SOLAR ENERGY AND BUILDING PHYSICS LABORATORY

LABORATOIRE D'ENERGIE SOLAIRE ET DE PHYSIQUE DU BÂTIMENT

LESO-PB

Activity Report 2018

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Energy Efficiency & 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 45 45
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 2018

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 three group and project leaders, the laboratory counts about 30 scientists, engineers, architects and technicians. This report presents the 2018 teaching, research and technology transfer activities of the lab.

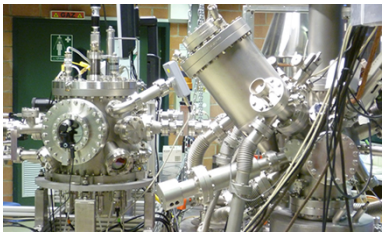
LIST OF CONTENTS

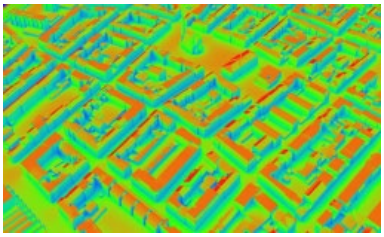
RESEARCH

INTRODUCTION

The research activities of the EPFL 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 2018, structured along the following priority axes:

- Integrated day and electric lighting
- Nanotechnology for solar energy conversion
- Urban data mining, artificial intelligence and simulation
- Smart buildings / Smart cities
- Building integration of renewable energy





Research highlights in 2018 - Shaping a more sustainable future

- A unique Scanning Tunneling Microscope (STM) was set up thanks to funding by ENAC and STI schools and many man-hours of work. The STM allows investigating the topography of surfaces with atomic resolution as well as the electronic properties of nanocrystalline thin films on the nanometric scale.
- A general data-driven approach, combining Geographic Information Systems (GIS) and Machine Learning (ML) methods, was developed to map the large-scale energy potential for three renewable sources: wind energy (using horizontal axis wind turbines), geothermal energy (using very shallow ground source heat pumps) and solar energy (using solar photovoltaic panels over rooftops). The results are highly promising and methods are widely applicable.
- Access was obtained to CADMOS facilities for high performance computing, which opens up new perspectives for data driven machine learning in the framework of our research on Big Data.
- The NEST SolAce pilot unit, inaugurated in September, was built in collaboration with Lutz Architects and EMPA. This Energy-Plus and Low Carbon combined working/living space showcases and tests several multi-functional facade technologies developed by the EPFL in partnership with industrial partners. All technologies will undergo monitoring and performance analysis.

Awards & Distinctions

- Jing Gong, André Kostro, Jean-Louis Scartezzini and Andreas Schüler received the best paper award in non-imaging optics for their paper “Feasibility study on a novel daylighting system with embedded micro compound parabolic concentrators (CPCs)”, presented at the SPIE Optical Engineering & Applications Conference of 19-20 August 2018, in San Diego, CA, USA .
- A.T.D. Perera, Silvia Coccolo, Jean-Louis Scartezzini and Dasaraden Mauree won the Applied Energy ICEA outstanding paper award for 2017. The paper "Quantifying the impact of urban climate by extending the boundaries of urban energy system modeling" was one in 8 out of 800 selected for an award by the Applied Energy Editorial Board.
- Sara Torabi Moghadam received a best PhD thesis in Urban & Regional Development award for her PhD thesis on “Multi-Criteria Spatial Decision Support System for Urban Energy Planning”, carried out partly at LESO-PB/EPFL and supervised by Dasaraden Mauree.
- Prof. Jean-Louis Scartezzini was elected Member of the new Extended Energy Commission of the Swiss Academy of Arts and Sciences (a+).

INTEGRATED DAYLIGHTING AND ELECTRIC LIGHTING

Group leader: Prof. Jean-Louis Scartezzini
Senior Scientist: Prof. Jérôme Kämpf (HEIA-FR)
PhD students: Yujie Wu, Marta Benedetti

The embedded photometric device assessing work-plane illuminance based on sky monitoring.

The Integrated Daylighting 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) daylighting systems have been developed by the group. Furthermore, a bidirectional transmission goniophotometer based on digital imaging allows assessing the characteristics of complex fenestration systems. A photobiological laboratory completes the equipment and, more recently, advanced monitoring devices were developed both for real-time outdoor and indoor photometric and glare risk monitoring.

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 ergonomic daylighting test modules
- High-resolution mapping of the sky and ground vault
- Visual comfort monitoring devices

2018 Activities

In the framework of Module “Building Human Interaction” of the Swiss Competence Center for Energy Research “Future Energy Efficient Buildings and Districts”, R&D in 2018 focused mainly on improving daylighting and electric lighting control systems through human centric daylight sensors and real-time on-board lighting simulation by means of an embedded device for high resolution mapping of the sky and ground vault.

A high dynamic range vision sensor developed at LESO-PB and CSEM was installed in the NEST SolAce pilot unit in Dübendorf where it is now undergoing validation and fine-tuning.

Furthermore, an embedded device for high resolution mapping of the sky and ground vault was developed and fine-tuned in testbeds located at EPFL and in Berkeley National Lab in the USA.

Research results in the field of day and electric lighting are fully integrated in smart building control systems.

Current Projects

SCCER FEEB&D Phase II, Task 1.2.2 Automated "Eyesight" Venetian Blinds
Funding: Commission for Technology and Innovation (CTI)
Duration: 2017- 2020

External Venetian Blinds (EVB) are prevalently used to manage daylight and solar radiation in dwellings and office buildings. Automation of the blinds can enhance occupants' visual comfort and achieve energy savings regarding electric lighting as well as cooling/heating load. In this task, an integrated 'open-loop' automated EVB system is developed by implementing a digital camera in the outer part of a window frame, pointing toward the sky vault. Issues of traditional 'close-loop' systems such as installing separate indoor sensors in the working space will be avoided by that way. Based on image processing and lighting computations, glare risks and luminance distribution (horizontally and vertically) in the room are evaluated in order to satisfy occupants' visual comfort. Both algorithms will be implemented in an ultra-fast microprocessor for real-time calculation in the system embedded in the window frame.

NEST SolAce | REcomfort - Perception based Human Comfort and Multi-Functional Solar Facade
Funding: ETH Board
Duration: 2017-2020

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 are investigated by EPFL Researchers and their industrial partners in the SolAce | REcomfort unit: multifunctional facade technologies are implemented to achieve an Energy-Plus and Low Carbon combined working/living space.

