

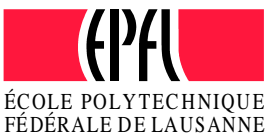
SOLAR ENERGY AND BUILDING PHYSICS LABORATORY

LABORATOIRE D'ENERGIE SOLAIRE ET DE PHYSIQUE
DU BÂTIMENT



LES-PB

Activity Report 2016



Energy Efficiency & Renewables in the Built Environment

Solar Energy and Building Physics Laboratory (LESO-PB)

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

ACTIVITY REPORT 2016

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, architects and technicians. This report presents the 2016 teaching, research and technology transfer activities of the lab.

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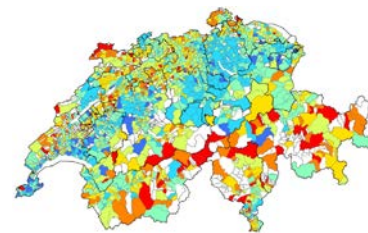
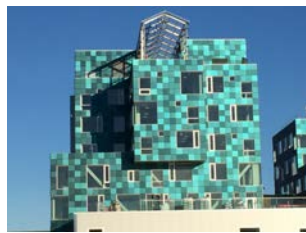
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RESEARCH HIGHLIGHTS

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. This report describes the activities of the lab in 2016, 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
- Building integration of renewable energy



Highlights 2016

- Intense research and collaborative activity has taken place in the framework of the Swiss Competence Center for Energy Research “Future Energy Efficient Buildings & Districts” (SCCER FEEB&D). Results of the first phase were widely published. Concrete results for the Swiss Energy Turnaround 2050 are being fostered and obtained.
- The LESO-PB group Nanotechnology for Solar Energy Conversion led by Dr Andreas Schüler has been much cited in the media thanks to breakthroughs in windows that combine thermal insulation and mobile phones reception, an innovation which will have a major impact in the field of train and building fenestration.
- A web-service for large scale geo-building energy databases was set up by Dr Nahid Mohajeri and Dan Assouline in collaboration with University of Geneva. This platform will help mapping the renewable energy potential of urban sites in the whole of Switzerland.
- A European patent has been granted for a window-glazing system that uses micro-mirrors to improve the lighting and visual comfort inside buildings and could also make solar blinds obsolete. Further patent applications have been submitted with regard to integrated electric lighting and shading control based on novel High Dynamic Range (HDR) Vision Sensors.

Awards

- Dr. Maria Cristina Munari Probst and Christian Roecker have received the prestigious Swedish Sustainable Energy Award (category Innovation) thanks to their pioneering work with regard to architectural integration of solar technology and their recent development of a unique decision tool to help with integration decisions in urban environments.
- Ali Motamed et al. : Best Paper award IAQVEC 2016 in Seoul, Rep. Korea “Impact of integration of non-image forming (NIF) effect of light on electrical lighting control in non-residential buildings”.
- Sara Vanzo, Politecnico di Torino, Best Master Thesis in the field of Sustainability & Energy Savings, carried out at LESO-PB, “A novel glazing technology for building envelopes – an evaluation of the energy performance and its influence on the thermal control”

INTEGRATED DAY LIGHTING AND ELECTRIC LIGHTING

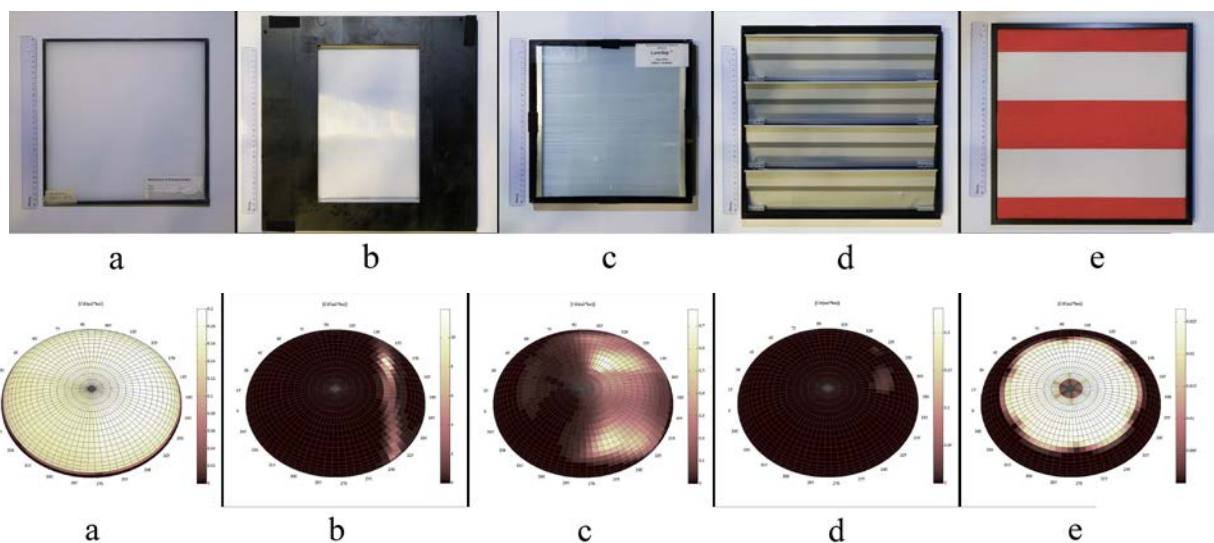
Group leader: Prof. Jean-Louis Scartezzini

Senior researchers: Dr Jérôme Kämpf, Dr Bernard Paule (Estia SA)

PhD student: Yujie Wu

The Integrated Day lighting 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 and advanced monitoring devices are under development.



Complex Fenestration Systems (CFS) and BTDF hemispherical projection: : a) Opalescent plexiglas b) CFS3 c) Lumitop d) Venetian blinds e) Fabric blinds.

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

2016 Activities

The long-term goal is to provide a database of Bidirectional Transmission Distribution Functions (BTDF data) from selected Complex Fenestration Systems (CFS) to be able to access it from different lighting simulation software (e.g. RADIANCE, Geronimo and Relux Pro). Five different samples were monitored using the EPFL-LESO bidirectional goniophotometer based on CCD imaging in order to get to their respective BTDF data. Five different categories were selected showing very different light transmission properties: (i) Diffusing material, (ii) Sunlight redirecting material, (iii) Prismatic panels, (iv) Venetian blinds and (v) Fabric blinds. Future categories defined for the product database will follow the latter; each category will be further populated with samples so that a coherent and usable database can be established. The goal is to provide the practitioners (lighting industry, energy consultants and architects) with a complete set of existing CFS in their favourite simulation tool to foster their dissemination and use in daily life (e.g. similar to electric lighting fixtures).

Current Projects

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

Funding: 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 focuses on the development of 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 retrofiting buildings

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2013-2016

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 was focused on non-residential buildings dealing with advanced lighting solutions and tools 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: 2013-2016, patent granted in 2016

The innovative glazing system proposed in this project combines 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.

