

# IEA SHC Task 50:

# Advanced lighting solutions for retrofitting buildings



Daylighting

Electric Lighting

Lighting Controls

January 2013 – December 2015



# Lighting and Energy: Potentials in Retrofitting

Only small volume of new building constructions

**40-50%** of turnover of facade and lighting industry in retrofitting



Geo-reisecommunity

**~3%** retrofit rate

(estimation facade and lighting industry)

**75 %** of appliances outdated (older than **25 a**)



Wikipedia...Apl6e3748

**“Lighting retrofits can save significant amounts of energy costeffectively”**

LIGHT'SLABOUR'S LOST, Policies for Energy-efficient Lighting, IEA, 2006

# Task Structure

The objective is to accelerate retrofitting of daylighting and electric lighting solutions in the non-domestic sector using cost - effective, best practice – approaches, which can be used on a wide range of typical existing buildings.

## ***IEA SHC Task 50***

### **Advanced lighting solutions for retrofitting buildings**

*Operating Agent: J. de Boer, DE*

#### **Subtask A**

*M. Fontoynt,  
DK*

**Market  
and  
Policies**

#### **Subtask B**

*M. Knoop, DE*

**Daylighting  
and Electric  
Lighting  
Solutions**

#### **Subtask C**

*J. Kaempf &  
B. Paule, CH*

**Methods  
and  
Tools**

#### **Subtask D**

*M.-C. Dubois, SE*

**Case  
Studies**

**Joint Working Group: "Lighting Retrofit Adviser"**

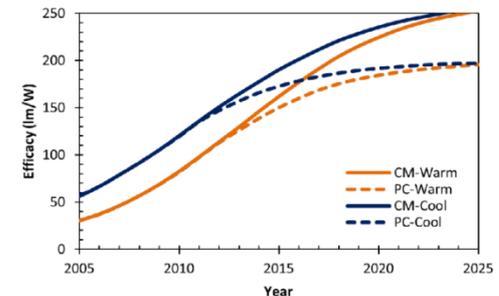
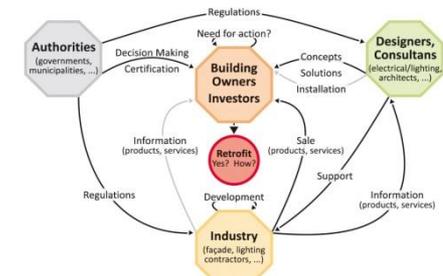
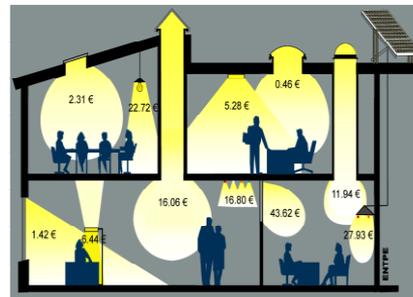
# Subtask A: Market and Policies

[Coordination: M. Fontoynt, SBI, Denmark]



**Objective:** To understand and model the financial and energy impact associated to retrofitting daylighting and electric lighting of buildings.

- A.1 Global economical models
- A.2 Barriers and benefits
- A.3 Building Energy regulation and certification
- A.4 Proposal of action concerning value chain



	Typology / best solutions	TCO of lighting	Value benefit	Energy benefit	Function benefit	Human benefit	Other benefit
1.	Offices New blind system and blind control Ambient task lighting Task lighting conrio Daylight harvesting	€/m <sup>2</sup>	2000 €/m <sup>2</sup> (value) [ref] €/m <sup>2</sup>	2 €/m <sup>2</sup> .yr (lighting) 4€/m <sup>2</sup> .yr (cooling & lighting )	Higher productivity €/m <sup>2</sup>	less stress extra hours of comfortable work €/m <sup>2</sup>	€/m <sup>2</sup>

# Subtask B: Daylighting and Electric Lighting Solutions

[Coordination: M. Knoop, TU Berlin, Germany]



**Objective:** To assess quality of existing and new solutions in the field of façade and daylighting technology, artificial lighting and lighting controls. To identify and structure existing and develop new lighting system technologies.

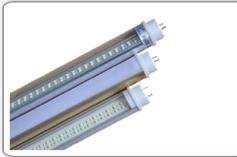
- B.1 Definition - system characterization
- B.2 Definition of (regional) baseline conditions
- B.3 Review of state of the art technology and architectural solutions
- B.4 New technical developments
- B.5 Measurements of selected state of the art and new technologies
- B.6 Source book

Building intervention level

PROJEKT TAGESLICHTNUTZUNG IN GEBÄUDEN IV

Home Projekt Technologien Kontakt

### LED Retrofit for T8/T5 lamps



**LED Retrofit for T8 / T5 lamps**  
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.

**Performance of LED Retrofit for T8 / T5 lamps**

The majority of LED Retrofit for T8 lamps are slightly more energy efficient (up to 10% 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 contribution to the vertical plane, which can affect lighting quality (darker walls and ceiling).  
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. The ballast of the fluorescent lighting solution needs to be disconnected and the retrofit lamp can be placed directly in the lamp holder.

