



EUPVSEC

22 — 26
September

BEC —
Bilbao Exhibition Center

Bilbao —
Spain

EU PVSEC

42nd European
Photovoltaic Solar Energy
Conference and Exhibition

2025

**Conference
Programme —**

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42nd European Photovoltaic Solar Energy Conference and Exhibition

Conference Program

Monday, 22. September 2025

MONDAY MORNING

CONFERENCE OPENING

PLENARY PRESENTATIONS 4AP.1

08:30 - 09:30 PV Everywhere

Chairpersons:

Invited

Robert P. Kenny

European Commission JRC, Ispra, Italy

4AP.1.1 Invited Presentation on Direct Uses of PV Electricity

4AP.1.2 Agrivoltaic System Potential to Mitigate Effects of Climate Change in Viticulture

Natalie Hanrieder¹, Stefan Wilbert¹, Álvaro Fernández Solas¹, Anna Kujawa¹, Rabea Weil², Matthias Meier³, M. del Carmen Alonso García⁴, Luis Zarzalejo⁴, Isabel Oller Alberola⁵, Estefanía Sánchez Vizcaino⁶

¹ DLR, Almería, Spain; ² DLR, Oldenburg, Germany; ³ FZJ, Jülich, Germany; ⁴ CIEMAT, Madrid, Spain; ⁵ CIEMAT, Almería, Spain; ⁶ Cortijo el Cura, Laujar, Spain

4AP.1.3 Micro-Concentrator Photovoltaics for Deep Space Missions: Overcoming LILT Challenges with High-Specific-Power Solar Arrays

Guido Vallerotto¹, Anderson Bermudez-Garcia², Gerald Siefer³, Maike Wiesenfarth³, Almudena Garcia-Sanchez¹, Ignacio Antón¹, César Domínguez¹, Carsten Baur⁴, Pier Luigi Coz⁴

¹ UPM, Madrid, Spain; ² Thales Alenia Space, Cannes, France; ³ Fraunhofer ISE, Freiburg, Germany; ⁴ European Space Agency – ESTEC, Noordwijk, The Netherlands

10:30 - 12:00

Becquerel Prize Ceremony

Opening Addresses

Moderated Panel Discussion

ORAL PRESENTATIONS 1AO.4

13:30 - 15:00 UV-induced Degradation and Material Parameters | Contacting Approaches for Characterisation of Silicon Solar Cells

Chairpersons: Giso Hahn

University of Konstanz, Germany

Alona Otaegi

UPV, Bilbao, Spain

1AO.4.2 Mitigating UV-Induced Degradation: Impact of PECVD and PEALD AlOx Layers Deposited in a Tube-Type Direct Plasma-Enhanced Chemical Vapor Deposition System

Christina Hollemann¹, Byungsul Min¹, Sonja Bräunig¹, Thomas Daschinger¹, Kishan Moliya¹, Carolin Römer¹, Viet X. Nguyen², Thomas Pernau², Daniela Seiffert², Helge Haverkamp², Rolf Brendel¹, Henning Schulte-Huxel¹

¹ ISFH, Emmerthal, Germany; ² centrotherm international, Blaubeuren, Germany

1AO.4.3 New Insights on UV-Induced Degradation of SHJ Solar Cells

Hugo Lajoie¹, Frederic Jay¹, Maxime Babics¹, Romain Couderc¹, Sandrine Therias²

¹ CEA, Le Bourget-du-Lac, France; ² CNRS, Aubière, France

1AO.4.4 Bulk Carrier Lifetime Measurement of High Lifetime N-Type Silicon Ingots with Advanced Evaluation

Dávid Krisztián, Ferenc Korsós, Gergely Havasi, Kinga Szőke
SEMILAB, Budapest, Hungary

1AO.4.5 Universal Contacting Approaches for the Characterization of Solar Cells

Michael Rauer, Andreas Fell, Katinka Kordelos, Martin C. Schubert, Jochen Hohl-Ebinger
Fraunhofer ISE, Freiburg, Germany

1AO.4.6 Contact-Free J-V: a Simple Technique for Universal State-of-the-Art Solar Cells

Shuai Nie, Yan Zhu, Felix Gayot, Ziv Hameiri
UNSW, Sydney, Australia



ORAL PRESENTATIONS 4AO.7

13:30 - 15:00

Solar Resource Assessment

Chairpersons:

Invited

Vicente Lara-Fanego

Solargis, Bratislava, Slovakia

4AO.7.1 Worldwide Solar Radiation Measurement Database with Quality-Control Added Value

Anne Forstinger¹, Stefan Wilbert², Adam R. Jensen³, Dazhi Yang⁴, Ana Gracia⁵, Xabier Olano⁵, Niklas Blum², Diego Miranda², Elena Collino⁶, Dario Ronzio⁶, Anton Driesse⁷, Ioannis Sifnaios³, Birk Kraas¹, Faiza Azam⁸, Jesus Polo⁹, Christian Gueymard¹⁰, Carlos F. Peruchena¹¹, Yves-Marie Saint-Drenan¹², Irena Balog¹³, Josh Peterson¹⁴, Wilfried van Sark¹⁵, Cristina Cornaro¹⁶, Jorge Lezaca⁸, Thomas Schmidt⁸, Abdellatif Ghennoui¹⁷, Mounir Abriam¹⁷, Joaquin Alonso-Montesinos¹⁸

¹ CSP Services, Cologne, Germany; ² DLR, Tabernas, Germany; ³ DTU, Kgs. Lyngby, Denmark; ⁴ Harbin Institute of Technology, Harbin, China; ⁵ CENER, Sarriguren, Spain; ⁶ RSE, Piacenza, Italy; ⁷ PVPL, Freiburg, Germany; ⁸ DLR, Cologne, Germany; ⁹ CIEMAT, Madrid, Spain; ¹⁰ Solar Consulting Services, Colebrook, United States of America; ¹¹ SERIM, , Spain; ¹² Mines ParisTech, Sophia-Antipolis, France; ¹³ ENEA, Rome, Italy; ¹⁴ University of Oregon, Oregon, United States of America; ¹⁵ Utrecht University, Utrecht, The Netherlands; ¹⁶ Tor Vergata University of Rome, Rome, Italy; ¹⁷ Green Energy, BenGuerir, Morocco; ¹⁸ University of Almeria, Almeria, Spain

4AO.7.2 Improving the National Solar Radiation Data Base using PSM V4

Manajit Sengupta¹, Yu Xie¹, Aron Habte¹, Brandon Benton¹, Paul Edwards¹, Jaemo Yang¹, Michael Foster², Andrew Heidinger³

¹ NREL, Golden, United States of America; ² University of Wisconsin, Madison, United States of America; ³ NOAA, Madison, United States of America

4AO.7.3 Localized Uncertainty Model of the CAMS Radiation Service Irradiance Product

Jorge Lezaca¹, Yves-Marie Saint-Drenan², Marion Schroedter-Homscheidt¹

¹ DLR, Oldenburg, Germany; ² MINES Paris, Sophia-Antipolis, France

4AO.7.4 Potential of Decimeter-Resolution Ground-Albedo Data for Bifacial Photovoltaics

Niklas Blum, Bijan Nouri, Yann Fabel, Stefan Wilbert

DLR, Almeria, Spain

4AO.7.5 Method for the Determination of Spectral Responsivity of Digital Solar Irradiance Sensors

David Hinken, Sebastian Denke, Karsten Bothe, Rolf Brendel

ISFH, Emmerthal, Germany

4AO.7.6 AI Solar Spectra Prediction using few Basic Meteorological Inputs

Miguel Ángel Sevillano-Bendezú, Micaela Rodríguez-Peña, Jerónimo

Buencuerpo, José María Ripalda

CSIC, Madrid, Spain

ORAL PRESENTATIONS 2AO.1

13:30 - 15:00

CIGS Solar Cells

Chairpersons:

