SOLAR ENERGY AND BUILDING PHYSICS LABORATORY

LABORATOIRE D'ENERGIE SOLAIRE ET DE PHYSIQUE DU BÂTIMENT

LESO-PB

Activity Report 2014

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Energy Efficiency and Renewables in the Built Environment

Solar Energy and Building Physics Laboratory (LESO-PB)
Swiss Federal Institute of Technology Lausanne (EPFL)
School of Architecture, Civil and Environmental Engineering (ENAC)
Civil Engineering Institute (IIC)

EPFL – ENAC – LESO-PB
Bâtiment LE
Station 18
CH-1015 Lausanne
Switzerland

Phone: +41 21 693 4545
Fax: +41 21 693 2722
Email: leso-pb@epfl.ch

http://leso.epfl.ch

EPFL Solar Energy and Building Physics Laboratory (LESO-PB)

ACTIVITY REPORT 2014

The Solar Energy and Building Physics Laboratory (LESO-PB) works at the forefront of research and technological development in renewable energy, building science and urban physics. It is part of the Civil Engineering Institute (IIC) of the School of Architecture, Civil and Environmental Engineering (ENAC) of the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. Placed under the responsibility of Prof. Dr Jean-Louis Scartezzini and four group and project leaders, the laboratory counts about 40 scientists, engineers and technicians. This report presents the teaching, research and technology transfer for 2014.

LIST OF CONTENTS

RESEARCH HIGHLIGHTS

INTRODUCTION

The research activities of the Solar Energy and Building Physics Laboratory focus on the development and implementation of energy efficient and renewable energy technologies in the built environment. They are structured along the following priority axes:

- Integrated day and electric lighting
- Nanotechnology for solar energy conversion
- Urban systems simulation
- Complex urban systems
- Smart buildings / Smart cities
- Architectural integration of renewable energy

This report describes the activities of the lab in 2014.

Highlights 2014

- Official approval by the CTI Board of a proposal for a new Swiss Competence Center for Energy Research (SCCER) in the field of Future Energy Efficient Buildings and Districts (FEEB&D) and recruitment of seven new staff members for innovative research projects financed in this framework.
- Publication of four patents by the research group "Nanotechnology for Solar Energy Conversion" and major innovations in this domain, such as for example a black coating for solar thermal concentrators that considerably improves their life span.
- Involvement of researchers in the design of an energy efficient school campus in Dubai.

Further research activities are presented in the following pages.

Outreach

Promoting interdisciplinary dialog has always been an integral part of the Solar Energy and Building Physics Laboratory's program:

- Funded by and in collaboration with Velux-Stiftung Schweiz, Prof. Scartezzini organised in 2014 a transdisciplinary workshop with 20 selected international experts to detect hotspots in daylighting and solar technology. The fundamental reflexion and dialogue that took place on 11 September 2014 in Buchillon showed up many open issues and possible directions to take in future research.
- Prof. JL Scartezzini is Board Member and Work Package leader of the Swiss Competence Center for Energy Research in the field of Future Energy Efficient Buildings and Districts (SCCER FEEB&D). In this framework, he and the LESO-PB research team collaborate closely with researchers from several Swiss research institutions to rapidly find innovating solutions that will help Switzerland reach its ambitious "Energy Turnaround".
- At the end of 2014, LESO-PB launched a call for papers for the international scientific conference CISBAT 2015 to take place from 9 to 11 September 2015 under the heading "Future Buildings and Districts – Sustainability from Nano to Urban Scale". LESO-PB will host the conference for the 13th time in academic partnership with Cambridge University and MIT. CISBAT will also serve as a platform both for the Swiss Chapter of IBPSA as well as SCCER FEEB&D.

INTEGRATED DAY- AND ELECTRIC LIGHTING

Group leader: Prof. Jean-Louis Scartezzini
Senior researcher: Dr Jérôme Kämpf, Dr Bernard Paule (ESTIA SA)
PhD students: Apiparn Borisuit, Chantal Basurto, Yujie Wu

The Integrated Day and Electric Lighting research group works on advanced systems for optimal use of daylight in buildings with the aim to improve user comfort and health and reduce energy consumption.

The group has set up a sophisticated daylighting laboratory with, among other, a scanning sky simulator and an automated heliodon, which allow reproducing with very high precision all daylight conditions that exist around the world. Several anidolic (non-imaging) daylight systems have been developed and tested by the group. Furthermore, a bidirectional reflection and transmission goniophotometer based on digital imaging allows assessing the characteristics of complex fenestration systems. A photobiological laboratory completes the equipment.

Simulated daylighting distribution in an office room through a Laser Cut Panel (LCP) at noon, 3PM and 5PM on Spring equinox.

Published work relates to

- Circadian rhythms and impact of light in humans, visual comfort
- Daylighting computer design and analysis tools
- Integrated day- and electric lighting systems
- Bidirectional reflection and transmission goniophotometer
- Anidolic daylighting systems
- Experimental and ergonomical daylighting test modules
- High dynamic range vision sensors

2014 Activities

The PhD thesis of Chantal Basurto was successfully defended in 2014. It explores the potentiality of Complex Fenestration Systems (CFS) to improve the interior daylight distribution in buildings located at low latitudes while maintaining a satisfactory visual and thermal comfort for the occupants. The daylighting performance of two office buildings located in the central-north of México (Zacatecas 22° 783' N., 102° 583' W, Altitude: 2543m) was monitored for that purpose from 2011 to 2013. Illuminance and luminance were measured on critical periods (summer and winter solstices as well as spring equinox), in order to characterize the existing daylighting situation. The performance of several CFS (Laser Cut Panel, 3M Prismatic film, Light Louver™, Lumitop™) was assessed using computer simulations for clear sky conditions. Three main indicators were considered: i) the interior daylight distribution, ii) discomfort glare probabilities and iii) overheating risks. The impact of the CFS in the rooms were simulated using RADIANCE and Energy Plus together with BTDF data (Bidirectional Transmission Distribution Function) monitored using a bidirectional goniophotometer. The CFS contributed in an optimal way to the indoor lighting environment in each building without compromising the thermal and visual comfort of the occupants.

Current Projects

SCCER FEEB&D Self-Sufficient Lighting Systems – Efficient Integrated Day- and Electric Lighting Modelling

Funding: Swiss Commission for Technology and Innovation (CTI)

Duration: 2014-2016

The integration of advanced daylighting systems with high efficacy light sources (LEDs), energy efficient luminaries (based on non-imaging optics) and advanced controllers for HVAC and lighting systems (based on high dynamic range vision sensors) should allow reaching energy self-sufficiency for lighting systems. This task will develop advanced simulation tools for daylighting systems. It will include compression methods for simulating complex fenestration systems for which transmission properties are characterized using a Bidirectional Transmission Density Function (BTDF data) from a novel bidirectional goniophotometer. These improvements to simulation software can foster their dissemination among practitioners (lighting industry, energy consultants and architects).

IEA-SHC Task 50 Advanced lighting solutions for retrofitting buildings

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2013-2015

Lighting accounts for approx. 19% of the global electricity demand. Energy efficient lighting techniques including daylighting, electric lighting and control can contribute to significant reduction of the electricity consumption. IEA SHC Task 50 will be focused on non-residential buildings dealing with advanced lighting solutions for building retrofits.