Recent PhD theses in this domain

- Integrated Daylighting and Artificial Lighting Control based on High Dynamic Range Vision Sensors, *Ali Motamed, EPFL PhD Thesis #8277, 2017*
- 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 SCIEX 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, *Apiparn Borisuit, EPFL PhD thesis #6007, 2013*
- Energetic, visual and non-visual aspects of office lighting, *Friedrich Linhart, EPFL PhD Thesis #4587, 2010*

Recent publications

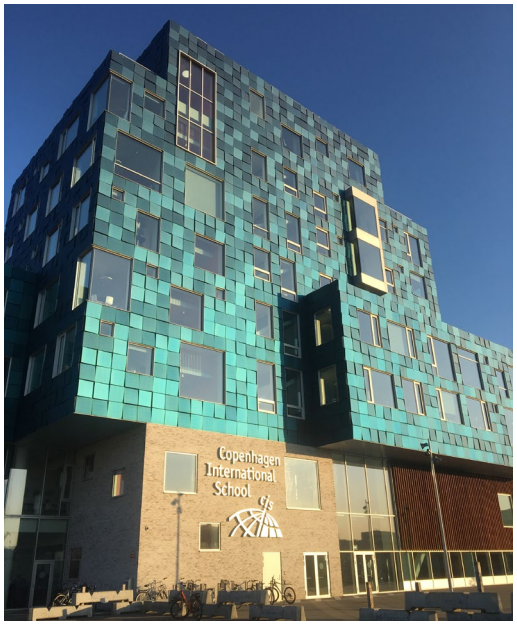
- Maierova L., Borisuit A., Scartezzini J., Munch M., Dynamics of Subjective Thermal Comfort and Skin Temperatures Under Self-Selected (Day-) Lighting Conditions, in Neuropsychobiology, vol. 76, no 1, p.23-23 , 2018
- Benedetti M., Scartezzini J., Munch M., Cajochen C., Motamed A., Integration of Non-Image-Forming (NIF) Effects of Light in Venetian Blinds and Electric Lighting Control, in Neuropsychobiology , vol. 76, no 1, 2018

Patents

- Sky monitoring system, WO/2019/030639, Wu, Yujie; Kämpf Jérôme Henri; Scartezzini, Jean-Louis

NANOTECHNOLOGY FOR SOLAR ENERGY CONVERSION

Group leader: Dr Andreas Schüler
PhD students: Olivia Bouvard, Jing Gong, Anna Krammer, Jérémy Fleury, Djamel Mansour (FhG-ISE, Germany)
Research assistants: Luc Burnier, Alexandre Diévart
Host scientist: Dr André Kostro (BASF)



Copenhagen International School with solar cladding based on technology patented by LESO-PB

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 Conversion" 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.

We focus especially on smart materials, such as thermochromic selective solar absorber coatings, and electrochromic coatings for switchable windows. Further applications include novel microstructured glazing with strong seasonal dependence of the solar heat gains, photoluminescent quantum dot solar concentrators for photovoltaic energy conversion, antireflection coatings on solar collector glazing, colored coatings with high solar transmittance for novel glazing of photovoltaic facades, selective solar absorber coatings for thermal solar collectors and thermoelectric power generation, as well as novel insulating glazing with high transmittance for the microwaves of mobile communication.

The group carries out fundamental research on novel nano-composite materials and thin film materials and pro-motes 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

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

2018 Activities

Highlights of this year include:

- Inauguration of the novel UHV Scanning Tunneling Microscope STM
- Best Paper Award in Non-Imaging Optics SPIE 2018
- Novel electrochromic devices based on solid ion conductors and *in-vacuo* lithiation, leading to future all-solid-state electrochromic windows with improved lifetime and quality, completion of a PhD thesis on the topic
- Inauguration of the NEST module Solace, showcasing several innovative developments of our group: coloured photovoltaics, coloured solar thermal collectors, insulating glazing with high transmission for the waves of mobile communication, and soon also microstructured glazing for daylight management

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 stagnation of solar thermal collectors lead to water evaporation, glycol degradation and stresses as well as degradation of collector component materials. In this project, thermochromic coatings that exhibit a change in optical properties at critical temperatures are further developed. The effect of doping on the transition temperature is studied. Multi-layered coatings for maximised performance are developed, applications explored, and promising fields for market introduction identified.

Reduzierung des Heizenergiebedarfs von Bahnfahrzeugen durch verbesserte Wärmedämmung der Fahrzeughülle
Funding: Swiss Federal Office of Energy (SFOE)
Duration: 2017-2019
To reduce electricity consumption in rail transport, a large project with multiple partners including LESO-PB investigates all relevant aspects of vehicle envelopes. Based on Phase I of this project, which included the development of insulation glazing transparent to microwaves used in mobile networks (Windowave), a prototype train wagon is installed, monitored and compared to a reference train.

SCCER FEEB&D Phase II, Task 1.1.2 Glazing with dynamic solar heat gains
Funding: Commission for Technology and Innovation (CTI)
Duration: 2017-2020
Novel glazing with dynamic solar heat gains is developed applying two approaches: the development of light-redirecting microstructures that allow a clear view while providing seasonal thermal control and visual comfort and the development of nanostructured electrochromic materials with enhanced switching speed and durability.

High-performance solar cooker (Project in collaboration with Urban Systems group)
Funding: ENAC Enable-InnoSeed Program
Duration: 2017-18
In this project, a new, high-efficiency solar cooker is developed with the aim of market introduction. Its novelty resides in the combination of high thermal performance glazing with low-emissivity coating, high window-to-wall surface ratio, vacuum insulation and a foldable high reflectivity concentration system.

Selected 2018 publications

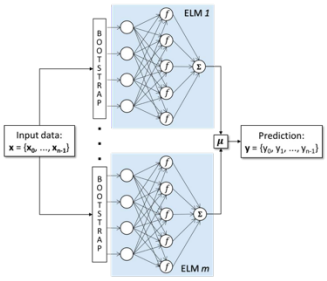
- Gong J., Delaunay A., Kostro A., Schüler A., Development of a novel mechanical micro-engraving method for the high-aspect-ratio microstructures of an advanced window system, in Microelectronic Engineering, vol. 191, p.48-53 , 2018
- Bouvard O., Burnier L., Oelhafen P ., Tonin A ., Wüst P ., Sidler F ., Zweifel G ., Schüler A ., Solar heat gains through train windows: a non-negligible contribution to the energy balance, in Energy Efficiency , 2018
- Krammer A., Demiere F. T., Schüler A., Infrared Optical Properties of Doped and Pure Thermochromic Coatings for Solar Thermal Absorbers, SWC2017/SHC2017, Abu Dhabi (2018)
- Gong J., Kostro A., Scartezzini J.-l., Schueler A., Feasibility study on a novel daylighting system with embedded micro compound parabolic concentrators (CPCs), Conference on Nonimaging Optics - Efficient Design for Illumination and Solar Concentration XV, San Diego, CA, Aug 19-20, 2018
- Gong J., Violakis G., Infante D., Hoffmann P., Kostro A., Schüler A., Microfabrication of curved sidewall grooves using scanning nanosecond excimer laser ablation, SPIE LASE 2018, San Francisco, California, United States, 27 January-1 February 2018
- Oliva N., Casu E. A., Yan C., Krammer A., Magrez A., Schueler A., Martin O., Ionescu M. A., MoS2/VO2 vdW heterojunction devices: Tunable rectifiers, photodiodes and field effect transistors, IEDM, San Francisco, California, USA, December 2-6, 2017 (2018)
- Gong J., Kostro A., Schüler A., Towards novel glazing with seasonal dynamics based on micro compound parabolic concentrators, ISES Solar World Congress 2017, Abu Dhabi, UAE, 29.10.-2.11.17 (2018)