Alessandro Romeo

University of Verona, Italy

Susanne Siebentritt

University of Luxembourg, Esch-sur-Alzette, Luxembourg

2AO.1.1 Toward High Efficiency Bifacial CIGS Solar Cells

Sascha Sadewasser¹, Pedro Salomé¹, Negar Naghavi², Stephane Collin³, Rico Gutzler⁴, Wolfram Witte⁴, Marika Edoff⁵, Romain Carron⁶, Saeed Bayat⁷, Susanne Siebentritt⁷, Phillip Dale⁷, Alejandro Pérez Rodríguez⁸, Roland Scheer⁹, Esko Niemi¹⁰, Andreas Zimmermann¹¹, Marcin Morawski¹², Conrad Spindler¹³, Capucine Tong¹⁴, Peter Borowski¹⁵, Ayodhya Tiwari¹⁶

¹ INL, Braga, Portugal; ² CNRS-IPVF, Palaiseau, France; ³ CNRS-C2N, Palaiseau, France; ⁴ ZSW, Stuttgart, Germany; ⁵ University of Uppsala, Uppsala, Sweden; ⁶ EMPA, Dübendorf, Switzerland; ⁷ University of Luxembourg, Luxembourg, Luxembourg; ⁸ IREC, Barcelona, Spain; ⁹ MLU, Halle, Germany; ¹⁰ Midsummer, Jarfalla, Sweden; ¹¹ Sunplugged, Schwaz, Austria; ¹² Roltec, Poznan, Poland; ¹³ Greendelta, Berlin, Germany; ¹⁴ Saint Gobain Research, Aubervilliers, France; ¹⁵ Avancis, Munich, Germany; ¹⁶ SOLTIWA, Zurich, Switzerland

2AO.1.2 Voltage Losses in Bifacial CIGS Solar Cells

Matteo De Marzi, Ceren Mitmit, Matthias Diethelm, Romain Carron

Empa, Dübendorf, Switzerland

2AO.1.3 Inline-Fabricated (Ag,Cu)(In,Ga)Se₂ Solar Cells with Transparent Conductive Oxides as Back Contacts

Rico Gutzler, Dimitrios Hariskos, Stefan Paetel, Wolfram Witte

ZSW, Stuttgart, Germany

2AO.1.4 Optimizing ACIGSe/Si Tandem Solar Cells: Achieving Current Matching through Bifacial Operation

Julia Horstmann¹, Matthias Maiberg¹, Roland Scheer¹, Mario Hanser², Jana-Isabelle Polzin², Martin Hermle²

¹ MLU, Halle (Saale), Germany; ² Fraunhofer ISE, Freiburg, Germany

2AO.1.5 Device Characterization via Transient Model Involving VCu-VSe Complex for Cu(In,Ga)Se₂ Solar Cells

Takahito Nishimura, Ryotaro Fukuda, Akira Yamada

Institute of Science Tokyo, Japan

2AO.1.6 Invited Presentation: 14.2% Efficient and Stable Cu(In,Ga)S₂ Solar Cell on Transparent Back Contact for Top Cell in Tandem Devices

VISUAL PRESENTATIONS 3AV.1

13:30 - 15:00

PV Module Design and Manufacturing

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.



ORAL PRESENTATIONS 2AO.2

15:15 - 16:45 **Advances in Chalcogenide Devices**

Chairpersons: Marika Edoff (i)
 Uppsala University, Sweden
 Invited

2AO.2.1 Invited Presentation: Sulfur based CIGS - a Review of Recent Developments

2AO.2.2 Towards the Development of Advanced In-Line Methodology for Monitoring and Accelerated Research of Thin-Film PV Devices

Gina Y. Soracá-Pérez¹, Robert Fonoll Rubio¹, Jon Garí¹, Victoria Rotaru¹, Esko Niemi², Israr Qadir², Ginner Laurin³, Paul Pistor⁴, Thomas Unold⁵, Stefan Paetel⁶, Krzysztof Stanik⁷, Konrad Wojciechowski⁷, Andreas Zimmermann⁸, Fernando Miranda Bardales¹, Pedro Vidal Fuentes¹, Alejandro Pérez Rodríguez¹, Victor Izquierdo Roca¹, Maxim Guc¹
¹ IREC, Sant Adria del Besos, Spain; ² Midsummer, Järfälla, Sweden; ³ AIT, Vienna, Austria; ⁴ Pablo de Olavide University, Sevilla, Spain; ⁵ HZB, Berlin, Germany; ⁶ ZSW, Stuttgart, Germany; ⁷ Saule, Wrocław, Poland; ⁸ Sunplugged, Wildermieming, Austria

2AO.2.3 A New Method for Sb-doped CdSeTe/CdTe Devices with Superior Stability

Elisa Artegiani, Mariyam Mukhtar, Alessandro Romeo
University of Verona, Italy

2AO.2.4 Explainable Artificial Intelligence Driven Methodology for Accelerated Research of Thin Film PV Technologies: Case Study of Kesterite-Based Devices

Jon Garí-Galíndez, Robert Fonoll-Rubio, Jacob Andrade-Arvizu, Alejandro Perez-Rodriguez, Pedro Vidal-Fuentes, Maxim Guc, Victor Izquierdo-Roca
IREC, Barcelona, Spain

2AO.2.5 Over 10% Efficient Stannite Solar Cells with Bandgap Below 0.9 eV Through Dominant Defect Transformation and Microstructure Enhancement

Zixuan Yu¹, Guangxing Liang², Chang Yan²
¹ The Hong Kong University of Science and Technology, Guangzhou, China; ² Shenzhen University, China

ORAL PRESENTATIONS 1AO.5

15:15 - 16:45 **Si TOPCon Solar Cells and Related Processing Steps**

Chairpersons: Rolf Brendel
 ISFH, Emmerthal, Germany
 Francesca Menchini
 ENEA, Rome, Italy

1AO.5.1 Large Area i-TOPCon Solar Cells with 25.9% Record Efficiency

Daming Chen, Zigang Wang, Tao Wang, Zhijun Wang, Kuiyi Wu, Lin Zhang, Jing Pan, Xiwen Chen, Keng Siew Chan, Chengfa Liu, Jian Huang, Pietro P. Altermatt, Pierre Verlinden, Zhiqiang Feng, Yifeng Chen
TrinaSolar, Changzhou, China

1AO.5.2 A Comprehensive Investigation of the LECO Process on TOUCAN Solar Cells with N-Type and P-Type TOPCon Layers: LECO Parameter Study, Efficiency Potential and Microstructural Working Model

Stefan Lange¹, Sina Swatek¹, Marko Turek¹, Stephan Groß¹, Jan Hoß², Saman Sharbaf Kalaghchi², Jonathan Linke², Jan Lossen², Eve Krassowski³
¹ Fraunhofer CSP, Halle (Saale), Germany; ² ISC Konstanz, Germany; ³ CE Cell Engineering, Kabelsketal, Germany

1AO.5.3 Enhancing Broadband Antireflection Performance of Silicon Solar Cells Using Grass-Like Alumina via Atomic Layer Deposition

Jiahui Xu¹, Yuxuan Li², Wenjing Zhang¹, Geng Zhang³, Pierre Verlinden¹, Cui Liu², Xiao Yuan¹
¹ Yangtze Institute for Solar Technology, Jiangyin, China; ² East China University of Science and Technology, Shanghai, China; ³ Jolywood (ShanXi) Solar Technology, Taiyuan, China