MICRO3D – Innovative fenestration system combining seasonal thermal dynamics, daylighting, glare protection and transparency – Manufacturing of embedded 3D microstructures

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2013-2015

The innovative glazing system proposed in this project will combine several functions. Solar gains will be used during wintertime to reduce the heating demand; sunrays will be blocked during summertime to mitigate the cooling load and avoid glare. A judicious use of daylighting will reduce furthermore the electricity demand for lighting and improve the wellbeing of occupants.

Postdoctoral Fellowship in Daylighting & Perception

Funding: VELUX Foundation (Switzerland)

Duration: 2013-2015

This project aimed to strengthen the education and research activities in the fields of building science and chronobiology and initiated innovating activities in relation to psycho-physiological aspects of daylight with an emphasis on human response factors, such as the perception of three-dimensional spaces and luminous environment.

PhD theses published in this domain at LESO-PB

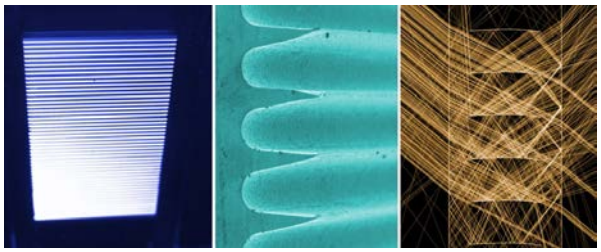
- *On advanced daylighting simulations and integrated performance assessment of complex fenestration systems for sunny climates*, Chantal Basurto, EPFL PhD Thesis #6425, 2014
- *The impact of light including non-image forming effects on visual comfort,* Apiparn Borisuit, EPFL PhD thesis #6007, 2013
- *Energetic, visual and non-visual aspects of office lighting,* Friedrich Linhart, EPFL PhD Thesis #4587, 2010
- *Comparing physical and virtual methods for daylight performance modelling including complex fenestration systems,* Anothaï Thanachareonkit, EPFL PhD Thesis #4130, 2008
- *Bayesian optimisation of visual comfort,* David Lindelof, EPFL PhD Thesis #3918, 2007
- *Innovative bidirectional video-goniophotometer for advanced fenestration systems,* Marilyne Andersen, EPFL PhD Thesis #2941, 2004

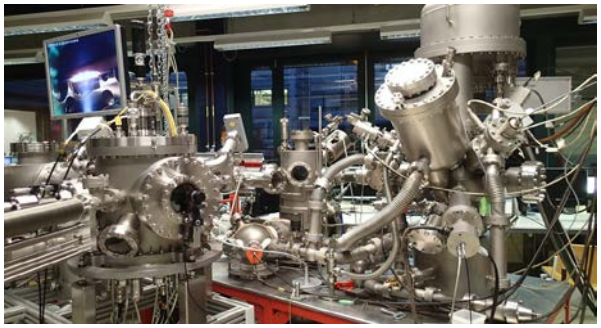
Awards in this domain

- Marilyne Andersen, EPFL PhD Thesis #2941 (2004), Chorafas Award 2005

NANOTECHNOLOGY FOR SOLAR ENERGY CONVERSION

Group leader: Dr Andreas Schüler
Postdoctoral researcher: Dr André Kostro, Marina Gonzalez Lazo
PhD students: Olivia Bouvard, Jing Gong; Visiting scholars: Anna Krammer, Sara Vanzo





Due to their fascinating optical and electronical properties, nanometric scaled structures play an important role in solar energy conversion. The research group "Nanotechnology for Solar Energy Conversions" develops and characterizes novel nanostructured materials for solar energy applications. The nanocomposite coatings consist typically of dielectrics, semiconductors or metal nano-crystals embedded in a dielectric matrix. Applications include antireflection coatings on solar collector glazing, coloured coatings with high solar transmittance for novel glazing of solar thermal façades, photoluminescent quantum dot solar concentrators for photo-voltaic energy conversion and optical selective absorber coatings for thermal solar collectors and thermoelectric power generation.

The research group carries out fundamental research on novel nanocomposite materials and thin film materials and promotes the introduction of novel solar technologies through upscaling of the corresponding innovative manufacturing processes.

Published work relates to

- Coloured thermal collectors and PV modules for solar facades and solar roofing
- Nanostructured low refractive index materials on solar collector glazing
- Quantum dot solar concentrators for building integrated photovoltaics
- Durable selective absorber coatings for solar thermal collectors and electricity generation by concentrated solar power (CSP)
- Thermochromic films for smart solar energy applications
- Optical Microstructures for advanced architectural glazing

2014 Activities

Promotion of patent applications in the fields of highly durable selective solar absorber coatings, colored solar glazing for photovoltaic modules/solar thermal collectors, novel microstructured glazing for daylighting.

Research highlights include:

- Deposition of electrochromic coatings for smart windows
- Detailed study on reduction of thermal loads by microstructured glazing
- Novel doping of thermochromic thin films for matching the transition temperature to the needs of overheating protection of solar thermal collectors
- Energy efficiency in public transport: novel coatings for better train windows
- Angular dependent optical and thermal properties of advanced architectural glazing: characterization of translucent photovoltaic modules based on dye-sensitized solar cells

Current Projects

Thermochromic coatings for overheating protection of solar thermal collectors – Temperature matching and triggering

Funding: Swiss Federal Office of Energy (SFOE)
Duration: 2012-2014

Overheating and the resulting stagnation of solar thermal collectors is a common problem even in central European latitudes. During stagnation high temperatures lead to water evaporation, glycol degradation, and stresses in the collector with increasing vapor pressure. A protection of solar thermal systems without any mechanical device (e.g. for shading or for pressure release) might be provided by thermochromic coatings which exhibit a change in optical properties at a critical temperature Tc. This project aims at adapting the transition temperature and improving the range of optical switching as well in thermal emittance as in solar absorptance of the system. The proposed approach is based on suitable doping of the coatings, advanced multilayer design, and a novel way of triggering the optical transition.

Energy efficiency of public transportation

Funding: SwissElectric Research (SER), Swiss Federal Office of Energy (SFOE), Federal Office of Transport (FOT)
Duration: 2012-2015

Recent studies have shown that the energy used for heating and cooling of trains and trolleybuses can be in the same order of magnitude than the energy used for traction. The project aims at understanding the reasons for these tremendous energy losses, and at making suggestions for improvement. Several trains are equipped with data acquisition systems for a detailed monitoring of the various consumers on board, as well as with sensors for characterizing the outdoor and indoor climatic conditions. Thermal models of the trains and trolleybuses allow quantifying the potential impact of measures for improving their energy efficiency. Within this project, the focus will be placed on improvement of the envelope of trains and trolleybuses.

SCCER FEEB&D Dynamic Glazing & Multi-Functional Building Envelopes

Funding: Swiss Commission of Technology and Innovation CTI
Duration: 2014-2016

Novel windows with dynamic solar gains will contribute to an optimal management of the energy and light fluxes in buildings. So far, the effective g-value of most windows installed today cannot be switched, shows only a relatively weak angular dependence and thus exhibits only very small variations between summer and winter. If the g-value could be varied, overheating in summer could be reduced while maintaining large solar gains in winter. This can be achieved following two main approaches, by novel glazing with angle-selective energetic transmission or by a novel generation of switchable "smart" windows. The variation of the g-value can be combined with improved daylighting and glare protection while maintaining a clear view.

