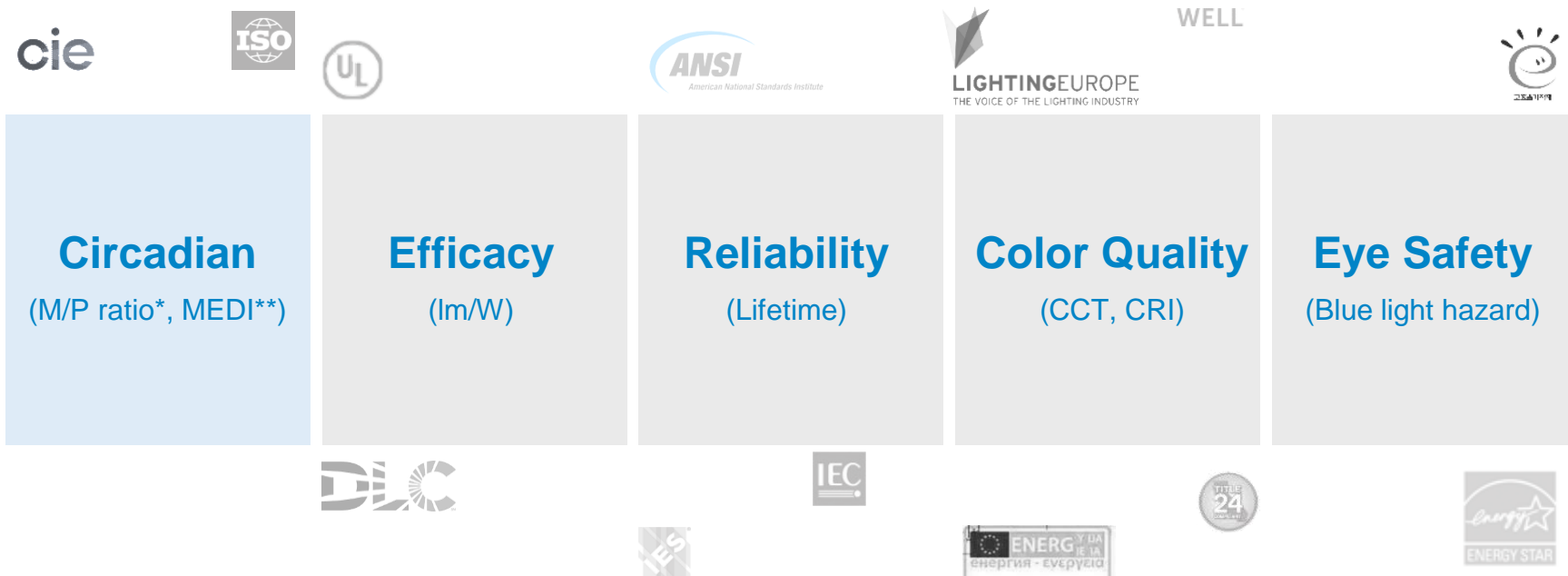


* M/P Ratio: Melanopic/Photopic Ratio

** MEDI: Melanopic Equivalent Daylight Illuminance

HCL must become General Lighting

There are key considerations in human-centric lighting to being a practical lighting



* M/P Ratio: Melanopic/Photopic Ratio

** MEDI: Melanopic Equivalent Daylight Illuminance

HCL must become General Lighting

There are key considerations in human-centric lighting to being a practical lighting



* M/P Ratio: Melanopic/Photopic Ratio

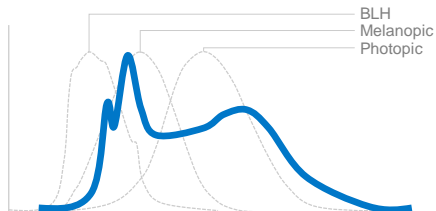
** MEDI: Melanopic Equivalent Daylight Illuminance

