

LED lighting today: tales or facts?
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LED Lighting Applications and Energy Usage in Developing Countries and Special Applications in Industrialized Countries

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Outline

- ❑ **Lighting Energy and Efficiency**
- ❑ **IEA Annex 45 Energy Efficient Lighting for Buildings**
- ❑ **LED lighting**
- ❑ **Lighting and Energy in Developing Countries**

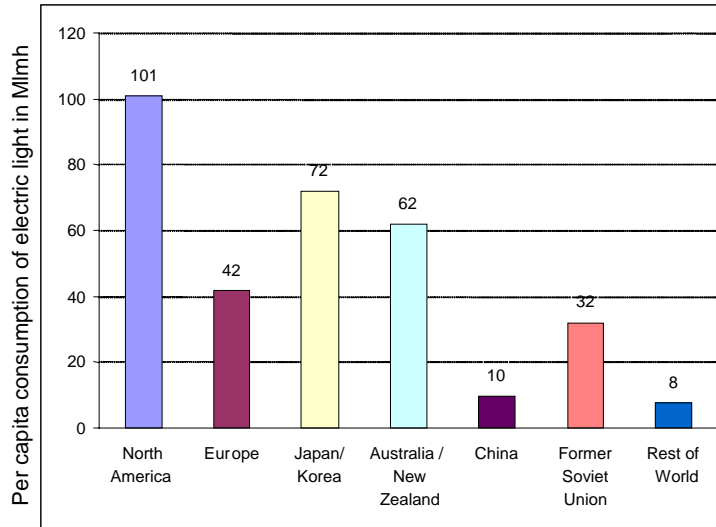
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Energy Usage of Lighting

- ❑ In 2005 the electricity consumed by lighting was 2 650 TWh worldwide, about 19 % of the total global electricity consumption.
- ❑ Carbon dioxide emissions (Lighting) were 1775 million tonnes, of which approximately 511 million tonnes in IEA member countries
- ❑ Lighting electricity use ranges from 5 % to 15 % in industrialized countries, up to 86 % in developing countries of the total electricity use
- ❑ Global lighting electricity use is distributed: 28 % residential, 48% service, 16 % industrial, 8 % street and other lighting
- ❑ More than one-quarter of world's population uses liquid fuel (kerosene) to provide lighting