PhD theses published in this domain at LESO-PB

- Microstructured glazing for daylighting, glare protection, seasonal thermal control and clear view, André Kostro, EPFL PhD Thesis #6465, 2015
- Switchable Selective Absorber Coatings for Overheating Protection of Solar Thermal Collectors, Antonio Paone, EPFL PhD Thesis #5878, 2013
- Développement et optimisation de revêtements nanostructurés pour capteurs solaires thermiques et modules photovoltaïques, Martin Joly, EPFL PhD Thesis #5541, 2012

Awards in this field

Solar Energy Journal Best Paper Award 2012-2013 for the publication « Novel black selective coating for tubular solar absorbers based on a sol-gel method", Martin Joly *et al.*

URBAN SYSTEMS SIMULATION

Group leader: Dr Jérôme Kämpf
Postdoctoral researcher: Dr Dasaraden Mauree
PhD students: Govinda Upadhyay, Silvia Coccolo, Amarasinghage T. Dasun Perera
Visiting scholar: Antonio Pereira

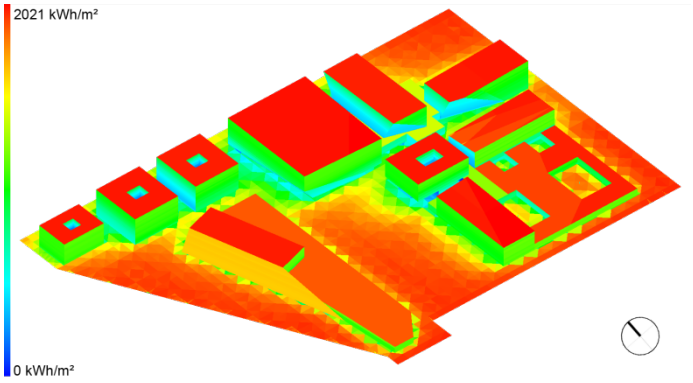


Figure 1: Analysis of the annual solar irradiation on the Swiss International School Campus in Dubai (by S. Coccolo)

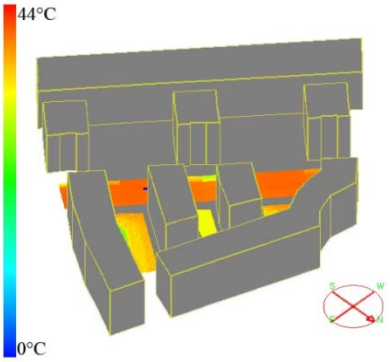


Figure 2: A snapshot of the road surface temperature of Rue des Maraîchers in Geneva (by G. Upadhyay)

The principal mission of the group is to better understand how to improve the environmental sustainability of urban systems through the simulation of physical processes. Urban systems, generally large groups of buildings, are simulated together to account for the numerous interactions happening between the elementary building objects. These interactions can be radiative (with the exchange of shortwave and longwave contributions), conductive and convective (through the exchange of heat) but also through an exchange of matter (gas, hot or cold liquid) or electricity. Due to the extensive nature of the simulation objects, simplified modelling is used wherever possible to maintain a balance between accuracy and computing time. A reasonable simulation time gives rise to enhance the urban performance by the use of optimization algorithms (such as Evolutionary Algorithms).

Published work relates to

- Simulation of energy and matter resource flows in urban systems
- Urban heat island effect, including urban microclimatology
- Outdoor environmental comfort
- Stochastic modelling of human activities
- Sustainable urban design

2014 Activities

The research team was set-up on September 1st 2014 and replaces the former group named “Computer Modelling of Complex Systems”. A participation to the Swiss Competence Center for Energy Research (SCCER) in Future Energy Efficient Buildings and Districts (FEEB&D) was initiated through activities within the WP3 “Urban Decentralized Energy Systems” more precisely relating to the Module 3.2: Modelling and Simulation. Last year saw also the completion of the MEU project “Innovative Planning and Management Instruments of Urban Energy Systems” initiated by the EPFL Energy Centre and supported by four Swiss municipalities.

Current Projects

SCCER FEEB&D Urban Decentralized Energy Systems - Modelling and Simulation

Funding: *Commission for Technology and Innovation (CTI)*
Duration: *2014-2016*

The goal of decentralized energy systems with respect to the Energy Strategy 2050 is to achieve an effective use of local renewables and waste heat resources as well as efficient energy management including supply, distribution, storage, and consumption within districts of various sizes. The aim of considering a district instead of individual buildings is to increase the overall efficiency performance by achieving synergies between the differing behaviours of individual buildings and to reduce the overall investment costs. In this way a district can either have a net zero energy balance, or provide services to the wider region or to other decentralised energy systems (DES), respectively. The general goal of the studied module is on the one hand to develop DES and on the other hand to assess the advantages and disadvantages of DES compared to existing supply systems and central generation strategies through simulations. The holistic integration of such DES into the overall Swiss energy system is expected to reduce the total final energy demand and CO_2 emissions for Switzerland in accordance to 2035 and 2050 objectives.

IDEAS4cities – Integration of Decentralized Energy Adaptive Systems for cities

Funding: *Competence Center Energy and Mobility (CCEM)*
Duration: *2013-2016*

This project is centred on introducing the concepts of the urban energy hub, a facility that manages the energy flows within a city quarter or community, and the urban microgrid, a small-scale urban energy system integrating electrical and thermal local generation, loads and storage having the possibility to locally interact with these devices to achieve optimal control functionalities. The integration of energy hubs and microgrids in urban energy systems would lead to new system configuration where the pros and cons of the different energy carriers are better utilized as compared with today's urban energy system.

UMEM - Sustainable cities and urban energy systems of the future: Urban Multiscale Energy Modelling

Funding: *Competence Center Energy and Mobility (CCEM)*
Duration: *2012-2015*

In this project the focus is on finding sustainable solutions for achieving energy targets on city quarter level, rather than at building scale. The urban energy retrofit scenarios profit from the enlarged economical potential of energy efficiency, energy production and energy storage by a cluster of buildings which are interconnected in a city neighbourhood and profiting from the urban energy infrastructure. The new urban energy retrofit scenarios have to take into account the impact of the urban heat island effect and the changing urban microclimate (e.g. heat waves) due to climatic change. The new concepts have to guarantee sustainable living conditions, comfort and health for their inhabitants in the urban and building environment.

The developed urban energy simulation framework will help collectivities, urban planners and stakeholders to evaluate the environmental impact of cities in a changing climate and to provide a basis for testing new urban energy retrofit scenarios.