PhD theses in this domain

- Lighting Environment in Buildings - Nonvisual Light Perception and Inter-Individual Differences, *Lenka Maierova, PhD Thesis* Czech Technical University in Prague, Faculty of Civil Engineering 2015, based on studies performed in the framework of a SCIE X Scholarship at our Lab from 2011-2013
- 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, *Apiarn Borisuit, EPFL PhD thesis #6007, 2013*
- Energetic, visual and non-visual aspects of office lighting, *Friedrich Linhart, EPFL PhD Thesis #4587, 2010*
- Innovative bidirectional video-goniophotometer for advanced fenestration systems, *Marilyne Andersen, EPFL PhD Thesis #2941 (2004)*

Selected 2016 publications

- L. Maierova, A. Borisuit, J.-L. Scartezzini, S. M. Jaeggi and C. Schmidt et al. Diurnal variations of hormonal secretion, alertness and cognition in extreme chronotypes under different lighting conditions, in *Nature Scientific Reports*, vol. 6, num. 33591, 2016
- A. Borisuit, J. Kämpf, M. Münch, A. Thanachareonkit and J.-L. Scartezzini. Monitoring and rendering of visual and photo-biological properties of daylight-redirecting systems, in *Solar Energy Journal*, vol. 129, p. 297-309, 2016

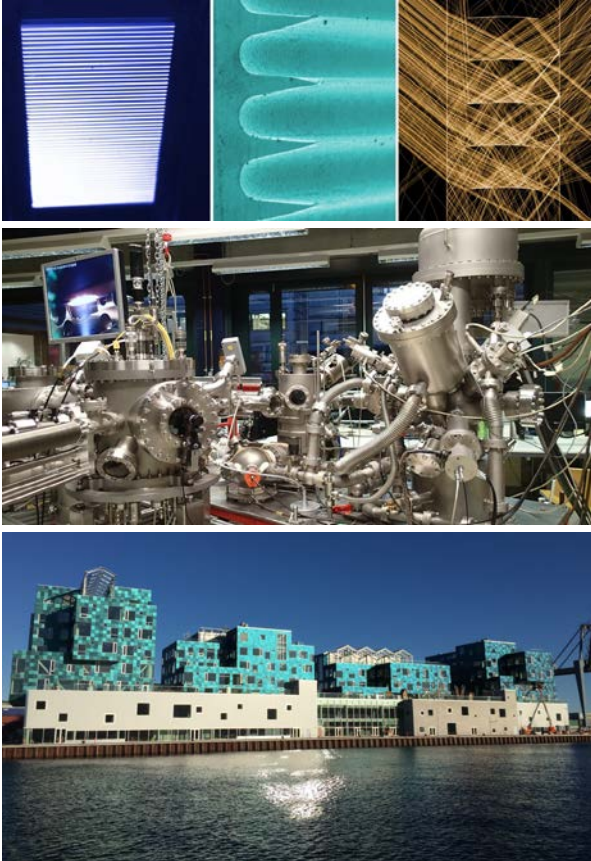
NANOTECHNOLOGY FOR SOLAR ENERGY CONVERSION

Group leader: Dr Andreas Schüler

Postdoctoral researchers: Dr André Kostro, Dr Marina Gonzalez; Research fellow: Luc Burnier

PhD students: Olivia Bouvard, Jing Gong, Anna Krammer

Visiting scholars, Antoine Delaunay, Tom Walet, Djamel Mansour, Alexandre Diévert, Samson Taylor



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 facades, 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.

It has submitted and been granted several patents.

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
- Structured transparent low emissivity coatings with high microwave transmission

2016 Activities

Highlights of this year include:

- Novel train windows with low U-value and high microwave transparency for mobile communication: Successful implementation and industrial scale production.
- Design and simulation of novel optical microstructures for innovative glazing combining seasonal thermal control, enhanced use of daylighting and improved visual comfort: patent granted
- Detailed study on electronic properties of electrochromic coatings for smart windows
- Novel doping of thermochromic films for matching the transition temperature to the needs of overheating protection of solar thermal collectors

Current Projects

Target 95 - Thermochromic coatings for overheating protection of solar thermal collectors - novel type of doping

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2015-2018

Overheating and the resulting stagnation of solar thermal collectors lead to water evaporation, glycol degradation and stresses in the collector with increasing vapor pressure. Additionally, the occurring elevated temperatures cause degradation of the materials that compose collector components. A protection may be provided by thermochromic coatings which exhibit a change in optical properties at a critical temperature T_c for high solar absorptance and low thermal emittance below the T_c , and low solar absorptance and high thermal emittance above T_c . Thermochromic films have been developed at EPFL/LESO-PB earlier. In this project, the effect of doping on the transition temperature studied in more detail. It will be investigated to which extent the transition temperature can be raised. Suitable designs of multi-layered coatings for maximised performance shall be developed, the variety of applications shall be explored, and promising fields for market introduction shall be identified.

WindowWAVE: Zugfenster mit kleinem U-Wert und hoher Mikrowellentransmission

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2014-2015 – Market introduction 2016

In order to reduce the energy consumption of buildings, modern windows include metal containing coatings. These coatings strongly attenuate the microwaves used for mobile communications. Within this project, we develop a novel approach for creating metal containing coatings for train windows with improved radio signal transmission. Preliminary results have shown that it is possible to reach a level of attenuation close to the one of the glazing without metallic coating. The focus of this project is on the upscaling of the fabrication process for industrial fabrication, the production of prototype series, and the test on the real scale. The results of this project will be of major importance for the building and transportation sector as it might reduce the need for repeaters.

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

Funding: Commission for 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.

Selected 2016 publications

- J. Gong, A. G. Kostro, A. Motamed and A. Schueler. Potential advantages of a multifunctional complex fenestration system with embedded micro-mirrors in daylighting, in *Solar Energy Journal*, vol. 139, p. 412-425, 2016
- A. G. Kostro, M. Geiger, J.-L. Scartezzini and A. Schueler. CFSpro: ray tracing for design and optimization of complex fenestration systems using mixed dimensionality approach, in *Journal of Applied Optics*, vol. 55, num. 19, p. 5127-5134, 2016
- O. Bouvard, A. Krammer and A. Schueler. In situ core-level and valence-band photoelectron spectroscopy of reactively sputtered tungsten oxide films, in *Surface and Interface Analysis*, vol. 48, num. 1, 2016

Patents

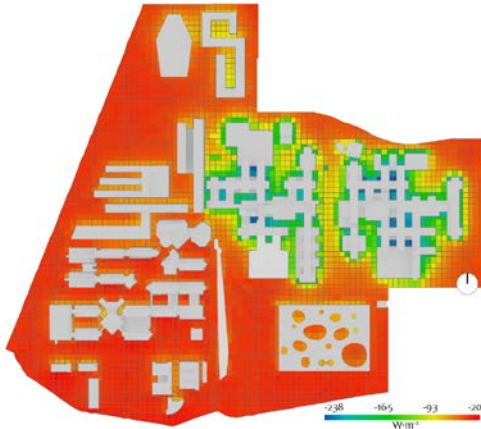
- EP2882921: Glazing with embedded microstructures for daylighting and seasonal thermal control
- WO 2014045141 A2: Laminated glazing with coloured reflection and high solar transmittance suitable for solar energy systems
- WO 2014045144 A1: Interference filter with angular independent orange colour of reflection and high solar transmittance, suitable for roof-integration of solar energy systems

Awards

- Second best poster award, SATF 2016 in Cesme, Turkey, Olivia Bouvard et al.
- IBPC 2015 Best Paper Award, Int. Building Physics Conference, Torino, Italy, Olivia Bouvard et al.
- 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 leaders: Dr Jérôme Kämpf / Dr Dasaraden Mauree
 PhD students: Silvia Coccolo, Amarasinghage T. Dasun Perera
 Guest visitors: Prof. Emanuele Naboni, Prof. Sameh Monna
 Master students: Marta Carozza, José Vazquez



Outdoor comfort map on EPFL campus (by S. Coccolo)



MOTUS – new measuring mast

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
- Multi-criteria assessment of Energy Systems

2016 Activities

The research team is part of the SCCER FEEB&D through activities within WP3 “Urban Decentralized Energy Systems” focusing on Modelling and Simulation. The UMEM project “Sustainable cities and urban energy systems of the future - Urban Multiscale Energy Modelling” was completed early 2016. The group is now leading the MOTUS project, which focuses on the measurement of turbulence in an urban setup, for which a 27 m mast was set up on the EPFL campus.

