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Editor

Florin POP, Professor Dr.
UTC-N – Universitatea Tehnicã
Str. C. Daicoviciu Nr. 15
RO-400020 - Cluj-Napoca, România
Fax: +40 264 592055
e-Mail: florin.pop@insta.utcluj.ro
Web: http://users.utcluj.ro/~lec/journal

INGINERIA ILUMINATULUI - Lighting Engineering journal has a scientific presentation and content, targeted to the continuing education in the lighting field, without any insertion of the commercial advertisings inside of its pages. It has a half-yearly appearance.

The objectives of the journal consist of the presentation of the results of the lighting research activity, the dissemination of the lighting knowledge, the education of the interested people working in public administration, constructions, designers, dealers, engineers, students and others.

The responsibility for the content and the English language of original paper rests solely with its author.

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Technical University of Cluj-Napoca
Lighting Engineering Center
http://users.utcluj.ro/~lec/enerlin

Professor Florin POP
florin.pop@insta.utcluj.ro

Programme director
Reader Dorin BEU
dorin_beu@cluj.astral.ro

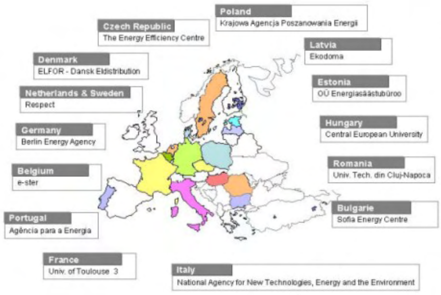
EnERLIn Programme - European Efficient Residential Lighting Initiative

by promoting Compact Fluorescent Lamps in households

Grant EIE/05/176/SI2.419666 (2006-2008)

coordinator Professor Georges ZISSIS, University Paul Sabatier, Toulouse, France

http://www.enerlin.enea.it/



EnERLIn Programme Objectives

Substantial increase of household lighting efficiency in some EU countries

To promote cheap Compact Fluorescent Lamps offer to answer various needs of shapes, dimensions, color rendering and electrical sockets

To support CFLs luminaires design with aesthetic trend through specialized shops

To make and implement a promotional campaign for Compact Fluorescent Lamps and adequate luminaires, according to quality request of European CFL Quality Charter

Luminaires dedicated to CFLs

Different shapes of CFLs

Compact Fluorescent Lamps features

Reduced energy consumption by 80% for the same luminous flux faced to incandescent lamps
Lamp life more than 8 times longer compared to incandescent lamps
Average lamp life of 5 years by using 3.3 hours/ day
Lamp base type E14, E27 or B22
Multiple applications due to the broad range of available lamps
Color temperature range of 2700, 3000, 3500, 4000 and 6000 K - warm white, neutral white and daylight white
Power range from 6 W to 30 W equivalent of incandescent lamps from 25 W to 150 W
A and B energy classes according to the European label systems for household appliances

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SUSTAINABLE LIGHTING

Dr. Florin POP,
Professor

This issue is based on the papers presented at the international conferences - the 4th Balkan Light Conference on Lighting, Ljubljana, Slovenia and the 4th International Symposium on Energy Efficiency, Cluj-Napoca, Romania. It is the forth and last issue edited under the frame of the EnERLIn IEE program, ending on 31 December 2008.

For what reason I choose this title of my editorial "Sustainable Lighting"? Mainly due to two reasons. The first one is determined by the one of the most impressive conference in the last year – the 7th International Conference on Sustainable Energy Technologies SET 2008 Seoul - where I had the chance to present some results of our contribution to the IEE program EnERLIn. The conference was excellently organized by the KIEAE – Korea Institute of Ecological Architecture and Environment – and WSSET World Society of Sustainable Energy Technologies, under the General Chair of Professor Jeong Tai KIM.

See http://www.SET2008.org

The second reason is based on the presentation of **L BEDOCS** at Ljubljana. He proposed a PEC (short for Performance, Efficiency and Comfort) unique and dynamic holistic design tool conceived to provide efficient and sustainable lighting solutions. The philosophy of PEC is based on the principle that Performance, Efficiency and Comfort determine the effectiveness of lighting, its impact on people using it, and its impact on the natural environment. The sum of Performance, Efficiency and Comfort is equal with the QUALITY in the lit environment. The PEC programme can be applied during the design of products, schemes or projects routinely. There is proposed the way to optimise the lighting solution in eight steps. There is also presented the PEC application in four cases – office, education, urban and sports lighting.

GK COOK examines a small selection of the results from a series of photometric measurements which took place in 57 homes occupied by people with low vision. The occupiers were required to indicate a satisfaction rating for the general and task lighting. In this way quantitative and qualitative data was obtained. There is clear evidence of little good quality lighting. The satisfaction rating scale was: 1=Very Good, 2=Good, 3=Fair, 4=Poor, 5=Very Poor. An average satisfaction rating of <2.5 could be assumed to represent the provision of good quality lighting. The relationship between illuminance and satisfaction rating is weak and erratic although the need for control and adjustment in the lighting provision for this user group is clearly identified. A design guide for lighting the homes of people with low vision, which draws from the larger work summarised here, is now available.

The work of **D COSTEA, FM POP**, **V RUSU**, **D BEU,** and **FR POP** presents the analyses of the EnERLIn questionnaire campaign. During 2008, between January and May, took place the final campaign for

EnERLIn questionnaires developed by project partners – Electrica S.A. Transylvania North Branch, S.C. EnergoBit S.R.L. and S.C. Pragmatic Comprest S.R.L., based on the model presented at the end of this work. Based on EnERLIn's observations the strength report for analyzing energetic and economic efficiency is 1:4 according to Quality Cart of Fluorescent Compact Lamps. Replacing a GSL of 100 W with a CFL of 24 W allows a saving of 76 W of installed power. For a 3 hours average daily consumption the savings are 54.700 kWh in 8 months, which means almost 22 RON in 8 months (related to the actual price of electric power - June 2008). Conclusively, this kind of investment can be recover in less that a year (8 months). According to the applied questionnaires, the reasons why CFL are not very used on a large scale are: CFL's qualities are not known - a continuous promotional campaign is needed; Lack of trust for no-name products - only main producers are known; CFL needs a certification to be reliable; People don't know that CFL last many years, around 8000 hours: GSL for example last in time only 1000 hours.

The paper submitted by **Mihaela POP, F POP, HF POP** approaches one of the components of indoor environment – the lighting quality, based on a Ph.D. research. Evaluation of quality of an indoor lighting system using a Quality Level numeric indicator is proposed. The application of hierarchical classification method on the responses of 52 subjects allows for the invalidation of certain input data and the selection of respondents. Analysis of an indoor lighting system in real operation conditions presents the users' response related to the illumination level and colour temperature of light sources. Both parameters in an experimental study regarding the 12 users' options in a real work place, which daily activity is performed in continuous operation lighting system. The behaviour of participants to the study of different lighting installations through opinion polls is subject to appreciation errors and human subjectivism concerning the conditions of the working environment. The study underline the difficulty of users' evaluation of sensitive differences of illumination and apparent colour levels of a lighting system.

Raluca BUZDUGAN proposes in her Ph. D. thesis a Poetics of Lighting and a work tool, The E Matrix, designed for architects and interior designers. The Poetics and the E matrix are two "instruments" designed to recover and bring within the architect's control an extraordinary building material: artificial light.

C ŞUVĂGĂU continues his always interesting and exhaustive column, "The Lighting in The New World", with the presentation of the IESNA annual conference, Savannah, 2008. "Architects, Engineers, Designers: Who is Responsible for Daylighting?" was the first General Session. Lighting and Daylighting, need to be an integral and early part of a project team's building design if it is to benefit a building's form, function, use of energy and long-term impact on the environment.

We are proud to announce a success of two of our long time collaborators and friends. The professionalism of **A STOCKMAR** was highly recognised by receiving the Honorary Professor title at the Technische Fachhochschule Hanovra. An integrated team of Canadian researchers and experts from National Research Council of Canada (NRC) and the British Columbia Electrical Utility (BC Hydro) has recently won the prestigious Taylor Technical Talent Award from the Illuminating Engineering Society (IES), the Lighting Authority in North America. Dr. **C ŞUVĂGĂU** is a member of awarded team from BC Hydro.

PEC A DESIGN TOOL FOR SUSTAINABLE QUALITY LIGHTING

Lou BEDOCS
Thorn Lighting UK

Today there are many requirements and constraints that need to be overcome to provide effective high quality lighting for people and places. To embrace all the challenges and to ensure the provision of quality lighting there is a need for a new approach to design. The PEC (short for Performance, Efficiency and Comfort) programme offers such approach. PEC is a unique and dynamic holistic design tool conceived to embrace all the issues and drive design of luminaires and lighting schemes to provide efficient and sustainable lighting solutions without sacrificing the quality of lighting. PEC can help to bring together all the considerations needed for visual effectiveness, environmental matters and human factors.

1. Introduction

Vision is our main source of sensory input. Almost 80% of the signals the brain has to deal with come through our eyes and the signal is delivered via light. So lighting is very important to people in all places such as industry, commerce, education, and healthcare buildings, on roads, urban places, sports and leisure areas. Lighting also impacts directly on our health and wellbeing – much of it through the recently discovered third receptor [1]. Light energy affects the secretion rate of the melatonin hormone that mainly controls the circadian cycle and impacts on alertness and general health. The importance of lighting is also underlined by the many lighting application standards covering indoor and outdoor workplaces, emergency lighting, sports lighting and road lighting. But today there are new demands from the changing society with – ageing labour force, working longer with more varied working hours, changing shift work patterns, greater variety of tasks and locations, the 24 hours society with more leisure time, having stricter health and safety rules and enhanced environmental awareness.

2. Environmental matters

The environmental issues need urgent considerations and actions by all, including the lighting industry. These matters include, crowded cities, expanding urban areas, high toxic wastes, excess end of life waste, depletion of raw materials, increased energy usage responsible for much harmful gas emissions, have become daily news. They are responsible for global warming leading to climate change causing storms, floods, drought, rising sea levels and use up valuable land in the disposal of non-recoverable waste. Clearly we have a duty to take action to reduce the use of raw materials, reduce waste and harmful emissions, to reduce power demand and energy use. In Europe regulations and directives are already in place to restrict the use of toxic substances [2], to take back packaging and equipment at end of life for recycle [3] and to practice eco-design, a sustainable design technique for the creation of the fast growing electrical and electronic equipments, to improve the energy efficiency of products [4] and systems in particular the high energy demands for buildings [5] that are responsible for almost half of the carbon dioxide (CO_2) emissions. The response to these many drivers has lead to the development of the PEC programme – a tool for the design of quality lighting solutions that is sustainable.

3. PEC Philosophy

The PEC concept reconciles the need for low direct costs and environmental costs with the need to deliver workplace and public lighting that promotes efficiency, safety, healthy environment and productivity. PEC offers the ability to provide optimum lighting solutions for people and places while conserving raw materials, energy and costs. PEC enables us to use standard lighting components to create specific and environmentally sensitive lighting that satisfies the unique needs of every site, user and application. The philosophy of PEC is based on the principle that Performance, Efficiency and Comfort determine the effectiveness of lighting, its impact on people using it, and its impact on the natural environment.

The PEC programme recognises that projects and their locations vary and require different balance between the three components.

Figure 1 The PEC triangle

P + E + C = Quality in the lit environment where;

Performance is to achieve visual effectiveness, meet requirements and targets so that tasks can be completed quickly, accurately and safely within the required period.

Efficiency is to conserve energy and effort, reduce CO_2 emissions and waste and be practical to install, operate and use thereby preserving natural resources and care for the environment.

Comfort is to give people complete satisfaction, stimulating atmosphere, enjoyment and sustainable wellness.

Correctly satisfying these three parameters, during the design process, will yield high quality lighting solutions. PEC can be used for any product, lighting scheme and project. The balance between P, E and C will changes according to the application. The PEC programme delivers effective and efficient lighting designed for people to fulfil all their visual needs.

- Make work task visible and easier to detect
- Provide source of comfort in places
- Maximise safety at work, travel or at play

- Create atmosphere and mood in the place
- Establish calm and privacy in busy office
- Stimulate learning in schools and colleges
- Provide reassurance at night in urban areas
- Support the circadian cycle for comfort
- Improve clarity of colours and textures
- Enable safer driving and travel
- Reduce mistakes made in any places

3.1 The PEC criteria

These can be defined and used for evaluations as,

Performance – Task visibility (reveal details in required direction), Contrast (easy detection and clear discrimination), Colour (true image with more information), Modelling (reveal shapes, textures and human features), Glare free (no luminance handicaps)

Efficiency – Effective (fit for purpose and economic), Efficient (energy efficient, low CO_2 emission, low obtrusive light emission), Managed (controllable, linked to presence, maintained level, daylight), Practical (easy to install, use and own), Sustainable (low waste, recycle, reuse)

Comfort – Ambience (welcoming, balanced brightness), Atmosphere (calm, lively, exciting), Stimulating (inspire, motivate), Satisfaction (fulfilling), Safe (reassuring), Ergonomic (free of stress and discomfort glare, accommodating), Integrated (meeting architectural expectations, aesthetic), Colourful (scenic, blended match), Interest (variety, variations), Health (bio rhythmic, arouse, wellness), Flow of light (side light, feel of light movement).

3.2 PEC measures

Performance and efficiency criteria can be quantified and the solutions engineered to conform to the requirements or recommended targets. Comfort criteria are subjective and influenced by psychology of lighting and the solutions are prepared to design rules and creative experience.

Some examples of measures for PEC criteria are:

Performance – Illuminance [lux], Luminance [cd/m²], Disability glare [cd], Colour rendition [Ra], Uniformity ratios.

Efficiency – Efficacy [lm/W], Economy [cost/m²], CO2 emission [kg/y], Energy [kWh], Managed link portion [%], Recycled portion [%], Lighting Energy Numeric Indicator (LENI) [kWh/(m² x y)] Ownership cost [cost/y for life]

Comfort – Subjective, creative, aesthetic, architectural, design

4. Application of PEC

The PEC programme can be applied during the design of products, schemes or projects routinely.

PEC helps to bring into focus the critical parameters for consideration. The process makes use of existing requirements and standards and culminates in the PEC analyses for fulfilment of the objectives. For example in product design the PEC programme can help to optimise the solution in eight easy steps –

1. Select the criteria (PEC and Product standards)

2. Select light source (shape, Ra, LSF, LMMF)
3. Define the circuit and controls
4. Design optics (intensity distribution, LOR)
5. Style the design (materials, construction, fixing, IP, LMF, eco profile, features)
6. Test and measure (photometry, safety, kite mark, power, VA, CO2 footprint)
7. Establish costs
8. Assess the PEC fulfilment

A similar approach can be taken with the PEC programme to aid scheme/project design –

1. Select criteria (PEC and Application standards)
2. Select the lighting design techniques
3. Choose the solutions (fit for purpose)
4. Plan scheme (optimise, integrate, layout, service)
5. Estimate cost (supply and install)
6. Estimate running costs (energy use, efficiency, CO2 footprint and service)
7. Estimate cost of ownership and to environment
8. Assess the PEC fulfilment

PEC in use is best demonstrated by examples of applications, projects and products.

4.1. Office lighting – Application

In office lighting applying PEC improves the office environment for employees, employers and the local community. The good environment leads to comfort and safety, minimises health risk and reduces absenteeism, increase productivity and lowers ownership and environmental costs.