LM302N DAY - First Practical HCL Component

Controlling direct-cyan realizes well balanced energizing lighting solution

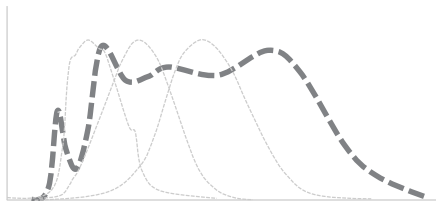
LM302N DAY

Blue Chip + Cyan Chip



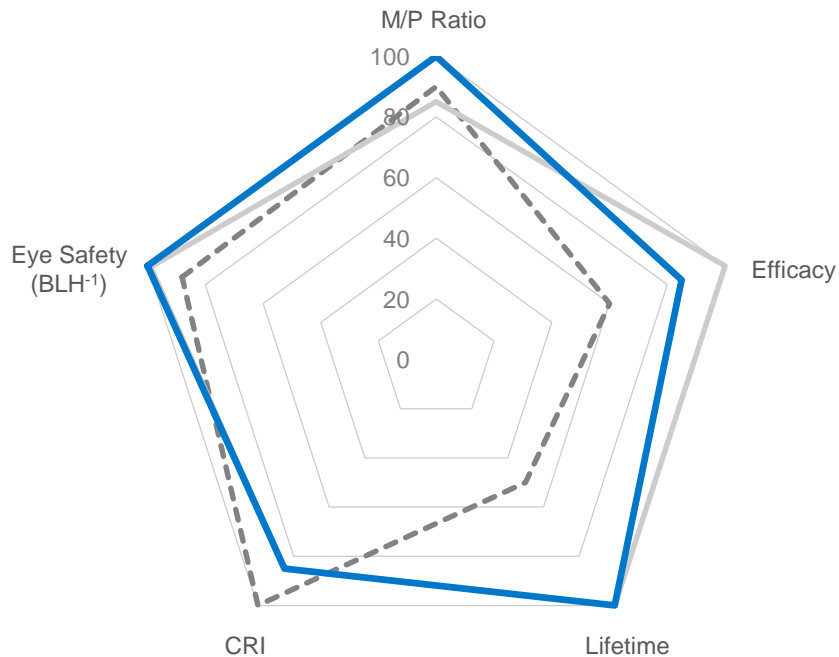
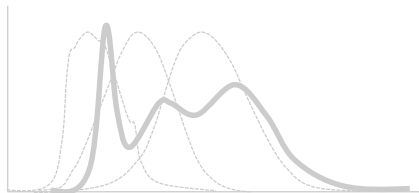
Near UV Solution

nUV Chip + Blue Phosphor



Phosphor approach

Blue Chip + Short Green Phosphor

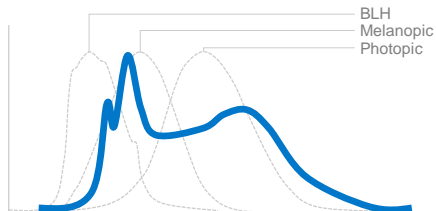


LM302N DAY - First Practical HCL Component

Controlling direct-cyan realizes well balanced energizing lighting solution

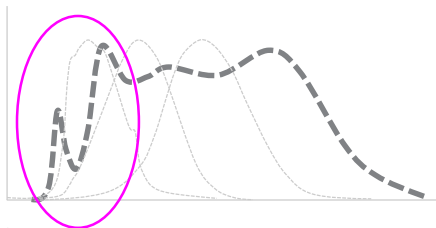
LM302N DAY

Blue Chip + Cyan Chip



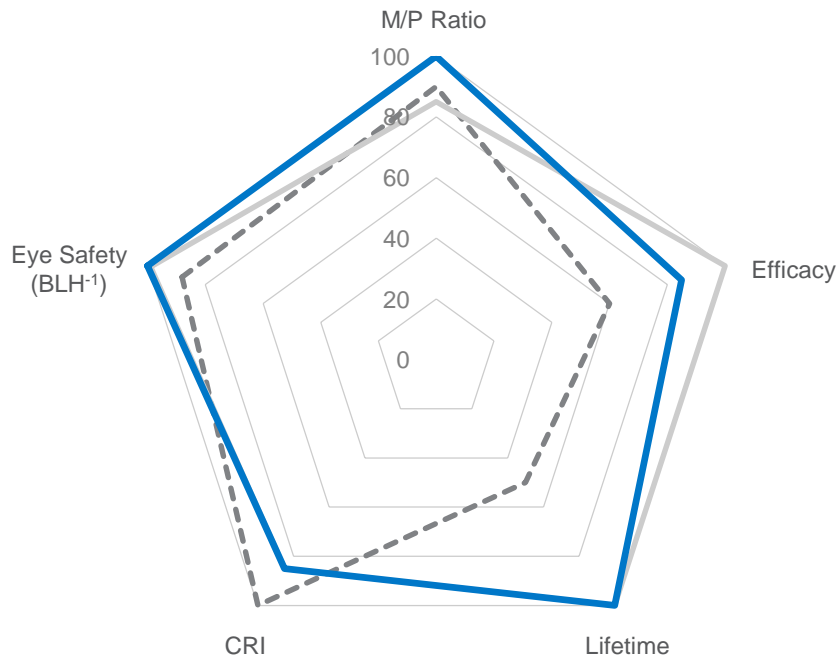
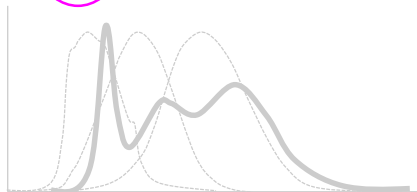
Near UV Solution