Per Capita Consumption of Electric Light

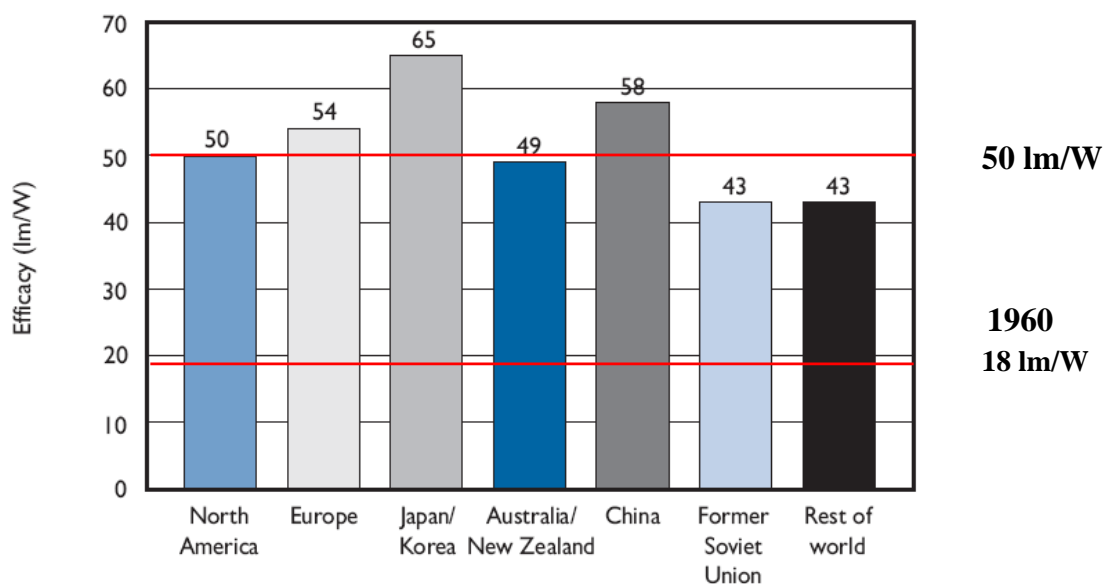


Global consumption of artificial light 133 Plmh

- Annual consumption by people with access to electricity – 27.6 Mlmh
- Annual consumption by people without access to electricity – 50 klmh

Average Electric Lighting System Efficacy

Average lighting-system efficacy by region in 2005



IEA Annex 45

Energy Efficient Electric Lighting for Buildings

2004 - 2009



International Energy Agency
**Energy Conservation in
Buildings and Community
Systems Programme**

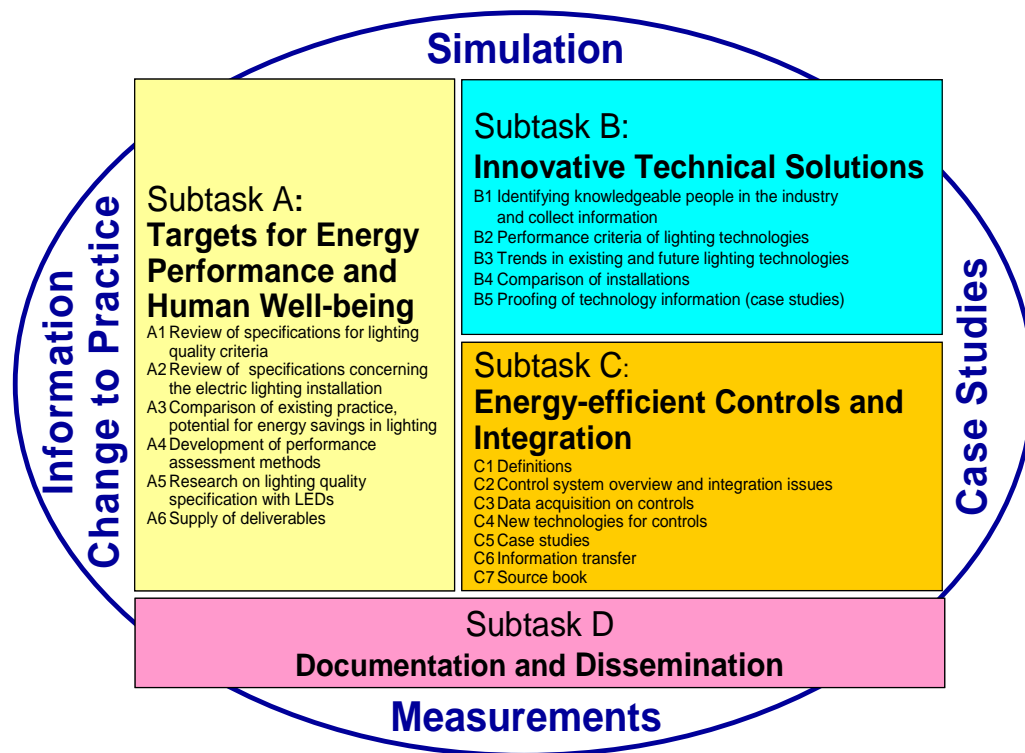
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IEA Annex 45: Participating and Corresponding Members 21 Countries and 37 Organizations



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Structure of IEA Annex45



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E³Light

Annex 45
 Energy Efficient Electric
 Lighting for Buildings

Biannual
 Newsletter
 2/2007

Newsletter 6



International Energy Agency
 Energy Conservation in
 Buildings and Community
 Systems Programme

Web-site:
lightinglab.fi/IEAAnnex45



COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE
 INTERNATIONAL COMMISSION ON ILLUMINATION
 INTERNATIONALE BELEUCHTUNGSKOMMISSION

CIE Statement on Energy Conservation

The issue of energy conservation in lighting was present in most debates during CIE Session held in Beijing in July 2007. It was brought to the General Assembly by the Finnish National Committee, and its concern was largely shared by other delegates. After the Session CIE published a statement on energy conservation.