Most retrofit lamps have a colour rendering index above 80, additional information on the performance on red tones can give more 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.  
In general this retrofit solution will not increase lighting quality or address non-visual effects.

Still missing:  
Power factor information, lumen depreciation, flicker details, dimm characteristics, glare due to small light sources

[Link zur Fallstudie...](#)

Energy efficiency: [Progress bar]

Maintenance & Costs: [Progress bar]

Lighting Quality: [Progress bar]

Ease of use & retrofit aspects: [Progress bar]

- Quick replacement possible, long lifetime
- Medium reduction of energy consumption (20 - 40%)
- Possibly weak on lumen output and colour rendering
- The majority of lamps has a smaller beam angle resulting in lower vertical illuminances

**To be used when a simple retrofit is required and low maintenance and life time are important. Lighting quality is not enhanced.**

Myer M.A., Paget, M.L., Lingard, R.D. (2009) CALiPer Benchmark Report - Performance of T12 and T8 Fluorescent Lamps and Troffers and LED Linear Replacement Lamps

Ryckaert, W.R. et al. (2011): Performance of LED linear replacement lamps.

Ryckaert, W.R.; Smet, K.A.G.; Roelands, I.A.A.; van Gils, M.; Hanselaer, P. (2012): Linear LED tubes versus fluorescent lamps: An evaluation.

BACK

Fachgebiet Lichttechnik der Technischen Universität Berlin  
Impressum

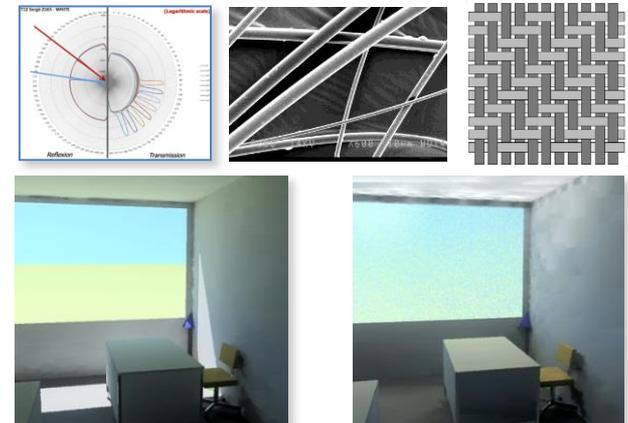
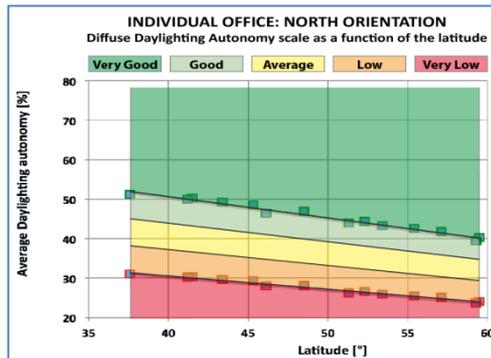
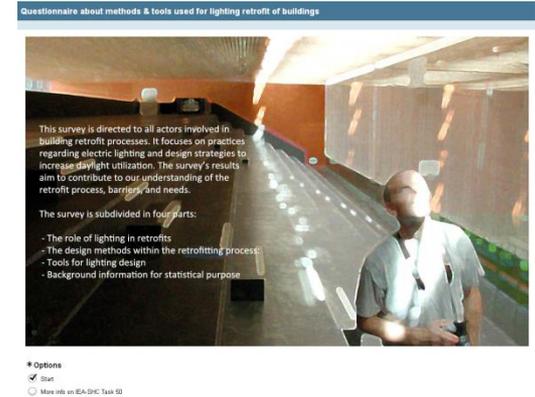
# Subtask C: Methods and Tools

[Coordination: Jérôme Kaempf, EPFL, Bernard Paule, Estia, Switzerland]



**Objective:** Provide methods and tools to make energy efficiency and economics of lighting retrofits transparent to stakeholders.

