

COST Action PEARL PV (CA16235)

Performance and Reliability of Photovoltaic Systems:
Evaluations of Large-Scale Monitoring Data



Seminar “Designing with Photovoltaics”

5th of July 2021

Transilvania University of Braşov, Braşov, Romania



**Transilvania
University
of Braşov**



Photo on front cover: Solar powered interior lamp designed by Marjan van Aubel, 2021

Program booklet for seminar “Designing with Photovoltaics” of COST Action PEARL PV
Editors: Angèle Reinders, University of Twente and Eindhoven University of Technology, The Netherlands, and Bogdan-Gabriel Burduhos, Transilvania University of Brasov, Romania

This publication is based upon work from COST Action CA16235 PEARL PV supported by COST (European Cooperation in Science and Technology)

<https://www.pearlpv-cost.eu/event/seminar-on-simulation-tools-and-models-for-the-analysis-of-pv-system-performance/>

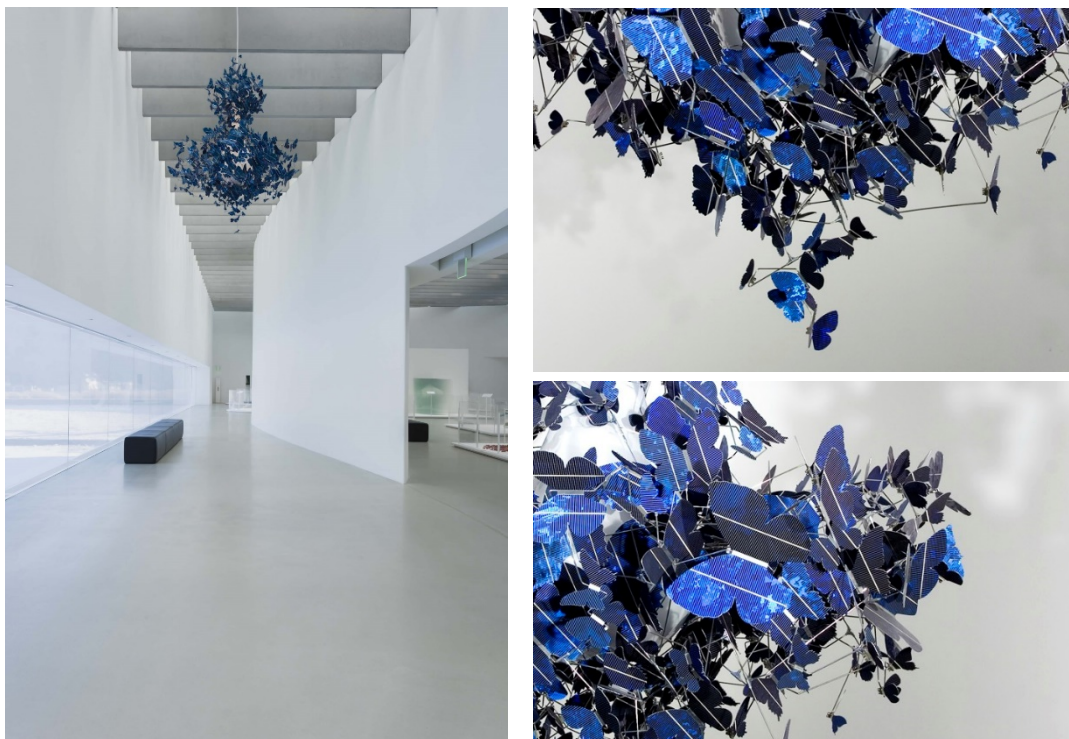
Table of Contents

Introduction	4
Schedule of events	5
Speakers	6
Organizers	16
Practical information	21

Introduction

In the past decade, there have been great advances in not only the performance, but also the potential application range of photovoltaic technologies. Therefore this seminar on the topic "Designing with Photovoltaics" covers a broad range of topics related to the design of products, buildings and vehicles with integrated photovoltaic (PV). In this seminar, which is organized by COST Action PEARL PV, diverse categories of product integrated PV are discussed including applications of solar power for mobility and building integrated systems along with design and manufacturing related information about solar cells. The seminar will pay attention to theories on "how to design with photovoltaics", as well as the use of simulation tools during these design processes. Moreover, real design cases will be presented to visualize design processes entailing photovoltaic technologies, while involving end-users and environmental aspects of PV applications. This seminar is aimed at senior undergraduates, graduates and professionals in electrical engineering, architecture, design, physics, mechanical engineering and naturally also those specifically studying or researching photovoltaics.

