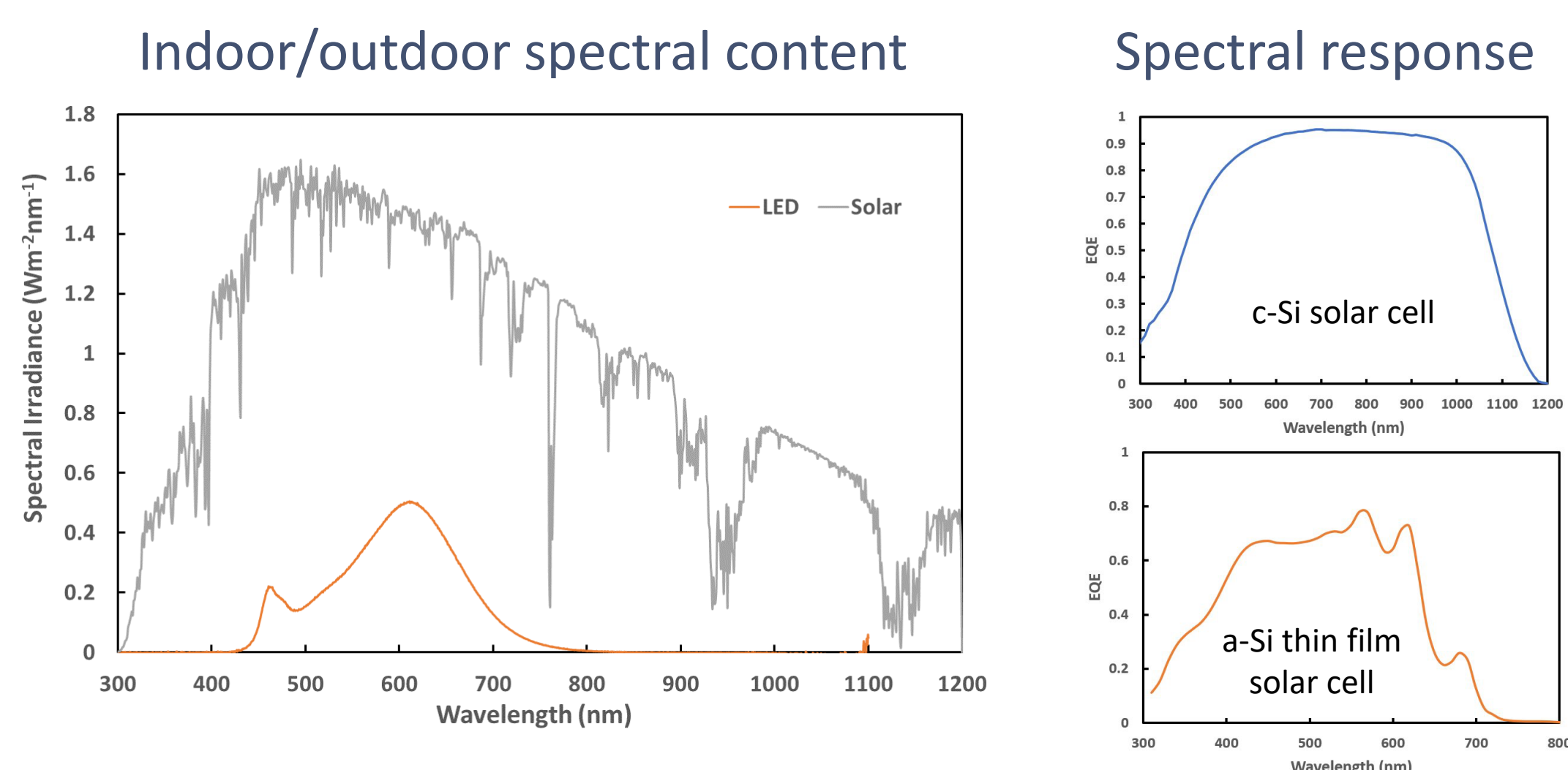


## Solar harvesting solutions at CSEM

G. Christmann, J.-W. Schüttauf, F. Meyer, L. Pires Da Veiga, P. Duvoisin, C. Charrière, B. Bonnet-Eymard, M. Despeisse, A. Ingenito, and C. Ballif.  
CSEM SA, Rue Jaquet-Droz 1 2002 Neuchâtel, Switzerland  
gabriel.christmann@csem.ch