PhD theses published in this domain at LESO-PB

- *A framework to model and simulate the disaggregated energy flows supplying buildings in urban areas,* Diane Perez, EPFL thesis #6102, 2014
- *Probabilistic Bottom-Up Modelling of Occupancy and Activities to Predict Electricity Demand in Residential Buildings,* Urs Wilke, EPFL thesis #5673, 2013
- *On the unification of behavioural modelling, human comfort and energy simulation in buildings,* Frédéric Haldi, EPFL thesis #4587, 2010
- *Optimisation of Urban Form by the Evaluation of the Solar Potential,* Marylène Montavon, EPFL thesis #4657, 2010
- *On the modelling and optimisation of urban energy fluxes,* Jérôme Kämpf, EPFL thesis #4548, 2009
- *Multiscale modelling of urban climate,* Adil Rasheed, EPFL thesis #4531, 2009

COMPLEX URBAN SYSTEMS

Project leader: Dr Nahid Mohajeri
PhD student: Dan Assouline

In order to model the dynamics of built environment and understand their sustainable development, as well as their interactions with infrastructure networks and urban ecosystem we need a comprehensive theoretical understanding of cities as complex systems. One principal aim of this research is to use the complex system theories and methods from physics and engineering in order to reduce the negative environmental impact of the cities through the following approaches: (1) developing energy-efficient urban forms, (2) modelling and identifying renewable energy resources from regional to city scale, (2) improving our understanding of urban metabolism, (3) improving the environmental impacts of urban infrastructure networks and mobility patterns through data-driven approaches and real-time data (4) assessing and minimising the ecological footprints of cities.

Published work relates to

- Statistical modelling of the built environment
- Physics of urban form
- GIS (Geographic Information Systems) and spatial data analysis
- Transportation networks
- Sustainable urban planning

The Complex Urban Systems Group has been expanded to the following 4 main research themes: (1) Urban metabolism, (2) Energy-Efficient Urban Forms, (3) Size, Scaling Relations and Urban Metabolism, (4) Urban Data and Renewable Energy Potentials.

2014 Activities

The Swiss Competence Center for Energy Research (SCCER) Future Energy Efficient Buildings and Districts (FEEB&D) was initiated in June 2014. Within the Work package 3 “Urban Decentralised Energy Systems” the following task was started in October in 2014: “Data Mining: Geo-Dependent Energy Supply in Relation to Urban Form”, a new collaboration between EPFL-LESO, ETHZ, Empa, Geneva University and HSLU.

Current Projects

SCCER FEEB&D Urban Decentralized Energy Systems - Geo-dependent energy supply in relation to urban form

Funding: *Swiss Commission for Technology and Innovation (CTI)*

Duration: *2014-2016*

Decentralized systems will require novel types of geo-spatial databases, new methods of urban pattern analysis, and new technology and modelling approaches. The aim is to develop geo-dependent energy-related tools, based on Geographic Information Systems (GIS), together with remote sensing and geo-statistics, as well as machine learning so as to identify the potential renewable energy resources (wind, solar, biomass, geothermal heat, and waste heat) and to model their spatio-temporal distributions from large to neighbourhood scale across Switzerland.

SMART BUILDINGS – SMART CITIES

Group leader: Prof. Jean-Louis Scartezzini
Postdoctoral researcher: Dr Vahid Nik
Senior adviser: Dr Nicolas Morel
PhD student: Nikos Zarkadis, Ali Motamed. Visiting scholar: Shaoqing Gou

Self-adaptive control system

Bio-mimetic control of building services (heating, cooling, ventilation, blinds, electric lighting) can simultaneously optimize energy use and indoor comfort (thermal, visual, air quality) through the use of advanced computer methodologies such as artificial neural networks, genetic algorithms, fuzzy logic, or advanced optimization algorithms. Our laboratory investigates control algorithms allowing at the same time:

- an optimal response to changing conditions (weather, building occupancy, lighting levels, thermal characteristics)
- a progressive adaptation to (possibly changing) building characteristics and to user preferences.

Research projects normally include two steps:

- development of innovative control algorithms and evaluation with computer simulation tools
- testing under real situations and evaluation of energy and comfort performances as well as acceptance by users.

Most bio-mimetic controllers are evaluated in the LESO building, which represents a powerful tool for our group.

Published work relates to

- Self-adaptive integrated building control systems
- Blind and electric lighting control algorithms
- Advanced control of electrochromic glazing
- Genetic algorithms for adaptation to user preferences
- Fuzzy logic for implementing building physics expert knowledge into the control algorithms
- Artificial neural networks for adaptive models and various control systems (for instance thermal model of the building or weather evolution).

2014 Activities

The activities were focused on the project Green-Mod supported by the Hasler Foundation; it aims elaborating of an information system able to optimize energy consumption in buildings while preserving human comfort. The main innovation of the project is the use of state-based stochastic modelling applied to temporal signals acquired from heterogeneous sources, such as distributed sensors as well as user wishes and preferences.

Current Projects in Biomimetic Building Control

SCCER FEEB&D Self-Sufficient Lighting Systems – High Dynamic Range Vision Controller

Funding: Swiss Commission for Technology and Innovation (CTI)

Duration: 2014-2016

The integration of advanced daylighting systems with high efficacy light sources (LEDs), energy efficient luminaries (based on non-imaging optics) and advanced controllers for HVAC and lighting systems (based on high dynamic range vision sensors) should allow reaching energy self-sufficiency for lighting systems. The main objective is to implement a high dynamic range vision sensor within daylighting and users presence responsive building controllers. The novel device will be set-up in an office room benefitting from integrated day- and electric lighting systems; its energy performance and users acceptance will be monitored "on-site" in a working environment. A technology transfer to the market and the real world will be set-up with industrial partners.

Green-Mod: Toward Reliable Stochastic Data-Driven Models Applied to the Energy Savings in Buildings

Funding: Hasler Foundation

Duration: 2012-2015

The Green-Mod project aims to produce a Building Information Management System (BIMS) able to minimize the energy demand in buildings while preserving human comfort. The main innovation of this BIMS for HVAC, sunshadings and electric lighting will be the use of state-based stochastic modelling applied to temporal signals acquired from heterogeneous sources.

PhD theses published in this domain at LESO-PB

- *On the adaptation of building controls to the envelope and the occupants*, David Daum, EPFL PhD Thesis #4935 (2010)
- *Bayesian optimisation of visual comfort,* David Lindelöf, EPFL PhD Thesis #3918 (2007)
- *Simulating occupant presence and behaviour in buildings, Jessen Page,* EPFL PhD Thesis #3900 (2007)
- *Using Genetic Algorithms to Take into Account User Wishes in an Advanced Building Control System,* Antoine Guillemin, EPFL PhD Thesis #2778 (2003)

Awards in this domain

- Antoine Guillemin, EPFL PhD Thesis #2778 (2003), Chorafas Award 2004

BUILDING INTEGRATION OF RENEWABLE ENERGIES

Project leader: Dr Maria Cristina Munari Probst
Senior adviser: MSc. Christian Roecker (cap77 sàrl)
PhD student: Pietro Florio

PV system on the roof of Aula Pierluigi Nervi, Vatican City.

Many building surfaces are ideally suited for the use of solar energy, but high costs, technical and aesthetic considerations have long kept building owners and architects from using even a small part of this potential. The group "Renewables Integration into the Built Environment" addresses the key issue of optimal architectural integration of photovoltaic and thermal solar systems at the building and urban scales. The activities are structured around the three main axes of research hereafter.

Published work relates to

- Development of new and comprehensive urban and building strategies, to maximise solar energy use while ensuring an appropriate architectural quality to the local contexts. (LESO-QSV, Cross-mapping solar irradiation maps with criticity maps)
- Development of new adapted solar products, conceived for building integration
- Development and diffusion of architects' and solar product manufacturers' knowledge on solar integration issues / available solar technologies / integration criteria

2014 Activities

One key activity of the group was the implementation at urban scale of the criteria defining the quality of architectural integration established previously. This included the further development of the LESO-QSV method for communities, to help assess the acceptability of solar installations in the urban context.