Given this context, this seminar's program will cover design, research and innovation of solar PV powered buildings, cities, vehicles, interior products, textile and fashion, to be explained by world famous experts, top designers and innovative frontrunners working for Sono Motors, UNStudio, TNO, SUPSI, ENEA, University of Twente, Eindhoven University of Technology, Studio Van Aubel and Studio Van Dongen. Through a series of lectures ranging from simulations and engineering to design and prototyping, we hope to enliven the debate, foster new collaborations and tackle barriers that should be lowered or eliminated to create commercially available, appealing and user friendly PV applications with a good performance.



Solar powered chandelier, Virtue of Blue, DeMakersVan, The Netherlands, 2010

Schedule of events

Time	Speaker / activity	Title
8:30-9:00h	ICDT, L2 building, ground floor	
9:00 – 9:30h	Opening session by: - Bogdan-Gabriel Burduhos – organizer - Codruța-Ileana Jaliu – DPM faculty dean - Anca Duță – coordinator of RESREC research center - Transilvania University of Brașov – Romania - Angèle Reinders University of Twente and Eindhoven and University of Technology - Netherlands	
9:30-10:15	Moritz Kitshhoff and Mathieu Baudrit – Sono Motors - Germany	Challenges of solar Integration on BEV
10:15-11:00	Francesco Frontini – SUPSI - Italy	BIPV Status Report in Europe: lessons learned from nearly 40 years of projects
11:00-11:30	<i>Break</i>	<i>Coffee / tea</i>
11:30-12:00	Neel Patel – Forschungszentrum Jülich - Germany	VIPV modelling method for dynamic scenarios
12:00-12:30	Angèle Reinders – University of Twente and Eindhoven University of Technology - Netherlands	Designing with photovoltaics
12:30-14:00	<i>Lunch</i>	
14:00-14:45	Marjan van Aubel – Studio Van Aubel - Netherlands	Solar design in every day environments
14:45-15:15	Bonna Newman – TNO - Netherlands	From squares to racing stripes: Designing PV for vehicles
15:15-15:45	<i>Break</i>	<i>Refreshments</i>
15:45-17:30	Tom Minderhoud – UNStudio - Netherlands	The future evolution of PV in architectural design
17:30-18:15	Pauline van Dongen – Studio Van Dongen - Netherlands	Soft and embodied solar design: a practice-based perspective on weaving solar energy into everyday life
18:15-19:00	<i>Break</i>	
19:00 -	<i>Dinner and further evening programme</i>	<i>To be announced</i>

This is a hybrid physical/on-line event. On-line participation will be available for those who are unable to travel. Please notice that timings are based on Eastern European Time (Brasov).

Speakers

Moritz Kitshhoff and Dr. Mathieu Baudrit – Sono Motors - Germany



Sono Motors' Sion front close-up, 2021

Moritz Kitshhoff - (Solar) Car designer

Moritz Kirchhoff joined Sono Motors one year ago and took over the product design responsibilities . This includes the integration of PV into the exterior design and the design of the interior of the car. Previously he graduated from Pforzheim University with a collaboration thesis sponsored by BMW Design. He also has automotive design experience with Volkswagen Design. What he finds challenging but also exciting is to bring together traditional exterior design and pv integration. If he could start from scratch, he would design a solar car, defined and designed by its technology, orchestrating sustainable innovation.



