



IEA Technology Collaboration Programme
on Energy Efficient End-Use Equipment

Advanced Smart Lighting must also be Energy Smart

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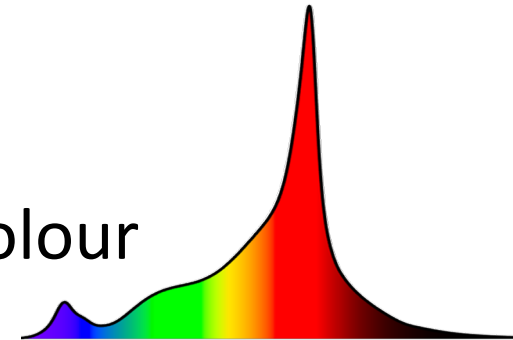
Stockholm, 27 March 2023

International Lighting Seminar: Perspectives on Sustainability, Performance, Health & Smart Lighting

iea-4e.org

Agenda

1. What is Smart Lighting?
2. Market and Barriers
3. Integrating with controls and HCL
4. Smart Lighting Report 15 Nov 2023
5. Test method and IEC/CIE standards
6. Standby power measurements
7. Huge standby Saving Potential
8. Efficacy when dimming or changing colour
9. Recommendations

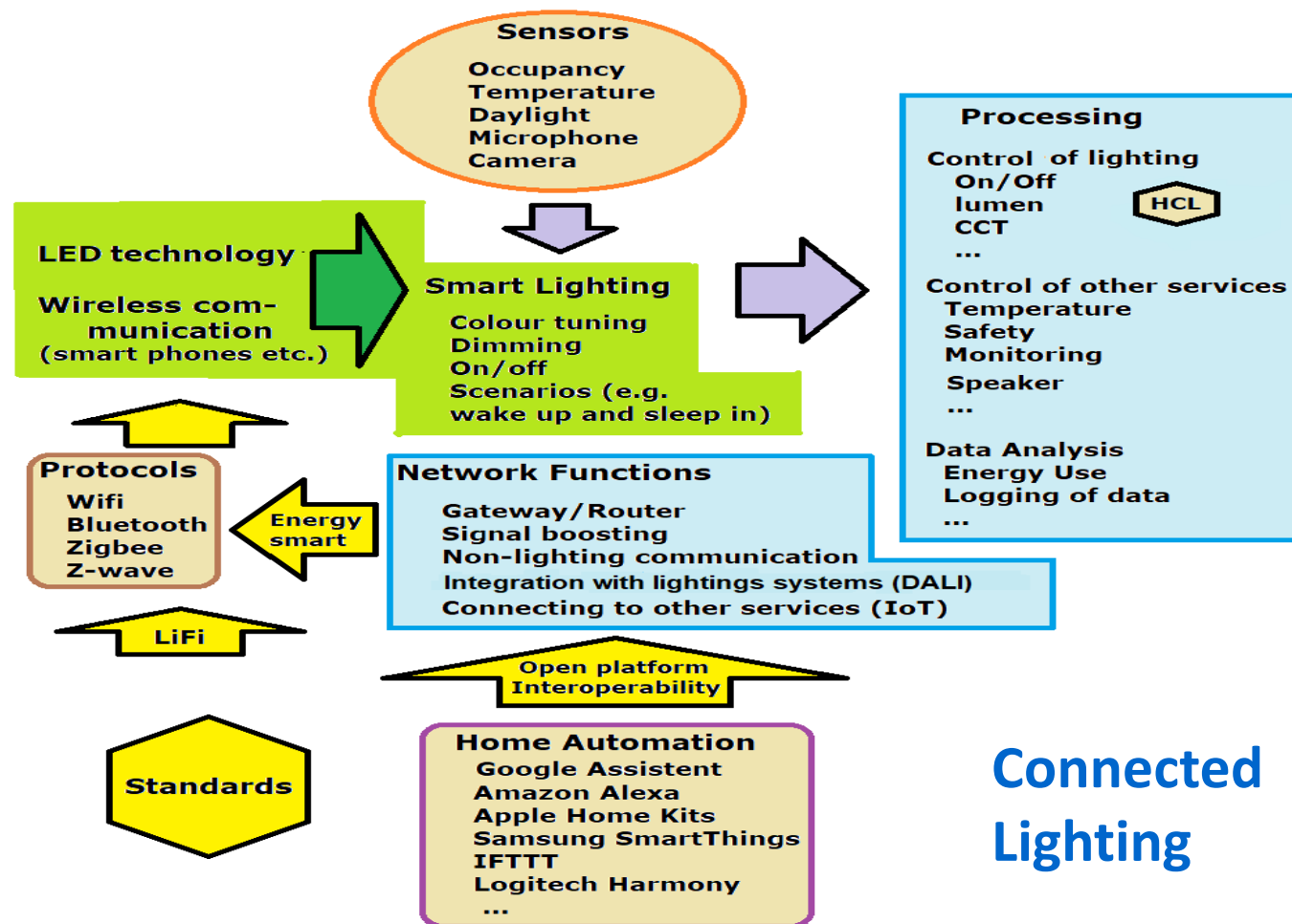


What is Smart Lighting?