nUV Chip + Blue Phosphor



Phosphor approach

Blue Chip + Short Green Phosphor

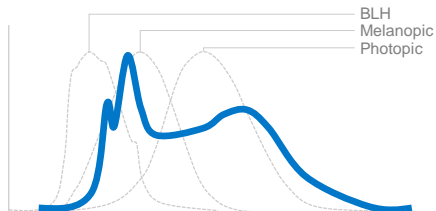


LM302N DAY - First Practical HCL Component

Controlling direct-cyan realizes well balanced energizing lighting solution

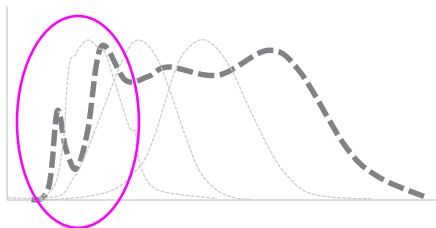
LM302N DAY

Blue Chip + Cyan Chip



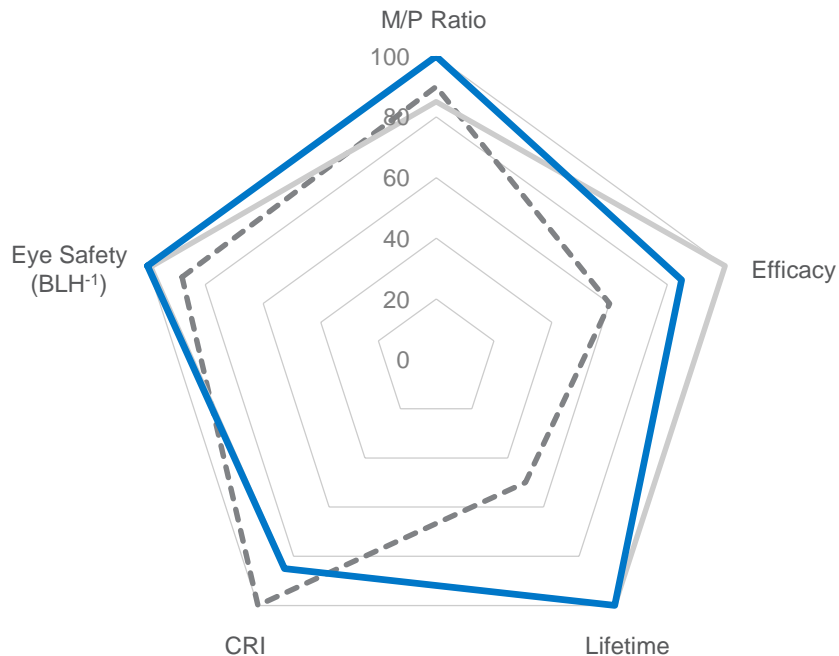
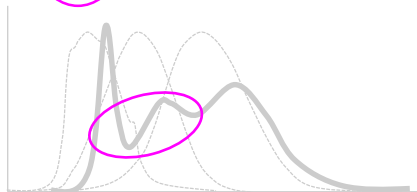
Near UV Solution