Highlights in 2016 were

- Development of a new simplified model that can help engineers and meteorologists quickly calculate the effect that city buildings have on local weather patterns. The potential for this research is not only reducing building energy consumption, but also improving the overall design of urban spaces.
- Investigation of energy demand related to urban micro climate and outdoor comfort both for temperate and hot climates
- Design optimization of grid integrated hybrid energy hubs

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 and their environment. These interactions can be radiative (with the exchange of shortwave and longwave contributions), conductive and convective (through the exchange of heat), impact of built surfaces on air flow, but also due to 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).

Current Projects

SCCER FEED&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 CO₂ 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: 2012-2016

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.

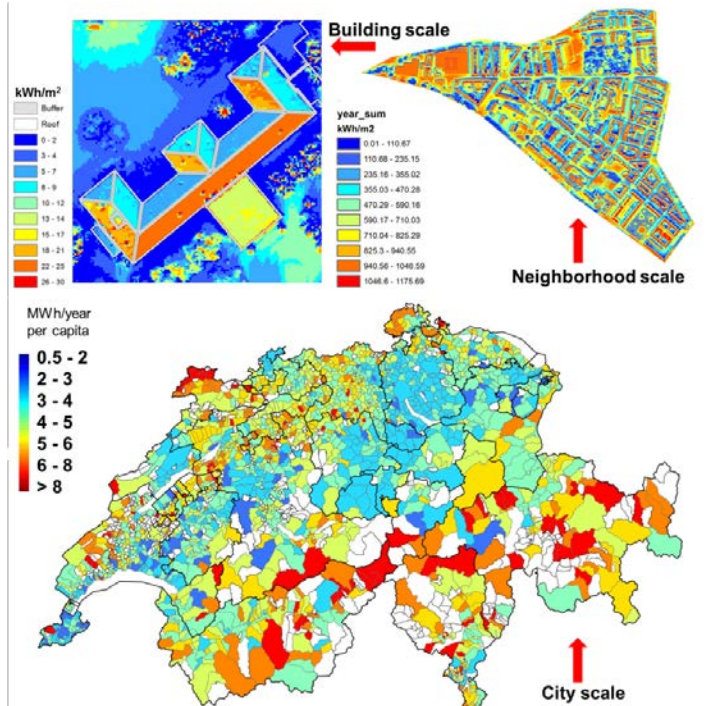
Selected 2016 publications

- S. Coccolo, D. Mauree, J. Kämpf and J.-L. Scartezzini. Integration of outdoor human comfort in a building energy simulation database using CityGML Energy Ade. Sustainable Built Environment (SBE) Regional Conference - Expanding Boundaries: Systems Thinking for the Built Environment, Zurich, Switzerland, June 15-17 2016
- D. Mauree, S. Coccolo, J. Kämpf and J.-L. Scartezzini. Multi-scale modelling to assess human comfort in urban canyons. Sustainable Built Environment (SBE) regional conference - Expanding boundaries, Zurich, Switzerland, June 15-17 2016
- S. Coccolo, S. Monna, J. H. Kaempf, D. Mauree and J.-L. Scartezzini. Energy demand and urban microclimate of old and new residential districts in a hot arid climate. PLEA 2016 - 36th International Conference on Passive and Low Energy Architecture, Los Angeles, USA, July 11-13, 2016
- A. T. D. Perera, V. M. Nik, D. Mauree and J.-L. Scartezzini. Design optimization of electrical hubs using hybrid evolutionary algorithm. ASME 2016 10th International Conference on Energy Sustainability, Charlotte, North Carolina, USA, June 26-30, 2016

COMPLEX URBAN SYSTEMS

Projects leader: Dr Nahid Mohajeri

PhD student: Dan Assouline



Modelling solar energy potential from building scale to neighborhood and city scale (Contribution from A. Bill; J.P. Crettaz; V. Fournier; Z. Wang and D. 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. The group's research focus is therefore on (1) Urban metabolism, (2) Energy-Efficient Urban Forms, (3) Size, Scaling Relations and Urban Metabolism, (4) Urban Data and Renewable Energy Potentials.

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

2016 Activities

Research has advanced on the project 'Data Mining: Geo-Dependent Energy Supply in Relation to Urban Form', a collaboration between EPFL-LESO-PB, ETHZ, Empa, Geneva University and HSLU within the Swiss Competence Center for Energy Research "Future Energy Efficient Buildings and Districts". The focus in 2016 was on

- The complexity of roof-shape and solar energy potential. A multidisciplinary approach for classification of different roof shapes has been developed, analysing the solar potential for each type of roof, and assessing the roofs based on different characteristics in order to find out how well they receive solar energy.
- Street canyon and accessibility of solar energy potential. GIS tools and CitySim were used to investigate how street configuration controls solar potential, particularly with regard to street surface and facades.
- A web-service for large scale geo-building energy databases was set up in collaboration with University of Geneva. This platform will help mapping the renewable energy potential of urban sites in the whole of Switzerland.

Furthermore, several semester projects investigated on the one hand the relation between Energy consumption and Urban Form and on the other the Energy Hub concept for two villages in Switzerland.

Current Projects

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

Funding: 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.

Selected 2016 publications

- A. Bill, N. Mohajeri and J.-L. Scartezzini. 3D Model for Solar Energy Potential on Buildings from Urban LiDAR Data. UDMV 2016 - Eurographics Workshop on Urban Data Modelling and Visualisation, Liège, Belgium, December 8, 2016
- N. Mohajeri, D. Assouline, B. Guiboud and J.-L. Scartezzini. Does roof shape matter? Solar photovoltaic (PV) integration on building roofs. Zurich, June 15-17 2016; Sustainable Built Environment (SBE) regional conference, Zurich, Switzerland, June 15-17, 2016
- N. Mohajeri, A. Gudmundsson, T. Kunckler, G. Upadhyay and D. Assouline et al. How street canyon configuration control the accessibility of solar energy potential: Implication for urban design. PLEA - 36th International Conference on Passive and Low Energy Architecture. Cities, Buildings, People: Towards Regenerative Environments, Los Angeles, July 11-13, 2016
- N. Mohajeri, G. Upadhyay, A. Gudmundsson, D. Assouline and J. Kämpf et al. Effects of urban compactness on solar energy potential, in Renewable Energy, vol. 93, p. 469 - 482, 2016

SMART BUILDINGS/SMART CITIES

Group leader: Prof. Jean-Louis Scartezzini

PhD students: Ali Motamed, Marta Benedetti; Visiting scholar: Maíra Vieira Dias



Latest HDR vision sensor Vision-In-Package (VIP)
issued from CSEM

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).

