IEA SHC Task 50: Advanced lighting solutions for retrofitting buildings

Lighting Retrofit Adviser (LRA)

28.9.2015
Lighting Retrofit Adviser

Objective: Develop as a joint activity an electronic interactive source book including design inspirations, design advice, decision tools and design tools

- Key role in Dissemination of Task results
- Collects and combines input the sub tasks
- Available for different mobile platforms
Lighting Retrofit Adviser: Link with other subtasks

ST A
Market and policy issues including benchmarks
- Market information, Benchmarks
- Retrofit Techniques
- Case-Studies
- Method and Tools

ST B
Lighting retrofit technology source book including specific new retrofit technologies.

ST C
Calculation Engine, Set of simple energetic and economic rating and calculation methods and tools.

ST D
Building Stock Analysis Case study source book.

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Information
- Market information, Benchmarks
- Retrofit Techniques
- Case-Studies
- Method and Tools

Integrated Calculation & Rating
- Light
- (Overall-) Energy
- Economics

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Provide tailored information to target groups

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Information
- Market information, Benchmarks
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- Case-Studies
- Method and Tools

Integrated Calculation & Rating
- Light
- (Overall-) Energy
- Economics

Owners / Investors

Authorities

Designers

Industry

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design inspiration, design advice, decision and design tools for relighting

Information Components:

- Benchmarking
- Technology Consultant
- Case Studies
- FAQ
- Markets & Policies
- Loans and Subsidies
- Legal Frameworks

Calculation & Rating Components:

- Collection of Tools
- Portfolio Analysis
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Your are a: Owner/Investor

Figure 8: The complex value chain

Role Of Lighting

Learn about Retrofit Potentials

Identify the potentials of your building(portfolio)

Initialize potential allocation
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Your are a: Designer / Consultant

Continue

Lighting retrofit as part of your service

Acquire specific knowledge (in a dynamic environment)

Apply and optimize services

...
Learn about Retrofit Potentials
Discover what potentials (energy and added value) lie in relighting and specifically in your building (portfolio), then decide how to proceed.

One morning, when Gregor Samsa woke from troubled dreams, he found himself transformed in his bed into a horrible vermin. He lay on his armour-like back, and if he lifted his head a little he could see his brown belly, slightly domed and divided by arches into stiff sections. The bedding was hardly able to cover it and seemed ready to slide off any moment.

* Additional information can be found here
E.g. Subtask reports...

Suited Tools
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- Technology Consultant
- Case Studies
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design inspiration, design advice, decision and design tools for relighting

Information Components:

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Calculation & Rating Components:

- Collection of Tools
- Portfolio Analysis
State your preferences:

- Energy Efficiency: Not Important
- Lighting Quality: Not Important
- Thermal impact: Impact unimportant
- Costs: Not important
- Climate: Not important

See the solutions:

- Daylighting
  - control system
  - product
  - Electrochromic glazing

- Electric Lighting
  - control system
  - product
  - Laser cut panel

- Occupancy control

- LED Retrofit for T8 lamps

Building Interior
Electrochromic glazing
A coating on the inner surface of the outer pane allows the glass to change transmittance in response to a small applied voltage. Spectral selective transmittance results in a rejection of solar heat gains while admitting daylight.

Performance of electrochromic glazing
Low-voltage power is required to switch electrochromic (EC) windows. For some types, a small applied voltage is needed to keep the EC in a constant state, irrespective of the level of tint. Average daily power consumption for switching and maintaining steady state for a 12-hour day is about 0.03 – 0.07 W/ft² floor area. The EC window can be operated automatically or manually to control light penetration, without compromising the view out. By providing unobtrusive dynamic shading in this way, EC glazing has significant potential to improve daylighting and energy use in new and existing buildings. A shift in spectral distribution might take place if all windows are equipped with EC glazing. Design guidelines should be followed to maintain neutral daylight (see references). The visible transmittance (tD65) and solar heat gain coefficient (SHGC) range of EC coatings vary depending on the material composition. U-factor is not affected by the change in tint.

Significant lighting energy savings potential is achievable when the window is zoned and controlled properly. Average daily lighting energy savings in a private south-facing office in Berkeley, California were 10 – 23% given non-optimized glare / daylight control, compared to a conventional high-transmittance window (tD65 = 0.60) with a fully – lowered, slightly open venetian blind (comparable level of glare control to EC window) with the same daylighting control system. Savings of 44% are attained if the reference case has no daylighting controls.

Typically limited sizes and shapes are available, to keep costs down. EC glass cannot be installed in existing window frames. EC glass must be part of a sealed insulating glass unit assembly.

To be applied when solar heat gains need to be reduced, while allowing a view out and daylight contribution.