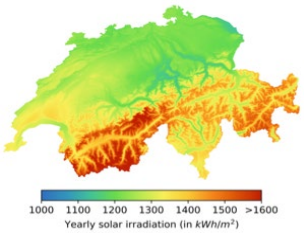
Patents

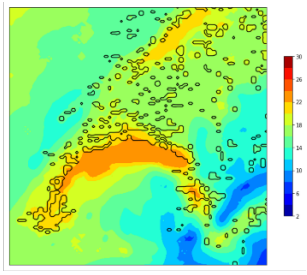
- WO2017134589 A1: Coating for optical and electronic applications
- EP2882921: Glazing with embedded microstructures for daylighting and seasonal thermal control
- WO 2014045141 A2: Laminated glazing with coloured reflection and high solar transmittance suitable for solar energy systems
- WO 2014045144 A1: Interference filter with angular independent orange colour of reflection and high solar transmittance, suitable for roof-integration of solar energy systems

URBAN DATA MINING, ARTIFICIAL INTELLIGENCE & SIMULATION

Topic leaders: Dr Dasaraden Mauree / Dr Roberto Castello
Post-doctoral fellow: Dr Silvia Coccolo
PhD students: Amarasinghage T. Dasun Perera, Dan Assouline, Alina Walch
in collaboration with: Prof. Vahid Nik (Lund/Chalmers University), Dr Nahid Mohajeri (Oxford University)







Mean monthly 2m air temperature (°C) at 05.00

The group studies urban systems through their physical processes, by modelling their dynamics and their renewable energy potential in order to improve their environmental sustainability.

Urban systems are analysed in depth to account for the numerous interactions occurring between the elementary building objects and the natural environment in relation to the changing availability of energy resources. The impact of climate change on the energy demand in the future and the influence of urban planning scenarios are assessed. Furthermore, the group works on the integration of decentralized energy systems in urban areas.

Machine learning algorithms and simulation tools are applied to model the spatio-temporal variability of renewable energy potential and energy demand in the built environment. They rely on the large amount of data, satellite imagery and remote sensing mostly accessible via open access databases. Combined with state-of-the-art deterministic models, they are used to model environmental variables in the urban canopy, to measure the uncertainty associated to predictions, and to forecast their long-term evolution.

Published work relates to

- Building energy demand in urban settings
- Distributed energy systems
- Multi-scale modelling of urban energy fluxes
- Big Data and Machine Learning methods for renewable energy potential
- Urban microclimatology
- Statistical modelling of the built environment
- GIS (Geographic Information Systems) and spatial data analysis

2018 Activities

The Urban Systems Simulation group was involved in multiple projects and initiatives, within the framework of the Swiss Competence Center for Energy Research - Future Energy Efficient Buildings and Districts (SCCER-FEEB&D) and the Swiss National Science Foundation PNR 75 series of projects. Its main focal points were urban microclimate, distributed energy systems, renewable energy potential estimate using Big Data, urban planning and climate change impacts.

Current Projects

SCCER FEEB&D Phase II, Task 2.3.1 Analysis and assessment of RDES cases
Funding: Innosuisse/ Duration: 2017- 2018
Development of new modelling tools and transfer of findings into practice with the assessment of demonstrators and applications in typical project cases. Renewable decentralised energy systems (RDES) require new integrated energy system solutions. Multi-energy grid (MEG) and energy hub (EH) are expected to help facilitate their effective operation and integration. The purpose of this project is to analyse and assess RDES cases with a quantitative illustration of the energy and emission reduction potentials using RDES solutions with MEG/EH and comparing with conventional or alternative approaches.

SCCER FEEB&D Phase II, Module 3.2 Spatio-temporal renewable energy modeling
Funding: Innosuisse / Duration: 2017-2020
We develop a novel methodology combining Geographic Information Systems (GIS) and a Machine Learning (ML) algorithm, Random Forests, to estimate the technical potential for rooftop PV solar energy at the scale of a country. The study focuses on Switzerland and provides the rooftop PV technical potential for each pixel of a grid covering the entire country. It is generalizable to any region for which similar data is available. Prediction Intervals are also provided to measure the uncertainty of estimations.

MOTUS
Funding: ENAC Equipment call / Duration: 2016-2019
A 27m mast with instruments at a regular interval (4m) along the vertical axis to obtain a high-resolution profile of meteorological parameters was installed in 2016. The installation was completed with 6 additional anemometers on the LESO-PB south façade to improve the understanding of turbulent processes and the automated control of blinds. Extension for its funding was obtained until December 2019.

HYENERGY - Hybrid renewable energy potential for the built environment using big data
Funding: Swiss National Science Foundation – National Research Program 75 "Big data" / Duration: 2017-2020
Development of a method for forecasting the spatio-temporal potential of a combination of renewable energy sources for built areas. A data-driven approach and machine learning algorithms are used to (i) estimate the hybrid renewable energy potential in the built environment, in order to mitigate the effects of variability in individual energy resources and improve the reliability of power generation, (ii) process & analyse spatio-temporal environmental data, (iii) apply developed algorithms to the built environment for predicting energy generation, (iv) analyse forecasting models, (v) estimate uncertainty & validate models using measurement data, and (vi) propose a Building Renewable Energy Database (BRED), geo-visualisation tools and renewable energy mapping to support evidence-based decision-making processes.

Integrating urban form and sociotechnical potentials of decentralised energy supply for sustainable urban development
Funding: SNSF – Advanced Postdoc Mobility Fellowship Dr Nahid Mohajeri (University of Oxford)
Duration: 2017-2019
The project aims to refine our knowledge of the resource and PV potential for Switzerland with application to other areas and to analyse how solar energy technologies and associated acceptance and affordability evolve together and how this may affect sustainable urban development and energy policies.

