SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2014 HIGHLIGHTS

SHC Task 50
Advanced Lighting Solutions for Retrofitting Buildings

THE ISSUE

Lighting accounts for approximately 19% (~3000 TWh) of global electric energy consumption. Without essential changes in policies, markets and practical implementations, it is expected to continuously grow despite significant and rapid technical improvements like solid-state lighting, new façades and light management techniques. Major lighting energy savings can be realized by retrofitting existing out-of-date lighting installations, as new solutions allow a significant increase in efficiency along with highly interesting payback times. However, lighting refurbishments are still lagging behind compared to what is economically and technically possible and feasible.

OUR WORK

The overall objective of SHC Task 50 is to accelerate the retrofitting of daylighting and electric lighting solutions, using cost effective, best-practice approaches that can be applied in a wide range of existing buildings.

The Task work includes the following activities:

- Developing a sound overview of the lighting retrofit market.
- Triggering discussion and initiating revision of regulations and certifications.
- Increasing robustness of daylight and electric lighting retrofit approaches (technically, ecologically and economically).
- Increasing the understanding of lighting retrofit processes and stakeholders involved.
- Demonstrating state-of-the-art lighting retrofits
- Developing an electronic interactive source book, including design inspirations, design advice, decision tools and design tools.

Participating Countries

Austria
Belgium
Brazil
China
Denmark
Finland
Germany
Italy
Japan
Norway
Slovakia
Sweden
Switzerland

Industry
Philips

Task Date	2013-2015
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KEY RESULTS OF 2014

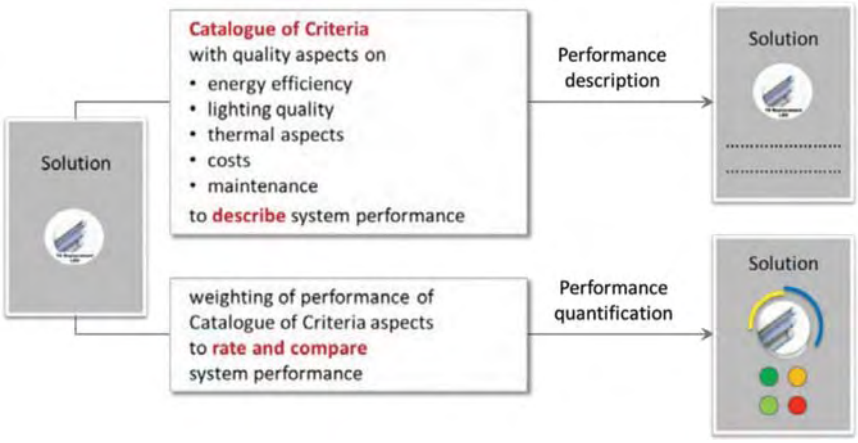
Set of Criteria to Assess and Compare Retrofit Solutions in a Holistic Way

Various retrofit strategies can be applied to save energy, reduce costs and increase lighting quality. In order to encourage practitioners to apply different retrofit strategies a holistic approach to compare the different solutions is needed. Therefore a catalogue of criteria was developed including different aspects such as:

- Ecology and economy
- User requirements
- Impact on the overall retrofit process
- Thermal behavior of daylighting systems
- Geographical and climatological applicability

Based on these criteria a comparison of different retrofit approaches on a common basis is possible. Additionally, for the different retrofit solutions descriptive, qualitative performance assessments are provided.

In order to allow for a quantitative assessment, set quality criteria are applied to assess the systems' performance for designated topics: 'Reduce energy efficiency' and 'Increase lighting quality' as well as the thermal impact of daylighting retrofit solutions. The relevance of each topic within the main categories is reflected in a weighting factor per item, which is used to determine the overall performance of a retrofit approach.