nUV Chip + Blue Phosphor

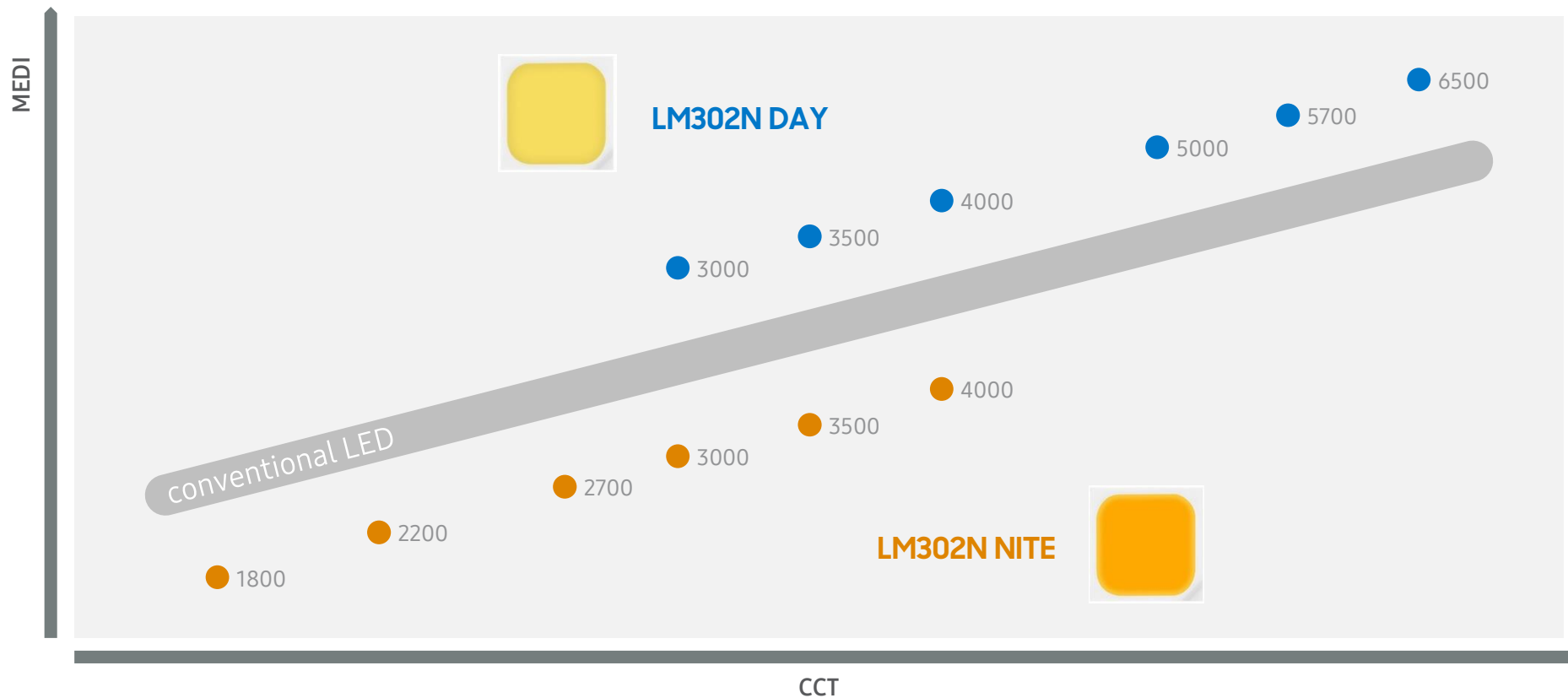


Phosphor approach

Blue Chip + Short Green Phosphor