Selected 2018 publications

- Assouline D., Mohajeri N., Scartezzini J., Large-scale rooftop solar photovoltaic technical potential estimation using Random Forests, in Applied Energy, vol. 217, p.189-211 , 2018
- Mauree D., Blond N., Clappier A., Multi-scale modeling of the urban meteorology: Integration of a new canopy model in the WRF model, in Urban Climate, vol. 26, p.60-75 , 2018
- Mauree D., Coccolo S., Perera A., Nik V., Scartezzini J.-L., Naboni E., A New Framework to Evaluate Urban Design Using Urban Microclimatic Modeling in Future Climatic Conditions, in Sustainability, vol. 10, num. 4, p.1134 , 2018
- Perera A.T.D., Coccolo S., Scartezzini J.-L., Mauree D., Quantifying the impact of urban climate by extending the boundaries of urban energy system modeling, Applied Energy, vol.222, p.847-860 , 2018
- Coccolo S., Kämpf J. H., Mauree D., Scartezzini J.-L., Cooling potential of greening in the urban environment, a step further towards practice, in Sustainable Cities and Society , 2018
- Mohajeri N., Assouline D., Guiboud B., Bill A., Gudmundsson A., Scartezzini J.-L., A city-scale roof shape classification using machine learning for solar energy applications, in Renewable Energy, vol.121, 2018
- Le Guen M., Mosca L., Perera A.T.D., Coccolo S., Mohajeri N., Scartezzini J.-L., Improving the energy sustainability of a Swiss village through building renovation and renewable energy integration, in Energy and Buildings, vol. 158, p.906-923, 2018
- Honeck, E., Castello, R., Chatenoux, B., Richard, J.-P., Lehmann, A., Giuliani, G. From a Vegetation Index to a Sustainable Development Goal Indicator: Forest Trend Monitoring Using Three Decades of Earth Observations across Switzerland, ISPRS International Journal of Geo-Information. 2018;7(12):455

SMART BUILDINGS / SMART CITIES

Group leader: Prof. Jean-Louis Scartezzini
Post-doctoral fellow: Dr Ali Motamed
PhD student: Marta Benedetti

NEST SolAce Pilot unit

Smart 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 smart controllers are evaluated in the LESO building, which represents a powerful tool for this 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 control systems.

2018 Activities

HDR vision sensors developed in the framework of Ali Motamed's PhD thesis and further developed in collaboration with CSEM were integrated in a sun shading and electric lighting control platform in the NEST SolAce pilot unit at EMPA in Dübendorf. to measure photometric variables in a workspace: (i) the daylight glare probability experienced by the user and (ii) the workplane horizontal illuminance. Tests for multiple users were set up and contacts were established with industrial partners and research institutions for their further implementation and development.

Furthermore, work progressed on a system set to integrate the non-image-forming effect of light in venetian blind and electric lighting control.

Current Projects in Smart Buildings

SCCER FEEB&D Phase II, Task 1.2.1 - High Dynamic Range (HDR) Vision Sensing Technology
Funding: Commission for Technology and Innovation (CTI)
Duration: Phase II 2017-2018

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 should allow reaching energy self-sufficiency for lighting systems. In Phase I of this project, a high dynamic range (HDR) vision sensor was configured for use in a sun shading and electric lighting control platform, and its suitability for luminance measurements in a working environment as well as for glare risks assessment based on the Daylight Glare Probability was validated. In Phase II, sensing devices will be further refined and adapted to the needs of the lighting and shading industry. The controllers will undergo field testing in diverse testbeds.

NEST SolAce | REcomfort - Perception based Human Comfort and Multi-Functional Solar Facade
Funding: ETH Board
Duration: 2017-2020

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 are investigated by EPFL Researchers and their industrial partners in the SolAce | REcomfort unit: multifunctional facade technologies are implemented to achieve an Energy-Plus and Low Carbon combined working/living space.

Recent PhD theses in this domain

- Integrated Daylighting and Artificial Lighting Control based on High Dynamic Range Vision Sensors, *Ali Motamed, EPFL PhD Thesis #8277, 2017*
- Novel models towards predictive control of advanced building systems and occupant comfort in buildings, *Nikos Zarkadis, EPFL PhD Thesis #6440, 2015*
- Probabilistic Bottom-Up Modelling of Occupancy and Activities to Predict Electricity Demand in Residential Buildings, *Urs Wilke, EPFL PhD Thesis #5673, 2013*
- On the adaptation of building controls to the envelope and the occupants, *David Daum, EPFL PhD Thesis #4935, 2010*
- Towards a unified model of occupants' behaviour and comfort for building energy simulation, Frédéric Haldi, *EPFL PhD Thesis #4935, 2010*
- Bayesian optimisation of visual comfort, *David Lindeloef, EPFL PhD Thesis #3918, 2007*
- Simulating occupant presence and behaviour in buildings, *Jessen Page, EPFL PhD Thesis #3900, 2007*

Patents

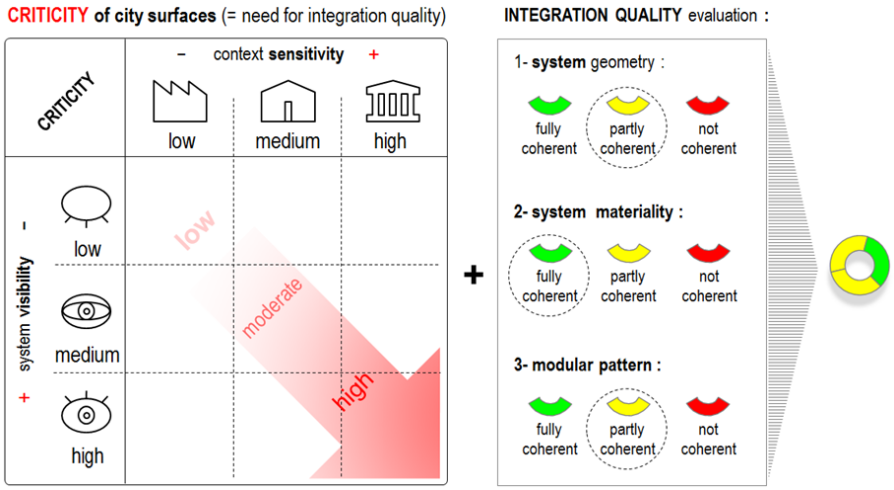
- WO2017216623 (A2) Motamed A., Deschamps L., Scartezzini J.-l., Lighting control system, 2017

2018 Publications

- Motamed A., Deschamps L., Scartezzini J.-L., Novel miniaturized indoor glare sensor for human centric control of shading and lighting system, Licht 2018, 9-12 September 2018, Davos

BUILDING INTEGRATION OF RENEWABLE ENERGIES

Group leader: Prof. Jean-Louis Scartezzini
Senior advisers: Dr Maria-Cristina Munari Probst, MSc. Christian Roecker (Cap77 sàrl)
PhD student: Pietro Florio



QSV method

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 criticity maps)
- Development of new adapted solar products, conceived for building integration
- Development and promotion of architects' and solar product manufacturers' knowledge on solar integration issues / available solar technologies / integration criteria

2018 Activities

In collaboration with HEIA-FR and industry partners, LESO-PB led the design of an R&D pilot unit in the NEST experimental building inaugurated at EMPA Dübendorf. Called SolAce and inaugurated on September 28th, 2018, it features multi-functional facade technologies to be tested and monitored in order to achieve an Energy-Plus and Low Carbon combined working/living space.