The elaboration of a new software tool (LESO-QSV GRID) has been initiated to facilitate the implementation of the method by its intended users. An important activity consisted in the lead of the working group on "Processes, methods and tools" within the IEA SHC Task 51 "Solar Energy in Urban Planning". In this context, the development of an innovative approach consisting in combining information of solar potential with urban sensitivity and system visibility has been proposed and initiated (cross-mapping).

A major contribution was delivered in the preparation of the future EPFL participation to the SOLAR DECATHLON competition (project structure, organisation and lead of summer workshop, site visits). Preparatory work has been conducted to ascertain the relevance and feasibility of a new PhD Thesis on urban criticity concept.

Current Projects

IEA SHC Task 51 Solar Energy in Urban Planning

Funding: Swiss Federal Office of Energy (SFOE)
Duration 2013 – 2016

The main objective of Task 51 is to provide support to urban planners, authorities and architects to propose urban areas and eventually whole cities with architecturally integrated solar energy solutions (active and passive), contributing to cities with a large fraction of renewable energy supply. This includes the objective to develop processes, methods and tools capable of assisting cities in developing long term urban energy strategies.

LESO QSV method

Funding: Swiss Federal Office of Energy (SFOE)
Duration 2011-2016

The goal of the project is to propose a method to help improving the architectural quality of the active solar installation projects. The method offers a way to assess the quality of a proposed integration, and helps define required quality levels, function of site sensitivity and system visibility. Extension of the concept of criticity into urban planning, in combination with irradiation mapping, was additionally included in the method.

Task 41 DA2 Manual update and multi-translations

Funding: Swiss Federal Office of Energy (SFOE)
Duration 2014-2015

One of the main results of SHC Task 41-Solar Energy in Architecture- is the manual for Architects "Solar Energy Systems in Architecture – integration criteria and guidelines". Unfortunately this manual is available in English only, which limits its use in Switzerland. Therefore this project proposes a major update and the translation and publication in French and Italian, with a later option for German.

Recent publications in this domain

Munari Probst MC, Roecker C, Innovative solar products for architectural integration: a joint Task 41 and Task 51 IEA website, in proceedings Eurosun 2014, Chambéry (F), September 2014.

Solar Energy and Architecture – Designing Solar Thermal Systems for Architectural Integration, Maria Cristina Munari Probst, Christian Roecker Editors, Solar Heating & Cooling Programme, International Energy Agency, p.1-104, November 2013.

Solar Energy Systems in Architecture – Integration criteria and guidelines, Maria Cristina Munari Probst, Ch. Roecker Editors, IEA SHC Task 41 Report T.41.A.2 SHC, Solar Heating & Cooling Programme, International Energy Agency, p.1-228, September 2012.

Architectural integration and design of solar thermal systems, Maria Cristina Munari Probst, Ch. Roecker, PPUR Routledge, 2011, ISBN 978-0-415-66791-3

PhD theses published in this domain at LESO-PB

- *Architectural integration and design of solar thermal systems,* Maria Cristina Munari Probst, EPFL PhD Thesis #4258 (2008)

EDUCATION AND TEACHING

COURSES AND STUDENT FIGURES 2013/2014

Bachelor/Master Programmes

Course title	Lecturer	Students	Students numbers
Building Physics I	Prof. J.-L. Scartezzini	AR BA1	305
Building Physics II	Dr A. Schueler	AR BA2	295
Building Physics III	Dr J. Kaempf	AR BA3	170
Building Physics IV	Dr J. Kaempf	AR BA4	160
Building Physics V	Prof. J.-L. Scartezzini	AR BA5	164
Building Physics VI	Prof. J.-L. Scartezzini	AR BA6	158
Quartiers, infrastructures et aménagement durable	Prof. J.-L. Scartezzini, Prof. A.-G. Dumont, Prof. R. Schlaepfer, Dr P. Tosolini, Dr. Ch. Ludwig, MSc D. Hofstetter, Dr N. Mohajeri,	AR/GC/SIE BA (ENAC Learning Units)	28
Architecture & Energie solaire: SOLAR DECATHLON 2016	MSc C. Roecker Dr M.C. Munari Probst, Dr P. Tosolini	AR/GC BA (ENAC Learning Units)	37
Diagnostic en ENAC, démarche et outils de mesure	Dr M. Bensimon MSc O. Burdet MSc. M. Deront M. Kradolfer Dr N. Morel	AR/GC/SIE BA (ENAC Weeks)	28

Outside Teaching

Title	Institution	Year
Dr M.C. Munari Probst , lecturer course "Glass Structures and Facades", GC Master 2014-2015	EPFL GC Master	2014-2015
Dr M.C. Munari Probst, lecturer course "Energie et Développement durable dans l'environnement bâti"	HES-SO MAS	2014-2015
Dr M.C. Munari Probst, lecturer course "Développement durable"	EIA Fribourg	2014-2015

ADVISING

PhD 2014

Title	Name	Advisers	End	# EPFL-Thesis
Modelling and assessment of urban energy systems	A.T.D. Perera	Prof. J.-L. Scartezzini Dr V. Nik (Lund Univ.)	2018	N/A
Geo-dependent energy supply in relation to urban form	D. Assouline	Prof. J.-L. Scartezzini Dr N. Mohajeri	2018	N/A
Novel materials for switchable windows	O. Bouvard	Prof. J.-L. Scartezzini Dr A. Schueler	2018	N/A
Integrated Daylighting and Artificial Lighting Control based on High Dynamic Range Vision Sensors	A. Motamed	Prof. J.-L. Scartezzini	2018	N/A
Architectural integration criticality and visibility evaluation of solar energy applications in urban sites	P. Florio	Prof. J.-L. Scartezzini Dr M.C. Munari Probst	2018	N/A
Bioclimatic Design of Sustainable Campuses using Advanced Optimisation Methods	S. Coccolo	Prof. J.-L. Scartezzini Dr J. Kämpf	2017	N/A
Urban Multiscale Energy Modelling	G. Upadhyay	Prof. J.-L. Scartezzini Dr J. Kämpf	2016	N/A
Building integrated PV – visual assessment with saliency map method	R. Xu	Prof. J.-L. Scartezzini Prof. S. Wittkopf (NUS/HSLU Luzern)	2016	N/A
Novel models towards predictive control of advanced building systems and occupant comfort in buildings	N. Zarkadis	Prof. J.-L. Scartezzini Dr N. Morel	2015	6440
Reactively Sputtered Nano-structured Multilayer Coatings on Architectural Glazing for Active Solar Energy Facades	S. Mertin	Prof. J.-L. Scartezzini Prof. P. Muralt	2015	6485
Microstructured glazing for daylighting, glare protection, seasonal thermal control and clear view	A. Kostro	Prof. J.-L. Scartezzini Dr A. Schueler	2015	6465
On advanced daylighting simulations and integrated performance assessment of complex fenestration systems for sunny climates	C. Basurto Davila	Prof. J.-L. Scartezzini Dr J. Kaempf	2014	6425
A framework to model and simulate the disaggregated energy flows supplying buildings in urban areas	D. Perez	Prof. J.-L. Scartezzini Dr J. Kaempf	2014	6102

