



Update on Life Cycle Assessment of Smart Lamps and SSL Annex LCA report

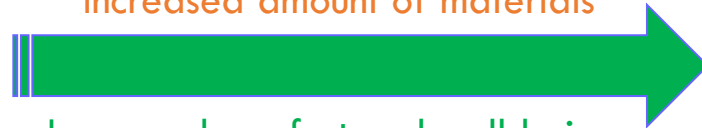
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LED

DOE US (2012)

Dillon & al. (2019)

Standby & gateway consumption
Lower efficacy
Increased amount of materials



Increased comfort and well-being
Reduced usage ?

Smart LED

(8 LED / house)

Scenario 1 : 2,7h / day

Scenario 2 : **Reduced use**
time / dayCFL E27

Naviguant

(2009)

Two case studies with different configurations:

- EU : Standby Consumption = 0,5W
- US-California : Standby Consumption = 0,2W

Configurations :

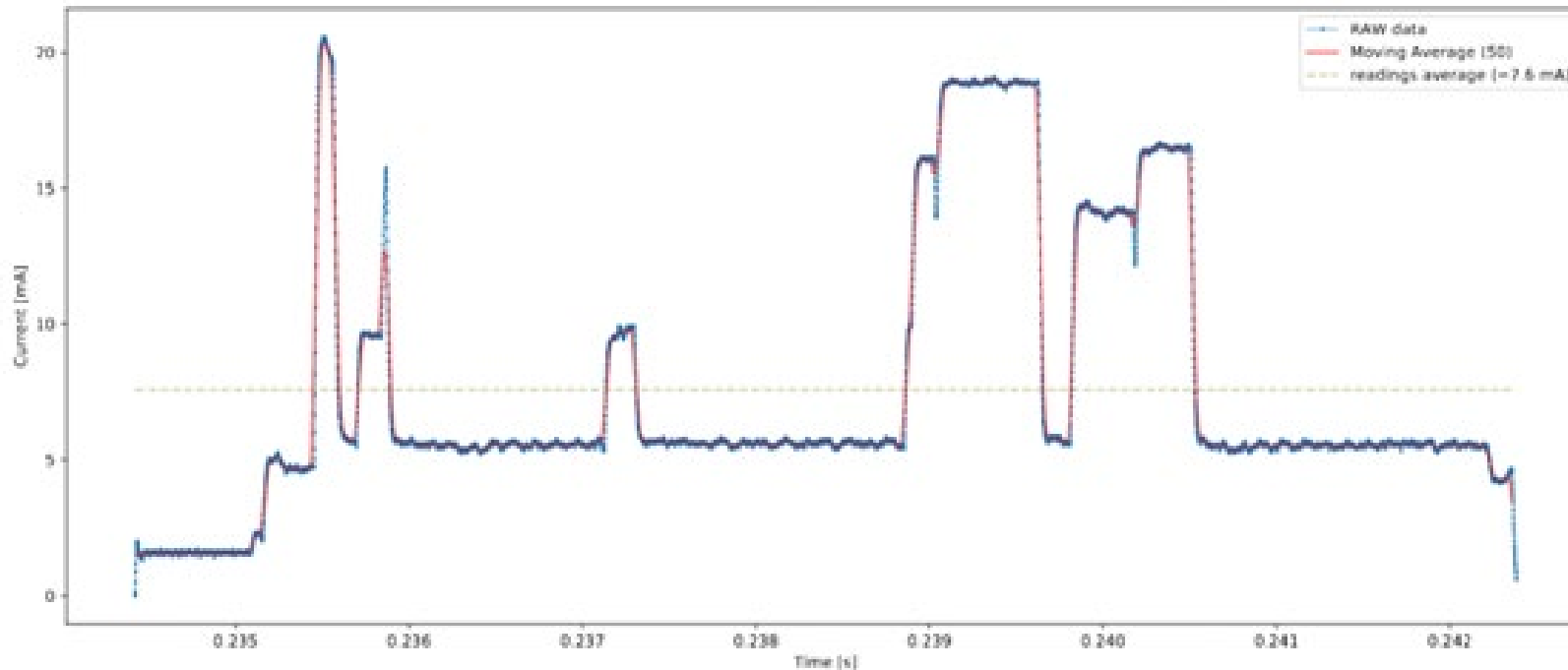
- 2 dedicated motion detectors + Gateway (1,5W)
- 2 dedicated motion detectors – No gateway
- Sensor included in each lamp – No Gateway

➤ Goal : Find the daily light saving to be achieved in order to compensate for the additional energy consumption due to smart layer.