- *LED lighting + wireless control*
- *Dimming, Change colour, Timers, Programming*
- *Non-lighting: Music, Camera, WiFi booster ...*
- *In some museums and shopping centres, the lamps are used as WiFi nodes for navigation with possibility for activating visual and aural information.*
- *“Cost”: standby energy consumption (always on).*



More Complex Smart Lighting



Market and Barriers

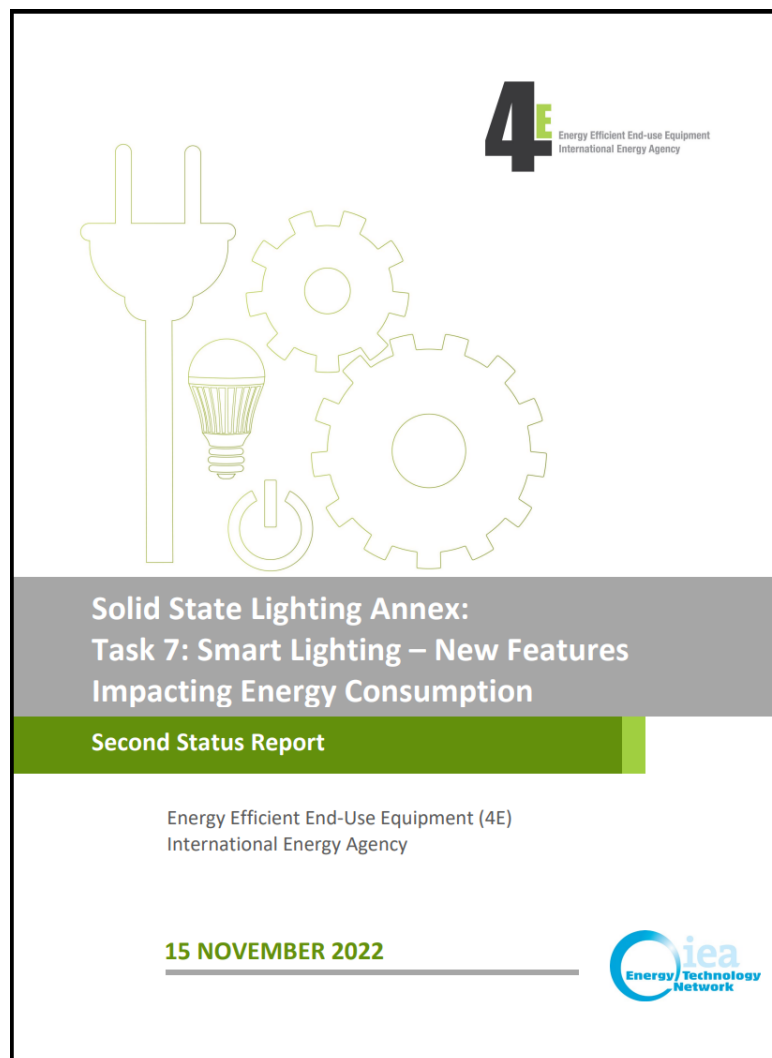
- Large investments
- Uptake lower than expected
- Barriers: cost, complexity, lack of open systems, interoperability, standards and consistent systems, no connection to wired systems, ...
- Decreasing prices – going mainstream
- The industry works on simplification, plug and play, higher user-friendliness, ...
- Gateways to wired control (DALI)



Integration with Controls and HCL

- So far, movement and/or daylight sensors are seldom included in domestic smart lighting products. Inclusion of these sensors would increase the potential energy savings substantially.
- Research has shown that the mimicking of daylight variation including use of daylight sensors may improve the user's wellbeing, mood, and cognitive performance.
- Human Centric Lighting (HCL) is used in hospitals and Nursing homes – in the near future maybe also offices?
- The potential for use of smart lighting in the tertiary sector will increase with implementation of gateways to wired control (DALI) and communication by “Connected Lighting”.