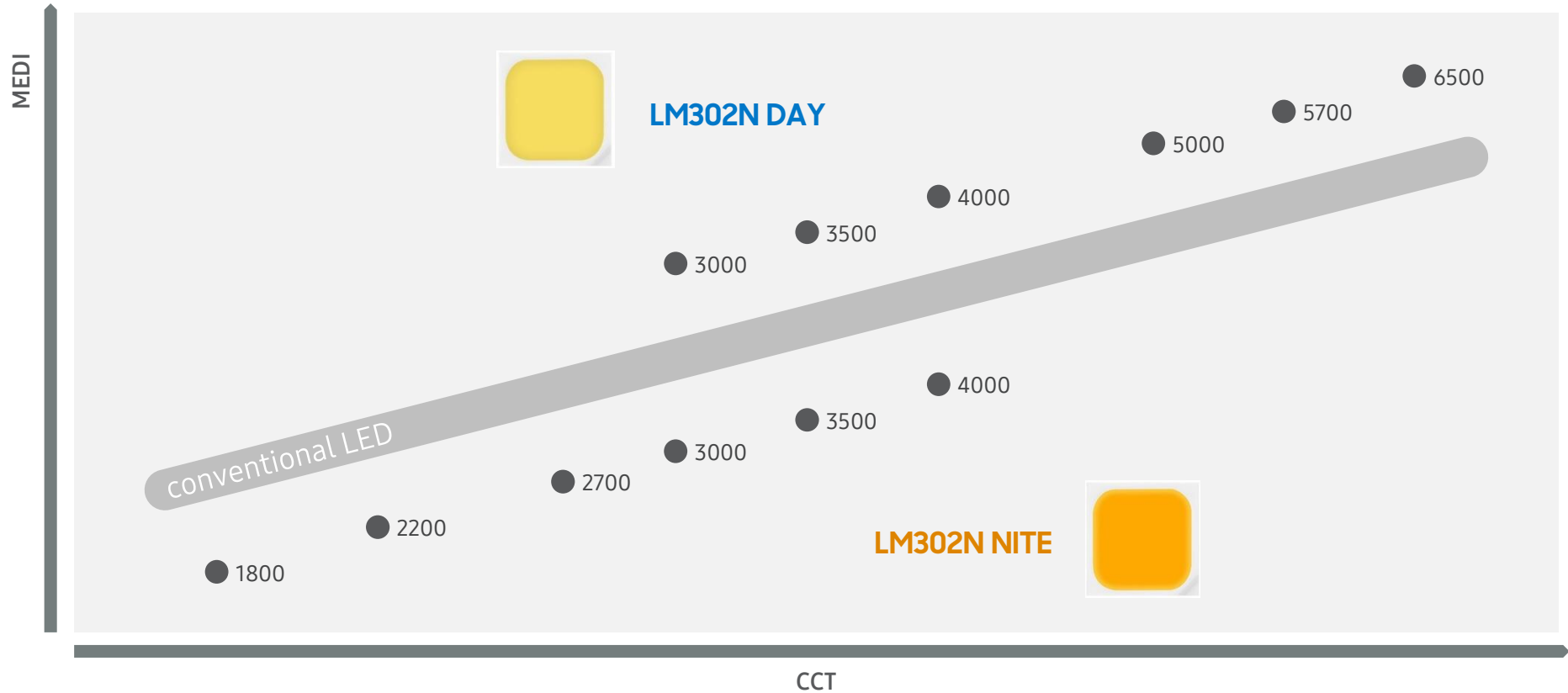


LM302N DAY & NITE



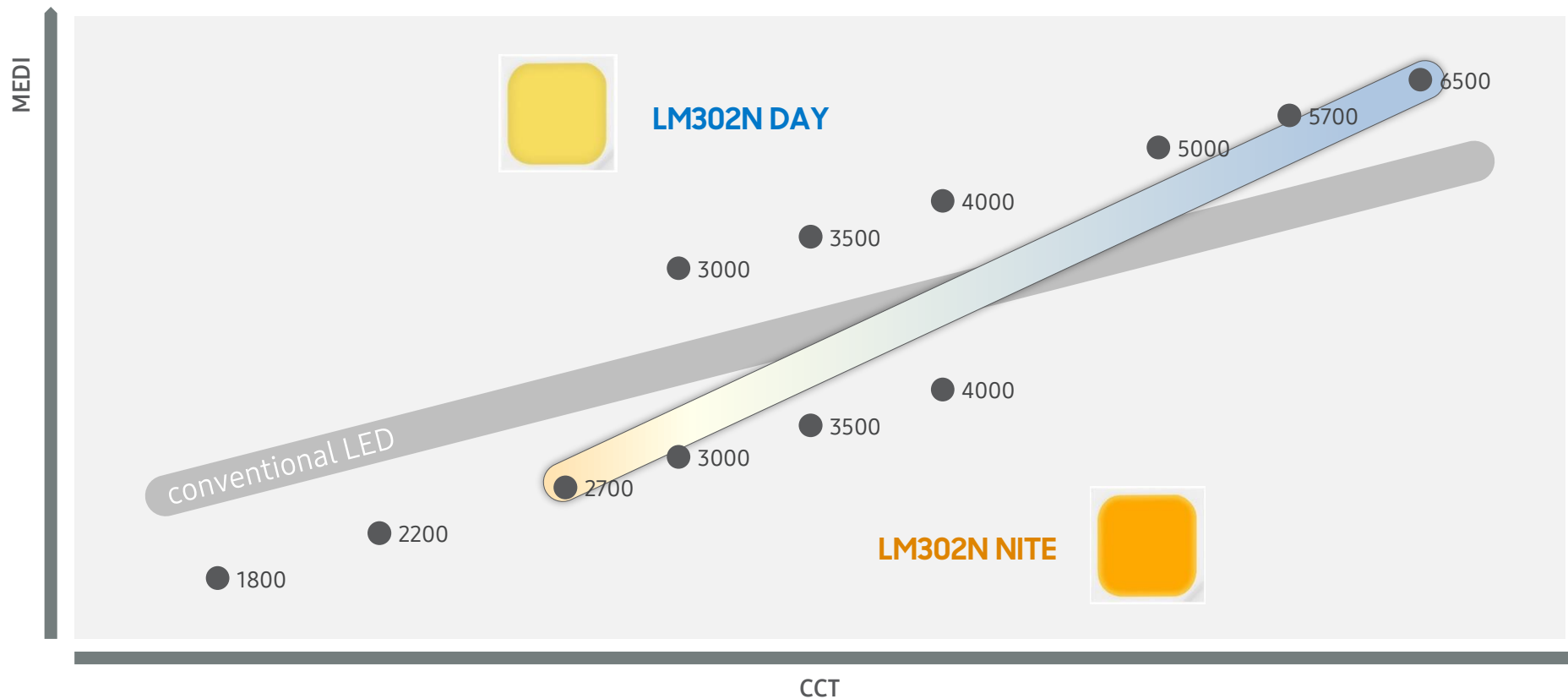
** MELI (Melanopic Equivalent Daylight