2016 Activities

The integration of HDR vision sensors in a sun shading and electric lighting control platform was carried-out in the framework of the SCCER FEEB&D. Two identical sensors are used to measure two photometric variables in a workspace: (i) the Daylight Glare Probability experienced by the user and (ii) the workplane horizontal illuminance. The first sensor is located as close as possible to the user's viewpoint; the second one is mounted on the ceiling. A control platform was set-up to guarantee the proper data acquisition and logging, flawless initialization as well as actuators commanding. In order to verify the robustness and the performance of the platform, a sun shading and electric lighting controller based on fuzzy logic was set-up and successfully tested. The platform is currently ready to operate and was used to assess several energy efficient control approaches. The current HDR vision sensors (lab edition) will be further improved (market edition) with the collaboration of CSEM and Analog Device Inc. (recent buyer of SNAPsensor) to provide similar integrated lighting controllers in daily life in collaboration with industrial partners.

Current Projects in Smart Buildings/Smart Cities

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

Funding: Commission for Technology and Innovation (CTI)

Duration: 2014-2016

The integration of advanced daylighting systems with high efficacy light sources (LEDs), energy efficient luminaires (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 user 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 user 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.

NEST SolAce | REcomfort

Perception based Human Comfort and Multi-Functional Solar Facade

Funding: ETH Board

Duration: 2016-2020

Even in old-established branches like the heating, ventilating and air conditioning industry there are blank areas: one of these spots is the capture of solar energy and daylight by the building envelope. These topics will be investigated by EPFL Researchers and their industrial partners in the SolAce | REcomfort unit: multifunctional facade technologies will be implemented to achieve an Energy-Plus and Low Carbon combined working/living space.

Selected 2016 publications

- A. Motamed, M. Benedetti and J.-L. Scartezzini. On the Impact of Integration of Non-Image Forming (NIF) Effect of Light on Electrical Lighting Control in Non-Residential Buildings. 9th International Conference on Indoor Air Quality Ventilation & Energy Conservation In Buildings IAQVEC 2016, Songdo, Incheon. Republic of Korea, October 23-26, 2016
- A. Motamed, L. Deschamps and J.-L. Scartezzini. Toward an Integrated Platform for Energy Efficient Lighting Control of Non-Residential Buildings. Sustainable Built Environment (SBE) regional conference - Expanding boundaries, Zurich, Switzerland, June 15-17 2016

Awards

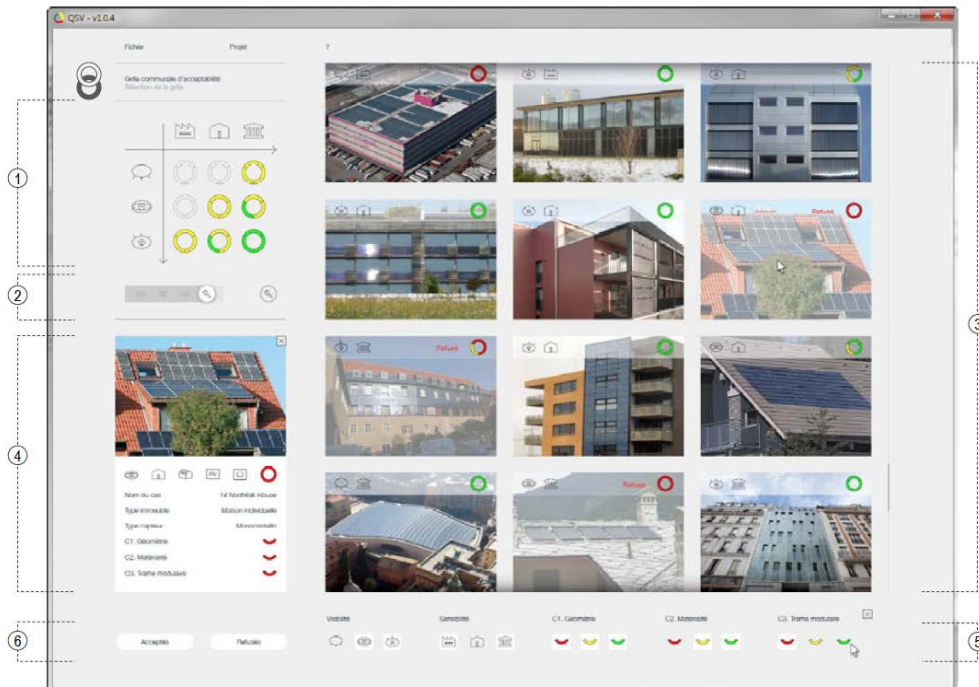
- A. Motamed et al. : Best paper award 9th International Conference on Indoor Air Quality Ventilation & Energy Conservation In Buildings IAQVEC 2016, Seoul, Rep. of Korea, for paper “On the impact of integration of non-image forming (NIF) effect of light on electrical lighting control in non-residential buildings”

BUILDING INTEGRATION OF RENEWABLE ENERGIES

Projects leader: Dr Maria Cristina Munari Probst

Senior adviser: MSc. Christian Roecker (Cap77 sàrl)

PhD student: Pietro Florio



LESO-QSV: Learning Tool Grid

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. Our projects address the key issue of optimal architectural integration of photovoltaic and thermal solar systems at the building and urban scales.

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 criticality 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

2016 Activities

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, an innovative approach to combine information of solar potential with urban sensitivity and system visibility was developed (cross-mapping).

Furthermore, the LESO-QSV method for implementation at urban scale of criteria defining the quality of architectural integration was transferred to practice in collaboration with several local councils and universities. Much effort has also been spent on the transfer of knowledge gained from recent research and development to students both at EPFL and at Venice IUAV University.

In collaboration with other EPFL Labs, LESO-PB has also been very active in the design of a blueprint for an R&D building unit in the NEST experimental building currently under construction at EMPA. Called SolAce | REcomfort, it will feature and test multi-functional facade technologies with the aim of achieving an Energy-Plus and Low Carbon combined working/living space. After several months of planning, the building permit was granted in the beginning of 2017.

IEA SHC Task 51 Solar Energy in Urban Planning

Funding: Swiss Federal Office of Energy (SFOE)

Duration: 2013 – 2017

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: 2011-2017

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 criticality into urban planning, in combination with irradiation mapping, was additionally included in the method.

NEST SolAce | REcomfort

Perception based Human Comfort and Multi-Functional Solar Facade

Funding: ETH Board

Duration: 2016-2020

Even in old-established branches like the heating, ventilating and air conditioning industry there are blank areas: one of these spots is the capture of solar energy and daylight by the building envelope. These topics will be investigated by EPFL Researchers and their industrial partners in the SolAce | REcomfort unit: multi-functional facade technologies will be implemented to achieve an Energy-Plus and Low Carbon combined working/living space.

Selected publications in 2016

P. Florio, C. Roecker, M. C. Munari Probst and J.-L. Scartezzini. Visibility of Building Exposed Surfaces for the Potential Application of Solar Panels: A Photometric Model. Eurographics Workshop on Urban Data Modelling and Visualisation, Liège, Belgium, December 8, 2016.