	CFL	LED	Smart LED 1	Smart LED 2
Power (W)	12	7.7	9	9
Efficacy (lm/W)	68	104.9	90	90
Flux (lm)	816	808	810	810
Lifetime (kh)	10	15	15	15
Day use (h)	2.7	2.7	2.7	1.3
Lifetime (year)	10.1	15.2	15.2	22.8
Annual consumption(kWh/yr)	11.8	7.59	8.87	4.43
Klm.yr (Functional Unit)	8.28	12.3	12.3	18.5
Reference flow	1,49	1	1	0,667

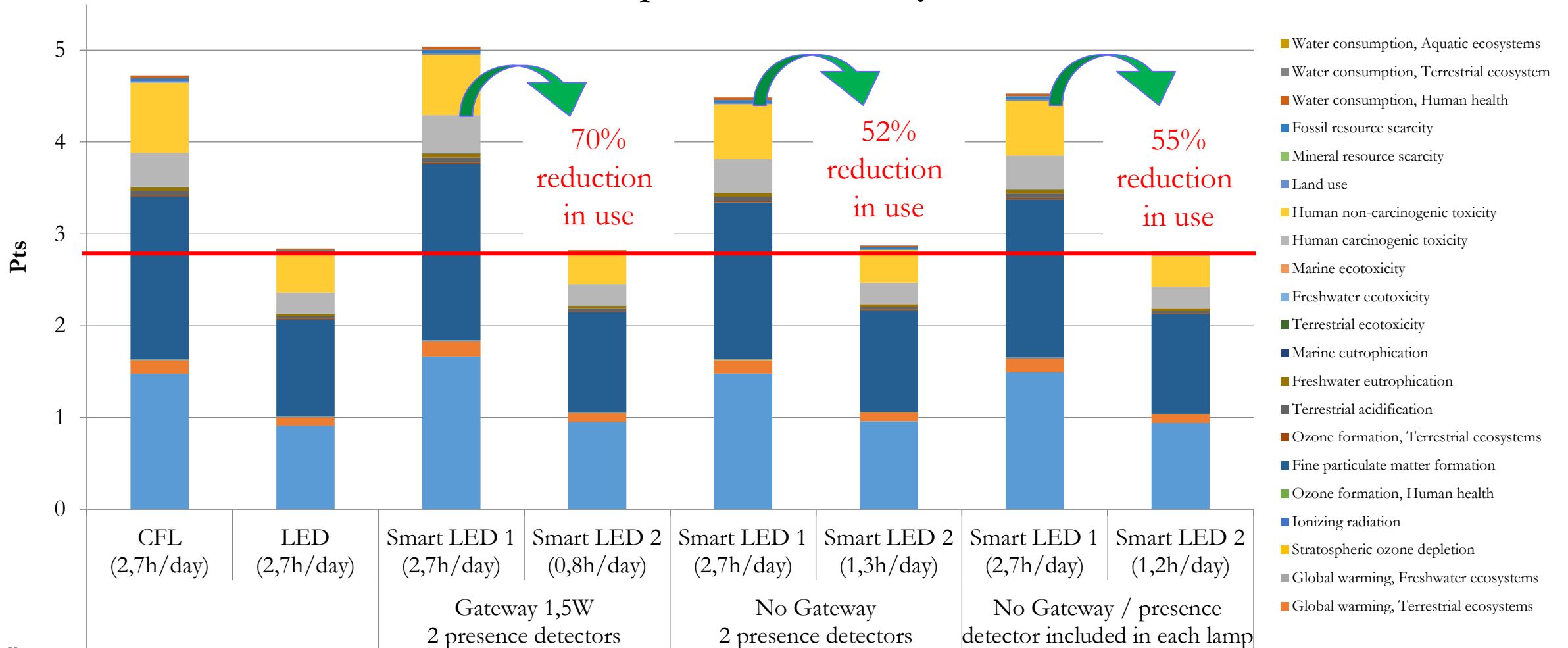
- Gateway consumption for smart lamps : 1,5W
- Standby mode consumption : EU 0,5W / US 0,2W
- Average use of lamp for residential lighting : 2,7h/day
- Increase of production phase impact for the smart layer :
 - Gateway + 2 dedicated presence detectors : +10% embodied energy
 - No Gateway - 2 Dedicated presence detectors : +2% embodied energy
 - No Gateway – presence detector included in luminaire : +0,5% embodied energy per lamp

For the presence detector, the supply current was measured by supplying the nominal voltage (i.e. 3V DC) via a voltage generator (DC Power Supply PS3003) instead of batteries (2 x AAA, 1.5 V). A typical profile of the measured current is shown below.