Smart Lighting Report 15 Nov. 2022

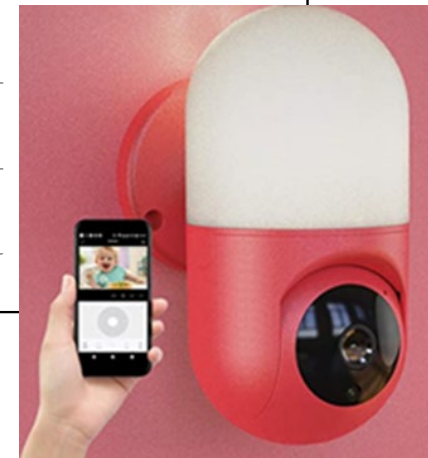
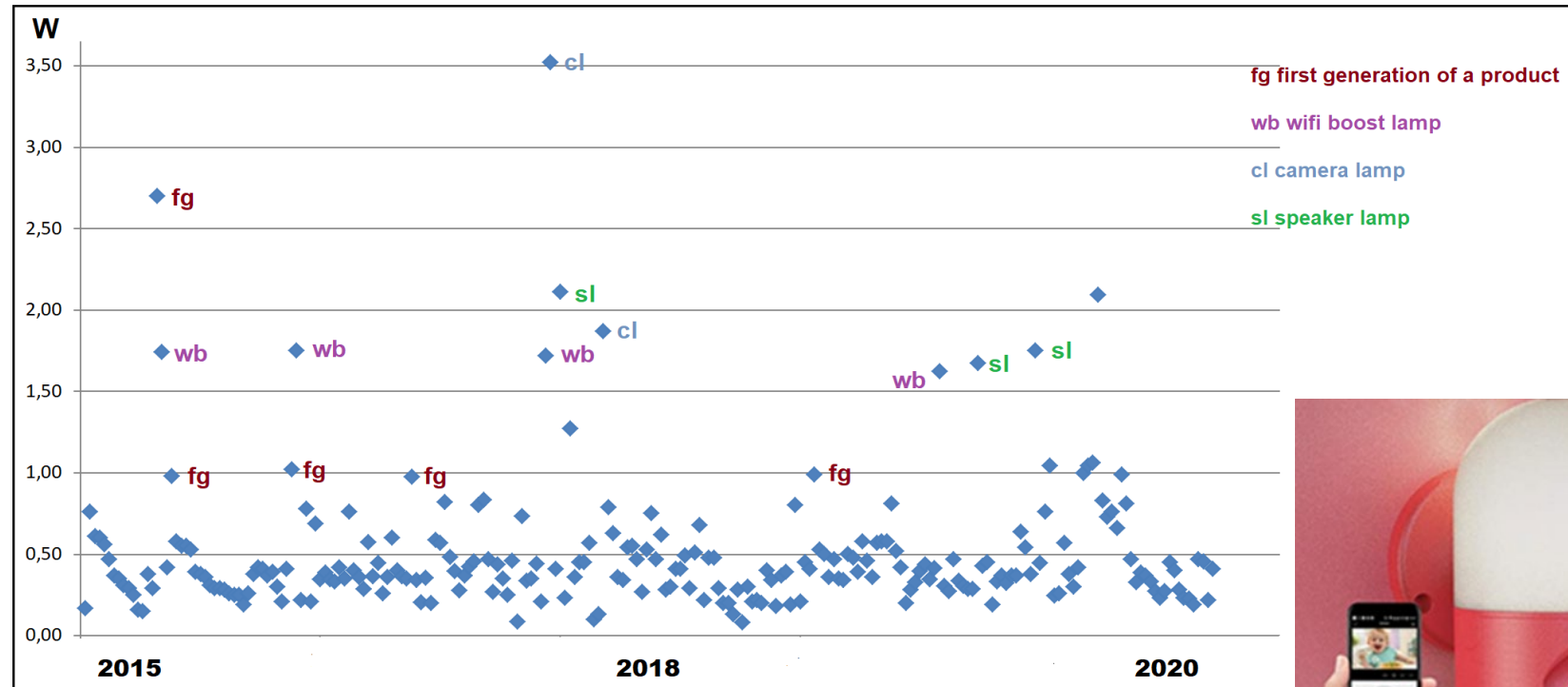


- Key Terms, Protocols and Network Architectures
- Test Method
- Results from Testing
- Saving Potential
- Market Potential and Barriers
- Conclusions and Recommendations for Policy makers.

Test Methods and IEC/CIE standards

- The Report outlines an interim test method for laboratories to conduct benchmark testing, and potentially for future compliance or enforcement testing.
- This test method was developed with reference to the following international test standards:
 - CIE S 025/E:2015 Test Method for LED Lamps, LED Luminaires and LED Modules
 - IEC 63103 Ed. 1.0 en:2020 Lighting equipment - non-active mode power measurement
- Besides the method is also provided includes optional additional steps and/or practical notes for the person conducting the test.