Award

Maria Cristina Munari Probst, Christian Roecker: Swedish Sustainable Building Award, category “Innovator of the Year” 2016, given by the Foundation for the development of energy efficient construction, the Foundation for the development of good building culture, Lund University, the journal Fastighetsvärlden, and the Eliasson family (www.åretsframtidbyggare.se)

EDUCATION AND TEACHING

2016 COURSES AND STUDENT FIGURES

Bachelor/Master Programmes

Course title	Lecturer	Students	Students numbers
Building Physics I	Prof. J.-L. Scartezzini	AR BA1	307
Building Physics II	Dr A. Schueler	AR BA2	255
Building Physics III	Dr A. Kostro	AR BA3	156
Building Physics IV	Dr A. Kostro	AR BA4	181
Building Physics V	Prof. J.-L. Scartezzini	AR BA5	136
Building Physics VI	Prof. J.-L. Scartezzini	AR BA6	105
Quartiers, infrastructures et aménagement durable	Prof. J.-L. Scartezzini, Prof. A.-G. Dumont, Prof. A. Buttler, Prof. P. Tosolini, Dr Ch. Ludwig, MSc D. Hofstetter, Dr N. Mohajeri, S. Cocco, Dr M. Pfister	AR/GC / ENAC BA6 (ENAC Learning Units)	19
Technical ecology of human communities	Dr. M.A. Messer, Prof. S. Takahama, Dr N. Mohajeri, Prof. J. Russell	AR/GC/SIE BA (ENAC Weeks)	17
Projets de master	Prof. J.-L. Scartezzini et al.	AR-MA, MT-MA	67

Additional Teaching and Studio Jury

Name, role	Institution	Year
Dr M.C. Munari Probst, Invited Professor (27.10.-19.12.2015)	University IUAV of Venice, Italy	2016

ADVISING

PhD

Name	Title	Advisers	End	# EPFL Thesis
Gong, Jing	Novel glazing with strong seasonal dynamics	Prof. J.-L. Scartezzini Dr A. Schueler	2019	N/A
Krammer, Anna	Thermochromic films for smart solar energy applications	Prof. J.-L. Scartezzini Dr A. Schueler	2019	N/A
Wu, Yujie	Self-sufficient lighting systems	Prof. J.-L. Scartezzini	2019	N/A
Perera, A.T.D.	Modelling and assessment of urban energy systems	Prof. J.-L. Scartezzini Dr V. Nik (Lund University)	2018	N/A
Assouline, Dan	Geo-dependent energy supply in relation to urban form	Prof. J.-L. Scartezzini Dr N. Mohajeri	2018	N/A
Bouvard, Olivia	Novel materials for switchable windows	Prof. J.-L. Scartezzini Dr A. Schueler	2018	N/A
Motamed, Ali	Integrated Daylighting and Artificial Lighting Control based on High Dynamic Range Vision Sensors	Prof. J.-L. Scartezzini	2018	N/A
Florio, Pietro	Architectural integration criticality and visibility evaluation of solar energy applications in urban sites	Prof. J.-L. Scartezzini Dr M.C. Munari Probst	2018	N/A

Advising [cont'd]

Coccolo, Silvia	Bioclimatic Design of Sustainable Campuses using Advanced Optimisation Methods	Prof. J.-L. Scartezzini Prof. J. Kämpf (HEIA-FR)	2017	N/A
Vieira Dias, Maira (guest PhD student from University of Campinas, Brazil)	Lighting in Industrial Environment and its Influence on Employee's Visual Field	Prof. Paulo Sergio Scarazzato (Univ. Campinas) Prof. J.-L. Scartezzini	2017	N/A
Xu, Ran	Building integrated PV – visual assessment with saliency map method	Prof. J.-L. Scartezzini Prof. S. Wittkopf (HSLU)	2016	7236
Hammes, Emily Ann	Gas Sampling Using Convection and Humidity Stabilization to Improve Point Gas Sensor Responses	Prof. J.-L. Scartezzini (thesis jury member)	2017	7029

Master Theses

Student/Institution	Title	LESO-PB Supervisor
Benedetti Marta (MSc Energy Eng., University Bolzano, It)	Impact of lighting control systems based on “Non-image-forming” effects of light on electric lighting energy demand and user’s confort and performance	Motamed, Ali Scartezzini, Jean-Louis
Carozza Marta, Politecnico di Torino Italy	Il consumo energetico per la climatizzazione degli edifici e la forma urbana. I casi studio di Torino e Dubai	Coccolo, Silvia Kämpf, Jérôme G. Mutani, A. Rolando (Polit.Torino)
Delaunay, Antoine Robert Michel	Realisation of optical microstructures for advanced fenestration systems	Kostro, André Schueler, Andreas
Diévar, Alexandre, ENPC ParisTech	High performance solar cooker	Schueler, Andreas Bouvard, Olivia; Mauree, Dasaraden
Mansour, Djamel Eddine, University of Paris 7 Diderot	Deposited by magnetron sputtering for advanced windows	Bouvard, Olivia ; Schueler, Andreas
Vazquez Canteli, José Ramón	Simulating and analyzing the heating, cooling, and electricity demands of a neighborhood of the city of Geneva, for different climate change and refurbishment scenarios	Kämpf, Jérôme Coccolo, Silvia
Walet, Tom Charles Maurice	Development of novel electrochromic material deposited by vacuum deposition for advanced windows	Bouvard, Olivia Schueler, Andreas Mural, Paul
Bichsel Aurélie Tornberg Fia-Maria	Dans l'épaisseur du mur. Habitat bioclimatique en milieu urbain / Habitat en transition. Approche bioclimatique en milieu urbain.	Ortelli Luca (dir. pédagogique); Scartezzini Jean-Louis (prof.); Barcelloni Corte Martina; Kämpfen Beat (expert)
Grobéty, Nathalie	Un hôtel diffus à la montagne. Transformation du hameau d'Aï à Leysin	Ortelli Luca (dir. pédagogique); Scartezzini Jean-Louis (prof.); Wall Gago Catarina (maître EPFL); Gueissaz Philippe (expert)

