IEA SSL Annex

Swedish Energy Agency

Task 5

Online Nov 4, 2021 Task 5

Christofer Silfvenius, Jonas Pettersson, Peter Bennich

Swedish Energy Agency

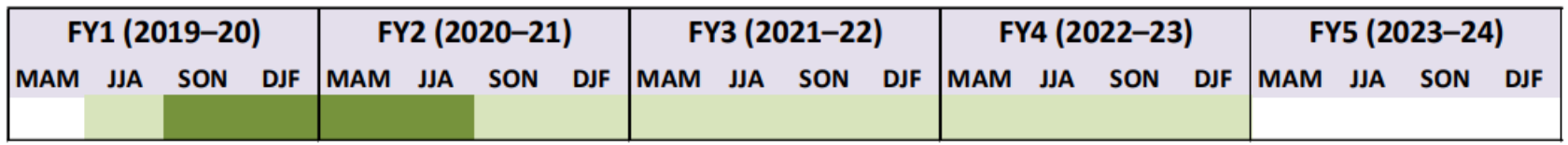
Task 5. Test Method Assessment

Task Leader: Peter Bennich, Sweden

Objectives	This Task aims to conduct a generic review of the metrics and requirements set-out in existing regulations and the measurement standards that underpin those requirements to determine the accuracy and cost of conducting testing of SSL products. The aim is to provide guidance to policy makers to help formulate improved requirements and how these requirements can be realistically verified.

Description	This is a new research Task for the SSL Annex which is planned because it has been found that sometimes policy-makers can be hampered by standardisation bodies that do not provide adequate test metrics or methods for setting robust policy measures. For example, in Europe it was not possible to set regulatory requirements for dimming because there is no dimming standard, and the new draft lighting policy measure proposed by the Commission is regulating colour quality with the 8-tile colour rendering index and defining the scope of white-light coverage with x,y chromaticity coordinates. This Task may also look at other parameters that address endurance tests, lifetime, colour consistency, standby power and temporal light modulation. Depending on the metric or test method being discussed, various SSL Annex Experts may be involved in supporting this task. In this Task, the Experts will review the metrics and requirements set-out in existing SSL regulations as well as metrics that are not included and assess the measurement standards that underpin those regulations. This assessment will investigate the accuracy of the measurement, the cost and the time for doing it. If any gaps are found, or alternative, more accurate and/or less costly methodology identified, feedback will be provided to the standardisation bodies to address the identified issues. The SSL Annex Experts may also make recommendations to the standardisation bodies on how best to address these issues.

Schedule	The work will be initiated in Year 1, as this is an urgent topic for governments and the research conducted in this Task can inform the on-going work of standardisation bodies and support regulatory updates that may occur in the near future (e.g., the European Commission's lighting regulation in 2023). A low-level of effort is projected out through Year 4 as work may be needed to develop recommendations.
Deliverables	The deliverable from this Task will be a report that reviews test methods used to measure metrics commonly used in regulations (or not used because of a lack of test method). This Task will be led by Peter Bennich with logistical support and coordination across the Experts by the Operating Agent. When complete, a policy brief will be prepared to accompany the Test Method Assessment Report.



Input for Task 5 –Test Methods and Performance Metrices

- Temporal Light Modulation: PST, SVM, THD
- Light Quality: IES TM-30
- Lumen Maintenance (3600h EU cycling)

Input for Task 5 – PST, SVM and THD

- Temporal Light Artefact measurements (PST and SVM)
- Included also THD % for current, due to argument from industry
- In Nov 2020 we sumarised SVM and THD from 785 measured objects from 195 models
- 41% PASS ahead of coming regulation. Including THD testing.