- C.1 Analysis of workflow and needs
- C.2 State of the art review
- C.3 Development of a simple integrated rating model
- C.4 Energy audit and inspection procedures
- C.5 Advanced and future simulation tools



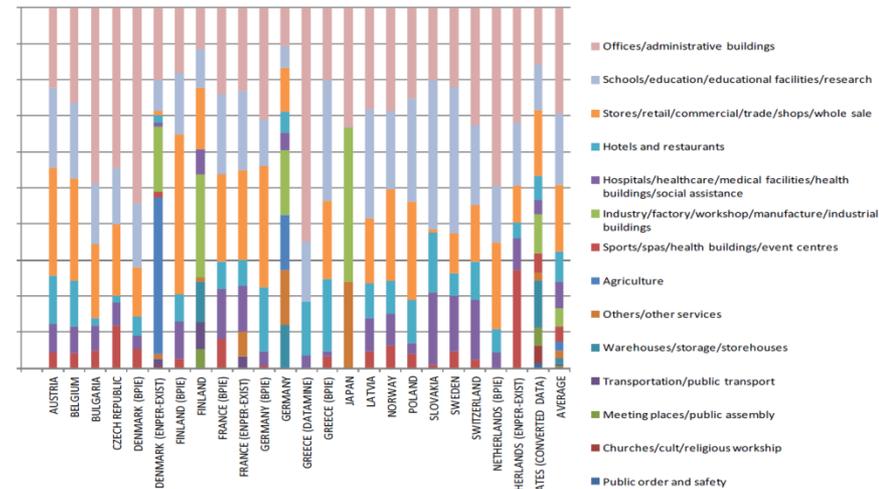
# Subtask D: Case Studies

[Coordination: Marie-Claude Dubois, Niko Gentile, Lund University, Sweden]



**Objective:** Perform building stock analysis including generation of a building typology for lighting retrofits. Based on this deliver proven and robust evidence on achievable savings and show integrated retrofit strategies for representative Case studies

- D.1 Building stock/typology
- D.2 State-of-the-art review
- D.3 Assessment and monitoring procedure
- D.4 Case study assessment
- D.5 Overall conclusions, lessons learned
- D.6 Case study book / e-documentation



# Lighting Retrofit Adviser

*design inspirations, design advice, decision and design tools for relighting*

Select your Country



You are

Investor / Owner ▼

START

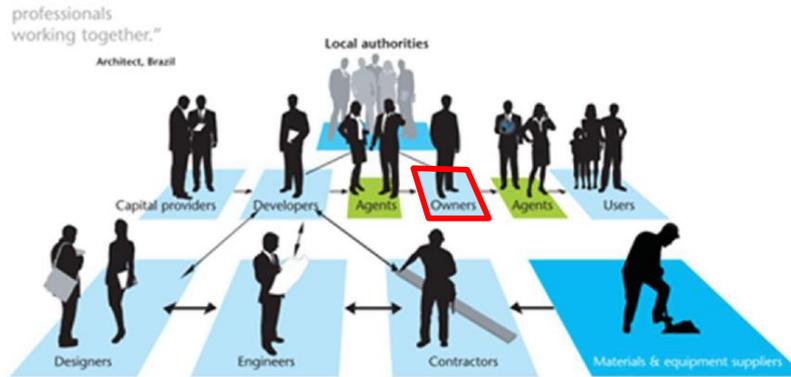
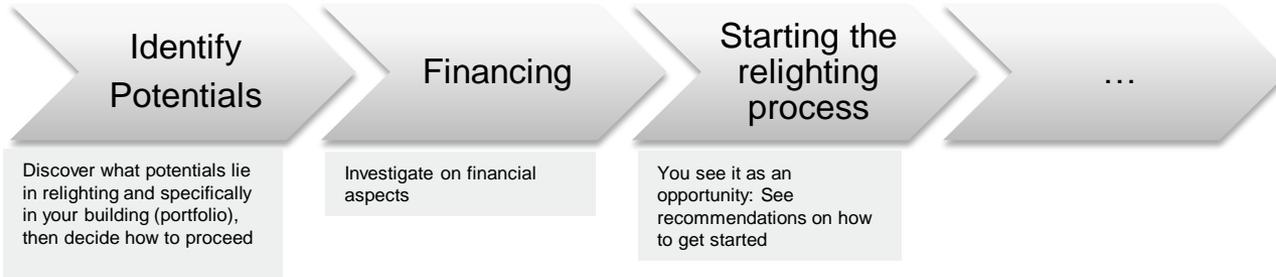
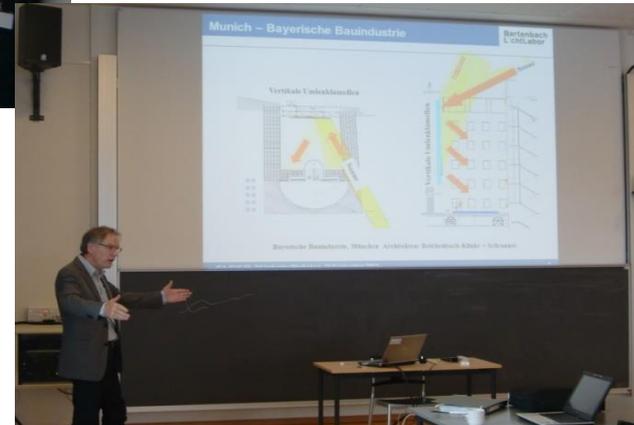