Semester projects

Student/Institution		Title	Supervisor
Bill, A.	EME-MA2	Energy management and sustainability II, How the urban form influences the renewable energy potential in the neighbourhood	Mohajeri, Nahid
Bittel, Henri Max	GM-MA2	Clustering of demand for a neighbourhood in Geneva	Perera, Dasun Mauree, Dasaraden Scartezzini, Jean-Louis Maréchal, François
Chatelain, Timothée	GM-MA3	Optimizing operation of Energy Hubs considering flexible demands: a case study in Geneva	Scartezzini, Jean-Louis
Crettaz, Jean-Philippe	EME-MA2	Energy management and sustainability II, Energy and Urban Form	Mohajeri, Nahid
Cui, Kejia	MX-MA2	Research project in materials II: Shape Fidelity of Replication for Glazing with Micro Mirrors	Schueler, Andreas Gong, Jin Leterrier, Yves
Declerck, Valentine	GC-MA2	Le Smart Living Lab à Fribourg, un campus auto-suffisant	Kämpf, Jérôme Coccolo, Silvia Scartezzini, Jean-Louis
Demièrre, Fabrice	MX-MA2	Determination of optimal deposition parameters and characterization of thermochromic VO ₂ thin films for overheating protection of solar thermal collectors.	Krammer, Anna Schueler, Andreas Setter, Nava (PH-STI)
Devillers, Vincent	GC-MA1	Project ENAC: Summer decathlon	Munari Probst, Maria Cristina
Duc, Yannick	MX-MA2	Thickness of thermochromic vanadium dioxide	Krammer, Anna Schueler, Andreas Setter, Nava (PH-STI)
Fournier, Vincent	EME-MA2	Project in energy management and sustainability II, Energy and Urban Form, project in Junction, Geneva	Mohajeri, Nahid Scartezzini, Jean-Louis
Kühner, Antoine	EME-MA2	Techno-economic assessment of energy-hub concept for two villages in Switzerland. A case study in Cartigny	Coccolo, Silvia Perera, Dasun Mohajeri, Nahid Scartezzini, Jean-Louis
Mdeihli, Nour	ME-MA1	Techno-economic assessment of energy hub concept for two villages in Switzerland. A case study in Cartigny	Scartezzini, Jean-Louis Mohajeri, Nahid Perera, Dasun Coccolo, Silvia
Meyer, Frank	MX-MA2	Durability analysis of UV printed polymer microstructure under thermal ageing for a novel glazing system	Gong, Jing Leterrier, Yves (SMX-ENS) Schueler, Andreas
Mosca, Lucas Le Guen, Morgane	ME-MA1	Techno-economic assessment of energy hub concept for two villages in Switzerland. A case study of Hemberg	Mauree, Dasaraden Scartezzini, Jean-Louis
Siraganyan, Karni	SIE-MA1	Evaluating the need for energy storage to enhance the autonomy of neighbourhoods	Mauree, Dasaraden Scartezzini, Jean-Louis
Trolliet, Alix Peltier, Margaux	GC-MA1	Projet ENAC: Summer Decathlon	Munari Probst, Maria Cristina
Walet, Tom	MX-MA2	Development of novel electrochromic material deposited by vacuum deposition for advanced windows	Bouvard, Olivia Schueler, Andreas; Murali, Paul (SCI-PM)
Wang, Zhengchao	EME-MA2	Project in energy management & sustainability II: How the urban form influence the renewable energy potential in the neighbourhood	Scartezzini, Jean-Louis Mohajeri, Nahid
Zanchetta, Enio Daniel	GC-MA2	Thickness on thermochromic vanadium dioxide	Coccolo, Silvia Scartezzini, Jean-Louis Kämpf, Jérôme

Trainees and hosts from foreign universities, visiting scholars, interns and grant holders

Student/Visitor	Domain	Programme/Institution
Prof. Monna, Sameh	Guest scientist	An-Najah National University (Swiss Government excellence scholarship).
Prof. Moussavi Nik, Vahid	Guest scientist	Lund University, Sweden (SNSFgrant)
Prof. Naboni, Emanuele	Guest scientist	Royal Danish Academy of Fine Arts, Denmark
Vieira Dias, Máira	Visiting scholar	University of Campinas, Brazil
Delaunay, Antoine	Master student	Cranfield University, UK
Carozza, Marta	Master student	Politecnico di Torino, Italy
Diévert, Alexandre	Master student	Ecole des Ponts Paris Tech, France
Mansour, Djamel	Master student	Université Paris Diderot, France
Vasquez Canteli, José	Master student	Comillas Pontifical University, Spain
Stoll Alexandre	IT Apprentice	EPSIC
Divià, Michael	IT Apprentice	EPSIC
Marquez, Jonathan	IT Intern	ETML
Grandin, Julien	IT Intern	ETML
Taylor Samson	Nanotechnology lab	Student research assistant

PUBLICATIONS 2016

REFEREED SCIENTIFIC JOURNALS

Coccolo S., Kämpf J., Scartezzini J.-L., Pearlmutter D., Outdoor human comfort and thermal stress: A comprehensive review on models and standards, in *Urban Climate*, vol. 18, p.33–57, 2016

Gong J., Kostro A. G., Motamed A., Schueler A., Potential advantages of a multifunctional complex fenestration system with embedded micro-mirrors in daylighting, in *Solar Energy Journal*, vol. 139, p.412-425, 2016

Maierova L., Borisuit A., Scartezzini J.-L., Jaeggi S. M., Schmidt C., Münch M., Diurnal variations of hormonal secretion, alertness and cognition in extreme chronotypes under different lighting conditions, in *Nature Scientific Reports*, vol. 6, num. 33591, 2016

Muench M., Kourti P., Brouzas D., Kawasaki A., Variation in the pupil light reflex between winter and summer seasons, in *Acta Ophthalmologica*, vol. 94, num. 3, p.E244-E246, 2016

Figueiredo A., Kämpf J. H., Vicente R., Passive House Optimization for Portugal: Overheating Evaluation and Energy Performance, in *Energy and Buildings*, vol. 118, p.181–196, 2016

Kostro A. G., Geiger M., Scartezzini J.-L., Schueler A., CFSpro: ray tracing for design and optimization of complex fenestration systems using mixed dimensionality approach, in *Journal of Applied Optics*, vol. 55, num. 19, p.5127-5134, 2016

Nik M. V., Mata E., Kalagasidis Sasic A., Scartezzini J.-L., Effective and robust energy retrofitting measures for future climatic conditions — Reduced heating demand of Swedish households, in *Energy and Buildings*, vol. 121, p.176–187, 2016

Mohajeri N., Upadhyay G., Gudmundsson A., Assouline D., Kämpf J., Scartezzini J.-L., Effects of urban compactness on solar energy potential, in *Renewable Energy*, vol. 93, p.469 - 482, 2016

Borisuit A., Kämpf J., Münch M., Thanachareonkit A., Scartezzini J.-L., Monitoring and rendering of visual and photo-biological properties of daylight-redirecting systems, in *Solar Energy Journal*, vol. 129, p.297-309, 2016

Vitale W. A., Petit L., Moldovan C. F., Fernández-Bolaños M., Paone A., Schueler A., Ionescu M. A., Electrothermal actuation of vanadium dioxide for tunable capacitors and microwave filters with integrated microheaters, in *Sensors & Actuators: A. Physical*, 2016

Bouvard O., Krammer A., Schueler A., In situ core-level and valence-band photoelectron spectroscopy of reactively sputtered tungsten oxide films, in *Surface and Interface Analysis*, vol. 48, num. 1, 2016

CONFERENCE PROCEEDINGS

Florio P., Roecker C., Munari Probst M. C., Scartezzini J.-L., Visibility of Building Exposed Surfaces for the Potential Application of Solar Panels: A Photometric Model, Eurographics Workshop on Urban Data Modelling and Visualisation, Liège, Belgium, December 8, 2016

Jayasuriya W. J. A., Athukorala A. U. C. D., Perera A. T. D., Sirimanna M. P. G., Attalage R. A., Performance analysis of photovoltaic thermal (PVT) panels considering thermal parameters, ASME Power Conference POWER2016

Perera A. T. D., Optimum design of standalone hybrid energy systems minimizing waste of renewable energy, 10th ASME International Conference on Energy Sustainability

Bill A., Mohajeri N., Scartezzini J.-L., 3D Model for Solar Energy Potential on Buildings from Urban LiDAR Data, UDMV 2016 - Eurographics Workshop on Urban Data Modelling and Visualisation, Liège, Belgium, December 8, 2016

Conference proceedings [cont'd]

Muench M., Bieler K., Schmieder M., Goldbach R., Scartezzini J.-L., Wirz-Justice A., Cajochen C., Siegrist C. - A., Effects of light on sleep, emotions and immunological variables in demented patients, 23rd Congress of the European-Sleep-Research-Society.