Illuminance)

LM302N DAY & NITE



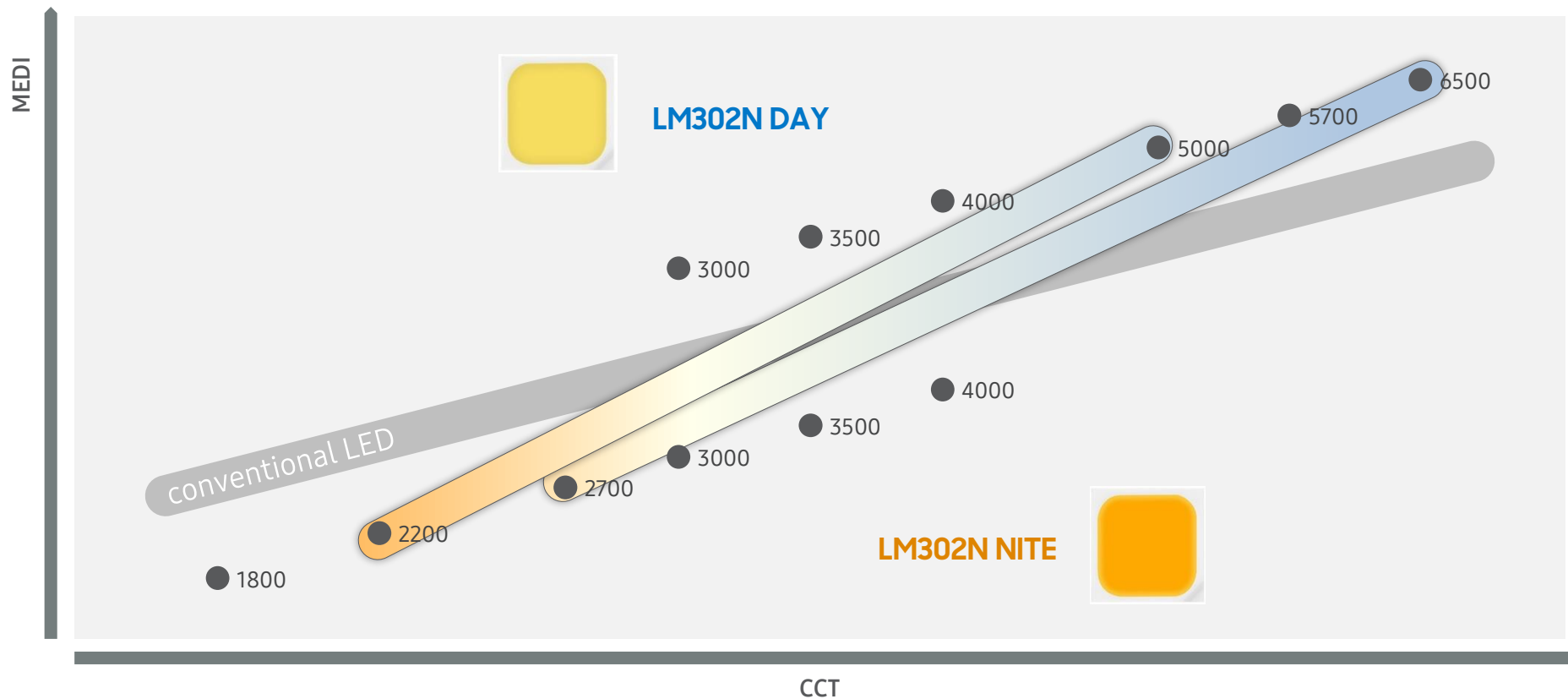
** MELI (Melanopic Equivalent Daylight Illuminance)