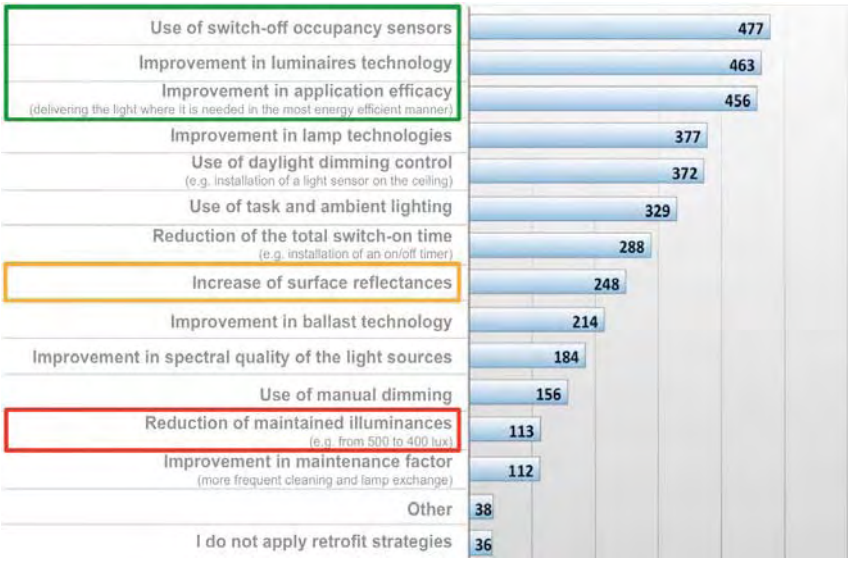


This catalogue of criteria is currently being applied within SHC Task 50 to an evolving collection (database) of more than 50 different retrofit techniques.

Evaluation of the Questionnaire about Methods & Tools Used for Lighting Retrofit

In the 2013 Highlights a questionnaire on the analysis of workflow and needs in practical retrofitting processes was introduced. In seven months more than 1,000 answers were received. The evaluation showed several key results:

- Dealing with artificial lighting as a retrofitting strategy is much more widespread than applying daylighting strategies.
- For practitioners, the user-friendliness, the quickness and the costs are the most important points regarding a retrofit supporting tool.



In conclusion, the overall answers to the questionnaire showed in an early period stage that the main barriers in using the simulation tools are essentially their complexity and the amount of time it takes to complete a study. Practitioners are keen to use tools in preliminary design stage and would like to be able to estimate the cost and other key figures (energy consumption and lighting levels) at this stage.

Test of the Developed Monitoring Protocol Ensuring Qualitative Measurements and First Usage Experiences

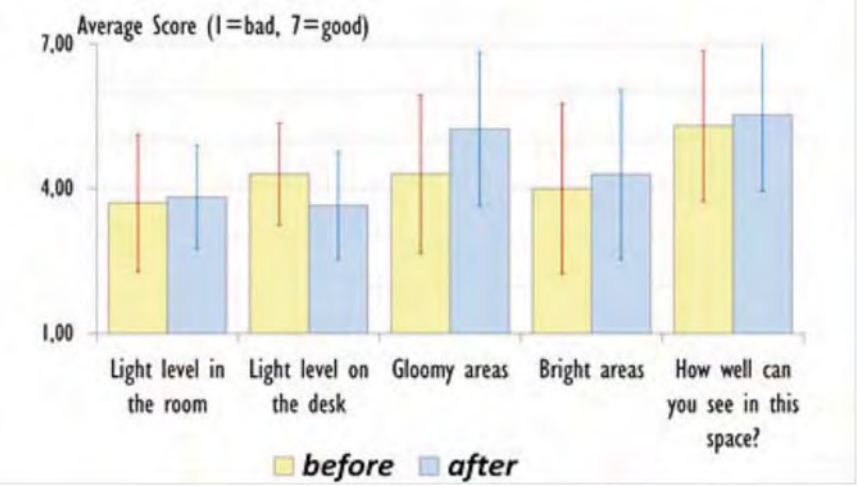
A monitoring protocol for the evaluation of the overall performance of lighting and/or daylighting retrofit projects was developed to assess buildings before and after retrofit or only post-retrofit with comparison to benchmark values. The protocol covers the following four key aspects:

- Energy efficiency
- Costs
- Light environment
- Users' satisfaction

It is presented as a non-expert guideline document that follows a 5-phase procedure 1) initial visit survey, 2) decision phase, 3) preparatory phase, 4) monitoring program, and 5) analysis phase. The developed monitoring protocol was first used when monitoring an open-plan office in Stockholm, Sweden. Because the retrofitting was ongoing, two floors representing both pre- and post-retrofit could be monitored at the same time. The results showed that although the daylight was drastically enhanced, the energy use for lighting was just slightly reduced. Although the new lamps are more efficient, the lighting control system did not work as expected. The light fixtures over the workspaces were on most of the time, even with sufficient daylight or when unoccupied.

A questionnaire assessed the subjective experience of lighting quality. An example is represented in the figure, where answers on perceived light levels and gloomy/bright areas are depicted. Altogether the monitoring protocol showed that the users benefit from the retrofitting.

By independently checking the different aspects energy, costs, light environment and user satisfaction, the lighting retrofit can be evaluated in its entirety. The retrofit is not evaluated through a simple "very good – very bad" verdict, but each action undertaken is reported. In this way, the case study assessment of SHC Task 50 will represent a useful guide for the decision makers, which need to deal with various aspects of lighting retrofit projects.



SHC Task 50 is a 3-year collaborative project that will be completed in December 2015.