Evaluation:
- Energy Efficiency
- Lighting Quality
- Thermal Impact
- Costs

Highlights:
- Preserve outward view while modulating transmitted light, glare and solar heat gains
- Energy savings due to reduced demand for electric lighting, heating and cooling
- No glare; Protection for direct sunlight
- High initial costs (installation and investment)

R. Kelly et al. (2013) Retrofit electrochromic glazing in an open plan office: a case study
Lawrence Berkeley National Laboratory (2006) Advancement of electrochromic windows
A. Azens (2003) Electrochromic smart windows: energy efficiency and device aspects
Saint Gobain (2014) How to Maintain Neutral Daylight Illumination with SageGlass® Electrochromic Glazing
LED Retrofit for T8

are applied to replace fluorescent lighting solutions, to reduce energy consumption and to increase lifetime of the lighting solution. LED retrofit lamps have the size of the conventional light source and typically include a ballast.

Evaluation:
- Energy Efficiency
- Lighting Quality
- Thermal Impact
- Costs

Performance of LED Retrofit for T8 lamps

The majority of LED Retrofit for T8 lamps are slightly more energy efficient (up to 105 lm/W) than the T8 fluorescent lamps. The required luminous flux is typically lower, as the beam angle of the light source is smaller. Resulting, the lighting condition is more efficient in illuminating horizontal planes, positively affecting the energy consumption. In some cases, this can lead to a lower light contribution to the vertical planes, which can affect lighting quality (darker walls and ceiling).

Most retrofit lamps have a colour rendering index above 80. Some products are weak in the red part of the spectrum. Additional information on the performance on red tones (e.g. colour rendering index R9) can give a better insight into the lamp performance. A review of available LED retrofit lamps indicates that some products still have an insufficient luminous flux or colour rendering index. Lamps with a clearly visible line of single LEDs seem to induce more glare than the conventional fluorescent lamps.

The lifetime of the retrofit lamps is typically longer (30 000 – 50 000 h), which will reduce the maintenance costs.

Retrofit can be done by a quick replacement of the lamp. In most cases, the LED retrofit lamp includes a ballast (internal converter). The ballast of the fluorescent lighting solution needs to be disconnected and the retrofit lamp can be placed directly in the lamp holder (follow the mounting instructions and pay attention that the starter of the converter is bypassed). Other solutions have an external converter. In this case a complete retrofit of the lamp with ballast is required. The replacement of the old lamp and ballast might require additional installation time.

To be used when an simple retrofit is required and low maintenance and life time are important. Lighting quality could be slightly reduced.


Description of the lighting and/or daylighting retrofit

This text presents a description of the lighting and/or daylighting retrofit explaining the purpose of the project and the main features of the retrofit project. This text presents a description of the lighting and/or daylighting retrofit explaining the purpose of the project and the main features of the retrofit project. This text presents a description of the lighting and/or daylighting retrofit explaining the purpose of the project and the main features of the retrofit project. This text presents a description of the lighting and/or daylighting retrofit explaining the purpose of the project and the main features of the retrofit project.

Key statements:

- Reduce operation costs
- Improve lighting quality
- Improve organisation’s image
- Obtain environmental credits
- General refurbishment of the building
- Change in the organisation structure
Electric lighting
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Key statements:
- Suspended task lamps
- Absence detectors
- LED
- No integration with daylighting
**Benchmarking**

### Installed Power (in zone)
- **Your Building**
  - **Installed Power [W]**
  - **Floor area [m²]**
  - **Specific [W/m²]**: 18

### Electricity Consumption
- **Your Building**
  - **Electricity Consumption [kWh]**
  - **Floor area [m²]**
  - **Specific [kWh/m²]**: 30

### Energy for Lighting

**Your building/zone compared to the national building stock:**

- **Installed Power [W/m²]**
  - **Max:**
  - **Average:**
  - **Min:**

- **Electricity Consumption [kWh/m²]**
  - **Max:**
  - **Average:**
  - **Min:**

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Ergebnisse des Tyraums
Berechnung wurde mit Beispielwerten durchgeführt.
Installierte Leistung: 452.4 [W]
Flächenbezogene Leistung: 22.62 [W/m²]
Energiebedarf: 814.08 [kWh/a]
Energiebedarf: 40.7 [kWh/(a*m²)]
Auswahl der Sanierungsvarianten

V2a: Austausch der Leuchten
V2b: Austausch der Leuchten
V3: B + Sanierung des Lichtmanagements
V4: V3 + Sanierung der Fassade
V5: B + Sanierung der Raumreflexionsgrade
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Additional information can be found here E.g. Subtask reports...
Available in 2015
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Simon Wössner
Fraunhofer Institute of building physiks
simon.woessner@ibp.fraunhofer.de

www.ibp.fraunhofer.de/wt