4.1.1 Office lighting – Project

Royal Bank of Scotland, Edinburgh, UK

This distinctive two storey building in the Gogarburn campus, with six 'business houses' arranged around a central 280 m internal street, houses world-class office accommodation for 3250 of the bank staff. The outstanding lighting feature of the scheme is the use of low brightness luminaires employing 1x35 W T16 lamps integrated on the two sides of the chilled beams.

The PEC profile –

Performance

- Good vertical and horizontal illuminance for excellent task and ambient lighting
- Low brightness reflector giving batwing light distribution for modelling
- Good uniformity and no glare
- Ra 80 lamp for good colour discrimination

Efficiency

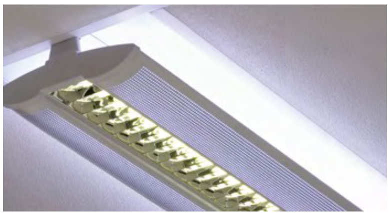
- HF electronic system with lighting controls
- Excellent BREEAM energy efficiency rating ('BREEAM'

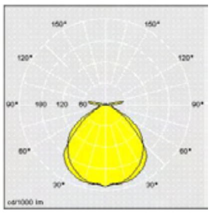
Building Research Establishment Environmental Assessment Method)

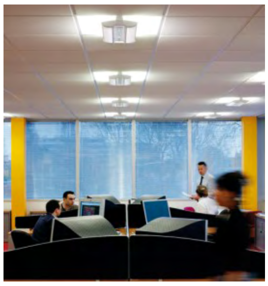
Comfort

- Balanced brightness on walls and ceiling
- Absence of flicker from HF operation
- Stimulating colours
- Highly satisfying environment

4.1.2 Office lighting – Luminaire







Menlosoft SR

This semi-recessed modular fluorescent lamp luminaire gives controllable direct/indirect light output with the option of dual colours.

PEC profile –

Performance

- Wide light distribution for high contrast rendition and good modelling
- LOR > 63% direct/indirect for effective task and surround illuminance
- T16 Ra80 lamp for good colour rendition

Efficiency

- Electronic system for low energy use
- Sensa control for presence and daylight
- Installed efficacy > 45 lm/W

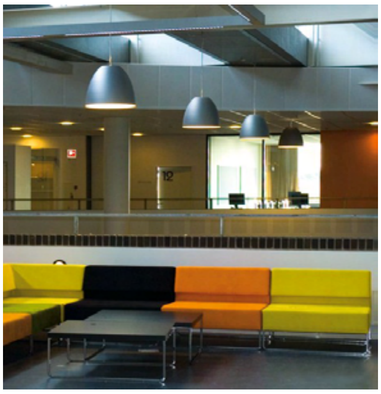
Comfort

- Upward light output with direct light to the ceiling and providing balanced brightness
- High frequency system eliminates flicker
- Dual colour lamp option to yield variety, stimulation and satisfaction.

4.2. Education lighting – Application

In education lighting PEC can improve the learning and teaching experience for pupils, parents, teachers and public. The application of PEC to lighting in the educational world enables authorities to create lit environments within which students and staff can carry out their activities easily and comfortably, in attractive and stimulating surroundings. PEC helps architects and school managers to create an optimum lighting installation that is economic by using integrated design approach.

4.2.1 Education lighting – Project



Ega Gymnasium Secondary School, Denmark

This secondary school has been designed to bring about a change in learning culture by placing greater emphasis on individual study and project work. An outstanding feature of the building is its large circular atrium – Denmark's largest skylight – known as the Forum. A basic idea behind the building design is that each room should have several functions and each supported by an appropriate lighting system. The lighting solutions comprise, for example in the Forum, with by large suspended pendants, augmented by dimmable recessed wall lights and linear T16 lamp luminaires that can suitable create social and teaching zones.

The PEC profile –

Performance

- The versatile and flexible lighting system gives good task illuminance and uniformity for each student for the full range of activities.

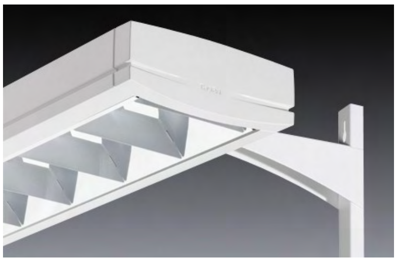
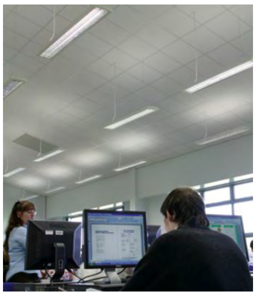
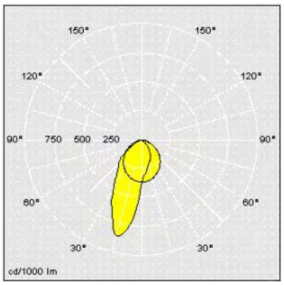
Efficiency

- Good use of daylight link with simple controls
- Applied power demand is under $6W/m^2$

Comfort

- The task adapted lighting aids concentration, gives stimulation and relaxation
- Variety of colour and brightness patterns provide interest and satisfaction

4.2.2 Education lighting – Luminaire

Optus IV for Whiteboard

This surface or suspended mount linear fluorescent luminaire brings modern design into educational premises. The concave slender body contains the reflector optic giving asymmetric light distribution specific for lighting wall-mounted whiteboards.
PEC profile –

Performance

- Asymmetric distribution generates high luminance to details on the whiteboard
- Specular reflector for well controlled beam
- Ra 80 lamp for good colour rendition.

Efficiency

- HF electronic system yielding high energy efficiency
- Dimmable circuit for effective lighting control
- Sustainable design built with recyclable material.

Comfort

- HF control gear eliminates flicker
- Fast run-back to 60º cut-off to eliminate discomfort glare.

4.3 Urban Lighting – Application

In the urban environment PEC can improve the perception of urban life for individuals, for culture and for business. The application of PEC enables local authorities to create an attractive nightscape that makes places safer to live in and more attractive for visitors, business people and residents to enjoy. The drive for lighting the urban environment varies according to user groups. The justifications maybe made to improve safety, security, and ease of navigation around by the public, to attract shoppers out at night or for economic and social development including crime preventions by the authorities.

4.3.1 Urban lighting – Project


Corso Garibaldi, Benevento, Italy

The town of Benevento, in the southern Italy, has at its centre the historical street – Corso Garibaldi – that has recently been revitalized for the benefit of locals and tourists. A total of 138 Decostreet semi cut-off lanterns, each with 70W metal halide lamp, have been installed on special 4m high columns. Each column carries three lanterns spaced 120º apart with 2 on the street side and 1 to light the pavement.
PEC profile –

Performance

- Good visibility and low glare
- 50 lux on the road surface
- Excellent colour rendition, Ra 80 lamps

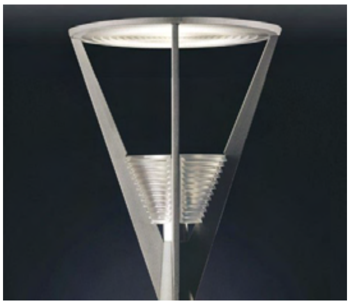
Efficiency

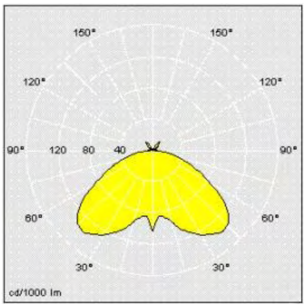
- Low circuit watts for energy efficiency
- Optical control for low obtrusive light emission
- Fit for purpose

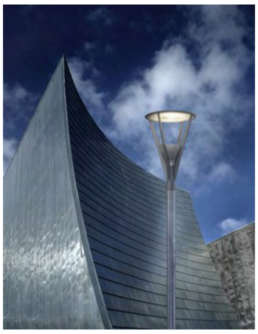
Comfort

- Inviting warm light of 2800K
- Stylish appearance by day and night
- Friendly atmosphere and ambience.

4.3.2 Urban lighting – Luminaire







Avenue virtual

The Avenue Virtual is an indirect emission lantern that uses a unique concentric ring top reflector system combined with a precision light projector, housed in the silver grey finished body. The enclosed projector emits 97% of the light output on to the top reflector, thus minimising light spill and excellent control of glare and light distribution. The lantern provides strong aesthetic features in attractive appearance.

PEC profile –

Performance

- Flat concentric reflector for providing uniform illumination glare free
- Ra 80 lamp yields good colour rendition

Efficiency

- Two part optic for indirect output providing efficient illumination
- Electronic circuit use less energy
- IP 65 seal gives high MF with low service cost

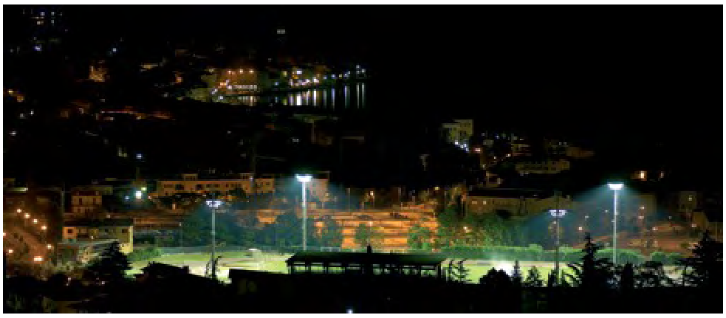
Comfort

- Aesthetic design of stylish appearance by day or night
- The indirect light output gives intriguing visual effects aiding the urban ambience and atmosphere.

4.4. Sports lighting – Application

The application of PEC to sports lighting helps authorities and users to make most of today's modern multi-purpose, community oriented sports complexes. PEC can help to improve the usability and visual appeal of multifunctional venues, indoors and outdoors. Many contemporary sporting centres may include facilities such as shops, restaurants, children's play area and cafes, as well as fitness and health centres, playing fields and running tracks. There maybe spaces for conferences and car parks on which markets are held.

4.4.1 Sports Lighting – Project



Due PINI Stadium, Salo, Italy

This multi-purpose Due Pini (two pines) Stadium in Salo, northern Italy, uses 52 off Champion 2kW metal halide floodlights, mounted on four 25m high masts. The stadium is used for functional and community focused activities. The lighting system provides excellent lighting and environmental conditions to satisfy the requirements of athletics and football governing bodies. The solution prevents the escape of stray light and respects the quality of life of nearby residents.
PEC profile –

Performance

- Illuminance values meet EN 12193 targets for running tracks, playing fields, football and Olympic criteria
- Good uniformity over the playing areas
- Excellent colour rendition

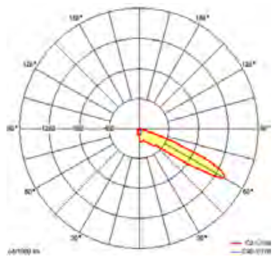
Efficiency

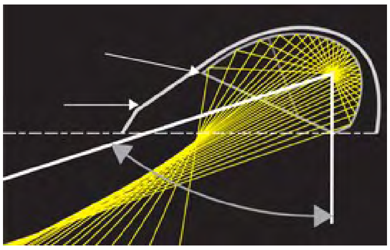
- No stray obtrusive light emission
- 3 light levels provided by switching
- Fit for purpose installation

Comfort

- Good quality light for performers
- Clear view for spectators
- Natural dark sky

4.4.2 Sports lighting – Luminaire





Champion floodlight

The Champion combines the performance features of classic floodlights of high light output with those of 'flat glass' projectors aimed to control obtrusive light pollution. The precision reflector system allows for each lamp option 3 lamp positions to provide different light distributions from one installed set up. Instead of a 'flat glass' construction Champion's front glass closure is inclined inside the floodlight. The front of the body acts as a cowl for full cut-off and provides a virtual light-emitting surface, which is aimed parallel (flat) to the ground. The performance of the optical system can be seen with these ray tracing lines.

PEC Profile –
Performance

- Asymmetric optic for precise light control yielding good uniformity
- Tight light cut-off limits stray light outside target area
- High position beam angle needs no tilting.

Efficiency

- No light above horizontal no waste
- Multi lamp for matching efficiency
- Sustainable design fully recyclable body.

Comfort

- Precision optics provide for perfect seeing conditions for players, officials and spectators
- Highly controlled beam avoids glare or spill light to neighbours
- No upward emission gives dark sky

5. Conclusion

Light and Lighting is important to mankind but there are many new and emerging factors influencing lighting decisions. The PEC programme can help to provide answers. The PEC is a holistic conceptual tool to deliver the key criteria of performance, efficiency and comfort the cornerstones of quality lighting. PEC can be applied to products, projects and applications. PEC can deliver better lighting, better efficiency and better environment sustainably.

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Lou BEDOCS
CEng, MIET, FCIBSE, FSLL
Strategic Lighting
Applications Department
Thorn Lighting Limited
Lighting Technology Centre
Merrington Lane Industrial Estate
Spennymoor County
Durham
DL16 7UR UK
Tel: +44 (0) 191 301 3074
Email: lou.bedocs@thornlighting.com

Lou Bedocs is a Chartered electrical engineer and a Thorn employee for over 50 years of which 47 years in the lighting business specialised in lamps, circuits, optics and lighting application techniques. Currently he is responsible in Thorn's strategic lighting application department for technical training/standards/support and representations in external national and international bodies (Standards, Learned bodies, Syndicates, Government agencies). He is also the champion of the Thorn PEC programme.

Lou serves on many National, European and International standards and Learned Institutes committees. He currently chairs the CIE TC 3.43 The CIE standard UGR table, CIE R 3.40 Maintenance of indoor lighting systems, ISO TC159/SC5 WG2 Lighting of Work Places, CEN TC169WG9 Energy Performance of Buildings – Lighting Requirements and SLL TG 12 Emergency Lighting.

He is the International President and a Director of the Lighting Industry Federation (LIF), chairs it's Technical Board and provides technical links with relevant UK and EU government departments. Visiting lecturer to several UK Universities and published several technical papers. He is a past president of Lux Europa and a past Chairman of the Lighting Division of CIBSE (formally the IES UK) and now renamed as the SLL Society of Light and Lighting of the CIBSE.

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THE PROVISION OF GENERAL AND TASK LIGHT IN 57 HOMES OCCUPIED BY PEOPLE WITH LOW VISION

Dr Geoffrey K COOK
The University of Reading, UK

This paper examines a small selection of the results from a series of photometric measurements which took place in 57 homes occupied by people with low vision. The general lighting was measured on the floor surface of all rooms in the 57 homes and the task lighting was measured around fourteen lifestyle tasks, although only four are reported here. The occupiers were required to indicate a satisfaction rating for the general and task lighting. In this way quantitative and qualitative data was obtained. There is clear evidence of little good quality lighting. The relationship between illuminance and satisfaction rating is weak and erratic although the need for control and adjustment in the lighting provision for this user group is clearly identified. The occupiers of the 57 homes were assed to determine their functional vision as other factors including visual acuity and field of vision were not appropriate for this study which was focused on lifestyle issues. A design guide for lighting the homes of people with low vision, which draws from the larger work summarised here, is now available.

1. Introduction

This paper summarises a series of studies concerned with the artificial lighting requirements of visually impaired people in their own homes. These studies were undertaken as this is an increasingly significant sector of the ageing UK population and there is a need to provide lighting design guidance founded on research based evidence. The results summarised here are drawn from 57 home visits to people with a visual impairment. The other associated studies which are not reported here, included an extensive questionnaire and a semi-structured interview with the occupants of the 57 homes (Thomas Pocklington Trust, 2003 & 2007).