1AO.5.4 Screen Printed Cu-TOPCon Cells With Reduced Ag Consumption

Jan Lossen, Justus Carstens, Mertcan Comak, Dominik Rudolph, Pirmin Preis, Lejo Koduvelikulathu
ISC Konstanz, Germany

1AO.5.5 Gallium-Emitter Development for Lean TOPCon c-Si Solar Cells based on Plasma-Deposited Gallium Diffusion Source

Thibault Schaller¹, Ezgi Genç¹, Julien Hurni¹, Christophe Ballif¹, Audrey Morisset², Franz-Josef Haug¹
¹ EPFL, Neuchâtel, Switzerland; ² CSEM, Neuchâtel, Switzerland

1AO.5.6 Impact of Illumination on Solar Cell Properties: Insights into Atomic Hydrogen Release

Wolfram Kwapił, Jonas Schön, Benjamin Hamann, Stefan W. Glunz
University of Freiburg, Germany



ORAL PRESENTATIONS 4AO.8

15:15 - 16:45

Solar Irradiance Forecasting

Chairpersons:

Shukla Poddar
UNSW, Sydney, Australia
Takashi Oozeki (i)
AIST, Koriyama, Japan

4AO.8.1 Dynamical Downscaling of Climate Projections for Renewable Energy Resource over Conus

Manajit Sengupta, Jaemo Yang, Aron Habte, Yu Xie
NREL, Golden, United States of America

4AO.8.2 Cutting-Edge Generative AI for Intra-Hour Solar Forecasting

Yann Fabel¹, Dominik Schnaus², Bijan Nouri¹, Niklas Blum¹, Stefan Wilbert¹, Luis F. Zarzalejo³, Julia Kowalski⁴, Robert Pitz-Paal⁵
¹ DLR, Almería, Spain; ² TUM, Garching, Germany; ³ CIEMAT, Madrid, Spain; ⁴ RWTH, Aachen, Germany; ⁵ DLR, Cologne, Germany

4AO.8.3 Short-Term Solar Irradiance Forecasting using All-Sky Imagers: a Hybrid Artificial Intelligence Approach Combining Support Vector Machines and Convolutional Neural Networks

Khadija Barhmi¹, Sara Mirbagheri Golroodbari¹, Wouter Knap², Wilfried van Sark¹
¹ Utrecht University, The Netherlands; ² KNMI, De Bilt, The Netherlands

4AO.8.4 Integrating Satellite Imagery and Graph Neural Networks for Improving Day-Ahead Solar Irradiance Forecasting

Baptiste Schubnel, Jelena Simeunovic, Corentin Tissier, Pierre-Jean Alet, Rafael E. Carrillo
CSEM, Neuchâtel, Switzerland

4AO.8.5 Enhancing Intra-Hour Solar Irradiance Forecasting: Combining ASI and Satellite Forecasts

Bijan Nouri¹, Jorge Lezaca², Yann Fabel¹, Annette Hammer², Niklas Blum¹, Stefan Wilbert¹
¹ DLR, Almería, Spain; ² DLR, Oldenburg, Germany

4AO.8.6 Co-Simulating Photovoltaics and Environments to Improve Solar Forecasting

Baptiste Amiot¹, Joseph Vernier², Baptiste Berlioux², Benoît Cuilhé¹, Rémi Le Berre², Sylvain Edouard², Martin Ferrand³
¹ Ecole des Ponts, Marne la Vallée, France; ² EDF RD, Ecuelles, France; ³ EDF RD, Chatou, France

VISUAL PRESENTATIONS 3AV.2

15:15 - 16:45

PV Module Durability and Reliability

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 2AO.3

17:00 - 18:30

III-V Based Devices | Tandem and Perovskite Solar Cells

Chairpersons:

Christiane Becker
HZB, Berlin, Germany
Gianluca Timò
RSE, Piacenza, Italy

2AO.3.1 III-V/Germanium Cells beyond Solar Photovoltaics: Recent Advances in Thermophotovoltaic and Laser Power Converters

Ignacio Rey-Stolle, Pablo Martín, Aitana Cano, Simeon Nikolaev, Iván García UPM, Madrid, Spain

2AO.3.2 Tandem III-V on Si Solar Cells using Low-Cost Multifunctional Bonding Layer

Elise Salmon¹, Jerónimo Buencuerpo², Jérémie Schuhmann³, Thomas Bidaud³, Oleh Ivashtenko³, Oliver Höhn⁴, David Lackner⁴, Frank Dimroth⁴, Amaury Delamarre³, Andrea Cattoni⁵, Stéphane Collin³
¹ IPVF, Palaiseau, France; ² IMN-CSIC, Madrid, Spain; ³ C2N, Palaiseau, France; ⁴ Fraunhofer ISE, Freiburg, Germany; ⁵ Polytechnic University of Milan, Italy

2AO.3.3 Micro-Crystal GaAs Array Sub-Cells for Si Tandem Solar Cells

James Patrick Connolly¹, Alexandre Jaffré¹, José Alvarez¹, Jean-Paul Kleider¹, Denis Mencaraglia¹, Géraldine Hallais², Frederic Hamouda², Laetitia Vincent², Daniel Bouchier², Charles Renard²
¹ CNRS, Gif-sur-Yvette, France; ² CNRS, Palaiseau, France

2AO.3.4 Impact of Luminescent Coupling on Tandem EQE Quantified by Rigorous Opto-Electronic Simulation

Simon Zeder¹, Tabea Krucker², Davide Moia¹, Beat Ruhstaller¹, Urs Aeberhard¹
¹ Fluxim, Winterthur, Switzerland; ² ZHAW, Winterthur, Switzerland

2AO.3.5 Multiscale Models for Perovskite Optimisation

Philippe Baranek¹, James Connolly², Antoine Gissler¹, Philip Schulz³, Michel Rerat⁴, Roberto Dovesi⁵
¹ EDF R&D, Palaiseau, France; ² GEEPS, Gif sur Yvette, France; ³ UMR IPVF, Palaiseau, France; ⁴ IPREM, Pau, France; ⁵ Accademia Delle Scienze, Torino, Italy

2AO.3.6 Modelling Perovskite Solar Cell Recovery under Dark during Light-Dark Cycling to Enhance Stability

Guillem Álvarez-Pérez, Jean Baptiste Puel, Jean François Guillemoles
IPVF, Palaiseau, France



ORAL PRESENTATIONS 1AO.6

17:00 - 18:30 Si Heterojunction Solar Cells and Related Processing Steps

Chairpersons: Pere Roca i Cabarrocas
LPICM-CNRS, Palaiseau, France
Audrey Morisset (i)
EPFL, Neuchâtel, Switzerland

1AO.6.1 Evaluating Silicon Heterojunction Solar Cell Stability under Industrial Illuminated Hydrogenation Conditions

Maysa Sarsour, Chukwuka Madumelu, Alison Ciesla, Fiacre Rougieux, Martin Green, N.J. Ekins-Daukes, Jessica Yajie Jiang
UNSW, Sydney, Australia

1AO.6.2 High Efficiency Silicon Heterojunction (SHJ) Solar Cells with Silver-Free Metallization; Comparing Ag, AgCu and Cu Metallization

Mohamed Issifi Yacouba, Andreas Lambert, Yanxin Liu, Henrike Gattermann, Volker Lauterbach, Karsten Bittkau, Uwe Rau, Kaining Ding
FZJ, Jülich, Germany

1AO.6.3 Al-Doped ZnO as Highly Passivating, Transparent and Conductive Electron-Contacts in Silicon Solar Cells: from Fundamentals to Future Prospects