LM302N DAY & NITE



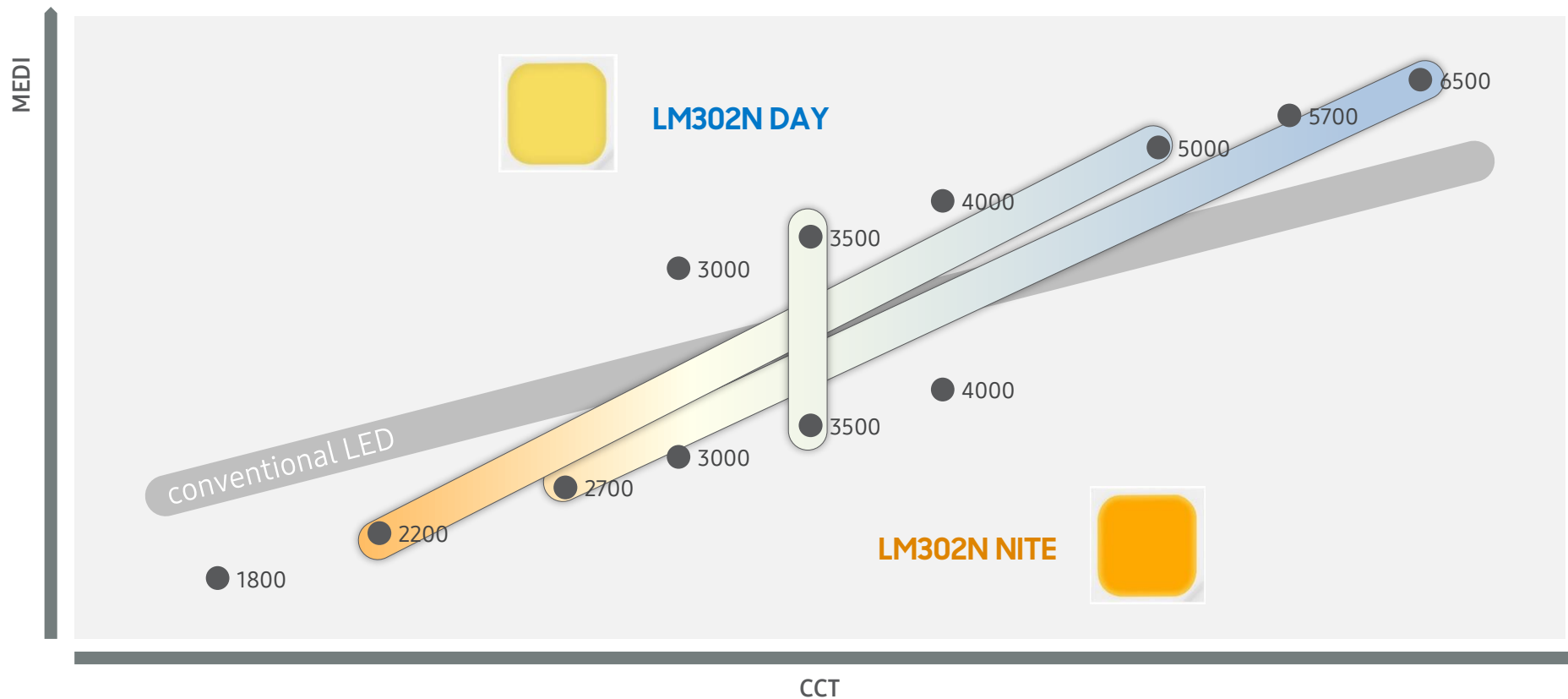
** MELI (Melanopic Equivalent Daylight Illuminance)