PhD External Committees

Involvement	Name	University	Adviser	Completion Year
PhD thesis committee	Viitanen, Janne	Aalto University	Prof. J.-L. Scartezzini	2014
Co-supervisors	Gou, Shaoqing	Tongji University, China	Prof. J.-L. Scartezzini Dr V. Nik	2015

Master Theses 2014

Title	Student/Institution	Year	Programme
Planification des concepts énergétiques dans le cadre du développement immobilier d'un quartier durable appliqué à une entreprise totale	Amchikak, Marwan (EPFL)	2014	MSc Génie Civil
Les Bouquetins, une nouvelle cabane sur la haute route Chamonix-Zermatt (F, CH)	Hasler, Stéphanie Aline (EPFL)	2014	MSc Architecture
Les Bouquetins, une nouvelle cabane sur la haute route Chamonix-Zermatt (F, CH)	Pisanova, Barbora (EPFL)	2014	MSc Architecture
Diagnostic et Expertise Energétique d'un bâtiment administratif « Minergie-ECO » construit en paille à Lausanne	Chaussinand, Adrien (INSA, Strasbourg/France)	2014	M. Eng. Génie Climatique
Effect of doping on VO2 thermochromic thin films deposited by magnetron sputtering	Krammer, Anna (INP, Grenoble /France)	2014	MSc FAME
Complex Geometry Facade Design and Daylighting Analysis	Shafeiminabad, Ayda (EPFL)	2014	MSc MES
Novel glazing technology for building envelopes: evaluation of the energy performance and its influence on the thermal control	Vanzo, Sara (Politecnico di Torino/Italy)	2014	M. Eng. Energy
Un « Energy Hub » sur le campus de l'EPFL : besoins et approvisionnement en chaleur	Walter, Emmanuel (EPFL)	2014	MSc MES

Students from foreign universities, interns and grant holders

Research	Student/Institution	Programme
Climate responsive strategies of traditional Chinese dwellings	S. Gou, Tongji University, China	Visiting scholar
Nanotechnology for solar energy conversion	R. Kukreja, IIT Bombay	Visiting scholar
IT	M. Leuret	Apprentice
Urban systems simulation	S. Seelig	Visiting scholar
IT	P. Roulin	Intern (Maturity)
IT	A. Stoll	Apprentice
IT	M. Winter	Apprentice
IT	R. Zweifel	Apprentice
Users probabilistic Modelling	U. Wilke	Programme BNF

Semester Projects 2014

Title	Student/Institution	Year	Programme
Energy use in Swiss building stock with changing climate	I. Dagsland Halderaker (NTNU Norway)	2014	-
Ecobilan comparatif ventilation double-flux / ventilation hybride	Favre, Adrien (EPFL)	2014	SIE-MA2
Built Form and Energy Efficiency (case study: Fribourg)	Gantet, Max Lucas (EPFL)	2014	EME-MA1
Ecobilan comparatif ventilation double-flux / ventilation hybride	Martinasso, Mélanie (EPFL)	2014	SIE-MA2
Energy and Urban Form	Minnig, Morgane (EPFL)	2014	EME-MA1

PUBLICATIONS 2014

REFEREED SCIENTIFIC JOURNALS

Zarkadis, Nikos; Ridi, Antonio; Morel, Nicolas; A Multi-sensor Office-building Database for Experimental Validation and Advanced Control Algorithm Development, in *Procedia Computer Science*, vol. 32, p.1003-1009, 2014.

Roulet, Claude-Alain; Concevoir un bâtiment confortable et sain, in *Les Cahiers de l'IAU*, num. 170/171, p.147-, 2014.

Gudmundsson, Agust; Lecoeur, Nora; Mohajeri, Nahid; Thordarson, Thorvaldur; Dike emplacement at Bardarbunga, Iceland, induces unusual stress changes, caldera deformation, and earthquakes, in *Bulletin of Volcanology*, vol. 76, num. 10, 2014.

Gou, Shaoqing; Li, Zhengrong; Zhao, Qun; Nik, Vahid; Scartezzini, Jean-Louis; Climate Responsive Strategies of Traditional Dwellings located in an Ancient Village in Hot Summer and Cold Winter Region of China, in *Building and Environment* Vol. 86, p. 151-165, 2014.

Borisuit, Apiparn; Linhart, Friedrich; Scartezzini, Jean-Louis; Münch, Mirjam; Effects of realistic office daylighting and electric lighting conditions on visual comfort, alertness and mood, in *Lighting Research and Technology*, vol. 47, issue 2, p. 192-209, 2014.

Paone, Antonio; Geiger, Mario; Sanjines, Rosendo; Schueler, Andreas; Thermal solar collector with VO2 absorber coating and V1-xWxO2 thermochromic glazing – Temperature matching and triggering, in *Solar Energy*, vol. 110, p.151–159, 2014.

Cajochen, Christian; Altanay-Ekici, Songuel; Muench, Mirjam; Frey, Sylvia; Knoblauch, Vera; Wirz-Justice, Anna; Pollinator-induced twisting of flowers sidesteps floral architecture constraints Reply, in *Current Biology*, vol. 24, num. 17, p.R795-R795, 2014.

Mohajeri, Nahid; Gudmundsson, Agust; Analyzing Variation in Street Patterns: Implications for Urban Planning, in *Journal of Architectural and Planning Research*, vol. 31, num. 2, p.112-127, 2014.

Mohajeri, Nahid; Gudmundsson, Agust; The Evolution and Complexity of Urban Street Networks, in *Geographical Analysis*, vol. 46, num. 4, p.1-23, 2014.

Münch, Mirjam; Plomp, Gijs; Thunell, Evelina; Kawasaki, A.; Scartezzini, J. L.; Herzog, Michael H.; Different colors of light lead to different adaptation and activation as determined by high-density EEG, in *NeuroImage*, Vol. 201, p. 547-554, 2014.

Mohajeri, Nahid; Gudmundsson, Agust; Quantifying the Differences in Geometry and Size Distributions of Buildings Within Cities, in *Nexus Network Journal: architecture and mathematics*, vol. 16, num. 2, 2014.

Mohajeri, Nahid; Poursistani, Pooneh; Poursistani, Poopak; Gudmundsson, Agust; Quantitative analysis of structural changes during rapid urban growth, in *Journal of Urban Planning and Development*, p.05014014-1, 05014014-10, 2014.

Kawasaki, Aki; Collomb, Sylvie; Leon, Lorette; Muench, Mirjam; Pupil responses derived from outer and inner retinal photoreception are normal in patients with hereditary optic neuropathy, in *Experimental Eye Research*, vol. 120, p.161-166, 2014.

Mertin, Stefan; Hody-Le Caër, Virginie; Joly, Martin; Mack, Iris; Oelhafen, Peter; Scartezzini, Jean-Louis; Schueler, Andreas; Reactively sputtered coatings on architectural glazing for coloured active solar thermal façades, in *Energy and Buildings*, vol. 68, p.764-770, 2014.

Mohajeri, Nahid; Gudmundsson, Agust; Street networks in relation to landforms: Implications for fast-growing cities, in *Journal of Geographical Sciences*, vol. 24, num. 2, p.363-381, 2014.