Standby Power for 236 lighting products

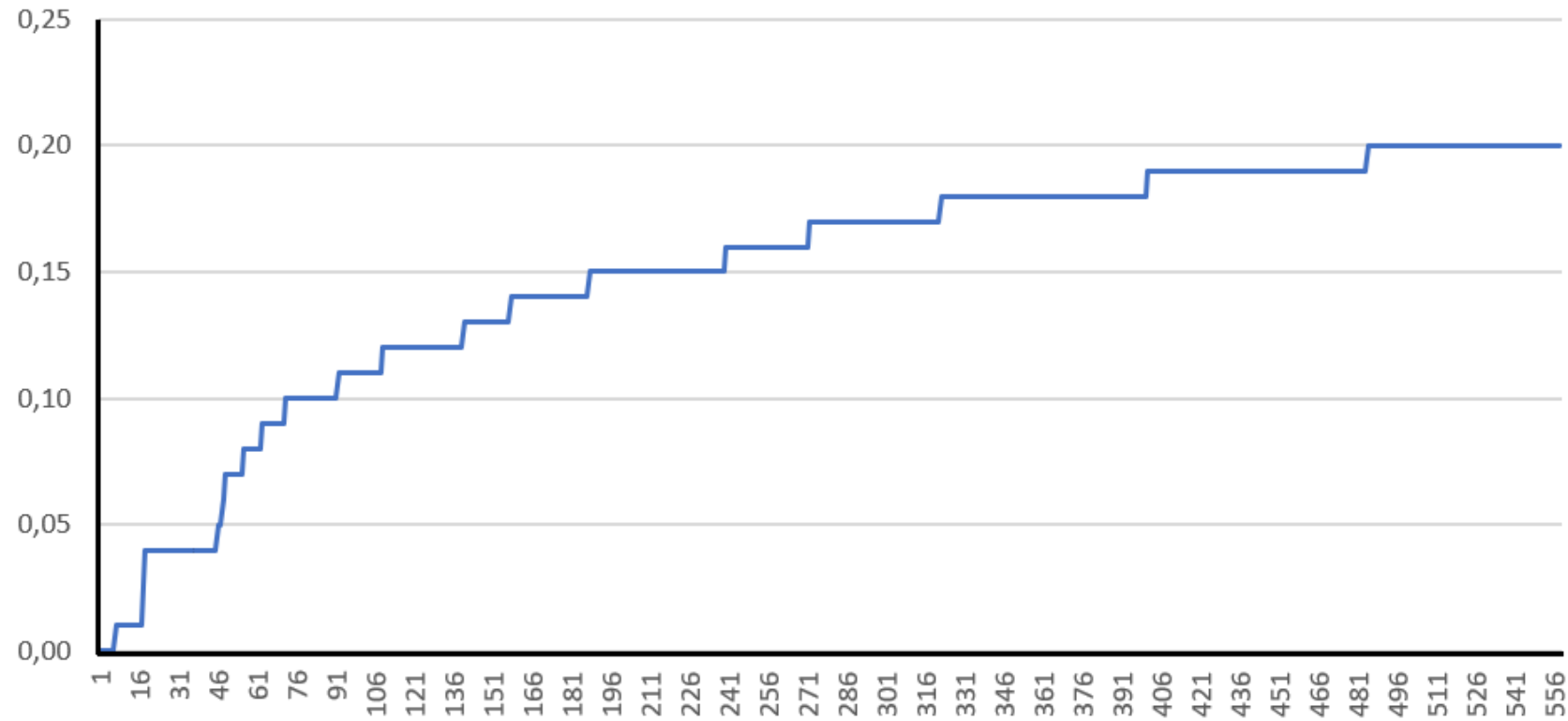


- Lowest 0.08W and highest 3.5W
- Average 0.51W (median 0.39W)

Standby Power Regulation in California

1/9 2019 California the standby power ≤ 0.2 W.