Leonard Simeonov, W. M. M. Kessels, Bart Macco
TU Eindhoven, The Netherlands

1AO.6.4 DC- and RF-Sputtered MoO_x for Silicon Heterojunction Solar Cells

Yi Zheng¹, Yifeng Zhao¹, Liqi Cao¹, Christian Linke², Engin Özkol¹, Yingwen Zhao¹, Luana Mazzarella¹, Olindo Isabella¹
¹ TU Delft, The Netherlands; ² Plansee, Reutte, Austria

1AO.6.5 Indium-Free Silicon Heterojunction Solar Cells: Achieving High Conductivity with Magnetron-Sputtered SnO₂

Takashi Koida, Takuya Matsui, Hitoshi Sai
AIST, Tsukuba, Japan

1AO.6.6 Investigating the Degradation Behavior Induced by a Screen Printed Copper Paste on SHJ Solar Cells

Valentin Duval¹, Adeline Lanterne¹, Erwann Fourmond², Johann Jourdan¹, Gustavo Rodrigues Lopes¹, Benoit Marie¹, Gauthier Lefevre³
¹ CEA-INES, Le Bourget du Lac, France; ² INSA, Lyon, France; ³ CEA-LITEN, Grenoble, France

ORAL PRESENTATIONS 4AO.9

17:00 - 18:30 Irradiance for PV Design | Shading and Glare Mitigation

Chairpersons: Ana Maria Gracia Amillo
CENER, Sarriena, Spain
Invited

4AO.9.1 Reflective Properties of Urban Materials and Their Impact on PV Yield

Christian Schläger¹, Dennis Bredemeier¹, Arne Dittrich², Jan Hendrik Pfau¹, Philip Kühne¹, Rolf Brendel²
¹ Leibniz University Hannover, Germany; ² ISFH, Emmerthal, Germany

4AO.9.2 Impact of Dust Storms on Photovoltaic Generation: Role of Weather Parameters in Dust Accumulation and Mitigation Strategies

Shukla Poddar, Merinde Kay, Bram Hoex
UNSW, Sydney, Australia

4AO.9.4 Power Electronics Response to Moving Shade in Hybrid Solar Wind Park

Antonius R. (Teun) Burgers¹, Nico J.J. Dekker¹, Lenneke H. Slooff¹, Jaco Hovius²
¹ TNO, Petten, The Netherlands; ² Vattenfall, Amsterdam, The Netherlands

4AO.9.5 PV Shading Models with PVLIB

María Martínez-Barbeito, Clara Casas Castedo, Miguel Sánchez de León Peque, Adrián Blanco Aguiar, Brais González Rodríguez
ieco.io, Vigo, Spain

4AO.9.6 Addressing Glare Problematics for Photovoltaic Projects in the Immediate Proximity of Roads and Railways through the Use of Accurate Digital Surface Models

John Coutel, Aina Razanajao, Christophe Vernay, Sébastien Pitaval
SOLAIS, Valbonne, France

VISUAL PRESENTATIONS 3AV.3

17:00 - 18:30 PV Modules Characterisation and Performances Assessment

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.



Tuesday, 23. September 2025

ORAL PRESENTATIONS 1-2BO.1

08:30 - 10:00 Interplay of Interfaces on the Property of Perovskite | Silicon Tandems

Chairpersons: Ivan Gordon
imec, Genk, Belgium
Delfina Muñoz (*i*)
CEA, Le Bourget-du-Lac, France

1BO.1.1 Optimization of TOPCon-based Bottom Cells for High Open-Circuit Voltage (>2V) Perovskite/Silicon Tandems

Julien Hurni¹, Kerem Artuk¹, Christophe Allebé², Bertrand Paviet-Salomon², Christian Wolff¹, Christophe Ballif¹, Audrey Morisset², Franz-Josef Haug¹
¹ EPFL, Neuchâtel, Switzerland; ² CSEM, Neuchâtel, Switzerland

1BO.1.2 TOPCon²-Based Perovskite/Silicon Tandem Solar Cells

Armin Richter, Mario Hanser, Jana-Isabelle Polzin, Anna Damm, Martin Bivour, Jan Benick, Stefan Glunz
Fraunhofer ISE, Freiburg, Germany

1BO.1.3 Impact of c-Si Bottom Cell Nanoroughness on the Performance of Perovskite/c-Si Tandem Solar Cells

Yifeng Zhao¹, Esma Ugur², Arsalan Razzaq², Thomas G. Allen², Paul Procel¹, Adi Prasetyo², Katarina Kovačević¹, Luana Mazzarella¹, Erkan Aydin³, Stefaan De Wolf², Olindo Isabella¹
¹ TU Delft, The Netherlands; ² KAUST, Thuwal, Saudi Arabia; ³ LMU, Munich, Germany

2BO.1.4 Impact of Substrate Topography on Sequentially Evaporated Perovskite Film Growth: a Comparative Study of Planar and Textured Silicon Substrates for Tandem Application

Mohamed A. A. Mahmoud¹, Tobias Schulz², Yashika Gupta¹, Michael Günthel¹, Oussama Er-Raji¹, Oliver Fischer¹, Martin Bivour¹, Juliane Borchert¹
¹ Fraunhofer ISE, Freiburg, Germany; ² Martin-Luther-University, Halle, Germany

2BO.1.5 Indium-free Materials in the Tunnel Recombination Junction for Perovskite/Silicon Tandem Solar Cells

Angelika Harter, Dorothee Menzel, Lea Zimmermann, Sergei Trofimov, Darja Erfurt, Bor Li, Steve Albrecht, Bernd Stannowski
HZB, Berlin, Germany

2BO.1.6 Hybrid Two-Step Inkjet-Printing for Scalable and Conformal Perovskite-Si Tandem Solar Cells

Raphael Pesch¹, Johannes Sutter¹, Ulrich Lemmer¹, Ulrich Wilhelm Paetzold¹
¹ KIT, Karlsruhe, Germany

ORAL PRESENTATIONS 4BO.6

08:30 - 10:00 Assessing the Reliability of PV Systems

Chairpersons: Gisele A. dos Reis Benatto
DTU, Roskilde, Denmark
Joshua S. Stein (*i*)
Sandia National Laboratories, Albuquerque, United States of America

4BO.6.1 Three Decades, Three Climates: Insights and Lessons on PV Reliability

Hugo Quest¹, Ebrar Özkalay², Anika Gassner³, Alessandro Virtuani⁴, Gabriele Eder³, Stefanie Vorstoffel⁵, Claudia Buerhop-Lutz⁵, Gabi Friesen², Christophe Ballif⁶, Matthias Burri⁷, Christof Bucher⁷
¹ 3S Swiss Solar Solutions, Gwatt (Thun), Switzerland; ² SUPSI, Mendrisio, Switzerland; ³ OFI, Vienna, Austria; ⁴ CSEM, Neuchâtel, Switzerland; ⁵ HI ERN, Erlangen, Germany; ⁶ EPFL, Neuchâtel, Switzerland; ⁷ BFH, Burgdorf, Switzerland

4BO.6.2 Solar Bankability: A Decade of Insights and Future Directions

Sandra Gallmetzer¹, Atse Louwen¹, Guillermo Hernandez², Paolo Busetta³, David Moser¹
¹ Eurac Research, Bolzano, Italy; ² BayWa, Rome, Italy; ³ Saidea, Trento, Italy

4BO.6.3 Non-Destructive Detection of Water Ingress in Solar Modules using NIR Spectroscopy

Oleksandr Mashkov¹, Oleksandr Stroyuk¹, Claudia Buerhop¹, Sanna Bind², Dylan Clark², Jens Hauch¹, Ian Marius Peters¹
¹ HI ERN, Erlangen, Germany; ² i-MEET FAU, Erlangen, Germany