Figure 8: The complex value chain



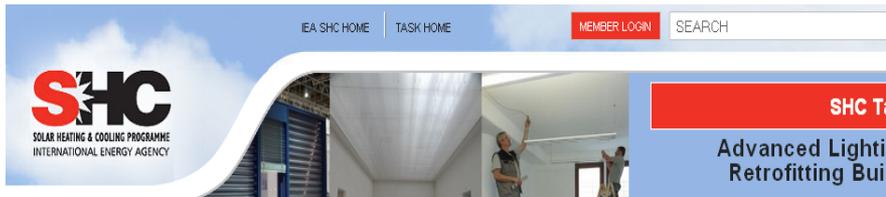
- Identify demands by simple question, who the user is
- Configure the contained information (components) into a suited workflows
- Leave access to other information (components) open
- Here a more target group oriented starting page.

# Who is behind the activity ...



30 participants  
18 universities/institutes/companies  
14 Countries

# Information & Dissemination



## Newsletter 1 Overview and first results

March 2015

### IEA SHC Task 50: Advanced Light- ing Solutions for Retrofitting Buildings

#### DAYLIGHTING – ELECTRIC LIGHTING – LIGHTING CON- TROLS

##### BACKGROUND AND OBJECTIVES

Lighting accounts for approx. 19 % (~3000 TWh) of the global electricity 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 façade and light management techniques. With a small volume of new

buildings, major lighting energy savings can only be realized by retrofitting the existing building stock. Compared to existing installations, the majority of new solutions allow a significant increase in efficiency – easily by a factor of three or more – going along with highly interesting payback times. However, lighting refurbishments are still lagging behind compared to what is economically and technically possible and feasible.

With the activities in Task 50, we aim at improving the lighting refurbishment process in non-residential buildings in order to unleash energy saving potentials while at the same time improving lighting quality. The overall objective is to accelerate retrofitting of day-lighting and electric lighting solutions in the non-domestic sector using cost effective, best-practice approaches, which can be used on a wide range of typical existing buildings.

This includes the following activities:

- Develop a sound overview of the lighting retrofit market
- Trigger discussion, initiate revision and enhancement of local and national regulations, certifications and loan programs
- Increase robustness of daylight and electric lighting retrofit approaches technically, ecologically and economically
- Increase understanding of lighting retrofit processes by providing adequate tools for different stakeholders
- Demonstrate state-of-the-art lighting retrofits
- Develop as a joint activity an electronic interactive source book including design inspirations, design advice, decision tools and design tools

This newsletter presents first results of IEA Task 50 addressing current topics in lighting retrofits.

##### Content

By-passing Barriers for lighting retrofits: Is Solid State Lighting already changing the game?	Page 2
Towards a database of lighting retrofit technologies: Catalogue of criteria	Page 4
Lighting retrofit in current practice: Evaluation of a survey with more than 1000 participants	Page 6
Assessment of lighting retrofits in practice: First application of a new monitoring protocol	Page 7
Outlook – Interactive presentation of results in an electronic source book: The Lighting Retrofit Adviser	Page 9
Further information on IEA-SHC Task 50	Page 10

Search:   
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### Project (Task) Publications

The following are publications developed under Task 50:

**Task 50 Brochure**  
*Advanced Lighting Solutions for Retrofitting Buildings*  
Juli 2013 - PDF 1,45MB - Posted: 7.16.2013

The overall objective is to accelerate retrofitting of daylighting and electric lighting solutions non-residential sector using cost effective best practice approaches, which can be used on typical existing buildings.



Example of a simple tool easy and quick

#### Deliverables

Within the scope of Task 50, the deliverables are anticipated:

- Report on the lighting retrofit policy issues and proposal
- Source book on daylighting retrofit technologies, covering advanced retrofit solutions
- Toolbox with (simple) method and economic auditing, ray simulation
- Documentation of realized lighting retrofits for different building types
- "Lighting Retrofit Adviser" - An electronic, interactive design advice and recommendation making tools and design tool

Most deliverables will be available in addition, Workshops and News progress and disseminate information

PARTICIPATING COUNTRIES: AUSTRIA · BELGIUM · CHINA · DENMARK · FINLAND · GERMANY · ITALY · JAPAN · NETHERLANDS · NORWAY · SOUTH AFRICA · SWEDEN · SWITZERLAND

<http://task50.iea-shc.org/>

IEA SHC Task 50 *Advanced lighting solutions for retrofitting buildings*



# „Low hanging fruits“