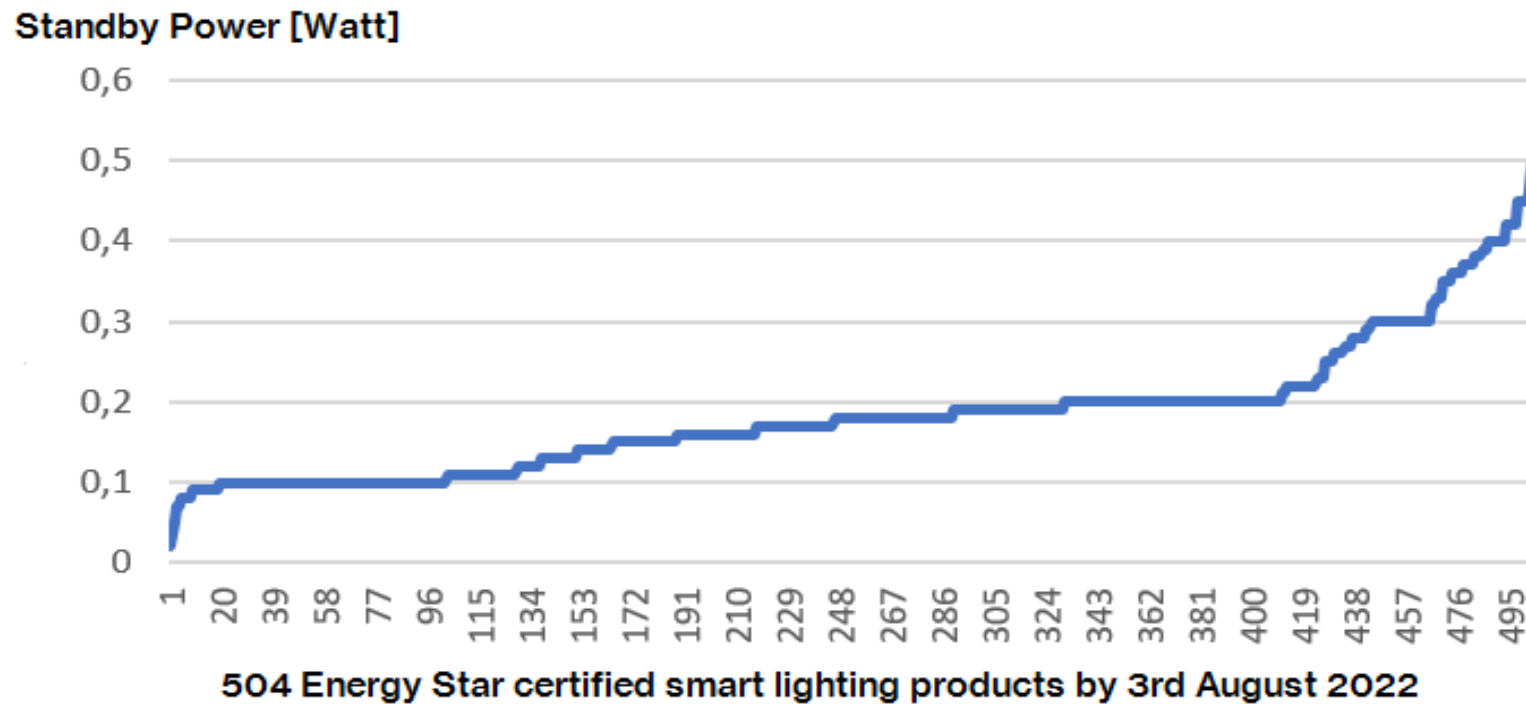
Standby Power [W]



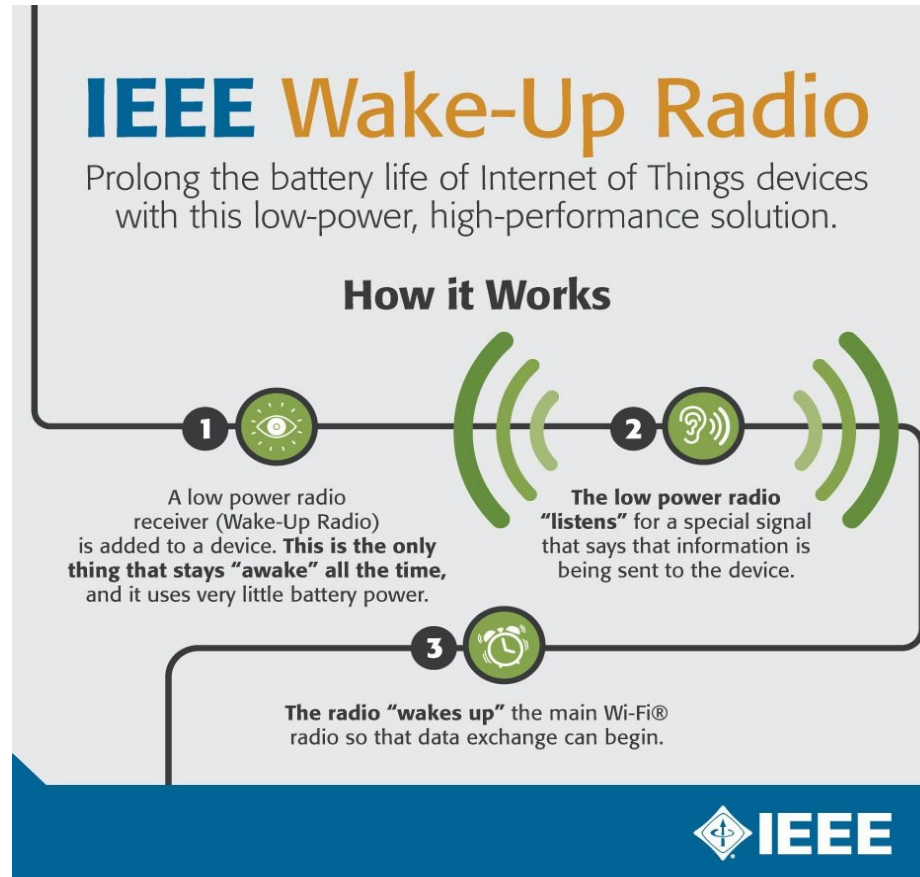
558 CEC certified Products by 18th July 2022