Socket	Dimmable	Models	SVM < 0.4	< 5W (no THD req)	>5W and THD < 70%	>5W and THD > 70%	Total Pass	Total Pass %
E14	All	23	15	19	1	3	12	**52%**
E27	All	66	51	38	6	22	31	**47%**
G4	All	6	5	6	NA	NA	5	**83%**
G9	All	32	13	31	NA	1	12	**38%**
G13 (230V)	All	19	4	NA	TBD	TBD	TBD	TBD
G13 (HF)	All	9	4	NA	TBD	TBD	TBD	TBD
GU5.3	All	21	20	7	NA	14	7	**33%**
GU10	All	16	12	11	4	1	11	**69%**
R7S	All	3	1	0	3	0	1	**33%**
	TOTAL	**195**	**125**	**112**	**14**	**41**	**79**	**41%**
	TOTAL %	**100%**	**64%**	**57%**	**7%**	**21%**	**41%**	

Swedish Energy Agency

758 objects

Input for Task 5 – PST, SVM and THD

- From Dec 2020 – May 2021 there are additional measurements yet to be included in SVM/THD summary overview:

Project	~ Samples	~ Models
Decorational lamps	50	50
Nordsyn (Nordic MVE)	127	66
Scanning of government procured products	164	164
	====	====
TOTAL	341	280

Input for Task 5 – PST, SVM and THD

- Measured SVM and THD from 195+280 = 475 models
- In total, we assessed more than 500 models including other measurements
- Experience of evaluating technical standards (methods) from building a PST, SVM, THD measurement setup is shared in a separate presentation.

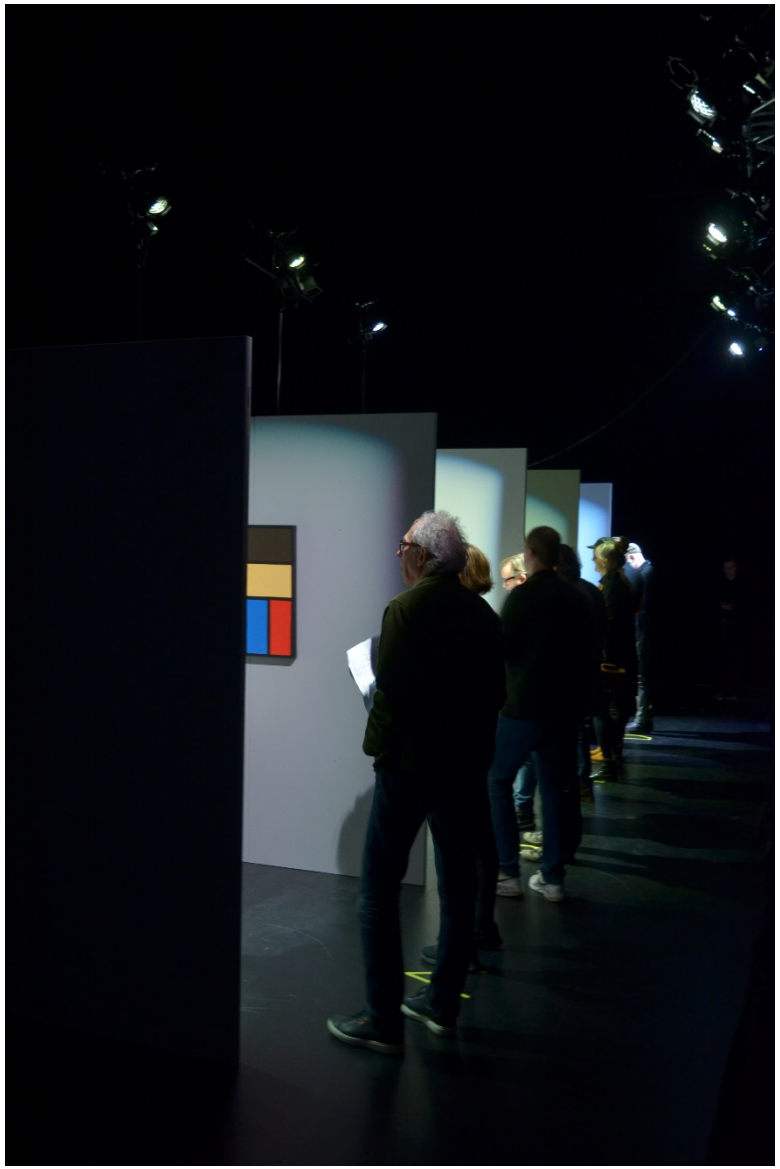
Swedish Energy Agency

Data input update

- We need to find a better way to create statistics
- The SSL Annex database at DTU is the best option
- Upload data directly from measurement software

Input for Task 5 – TM-30

- During the proposed phase out of halogen for performing arts, there was a debate about the inability of LED to replace halogen due to light quality issues.
- A research project was initiated to define light quality for performing arts and bridge communication gap.
- The theater lighting experts have now identified IES TM30 as a useful tool to define white light quality and give feedback to stage luminaire manufacturers.
- Swedish National Heritage Board have also joined the project.
- Practical workshops on TM30 are planned.