Motamed A., Benedetti M., Scartezzini J.-L., On the Impact of Integration of Non-Image Forming (NIF) Effect of Light on Electrical Lighting Control in Non-Residential Buildings, 9th International Conference on Indoor Air Quality Ventilation & Energy Conservation In Buildings IAQVEC 2016, Songdo, Incheon. Republic of Korea, October 23-26, 2016

Krammer A., Gremaud A., Bouvard O., Sanjines R., Schueler A., In situ photoelectron spectroscopic characterization of reactively sputtered, doped vanadium oxide thin films, 16th European Conference on Applications of Surface and Interface Analysis (ECASIA)

Vitale W. A., Moldovan C. F., Paone A., Schuler A., Ionescu A. M., Investigation of the metal-insulator transition in VO₂ for Electronic Switches with Sub-1mV/Decade Steep Subthreshold Slope, 2016 IEEE Silicon Nanoelectronics Workshop (SNW), Honolulu, HI, USA, 12-13 June 2016

Figueiredo A., Vicente R., Kämpf J., Cardoso C., Scartezzini J.-L., Rodrigues F., Editor(s):Habert G. S. A., Overheating reduction of a cold formed steel-framed building using a hybrid evolutionary algorithm to optimize different PCM solutions, Sustainable Built Environment (SBE) regional conference - Expanding boundaries, Zurich, Switzerland, June 15-17 2016

Motamed A., Deschamps L., Scartezzini J.-L., Toward an Integrated Platform for Energy Efficient Lighting Control of Non-Residential Buildings, Sustainable Built Environment (SBE) regional conference - Expanding boundaries, Zurich, Switzerland, June 15-17 2016

Coccolo S., Mauree D., Kämpf J., Scartezzini J.-L., Integration of outdoor human comfort in a building energy simulation database using CityGML Energy Ade, Sustainable Built Environment (SBE) Regional Conference - Expanding Boundaries: Systems Thinking for the Built Environment, Zurich, Switzerland, June 15-17 2016

Mauree D., Coccolo S., Kämpf J., Scartezzini J.-L., Editor(s):Habert G. S. A., Multi-scale modelling to assess human comfort in urban canyons, Sustainable Built Environment (SBE) regional conference - Expanding boundaries, Zurich, Switzerland, June 15-17 2016

Mauree D., Coccolo S., Monna S., Kämpf J., Scartezzini J.-L., On the impact of local climatic conditions on urban energy use: A case study, PLEA 2016 - 36th International Conference on Passive and Low Energy Architecture, Los Angeles, USA, July 11-13, 2016

Monna S., Coccolo S., Kämpf J., Mauree D., Scartezzini J.-L., Energy Demand Analysis for Building Envelope Optimization for Hot Climate: A Case Study at AN Najah National University, PLEA 2016 - 36th International Conference on Passive and Low Energy Architecture, Los Angeles, USA, July 11-13, 2016

Coccolo S., Monna S., Kaempf J. H., Mauree D., Scartezzini J.-L., Energy demand and urban microclimate of old and new residential districts in a hot arid climate, PLEA 2016 - 36th International Conference on Passive and Low Energy Architecture, Los Angeles, USA, July 11-13, 2016

Mohajeri N., Assouline D., Guiboud B., Scartezzini J.-L., Does roof shape matter? Solar photovoltaic (PV) integration on building roofs, Zurich, June 15-17 2016; Sustainable Built Environment (SBE) regional conference, Zurich, Switzerland, June 15-17, 2016

Mohajeri N., Gudmundsson A., Kunckler T., Upadhyay G., Assouline D., Kämpf J. H., Scartezzini J.-L., How street canyon configuration control the accessibility of solar energy potential: Implication for urban design, PLEA - 36th International Conference on Passive and Low Energy Architecture. Cities, Buildings, People: Towards Regenerative Environments, Los Angeles, July 11-13, 2016

Perera A. T. D., Nik V. M., Mauree D., Scartezzini J.-L., Design optimization of electrical hubs using hybrid evolutionary algorithm, ASME 2016 10th International Conference on Energy Sustainability, Charlotte, North Carolina, USA, June 26-30, 2016

Perera A. T. D., Mauree D., Scartezzini J.-L., Nik V. M., Sensitivity of the dispatch strategy in designing grid integrated hybrid energy systems, IEEE International Energy Conference ENERGYCON 2016, Leuven, Belgium, April 4-8, 2016

Perera A. T. D., Mauree D., Scartezzini J.-L., Nik V. M., Optimum design and control of grid integrated electrical hubs considering lifecycle cost and emission, IEEE International Energy Conference ENERGYCON 2016, Leuven, Belgium, April 4-8 2016

BOOKS

J.-L. Scartezzini and A. Grêt-Regamey. Chapitre 3.8 Stratégies urbaines face au changement climatique, in Coup de projecteur sur le climat suisse - Etat des lieux et perspectives, p. 186-189, Swiss Academies Reports 11 (5), 2016.

PHD THESES

Xu R., Advisor(s): Scartezzini J.-L., Wittkopf S., Visual impact assessment of BIPV in building retrofits using saliency models, Thèse EPFL, n° 7236, 2016

INVITED PRESENTATIONS & OTHER EVENTS

Key person	Role / Title of talk	Location	Date
Kämpf, Jérôme	CityGML Energy ADE Workshop, Invited speaker	Vienna, Austria	5/16
Kämpf, Jérôme	Bartenbach Workshop, Invited speaker	Innsbruck, Austria	8/16
Mauree, Dasaraden	Built and Connect 2016 (Pôle Fibres – Energievie), Invited speaker on “Refroidir la ville, des solutaitons contre les îlots de chaleur”	Strasbourg, France	11/16
Mohajeri, Nahid	University of Sheffield Invited speaker on Sustainable Built Environment	Sheffield, UK	2/16
Mohajeri, Nahid	University of Southampton Invited speaker on Energy in the Built Environment	Southampton, UK	9/16
Mohajeri, Nahid	Chalmers University Invited speaker on Main Societal Challenge for Building Futures	Sweden	11/16
Munari Probst Maria Cristina	SI-REN Lausanne Presentation of LESO-QSV method	Lausanne, Switzerland	1/16
Munari Probst Maria Cristina	Solar Energy and Heritage Seminar, Invited speaker on architectural integration of solar energy	Stockholm, Sweden	3/16
Munari Probst Maria Cristina	Commission Romande des Déléguées à l’Energie, Presentation of LESO-QSV method	Bern, Switzerland	4/16
Munari Probst Maria Cristina	IEA Task 51 Workshop on Solar Tools, presentation of LESO-QSV method	Berlin, Germany	10/16
Munari Probst Maria Cristina	Eurosun 2016, Keynote presentation on Solar Energy & Architecture: an Integration Challenge	Palma di Mallorca, Spain	10/16
Munari Probst Maria Cristina	Théâtres de la connaissance, Speaker on Les territoires du photovoltaïque – planification des politiques solaires dans le canton de Neuchâtel	La Chaux de Fonds, Switzerland	10/16
Munari Probst Maria Cristina, Roecker Christian	Journée des conservateurs romands et tessinois, presentation of LESO-QSV method	Lausanne, Switzerland	10/16
Scartezzini, Jean-Louis	SCCER FEEB&D CTI Evaluation panel, invited talk on Building Energy Management R&D WP2	Dübendorf, Switzerland	10/16
Scartezzini, Jean-Louis	SCCER FEEB&D Peak Session 2016 Task leaders meeting, Invited talk	Olten, Switzerland	1/16
Scartezzini, Jean-Louis	NEST - SolAce Review Meeting, Invited talk	Dübendorf, Switzerland	9/16
Scartezzini, Jean-Louis	Daylight Academy Annual Conference, inauguration talk	Zürich, Switzerland	11/16
Scartezzini, Jean-Louis	NEST SolAce Unit Kick-off Meeting, invited talk	Lausanne, Switzerland	1/16