4BO.6.4 Massive LeTID Recovery Tool. Field Demonstration in a Utility Scale PV Plant

Mario Martinez, Sergio Suarez, Hanfei Liu, Manuel Rodríguez, Gustavo Navas, Jose Manuel Rivas, Sofia Rodriguez-Conde
Enertis Applus+, Madrid, Spain

4BO.6.5 Finding the Needle in a 100 MWp Haystack

Marie Syre Wiig, Magnus Moe Nygård, Bjørn Aarseth, Erik S. Marstein
IFE, Kjeller, Norway

4BO.6.6 Cost-Benefit Analysis of Luminescence Techniques vs. Infrared Thermography in Utility-Scale PV Inspections

Lukas Koester¹, Sandra Gallmetzer¹, Mousa Sondoqah¹, Atse Louwen¹, Giampaolo Manzolini², David Moser¹
¹ Eurac Research, Bolzano, Italy; ² Polytechnic University of Milan, Italy



ORAL PRESENTATIONS 3BO.11

08:30 - 10:00 Imaging Techniques for PV Modules

Chairpersons: Marios Theristis (i)
Sandia National Laboratories, Albuquerque, United States of America
Aline Kirsten Vidal de Oliveira (i)
UFSC, Florianópolis, Brazil

3BO.11.1 Latent Fault Identification for HJT Modules Subjected to Severe Hailstorm

Nicola Trivellin, Marco Nicoletto, Davide Panizzon, Alessandro Caria, Carlo De Santi, Matteo Buffolo, Gaudenzio Meneghesso, Enrico Zanoni, Matteo Meneghini
University of Padova, Italy

3BO.11.2 Investigating the Correlation between Cracks and the Extracted Performance Parameters in PV Modules

Ahmad Hashem¹, Zonghan Jiang¹, Guido Willers¹, Leila Mortazavifar¹, Bengt Jaeckel², Ralph Gottschalg²
¹ Anhalt University of Applied Sciences, Köthen, Germany; ² Fraunhofer CSP, Halle (Saale), Germany

3BO.11.3 An Electroluminescence Dataset for Visual Question Answering Foundation Models

Mohanad Diab, Lukas Koester, Atse Louwen, David Moser
Eurac Research, Bolzano, Italy

3BO.11.4 Unlocking PV Performance: AI-Driven Defect Detection with Multi-Spectral Imaging

Ebrar Özkalay¹, Ralf Jandl², Danuta Paraficz², Martina Perani², Mattia Ceretti¹, Mauro Caccivio¹
¹ SUPSI, Mendrisio, Switzerland; ² FFHS, Zurich, Switzerland

3BO.11.5 Asynchronous Daylight Luminescence obtained without Programmable Power Sources

Cristian Terrados, Eva de la Viuda, Kabir Paul Sulca, Julian Anaya, Miguel Ángel González, Oscar Martínez
University of Valladolid, Spain

3BO.11.6 Reliability of Quantitative Analysis of Lock-in Electroluminescence Images of PV Modules Based on Histogram Statistical Parameters

Jose Domingo Santos¹, Eneko Setien¹, Alberto Del Pozo¹, Liviu Stoicescu², Aritz Villodas¹, Aingeru Lucea¹, Ainhoa Pereda¹, Ricardo Alonso¹
¹ TECNALIA, Derio, Spain; ² Solarzentrum Stuttgart, Germany

ORAL PRESENTATIONS 4BO.16

08:30 - 10:00 Color in Photovoltaics

Chairpersons: Gabriele C. Eder
OFI, Vienna, Austria
Jun-Tae Kim
Kongju National University, Cheonan, South Korea

4BO.16.1 Experimental Investigation of Colored BIPV/T Systems for Wood-Framed Roofs

Anna-Maria Sigounis, Andreas Athienitis
Concordia University, Montreal, Canada

4BO.16.3 How to Perform Accurate Colour Measurements for BIPV Module Glass Covers: an IEA PVPS Task 15 Round-Robin Measurement Campaign

Markus Babin¹, Gabriele C. Eder², Helen R. Wilson³, Yuliya Voronko², Sune Thorsteinsson¹, Janina Willmann³, Janne Halme⁴, Thomas Friesen⁵, Martina Pelle⁶, Laura Maturi⁶, Fabrizio Leonforte⁷, Niccolò Aste⁷, Claudio Del Pero⁷, Jun-Tae Kim⁸, Gabriele Friesen⁹, Francesco Frontini⁹
¹ DTU, Roskilde, Denmark; ² OFI, Vienna, Austria; ³ Fraunhofer ISE, Freiburg, Germany; ⁴ Aalto University, Espoo, Finland; ⁵ Megasol Energie, Deitingen, Switzerland; ⁶ Eurac Research, Bolzano, Italy; ⁷ Polytechnic University of Milan, Italy; ⁸ Kongju National University, Chungnam, South Korea; ⁹ SUPSI, Mendrisio, Switzerland

4BO.16.4 Optical Design of Structural Colored Interlayers with Low Angular Color Dependence for Building-Integrated Photovoltaic Modules

Catarina Ferreira¹, Jani Lamminaho², Ananta Paul², Markus Babin³, Nanna Lysgaard Andersen³, Peter Behrendorff Poulsen³, Sune Thorsteinsson³, Karlis Petersons⁴, Leif Yde⁴, Jan Stensborg⁴, Joel Cox¹, Morten Madsen²
¹ SDU, Odense, Denmark; ² SDU, Sønderborg, Denmark; ³ DTU, Roskilde, Denmark; ⁴ Stensborg, Roskilde, Denmark

4BO.16.5 A New Algorithm to Design PV with Arbitrary Color

Jonas Schaible¹, Markus Götz², Sven Burger³, Christiane Becker⁴, Klaus Jäger¹
¹ HZB, Berlin, Germany; ² KIT, Karlsruhe, Germany; ³ Zuse Institute Berlin, Germany; ⁴ HTW, Berlin, Germany

4BO.16.6 Predicting Light Scatter and Angular Color Stability in Structural Colored BIPV Modules using Radiance

Nanna L. Andersen¹, Markus Babin¹, Karlis Petersons², Leif Yde², Jan F. Stensborg², Catarina G. Ferreira³, Ananta Paul³, Jani Lamminaho³, Joel D. Cox³, Morten Madsen³, Peter B. Poulsen¹, Sune Thorsteinsson¹
¹ DTU, Roskilde, Denmark; ² Stensborg, Roskilde, Denmark; ³ University of Southern Denmark, Odense, Denmark



VISUAL PRESENTATIONS 2BV.1

08:30 - 10:00 New Materials, Devices and Conversion Concepts | New Modelling and Characterisation Techniques

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 1BO.2

10:30 - 12:00 Characterisation and Modelling of Si Solar Cells

Chairpersons: Ronald Sinton (i)
Sinton Instruments, Boulder, United States of America
Hatice Duman
KalyonPV, Ankara, Türkiye

1BO.2.1 Special Introductory Presentation: Novel c-Si Solar Cell Designs for Unlocking 28% Efficiency and Beyond

Paul Procel Moya, Yifeng Zhao, Olindo Isabella
TU Delft, The Netherlands

1BO.2.2 Detecting Local Laser-Doping Variations by Hyperspectral Imaging and Machine Learning Models

Marko Turek¹, Stefan Eiternick¹, Jonathan Linke², Jan Hoß²
¹ Fraunhofer CSP, Halle (Saale), Germany; ² ISC Konstanz, Germany

1BO.2.3 Correlation Between Chemical Bonding State and Interface Passivation in TiOx Electron Selective Passivating Contact for Si Solar Cells