TM30 workshop in

Göteborg and Stockholm,

October 2021

Swedish Energy Agency

ARE THE DEMANDS IN ENTERTAINMENT LIGHTING TOO HIGH FOR WHITE LIGHT EMITTING DIODES?

Nilsson Tengelin, M., Mylly, N., Hedekvist, P. O.
Department of Measurement Science and Technology, RISE Research Institutes of Sweden, Borås, SWEDEN
Maria.Nilssontengelin@ri.se

Abstract

This paper reports the result of a survey on entertainment lighting distributed to 246 museums and 56 theatres in Sweden. The questions concerned the lighting technology used, experience from changing lighting systems, plans, problems, apprehensions and expectations. The replies showed that the transition to LED has been much faster in museums than in theaters and 35% of the theatres do not plan for a transition to LED. Reasons given are economy, light quality, and dimming functionality. Lighting professionals are generally sceptical in exchanging halogen lights. The artistic expression in lighting design goes beyond the specifications and what is promised in the data sheet. To facilitate a smoother transition to modern lighting technologies, the quality of the white light and proper function of the luminaires must be ensured and the communication between the manufacturers, retailers, lighting professionals and other artistic functions must be improved.

Keywords: Entertainment lighting, Stage Lighting, Theatres, Museums, Colour Rendering

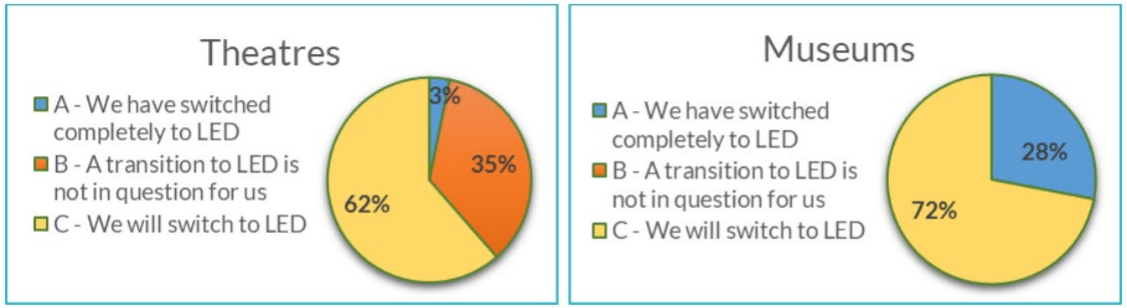


Figure 3 – Transition to LED-based spotlights in theatres (left) and museums (right).

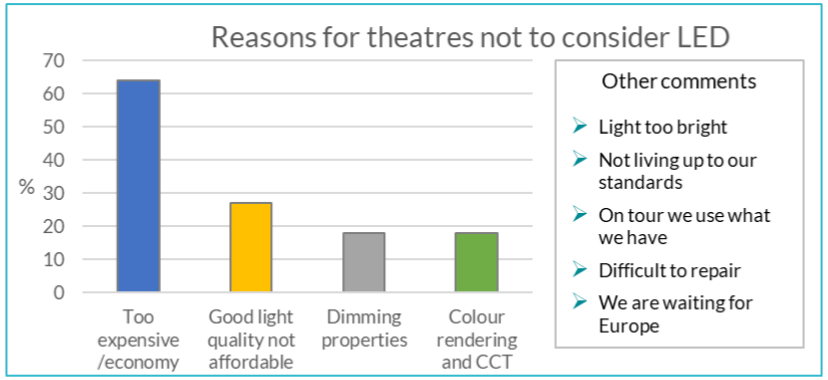


Figure 4 – Comments from theatres on reasons not to consider LED. Number of replies is 11.

Discussion

Museums are significantly more positive to LED lighting technology than theatres.

Replacing the lighting system is generally a smaller investment for a museum since they often use smaller spotlights and not in as many different positions as the theatres do.