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26th Session of the CIE

4 - 11 July Beijing, China

Three invited, one hundred and six presented papers and more than two hundred posters were presented at 26th Session of the CIE. In the conference there was a session on energy, chaired by Lillelien from Norway. Report on the Session can be found on the CIE News 4/2007, <http://www.cie.co.at/news/new583.pdf>.



The winner of the 2006 Millennium Technology Prize, Shuji Nakamura and Professor Liisa Halonen who received this year's Millennium Distinction award.

Millennium Distinction Award 2007

Millennium Distinction Awards 2007 were given for developers and researchers working in the Finnish optoelectronics sector.

Two Finnish growth companies and two university professors received this year's Millennium Distinction Awards from the Millennium Technology Prize Foundation. Heikki and Ulla Mustonen of Tepcomp Oy and Harry Asonen of Corelase Oy received Millennium Distinction Awards in the category "Founders and drivers of growth companies based on the productive exploitation of innovative new technology." Professor Liisa Halonen (Helsinki University of Technology) and Professor Markus Pessa (Tampere University of Technology) received Millennium Distinction Awards for their valuable contributions to the furthering of Finnish university education in the optoelectronics sector and for initiating associated high-level research activities in Finland.

New Doctors in the Lighting Field

M.Sc. Heini Juslén defended his Doctoral Thesis *Lighting, productivity and preferred illuminances - field studies in the industrial environment* at Helsinki University of Technology, Finland.

Continued on page 6.

<http://lightinglab.fi/IEAAnnex45>

IEA Annex 45 Guidebook



International Energy Agency
Energy Conservation in
Buildings and Community
Systems Programme

Annex 45
Energy Efficient Electric
Lighting for Buildings

Guidebook on Energy Efficient Electric Lighting for Buildings

Edited by Liisa Halonen & Eino Tetri
Helsinki University of Technology
Lighting Laboratory



Contents

- 1 Introduction
- 2 Lighting energy in buildings
- 3 Lighting quality criteria
- 4 Lighting and energy standards and codes
- 5 Lighting technologies
- 6 Lighting system control
- 7 Commissioning of lighting systems
- 8 Case studies
- 9 Technical potential for energy efficient lighting and savings
- 10 Proposals to upgrade recommendations and codes
- 11 Conclusions

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LED Applications



Automotive
Signage

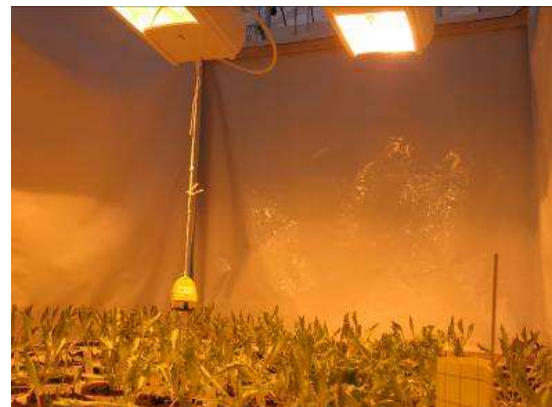


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LEDs in general lighting



LED-based lighting system for plant illumination



Lighting in developing countries



Almost 2 billion people live in the dark

Lighting in developing countries

**“We will make electricity so cheap
that only the rich will burn candles”
-Thomas Edison**



**There are more non-electrified households
today than the total number of households
in Edison's time**

Lighting in Developing Countries

- More than 2 billion people – without access to electricity – use fuel based lighting
- Almost all of them live in developing countries