Standby Power for Energy Star certified products

Energy Star (USA and Canada) certified LED products with standby power ≤ 0.5 W α). The Energy Star product database show 81% of the products fulfill the CA requirement ≤ 0.2 W.



Huge Standby Saving Potential



- Developed for connected devices on battery.
- Wake up 2 millisec. out of every 100 millisecond reduces the average power from 0.5W to around 0.01 W.

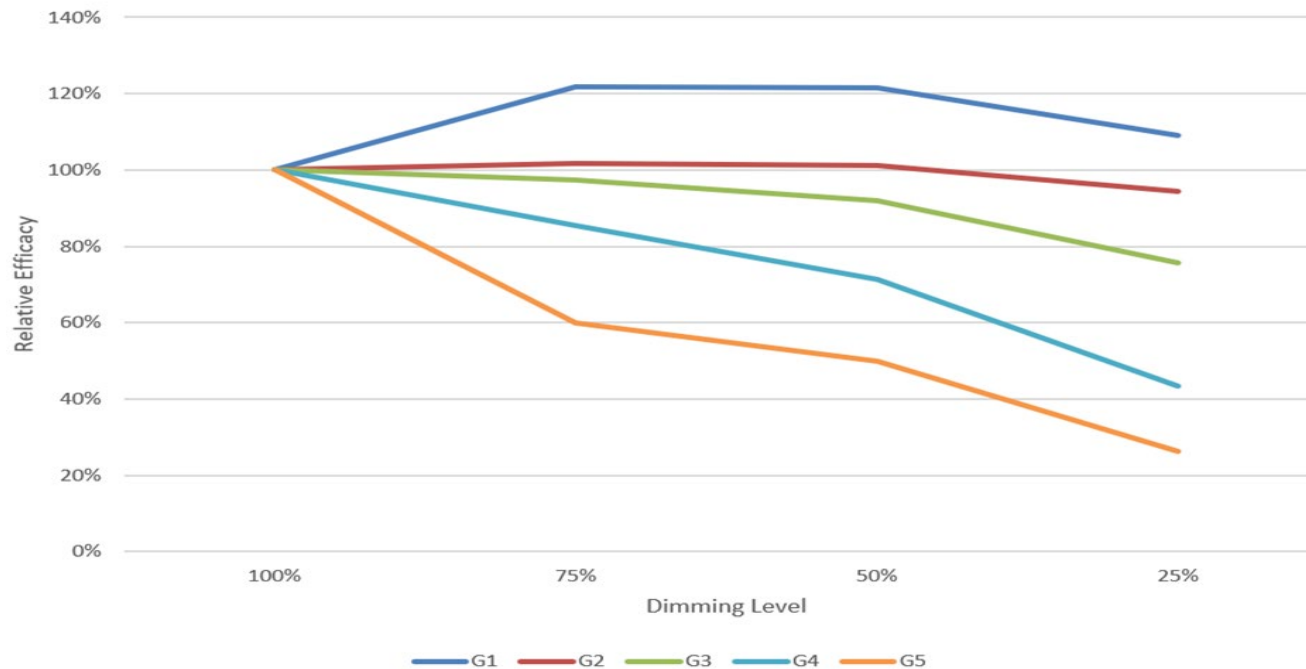
Standby Consumption Share of the total

			Usage 1 hour/day				Usage 2 hours/day			
Lamp	ON (W)	Standby (W)	ON (kWh)	Standby (kWh)	Standby (%)	Total (kWh)	ON (kWh)	Standby (kWh)	Standby (%)	Total (kWh)
360 lm 3 W	3.0	0.50	1.10	4,20	79%	5,3	2,19	4,02	65%	6,2
		0.20		1,68	61%	2,8		1,61	42%	3,8
		0.10		0,84	43%	1,9		0,80	27%	3,0
		0.01		0,08	7%	1,2		0,08	4%	2,3
806 lm 6.7 W	6.7	0.50	2.45	4,20	63%	6,6	4,89	4,02	45%	8,9
		0.20		1,68	41%	4,1		1,61	25%	6,5
		0.10		0,84	26%	3,3		0,80	14%	5,7
		0.01		0,08	3%	2,5		0,08	2%	5,0

The standby power consumption doesn't become insignificant until it is lowered to around 0.01 W.