The functional visual performance of all occupants was determined using a method previously adopted by the research team. There are no published national statistics for the functional vision of visually impaired people, although all of those people who received a home visit had sufficient functional vision to benefit from lighting provision.

The sample of house types which received a home visit contained a greater proportion of flats, around 49%, than those shown in the English House Condition Survey (DCLG, 2007), where around 19% are included. Therefore a lower proportion of Terraced Houses, Semi-detached Houses and Detached Houses were present. This was due to the types of properties which were made available to the projects and the difficulty in recruiting visually impaired people. In general the people who received home visits were not required to move around large distances in their homes and there were relatively few different areas in their homes to use and to light.

The age profile of the visually impaired people who received home visits was significantly younger than the national age profile as shown in National Statistics (DH, 2007), with 46% being aged 75 years or older compared to the 66% shown in National statistics. These factors suggest that the responses reported here are from people who have relatively simple types of home to light and are likely to take a long term interest in providing lighting in their home.

2. Functional Vision Assessment

The functional vision assessment used in these studies (Mc Coy & Smith, 1992) was determined by the responses to six questions. This method was considered to be a more representative measure for this study than visual acuity, field of vision or contrast sensitivity, since it is concerned with the visual aspects of daily living. The six questions identify the type and extent of a respondent's low vision and allow their functional vision to be classified as Good, Moderate or Poor. The questions are:

- Are you able to see where windows are in a room?
- Are you able to see the shape of furniture?
- Are you able to recognise a friend's face close up?
- Are you able to recognise a friend's face at arm's length?
- Are you able to recognise a friend's face across the room?
- Are you able to recognise a friend's face across the road?

A score of 1 was assigned to a positive response and a score of 2 to a negative response for each of the six questions, leading to a total score ranging between 6 and 12. A score of 6 would indicate a positive answer for each question and indicate Good functional vision while a score of 12 would correspond to six negative answers and indicate Poor functional vision. The term ''Good'' was allocated to a score between 6 and 8, ''Moderate'' for a score between 9 and 11 and "Poor" for a score of 12.

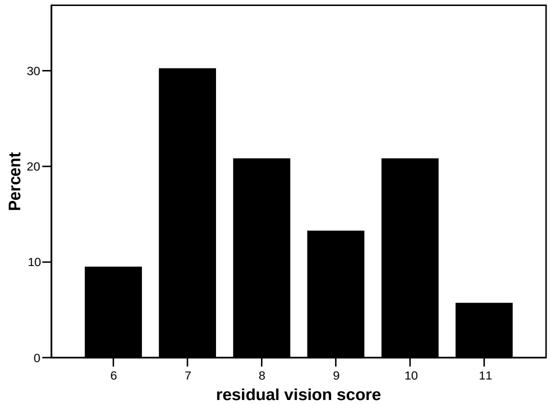

Figure 1 Percentages of respondents categorised by functional vision assessment within the 57 homes.

The percentages of respondents categorised by functional vision assessment is shown in Figure 1. This shows that those with moderate function vision account for 60% of the respondents and that no respondent scored 12 points, which would represent

'Poor' functional vision and very little useful light perception. The larger study, referred to earlier, identified a range of other attributes of the respondents, including those registered blind or partially sighted and the nature of their low vision. A statistical comparison between the functional vision assessment of the 57 respondents and those in the larger study showed no significant differences ($p \leq 0.05$). Although there are no national statistics for functional vision, this correlation has enabled useful additional comparisons to be examined across all of the studies.

3. Illuminance measurement

The home visit allowed a wide range of lighting (Photometric) measurements to be taken and allowed the occupant to participate in a semi-structured interview about their lighting provision. Since the project was concerned with artificial lighting, efforts were made to exclude daylight when photometric measurements were taken. When this was not possible a repeat evening visit was arranged.

The measurement of the average maintained illuminance, a defined term (SLL, 2006) that is understood by lighting designers, is relatively complicated, time consuming and was not practicable for this study. However individual or "spot" illuminance measurements were feasible and provide a useful approximation of the relative amount of illuminance present in the homes. Measurements were taken with a Hagner E2 Luxmeter.

3.1 Illuminance - General surfaces

Individual illuminance measurements were taken on the general Floor, Walls and Doors and Ceiling surfaces in the Hallway, Lounge, Kitchen, Bathroom, Bedroom, Landing and Stairs, where they were within the occupant's home, in all 57 homes. A summary of the measurements taken at floor level are shown in Table 1.

Table 1 shows that the illuminance at the floor was found to be highly variable across the 57 homes. When the average illuminance measurements are compared to those recommended by the Society of Light and Lighting (SLL) for the horizontal illuminance in similar spaces, there are significant differences. All surfaces have a lower average illuminance than that recommended by the SLL. This may be due to two factors, firstly that the SLL recommendations apply to the working plane illuminance, which may not always be at floor level. Secondly, that the SLL recommendations are for people with good vision. The nature of visual impairment is such that some people prefer very low illuminance conditions. This may be due to an increased sensitivity to glare or where their eye condition causes a diffusion of light within the eye. This diffusion may be caused by a range of factors including lens clouding. The use of an average illuminance value is simplistic and used here to provide an approximate overview. A more detailed statistical analysis was carried out which determined the variance and Standard Deviation (SD) of the illuminance measurements. This is shown in Table 1 and was used to compare the relationship between illuminance and satisfaction rating.

The stairs are of particular interest. Although only 28 of the 57 homes had stairs within the home, the average illuminance on the stair treads was the lowest of all rooms within the 57 homes. The stair presents a risk of tripping and falling to people who are visually impaired, the incidence of which were recorded in the other studies, and good lighting can provide a safe environment.

3.2 Illuminance – Tasks

The 57 occupants were asked to demonstrate how the lighting was normally set up for a range of 16 lifestyle tasks in the Hallway, Lounge, Kitchen, Bathroom, Bedroom, Landing and Stairs where they were within the occupant's home. The occupants were then observed undertaking these tasks and individual or 'spot' illuminance measurements were taken. A summary of the measurements taken for four tasks are shown in Table 2.

Table 2 shows that the illuminance for the four tasks was found to be highly variable between the 57 homes. When the average illuminance measurements are compared to those recommended by the Society of Light and Lighting (SLL) for the illuminance of similar tasks, there are significant differences. No SLL recommendation is provided for the tasks of 'Finding keys' in the Hallway or 'Choosing clothes' in the Bedroom. The other two tasks have a lower average illuminance than that recommended by the SLL. This may be due to the two factors described earlier. The use of an average illuminance value is simplistic and used here to provide an approximate overview. A more detailed statistical analysis was carried out, as described earlier, and this was used to compare the relationship between illuminance and satisfaction rating for the four tasks.

4. Satisfaction Rating

The response to a wide range of questions designed to rate the occupants satisfaction with their lighting on general surfaces and for 16 lifestyle tasks was classified on a five point scale. Typical questions including, 'How is the light level on the floor surface of your Hallway?' and 'How is the light level for carrying out the task of finding your keys in the Hallway?' This approach is easily understood although it has an increased risk of respondents choosing the middle or average position. That risk was considered to be minimal for these studies where there was a clear objective to identify good quality lighting. The use of a satisfaction rating allowed the study to examine the relationship between satisfaction rating and the measured illuminance in order to identify the extent of the personal preference for the amount of light which is present on general surfaces and for lifestyle tasks in the home. The satisfaction rating scale was; 1=Very Good, 2=Good, 3=Fair, 4=Poor, 5=Very Poor. An individual rating of less than or equal to 2 was considered to be the minimum required to identify good quality lighting. Within the overall averaging of the results the boundary between each rating was considered to be at the arithmetic mid-point. Therefore an average satisfaction rating of <2.5 could be assumed to represent the provision of good quality lighting.

4.1 Satisfaction Rating – General surfaces

When the <2.5 satisfaction rating criteria is applied to the results shown in Table 1, only the stair treads and the floor in the Hallway provided good quality lighting. When the average satisfaction rating and average illuminance for the floor surface in the hallway and on the stair treads are compared there appears to be evidence of a preference for a low illuminance. However, except for the Bedroom, as shown in Table 2, there is no significantly correlation across the 57 homes between satisfaction rating and average illuminance. The Bedroom has an average satisfaction rating of 2.55 and therefore close to the threshold value of 2.50 and an average floor illuminance close to that of the Lounge which has a significantly different satisfaction rating. These summary results confirm the results of the other related studies and show that occupant satisfaction rates are highly variable across different locations and surfaces and are generally not related to illuminance. This further confirms the view that good lighting of surfaces for people who are visually impaired is not easily generalised and should be adaptable to their individual lighting needs.

Location	**Hallway**
Surface	**Floor**
Average Satisfaction Rating ± SD	2.37 ± 1.05
Measured E (lux) Range	3 - 360
Average E (lux) ± SD	82.75 ± 88.73
Recommended SLL (lux)*	200
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.214 p = 0.173
Location	**Lounge**
Surface	**Floor**
Average Satisfaction Rating ± SD	2.69 ± 1.05
Measured E (lux) Range	3 - 337
Average E (lux) ± SD	60.89 ± 48.51
Recommended SLL (lux)*	150
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.159 p = 0.296
Location	**Bedroom**
Surface	**Floor**
Average Satisfaction Rating ± SD	2.55 ± 1.09
Measured E (lux) Range	3 – 348
Average E (lux) ± SD	61.67 ± 54.73

Recommended SLL (lux)*	100
Correlation between Average Satisfaction Rating and Average E (lux)	Significant r = -0.335 p = 0.020
Location	**Stairs**
Surface	**Floor****
Average Satisfaction Rating ± SD	2.50 ± 1.07
Measured E (lux) Range	4 – 126**
Average E (lux) ± SD	46.74 ± 36.23
Recommended SLL (lux)*	100
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.159 p = 0.296

Table 1: Correlations between the light satisfaction ratings and average Illuminance (lux) on the floor surface of the Hallway, Lounge, Bedroom and Stairs of the 57 homes which received a home visit.
Notes:
SD = Standard Deviation; E = Illuminance from individual or 'spot' measurements
* The designed maintained illuminance recommended by the Society of Light and Lighting (SLL, 2001); ** The illuminance measured at the stair tread; r = Coefficient of correlation (Spearman); p = Probability associated with the coefficient of correlation

Location	**Hallway**
Task	**Finding keys**
Average Satisfaction Rating ± SD	2.67 ± 1.02
Measured E (lux) Range	4 - 519
Average E (lux) ± SD	88.80 ± 77.99
Recommended SLL (lux)*	NA
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.113 p = 0.495
Location	**Lounge**
Task	**Reading**
Average Satisfaction Rating ± SD	3.26 ± 1.05
Measured E (lux) Range	6 - 710
Average E (lux) ± SD	170.12 ± 94.53
Recommended SLL (lux)*	300
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.159 p = 0.296
Location	**Bedroom**
Task	**Finding clothes**
Average Satisfaction Rating ± SD	2.83 ± 1.09

Measured E (lux) Range	3 - 646
Average E (lux) ± SD	78.94 ± 71.60
Recommended SLL (lux)*	NA
Correlation between Average Satisfaction Rating and Average E (lux)	Significant r = -0.335 p = 0.020
Location	**Stairs**
Task	**Finding handrail**
Average Satisfaction Rating ± SD	2.06 ± 1.07
Measured E (lux) Range	4 - 349
Average E (lux) ± SD	80.35 ± 76.67
Recommended SLL (lux)*	100
Correlation between Average Satisfaction Rating and Average E (lux)	Unlikely r = -0.144 p = 0.274

Table 2: Correlations between the light satisfaction ratings and average Illuminance (lux) for four tasks within the 57 homes which received a home visit.
Notes:
SD = Standard Deviation; E = Illuminance from individual or ‘spot’ measurements;
* The designed maintained illuminance recommended by the Society of Light and Lighting (SLL) (SLL, 2001); NA = No SLL recommendation; r = Coefficient of correlation (Spearman);
p = Probability associated with the coefficient of correlation

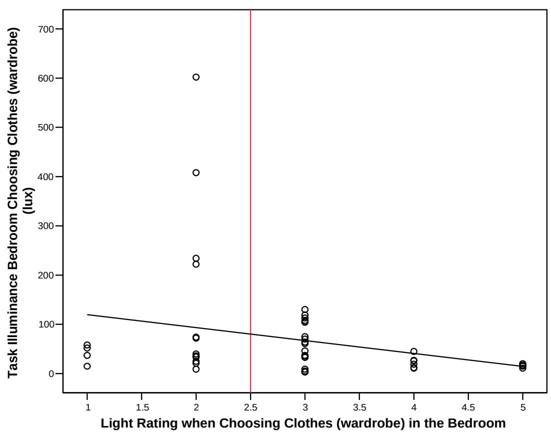

Figure 2 Illuminance (lux) & Light Satisfaction rating
Task: Finding clothes in the Bedroom

4.2 Satisfaction Rating – Tasks

When the <2.5 average satisfaction rating is applied to the results shown in Table 2, only the task of ‘Finding the handrail’ on the stairs has good quality lighting. When the average satisfaction rating and average illuminance for the four tasks are compared there appears to be little clear evidence of a preference for low illuminance, as both task illuminance and satisfaction rating are low. However, as shown in Table 2, the only task which shows a significant correlation between satisfaction rating and illuminance across the 57 homes (r = -0.335 p = 0.020) is ‘Finding clothes’ in the Bedroom. This is shown on Figure 2. These summary results confirm the results of the other related studies and show that occupant satisfaction rates are highly variable across different location and lifestyle tasks and are generally not related to illuminance. This further confirms the view that good lighting of surfaces for people who are visually impaired is not easily generalised and should be adaptable to their individual lighting needs.

5. Summary

A careful analysis of the results reported shows that there is considerable variability in the illuminance on floor surfaces and on the four lifestyle tasks. In addition, the satisfaction ratings from the occupants of the 57 home visits show that there is very little good quality lighting in their homes and that a range of different satisfaction ratings were ascribed to a similar illuminance. This lack of lighting quality may be due to a variety of reasons, and whilst this was examined in the other related studies (Thomas Pocklington Trust, 2003 & 2007) it is not possible to report the complete findings in this paper. However, some of the key factors have been summarised here.

It could be assumed that the functional vision score would influence satisfaction ratings. Low scores indicate ‘Good’ functional vision and therefore the ability to effectively use a wide range of lighting conditions. High scores could, conversely, be assumed to limit the effective use of the lighting conditions. Examination of this hypothesis produced mixed results for floor surfaces but significant correlations for the four lifestyle tasks shown in Table 2.

All but two of the 57 occupants who received a home visit perceived a lack of control over their lighting. Surprisingly only 14 homes had dimmer switches fitted and none of these had dimmer switches provided throughout their homes. Many respondents, 32 of the 57, disliked compact fluorescent lamps due to their perceived lack of control as none of the lamps were dimmable. However, on closer examination this dislike was due to poor shading of the lamp which caused glare. The relatively slow warm-up time allowed occupants to adapt to the lighting and all occupants were aware that they were cheaper to run and environmentally friendly.

Many participants were aware of the importance of lighting but perceived difficulties in finding out about lighting and being able to see lighting in use. 34 occupants would like to loan lighting equipment in order to trial it within their home. Within the other studies, not reported here, 17 different types of lighting equipment were trialed in 24 homes for 7 to 10 days.

There were also perceived problems for the occupants with making changes to their lighting. This is not possible for most people who are visually impaired. The support from Social Services concerning lighting was variable and rarely involved extensive alterations to lighting. In some instances, and because of the age of the occupant, changing the lighting this was considered to be not worth doing.

