Chapter 1: Introduction

Topics covered

1 Introduction

1.1 How to use the Guidebook

This Guidebook is the achievement of the work done in the IEA ECBCS Annex 45 *Energy efficient Electric Lighting for Buildings*. The Summary of the Guidebook is available as a printed copy. The whole Guidebook is available on the internet (http://lightinglab.fi/IEAAnnex45, and http://www.ecbcs.org). Additional information in the whole Guidebook includes Annex 45 newsletters, a brochure, and appendices.

This Guidebook is intended to be useful for lighting designers and consultants, professionals involved in building operation and maintenance, system integrators in buildings, end users/owners, and all others interested in energy efficient lighting.

1.2 About the Annex 45

1.2.1 Background

Lighting is a large and rapidly growing source of energy demand and greenhouse gas emissions. In 2005 grid-based electricity consumption for lighting was 2650 TWh worldwide, which was about 19% of the total global electricity consumption. Furthermore, each year 55 billion litres of gasoline and diesel are used to operate vehicle lights. More than one-quarter of the population of the world uses liquid fuel (kerosene oil) to provide lighting (IEA 2006). Global electricity consumption for lighting is distributed approximately 28% to the residential sector, 48% to the service sector, 16% to the industrial sector, and 8% to street and other lighting. In the industrialized countries, national electricity consumption for lighting ranges from 5% to 15%, on the other hand, in developing countries the value can be as high as 86% of the total electricity use (Mills 2002).

More efficient use of the energy used for lighting would limit the rate of increase of electric power consumption, reduce the economic and social costs resulting from the construction of new generating capacity, and reduce the emissions of greenhouse gases and other pollutants into the environment. At the moment fluorescent lamps dominate in office lighting. In domestic lighting the dominant light source is still the inefficient incandescent lamp, which is more than a century old. At the moment, important factors concerning lighting are energy efficiency, daylight use, individual control of light, quality of light, emissions during the life-cycle, and total costs.

Efficient lighting has been found in several studies to be a cost effective way to reduce CO_2 emissions. The Intergovernmental Panel on Climate Change for non-residential buildings concluded that energy efficient lighting is one of the measures covering the largest potential and also providing the cheapest mitigation options. Among the measures that have potential for CO_2 reduction in buildings, energy efficient lighting comes first largest in developing countries, second largest in countries with their economies in transition, and third largest in the industrialized countries (Ürge-Vorsatz, Novikova & Levine 2008).

The report by McKinsey (McKinsey 2008) shows the cost-effectiveness of lighting systems in reducing CO_2 emissions; see Figure 1-1. The global "carbon abatement cost curve" provides a map of the world's abatement opportunities ranked from the least-cost to the highest-cost options. This cost curve shows the steps that can be taken with technologies that either are available today or look very likely to become available in the near future. The width of the bars indicates the amount of CO_2 emissions that we could abate while the height shows the cost per ton abated. The lowest-cost opportunities appear on the left of the graph.

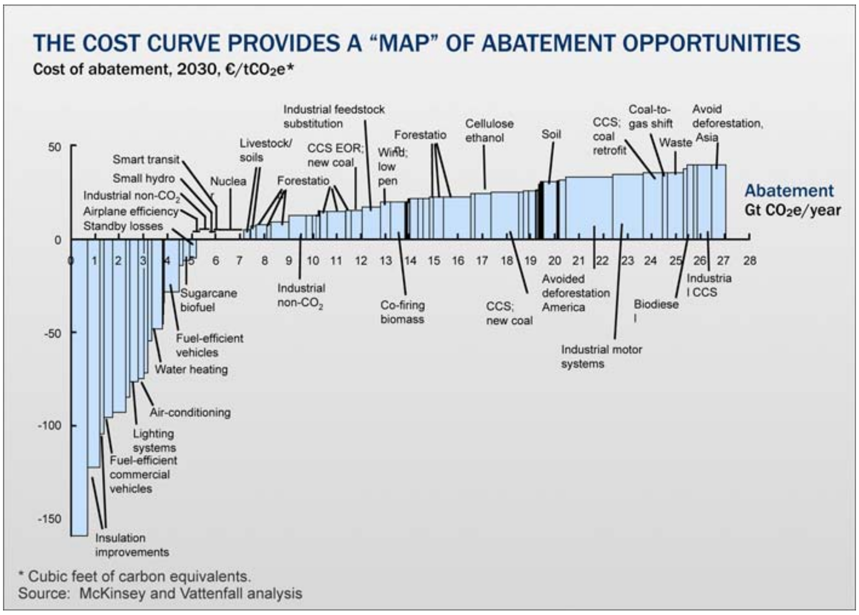

Figure 1-1. *Costs of different CO_2 abatement opportunities. (McKinsey 2008)*

1.2.2 Objectives and scope

The goal of Annex 45 was to identify and to accelerate the widespread use of appropriate energy efficient high-quality lighting technologies and their integration with other building systems, making them the preferred choice of lighting designers, owners and users.