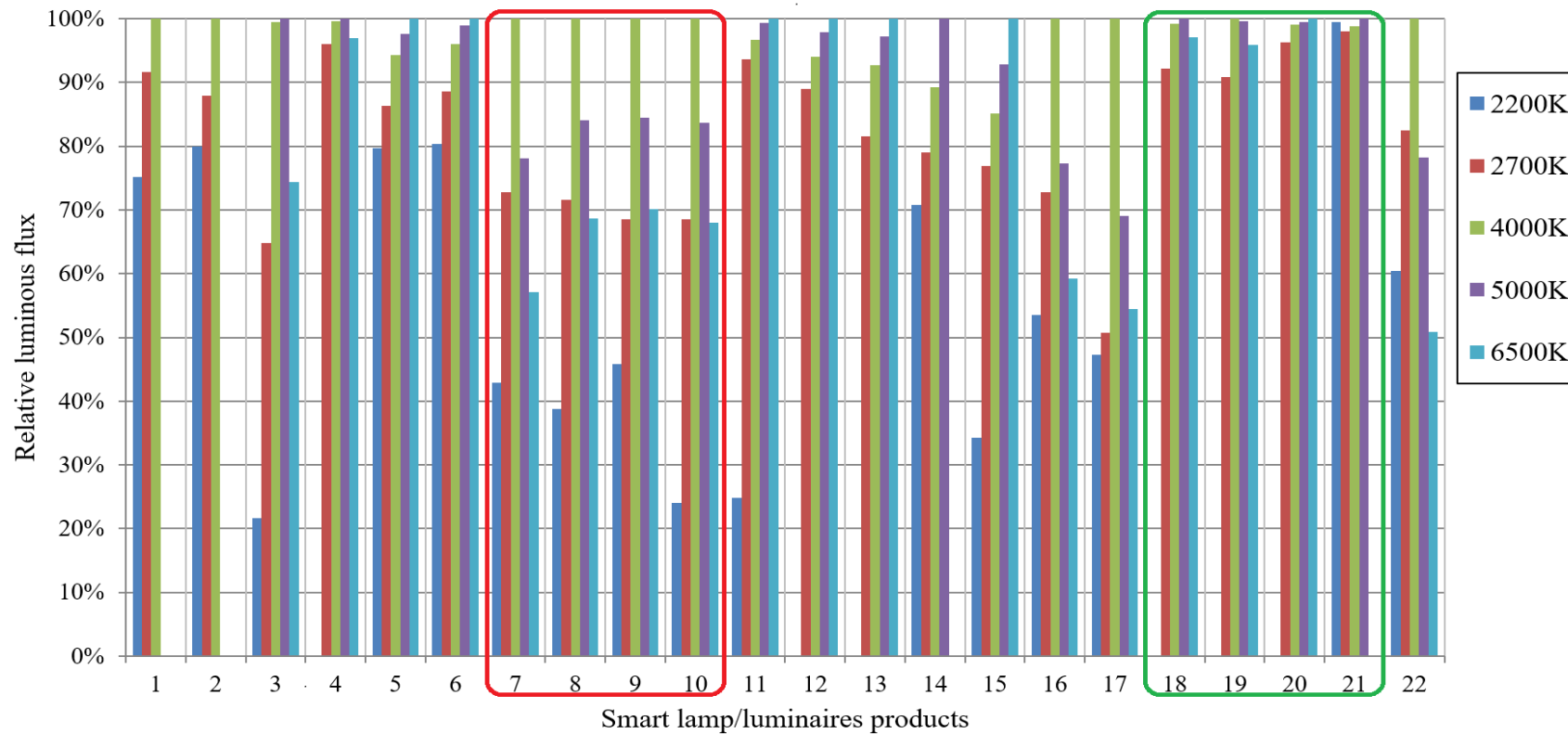
Luminous Efficacy when Dimming

Efficacy
relative to
the efficacy
without
dimming



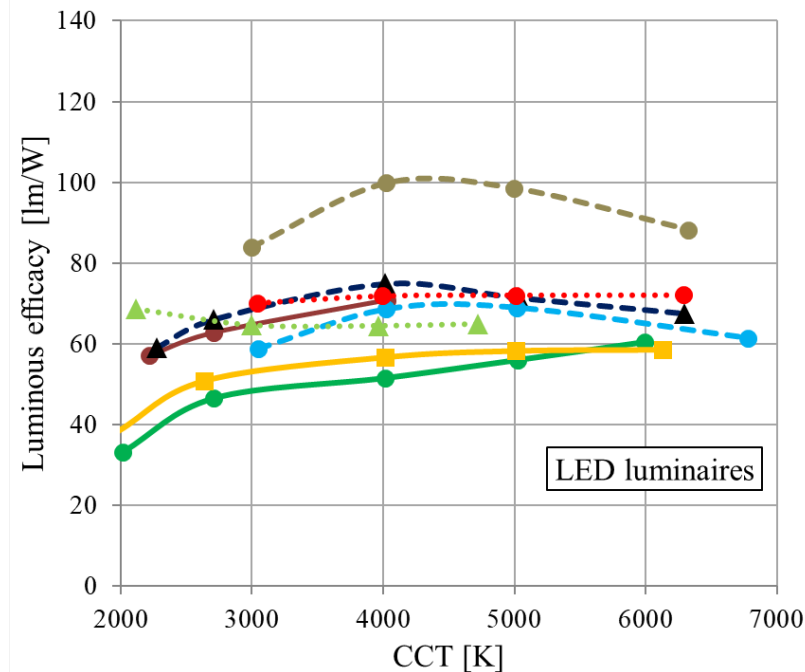
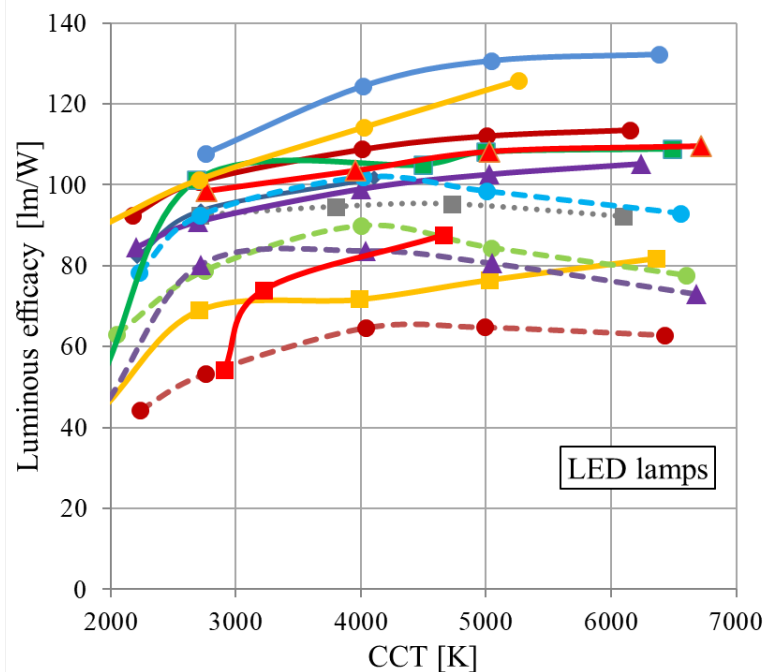
Five types of products. G4 and G5 (24% of the products) are critical with hardly any energy savings by dimming.

Luminous flux for 5 white Colours



Product 18-21: Lumen output closed to the claimed for all CCT's,
Product 7-10: Lumen output much lower than claimed for some CCT's.

Luminous Efficacy for 5 white Colours



Some products: Efficacy down to 20-50% of rated efficacy for some CCT's.



Recommendations

- Actually: Standby should be power $\leq 0.2 \text{ W}$ everywhere
- Future goal: Standby power $\leq 0.01 \text{ W}$
- Non-lighting features: Should be possible to switch **ON/OFF** . . .
Consider use of wake-up standby technology.
- **Claimed performance** should hold **for all stages** of Dimming and CCTs. Alternatively, the manufacturer must inform about the lumen output and power consumption for all five normative CCT's (2200, 2700, 4000, 5000 and 6500 K) and the lumen output levels 100%, 75%, 50% and 25%.
- More focus on **energy saving**: Products with integrated daylight or movement sensors are missing



Thank you for your attention
Questions?



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