Shohei Fukaya¹, Kazuhiro Gotoh², Tappei Nishihara³, Hitoshi Sai⁴, Yasuyoshi Kurokawa¹, Noritaka Usami¹, Takuya Matsui⁴
¹ Nagoya University, Japan; ² Niigata University, Japan; ³ JASRI, Hyogo, Japan; ⁴ AIST, Tsukuba, Japan

1BO.2.4 Numerical Modelling of UV Down-shifting Layers for Improved Stability and Energy Yield of Silicon Solar Cells

Benjamin Lipovšek¹, Nicolas Frédéric Rochat², Franz-Josef Haug², Antonin Faes², Christophe Ballif², Marko Topič¹
¹ University of Ljubljana, Slovenia; ² EPFL, Neuchâtel, Switzerland

1BO.2.5 Ultrathin a-Si:H/Oxide Transparent Solar Cells Exceeding 2% Light Utilization Efficiency for Indoor PV Applications

Alex J. Lopez-Garcia¹, Gustavo Álvarez-Suárez², Pau Estarlich², Gerard Masmitja², José Miguel Asensi³, Cristóbal Voz², Joaquim Puigdollers², Alejandro Perez Rodriguez¹
¹ IREC, Barcelona, Spain; ² UPC, Barcelona, Spain; ³ UB, Barcelona, Spain

ORAL PRESENTATIONS 4BO.7

10:30 - 12:00 Field Insights, Performance and Modelling of PV Systems

Chairpersons: Roland Einhaus
ZSW, Stuttgart, Germany
Invited

4BO.7.1 Special Introductory Presentation: LiDAR Meets Modelling: Collaborative Insights from a Round-Robin of Vertical Bifacial PV Simulations

Ioannis (John) Tsanakas¹, Stéphane Mollier¹, Hervé Colin¹, Ismaël Lokhat², Branislav Schnierer³, Daniel Chrkavy³, Martin Opatovsky³, S. Prithivi Rajan⁴, Jesús Robledo⁴, Jonathan Leloux⁴
¹ CEA, Le Bourget-du-Lac, France; ² Cythelia Energy, La Motte-Servolex, France; ³ Solargis, Bratislava, Slovakia; ⁴ LucSun, Villers-la-Ville, Belgium

4BO.7.2 Robust PV Performance Loss Rate Calculation for High Latitudes

Lauri Karttunen¹, Sami Jouttijärvi¹, Väinö Anttalainen¹, Juha A. Karhu², Anders V. Lindfors², Samuli Ranta³, Kati Miettunen¹
¹ University of Turku, Finland; ² Finnish Meteorological Institute, Helsinki, Finland; ³ TUAS, Turku, Finland

4BO.7.3 Detailed Analysis of Degradation Rates of Operating PV Assets in Tropical Climate Conditions

Xiaoqi Xu¹, André M Nobre², Han Cao¹, Yu Xu¹, Ian Marius Peters³, Thomas Reindl¹
¹ SERIS, Singapore; ² PV Doctor, Singapore; ³ FZ Jülich, Erlangen, Germany

4BO.7.4 Modeling the Electrical Mismatch Caused by Potential Induced Degradation in Crystalline Silicon Photovoltaic Modules and Strings

Aysha Mahmood, Peter B. Poulsen, Sergiu V. Spataru
DTU, Roskilde, Denmark

4BO.7.5 Detect, Decouple, Optimise: Insights into PV Faults and Performance Trends

Hugo Quest¹, Christophe Ballif², Alessandro Virtuani³
¹ 3S Swiss Solar Solutions, Gwatt (Thun), Switzerland; ² EPFL, Neuchâtel, Switzerland; ³ CSEM, Neuchâtel, Switzerland



ORAL PRESENTATIONS 3BO.12

10:30 - 12:00 Characterisation and Energy Rating of PV Modules

Chairpersons: Hanna Ellis
European Commission JRC, Ispra, Italy
Ana Maria Gracia Amillo
CENER, Sarriguren, Spain

3BO.12.1 Developing a Novel I-V Translation Methodology in Accordance with IEC 60891:2021 Correction Procedure 1 and 2

Wenhao (Frank) Xu¹, Yating Zhang¹, Mengdi Liu¹, Christos Monokroussos¹, Werner Herrmann², Giorgio Bardizza², Harald Mülleians³
¹ TÜV Rheinland, Shanghai, China; ² TÜV Rheinland Solar, Cologne, Germany; ³ European Commission JRC, Ispra, Italy

3BO.12.2 Testing VIPV Curved Modules: Methods and Challenges

Ricardo Moruno, Rubén Núñez, Rebeca Herrero, Luis Javier San José, Francisco Martín, Guido Vallerotto, Ignacio Antón
UPM, Madrid, Spain

3BO.12.3 Stable, Standardized PV Reference Cells for Field Performance and Yield Assessment

Anton Driesse¹, Aron Habte², Manajit Sengupta², Tao Song²
¹ PV Performance Labs, Freiburg, Germany; ² NREL, Golden, United States of America

3BO.12.4 Estimating the Energy Yield of Bifacial Photovoltaics with the JRC's Photovoltaic Geographic Information System

Nigel Taylor¹, Nikos Alexandris¹, Alexandros Falangas², Teodora Lyubenova¹, Robert Kenny¹, Ewan D. Dunlop¹, Blago Mihaylov¹
¹ European Commission JRC, Ispra, Italy; ² Trasys, Brussels, Belgium

3BO.12.5 An Update on Energy Rating Amendments – Integration of Bifacial Modules

Stefan Riechelmann¹, Hendrik Sträter¹, Ana María Gracia², Sophie Pelland³, Driesse Anton⁴
¹ PTB, Braunschweig, Germany; ² CENER, Pamplona, Spain; ³ Natural Resources Canada, Varennes, Canada; ⁴ PV Performance Labs, Freiburg, Germany

3BO.12.6 Characterization, Modeling, and Simulation of Ultraviolet Downshifting Front Encapsulant for Photovoltaic Modules

Nicolas Frédéric Rochat¹, Florian Ollagnon¹, Benjamin Lipovšek², Marko Topič², Hengyu Li³, Matthieu Despeisse³, Lison Marthey³, Jordi Escarré Palou³, Franz-Josef Haug¹, Antonin Faes¹, Christophe Ballif¹
¹ EPFL, Neuchâtel, Switzerland; ² University of Ljubljana, Slovenia; ³ CSEM, Neuchâtel, Switzerland

ORAL PRESENTATIONS 4BO.17

10:30 - 12:00 Performance of PV on/in Buildings

Chairpersons: Angele Reinders
Eindhoven University of Technology, The Netherlands
Simon Boddaert
CSTB, Sophia Antipolis, France

4BO.17.1 Modeling Partial Shading at the Cell Level on Photovoltaic Modules

Jean-Paul Calin¹, Jacques Levrat², Antonin Faes², Fahrudin Mujović², Paul Rémondeau³, Kléber Nicolet-dit-Félix³, Bénédicte Bonnet-Eymard², Didier Dalmazzone¹, Aïcha Hessler-Wyser³, Christophe Ballif³
¹ ENSTA Paris, Palaiseau, France; ² CSEM, Neuchâtel, Switzerland; ³ EPFL, Neuchâtel, Switzerland

4BO.17.2 Market Potential of Building-Integrated Photovoltaics: a Granular Analysis of the European Building Stock

Juan Ignacio Martinez¹, Julien Van Overstraeten², Philippe Macé², José Maria Vega de Seoane¹, Elina Bosch², Mélodie de l'Epine³
¹ Becquerel Institute España, San Sebastian, Spain; ² Becquerel Institute, Brussels, Belgium; ³ Becquerel Institute France, Lyon, France

4BO.17.3 Photovoltaics in the Built Environment – an Overview of Timely Topics for Research and Development