CONFERENCE PROCEEDINGS

Mohajeri, Nahid; Gudmundsson, Agust; Scartezzini, Jean Louis; Analysing and modelling the growth and efficiency of urban transportation infrastructures, *Symposium on Applied Urban Modelling - Planning Urban Infrastructure*, University of Cambridge, UK, April 1-3. 2014.

Mohajeri, Nahid; Gudmundsson, Agust; Kämpf, Jérôme; Scartezzini, Jean-Louis; Editor(s): Tourre, Vincent ; Besuievsky, Gonzalo ; Visualizing street orientation and solar radiation in relation to complex topography, *Workshop on Urban Data Modelling and Visualisation*, Strasburg, France., April 6, 2014.

Upadhyay, Govinda; Kämpf, Jérôme Henri; Scartezzini, Jean-Louis; Editor(s): Tourre, Vincent ; Besuievsky, Gonzalo ; Ground temperature modelling: The case study of Rue des Maraîchers in Geneva, *Eurographics Workshop on Urban Data Modelling and Visualisation*, Strasburg, France., April 6, 2014.

Vitale, Wolfgang Amadeus; Paone, Antonio; Fernández-Bolaños, Montserrat; Bazigos, Antonios; Grabinski, Wladek; Schüler, Andreas; Ionescu, Adrian; Steep slope VO2 switches for wide-band (DC-40 GHz) reconfigurable electronics, *72nd Device Research Conference*, Santa Barbara, California, USA, June 22-25, 2014.

Pascual Agullo, Carlos; de Castro San Roman, Julia; Kostro, André Gabriel; Schueler, Andreas; Light diffusion in GFRP laminates for building construction, CICE2014, *The 7th International Conference on FRP Composites in Civil Engineering*, Vancouver, Canada, August 20-22, 2014.

Kostro, André Gabriel; Schueler, Andreas; CFSPro: Ray Tracing for Profile Optimisation of Complex Fenestration Systems using mixed dimensionality approach, *Status-Seminar „Forschen für den Bau im Kontext von Energie und Umwelt“*, ETH, Zurich, Switzerland, September 4-5,2014, 2014.

Munari Probst, Maria Cristina; Roecker, Christian; Innovative solar products for architectural integration: a joint Task 41 and Task 51 IEA website, *Eurosun 2014*, Aix-les-Bains, France, 16-19 September 2014.

Vitale, Wolfgang Amadeus; Paone, Antonio; Moldovan, Clara Fausta; Schueler, Andreas; Ionescu, Mihai Adrian; Growth optimization of vanadium dioxide films on SiO2/Si substrates, *40th Micro and Nano Engineering, Lausanne*, Switzerland, September 22-26, 2014.

Coccolo, Silvia; Kämpf, Jérôme Henri; Vigliotti, Franco; Scartezzini, Jean-Louis; Improving outdoor comfort and energy consumption of a city district in a desert area, *The 5 th International Conference on Drylands, Deserts and Desertification Healthy Lands - Healthy People*, Blaustein Institutes for Desert Research Sede Boqer Campus of Ben-Gurion University, Israel, November 17-20, 2014.

PHD THESES

A framework to model and simulate the disaggregated energy flows supplying buildings in urban areas, Diane Perez, EPFL thesis #6102, 2014

On advanced daylighting simulations and integrated performance assessment of complex fenestration systems for sunny climates, Chantal Basurto, EPFL PhD Thesis #6425, 2014

OTHER PUBLICATIONS, REVIEWS, PATENTS, REPORTS

Schueler, Andreas Joly, Martin, Patent WO 2014045241 A2 Method for hardening a coating of a solar collector element, and elements produced by means of said method

Schueler, Andreas Le Caër, Virginie, Patent WO 2014045141 A2 Laminated glazing with coloured reflection and high solar transmittance suitable for solar energy systems

Schueler, Andreas Le Caër, Virginie Joly, Martin, Patent WO 2014045144 A1 Interference filter with angular independent orange colour of reflection and high solar transmittance, suitable for roof-integration of solar energy systems

Schueler, Andreas Kostro, André Gabriel, Patent WO 2014024146 A1 Glazing with embedded microstructures for daylighting and seasonal thermal control

INVITED PRESENTATIONS AND OTHER EVENTS

Scartezzini, J.-L. "Building Technology", Invited Lecturer, Ben Gurion University – EPFL workshop, 2-3 Feb. 2014.

Scartezzini, J.-L. "La Longue Marche du Soleil", Keynote Speaker, 40th anniversary Swiss Solar Energy Society, Bern 17th May 2014

Scartezzini, J.-L. "Green Lighting: a route toward Circadian Lighting", Keynote Speaker, Swiss Photonics Large Area Solid State Lighting Workshop, Basel, 30th October 2014

Scartezzini, J.-L. SCCER Future Energy Efficient Buildings and Districts, WP2 Building Energy Management, Keynote Speaker. Site visit by CTI, 14th November 2014 Dübendorf.

Schueler, A. "Solar Energy", Invited Lecturer – EPFL Workshop 2-3 February 2014

Coccolo S., Il progetto bioclimatico urbano e la realtà montana. Spunti e riflessioni, Invited Lecturer, Politecnico di Torino, 12th March 2013 (Italy)

Schueler, A. "Nanocomposite optical coatings for solar energy conversion", Keynote Speaker, Basler Forschungs Forum BASF, Basel, Switzerland 26 March, 2014

Munari Probst M.C., "Intégration des systèmes solaires actifs : critères d'acceptabilité urbaine", PV-Tagung 2014, Keynote Speaker, Lausanne, April 2014

Mohajeri N., "Quantitative methods and visualisations techniques in urban studies (Spatial data Analysis), Invited lecturer, London School of Economics and Political Science, LES Cities, 6 May 2015

Schueler, A. "Innovative Coloured Solar Glass for Enhanced Building Integration of Solar Energy Systems", Keynote Speaker, Conference EcOrient 2014, 4 June 014, Beirut, Lebanon

Mohajeri N., "Complex built environment systems", Invited lecturer, University College London, Faculty of the Built Environment, The Bartlett School, 9 September 2014

Mohajeri N., "Sustainable urban design", Keynote Speaker, Cardiff University, ARCHI – Welsh School of Architecture, 22 September 2014

Schueler, A. "Neues von der Glasfront", Keynote Speaker, EcoBau 2014, september 2014, Bern, Switzerland

Invited presentations and other events [cont'd]

Munari Probst M.C., "LESO QSV : Urban acceptability of solar technologies", Keynote Speaker, Conference Solenergi i stadsplaneringen, Lund, Sweden, 20.11.2014

Munari Probst M.C., "Energie et Architecture : le défi de l'intégration du solaire", Keynote Speaker, Solarwärme Tagung 2014, Luzern, November 2014

Kämpf, J. H. ETHZ Chair of information Architecture, Dr. R. König, December 2014

Nik, V. NSB 2014 – 19th Nordic Symposium on Building Physics, presenter and session chair.

Nik, V. "Future challenges for buildings in Europe until 2050", Invited Lecturer, June 2014

MEDIA

Munari Probst MC, Technologies Solaires et Architecture - une Synthèse delicate, opening article for the special issue *"Construction Solaire"* of the Swiss journals Tec 21, Tracé and Archi, 05/2013 (translated in French, German, Italian).