Furthermore, Pietro Florio obtained a PhD for his thesis entitled "Towards a GIS-based Multiscale Visibility Assessment Method for Solar Urban Planning", in which he explores the urban integration potential of solar systems as a function of insolation, urban context sensitivity and visibility.

The group also actively participated in the kick-off phase of the upcoming IEA Task "Solar energy in neighborhood planning", with Pietro Florio as group leader.

Other thematic focuses included social issues related with the energy transition, such as energy poverty.

Current Projects

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 are investigated by EPFL Researchers and their industrial partners in the SolAce|REcomfort building unit of the test building NEST set up at EMPA in Dübendorf: multi-functional facade technologies are implemented to achieve an Energy-Plus and Low Carbon combined working/living space.

LESO QSV Method
Funding: EPFL ENAC INNOSEED
Duration: 2017-2018
The QSV method developed at LESO-PB to help improving the architectural quality of active solar installation projects was to be transferred to practice. Courses and information meetings were held. The developed 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.

2018 Publications

- Florio P., Munari Probst M. C., Schüler A., Roecker C., Scartezzini J.-L., Assessing visibility in multi-scale urban planning: A contribution to a method enhancing social acceptability of solar energy in cities, in Solar Energy, vol. 173, p.97-109 , 2018-10-01
- Florio P., Coccolo S., Perera A. T. D., Scartezzini J.-L., Matching visual impact, solar energy production potential and energy system optimization for an enhanced solar integration. An experience with a novel pre-design tool, PLEA 2018: Smart and Healthy Within the Two-Degree Limit, Hong-Kong, December 10-12, 2018

PhD theses in this field

- Florio P., Advisor(s): Scartezzini J.-L., Munari Probst M. C., Towards a GIS-based Multiscale Visibility Assessment Method for Solar Urban Planning, EPFL Thesis n° 8826, 2018
- Munari Probst M.D., Advisor(s): Scartezzini J.-L., Architectural integration and design of solar thermal systems, EPFL thesis n° 4258, 200

EDUCATION AND TEACHING

2018 COURSES AND STUDENT FIGURES

Bachelor/Master Programmes

Course title	Lecturer	Students	Student numbers
Building Physics	Prof. J.-L. Scartezzini, Dr A. Schueler	AR BA1	218
Building Physics II	Dr A. Schueler	AR BA2	168
Building Physics III	Dr A. Kostro	AR BA3	168
Building Physics IV	Dr A. Kostro	AR BA4	179
Building Physics V	Prof. J.-L. Scartezzini, S. Coccolo, P. Florio	AR BA5	106
Building Physics VI	Prof. J.-L. Scartezzini, S. Coccolo, P. Florio	AR BA6	103
Quartiers, infrastructures et aménagement durable	Prof. J.-L. Scartezzini, Dr S. Coccolo, Dr D. Mauree et al.	AR/GC / ENAC BA6 (ENAC Learning Units)	22
Master projects	Prof. J.-L. Scartezzini et al.	AR-MA, MT-MA	124

ADVISING

PhD

Name	Title	Advisers	End
Fleury, Jeremy	Transparent nanomeshes for smart windows	Prof. J.-L. Scartezzini; Dr A. Schueler	2022
Walch, Alina	A data-driven methodology for the estimation of hybrid renewable energy potentials for the built environment in Switzerland	Prof. J.-L. Scartezzini; Dr N. Mohajeri (Oxford University)	2021
Mansour, Djamel (FhG-ISE)	Solartrain – Analysis of PV modules parameters and their correlation to degradation models	Prof. J.-L. Scartezzini; Dr A. Schueler	2021
Benedetti, Marta	Integration of Non-Image-Forming effects of light in venetian blinds and electric lighting control	Prof. J.-L. Scartezzini; Dr M. Münch (La Charité)	2020
Gong, Jing	Novel glazing with strong seasonal dynamics	Prof. J.-L. Scartezzini Dr A. Schueler	2019
Krammer, Anna	Thermochromic films for smart solar energy applications	Prof. J.-L. Scartezzini Dr A. Schueler	2019
Wu, Yujie	Self-sufficient lighting systems	Prof. J.-L. Scartezzini	2019
Perera, A.T.D.	Modelling and assessment of urban energy systems	Prof. J.-L. Scartezzini Dr V. Nik (Lund Univ.)	2019
Assouline, Dan	Geo-dependent energy supply in relation to urban form	Prof. J.-L. Scartezzini Dr N. Mohajeri	2019
Bouvard, Olivia	Novel materials for switchable windows	Prof. J.-L. Scartezzini Dr A. Schueler	2019
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
Torabi Moghadam, Sara (Politecnico di Torino)	Integrated GIS-based urban energy modelling with multi-criteria analysis	Dr D. Mauree	2018

Master Theses

Student/Institution	Title	Section	LESO-PB Supervisors
Chatelain, Timothée	Solar cooking potential in Switzerland : nodal modelling and optimization	GM-PME	Schueler Andreas ; Mauree Dasaraden
Fournier, Vincent	Comparaison des coûts face à l'impact environnemental entre travaux de rénovation sur l'enveloppe et changement de vecteur énergétique de plusieurs projets immobiliers à Genève	EME-PME	Florio, Pietro ; Scartezzini, Jean-Louis
Labedens, Sylvain (Institut Supérieur Aquitain, FR)	Effects of future urban planning on the Urban Heat Island intensity		Mauree, Dasaraden Scartezzini, Jean-Louis
Mori, Giovanni (Free Univ. Bozen & Univ. of Brescia, IT)	Assessment of CO2 emissions on EPFL campus		Castello, Roberto; Coccolo, Silvia; Scartezzini, Jean-Louis
Siraganyan, Karni	Strategies to maximise the autonomy of neighbourhoods with integration of renewable energies – Case study Weidmatt Basel and Eglantine (Morges)	SIE PMH	Mauree, Dasaraden; Scartezzini, Jean-Louis
Dodin, William	La morphogénèse haussmannienne	AR-PM	Scartezzini, Jean-Louis
Handley, Martin	Un « Data Island » dans la mer du Nord : une reconsidération des processus métaboliques sociaux au-delà de nos villes	AR-PM	Scartezzini, Jean-Louis
Hoffmeyer, Matthieu	Sauvegarde et extension d'un groupe scolaire CROCS. Le complexe des Bergières à Lausanne (M. Lévy, B. Vouga, 1968-75)	AR-PM	Scartezzini, Jean-Louis
Perrier, Clément Perrier, Delphine	La Chevallière, sauvegarde et extension d'un spécimen de l'habitat intermédiaire français des années 70	AR-PM	Scartezzini, Jean-Louis