Schueler, Andreas	Conference on Science & Applications of Thin Films, Keynote speaker on Nanocomposite optical coatings for solar energy applications	Cesme, Turkey	9/16
Schueler, Andreas	12 th Conference on Advanced Building Skins, Invited keynote speaker on Innovative glazing with dynamic solar heat gains	Bern, Switzerland	10/16
Schueler, Andreas	Engineered Skins 2016 Symposium, Invited keynote speaker on Smart Materials for Energy Efficient Glazed Facades	University of Cambridge, UK	9/16
Schueler, Andreas	Swiss Nano Convention 2016, Invited keynote speaker on Nanocomposite optical coatings for solar energy applications	Basel, Switzerland	7/16
Schueler, Andreas	2. Fachkongress Energy + Bauen, Keynote speaker on Dynamisches Glas: Wie sieht das Fenster 2020/2035 aus	St. Gallen, Switzerland	5/16

EVENTS: LESO LUNCHTIME LECTURES

Title	Lecturer	Date
Promotion du solaire & protection du patrimoine: la méthode LESO-QSV - qualité, sensibilité, visibilité	Maria Cristina Munari Probst, Researcher & Lecturer EPFL, Guest Lecturer IUAV University of Venice, Italy	2.12.2016
The future of energy systems in buildings	Umberto Desideri, Full Professor of Thermal Machines at University of Pisa, Italy	11.11.2016
Can energy efficiency/saving in buildings be achieved through managed urban forms?	Manon Kohler, Postdoctoral researcher, Leibniz Institute of Urban Ecology	21.10.2016
Light management with texturized polymer-based films: applications for building integrated photo-voltaics and complex fenestration systems	Marina Gonzalez Lazo, Postdoctoral Fellow EPFL	10.6.2016
Energy efficient design solutions for the food industry	David Linford, Founder & Director, Concept Consult Architects, Lausanne	18.5.2016
Impact of lighting control systems based on "Non-Image-Forming" effects of light on electric lighting energy demand and user's comfort and performance	Marta Benedetti, Graduate Energy Engineer, University of Bolzano	2.5.2016
Micro-level rebound effect of improvements in heating efficiency	Mehdi Farsi, Professor, University of Neuchâtel	15.4.2016
Energy Efficiency in the housing sector – Retrofit potential and Performance gap analysis based on case studies in Geneva	Jad Khoury, Geneva University, Senior Research Associate	26.2.2016
Lighting Environment in Buildings - Nonvisual Light Perception and Inter-Individual Differences	Lenka Maierova, senior research associate, UCEEB, Prague, Czech Republic	15.1.2016

REPRESENTATION

EPFL INTERNAL COMMITTEES

Name	Service	Role
Scartezzini, Jean-Louis	EPFL Excellence Fellowship Committee	Committee member
Scartezzini, Jean-Louis	Architecture Section - Academic Committee	Committee member
Scartezzini, Jean-Louis	ENAC IT Strategic Committee	Committee member
Scartezzini, Jean-Louis	Smart Living Lab, Scientific committee	Committee member
Scartezzini, Jean-Louis	Solar Decathlon Academic Committee	Committee member
Scartezzini, Jean-Louis	SLL EPFL Energy and Building Faculty Position Search Committee	Committee Member
Schueler, Andreas	Architecture Section - Teaching Committee	Committee member
Schueler, Andreas	COSEC Security	Lab coordinator

EXTERNAL COMMITTEES & APPOINTMENTS

Name	Service	Role
Kostro, André	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Scientific Committee Member
Kämpf, Jérôme	IEA Task 50 "Advanced Lighting Solutions for Retrofitting Buildings"	Subtask Leader
Kämpf, Jérôme	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Scientific Committee Member
Mauree, Dasaraden	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Scientific Committee Member
Mohajeri, Nahid	Frontiers in Built Environment: Sustainable Design and Construction Journal	Associate Editor
Mohajeri, Nahid	Frontiers in Built Environment: Urban Science	Associate Editor
Mohajeri, Nahid	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Scientific Committee Member
Mohajeri, Nahid	Frontiers in Built Environment Journal Special Issue on "Energy Demand and Energy Resources in Future Cities: Approaches, Challenges and Opportunities"	Guest Editor (with Dr Vahid Nik from Lund University, Sweden)
Munari Probst, Maria C.	IEA Task 51 Solar Energy in Urban Planning	Group Leader
Munari Probst, Maria C.	Swissolar Association (Bern), Architecture Group	Member
Munari Probst, Maria C.	University IUAV of Venice, Italy	Invited professor
Scartezzini, Jean-Louis	Solar Energy International Journal	Associate Editor
Scartezzini, Jean-Louis	Int. Council for R&I in Building & Construction CIB	EPFL Representative
Scartezzini, Jean-Louis	Europ. Renew. Energy Research Centres Agency EUREC	College of Members, EPFL Repr.
Scartezzini, Jean-Louis	SCCER Future Energy Efficient Buildings and Districts	Board Member, WP Leader
Scartezzini, Jean-Louis	ProClim IPCC WG3 Mitigation of Climate Change, Bern	Expert Reviewer
Scartezzini, Jean-Louis	University of Luxembourg, Esch Belval, Luxembourg	Expert Reviewer
Scartezzini, Jean-Louis	Fond National de la Recherche Scientifique, Brussels	Expert Reviewer
Scartezzini, Jean-Louis	CLIMA 2016 Conference, Aalborg University, Denmark	Scientific Committee Member
Scartezzini, Jean-Louis	SHC Conference, Istanbul, Turkey	Scientific Committee Member
Scartezzini, Jean-Louis	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Conference Chair
Scartezzini, Jean-Louis	Energy Innovation Research Programme for Building Energy Efficiency, Building Constr. Author., Singapore	Committee Member
Scartezzini, Jean-Louis	Daylight Academy	Steering Com. Member, Speaker
Scartezzini, Jean-Louis	NEST Steering Committee	Committee Member
Scartezzini, Jean-Louis	SIA Umsicht-Regards 2017 Award	Committee Member
Scartezzini, Jean-Louis	Swiss Academy of Arts and Sciences, Energy Committee	Committee Member
Schueler, Andreas	CISBAT 2017 Internat. Conference "Future Buildings & Districts - Energy Efficiency from Nano to Urban Scale"	Scientific Committee Member

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Swiss Federal Institute of Technology Lausanne (EPFL)

School of Architecture, Civil and Environmental Engineering (ENAC)

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