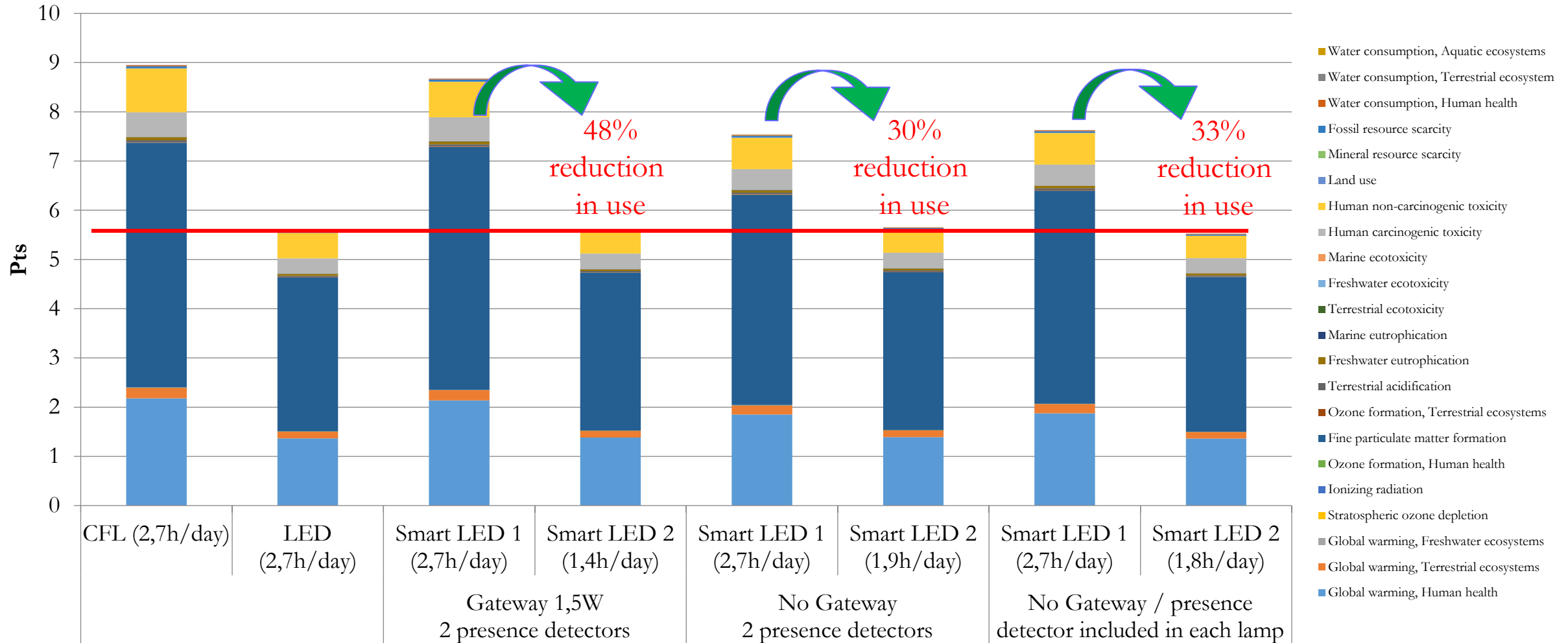


- Average current : 7,6 mA
- Average power : 22,8 mW
- Lifetime :
 - 132000 hours if dedicated
 - Equal to lamps lifetime if included in luminaire

Endpoint EU – Standby = 0,5W



Endpoint US - Standby = 0,2W



- ✓ In the EU residential context a 52% to 70% reduction in usage should be achieved (0,5W Standby power)
- ✓ In the US a 30% to 48% reduction in usage should be achieved (0,2W Standby power)
 - Neither the EU nor US standby power regulations seem to be sufficient for a relevant residential use, as it seems difficult (if not impossible) to achieve the reduction in usage.
- ✓ There is no significant difference between the motion sensors included in the luminaire and the 2 dedicated motion detectors. However, it might be easier to reduce usage with included sensors.
- ✓ Next steps:
 - ✓ Teardown of a gateway, a dedicated motion detector and sensor equipped lamps to verify the embodied energy hypothesis.
 - ✓ Keep in touch with Casper to work on a use case in the tertiary sector. The results from The Shift Project are more encouraging for smart luminaires in tertiary context due to a greater number of luminaires being controlled and a higher potential for reduce usage.

- ✓ LCA of light bulbs for different electrical mixes (EU, FR, AU, NZ) from my thesis manuscript

Lamps	Power (W)	Flux (lm)	Efficacy (lm/W)	Lifetime (kilo hours)
LED 0	11	1045	95	15
LED 1	8	1072	134	15
LED 2	8	1072	134	25
LED 3	5,3	1060	200	15
LED 4	5,3	1060	200	25
CFL	18	1224	68	10

➤ Any mixes you want to add ? US?

- ✓ LCA of T5, T8 and replacement LED Tubes

- ✓ Mike and his son sent us inventories for each lamp, we are currently working on the LCA

- Is it something we want/are allowed to include in the SSL Annex report ?

- ✓ LCA of smart lamps (a paper will be presented at the LS18 conference this summer)

- Residential? Tertiary? Both?

- ✓ End of my post-doctoral contract at the end of the week. Ridha will take care of the following actions.
- ✓ Thanks to all the members of the SSL Annex members. It was a fruitful collaboration for my PhD.
- ✓ My personal email : kevbertin@gmail.com