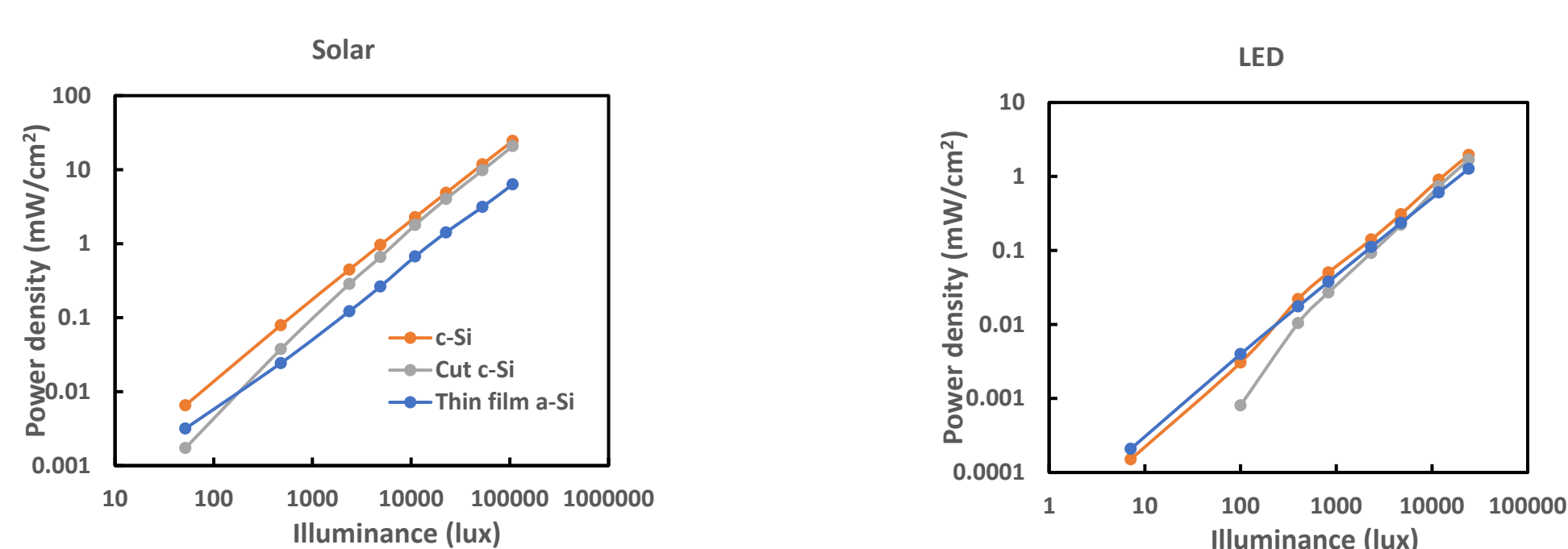
**ABSTRACT:** Solar harvesting offer a reliable and versatile solution to power autonomous devices. Depending on the application, the power output can be scaled from  $\mu\text{W}$  range for small low power IoT devices to kW range for large power-hungry devices like vehicles. CSEM addresses many of these use cases with a portfolio of solutions using either c-Si or thin film a-Si solar harvesters.

### Solar harvesting in different conditions



- Solar light has a lot of UV and IR irradiance: for similar illuminance, solar incident power is 3 times more than LED.
- c-Si quantum efficiency suitable to solar a-Si suitable to indoor