Mathieu Baudrit - Group lead Sono Solar

Mathieu Baudrit started to work in Photovoltaics in 2002. He has worked on all the value chain, from solar cells development, to high efficiency PV modules development. After 7 years at the Solar Energy Institute in Madrid, he joined the National Solar Energy Institute in France in 2009. He initiated the "High efficiency and Specific solar modules" activity and led this laboratory till 2018. After working on many PV products development in several international projects, he joined Sono Motors beginning 2018 where he is now leading the Vehicle Integrated PV business unit.



Dr. Mathieu Baudrit,
Sono Motors GmbH
Waldmeisterstraße 76
DE-80935 Munich
Germany
Email: mathieu.baudrit@sonomotors.com
Website: <https://sonomotors.com/>

Prof.dr. Francesco Frontini – SUPSI – Italy

Prof.dr. Francesco Frontini is since 2011 is the head of the Building Sector and of the Swiss BIPV competence Center at the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) and member of the Direction Board of the Institute for Applied Sustainability to the Built Environment (ISAAC). He is also co-founder and COO of iWin Sagl, an innovative startup of SUPSI.

He graduated in Building Engineering and Architecture from Politecnico di Milano (Italy). He collaborated with Engineer and Architect offices as Project manager from 2007 to 2010. Research activity was always supported by experimental work on the design of actual buildings and solar envelops. In 2009 he got a PhD cum laude in Building Engineering where he developed, together with different manufacturers, a new multifunctional BIPV façade for solar control and glare control. He worked as researcher (postdoc) in the Solar façades group at Fraunhofer Institute for Solar Energy Systems (in Germany), one of the largest Research institute in the World, where he gathered extensive experience in Building simulation and in Building Integrated Photovoltaic (BIPV) solution. He is a member of the CENELEC CLC/TC 82 standardization body which developed a new European BIPV standard (EN 50583) and now it is developing a new International Standard of Photovoltaic in buildings. Mr. Frontini is the author of different publication in the field of Energy in buildings, Daylighting and Building Integrated Photovoltaic systems.



Prof.dr. Francesco Frontini MSc Eng Arch.
Building System Sector, ISAAC
Scuola Universitaria Professionale della Svizzera Italiana
SUPSI Campus Trevano, CH-6952 Canobbio
Switzerland
Email: francesco.frontini@supsi.ch
Website 1: www.supsi.ch/isaac
Website 2: www.solarchitecture.ch

Neel Patel MSc – Forschungszentrum Jülich - Germany

Neel Patel has a background in Electrical Engineering and completed his M.Sc. in Renewable Energy Engineering from University of Freiburg in Germany in 2019. Currently, he is affiliated to Forschungszentrum Jülich in Germany and Eindhoven University of Technology in the Netherlands and is working towards a doctorate with a focus on quantifying impacts of PV in road transport sector by means of simulations of VIPV and solar PV systems in infrastructures.



Neel Patel MSc
Forschungszentrum Jülich
Wilhelm-Johnen-Straße
52428 Jülich
Germany
Email: n.patel@fz-juelich.de
Website: https://www.fz-juelich.de/iek/iek-5/EN/Home/home_node.html

Prof.dr. Angèle Reinders - University of Twente and Eindhoven University of Technology (TU/e) - The Netherlands

At present Angèle Reinders is a full professor in Design of Sustainable Energy Systems at TU/e, an associate professor at University of Twente, and a visiting professor of the School of Photovoltaics & Renewable Energy Engineering of UNSW in Sydney, Australia.

Angèle Reinders received an MSc in Experimental Physics at Utrecht University (1993) where she also received her PhD degree (1999) in Chemistry. In the past she conducted research at Utrecht University, Fraunhofer Institute of Solar Energy in Freiburg, the World Bank in Washington D.C., ENEA in Naples, Center of Urban Energy in Toronto and in Indonesia, and she was a professor of Energy-Efficient Design at TU Delft. Her research is focused on the optimal use and integration of sustainable energy technologies in products, buildings and local infrastructures. In this design-driven research theme improved designs of sustainable energy systems are explored and also developed by means of simulation, prototyping and testing. A strong interest exists in optimized applications of solar energy technologies in the context of buildings and mobility and affiliated energy technologies that support storage, enhanced user interactions and flexibility of sustainable energy.

