SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2024 HIGHLIGHTS

SHC Task 70 / EBC Annex 90: Low Carbon, High Comfort Integrated Lighting

THE ISSUE

Lighting accounts for 5% of the global CO2 emissions. Its carbon footprint has a significant impact on global warming. Also, in the transition to mainly electricity-based energy systems, lighting with 15% of the electrical energy consumption, is in strong competition with other existing or new consumers, e.g., e-mobility or heat pumps. With rising electricity prices and steadily higher directly taxed CO2 emissions also lighting costs increase significantly. Thus, to make today's high comfort lighting installation more efficient, the consumption of electric lighting systems must be cut further, and benefits of daylight used better. And, moreover, embodied energy for electric and daylighting - i.e., façade technology - must be taken into accounted. Thus, widening the rating perspective of lighting solutions to a more holistic view of its impact on CO2 emissions, encompassing the whole life cycle (the "lighting value chain") also in context of regional energy markets aspects, interaction with other building trades etc. is urgently deemed necessary. This goes far beyond pure LED lamp driven efficiency gains and can allocate big additional potentials.

Participating Countries

Australia
Austria
Belgium
Brasil
China
Denmark
Germany
Greece
Italy
Japan
Norway
Poland
SACREE
South Africa
Spain
Sweden
Netherlands
Türkiye
U.S.A.

OUR WORK

The aim of SHC Task 70 - EBC Annex 90 is to identify and support implementing the potentials of lighting (electric, façade: daylighting & passive solar) in the decarbonization on a global perspective while aligning the new integrative understanding of humans' light needs with digitized lighting on a building and a building related urban scale:

- Support broadening the view on lighting solutions as a whole in in decarbonization. Bridge the gap between a component view (manufacturer's focus) and design-oriented system approaches. Support the transition from energy focused views to a LCA perspective. Identify key impact factors and develop the most effective strategies and roadmaps while including regional specifics.
- Contextualize this with the fast-developing digitization of buildings/lighting installations on the technology, design, and operational side. Add to selected open points in the digital chain like better design processes.
- Align this with the ongoing understanding of user needs and, building upon results from earlier tasks (e.g. Task 61).
- Integrate competencies: Bring the different involved players (electric lighting, façade, industry, controls) so far not connected on low carbon solutions together in workshops and specific projects. Create added value by transferring into standardization, regulations, and building certificates.

Task Period 2023 – 2026
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KEY RESULTS IN 2024

Better (day) lighting with lower environmental impact - first case studies

Daylighting and lighting systems in buildings worldwide are being assessed for their quality and environmental impact. These evaluations often include existing solutions and hypothetical scenarios, revealing that the best lighting solutions may require balancing quality with sustainability. Two examples highlight this challenge. In one case, four offices in Turin were analyzed for their ability to support circadian rhythms through daylighting and electric lighting. Good daylighting design met circadian needs near windows, emphasizing the importance of interior layouts. However, achieving full circadian performance with electric lighting doubled energy use, significantly increasing the environmental impact. This shows that effective daylighting can meet both quality and environmental goals. The second example involves a planned renovation of a sports hall in Eslöv, Sweden, currently reliant on electric lighting. Three daylighting retrofits – sidelight windows, skylights, and tubular daylight devices - were tested for lighting quality, environmental impact, and cost. Using the shadow cost method, skylights offered the best performance but were more expensive in life cycle cost perspective, while tubular daylight devices were cost-effective due to lower maintenance. Over 30 years, all daylighting retrofits proved more sustainable than the existing setup, providing much better lighting quality with financial payback achieved within 24–28 years, depending on the financial context. These studies underline the potential of thoughtful daylighting design to improve lighting quality and sustainability. Further case studies will be published during the project —stay tuned!

Link into the building design processes: One standard published; another standardization activity started

Started in IEA SHC Task 61 / EBC Annex 77 the revision process of “ISO/CIE 10916 Light and lighting — Energy performance of lighting in buildings — Calculation of the impact of daylight utilization” has now formally ended with the publication in 10/2024. It brings IEA research into practice as it offers for the first time in lighting – like other building trades – a simple, fast applicable, hourly, energy calculation and rating method.

Meanwhile a new standardization effort has been launched by a group of IEA Task 70 / Annex 90 experts on BSDF Generation for complex fenestration systems. Shading or daylighting devices are of growing importance in the context of increasing overheating risks of buildings while maintaining high visual comfort for occupants. Mostly it is not specified how they can or should be represented. BSDFs offer an efficient possibility for this. Standardized methods do not yet exist for these “optically complex” or light scattering, shading and daylighting systems. This impedes objective evaluation of energy performance, solar distribution, daylighting, comfort, and other building performance qualities. The newly launched ISO/CIE AWI 25176 project in ISO/TC 274/JWG 1 aims to specify procedures for the BSDF characterization of CFS and the generation of tabular BSDF data sets as input to ISO 10916 as well as in simulation tools – this is based on the results of previous long term IEA SHC work.

Exchange with Industry and Design Practice

IEA SHC Task 70 – EBC Annex 90 continued exchange with industry with two well visited industry workshops in conjunction with the Experts meetings in Berkeley, USA, in spring and in Lyngby, Denmark, in fall 2024.

Short presentations followed up by intense panel discussions led to an excellent exchange especially on current issues like opportunities and obstacles in the façade market, especially on the deployment of new technologies in the market with opportunities and shortfalls of reducing the carbon footprint – in the Berkeley meeting. At DTU in Lynby the focus was on overarching topics such as the environmental impact of lighting and daylighting solutions towards circularity and the use of passive design strategies to reduce operational CO2 emissions. Representatives from 10 companies and design offices joined the task experts and were on the panels of the two workshops.