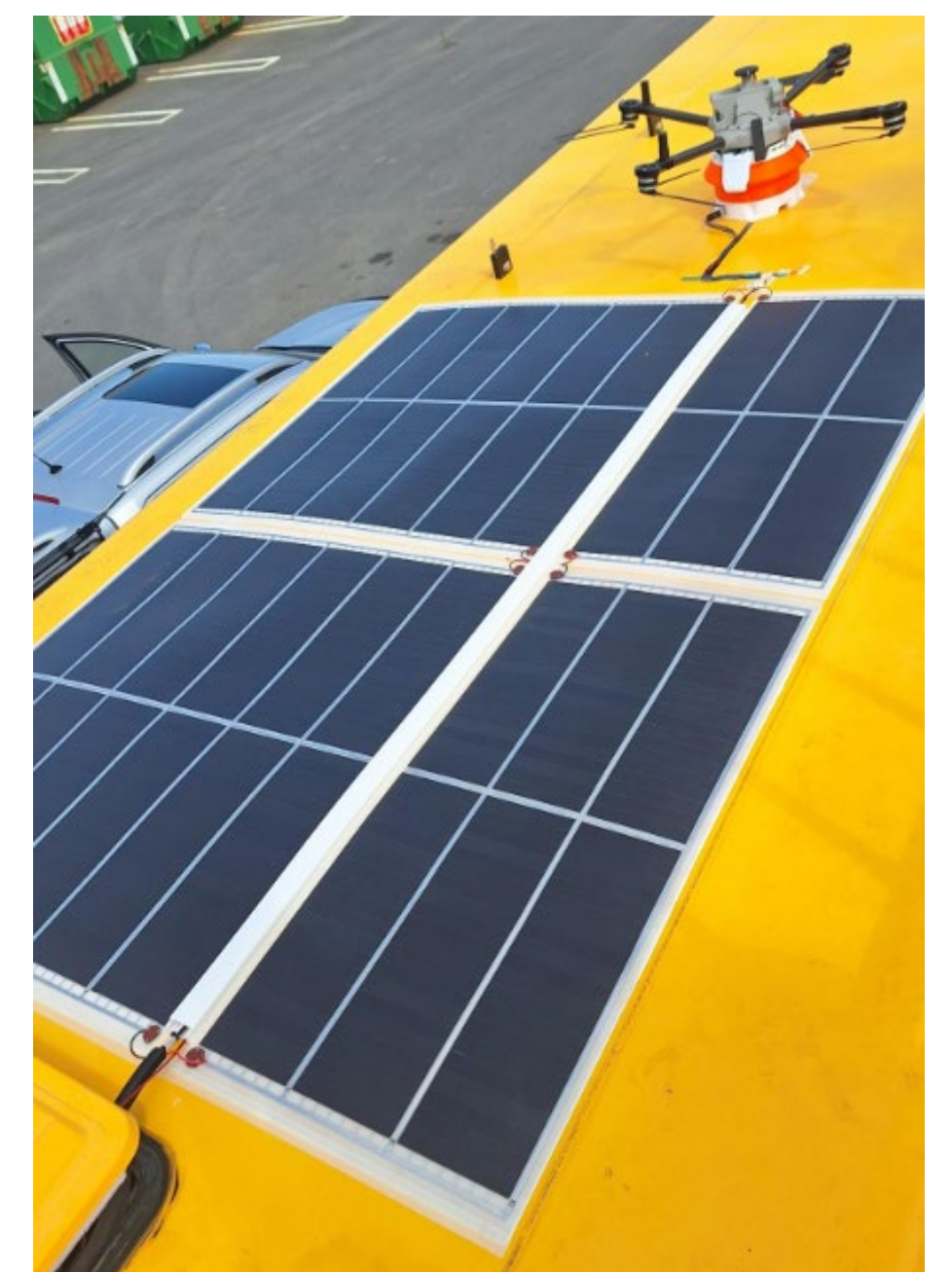
Illuminance (lux)	typical
50-1000	Indoor conditions
1000-25000	Outdoor indirect sunlight conditions
32000-100000	Outdoor direct sunlight conditions