At University of Twente, together with colleagues, she set up a new bachelor and master programme in Industrial Design Engineering. Based on these experiences her aim became to enhance design-driven research on sustainable energy products and systems to support the energy transition

Since 2017 she has been the chair of the EU COST Action PEARL PV on the performance of PV systems and she is conducting projects on smart energy systems. She is known for her books 'The Power of Design - Product Innovation in Sustainable Energy Technologies' (2012) and 'Photovoltaic Solar Energy From Fundamentals to Applications' (2017) as well as "Designing with Photovoltaics" (2020) and for her involvement in the international IEEE PVSC conference which she chaired in 2014 and 2017. In 2010 she co-founded the IEEE Journal of Photovoltaics for which she serves as an editor. She is also involved in various tasks of the International Energy Agency PVPS program, including Task 17 on PV for Transport. She is a dedicated member of the 'Solar Movement' and a board member of ASOM.



Prof.dr. Angèle Reinders
University of Twente & Eindhoven University of Technology
PO Box 217
7500 AE Enschede
The Netherlands
Email: a.h.m.e.reinders@utwente.nl and a.h.m.e.reinders@tue.nl
Website: <https://www.tue.nl/en/research/researchers/angele-reinders/>

Marjan van Aubel – Studio Van Aubel – The Netherlands

Marjan van Aubel is an award-winning solar designer. She brings solar energy into daily life through objects. Van Aubel's most notable works are Current Table, Power Plant and she designed the roof of the Dutch Pavilion at the World Expo 2020 in Dubai. Her work is in permanent collection of museums such as MoMA New York, the V&A London and Boijmans van Beuningen in the Netherlands, amongst others. She has collaborated with global brands such as Cos, Timberland, Swarovski with the aim of accelerating global energy transition to solar.

In 2020 she won the ECO coin Award by Next Nature Network, in 2019 a Dutch Design Award chosen by the Public and in 2018 the Climate Action Challenge by What Design Can Do. In 2017, Swarovski named Marjan the Designer of the Future, and in 2016 she received WIRED's Innovation Award, the Wallpaper Design Award and was chosen to be the Radicale Vernieuwer (Radical Pioneer) Netherlands by Neelie Kroes. She received the London Design festival Emerging Talent medal in 2015 and in 2012 she won the First Prize Dutch Material Award.



Marjan van Aubel
Marjan van Aubel Studio
Oudeschans 35
1011 KT Amsterdam
Email: mail@marjanvanaubel.com
Website: <https://marjanvanaubel.com/>

Dr. Bonna Newman – TNO – The Netherlands

Dr. Bonna K. Newman is a Senior Scientist and the Program Manager of cSi PV Module Technologies and PV and Mobility at TNO in the Netherlands. She received a PhD in Physics from MIT in 2008 and has worked in both industry and academia throughout the entire value chain of PV including absorber materials, cell technology, surface passivation, light management, module materials and interconnects, applications, and techno-economic modelling. She is the recipient of the Clare Boothe Luce Postdoctoral Fellowship in 2008 and the Netherlands SUNDAY Gran Crux Prize in 2018. More recently, her focus has been on integrating aesthetic PV into the electric transportation sector and adopting high throughput module manufacturing for on-board vehicle integrated PV for passenger cars, buses and trucks. In 2021, she co-founded the Alliance for Solar Mobility ASOM with a group of like-minded innovators, in order to build a future where everyone can choose sustainable and eco-friendly transportation solutions, powered by the sun.



Bonna Newman, PhD
TNO Energy Transition, Solar Energy
Westerduinweg 3
1755 LE Petten
The Netherlands
Email: bonna.newman@tno.nl
Website: <http://www.tno.nl>



Integrated PV in car roof, courtesy of Lightyear.