6. Conclusions

This summary of other larger studies confirms that good quality lighting in the homes of people who are visually impaired is not common. The stairs in particular is an area where the poor lighting provision has safety implications for the user. There is also clear evidence that good quality lighting, on floor surfaces or lifestyle tasks, cannot be solely provided by illuminance, but must take into account the functional vision of the user. However there is some evidence that people with good functional vision are more able to effectively use a range of lighting conditions.

The overall results show that, although visually impaired people gain benefit from lighting, they are generally unaware of the technology, are reluctant to change their lighting and therefore tolerate lighting conditions that for many respondents are unsatisfactory. These results and those of the wider studies have allowed improved lighting design guidance to be published (Thomas Pocklington Trust, 2008) which is endorsed by the SLL.

7. Acknowledgements

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Geoffrey K COOK.
BSc(Hons), PhD, CEng, FRSA, FCIOB, FSLL, MCIBSE, MIESNA
Reader in Inclusive Environmental Engineering School of Construction Management and Engineering,
The University of Reading, Whiteknights,
PO Box 219, Reading
RG6 6AW
Tel: 00 44 (0)118 378 6734
Email: g.k.cook@reading.ac.uk

Following a first class degree in Building at Aston University in 1976 and a PhD from Surrey in 1995, he is now a Reader and Director of Teaching and Learning in the School of Construction Management and Engineering at the University of Reading, UK.

His extensive research portfolio, largely funded by the Engineering and Physical Science Research Council, has examined environmental engineering aspects of disability and access with a particular focus on lighting and colour. Geoff is a Past-President of the Society of Light and Lighting; a committee member of BS8300:2008 *Design of buildings to meet the needs of disabled people* and authored BS8493:2008 *Light Reflectance Value of a surface – Method of test.* Geoff has published extensively on lighting, colour and educating engineers and runs the MSc Inclusive Environments programme at Reading.

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EnERLIn 2006-2008 A EUROPEAN PROGRAMME FOR PROMOTING ENERGY EFFICIENCY IN RESIDENTIAL LIGHTING

Dorin COSTEA[1], Florin Mircea POP[2], Vasile RUSU[3], Florin Radu POP[4], Dorin BEU[4]

[1]S.C. ELECTRICA FURNIZARE TRANSILVANIA NORD S.A.; [2]S.C. EnergoBit S.R.L.; [3]S.C. PRAGMATIC COMPREST S.R.L.; [4] Technical University of Cluj-Napoca, Lighting Engineering Center

In the light of Kyoto Agreement, the European Union and its members are interested in introducing some effective measures in order to reduce the CO_2 emissions and oppose the climate change.
The European Climate Change Program identified residential lighting as an essential chapter. However, the residential lighting market is still dominated by ineffective incandescent lamps (GSL). In order to ensure a consistent transformation of the market and a substantial growth in the use of Compact Fluorescent Lamps (CFL) in the residential area, it is essential to create an attractive market of high quality lamps. Developing valid promotional arguments and implementing coherent promotional campaigns are vital factors. It is necessary to scientifically train the final users (individual consumers) in order to achieve a self-sustained growth of the CFL market. The final objective of the EnERLIn programme is to substantially increase the efficiency of residential lighting. If a single 75W LIG is replaced with a 15W CFL in the 150 million households in Europe, the saving potential amounts to 22.5 TWh/year, which equals a reduction of 1.2 tons CO_2/year.
The main part of this project consisted in the development and implementation of some promotional campaigns for CFL and specialized lighting devices that meet the quality requests of the European CFL Quality Charter. These regional campaigns were carried out in cooperation with lamp producers, local dealers and the electric power supplier. The results and the general feed-back regarding the efficiency of the campaign provide useful information to the national/regional promoters concerning the residential area, the electric power consumed and the market potential for future research.

1. Objectives

The efficiency improvement of the consumed energy represents a central theme for the electric power policy of the UE, which is underlined in the White Book "Energetic policy for the European Union" because an efficient policy comprises all three purposes of the energetic policy: a safe supply, challenge and environmental protection.

All the electric appliances from households, industry and tertiary sector represent 40% of the entire intake of UE's electric energy, which is the most important source for the CO_2 emission.

Energetic efficiency reduces the energy intake and, accordingly, reduces the using of the finite resources and the dependence for the imported energy resources from outside the Community. It is essential for UE to be involved in energy demand by promoting efficient measures to save energy in buildings and in the transport sector.

Inside UE, an important energy consumer are the private and public buildings. In both cases, lighting represents major part of the intake. Many European or National Initiatives and Norms pursue to promote efficient lighting for buildings. These efforts might be considered successful regarding that CFL market represents 20% of the European market towards 17% worldwide.

The same market analyze made by the Lighting Companies show that ineffective GSL (including the halogen ones) still represent 30% of sales and that there is a severe lack of information and education of the individual consumers concerning CFL and this implies an important obstacle to develop efficient energetic strategies for residential sector. The best way to promote CFL seems to be a solid argumentation which must answer consumers specific questions and fears. The main hedges that have to be over-passed are to see CFL inconveniences, process them and finally provide answers based on scientific explanations. The things mentioned above must be "translated" so that every consumer can understand how CFL works. Of course that there are many barriers concerning the information about energetic efficient technologies (lighting inclusive), with connotations on penetration rates.

The lack of knowledge concerning the meaning of energy efficiency is spread in most of the countries.

People can not define what an efficient energetic technology is. Information barriers seem to be very important for those who make energetic politics.

The final goal of this project is to obtain a substantial growth in residential lighting efficiency in UE states and in candidate states too, based on arguments which can pass over the mentioned barriers and increase with 50% the number of CFL in each house, in participant countries. It's important to promote good offers including cheap CFL which can answer to a variety of necessities like dimensions, shapes, color precision and connection.

In order to successfully promote CFL, appropriate, aesthetic and functional devices should be made and displayed in specialized shops.

In the same time, this project assures to all participants in CFL promotion appropriate savings, which should meet the consumers' expectations regarding high quality lighting. If, on average, one GSL of 75 W is replaced with a CFL of 15 W, the energy gain will be significant.

The power difference between these two lamps is 60 W, the lamp can be used over 2500 hours/year (this depends on the location and room configuration). All of these benefits lead to a gain of electric power around 150 kW/h for a house and 22.5 TWh for 150 millions houses from UE. An important issue is that CFL's life time is about 10.000 hours while GSL has only 2000 hours.

Light is vital to life. Light sources are essential to everyday life and for everyone. Our world can't exist without light. Life quality, health and sometimes safety, depend on light and its quality.

OECD's estimations reveal that in the near future, west countries need for light will rise with a 3 times.

Simultaneously, people ask for high quality light in everyday life. Producing light requests energy: over 30 billion electric lamps that work everyday worldwide use more than 2100 TWh every year (10-15% of total energy production).Therefore, it's estimated that over 1000 billion metric tons of CO_2 are rejected in the atmosphere.

As the graphic shows, 28% from this energy is used for residential lighting. (Mills, 2003)

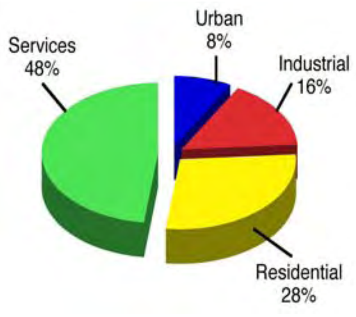

Figure1 Sectors of energy intake for lighting

2. Project consortium

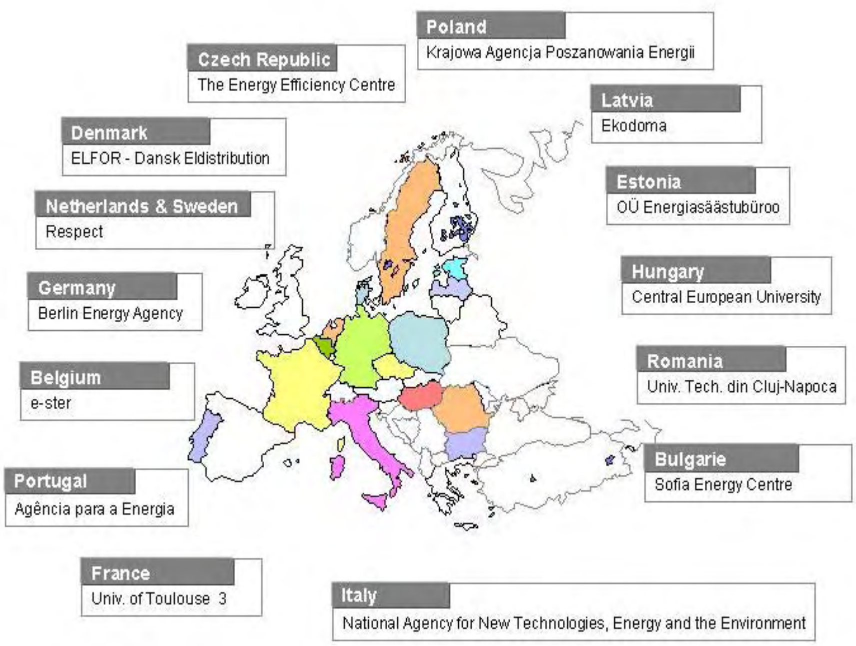

Figure 2 The EnERLIn consortium map

EnERLIn consortium consists in 14 partners from 14 countries (Respect is active in both countries, Holland and Sweden). It covers a significant part of Europe, form north to south and from east to west.

This is an important feature of the project due to different reactions of individual customers from one country to another (north countries prefer low colour temperatures lamps-warm ambiance- while south countries are more sensitive to high colour temperatures, cold ambiance). On the other hand, the consortium includes western countries with an increased economic level to eastern countries that have been already integrated in EU (Poland, Hungary, Czech Rep., Latvia and Estonia), and the newest EU countries (Bulgaria and Romania).

The ENERLIN consortium is a strongly cross-disciplinary entity and includes National and Regional Energy Agencies (ADENE, KAPE, ENEA, SEC, SEVEn, BE), one ESCO in Belgium, academic institutions (France, Hungary and Romania), a consultancy company (Respect) as well as independent consulting SMEs (Ekodoma, Energy Saving Bureau). Each partner has solid experience with EU projects (especially from DG TREN) and strong links with international entities (like CIE) and projects (like ELI), other European networks (COST-529) and programs (GreenLight). In the end, one of the partners are quite influential for policy-making bodies in both national (regional) and European levels.

3. Questionnaire campaign EnERLIn 2008

During 2008, between January and May, took place the final campaign for EnERLIn questionnaires developed by project partners – Electrica S.A. Transylvania North Branch, S.C. EnergoBit S.R.L. and S.C. Pragmatic Comprest S.R.L., based on the model presented at the end of this work. Statistic data processing shows that:

Electrica's questionnaire has been distributed at Zalau Agency in 500 samples, 151 were answered.

From those who had answered the questions, 47% are using CFL at home. For this people, average use of CFL lamps is 1.11 units/family.Towards all 151 persons who answerd **questionnaire** the average use of CFL lamps is 0.52 units/family. Favourite power for CFL is 8 W and 13-16 W.

Energobit's questionnaire - 150 samples have been distributed in three blocks of flats in Cluj-Napoca (Manastur, Marasti and Gheorgheni Districts), 58 were filled in. 53% of those who answered the questionaire use CFL.

For this people, average use of CFL lamps is 4.77 units/family. Towards all 58 respondents the average use of CFL lamps is 2.55 units/family. Favourite power for CFL is 13-16 W and 20 W.

Pragmatic's questionnaire – this one has been directly distributed to 163 people in its own shops from Cluj-Napoca (Plevnei Street, Horea Street, Manastur, Marasti Market) and also in Zalau. 88% of those who answered the questionnaire use CFL lamps at homes. For this people, average use of CFL lamps is 6.59 units/family, while the average for all the respondents is **5.78 units/family**. Favourite power for CFL is 13 W and 20 W.

Questions	Use of CFL		Nr of lamps CFL				Opinions							
questionnaire	Yes	No	8 W	13 W - 16 W	20 W	24 W	Last bought		Use period		Right price		Satisfied by the coulour of light	
							1-12 month	>1 year	yes	no	yes	Too high	yes	no
Total	31	27	22	52	43	31	15	16	23	35	40	18	16	42
Summ	58		148				31		58		58		58	
%	53	47	15	35	29	21	48	52	40	60	69	31	28	72

Questions	Use of CFL		Nr of lamps CFL				Opinions									
questionnaire	Yes	No	8 W	13 W - 16 W	20 W	24 W	Last bought		Use period		Right price		Satisfied by the coulour of light		Knoledge about CFL benefits	
							1-12 month	>1 year	yes	no	yes	Too high	yes	no	yes	nu
Total	71	80	38	35	6	0	15	29	79	72	81	69	73	76	94	57
Summ	151		79				44		151		150		149		151	
%	47	53	48	44	8	0	34	66	52	48	54	46	49	51	62	38

Based on EnERLIn's observations the strength report for analyzing energetic and economic efficiency is 1:4 according to Quality Cart of Fluorescent Compact Lamps. Replacing a GSL of 100 W with a CFL of 24 W allows a saving of 76 W of installed power. For a 3 hours average daily consumption the savings are 54.700 kWh in 8 months, which means almost 22 RON in 8 months (related to the actual price of electric power - June 2008).

Conclusively, this kind of investment can be recover in less that a year (8 months).

The results are the same for CFL 13 W-16 W.

Replacing a GSL of 25 W – 40 W with a CFL 8 W – 11 W seems to be justified according to the saved power but the investment will be recovered over a longer period of time. The initial price for CFL 13 W - 16 W it's the same with those of 20 W - 24 W, so gained savings will be minor. People don't use very often 8 W and 24 W CFLs.

According to the applied questionnaires, the reasons why CFL are not very used on a large scale are:

Question	YES	NO	PERCENTAGE YES	PERCENTAGE NO
1 Do you use CFL at home?	143	20	88%	12%
2 If yes, how many and what's their capacity ?	Items. 943		Items: 84, 70, 211, 80 W: 8, 11, 13, 14	Items: 84, 170, 73 W: 18, 20, 23
3 When was the last time you bought a CFL?			1-6 months– 69%; 7-12 months – 18%; last year– 38%	
4 Did you know that the use of CFL is very convenient?	157	5	96%	4%
5 Did you know that classy CFL lasts at least 3 years?	140	23	86%	14%
Do you think that CFL are less used because they don't fit in in GSL's iluminating devices ?	94	69	58%	42%
7 Are you satisfied with the colour of CFL ?	138	22	85%	15%
8 Do you think that CFL price , more expensive than the GSL's, is a right one ?	104	58	64%	36%
9 Do you know that with a classy CFL , valid 3 years, you can save enough power to recover your investment in arround 8 months?	127	33	78%	22%

- **CFL's qualities are not known:** a continuous promotional campaign is needed.
- **Lack of trust for no-name products:** only main producers are known; CFL needs a certification to be reliable
- **People don't know that CFL last many years, around 8000 hours:** GSL for example last in time only 1000 hours.

An interesting theme is people's opinion about the colour of the light and the price for CFL. 68% (Electrica), 72% (Energobit) and 78% (Pragmatic) of those who responded the questions didn't know that the power savings they made are able to recover their investment in 8 months.

We estimate that older population is not informed about CFL (they think the price is 3 or 4 times higher than it actually is in shops) and that's why they don't use them. On the other hand, they are the ones who stay at home most part of the day and for them power savings and costs are significant. People with high education know about CFL and use them.