Semester projects

Student/Institution	Title	Section	LESO-PB Supervisors
Bonsack, Loïc	Magnetron sputtering of La0.7Sr0.3MnO3 perovskite type thermochromic thin films	MX1	Schueler Andreas
Delannoy, Louis	European Climatic Projections Assessing energy demand (present & 2050 horizon) and optimizing energy supply over European capitals typical city centers	EME MA3	Perera, A.T.D.; Coccolo, Silvia; Mauree, Dasaraden
Houmani, Cynthia Krafess, Ismaël	Planning for climate friendly urban energy and greening infrastructures	EME MA1	Perera, A.T.D.; Coccolo, Silvia; Mauree, Dasaraden
Lemoine, Bruno	Development of smart solar collector material by vacuum deposition	EME MA1	Krammer, Anna ; Schueler, Andreas
Lüchinger, Richard (HSLU)	Effectiveness of industry collaborations in our research projects		Schueler, Andreas
Mancini, Gianluca Nutta, Tullio Zhang, Tianchu	Feature analysis for modelling of wind turbulence in the built environment	IN-H / GM-MA3	Castello, Roberto; Mauree, Dasaraden
Proby, Adrien	Optimization of deposition conditions of solid ion conductor for electrochromic devices	MTE MA2	Bouvard, Olivia; Schueler, Andreas
Puri, Salil	European Climatic Projections	EME MA2	Perera, A.T.D.; Coccolo, Silvia; Mauree, Dasaraden
Roquette, Simon Esguerra, Martin Guerra Alejos, Adrian	PV recognition in aerial images using Convolutional Neural Networks	SC MA2	Castello, Roberto
Schneiter, Marc	Measurement of turbulence in an urban setup and its impact on energy consumption	MA MA2	Mauree, Dasaraden

Apprentices and Trainees

Student/Visitor	Domain	Programme/Institution
Di Giacomo, Théo	IT Intern	ETML
Divià, Michael	IT Apprentice	EPSIC
Loup, Matthias	IT Intern	HEIA FR
Gomes, André Miguel	IT Intern	ETML
Santa Cruz Paz, Alejandro	IT Apprentice	EPSIC
Stoll Alexandre	IT Apprentice	EPSIC
Hofmann, Vincent	Civilist	CIVI
Deschamps, Justine	Student intern	UNIL

Visiting scholars, interns and grant holders

Student/Visitor	Domain	Programme/Institution
Daviran, Samaneh	Research in Solar absorber coatings for collectors	Swiss Confederation Grant, Tehran University, IR
Ferrini, Rolando	Lecture on solid-state lighting	CSEM, CH
Lemarchand, Philippe	Exchange and lecture on Key enabling technologies for smart and adaptive windows	Dublin Institute of Technology, IR
Maierova, Lenka	Consulting with regard to daylight studies with humans	Czech Technical University in Prague, CZ

PUBLICATIONS 2018

REFEREED SCIENTIFIC JOURNALS

E. Honeck; R. Castello; B. Chatenoux; J.-P. Richard; A. Lehmann et al. : **From a Vegetation Index to a Sustainable Development Goal Indicator: Forest Trend Monitoring Using Three Decades of Earth Observations across Switzerland**; *ISPRS International Journal of Geo-Information*. 2018-11-24. DOI : 10.3390/ijgi7120455.

P. Florio; M. C. Munari Probst; A. Schüler; C. Roecker; J.-L. Scartezzini : **Assessing visibility in multi-scale urban planning: A contribution to a method enhancing social acceptability of solar energy in cities**; *Solar Energy*. 2018-10-01. DOI : 10.1016/j.solener.2018.07.059.

D. Mauree; N. Blond; A. Clappier : **Multi-scale modeling of the urban meteorology: Integration of a new canopy model in the WRF model**; *Urban Climate*. 2018-08-24. DOI : 10.1016/j.uclim.2018.08.002.

J. Gong; A. Delaunay; A. Kostro; A. Schüler : **Development of a novel mechanical micro-engraving method for the high-aspect-ratio microstructures of an advanced window system**; *Microelectronic Engineering*. 2018-05-05. DOI : 10.1016/j.mee.2018.01.032.

A. Perera; S. Coccolo; J.-L. Scartezzini; D. Mauree : **Quantifying the impact of urban climate by extending the boundaries of urban energy system modeling**; *Applied Energy*. 2018-04-24. DOI : 10.1016/j.apenergy.2018.04.004.

D. Mauree; S. Coccolo; A. Perera; V. Nik; J.-L. Scartezzini et al. : **A New Framework to Evaluate Urban Design Using Urban Microclimatic Modeling in Future Climatic Conditions**; *Sustainability*. 2018-04-10. DOI : 10.3390/su10041134.

O. Bouvard; L. Burnier; P. Oelhafen; A. Tonin; P. Wüst et al. : **Solar heat gains through train windows: a non-negligible contribution to the energy balance**; *Energy Efficiency*. 2018-03-06. DOI : 10.1007/s12053-018-9643-7.

S. Coccolo; J. H. Kämpf; D. Mauree; J.-L. Scartezzini : **Cooling potential of greening in the urban environment, a step further towards practice**; *Sustainable Cities and Society*. 2018-01-31. DOI : 10.1016/j.scs.2018.01.019.

A. T. D. Perera; P. U. Wickramasinghe; J.-L. Scartezzini; V. M. Nik : **Integrating Renewable Energy Technologies into Distributed Energy Systems Maintaining System Flexibility**; *2018 5th International Symposium on Environment-Friendly Energies and Applications (EFEA)*. 2018. DOI : 10.1109/EFEA.2018.8617046.

S. T. Moghadam; S. Coccolo; G. Mutani; P. Lombardi; J. L. Scartezzini et al. : **A new clustering and visualization method to evaluate urban energy planning scenarios**. 2018. DOI : 10.31224/osf.io/b9znk.

S. Labedens; J. L. Scartezzini; D. Mauree : **Modeling the effects of future urban planning scenarios on the Urban Heat Island in a complex region**. 2018. DOI : 10.31223/osf.io/c8mzb.

F. Guignard; D. Mauree; M. Kanevski; L. Telesca : **Wavelet variance scale-dependence as a dynamics discriminating tool in high-frequency urban wind speed time series**. 2018.

S. Gou; V. Nik; J. Scartezzini; Q. Zhao; Z. Li : **Passive design optimization of newly-built residential buildings in Shanghai for improving indoor thermal comfort while reducing building energy demand**; *ENERGY AND BUILDINGS*. 2018. DOI : 10.1016/j.enbuild.2017.09.095.

D. Assouline; N. Mohajeri; J. Scartezzini : **Large-scale rooftop solar photovoltaic technical potential estimation using Random Forests**; *APPLIED ENERGY*. 2018. DOI : 10.1016/j.apenergy.2018.02.118.