Tom Minderhoud – UNStudio – The Netherlands

Tom Minderhoud is a Senior Architect and Associate with major involvement in a range of key UNStudio projects, contributing to the projects from early inception to completion. Among others, he has worked on large mixed-use projects, high-rise projects and on Innovation Areas internationally. He has contributed to the research discourse in European settings since 2011, developing new solutions for Building Integrated Photovoltaics and Full Color PV. He was one of the founding contributors for the company Solar Visuals (<https://www.solarvisuals.nl/>), a company that provides full color printed PV modules to allow design freedom and aesthetical integration of PV. In addition, he is part of the IADP a multi-disciplinary approach to the development of knowledge intensive architectural typologies within Areas of Innovation.



Tom Minderhoud Arch.
Stadhouderskade 113
1073 AX Amsterdam
The Netherlands
Email: t.minderhoud@unstudio.com
Website: <https://www.unstudio.com/>



UNStudio Office retrofit design, colored PV in spandrel panels of a curtain wall

Dr. Pauline van Dongen – Studio Van Dongen - The Netherlands

Pauline van Dongen is a fashion designer and researcher specialised in smart clothing and textiles. Her eponymous design studio, founded in 2010 and based in Arnhem, explores human-garment relations and alternative fashion (design) practices through the intersection of technology and textiles. In particular, how technologies when understood and approached as materials more than 'functional tools', can add new value and meaning to clothing and can enhance the way we experience the world around us. Her studio received international recognition with projects such as the Solar Shirt, Phototrope and Issho. Pauline also received several nominations for her work: she was selected by Forbes for their list of 'Top 50 Women in Tech Europe' (2018) and as 'MIT Innovator under 35 Europe' (2017). She has been focusing on the development of solar textiles since 2013 and is currently weaving thin-film solar technology into textiles for applications in textile architecture.

With her vision and through a hands-on, 'material aesthetics' approach she emphasizes the value of the physical, sensory experience of clothing and its nurturing qualities. This is central to her PhD dissertation entitled: "A Designer's Material-Aesthetics Reflections on Fashion and Technology" with which she received her doctoral degree from Eindhoven University of Technology in 2019. Besides leading her own design studio, Pauline was program manager of smart clothing at Holst Centre (TNO) between March 2019 and October 2020. She is one of the founders of the Solar Movement and the upcoming Solar Biennale (2022) and she currently is a member of the advisory board of the 'ArtEZ Fashion Professorship', and 'New Order of Fashion'.



Dr. Pauline van Dongen
Email: pauline@paulinevandongen.nl
Website: www.paulinevandongen.com
Linkedin: <https://nl.linkedin.com/in/paulinevandongen>
Instagram: [@paulinevandongen](https://www.instagram.com/paulinevandongen)
Vimeo: [@paulinevandongen](https://www.vimeo.com/paulinevandongen)

Organizers

Assoc.Prof.dr.eng. Bogdan-Gabriel Burduhos - Transilvania University of Brasov - Romania

Bogdan Gabriel BURDUHOS finished his PhD thesis in 2009 at the Transilvania University of Brasov developing different types of tracking algorithms which allow the increase of the received solar irradiance on moving photovoltaic modules. He got his M.Sc. degree in Engineering Design and Management of Renewable Energy Sources and the bachelor degree in Electrical Engineering at the same university in 2007 and 2006 respectively.

He coordinated four national R&D projects related to the increase of solar irradiance on photovoltaic modules, to the effect of clouds on the available solar irradiance and to the integration of photovoltaic modules in buildings from locations with different climatic profile. In October 2012 he also coordinated an EU funded SFERA project (Solar Facilities for the European Research Area) at the THEMIS Facility, PROMES-CNRS Institute in France.

During his experience he published 6 books and book chapters in national and international publishing houses and more than 50 research papers in international journals and conferences proceedings, which are related to integration of photovoltaic systems in the built environment, solar irradiance estimation and modelling, hybrid electrical systems based on renewable energy sources and building energy management systems.