The aim was to assess and document the technical performance of the existing promising, but largely underutilized, innovative lighting technologies, as well as future lighting technologies. These novel lighting system concepts have to meet the functional, aesthetic, and comfort requirements of building occupants.

This guidebook mostly concerns the lighting of offices and schools.

1.2.3 Structure of Annex 45

The work of Annex 45 was conducted during 2005-2009. The work of Annex 45 was divided into four Subtasks.

- Subtask A Targets for Energy Performance and Human Well-being
- Subtask B Innovative Technical Solutions
- Subtask C Energy efficient Controls and Integration
- Subtask D Documentation and dissemination

Subtask A: Targets for Energy Performance and Human Well-Being

The objectives of this subtask were to set targets for energy use, lighting quality and human well-being. Another aim was to propose an upgrade of lighting recommendations and codes to improve the energy performance of indoor lighting installations. The performance criteria include the quality of light (spectrum, colour rendering and colour temperature) and user acceptance. The energy criteria include the energy efficiency of lighting, life-cycle energy considerations, and the maintenance and control of light. The economic criteria include the initial costs and operating costs.

Subtask B: Innovative Technical Solutions
The objective of this Subtask was to identify, assess and document the performance, energy and economical criteria of the existing promising and innovative future lighting technologies and their impact on other building equipment and systems. The purpose was to reduce the energy use of buildings by investigating the saving potential by comparing the existing and future technologies and by providing information on concepts, products and lighting solutions. The technical solutions cover connection devices (ballast, control gear, current sources, etc.), light sources, luminaries, and control techniques.

Subtask C: Energy-Efficient Controls and Integration
Subtask C focused on the optimal use of controls that enable energy savings to be made whilst the user (occupant, facility manager, operation and maintenance team) has the chance to adjust the electric lighting according to their personal needs and preferences, within acceptable building operation requirements.

Subtask D: Documentation and Dissemination
The objective of Subtask D was to compile and widely disseminate the results of Subtasks A, B and C and to identify ways to influence energy policies and regulations in order to promote the use of energy efficient lighting. The aim of Subtask D was to improve current lighting practices in a manner that accelerates the use of energy efficient products, improves overall building performance and enhances the occupants' environmental satisfaction.

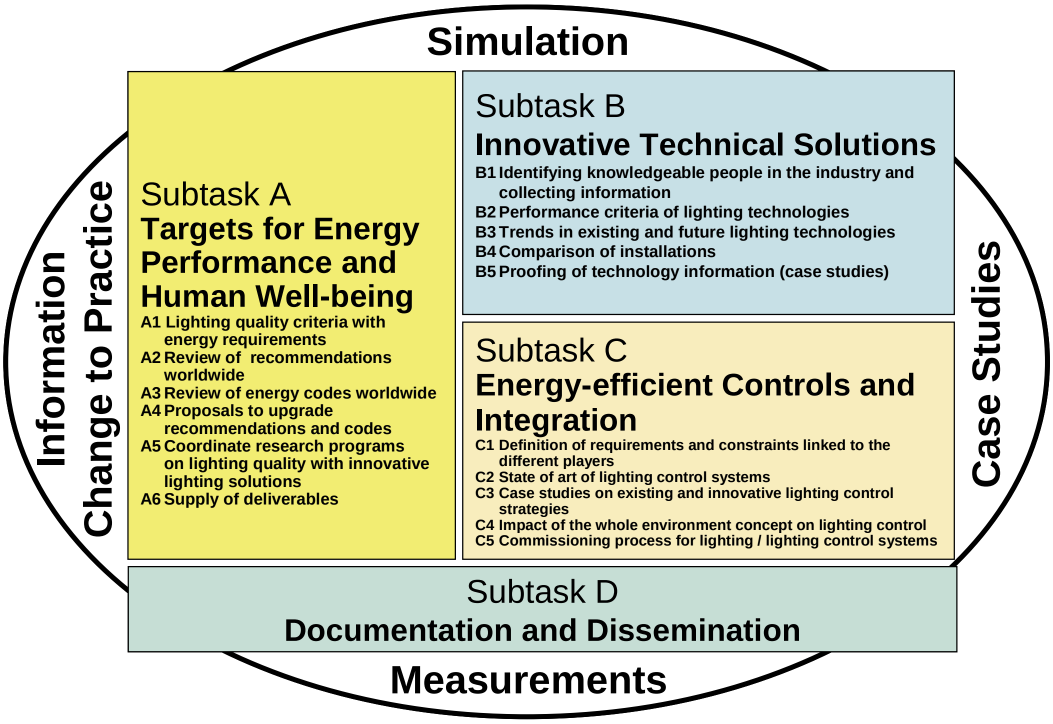

Figure 1-2. *Structure of Annex 45.*

References

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