Many theatres choose to wait for others or wait for the technology to improve while the museums do not have the same wait-and-see attitude.

The theatres are more divided on the question of satisfaction with LED light sources compared to the museums. Negative comments concern colour rendering, poor dimming functions and that the luminaires are expensive.

Positive comments include light quality, flexibility and sustainability. There are split opinions on however the LED lighting is worth it's price or not.

Regarding dimming properties, generally the museums are content with the fact that the LED light maintains its colour temperature when dimmed while many lighting professionals at theatres requests that the colour temperature decreases with dimming as is the case with halogen light.

The positive answers showed that those who had made informed choices to take into account the positions in which the luminaires were to be used and who had the finances to buy better quality are most satisfied.

Paper submitted to CIE-conference

Swedish Energy Agency

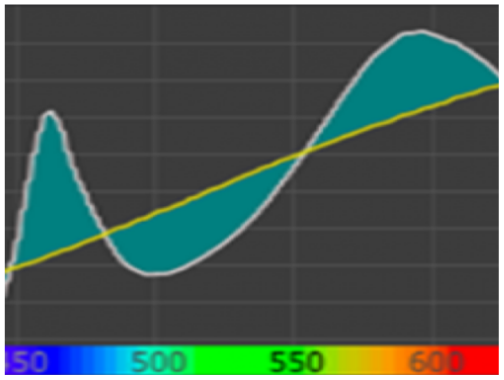
OSCAR STATUETTE

- Spectral Similarity Index (SSI) | Oscars.org | Academy of Motion Picture Arts and Sciences

AWARDS MUSEUM EXPLORE LEARN ACADEMY GOLD

HOME / SCIENCE & TECHNOLOGY / INDUSTRY-WIDE PROJECTS AND COLLABORATION / SPECTRAL SIMILARITY INDEX (SSI)

SPECTRAL SIMILARITY INDEX (SSI)



The Academy of Motion Picture Arts and Sciences, working with cinematographers, cinema lighting experts, lighting manufacturers, and lighting, imaging, and camera scientists and engineers, has developed a new index for the spectral evaluation of lights. The Spectral Similarity Index, or SSI, addresses issues with existing indices such as the Color Rendering Index (CRI) and the Television Lighting Consistency Index (TLCI) that make them inappropriate to describe lighting for digital cinema cameras -- issues that have become more evident with the emergence of solid-state lighting (SSL) sources such as LED's.

Swedish Energy Agency

Note

- One Swedish manufacturer suggests EU to use TM-30 and LM-80 standards

Input for Task 5 – lm/W

- Pre-schools contact SEA and claim to have 4000K 60x60 LED luminaires installed.
- Staff is complaining about the light quality
- There are also reasons to believe high lm/W 4000K luminaires are not appropriate for 1-6 year olds.
- How to connect the lm/W road map with application standards?
  - Intensity testing (cd)?
  - Blue light levels (scattering in the eye)?

Metric units vs task

Unit	Purpose	Pro	Cons
Lumen	Support trade	Established	What about children, elderly, animals, plants?
Lumen/Watt	For product efficiency		Not addressing rebound effect
Watt on system level			Measure power after driver?
TM30			Not accepted by EU (yet?)

Swedish Energy Agency

Other measurment comments

- Lumen – invented to support trade
- Time for additional lumen definitions?
  - Adult lumen
  - Child lumen
  - Sensitive lumen
  - Insect lumen
  - Wild life lumen
  - Human Lumen

- Measure W including driver and light source

Sweden Country Update

- SEA internal lighting strategy reviewed
- EELYS research program reviewed
- EELA online training program launched
- SEA order new portable lightspion goniometer for EELA training
- New CAS 140D array spectrometer to the sphere lab
- Luleå University, aging tests and driver schematics analyse
- Testlab relocating before summer 2022 and IEA 4E SSL Annex offers great opportunities to Testlab refugees

Swedish Energy Agency

LightingWeek 2021 Preliminary

- IEEE Smart Lighting Project + Greenhouses
- EELA Module 5 Day (business collaboration)
- Nordic collaboration (University, MVE)
- EELYS Research Project Day
- Lighting for Load balancing
- Study visit from KTH Architecture