Assoc.Prof.dr.eng. Bogdan-Gabriel Burduhos

Transilvania University of Brasov

Product Design, Environment Faculty

Renewable Energy Systems and Recycling Center

Eroilor, 29, 500036, Braşov

Romania

Email: bogdan.burduhos@unitbv.ro

Website: <https://www.unitbv.ro/contact/comunitatea-unitbv/2201-burduhos-bogdan-gabriel.html>

Prof.dr. Mircea Neagoe - Transilvania University of Brasov - Romania

Mircea Neagoe is a full professor at Transilvania University of Brasov and member of the Renewable Energy Systems and Recycling R&D Center within the Faculty of Product Design and Environment.

He has over 15 years of experience on theoretical and experimental research of solar tracking systems for PV & solar-collector applications and of speed increasers for wind turbines, as well as almost 30 years of activities on other complementary domains like integrated product design, advanced mechanical systems, artificial intelligence, robotics, eco-innovation, e-learning. His current research activities focus on design and optimization of PV tracking algorithms and systems implemented in the built environment, aiming at increasing the in-field electricity production during various meteorological conditions. Another research direction addresses innovative development of mechanical speed increasers for classical and counter-rotating wind turbines.



Prof.dr. Mircea Neagoe
Transilvania University of Brasov
Product Design, Environment Faculty
Renewable Energy Systems and Recycling Center
Eroilor, 29, 500036, Braşov
Romania
Email: mneagoe@unitbv.ro
Website: <https://www.unitbv.ro/contact/comunitatea-unitbv/2223-neagoe-mircea.html>

Prof.dr. Petru A. Cotfas - Transilvania University of Brasov - Romania

Petru A. Cotfas is a full professor at the Electronics and Computers Department, Faculty of Electrical Engineering, Transilvania University of Brasov, Romania. He received his BSc degrees in mathematics and physics and also in computer science in 1997 and 2001 respectively, and MSc degree in mathematics and computer science at Transilvania University of Brasov, in 1998. In 2007, he obtained the PhD degree in material science engineering at Transilvania University of Brasov.

Having a vast experience in the fields of photovoltaics and hybrid systems characterization and testing, virtual instrumentation, data acquisition, graphical programming and remote engineering, he published ten books or book chapters in national and international publishing houses and more than 140 papers in international and national journals and conferences proceedings. He received 3 awards at the world contest Graphical System Design Achievement Award organized by National Instruments in Austin, USA in 2013 for his Renewable Energy Laboratory (RELab) board development and the associated case study. The RELab board was also awarded with a gold medal at the international salon of inventions - EUROINVENT2015, Iasi, Romania.



Prof.dr. Petru A. Cotfas
Transilvania University of Brasov
Eroilor, 29, 500036, Braşov
Romania
Email: pcotfas@unitbv.ro

Prof.dr. Angèle Reinders - University of Twente and Eindhoven University of Technology (TU/e) - The Netherlands

See previous description in the list of speakers (page 10).

Practical information

Short description of the *Transilvania* University of Brasov

The *Transilvania* University of Brasov was founded in 1948, has 18 faculties and more than 1,200 employees (teachers, researchers and administrative staff). It offers undergraduate, master and doctoral study programs to over 19,000 students, with the aim to train specialists highly qualified in the field of sciences, engineering, economics, law, sociology, art and medical science, and to provide knowledge and services to society.