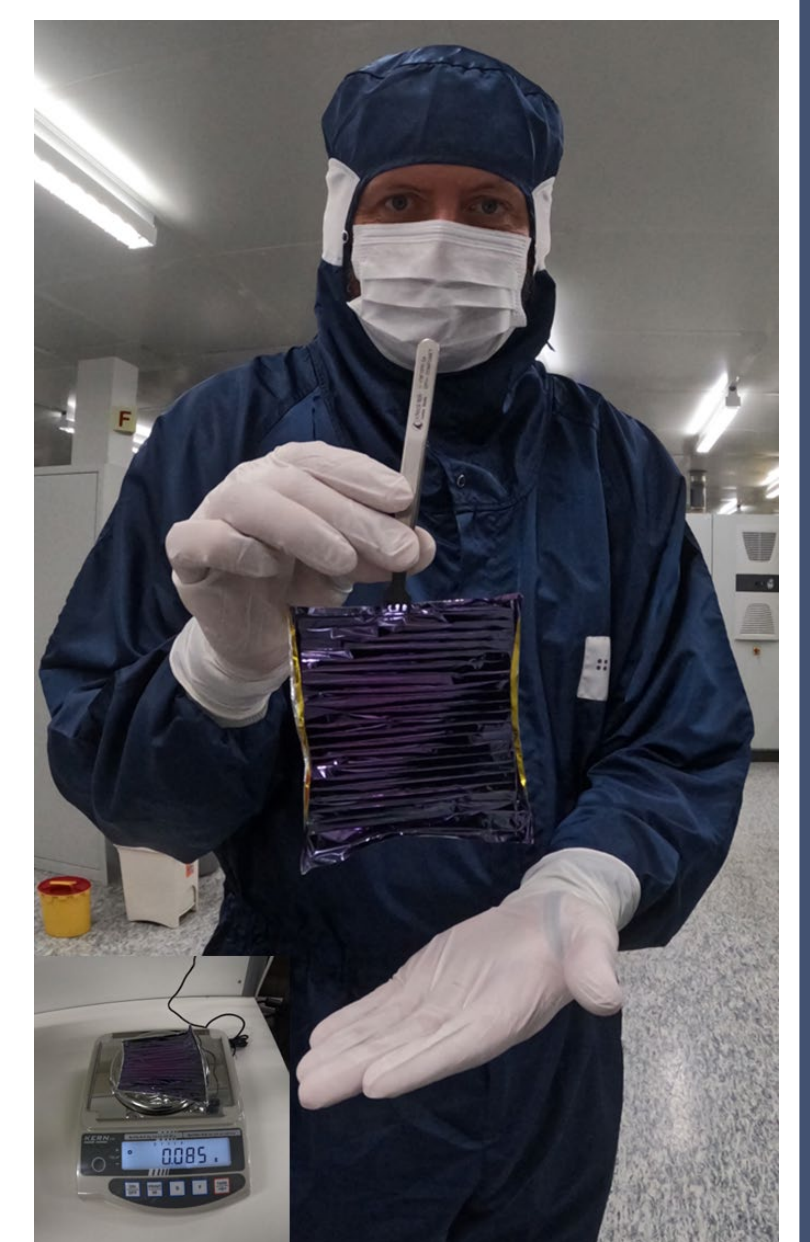
- c-Si better suited for solar light.
- c-Si performances drop under low illumination, particularly for small size harvesters with cut c-Si cells.

### Solar harvesters at CSEM

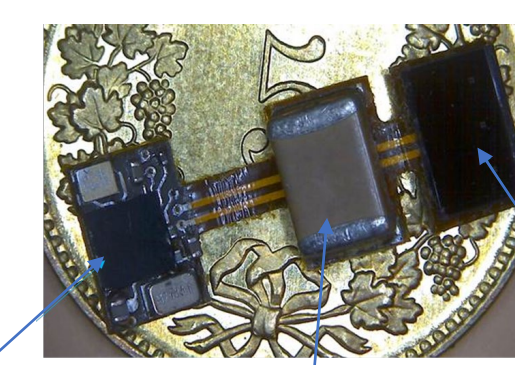
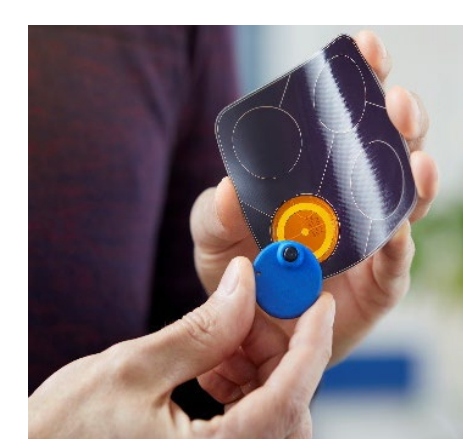
#### Lightweight solar panels



#### Thin film solar harvesters



#### Internal development to commercial product



Flexible panel

CSEM low power chip

Commercial battery

CSEM solar cell

Ultralight thin film module

### Acknowledgments

This work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI), co-funded by the Innosuisse – Swiss Innovation Agency, and was supported by the LoLiPoP IoT (<https://lolipop-iot.eu/>) Chips Joint Undertaking (Chips JU) under grant agreement No 101112286. The JU receives support from the European Union's Horizon Europe research and innovation programme and accordingly from the participating countries. The document reflects only the author's view, and the Commission is not responsible for any use that may be made of the information it contains.

#### ORGANISER



#### MEDIA SPONSORS



#### COMMERCIAL SPONSORS



#### TECHNICAL SPONSORS