Francesco Frontini¹, Angele Reinders²
¹ SUPSI, Mendrisio, Switzerland; ² TU Eindhoven, The Netherlands

4BO.17.4 Comparing the Energy Yield and Degradation Rates of Smart PV Modules Compared to Conventional PV System Designs in Shaded Urban Scenario's

Youri Blom, Rudi Santbergen, Olindo Isabella, Malte Ruben Vogt
TU Delft, The Netherlands

4BO.17.5 Advancing BIPV: Shingled HJT Technology for High-Efficiency and Aesthetic Solar Integration

Gabriella Gonnella, Alvaro De Gruijter, Jordi Veirman, Laura Maturi, David Moser
Eurac Research, Bolzano, Italy

4BO.17.6 PV-Planning and Simulation, Daylight Simulation and Energy-Certificate Calculation based on an Open-BIM-Building-Model

Astrid Schneider¹, Karin Stieldorf¹, Christian Schranz¹, Harald Urban¹, Alfred Waschl², Markus Feichtner³, Fedele Rende⁴, Andrea Aiello⁴, Martin Hauer⁵, Kurt Battisti⁶, Markus Dörn⁶, Jacqueline Scherret⁶, Martin Treberspurg⁷, Christoph Treberspurg⁷
¹ TU Wien, Austria; ² buildingSMART, Vienna, Austria; ³ Sonnenkraft, St. Veit an der Glan, Austria; ⁴ ACCA Software, Cosenza, Italy; ⁵ Bartenbach, Vienna, Austria; ⁶ A-Null Development, Vienna, Austria; ⁷ Treberspurg & Partner Architekten, Vienna, Austria



VISUAL PRESENTATIONS 2BV.2

10:30 - 12:00 **Compound and Organic Semiconductors**

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 1BO.3

13:30 - 15:00 **Si Solar Cell Manufacturing Processes**

Chairpersons: Marina Foti (i)
3Sun, Catania, Italy
Xinyu Zhang (i)
Jinko Solar, Minhang District, China

1BO.3.1 Strong and Resilient European High-Tech Manufacturing by Advancing Solar Innovation

Rudolf Harney¹, Puzant Baliozian², Thorsten Dullweber³, Wolfgang Jooß⁴, Ivona Kafedjiska⁵, Radovan Kopecek¹, Joris Libal¹, Sebastian Nold⁶, Ralf Preu⁶, Julian Reichle⁴, Udo Römer³, Rutger Schlatmann⁵, Bernd Stannowski⁵
¹ ISC Konstanz, Germany; ² VDMA, Frankfurt, Germany; ³ ISFH, Hamelin, Germany; ⁴ RCT Solutions, Konstanz, Germany; ⁵ HZB, Berlin, Germany; ⁶ Fraunhofer ISE, Freiburg, Germany

1BO.3.2 Pathway to TBC: Process, Design, and Cost Implications for New PERC & TOPCon Lines

Julian Reichle, Sraisth Sraisth, Mehul Raval, Gourab Das, Andreas Teppe, Wolfgang Jooss, Peter Fath
RCT Solutions, Constance, Germany

1BO.3.3 Industrial Implementation of 24.1% Efficient POLO IBC Solar Cells and Future Upgrade to > 26% POLO IBC

Thorsten Dullweber¹, Yevgeniya Larionova¹, Philip Jaeger¹, Sabrina Schimanke¹, Melanie Ripke¹, Ulrike Baumann¹, Alaa Osman¹, Udo Roemer¹, Robby Peibst¹, Rolf Brendel¹, Ozlem Coskun², Gamze Cekerek², Meric Caliskan Arslan², Geoffrey Gregory³, Erik Hoffmann³, Massimo Centazzo³
¹ ISFH, Emmerthal, Germany; ² Kalyon PV, Ankara, Türkiye; ³ EnPV, Karlsruhe, Germany

1BO.3.4 Using a Shadow Mask during Gas-Phase Etching: a one Step, Single-Side Patterning Method for Poly-Silicon Layers

Laurent Clochard¹, Thorsten Dullweber², Yevgeniya Larionova²
¹ Nines Photovoltaics, Dublin, Ireland; ² ISFH, Hamelin, Germany

1BO.3.5 From Pixels to Performance: Predicting Quality at Early-Stage and Revealing Defect-Formation in HJT Solar Cell Production

Matthias Demant¹, Aasaipriya Chandran¹, Alexandra Wörnhör¹, Jonas Haunschild¹, Thomas Brox², Stefan Rein¹
¹ Fraunhofer ISE, Freiburg, Germany; ² University of Freiburg, Germany

1BO.3.6 UV Stable Passivation Stack with Plasma-Enhanced Atomic Layer Deposition of Aluminum Oxide from an Industrial Tube-Type Direct Plasma-Enhanced Chemical Vapor Deposition System

Byungsul Min¹, Christina Hollemann¹, Viet Xuan Nguyen², Thomas Pernau², Daniela Seiffert², Helge Haverkamp², Thorsten Dullweber¹, Verena Mertens¹, Henning Schulte-Huxel¹, Rolf Brendel¹
¹ ISFH, Emmerthal, Germany; ² centrotherm international, Blaubeuren, Germany

ORAL PRESENTATIONS 2BO.8

13:30 - 15:00 **Advanced Conversion Devices**

Chairpersons: Claudia Malerba
ENEA, Rome, Italy
Govind Padmakumar
TU Delft, The Netherlands

2BO.8.1 Singlet Fission Route for >30% Efficient Solar Cells: Silicon Cell Requirements

Shona McNab, Alex J. Baldacchino, Pheobe Pearce, Alvin Mo, Alison Ciesla, Bram Hoex, Nicholas J. Ekins-Daukes, Murad J. Y. Tayebjee, Michael P. Nielsen
UNSW, Sydney, Australia

2BO.8.2 Over 18% Efficient Cu₂ZnSnS₄ Solar Cells for Indoor Applications Enabled by Alkali Doping and Cation Alloying

Yuancai Gong¹, Alex Jimenez-Arguijo¹, Ivan Cano¹, Romain Scaffidi², Alejandro Navarro-Güell¹, Oriol Segura-Blanch¹, Sergio Giraldo¹, Marcel Placidi¹, Zacharie Jehl Li-Kao¹, Edgardo Saucedo¹
¹ UPC, Barcelona, Spain; ² Hasselt University, Belgium

2BO.8.3 Hot Carrier Photocurrent as an Additional Loss in Solar Cells

Ihor Zharchenko, Jonas Gradauskas, Oleksandr Masalskyi, Steponas Ašmontas, Algirdas Sužiedėlis, Aurimas Čerškus, Edmunas Širmulis, Kazimieras Petrauskas, Muhammad Mujahid
Center for Physical Sciences and Technology, Vilnius, Lithuania



2BO.8.4 Surface Passivation of Black Germanium for Interdigitated Back Contact Thermophotovoltaic Cell

Mansur Gamel¹, Gerard Rivera¹, Gema Lopez¹, Mariia Terletskaia², Hanchen Liu², Ville Vahanissi², Hele Savin², Moises Garin³, Isidro Martin¹

¹ UPC, Barcelona, Spain; ² Aalto University, Espoo, Finland; ³ UVIC-UCC, Vic, Spain

2BO.8.5 Performance of a 4-Terminals Spectral Splitting Asymmetric Solar Concentrator in Diffuse Sunlight: a Numerical Study

Floriana Morabito¹, Daniela Fontani², Paola Sansoni², Mehdi Ahmadi³, Salvatore Lombardo³, Andrea Farina¹, Silvia Maria Pietralunga¹