S. Mertin; T. Lanzlinger; C. Sandu; J. Scartezzini; P. Muralt : **Combinatorial study of low-refractive Mg-F-Si-O nano-composites deposited by magnetron co-sputtering from compound targets**; *APPLIED SURFACE SCIENCE*. 2018. DOI : 10.1016/j.apsusc.2017.10.229.

S. Coccolo; D. Pearlmutter; J. H. Kämpf; J.-L. Scartezzini : **Thermal Comfort Maps to estimate the impact of urban greening on the outdoor human comfort**; *Urban Forestry & Urban Greening*. 2018. DOI : 10.1016/j.ufug.2018.08.007.

T. Q. Nguyen; D. Weitekamp; D. Anderson; R. Castello; O. Cerri et al. : **Topology classification with deep learning to improve real-time event selection at the LHC**. 2018.

E. A. Casu; A. A. Muller; M. Fernandez-Bolanos; A. Fumarola; A. Krammer et al. : **Vanadium Oxide Bandstop Tunable Filter for Ka Frequency Bands Based on a Novel Reconfigurable Spiral Shape Defected Ground Plane CPW**; *IEEE Access*. 2018. DOI : 10.1109/ACCESS.2018.2795463.

E. A. Casu; N. Oliva; M. Cavalieri; A. Muller; A. Fumarola et al. : **Tunable RF phase shifters based on Vanadium Dioxide metal insulator transition**; *IEEE Journal of the Electron Devices Society*. 2018. DOI : 10.1109/JEDS.2018.2837869.

N. Mohajeri; D. Assouline; B. Guiboud; A. Bill; A. Gudmundsson et al. : **A city-scale roof shape classification using machine learning for solar energy applications**; *Renewable Energy*. 2018. DOI : 10.1016/j.renene.2017.12.096.

M. Le Guen; L. Mosca; A. T. D. Perera; S. Coccolo; N. Mohajeri et al. : **Improving the energy sustainability of a Swiss village through building renovation and renewable energy integration**; *Energy and Buildings*. 2018. DOI : 10.1016/j.enbuild.2017.10.057.

CONFERENCE PAPERS

P. Florio; S. Coccolo; A. T. D. Perera; J.-L. Scartezzini : Matching visual impact, solar energy production potential and energy system optimization for an enhanced solar integration. An experience with a novel pre-design tool. 2018-12-08. PLEA 2018: Smart and Healthy Within the Two-Degree Limit, Hong-Kong, December 10-12, 2018.

J. Gong; G. Violakis; D. Infante; P. Hoffmann; A. Kostro et al. : **Microfabrication of curved sidewall grooves using scanning nanosecond excimer laser ablation**. 2018-02-19. SPIE LASE 2018, San Francisco, California, United States, 27 January-1 February 2018. p. 37. DOI : 10.1117/12.2286908.

N. Oliva; E. A. Casu; C. Yan; A. Krammer; A. Magrez et al. : **MoS2/VO2 vdW heterojunction devices: Tunable rectifiers, photodiodes and field effect transistors**. 2018-01-25. IEDM, San Francisco, California, USA, December 2-6, 2017. DOI : 10.1109/IEDM.2017.8268503.

N. Fezzioui; S. Mesmoudi; Y. Miloudi; C.-A. Roulet : **The effect of Green Building Envelopes on the thermal comfort and Cooling and heating energy performance in hot and dry climate**. 2018. IRSEC'18 – 6th International Renewable and Sustainable Energy Conference, Rabat, Morocco, December 5-8, 2018.

M. Mezaouari; N. Fezzioui; C. E. Miloudi; C.-A. Roulet : **Impact of urban density on energy consumption**. 2018. International Conference on Energy, Materials, Applied Energetics and Pollution ICEMAEP2018.

A. Krammer; F. T. Demiere; A. Schüler : **Infrared Optical Properties of Doped and Pure Thermochromic Coatings for Solar Thermal Absorbers**. 2018. SWC2017/SHC2017 ISES Solar World Congress 2017 - IEA SHC International Conference on Solar Heating and Cooling for Buildings and Industry 2017, Abu Dhabi, 29.10.-2.11.2017. p. 1-7. DOI : 10.18086/swc.2017.17.04.

D. Mauree; S. Coccolo; V. Nick; A. T. D. Perera; D. Lee et al. : **Study on the impact climate change on the resilience of the EPFL campus**. 2018. 10th International Conference on Urban Climate/ 14th Symposium on the Urban Environment, New York, NY, 6-10 August 2018.

M. Andreucci; S. Coccolo; D. Theochari; E. Naboni : **Adaptive design through nature-based technologies and solutions: an innovative process characterising urban regeneration**. 2018. Healthy landscapes: green, regeneration, safety, Bologna (Italy), 6 June 2018 - 8 June 2018.

E. Naboni; S. Coccolo; M. Meloni; J.-L. Scartezzini : **Outdoor comfort simulation of complex architectural designs: a review of simulation tools from the designer perspective.**. 2018. 2018 Building Performance Analysis Conference and SimBuild co-organized by ASHRAE and IBPSA-USA, Chicago, IL, September 26-28, 2018.

M. Harmanescu; S. Coccolo; E. Naboni : **Rethinking Sustainability Towards a Regenerative Economy (RESTORE) within an Adaptive Neighbourhood Design**. 2018. 34th International Conference on Passive and Low Energy Architecture, Hong Kong, 10-12 December 2018.

J. Gong; A. Kostro; J.-l. Scartezzini; A. Schueler : **Feasibility study on a novel daylighting system with embedded micro compound parabolic concentrators (CPCs)**. 2018. Conference on Nonimaging Optics - Efficient Design for Illumination and Solar Concentration XV, San Diego, CA, Aug 19-20, 2018. p. UNSP 1075807. DOI : 10.1117/12.2320478.

J. Gong; A. Kostro; A. Schüler : **Towards novel glazing with seasonal dynamics based on micro compound parabolic concentrators**. 2018. Solar World Congress 2017, Abu Dhabi, UAE, October 29 - November 1st, 2017.

BOOK CHAPTERS

Assouline D., Mohajeri N., Scartezzini J.-L., Amini M.H., Boroojeni K.G., Iyengar S.S., Pardalos P.M., Blaabjerg F., Madni A.M., **Estimation of Large-Scale Solar Rooftop PV Potential for Smart Grid Integration: A Methdological Review**, in Sustainable Interdependent Networks, 2018

PHD THESES

P. Florio : Towards a GIS-based Multiscale Visibility Assessment Method for Solar Urban Planning. Lausanne, EPFL, 2018. DOI : 10.5075/epfl-thesis-8826.

REPORTS

J.-L. Scartezzini; B. Smith : Solar Energy and Buildings Physics Laboratory - **Activity Report 2017**. 2018.