It is essential to continue informational campaign about the advantages and benefits of using CFL in residential lighting.

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Intelligent Energy Europe

Universitatea Tehnică din Cluj-Napoca Lighting Engineering Center

S.C. TRANSILVANIA NORD Electric Energy Distribution and Supply Branch S.A.

S.C. EnergoBit S.R.L.

S.C. PRAGMATIC COMPREST S.R.L.

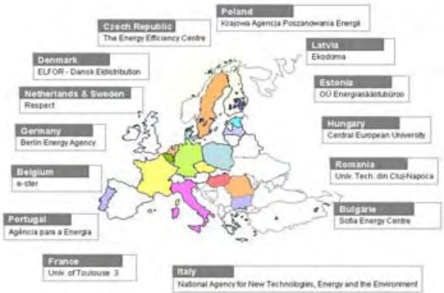
EnERLIn Programme - European Efficient Residential Lighting Initiative

by promoting Compact Fluorescent Lamps in households

Grant EIE/05/176/SI2.419666 (2006-2008)

coordinator Professor Georges ZISSIS, University Paul Sabatier, Toulouse, France

http://www.enerlin.enea.it/



EnERLIn Programme Objectives

Substantial increase of household lighting efficiency in some EU countries.

To promote cheap Compact Fluorescent Lamps offer to answer various needs of shapes, dimensions, color rendering and electrical sockets.

To support CFLs luminaires design with aesthetic trend through specialized shops.

To make and implement a promotional campaign for Compact Fluorescent Lamps and adequate luminaires, according to quality request of European CFL Quality Charter.

Prof. Florin POP
florin.pop@insta.utcluj.ro

Program director
Reader Dorin BEU
dorin_beu@cluj.astral.ro

http://users.utcluj.ro/~lec/enerlin

Luminaires dedicated to CFLs

Different shapes of CFLs

Compact Fluorescent Lamps features

Reduced energy consumption by 80% for the same luminous flux faced to incandescent lamps
Lamp life more than 8 times longer compared to incandescent lamps
Average lamp life of 5 years by using 3.3 hours/ day
Lamp base type E14, E27 or B22
Multiple applications due to the broad range of available lamps
Color temperature range of 2700, 3000, 3500, 4000 and 6000 K - warm white, neutral white and daylight white
Power range from 6 W to 30 W equivalent of incandescent lamps from 25 W to 150 W
A and B energy classes according to the European label systems for household appliances

Cluj-Napoca, March 2008

We thank you for the kindness in answering this questionnaire and for your support in promoting EnERLIn Program!

- ❖ Do you use CFL at home? ☐ Yes ☐ No
- ❖ If yes, how many and what's their capacity? (eg.: 5 itmes/8 W, 2 items/13 W) ....
- ❖ When was the last time you bought CFL? 1-3 month? Last year?
- ❖ Did you know that the use of CFL is very convenient? ☐ Yes ☐ No
- ❖ Did you know that a classy CFL lasts at least 3years-according to the producers label?☐ Yes ☐ No
- ❖ Do you think that CFL are less used because they don't fit in GSL's luminaires? ☐ Yes ☐ No
- ❖ Are you satisfied with the colour of CFL ? ☐ Yes ☐ No
- ❖ Do you think that CFL price, more expensive than a GSL's, is a right one? ☐ Yes ☐ No
- ❖ Do you know that clasy CFL, valid 3 years, can save enough power to recover your investment in arround 8 months? ☐ Yes ☐ No

Dorin Dumitru COSTEA
General Manager
S.C. Filiala de Furnizare
ELECTRICA Tranilvania
Nord S.A.
27, Memorandumului Str.,
RO-400080 Cluj-Napoca,
Romania
Tel.: + 40 264 205200,
Fax: +40 264 205204
e-mail: dorincostea@cj.electrica.ro

He graduated the Technical University of Iassy in 1991, as Electro Energetically engineer. The first step on his professional carrier was as technical advisor at Baia Borsa Mining Company, the Processing by Flotation of the final product. He done the same job for the Mining Company in Cluj until 1984, he applied for Electrical Utility Company Cluj Napoca, starting as designer project and Investments Department. Since 1998, he joined the Commercial Team of Company. He obtained the Certificate and Diploma of Management at OPEN University of London and the Strategically Development of Companies training program of AOTS in Japan. Today he leads the Supply Company of Electricity -Electrica North Transilvania as general manager.

Florin M. POP
47/11, Tăietura Turcului Str.
400221 Cluj-Napoca
Romania
Ph.: +40 264 207 527
Fax:+40 264 207 555
e-mail: florin.pop@energobit.com
http://www.energobit.com

He has a significant experience in the energy efficiency field. His expertise includes also the financing and marketing aspects. He worked for many Romanian industrial clients in all phases of energy projects: technical audit, issuing measure plans to reduce energy input, preparing financial report, implementation of proposed measures, operation and follow-up. Through the experience earned so far he was recommended as a Project Manager for many energy efficiency projects with international financing (World Bank, USAID – Ecolinks, UNDP – GEF). These projects have been appreciated by the clients and financial institutions, some of them being considered as «best practice» and recommended to other customers.

Vasile RUSU
18, Plevnei Str., Cluj-Napoca, Romania
Phone: +40 264 502105
Fax: +40 264 502107
E-mail: vasile@pragmatic.ro

Born in 1959, he graduated in Electronics and Telecommunications, 1989, the Polytechnic Institute at Cluj-Napoca. Starting with 1994, he is Executive Manager of S.C. PRAGMATIC COMPREST S.R.L. from Cluj-Napoca,where he manages the commercial activity with electric appliances en-gros and en-detail: lamps, luminaires, switches, sockets, cables.

Florin POP,
Professor, Dr.
Lighting Engineering Center,
Technical University of Cluj-Napoca
RO-400020 Cluj-Napoca, Romania
15, C. Daicoviciu Str.,
Ph.: + 40.727. 516276
Fax: + 40.264.592055
e-mail: florin.pop@insta.utcluj.ro

He graduated the Technical University of Cluj-Napoca in 1966. Ph. D. in Electrotecnics in 1980, Technical University of Timisoara. Professor in Electrical Installations and Lighting from 1990. Vicepresident of the Romanian National Committee on Illumination. Coordinator and participant at the scientific cooperation and research international programmes Tempus, Socrates, Leonardo, Peco-Joule. Head of the Lighting Engineering Center LEC-UTC-N. Editor of the Ingineria Iluminatului (Lighting Engineering) journal, chairman of the International Conference on Lighting ILUMINAT – Cluj-Napoca, Romania.

Dorin BEU, Reader Dr.
Lighting Engineering Center, Technical University of Cluj-Napoca
15, C. Daicoviciu Street,
RO-400020 Cluj-Napoca, Romania
Phone: + 40.723.661536
Fax: + 40.264.592055
e-mail:dorin_beu@cluj.astral.ro

He graduated the Technical University of Cluj-Napoca in 1990. Between 1993 and 1999 he attended several teaching and research grants at Liverpool, Grenoble, Helsinki, Barcelona and Budapest. Ph. D. in Lighting in 2000. Reader at Technical University of Cluj-Napoca. Participant at several European research programmes. Project leader for residential public lighting design in Cluj-Napoca, Dej and Sighet and for interior lighting design in office and retail buildings. Member of the Lighting Certificate Committee of the Romanian National Committee on Illumination.

Paper presented at the SIEE 08 International Symposium on Energy Effiency, September, 2008, Cluj-Napoca, Romania.

APPRAISAL OF INDOOR LIGHTING SYSTEMS QUALITY

Mihaela POP, Horia F. POP, Florin POP

The paper approaches one of the components of indoor environment – the lighting quality, based on a Ph.D. research. ***Evaluation of quality of an indoor lighting system*** *using a Quality Level numeric indicator is proposed. The application of hierarchical classification method on the responses of 52 subjects allows for the invalidation of certain input data and the selection of respondents.* ***Analysis of an indoor lighting system in real operation conditions*** *presents the users' response related to the illumination level and colour temperature of light sources. Both parameters in an experimental study regarding the 12 users' options in a real work place, which daily activity is performed in continuous operation lighting system.*

1. Introduction

Lighting is an important instrument in reducing the global consumption of electric power. The "European Greenlight" initiative has been launched in order to stimulate the conception of energy-efficient lighting installations. This European programme generated numerous initiatives at local levels. Lighting covers between 5% and 15% of the electric energy consumption in the industrialised countries, while reaching up to 85% in the developing countries. Besides the direct savings resulting from the reduction of energy consumption of lighting installations, indirect energy savings may be achieved from reducing the energy consumption related to heating and air conditioning. The corresponding lighting creates a visual ambient that gives the people the possibility to perform visual tasks efficiently, accurately and safely, with no induced visual discomfort or fatigue. Special attention must be given both to quantitative aspects and to qualitative aspects as well. Even if the lighting level necessary for the visual task is ensured, the visual perception depends both on the way the light is applied, the colour characteristics of the light source and of the room surfaces, and of the individual users' response – perception ability, visual aptitude.

2. Evaluation of quality of an indoor lighting system

Evaluation of quality of an indoor lighting system using a Quality Level numeric indicator is useful, even if it can only be partially subjective [9, 11, 12, 15, 16]. In order to avoid inherent confusion in appraising the quality, it is necessary that this numeric indicator to be adopted specifically at room level, given the particular character of each lighting system, according to the specificity of the respective room.

Table 1 Replies to a poll on quality of interior lighting installations (first half)

Data of the poll on evaluation of quality parameters weights of an interior lighting installation

Lumino-technical quality	Energetic quality	User aesthetics and comfort	Illumination level on the working plane	Illumination uniformity	Luminance contrast light source / ceiling	Luminance contrast ob. visual task / neighbor area	Luminance distribution on the visual field	Reflection factors for walls/ceiling/floor	Color rendering index
1a	**1b**	**1c**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
10	9	9	10	6	2	1	7	8	4
10	10	10	10	7	5	8	8	9	8
9	8	9	9	8	8	8	8	7	7
10	9	10	9	8	7	8	8	8	10
9	10	10	9	8	8	8	8	8	9
9	9	9	8	6	7	8	8	9	8
10	8	9	8	7	6	6	8	7	8
9	9	10	10	9	7	8	8	8	8
10	9	10	7	7	2	2	5	4	9
10	10	10	9	10	9	7	8	7	6
9	7	8	10	8	8	8	8	9	9
5	5	9	10	8	8	7	9	10	10
10	8	9	9	10	8	9	10	8	9
9	9	10	9	8	7	9	8	8	9
10	7	9	10	8	8	8	10	10	9
8	9	10	9	9	8	10	9	8	7
9	9	9	10	10	8	8	8	6	7
9	8	10	10	10	7	10	8	8	10
10	10	9	10	9	8	8	9	9	8
9	10	9	10	8	7	7	8	6	9
9	9	10	10	7	9	8	5	9	9
10	10	10	10	9	7	8	9	10	9
10	10	10	10	8	8	7	7	9	10
10	10	10	10	8	8	8	9	9	8
10	10	10	10	7	8	10	n/a	10	10
10	9	8	10	8	7	9	8	7	8
10	9	8	10	7	7	8	7	7	9
10	10	10	10	8	6	8	10	7	9
10	8	8	10	10	9	9	9	8	9
9	9	8	7	9	8	8	7	7	8
8	10	9	8	7	6	6	8	7	7
8	10	8	10	8	7	7	8	9	9
8	7	9	8	8	7	8	7	7	n/a
9	8	9	9	7	7	9	7	n/a	8
6	8	7	9	9	5	7	9	3	8
9	8	8	10	8	9	7	10	10	9
7	8	7	8	6	6	7	8	7	8
10	8	10	10	7	8	10	9	9	10
9	7	8	8	6	6	9	7	5	8
9	9	8	9	8	7	8	8	7	7
8	10	9	9	8	8	8	8	8	8
9	7	8	10	8	5	5	7	8	9
10	8	9	8	8	7	8	9	7	10
10	8	10	10	8	7	7	8	7	9
6	8	10	9	n/a	n/a	n/a	3	4	n/a
10	10	10	9	9	8	8	8	8	9
10	9	8	9	9	8	7	8	8	7
8	7	9	10	8	9	8	8	7	8
9	9	9	8	7	4	3	3	4	6
8	10	10	9	8	8	8	8	8	10
9	7	10	10	8	7	8	6	9	8
8	9	8	10	10	8	8	8	7	7

Table 2 Replies to a poll on quality of interior lighting installations (second half)

Data of the poll on evaluation of quality parameters weights of an interior lighting installation

Correlated color temperature	Directon of light - modeling	Lighting control	Useful	Useless	Partially objective	Objective	False	Acceptable	Confusion
9	**10**	**11**							
3	5		x		x			x	
7	8		x		x			x	
7	7		x			x		x	
9	8		x		x			x	
10	9		x		x			x	
6	9		x		x			x	
6	9		x		x			x	
10	9		x		x			x	
7	7		x		x			x	
7	9		x			x		x	
9	8	9	x		x			x	
10	9	8	x		n/a			n/a	
n/a	8	9	x		x			x	
9	8	6	x		n/a			n/a	
9	8	6	x		x			n/a	
8	6	8	x		x			x	
7	8	7	x		x			x	
9	9	8	x		x			x	
9	9		x			x		x	
7	9		x			x		x	
9	9		x		x				x
7	8		x		x			x	
8	7		x			x		x	
9	9		x			x		x	
n/a	10		x			x		x	
7	7		x			x		x	
8	8		x		x			x	
7	7		x		x			x	
9	9	9	x			x		x	
7	8	7	x		n/a			n/a	
7	9	7	x		x			x	
8	10	9	n/a		n/a			x	
8	8	8	x		n/a			n/a	
7	9	5	x		n/a			n/a	
7	8	6	x		x			x	
7	10	10	x		n/a			n/a	
8	9	10	x		n/a			n/a	
10	8	9	x		n/a			n/a	
9	10	5	x		x				x
7	7	8	x			x		x	
8	9	9	x		x			x	
5	8	8	x			x		x	
7	9	9	n/a		x			n/a	
8	8	9	x		n/a			n/a	
n/a	5	7	x		n/a			n/a	
9	9	10	n/a		x			n/a	
7	8	9	n/a		n/a			x	
7	9	9	x		x			x	
5	8	8	x			x		x	
8	8	10	x			x		x	
8	8	8	n/a		x			n/a	
8	7	9	n/a			x		n/a	

Certain components in the appraisal of quality change their weight depending on concrete requirements of certain activity, thus the user of the proposed appraisal system sets the values of the weighing factors for the appraised lighting system in accordance with the particular data of the room and the importance of the relevant component. Values of weighing factors of quality parameters revealed by a survey on 52 persons are presented, as resulted from the statistic analysis of the input data acquired from questionnaires concerning multiple quality aspects of the indoor lighting installations. The application of hierarchical classification method on the responses allows for the invalidation of certain input data and the selection of respondents [15].

The theory of fuzzy sets was introduced in 1965 by Lotfi A. Zadeh [19] as a natural generalization of the classical set concept. Let X be a data set, composed of n data items characterized by the values of s variables. A fuzzy set on X is a mapping $A : X \to [0,1]$. The value $A(x)$ represents the membership degree of the data item $x \in X$ to the class A. The advantage of this approach is that it allows a data item x to be a member of more classes, with different membership degrees, according to certain similarity criteria. Clustering algorithms based on fuzzy sets have proved their superiority due to their ability to deal with imprecise sets, imprecisely-defined boundaries, isolated points, and other delicate situations. The class of fuzzy clustering algorithms based on fuzzy objective functions [2] provides a large share of geometrical prototypes and combinations thereof, to be used according to the data substructure. On the other hand, the Fuzzy Divisive Hierarchical scheme, used here, provides an in-depth analysis of the data set, by deciding on the optimal subcluster cardinality and the optimal cluster substructure of the data set [5, 13].