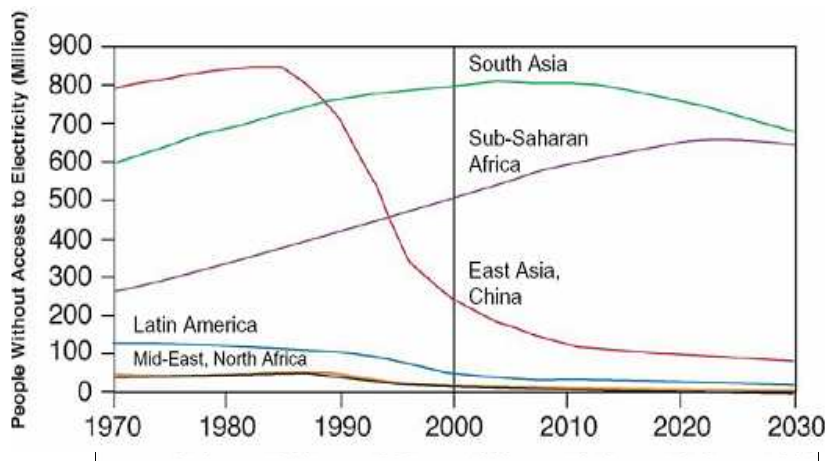
In 2000 in developing countries

- 14% of urban population and 49% of rural population had no access to electricity
- In Ethiopia and Uganda only 1% of households had electricity



Lighting in Developing Countries

- Intermittent access
 - Madhya Pradesh (India) - over 90% of rural electrified households use kerosene as a backup fuel for lighting**
- Population growth rate is higher than electrification rate



EC Asia-Link ENLIGHTEN

Partners

TKK Lighting Laboratory Finland
Co-ordinator

Kathmandu University Nepal
Vilnius University Lithuania



Household LED lighting activities in Nepal

- Co-operation with *Light up the World* Foundation
- Over 5 000 households and schools in remote communities of Nepal have been equipped with white-LED based lighting systems
- Powered by pedal DC generators, solar cells, and wind turbines
- Low maintenance costs (\$3/household/year).

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Lighting with LEDs using Renewables



In ENLIGHTEN project efforts were made to promote the use of LEDs for lighting in remote Nepalese villages, where they can be combined with solar panels.



Remote and Rural Nepal - HUMLA



Most remote place of Nepal, probably one of the world's remotest places



Remote and Rural Nepal - Humla



Fuel Based Lighting



Kerosene lighting



Jharro lighting

Price of liquid fuels increases proportionally with distance to nearest road



“Jharro”- Pine stick



Open fireplace for cooking and lighting

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Fuel Based Lighting

- ❖ Average illuminance 2 lx in one meter periphery
- ❖ Daily need for firewood per family for cooking and lighting is 20 -40 kg
- ❖ Impact on health, like respiratory problems, blindness, heart diseases



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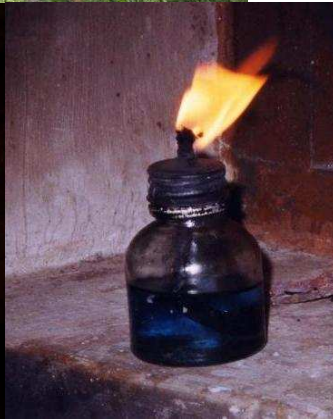


Luminous efficacy

- pine stick "jharro" 0,04 lm/W
- kerosine 0,08 lm/W
- LED 15 lm/W

Costs \$/klmh

- pine stick "jharro" \$4,36 / klmh
- kerosine \$0,78 / klmh
- LED \$0,22 / klmh



LED Lighting in Nepal



**A schoolboy
from remote
village
reading in
White LED
lamp light**



Thank You!