LM302N DAY & NITE



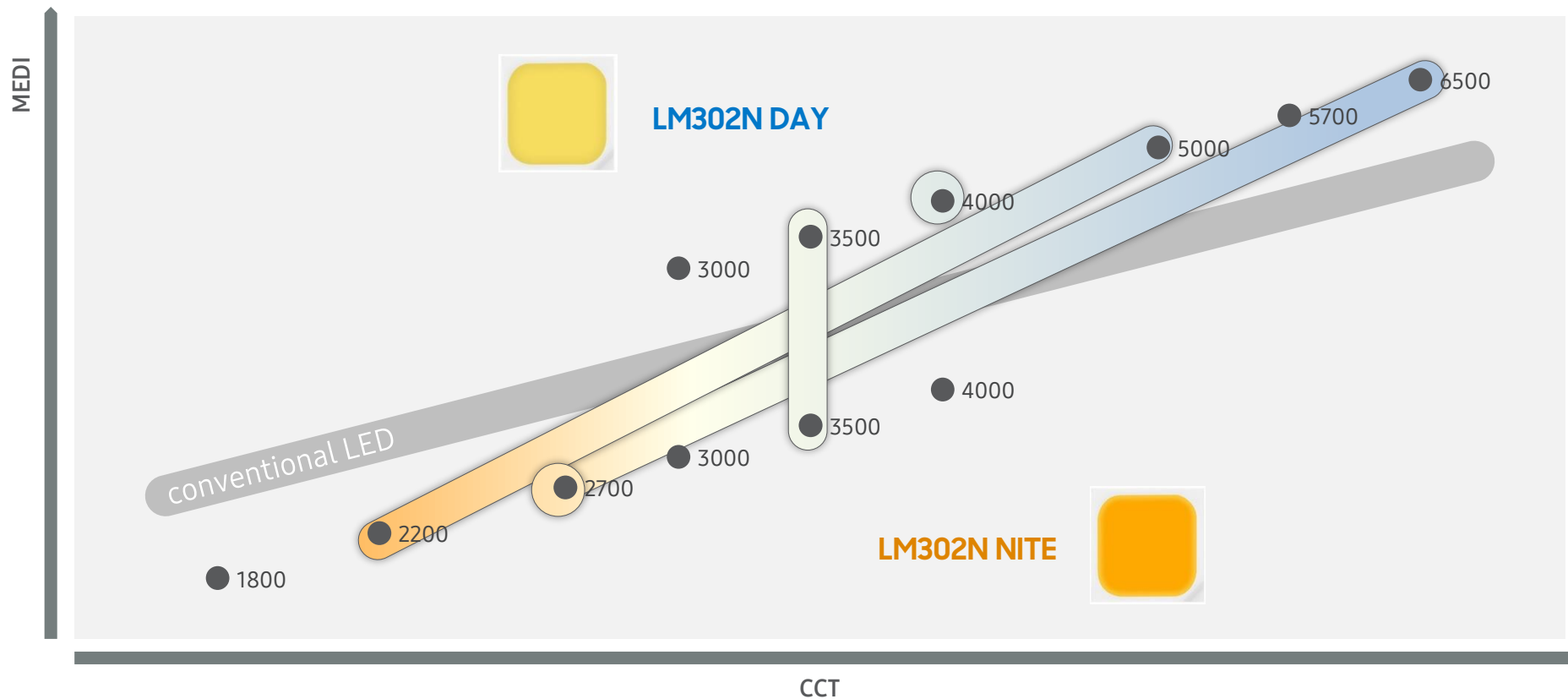
** MELI (Melanopic Equivalent Daylight Illuminance)

LM302N DAY & NITE



** MELI (Melanopic Equivalent Daylight Illuminance)

LM302N DAY & NITE



** MELI (Melanopic Equivalent Daylight Illuminance)

the next General Lighting

Spectrum Engineering for HCL