J. Fleury; A. Schueler : **BAV-RhB Projekt Reduzierung des Heizenergiebedarfs von Bahnfahrzeugen durch eine verbesserte Wärmedämmung der Fahrzeughülle**. 2018.

A. Krammer; A. Schueler : **Towards industrial implementation**. 2018.

A. Krammer; A. Schueler : **Thermochromic coatings for overheating protection of solar thermal collectors - novel type of doping (TARGET95)**. 2018.

PATENTS

D. Mauree; A. Schueler; A. Diévart; O. V. C. Bouvard ; EPFL: **Box-type solar cooker**. WO 2018/185646 A1 . 2018-10-11.

Y. Wu; J. H. Kämpf; J.-L. Scartezzini ; **Sky Monitoring System**. 102017007333.3 . 2018.

OUTREACH

INVITED PRESENTATIONS

Key person	Role / Title of talk	Location/Organizer	Date
Coccolo, Silvia	City Energy Modeling from Districts to Urban Microclimat	EuroTech 2018 Energy Systems: From Physics to Systems, EPFL Lausanne	02/2018
Florio, Pietro	IEA group leader	IEA Task "Solar Energy in Neighborhoods planning" Definition phase, Lund University, Sweden	10/2018
Florio, Pietro	The visual aspect in urban regenerative design	Parametric Tools for Regenerative Design in the Digital Practice Autumn Conference and Training School, Malaga, Spain	10/2018
Mauree, Dasaraden	Meteorological Modelling at the Urban Scale	EuroTech 2018 Energy Systems: From Physics to Systems, EPFL Lausanne	02/2018
Scartezzini, Jean-Louis	Toward Net-Zero and Energy Positive Buildings	EuroTech 2018 Energy Systems: From Physics to Systems, EPFL Lausanne	02/2018
Schueler, Andreas	Dynamisch und energieeffizient: Innovatives Architekturglas	14. IGE-Planerseminar, HSLU, Luzern	03/2018
Schueler, Andreas	Gläserne Zukunft	Forum Energie Zürich "Gebäudehülle der Zukunft"	04/2018
Schueler, Andreas	Semiconductor-to-metal transition in vanadium dioxide based thin films: from solar energy to microelectronics	Science and Applications of Thin Films, Conference & Exhibition (SATF 2018), Izmir, Turkey	09/2018
Schueler, Andreas	Tackling challenges in the development and industrial implementation of microstructured glazing	Swiss Competence Center of Energy Research in Future Energy-Efficient Buildings and Districts SCCER FEEB&D - Peak session	08/2018
Schueler, Andreas	Wärmeschutzfenster mit hoher Durchlässigkeit für Mobilkommunikation Grundlagen und Leistungseigenschaften	Energy Forum of the Swiss Federal Office of Transport FOT	01/2018

EVENTS ORGANISED

Date	Event title	Description
03/2018	Key enabling technologies for smart and adaptive windows	LESO Lunchtime Lecture Gregory Giuliani, University of Geneva
04/2018	Solid-state lighting: from lighting quality to human centric lighting	LESO Lunchtime Lecture Bruno Bueno, FhG ISE
11/2018	Modeling approaches and design strategies for more sustainable and livable urban areas	LESO Lunchtime Lecture Sven Kotlarski, Meteosuisse
12/2018	Swiss Data Cube: Big EO Data for Sustainable Development	LESO Lunchtime Lecture Rolando Ferrini, CSEM
05/2018	Temperature extremes and heat stress on Swiss and European scales: Activities at MeteoSwiss	LESO Lunchtime Lecture Philippe Lemarchand, Dublin Institute of Technology
10/2018	Daylight Academy Annual Meeting and General Assembly in Dublin, Ireland	General Assembly directed by Prof J.L. Scartezzini and Annual Meeting co-organised with Dublin Institute of Technology
09/2018	NEST SolAce Inauguration in Dübendorf	Inauguration of pilot unit in presence of F. Schiesser (CEPF/ETH Board), J.-L. Bona and P. Richner (EMPA Board), A. Mortensen (VP EPFL)
11/2018	Scanning Tunneling Microscope in LESO-PB nano group	Inauguration in presence of Prof. A. Barry (ENAC Dean) and Prof. A.M. Ionescu (STI Nanolab)

REPRESENTATION

EPFL INTERNAL COMMITTEES

Name	Service	Role
Scartezzini, Jean-Louis	EPFL Excellence Fellowship Committee	Committee member
Scartezzini, Jean-Louis	ENAC IT Strategic Committee	Committee member
Schueler, Andreas	Architecture Section - Teaching Committee	Committee member
Schueler, Andreas	COSEC Security	Lab coordinator
Mauree, Dasaraden	SDIS EPFL	Fire fighter
Mauree, Dasaraden	ENAC School Council	Member

EXTERNAL COMMITTEES & APPOINTMENTS

Name	Service	Role
Castello, Roberto	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era"	Scientific & Programming Committee Member
Coccolo, Silvia	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era"	Scientific & Programming Committee Member
Florio, Pietro	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era"	Scientific & Programming Committee member

Name	Service	Role
Mauree, Dasaraden	SCCER Future Energy Efficient Buildings and Districts	Work package deputy leader
Mauree, Dasaraden	European Geosciences Union	Editor of Atmospheric Sciences Blog Division
Mauree, Dasaraden	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era""	Scientific and Programming Committee Member
Scartezzini, Jean-Louis	Daylight Academy	Steering Committee Member, Speaker
Scartezzini, Jean-Louis	NEST Steering Committee	Committee Member
Scartezzini, Jean-Louis	Swiss Academies of Arts & Sciences, Energy Commission	Committee Member
Scartezzini, Jean-Louis	Solar Energy International Journal	Associate Editor
Scartezzini, Jean-Louis	International Council for Research and Innovation in Building and Construction	EPFL Representative
Scartezzini, Jean-Louis	European Renewable Energy Research Centres Agency (EUREC)	College of Members - EPFL Representative
Scartezzini, Jean-Louis	SCCER Future Energy Efficient Buildings and Districts	Board Member and Work Package Leader
Scartezzini, Jean-Louis	Fond National de la Recherche Scientifique, Brussels, Belgium	Expert Reviewer
Scartezzini, Jean-Louis	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era"	Conference Chair
Scartezzini, Jean-Louis	Natural Sciences and Engineering Research Council of Canada	Expert Reviewer
Schueler, Andreas	CISBAT 2019 International Conference "Climate Resilient Cities - Energy Efficiency & Renewables in the Digital Era"	Scientific & Programming Committee Member
Schueler, Andreas	3rd International Science and Applications of Thin Films, Conference & Exhibition (SATF 2018)	Scientific committee member

Dr Pietro Florio – LESO-PB PhD 2018 – with his supervisors Dr Maria Cristina Munari Probst and Prof. Jean-Louis Scartezzini

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