Due to space constraints, the fuzzy membership degrees of the polls to all the fuzzy sets are omitted from this paper, but complete results may be available directly from authors by request. The bi-dimensional representation of the data is given in Figure 1.

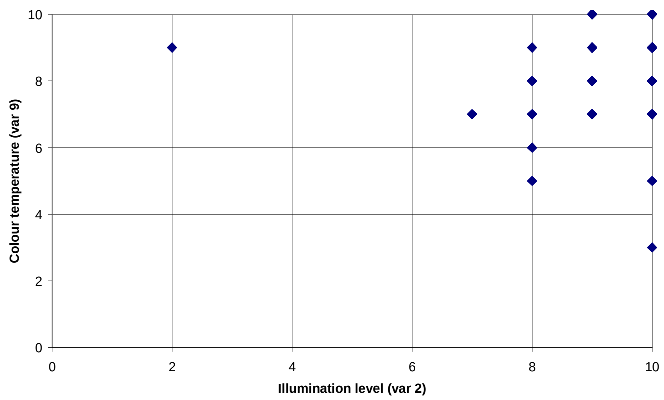


Figure 1 Bi-dimensional representation of polls using variables 2 - illumination level and 9 - colour temperature

Table 3 Statistical analysis of poll replies data on the setting of weighting values, described in Table 6.1

Statistical description					
Parameter	Number of valid values	Mean value	Minimal value	Maximal value	Standard deviation
lighting quality	52	9.04	5	10	1.15
energetic quality	52	8.69	5	10	1.15
users aesthetics and comfort	52	9.10	7	10	0.89
illumination level on the working plane	52	9.29	7	10	0.87
illumination uniformity	51	8.04	6	10	1.08
luminance contrast light source / ceiling	51	7.10	2	9	1.51
luminance contrast ob. visual task / neighbour surface	51	7.59	1	10	1.73
luminance distribution in visual field	51	7.82	3	10	1.44
reflection factors ceiling / walls / floor	51	7.63	3	10	1.60
colour rendering index	50	8.36	4	10	1.22
correlated colour temperature, apparent colour	49	7.71	3	10	1.39
light direction (modelling)	52	8.23	5	10	1.10

Table 4 The final partition produced by the divisive fuzzy clustering of the polls using variables 2 and 9 and the respective prototypes

Class	Name	Elements
1	1.1.1.	1 6 7 49
2	1.1.2.	9 30 31 33 37 43
3	1.2.1.	3 10 13 34 35 40 45 47
4	1.2.2.	2 17 20 22 25 26 28 36 42 48
5	2.1.	16 23 27 32 41 44 50 51 52
6	2.2.1.	4 11 14 15 18 19 21 24 29 46
7	2.2.2.	5 8 12 38 39

Class	Name	Prototype	
		2	9
1	1.1.1.	8.150	5.720
2	1.1.2.	7.794	7.051
3	1.2.1.	8.988	7.014
4	1.2.2.	9.981	6.978
5	2.1.	9.622	7.950
6	2.2.1.	9.908	8.987
7	2.2.2.	9.664	9.810

The divisive hierarchic clustering algorithm has been used to cluster the given data by considering only the variables 2 - illumination level and 9 - colour temperature. The obtained result was a clustering hierarchy with seven final classes. The final partition and the associated prototypes are described in Table 4.

The use of the hierarchic clustering method at the analysis of subjects replies to polls leads to a few interesting remarks: it is expected for the professional preparation and/or seriousness of approaching the study to reflect in a series of poll replies unable to be used because of the high distance of these elements from the centre of their group. Thus, different answers are grouped by their membership to classes based on distance similarity. The replies members of a certain class are quite homogeneous. The participants to this study were, indeed, a group homogeneous as professional preparation and with good lighting knowledge. Low membership degrees of some data items to the fuzzy sets in the final partition denote a possible lack of knowledge or a superficial consideration of the study. Such replies may be well removed from the data that are to be subjected to a statistical evaluation.

3. Analysis of an indoor lighting system in real operation conditions

In a work environment, activation as well as relaxation moments are needed. The colour and level of illumination may, together, determine such moments. Studies on a work environment (office) where the preferred colour temperature for electric lighting could have been remotely adjusted by tested people, during an entire day, showed that there is no pattern of individual preferences in this respect: everybody has a personal preference [3]. Researchers unanimously underline the difficulty of comparing visual performances under laboratory conditions, tested on subjects trained to solve the test, with those achieved at employees' workplaces. It is the difference between what the subjects *may* achieve as visual performance as part of a test in laboratory conditions and what employees *chose* to achieve on their real everyday working conditions. This real fact may lead to identifying the effect of lighting conditions on the task performance through the influence of lighting and light environment on the human psychology [4].

This is an aspect the authors monitored in an experimental study regarding the users' options in a real work place of an electric dealer company, which daily activity is performed in continuous operation lighting system. Twelve subjects were included in the experiment. The realised experiment targeted the users' response related to the illumination level and colour temperature of light sources. The desks placing is differentiated on the two sides of the room – on the left side there are desks with two work points, with the back towards the windows, and on the right side there are two desks with four work points each, in the central party, and two desks with two work points each at the two ends (see Figure 2).

Figure 2 The experiment room, with the two distinct lateral sides
up – electric lighting, partially off on the right side
down – mixed lighting, mainly natural

A simple modality has been proposed, with a low cost, to ensure two distinct functioning states:

Case 1 – The current lighting installation is operational since about three years, with a high depreciation – lamps aging, consistent dust presence on lamps and reflecting surfaces of lighting devices. The type of the lighting devices is PLATOS FIRI-07-414, they are equipped with fluorescent lamps TL5-14W/840, colour temperature T_{cc}=4000 K, initial luminous flow Φ_l=1200 lm.

Case 2 – The old fluorescent lamps have been replaced with new lamps, type TL5-14W/865 colour temperature T_{cc}=6500 K, initial luminous flow Φ_l=1100 lm.

Then the illumination has been measured on a small area around keyboard / office catalogues, in the two phases, for the 12 work posts from the right side: case 1 – values in red; case 2 - values in blue. The used measurement device was a digital luxmetre YF-170 digital, precision class 5%. The variation of measured illuminances ΔE,% between 20 - 48% is due, on one side, to the modification of the geometry of lamellar/reflecting panels of the illumination devices when repositioning after the change of lamps and, on the other side, to the difference in contribution of the illumination on the left side of the room. For the purpose of this experiment the obtaining of two levels of illumination, sensibly differentiated, before and after the change of lamps, was important.

The results of measurements of the illumination level are presented in Figure 3.

Measurement	**ΔE, %**	***E*, lx**	***E*, lx**	**ΔE, %**
1		**670**	**570**	
2	+38	**925**	**760**	+33
1		**745**	**575**	
2	+31	**865**	**850**	+48
1		**755**	**555**	
2	+24	**936**	**815**	+47
1		**815**	**655**	
2	+29	**1055**	**875**	+34
1		**865**	**660**	
2	+22	**1055**	**855**	+30
1		**760**	**670**	
2	+20	**915**	**815**	+22

Figure 3 The illumination levels achieved on desks, around keyboards and catalogues
1 – Illumination obtained from the current lighting installation - TL5-14W/840 lamps
2 – Illumination obtained from the modified lighting installation - TL5-14W/865 lamps

The experiment, to target the users' reaction at the change in lighting conditions of the working space – illumination level in the keyboard area and the colour temperature of the lighting source, was realised on a group of 12 persons, asked to fill a questionnaire concerning the appreciation of the illumination level and the colour temperature in the interior lighting installation.

Some net conclusions may be drawn from the questionnaire answers:

1. both illumination levels of 700 lx (an approximate average value between 555 – 865 lx) and 900 lx (an approximate average value between 760 – 1055 lx) are perceived as being “satisfactory” and “good”, without a clear separation of one of these;
2. the apparent neutral-warm colour T_{cc} = 4000 K is considered as “good” - 67% - and “very good” 33%;
3. the apparent cold colour T_{cc} = 6500 K is considered “unsatisfactory” by most of subjects – 83%;
4. the association of a 700 lx light level with a warm colour temperature of 4000 K is considered by most of them as “good” – 67% - and “very good” – 17%;
5. an equal number of subjects - 17% - consider as being “unsatisfactory” and “very good” the association of a high 900 lx light level with a cold colour temperature of 6500 K.

4. Conclusions

The behaviour of participants to the study of different lighting installations through opinion polls is subject to appreciation errors and human subjectivism concerning the conditions of the working environment.

The analysis of the polls replies through divisive hierarchic clustering is a way to select/eliminate some subjects with erroneous replies, contributing in this way to the accuracy of subsequent statistic analysis.

The study related to the perception of light and colour conditions of the working place underline the difficulty of users’ evaluation of sensitive differences of illumination and apparent colour levels of a lighting system.

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Mihaela POP, Ph.D.
Water Company Somes S.A. Cluj-Napoca
Project Implementation Unit
RO400124 Cluj-Napoca, Romania
Ph.: +40.745.003693
Fax: +40.264.597155
popmihaela@hotmail.com

She graduated as Mechanical Engineer B.Sc in Machine Building (*Faculty of Mechanical Engineering, Technical University of Cluj-Napoca*, 1994), M.Sc. in Energy Management and Mechanical Engineering (*International Technological University, Paris, France, Technical University of Cluj-Napoca, Romania, Division of Engineering and Technology of UNESCO, Paris, France*, 1996), Ph.D. student in Electrical Engineering (*Faculty of Electrical Engineering, Technical University of Cluj-Napoca).* Her field of interest in lighting is the Assessment of the Interior Lighting Systems Quality. She attended research grants at Liverpool, Barcelona and Eindhoven. Participant at research programmes in lighting.

Horia F POP,
Professor
Department of Computer Science, Babes Bolyai University
1 M. Kogălniceanu Street,
RO-400084 Cluj-Napoca,
Romania
Ph: +40.264.405327;
Fax: +40.264.591906
Email: hfpop@cs.ubbcluj.ro

Horia F. POP graduated in Computer Science from the Babes-Bolyai University of Cluj-Napoca (UBB) in 1991. He is with the Department of Computer Science, Faculty of Mathematics and Computer Science, UBB (since 1991). Ph.D. in Computer Science at UBB, with the thesis “Intelligent Systems in Classification Problems” (1995). He is teaching in areas related to Artificial Intelligence. He has realized, alone or in co-operation, around 100 scientific papers, among which 27 are indexed in ISI Web of Knowledge. He developed scientific visits at different western universities and institutions, among which we mention here the development of an NSF contract on Soft Computing with the University of Memphis (2000-2003), the participation to a DFG program on Natural Language Processing with the University of Hamburg (1999-2001), and the visiting professorship at the Wayne State University in Detroit, US (2006). His research interests are Fuzzy Sets, Intelligent Data Analysis, Soft Computing, and Artificial Intelligence.

Florin POP,
Professor, Dr.
Lighting Engineering Center,
Technical University of Cluj-Napoca
RO-400020 Cluj-Napoca,
Romania
15, C. Daicoviciu Str.,
Ph.: + 40.727. 516276
Fax: + 40.264.592055
e-mail: florin.pop@insta.utcluj.ro

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LIGHTING IN ARCHITECTURE A POETICS AND THE E MATRIX

Ph.D. student: arch. **Raluca BUZDUGAN**
University of Architecture and Urbanism Ion Mincu, Bucharest

Technical advisor: prof.dr. arch. Emil Barbu Popescu, president of University of Architecture and Urbanism Ion Mincu, Bucharest
The Ph.D. thesis was presented in a public debate at the University of Architecture and Urbanism Ion Mincu, Bucharest, Romania on June 14th 2008. Her author was awarded the scientific grade of Ph.D. in Architecture.

1. Contents

The Ph.D. thesis: Lighting in Architecture: A Poetics and the E Matrix" is structured on the following chapters:

- Introduction (Why a Poetics of Lighting. Opportunity. Historical perspective. Richard Kelly. Current theoretical and practice standards within the architectural lighting design field)
- Research areas (Innovating technologies. Research directions)
- Light-Art Artists (Dan Flavin, James Turrell, Fabrizio Corneli)
- A Poetics of Lighting (Definition, Story, Function, Space, Tools, Concept, Efficiency)
- Architectural lighting design (Residential, Office, Retail, Museums)
- The E Matrix (Definition, Case studies, Results, Examples)
- Conclusions (Positioning, Original contributions, Perspectives, Moral)

2. Outline of thesis

Aristotle wrote in his "Poetica" (335 B.C.) that "Imitation (…) is one instinct of our nature. Next, there is the instinct for harmony and rhythm (…). Persons, therefore, starting with this natural gift, developed (…) their special aptitudes, till their rude improvisations gave birth to Poetry."

The man started to build to protect himself, to get shelter. His instinct for Beauty gave birth to Architecture.

The research and study of Beauty discovered that all beautiful objects are embedded with compositional rules and methods, some subjective, cultural, and other of a mathematical, universal nature.

Throughout history, the civilizations established, followed and eventually abandoned the strict composition rules of their art and architecture.

Today, the structure of Beauty in architecture is free of formal rules. There is however a Poetics of Space, a Poetics of Architecture that goes beyond compositional canons.

This Poetics is unifying the Beauty of architectural shapes, despite different spatial geometries.

If using daylight was an integer part of architectural creation since antiquity, its methods having been described both scientifically and artistically, artificial lighting is only now getting to transcend its technical and functional stage.

By Analogy with literature, today, lighting has fairly well documented its Grammar.

The thesis proposes a Poetics of Lighting and a work tool, The E Matrix, designed for architects and interior designers.

The proposed Poetics is defined through six key components of an architectural lighting project, and the E Matrix is a software program which, by process of the Poetics rules, determines a structural frame for the architectural lighting of a space.

The professional literature within the architectural lighting design field is extremely scarce, once one goes beyond the professional magazines, conference papers or PhD thesis, the bulk of it being written by engineers for engineers. Also, the curriculum of most architectural schools, throughout the world, does very little to inform and educate the architect within the architectural lighting design field. It is a gap that will hopefully be closing up soon.

The paper is a plea for sensible and thoughtful design of the artificial lighting of a space by its architects, benefitting from the same attention for detail they put in day-lighting their buildings.

The studies done to develop and define the proposed Poetics and the E Matrix, researched many fields: the one specific to lighting engineering, as well as literature, visual arts, architectural theory and history, mathematics, anthropology, biology and medicine.

The Poetics of Architectural Lighting

The proposed Poetics follows the models of the two most famous Art Poetics: Aristotle's "Poetica" (335B.C.) and Vitruvius' "De Arquitectura" (27 B.C.).

In his "Poetica" Aristotle defines the six mandatory elements of a good (i.e. strong emotions triggering) Tragedy: the Story, the Characters, the Diction, the Thought, the Spectacle and the Music.

For Vitruvius, the first architect to document in writing the building techniques of his age, Architecture is dependent of: Order, Composition, Eurhythmy, Symmetry, Functionality and Efficiency: 6 terms which, when mastered correctly, would lead to Durability, Functionality and Beauty.