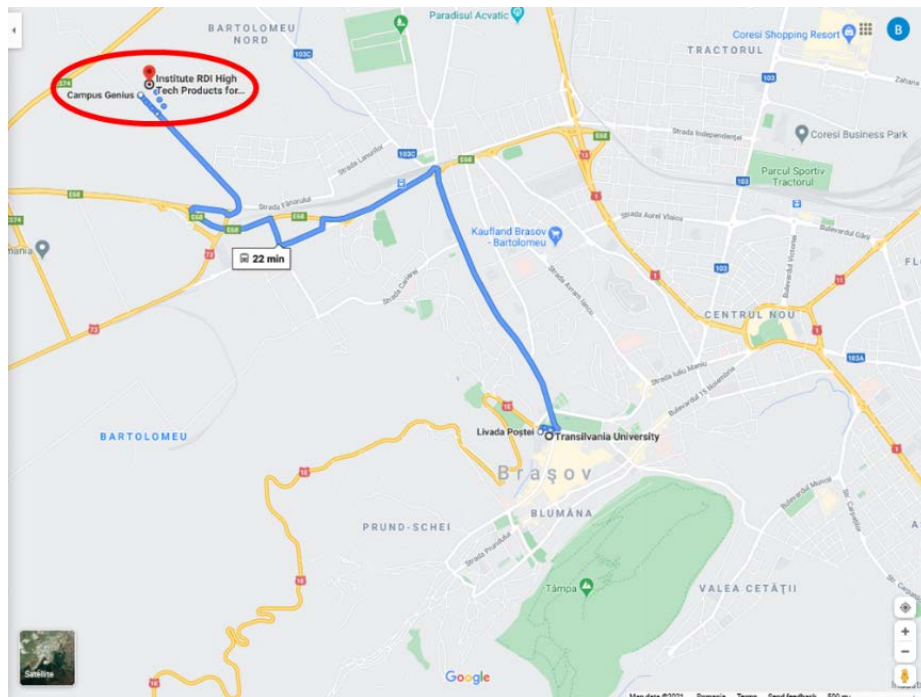
The advanced research is approached in 30 RTD (research and technical/technological development) centres, focusing on the major issues of the sustainable development: renewable energy systems, innovation in processes for energy efficiency, advanced solutions for energy saving, conservation and use of natural resources, health and quality of life, education, culture, communication and economic development, etc. The results research are transferred to students at various levels of undergraduate, master and doctoral degrees. Thus, the identity of the *Transilvania* University is built around the sustainable development concept.

The Research and Development Institute (RDI) of the *Transilvania* University collects all centres and has its headquarters on the GENIUS campus (Green, Energy Independent University Campus), where the 12 laboratory buildings that meet the standards of the Low Energy Building (LEB) with 68 equipment lines, have been developed in 2012 as part of the Structural Funds project RTD Institute High-Tech Products for Sustainable Development.

Venue and institute map

The RDI of the *Transilvania* University of Brasov is located in a new area of Brasov at about 15 minutes from the city centre. It can be reached easily by car or by public transport (lines 24 and 28).

The location of the seminar is the ground floor of building L2 and L7 (see map).



Travel Information

Three nearby airports can be used in order to get to Brasov, which are located at approx. 150 km. They are located in Otopeni – Bucuresti (Henri Coandă International Airport), Sibiu International Airport and Târgu Mures (Transilvania International Airport).

From all three airports car or shuttle transfer can be used in order to reach Brasov (<https://transferairport.ro/en> or <https://www.brasov-aeroport.ro>). Also, trains are available (<https://www.cfrcalatori.ro/en>) but may require switching.

Welcome to Brasov

Located in the centre of the country, where all the roads connecting the Romanian historical territories have always crossed, Braşov City has been and shall remain a bridge of connection and circulation of the material and spiritual values, as well as an area of symbiosis between the Romanian culture and the culture of the co-inhabiting nationalities.

Due to its favourable geographic position, its natural and cultural values, as well as its economic development, the old Saxon burg, or the “Crown City”, exerts a large capacity of attraction for both the Romanian and the foreign tourists.

Further useful information at: <http://www.ghid-brasov.ro/index-en.html>

Wireless Internet



Wireless Internet is available in all buildings of the Transilvania University of Brasov using Eduroam hotspots (www.eduroam.org) or free building hotspots.

Contact person at Transilvania University of Brasov

Assoc.Prof.dr.eng. Bogdan-Gabriel Burduhos
Transilvania University of Brasov
Product Design, Environment Faculty
Renewable Energy Systems and Recycling Center
Eroilor, 29, 500036, Braşov
Romania
Mobile phone: +40 721 452 105
Email: bogdan.burduhos@unitbv.ro
Website: <https://www.unitbv.ro>