Munari Probst, M. C., "Préserver la qualité architecturale" – Interview in « Efficience 21 », Autumn 2014

LESO LUNCHTIME LECTURES AND OTHER EVENTS

Title	Lecturer	Date
Detecting Hotspots in Daylighting and Solar Technology, International Workshop organised with and for Velux Stiftung Zürich	Prof. Jean-Louis Scartezzini, Dr Andreas Schüler, EPFL/LESO-PB	11.9.2014
Impact Assessment of Climate Change on the Hygrothermal Performance of Buildings	Dr Vahid Nik, EPFL/LESO-PB and Lund University, Sweden	11.04.2014
Architectural performative design: Case studies, processes and simulation tools	Prof Emanuele Naboni, LEED AP	06.06.2014
Thermal insulation – take some breaks in summer?	Dr Nikolaus Nestlé, BASF SE Ludwingshafen, Germany	27.06.2014
La construction en paille : Une innovation dans le développement des bâtiments durables ?	Adrien Chaussinand, INSA Strasbourg	04.09.2014
Improving Urban Climate Modeling from the City to the Building Scale	Dr Dasaraden Mauree, EPFL/LESO-PB	03.10.2014
Visual assessment of BIPV with saliency map method	Ran Xu, Lucerne University of Applied Sciences and Arts	07.11.2014
Design implications on future urban energy systems	Kristina Orehounig, ETH Zurich, EMPA	05.12.2014

REPRESENTATION

EPFL INTERNAL

Name	Board, committee etc.	Start	End
Prof. J.-L. Scartezzini	Member of EPFL Excellence Fellowship Committee	2012	-
Prof. J.-L. Scartezzini	Member of SAR Academic Committee	2012	-
Prof. J.-L. Scartezzini	Member of CISBAT 2015 Scientific Committee	2013	-
Prof. J.-L. Scartezzini	EPFL Doctoral Programme in Energy (EDEY), Member of Doctoral Committee	2010	-
Prof. J.-L. Scartezzini	Search Committee, ENAC Chair "Renewable Energy Integration in Buildings", Member	2014	-
Prof. J.-L. Scartezzini	ENAC IT Strategic Committee	2014	-
Prof. J.-L. Scartezzini	Smart Living Lab, Working Group for Demonstration activities	2014	-
Prof. J.-L. Scartezzini	Solar Decathlon Academic Committee	2014	-
Dr J. Kämpf	Member of CISBAT 2015 Scientific Committee	2013	-
Dr A. Kostro	Member of CISBAT 2015 Scientific Committee	2014	-
Dr N. Mohajeri	OQA/CTI Audit MES Teacher Meeting	2014	
Dr N. Mohajeri	Member of CISBAT 2015 Scientific Committee	2014	-
Dr N. Morel	Member of CISBAT 2015 Scientific Committee	2013	-
Dr M.C. Munari Probst	Member of CISBAT 2015 Scientific Committee	2013	
Dr A. Schueler	Member of SAR Teaching Committee	2013	-
Dr A. Schueler	Coordinator for Security COSEC for LESO-PB	2011	-
Dr A. Schueler	Member of CISBAT 2015 Scientific Committee	2013	-

EPFL EXTERNAL

Name	Organisation, Function	Start	End
Prof. J.-L. Scartezzini	Solar Energy International Journal, Associate Editor	2000	-
Prof. J.-L. Scartezzini	IPCC Working Group III – Mitigation of Climate Change, Expert Reviewer	2008	-
Prof. J.-L. Scartezzini	Qatar National Research Fund (QNRF), National Priorities Research Program (NRRP), Peer Reviewer	2007	-
Prof. J.-L. Scartezzini	SIA Regards 2013 – National award for sustainable and promising achievements, Swiss Society for Engineers and Architects (SIA), Zurich, Member of Jury Panel	2013	2014
Prof. J.-L. Scartezzini	Swiss Competence Centre for Energy and Mobility (CCEM-CH), Research Committee Chair	2005	2014
Prof. J.-L. Scartezzini	International Council for Research and Innovation in Building and Construction, EPFL Representative	2004	-
Prof. J.-L. Scartezzini	European Renewable Energy Research Centres Agency (EUREC), College of Member, EPFL Representative	2004	-
Prof. J.-L. Scartezzini	Canadian Foundation for Innovation (CFI), Expert Reviewer	2010	2014
Prof. J.-L. Scartezzini	InnoTech Award Committee, Services Industriels de Genève, 18th Nov. 2014, member	2014	-
Prof. J.-L. Scartezzini	40th IAHS World Congress, Scientific Advisory Committee, 16-19th Dec, 2014, Funchal, Portugal	2013	2014

Name	Organisation, Function	Start	End
Prof. J.-L. Scartezzini	ICERD-6 Conference, International Advisory Committee, 9-11th 2015, member	2014	2015
Prof. J.-L. Scartezzini	SCCER Future Energy Efficient Buildings and Districts, Board member and Work package leader	2014	2016
Dr M.C. Munari Probst	IEA Task 51 Solar Energy and Urbanism, Subtask B co-group leader	2013	2016
Dr M.C. Munari Probst	Swissolar Association (Bern), Member of Architecture Group	2010	-
Dr M.C. Munari Probst	International Conference Eurosun 2014, Aix-Les-Bains, September 2014, Scientific committee, Presenter and session chair	2013	2014
MSc C. Roecker	IEA Task 51 Solar Energy and Urbanism, Subtask B co-group leader	2013	2014
MSc C. Roecker	Swiss PV days programming group	2013	-
Dr J. Kämpf	Second Eurographics Workshop on Urban Data Modelling and Visualisation (UDMV), Strasbourg, April 2014, Program committee member	2014	-
Dr J. Kämpf	Building Simulation and Optimisation Conference 2014 (BSO14), 23-24.6.2014, Scientific committee member	2014	-
Dr J. Kämpf	IEA – Task 50 "Advanced Lighting Solutions for Retrofitting Buildings, Subtask co-leader	2012	2014
Dr J. Kämpf	Eurosun 2014, Reviewer	2014	-
Dr N. Mohajeri	Environment and Planning B: Planning and Design Journal, Reviewer	2014	-
Dr N. Mohajeri	Urban Studies Journal, Reviewer	2014	-
Dr N. Mohajeri	Journal of Geographical Systems, Reviewer	2014	-
Dr N. Mohajeri	International Journal of Geographic Information Science, Reviewer	2014	-
Dr A. Schüler	6th IBPC Conference – Building Physics for a Sustainable Built Environment, June 2015, Committee member	2014	2015
Dr V. Nik	Journal of automation in Construction, Reviewer	2014	-
Dr V. Nik	Solar Energy Journal, Reviewer	2014	-
Dr V. Nik	Journal of Building and Environment, Reviewer	2014	-

Solar Energy and Building Physics Laboratory (LESO-PB)

Swiss Federal Institute of Technology Lausanne (EPFL)
School of Architecture, Civil and Environmental Engineering (ENAC)
Civil Engineering Institute (IIC)

EPFL – ENAC – LESO-PB
Bâtiment LE
Station 18
CH-1015 Lausanne
Switzerland

Phone: +41 21 693 4545
Fax: +41 21 693 2722
Email: leso-pb@epfl.ch

http://leso.epfl.ch