The proposed Poetics of Lighting is defined through 6 critical components: The Story, The Function, The Space, The Tools, The Concept, and The Efficiency.

The Story is the one the lighting shall tell together with the architecture. The Story shall support the architecture in its quest for durability, functionality and beauty and shall embrace the story the architecture wants to tell: the space shall be grand, imposing, romantic or else, it should speak to you or embrace you, and so on. Once the story presents itself, the lighting concept will follow.

The Function is the careful assessment of all that the space, and the lighting, needs to do and to be. It is the function the given space hosts (museum, office, theater) and the role the lighting shall play (to make a certain visual task comfortable, to create a certain atmosphere). The more complete this inventory is, the better the lighting will be.

The Space is the research of all of the geometric, style and mood qualities of the space to be lit, as the lighting shall be applied differently for different geometries, regardless of the fact the function is the same.

The Tools are all the lighting techniques and technologies applied in a project to control the direction, the form, intensity and color of light and shadows.

The Concept is the Master Plan which represents and describes the projected results of the design. The quality of the concept depends on the designer's understanding of the architecture, his/her capacity of taking the best and most efficient design decisions, and his/her artistic potential.

The Efficiency is the analysis of the concept from the point of view of its esthetical, functional and economical performance and the adjustment of its weak points, thus insuring the quality of the design from a triple perspective: Beauty, Function and Durability.

The proposed Poetics shall direct the lighting designers towards creating or adhering to an existing "Ars Poetica", giving architectural lighting design a philosophical and logical structure, which should eventually lead to a more cohesive professional practice and result in a healthier, sustainable and more beautifully lit environment.

The E Matrix

The E matrix is a software program developed for architects and interior designers. It allows a fast and efficient evaluation of the available architectural lighting techniques for an interior space defined by its user through architectural functional, dimensional and stylistic parameters.

The Matrix has two modules: the input format, where the user selects and enters key data about the space, and the output format, which will give the user a series of recommendations regarding appropriate lighting sources and lighting techniques, medium illuminance levels and general luminous flux output allowing a preliminary dimensioning of the necessary light sources.

The elements on the input format are:

- Project title
- Main function / visual task
- Number of functions / number of different visual tasks to be performed in the space)
- Color rendering criteria
- Type of spatial volumetry
- Decoration Style / Complexity
- General dimensions of the space
- Height of the work plane

Once the user selects/defines all data on the input file, the output format will outline the following recommendations:

- Number of lighting systems to be used in the space
- Type of lighting (general, local, mixed)
- Average Illuminance
- Luminous flux

- Art / architectural effects
- Lighting techniques
- Recommended light sources, as incandescent, fluorescent, discharge
- Special recommendations
- Minimum power requirements for the recommended light sources

The construction of the E Matrix is based on the current international standards' recommendations and on the thorough analysis of successful lighting design projects completed throughout the world, as well as on the critical analysis of my own successful and unsuccessful attempts at "playing with light".

The E matrix is available for free-use at: **http://matrice.vsa.ro**

3. Conclusions.

The Light, both natural and man-made, impacts our existence in so many ways that us as architects cannot be opaque and insensitive about how our buildings and cities are lit. It is our duty as architects to learn to control and use light in an inteligent way.

The Poetics and the E matrix are two "instruments" designed to recover and bring within the architect's control an extraordinary building material: artificial light, thus ensuring architecture, the "masterly, correct, and magnificent play of form in light" (Le Corbusier, Towards a New Architecture, 1923) will not die after sunset.

Raluca **BUZDUGAN**
Architect (Ph.D., M. Arch., M.Urb.)
Partner, Vlad Simionescu & Asociatii Arhitecti
Associate lecturer, University of Architecture and Urbanism Ion Mincu, Bucharest
Phone: +40 21 411 0259
Fax: +40 21 410 0721
E-mail: rbuzdugan@yahoo.com

She graduated as an Architect (M.Arch.- University of Architecture and Urbanism Ion Mincu, Bucharest 1994), Master of Urbanism (University of Architecture and Urbanism Ion Mincu, Bucharest 1995), Ph.D. Architecture (University of Architecture and Urbanism Ion Mincu, Bucharest, 2008).

Fields of interest in lighting: Poetics and Theory of Architectural Lighting, Light-Art Installations, Lighting in Visual Arts, the practice of architectural lighting design.

The 4th BALKAN conference on lighting BALKANLIGHT 2008

Matej B. KOBAV

In October 2008 we had a beautiful opportunity to attend a Balkanlight 2008 conference. The Balkanlight society was founded in year 1999 at Varna, and its main aim is to promote lighting knowledge and practice in all fields, through technical, scientific and cultural links and cooperation among the Balkan countries. The first Balkanlight conference was held in Varna in 1999, the second one was in year 2002 in Istanbul and the third one was in year 2005 in Cluj-Napoca. During the third Balkanlight conference it was decided that the next conference would be organized by Slovenian Lighting Engineering Society. This decision gave us the honour to organize the meeting in 2008.

The 4^{th} Balkanlight conference took place in the capital of Slovenia, in Ljubljana and it was accompanied with several other events and meetings. The first event were meetings of the four technical committees (TC 3-39: Discomfort Glare from Daylight in Buildings, TC 3-44: Lighting for Older People and People with Visual Impairment in Buildings, TC 3-45: Luminance Based Design Approach and TC 3-46: Research Roadmap for Healthful Interior Lighting Applications), which were held on Monday, October 6th. Tuesday, October 7^{th} was reserved for CIE division 3 annual meeting. The opening ceremony of the Balkan Light conference was held in the morning of the October 8^{th}. The ceremony was short and we had three honoured guest: mayor of Ljubljana mr. Zoran Jankovič, president of Slovenian Lighting Engineering Society mr. Matjaž Merkan, and president of Slovenian NC of the CIE mr. Grega Bizjak. In two full days of conference we had an opportunity to hear more than 30 presentations and to meet nine presenters at the poster session. The conference guested invited speakers from almost countries of Balkanlight society. Among all distinguished presenters we would expose only a few names (Jan Ejhed, Janos Schanda, Ken Sagawa, Geoffrey Cook, Lou Bedocs, Manuel Melgosa, Mojtaba Navvab, Lars R. Bylund, Liisa Halonen).The last day of the week was reserved for Slovenian presenters and papers in Slovene language. As there were still many international participants in the audience, most of Friday presentations were also in English.

Almost 200 lighting people attended the conference and participants were coming from 24 countries (Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Denmark, Finland, Germany, Greece, Hungary, Israel, Italy, Japan, Netherlands, Norway, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, United Kingdom and USA).

In the week of the conference there was also a lighting workshop "3 Underways - Entrance to the City Park" for students. The workshop had two parts, the first one was lectures on public lighting and the second one was a real workshop on three case studies – three underpasses.

The proceedings of the conference are available on internet: www.balkanlight.eu.

06.12.2008

Slovensko društvo za razsvetljavo, Tržaška cesta 25, 1000 Ljubljana, http://www.sdr.si
Poslovni račun odprt pri NKBM, IBAN: SI56 0417 3000 0689 282
Davčna številka: SI21265607 Matična številka: 5114934

Grega BIZJAK
President of the Program Committee
President of Slovenian CIE National Committee

Center for Sustainable Healthy Buildings (CSHeB)

Jeong Tai Kim

Director of Center for Sustainable Healthy Buildings
Professor of Architectural Engineering
Kyung Hee University, Yongin, Gyeonggi-do 446-701, Korea (Republic of)

1. Center of Excellence

The Center of Excellence (COE) has been established for purpose of systematizing a pool of excellent researchers scattered at universities across the country and fostering a team of world-class leading scientists by providing intensive support for them funded by Korea Science & Engineering Foundation (KOSEF), and Ministry of Education, Science and Technology (MEST).

The COEs are composed of the Science Research Center (SRC) and the Engineering Research Center (ERC). The SRC formulates and provides basic theories required for in-depth and creative research on basic scientific areas and also high-tech areas for leading scientists. and the ERC, which carries out research for original technology related to industrial development, seeks to foster leading scientists.

Each COE has a large team composed of university professionals with a single research goal.

2. The Center for Sustainable Healthy Buildings (CSHeB)

The Center for Sustainable Healthy Buildings (CSHeB) has been nominated as an ERC in September 2008. It dedicates to the advancement of new ideas, substantiation of related researches, international cooperation, the training of professionals, and the growth of pragmatic knowledge in the field of healthy building design, control, construction, operation and management. The Center consists of six universities and 70 people.

3. Core Research Topics

- Architectural lighting systems
- Indoor air quality
- Moisture and biological contamination
- Soundscape environment and materials
- Construction management and composite structure systems
- Smart intelligent maintenance and management system

4. Grant and Duration

Total Grant is approximately US$ 10 million for 7 years (September of 2008 ~

February of 2015). Extra US$ 4.5 million for 3 years (March of 2015 ~ February of 2018) will be supported upon the achievement result.

5. International Collaboration

The CSHeB will be actively maintaining international collaboration by utilizing overseas research laboratory programs, hosting international symposium (seminar, conference), carrying out international joint research, inviting foreign researchers to the CSHeB and supporting the CSHeB' researchers to visit foreign countries.

Through such international cooperation, the CSHeB will build mutual trust and make considerable achievements in research areas of mutual concern with the prestigious schools and research organizations of many countries.

6. Industrial Collaboration

Most research outcomes are ready for commercialization through industrial cooperation. CSHeB may provide patented technologies to companies interested in commercialization.

Jeong Tai KIM
Professor, Ph.D.
Department of
Architectural Engineering,
Kyung Hee University
#1 Seocheon-dong,
Giheung-gu, Yongin-si,
Gyeonggi-do, 449-701,
Korea (Rep. of)
Tel.: +82-31-201-2539
Fax: +82-31-202-8181
E-mail: jtkim@khu.ac.kr

Dr. Jeong Tai Kim is the Director of LAEL (Light & Architectural Environment National Lab.), Vice president of KCIE, President elect of the Korea Institute of Ecological Architecture & Environment 2007-2008 and Honorary president of the Acoustical Society of Korea.

e-Learning modules on EnERLIn program

Georges ZISSIS, Florin POP

An innovative mass media tool were used to improve the technology transfer, in order to provide scientific information to different target users - the modular distant learning methodology set up by ENEA. The distant learning modular approach implies the production of “learning objects” at deeper and deeper levels of technical details in order to suite the needs of different class of user such as: citizens, student, teachers, vendors, producers, engineers working on building construction; architects; illumination engineers and consultants; policy makers; commercial engineers, etc. These training module could be integrated to normal initial curricula of the above mentioned disciplines or (and this is a main issue) could be proposed as part of life-long learning process. ENEA has already produced, for the European thematic network named CASCADE, three distant learning courses on LCA: LCA tools for SMEs, LCA data suppliers, LCA data and results; they are in English and can be freely used in the ENEA e-LEARN platform (http://odl.casaccia.enea.it).

A web site http://www.enerlin.enea.it was created under the frame of the EnERLIn program, for the free use of the teaching lectures of the Professors George ZISSIS (8 April 2008) şi Florin POP (25 September 2008):

Energy efficient indoor lighting technologies

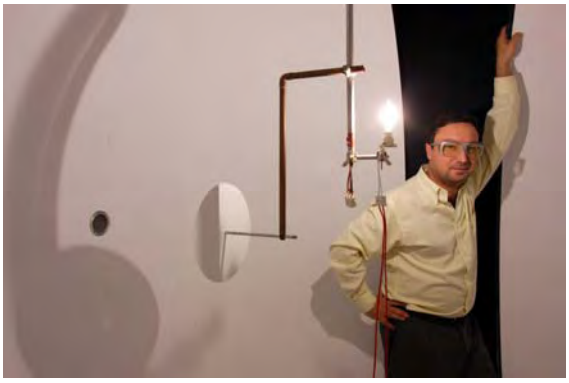
This e-learning module deals with the presentation of Energy Efficient Lighting (EEL) Technologies for indoor lighting applications. This module explains first how lighting systems operate and who is possible to achieve substantial energy savings but choosing the right system for each application. Then, the barriers that impede the EEL systems to penetrate effectively the residential market are listed. The barriers are analysed and different methods to bypass them are presented. Finally, a projection for 2030 is presented based on various scenarios for residential lighting energy consumption.

Nouvelles technologies d'éclairage pour une meilleure performance énergétique des bâtiments

Same talk as the previous one but in French Language.

De l'oeil aux sources de lumière

This talk (in French) deals with the presentation the global lighting system from the light source to the human perception of the light. First, the basics of the human visual system are presented. In a second time a discussion on the perception of brightness and colour is engaged. Finally, the visual system complex operation for the recognition of forms and objects is presented. Some visual illusions offer the opportunity to better understand how the human vision is working.



Professor Georges ZISSIS

Energy efficiency in residential buildings

The primary function of an electric lighting installation is to enable people to see, in order to live in their houses or to perform their professional tasks comfortably and safely. For avoiding an undesirable outcome from an electric lighting installation which achieves energy-efficiency at the cost of lighting, but makes people uncomfortable and puts their safety at risk, it is necessary to consider lighting quality as well as energy-efficiency when designing or evaluating lighting.

There are also presented some of the methods to obtain energy efficient interior lighting:

- installation of luminaires with fluorescent lamps for all relevant positions (ceiling or wall mounted) where a use of more than two hours daily is assumed - kitchen or living room, bathrooms, halls or bedrooms;
- use of CFL in dedicated luminaires instead of mounting them in GLS dedicated luminaires; this would encourage the use of CFL throughout the duration of existence of the building;
- use of CFL for portable luminaires with a use of more than two hours per day;
- use of luminaires with the energy label of type A - ENERGY STAR;
- use of presence sensors to open and close the light as needed;
- use of light colors for the interior walls, with the purpose of reducing the electric lighting.

Eficiența energetică în iluminatul rezidențial

Same talk as the previous one but in Romanian Language.

Echipamentul luminotehnic al clădirilor (Buildings lighting equipment)

Talk (in Romanian). Significant savings in energy consumption, and therefore cost, of providing lighting without reducing standards can be achieved by applying an energy-effective-design approach to lighting installations. Many existing lighting installations are far from energy/cost effective. Consequently, opportunities exist to convert them by using more efficient equipment to provide the same, or sometimes better, lighting for a lower energy consumption and cost. The objective is clearly to provide lighting to the quantity and quality standards required, with the minimum usage of electrical energy. To meet this basic requirement it is necessary to evaluate the equipment, techniques and services available for both existing and proposed installation. Even nowadays, the new and modernized lighting installations designed by devoted specialists meet requirements of new European standards, on the energy efficient and quality features. The presentation review the main futures of the buildings lighting equipments –lamps, luminaries, controls and building energy management systems - BEMS.

Professor Florin POP

Georges ZISSIS,
Univesrite de Toulouse, LAPLACE
UPS-Bat 3R2 ;
118 rte de Narbonne ; 31062 Toulouse cedex 9 ; FRANCE
Phone +33 5 61556996
Fax +33 5 61558447
e-mail georges.zissis@laplace.univ-tlse.fr
http://www.laplace.univ-tlse.fr

Dr. Georges ZISSIS, Senior member IEEE
Born in Athens in 1964, is graduated in 1986 form Physics dept of University of Crete (Greece) in general physics. He got his MSc and PhD in Plasma Science in 1987 and 1990 from Toulouse 3 University (France). Today, he is full professor in the Electrical Engineering Dept of Toulouse 3 University. He is working the domain of Light Sources Science and Technology. He is responsible of the “High Intensity Light Sources” research team that enrols 15 researchers. Prof Zissis won in December 2006 the 1st Award of the International Electrotechnics Committee (IEC) Centenary Challenge for his work on normalization for urban lighting systems. Prof Zissis is deputy director of “LaPlaCE”, a join laboratory between Toulouse 3 University, National Polytechnic Institute of Toulouse and CNRS (French National Council of Research). LaPlaCE represents a task force of 300 researchers. He acted as Chairman of the European Union COST-529 “efficient lighting for the 21st century” network, which regroups more than 80 academic and industrial institutions from 20 European countries; Today he is Chairman of the Lighting and Displays technical committee (ILDC) of IEEE-IAS; President of the Regional Branch of the French Illuminating Society (AFE) and National Secretary of the same organism.

Florin POP,
Professor, Dr.
Lighting Engineering Center,
Technical University of Cluj-Napoca
RO-400020 Cluj-Napoca, Romania
15, C. Daicoviciu Str.,
Ph.: + 40.727. 516276
Fax: + 40.264.592055
e-mail: florin.pop@insta.utcluj.ro

IES Awards 2008

Our publication has used readers with high standards of professionalism and interesting topics showcasing lighting research and initiatives fostering cooperation between different academia and business lighting communities throughout the world. We have the pleasure to announce a success of some of our long time collaborators.

An integrated team of Canadian researchers and experts from National Research Council of Canada (NRC) and the British Columbia Electrical Utility (BC Hydro) has recently won the prestigious Taylor Technical Talent Award from the Illuminating Engineering Society (IES), the Lighting Authority in North America. This award essentially recognizes the best technical paper published by the IES during the year. This year it was awarded to a paper on the energy analysis of the adaptive lighting system at an existing office, data which was collected in 2005.

The citation for the winning paper is: *Anca GALASIU, Dr. Guy NEWSHAM, Dr. Cristian SUVAGAU* and *Dan SANDER* "Energy saving lighting control systems for open-plan offices: a field study," *Leukos*, 4, (1), July, pp. 7-29, 2007.

This field study performed in a deep-plan office building (BC Hydro's Demand Side Management office in Vancouver, Canada) assessed energy savings from the use of workstation dedicated, pendant luminaires using integral occupancy sensors, light sensors for daylight harvesting, and individual dimming control adjusted by office occupants via their computer screens. Data were collected from 86 workstations over a year to examine the energy savings and power reduction attributable to the controls, and how the controls were used. Occupants were encouraged to use the individual lighting control feature by means of e-mail reminders. Energy savings and peak power reductions of up to 70% were determined by comparison to a conventional fluorescent lighting system installed on a neighbouring floor. This is one of the largest field study ever performed for adaptive lighting control that also successfully underlines the benefits of the system.

On November 11, 2008 *Anca GALASIU* representing NRC and *Dr. Cristian SUVAGAU, P.Eng.* of Power Smart Engineering representing BC Hydro have received the Taylor Award at the President Awards Gala of the IES Annual Conference in Savannah, Georgia (see coverage in the "Lighting in the New World" segment from Ingineria Iluminatului nr. 21)

This recognition shows the value of the excellent relationship BC Hydro has established over last decade with Canadian research council. It also shows the scientifically cooperation between collaborators to our publication. *Dr.*

Cristian SUVAGAU is hosting the “Lighting in the New World” segment, while the NRC team led by *Dr. Guy NEWSHAM* and *Dr. Jennifer VEITCH* has submitted high-quality and innovative lighting research studies several times. Interesting too, *Dr. Cristian SUVAGAU* and *Anca GALASIU* have graduated same year from the Faculty of Installations of the Technical University of Construction Bucharest, to surprisingly find themselves working on the same research project, 20 years after. So who can’t say that reality does not beat fiction…

Ingineria Iluminatului
Editorial Board

Dipl.-Ing. Axel STOCKMAR,
Honorar Professor at the Technische Fachhochschule Hanovra

source LICHT 10 (2008), page 911

PERSONALIEN

Dipl.-Ing. Axel Stockmar wird Honorarprofessor

an der Fachhochschule Hannover

1 Prof. Axel Stockmar (3.v.r.) im Kreise seiner Kollegen: Prof. Frank Popp (l.), Prof. Dr.-Ing. Werner Andres (2.v.l.), Präsident der FHH, Prof. Suzanne Koechert (3.v.l.), einem Vertreter des Senats der Hochschule (2.v.r.) und Dekan Prof. Dr. rer. pol. Rolf Hüper (r.).

Text + Foto: Britta Hölzemann, Berlin

Am 22. September 2008 wurde Dipl.-Ing. Axel Stockmar vom Präsidenten der Fachhochschule Hannover, Prof. Dr.-Ing. Werner Andres, zum Honorarprofessor der FHH ernannt. Die Ernennung erfolgte auf Vorschlag der Fakultät III – Abteilung Design und Medien. Er ist damit der vierte an der Hochschule tätige Honorarprofessor.

Die FHH würdigte mit der Ernennung Stockmars vielfältige Verdienste und sein außergewöhnliches Engagement für die Hochschule. Bereits seit 1985 ist er dort als Lehrbeauftragter für das Fach »Lichttechnik« im Studiengang Innenarchitektur tätig. Dekan Hüpers betonte, dass Axel Stockmars Ernennung einstimmig erfolge und unterstrich dessen nationale wie internationale Reputation. Prof. Dr.-Ing. Burghard Weinges hob in seiner Laudatio Stockmars »aufklärungsreiche, leidenschaftliche, nie enden wollende Informationslust« hervor, die die Studierenden »an seinen Lippen hängen ließe«. Prof. Stockmar, geehrt und gerührt, bedankte sich für die von der FHH selten verliehene Würde. Schwerpunkt seiner Lehre bilde zukünftig das Thema »Energieeffizienz + Lichtqualität«. An der Verleihung nahmen Stockmars Familie, Kollegen, Studierende, Ehemalige und Freunde, darunter Prof. Schierz, TU Ilmenau, und Prof. Völker, TU Berlin, teil.

Axel Stockmar

studierte von 1968 bis 1974 Elektrotechnik mit Schwerpunkt elektrische Energietechnik und Lichttechnik an der TU Berlin. Im Anschluss an ein Aufbaustudium Lichttechnik nach dem Graduierten-Förderungsgesetz betreute er bis 1981 als wissenschaftlicher Assistent am Institut für Lichttechnik der TU Berlin Studierende der Architektur und der Elektrotechnik in Labor-Übungen und bei Studien- und Diplomarbeiten. Seitdem ist er freiberuflich mit der Entwicklung von Werkzeugen zur Planung von Innenraum-, Straßen-, Tunnel- und Sportstätten-Beleuchtungsanlagen beschäftigt. Bis zu seiner Wahl im Jahr 2000 zum Vorsitzenden des Deutschen Nationalen Komitees (DNK) der internationalen Beleuchtungskommission (CIE) war er viele Jahre Mitglied des Vorstands der Deutschen Lichttechnischen Gesellschaft (LiTG). Als Lehrbeauftragter an der FH Hannover (seit WS 1985/86) hat er die Möglichkeit, die als Mitarbeiter in verschiedenen nationalen (DIN), europäischen (CEN) und internationalen (CIE) Fach- und Normungsgremien erworbenen Kenntnisse in die Vorlesung »Lichttechnik« einfließen zu lassen. Seit 2001 ist er als Gutachter tätig, speziell zu Fragen der Energieeffizienz von Innen- und Außen-Beleuchtungsanlagen und der Lichtimmission von Sportplatz-Beleuchtungsanlagen. Einen weiteren Schwerpunkt bildet die Erarbeitung von Konzepten zur Beleuchtung von Bahnsteigen oder zur Darstellung visueller Informationen im öffentlichen Raum. Über 100 Veröffentlichungen und zahlreiche Fachvorträge machten ihn im In- und Ausland bekannt.

LIGHTING IN THE NEW WORLD

Cristian Suvagau
BC Hydro, Vancouver

THE IESNA ANNUAL CONFERENCE, SAVANNAH, 2008

For a taste of Southern America, an inspired Executive Board of Directors of the Illuminating Engineering Society of North America decided that the 2008 Annual Conference to be hold in beautiful Savannah, Georgia.

Who actually new that the old, Victorian town would be such a quaint place and a true architectural jewel? A cloudless blue sky, mild temperature, a majestic river and the Atlantic Ocean, completed the perfect landscape for the theme of the conference: “Day & Night—An Exploration of Light: Moving Ideas Forward”.

The 300+ lighting professionals that descended on Savannah, November 9-11, for the 2008 IESNA Annual Conference did not only learn about the shape of things to come for the lighting industry, they also had a chance to pick up some fascinating facts about Savannah's colourful past.

Following two full days of board meetings and technical committee workshops, the conference began Sunday, November 9 with the presentation of the 2008 International Illumination Design Awards hosted at the historic, art deco Lucas Theatre of Arts in Downtown Savannah, followed by an outdoor cocktail reception. The showcase of the innovative, inspiring and energy efficient lighting designs from all over the world was a perfect kick start for an excellent conference. The awards will change format in 2009 becoming now the IES Illumination Awards and grace to a computerised, media advanced judging system are poised to bridge the various local lighting communities within North America. For those interested in participating more information is available on the society’s site at http://www.ies.org/programs/ia.cfm

The keynote address could not have been a better choice: Savannah’s College of Art Design Dean, Architecture Professor Emad Afifi discussed the city’s history, especially from an urban planning perspective, and welcomed the Society to his beloved town. Dean Afifi was recently awarded the 2008 National Council of Architectural Registration Boards Prize for the Building Systems Integration and Performance Studio.

Monday and Tuesday, November 10 and 11, were two full conference days structured in paralleled seminar tracks and joined by four General Sessions. The industry's most innovative leaders were invited to speak on a wide range of topics from human-centered design to transformational technology.

“*Architects, Engineers, Designers: Who is Responsible for Daylighting?*” was the first General Session, that featured Jim West, College of Architecture Dean, at Mississippi State University who tackled one of the industry's current hot topics: integrated design. All members of the project team from the architect, engineer, lighting designer to the builder and also involving the client have an ownership stake in daylighting. Since urban dwellers spend 90 percent of our time indoors, West's advice to the project team was to treat the building as a luminaire. Lighting and daylighting, need to be an integral and early part of a project team's building design if it is to benefit a building's form, function, use of energy and long-term impact on the environment.

"*Light Effects on Human Physiology*" was the second General Session. Dr. Joan Roberts, Department Chair of Natural Science at Fordham University spoke during the about how daylight and artificial lighting design decisions may impact human physiology. While there are many beneficial effects of daylight on human mood and immune response. complete darkness at night is essential to enhance the anti-tumor immune response and to prevent disruption of the sleep/wake cycle. Her discussion explained to architects and lighting practitioners the importance of considering the spectrum of light and the appropriate time of day for exposure when designing homes, workplaces and hospitals.

Other notable seminars on Monday were:

- "*Prospective Evaluation of the Circadian Efficacy of Day Light in Rooms"* (Marilyne Andersen, MIT) that is considering developing a design guideline to consider for circadian lighting impact.
- "*Transformation Technology: Sustainability vs. Conventional Lighting Wisdom*" (Panel Session led by Chip Israel, Lighting Design Alliance) that explored the occasional issues between sustainability, energy codes and regulations and common lighting quality sense in today's construction practice.
- "*Engineering Daylight: Embrace the Variability*" (Abhijeet Pande, Heschong Mahone Group, Inc.) This presentation provided an overview of current research characterizing the best applications for daylighting, design principles for optimizing performance and integrating with electric lighting, and new technologies that ensure energy savings.

The day closed with the always entertaining IES 2008 Progress Report, highlighting the year's most innovative lighting products, followed by a tabletop reception featuring new products and services offered by lighting manufacturers.

The last day of Conference, Tuesday, started with the third General Session; "*The Magnificent Night Sky – Why it Must be Protected from Light Pollution*" that addressed concerns about the dark sky from astronomer Richard Wainscoat from the University of Hawaii. E used spectacular photographs to illustrate what the night sky looks like from a dark location and to demonstrate how dramatic the effects of artificial lighting are. Prof. Wainscoat also touched on how artificial light can impact astronomers' telescope search for asteroids that may hit the earth. This could be the only natural disaster that we can actually do something about in advance, unlike earthquakes, hurricanes and floods. The presentation underscored the importance of on-going efforts by the lighting community to minimize unwanted light trespass and glare.

Along came the *Poster Session* were white papers or interesting demonstration projects were focusing on:

- Lighting Controls
- Lighting Calculations
- Daylight Modelling
- LED
- Daylighting and Human Factors
- Lamp Performance
- Vision
- Daylight Photometry.

Other notable seminars of the day were:

- "*Transformation Technology - Exterior Lighting and Controls Leveraging LED Technology to Create Communicative Exterior Environments*" (Panel led by Mark Roush, Acuity Brands Lighting) talking about how dynamic color LED technologies may transform exterior space.
- "*Creating Imaginative and Practical Public Lighting Strategies*" by reputable lighting designer Leni Schwendinger) reviewed the role that lighting atmospheres play in the quality of our experience of civic space after dark and how lighting practitioners can assists municipalities in bringing visual coherence to night-time environments.
- "An Overview of Energy Legislation and Regulations Affecting the Lighting Community"(by the always dynamical Larry Spielvogel) a highly entertaining and clever (almost) political debate about energy codes, regulations and common lighting sense.

The last General Session of the conference was given by Randy Moorhead, VP, Government Affairs, of Philips Electronics North America Corporation: "*How and Why Politics Affects the Lighting Business and Lighting Consumers*". With his long Washington DC political experience he offered a rare, first-hand glimpse into the US legislative process with regard to the Energy Independence and Security Act of 2007. The take-away from his presentation: those who are involved make the rules, so if you want to affect legislation related to lighting, get engaged and involved.

Finally, IES Awards were presented at the closing IES Gala Dinner, presided over by Dr. Ronald Gibbons, President of the IES and Fred Oberkircher, President-Elect. Guest speaker Josh Dorfman, author of The Lazy Environmentalist, gave a provocative talk on how self-interest and convenience, not guilt and preaching, will ultimately drive consumer acceptance of green products and turn the average American into an environmentalist.

This year the awardees were:

- Taylor Technical Tallent Award - for the LEUKOS paper "Energy Saving Lighting Control Systems for Open – Plan Offices: A Field Study" Anca Galasiu, Guy Newsham, Cristian Suvagau and Dan Sander.
- Distinguished Service Award: Martyn Timmings, Past President IESNA
- Louis B. Marks Award: Pamela Horner, Past President IESNA

Next Conference

The next Annual Conference will be hold in sleepless Seattle, Washigton, in November 15-17, 2009. If you want to participate or find more about the upcoming IES events you by visiting the IESNA site at www.iesna.org.

Dr. Cristian SUVĂGĂU
P.Eng.
LC, CEM, MIES, MCIE
BC Hydro, Customer Care & Power Smart
Suite 900, 4555 Kingsway, Burnaby, BC, V5H 4T8, Canada
Tel.: 604-453-6478
Fax: 604-453-6286
cristian.suvagau@bchydro.com

Dr. Cristian ŞUVĂGĂU, P.Eng., LC, has been practicing and teaching architectural lighting design and energy efficiency in Europe and North America for over 20 years. A lighting and energy management senior engineer with BC Hydro since 1998, he focuses on lighting Demand Side Management programs and projects in British Columbia. He is also President of the BC chapter of IESNA and holds a Ph.D. in lighting from the Technical University of Construction in Bucharest, Romania.

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