¹ CNR-IFN, Milan, Italy; ² CNR-INO, Florence, Italy; ³ CNR-IMM, Catania, Italy

2BO.8.6 GaAs for Thermophotonics: from Thin-Film Solar Cells to Highly Efficient LEDs

Natasha Gruginskie¹, Peter Mulder¹, Gerard Bauhuis¹, Jani Oksanen², John Schermer¹

¹ Radboud University, Nijmegen, The Netherlands; ² Aalto University, Espoo, Finland

VISUAL PRESENTATIONS 4BV.3

13:30 - 15:00

Solar Resource and Forecasting

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

PANEL DISCUSSION PRESENTATIONS

13:30 - 15:00

BO.13 Panel Discussion

ORAL PRESENTATIONS 1BO.4

15:15 - 16:45

Novel Metallisation Techniques

Chairpersons:

Peter Fath

RCT-Solutions, Konstanz, Germany

Eve Krassowski

CE Cell Engineering, Kabelsketal, Germany

1BO.4.1 Stability of Barrier Layer Stacks against Aluminum for Solar Cells with poly-Si/SiO_x Passivating Contacts

Heiko Plagwitz, Benjamin Gapp, David Bäurle, Emanuel Auerbacher, Barbara Terheiden

University of Konstanz, Germany

1BO.4.2 Advancements on Post-processing of High Efficiency Cells: Data from Mass Production and Experimental Roadmap

Alessandro Voltan¹, Francesco Dalla Torre¹, Bertrand Hladys², Grazia Litrico³, Alessandro Furnari³, Marcello Sciuto³

¹ Applied Materials, Treviso, Italy; ² CEA, Grenoble, France; ³ Enel Green Power, Catania, Italy

1BO.4.3 Reduction of Silver and Indium Consumption by Copper Plating with a Dielectric Masking Layer for Sustainable Production of Heterojunction Cells

Bertrand Paviet-Salomon¹, Agata Lachowicz¹, Jun Zhao¹, Jörg Schube², Christophe Ballif¹

¹ CSEM, Neuchâtel, Switzerland; ² Fraunhofer ISE, Freiburg, Germany

1BO.4.4 Influence of Particle Shape and Size in Copper based Low-Temperature Metallization Paste for Solar Cells

Oumaima Mhirs, M. Noah Wengenmeyr, Jonas Bartsch

Fraunhofer ISE, Freiburg, Germany



1BO.4.5 Advancements in String Printing for High Aspect Ratio Front Contacts

Jonas Valentijn, Hidde Stokkel, Mathis Van de Voorde, Janis Anderson,
Rebecca Saive
University of Twente, Enschede, The Netherlands

1BO.4.6 Inline Plating of Ni/Cu Contacts for Industrial TOPCon Si Solar Cells - Status and Outlook

Sven Kluska¹, Jonas Eckert¹, René Haberstroh¹, Christian Schmiga¹,
Sebastian Mack¹, Mathias Kamp², Damian Brunner², Florian Clement¹
¹ Fraunhofer ISE, Freiburg, Germany; ² Rena Technologies, Freiburg, Germany

ORAL PRESENTATIONS 2BO.9

15:15 - 16:45 New Materials and Structures for PV

Chairpersons: Natasha Gruginskie
Radboud University, Lent, The Netherlands
Shona McNab
UNSW, Sydney, Australia

2BO.9.1 High Thermoelectric Performance in Few-Layered p-Type Molybdenum Disulfide for Photovoltaics

Inés Durán¹, Jorge Rodríguez-Muro¹, Patricia Cancho García¹, Der-Yuh Lin²,
Antonio Martí¹, Elisa Antolin¹, Simon A. Svatek¹
¹ UPM, Madrid, Spain; ² National Changhua University of Education, Taiwan

2BO.9.2 Experimental Study of Hole Transport Layers for Enhanced Efficiency in Selenium Solar Cells

Oriol Segura Blanch, Arnau Torrens Dinarés, Ivan Caño Prades, Lorenzo
Calvo-Barrio, Zacharie Jehl, Pablo Ortego Villasclaras, Marcel Placidi,
Joaquim Puigdollers Gonzalez, Edgardo Saucedo
UPC, Barcelona, Spain

2BO.9.3 Advancing Transparent Conductive Oxides: SrNbO₃ as a New Interconnecting Layer in Si-Perovskite 2T Tandem Cells

Johnny Azzi, Hervé Roussel, Sonia Ortega, Jean-Luc Deschanvres,
Frédérique Ducroquet
University of Grenoble Alpes, France

2BO.9.4 CsPbCl₃:Yb³⁺/Mn²⁺ Nanocrystals in Free-Space Luminescent Solar Concentrators for Photovoltaic Yield Enhancement

Mathis Van de Voorde, Tim Bekius, Rebecca Saive
University of Twente, Enschede, The Netherlands

2BO.9.5 Honeycomb Textures on Glass for Solar Cells in Superstrate Configuration

Govind Padmakumar, Aravind S. Balaji, Federica Saitta, Paula Rodriguez,
Arno H. M. Smets
TU Delft, The Netherlands

2BO.9.6 Next-Generation Agrivoltaic Solutions: Novel Organic and Inorganic Spectrally Selective Thin-Film Solar Cells

Pasquale Morvillo, Rosa Ricciardi, Manuela Ferrara, Marco Della Noce, Iurie
Usatii, Paola Delli Veneri, Lucia Vittoria Mercaldo
ENEA, Portici, Italy



ORAL PRESENTATIONS 3BO.14

15:15 - 16:45 Characterisation and Outdoor Monitoring of Perovskite-based PV Modules

Chairpersons: Gianluca Coletti (*i*)
UNSW, Sydney, Australia
Gabi Friesen (*i*)
SUPSI, Mendrisio, Switzerland

3BO.14.1 Outdoor Measurements of Perovskite Modules

Hanna Ellis, Tony Sample, Harald Mülleians, Ewan D. Dunlop
European Commission JRC, Ispra, Italy

3BO.14.2 Module-level Comparison of the Performance and the Effects of Degradation in Two-, Three- and Four-Terminal Perovskite Silicon Tandems under Real-World Operating Conditions

Youri Blom, Wenang Suprayogi, Malte Ruben Vogt, Olindo Isabella, Rudi Santbergen
TU Delft, The Netherlands

3BO.14.3 Advanced Outdoor Characterization and Analysis of Meta-Stability in Perovskite Solar Cells using Bayesian Inference

Antoine Burgaud¹, Joseph Chakar², Karim Medjoubi³, Jorge Posadas⁴, Aimad-Eddine Admane⁵, Jean-Baptiste Puel⁵, Yvan Bonnassieux²
¹ IPVF, Cachan, France; ² LPICM, Paris, France; ³ IPVF, Palaiseau, France; ⁴ EDF, Palaiseau, France; ⁵ EDF, Paris, France

3BO.14.4 Perovskite Mini-Module Voltage Loss Quantification and Analysis by Large Scale Hyperspectral Photoluminescence Imaging

Alexandra Levchenko¹, Pilar Lopez-Varo¹, Marion Provost¹, Karim Medjoubi¹, Jean Rousset², Daniel Ory²
¹ IPVF, Palaiseau, France; ² EDF R&D, Palaiseau, France

3BO.14.5 Stability is (Almost) All You Need: Techno-Economic Assessment of All Dry Perovskite-on-Silicon Tandem PV Modules

Dmitry Bogachuk¹, Peter Tillmann¹, Hao-Cheng Wang², Li Wan², Yewei Zhang², Ye Tian², Delin Lu², Christian Peter¹
¹ Solarlab Aiko Europe, Freiburg, Germany; ² Zhejiang Aiko Solar, YiWu, China

3BO.14.6 Towards Inline IV Characterization of Commercial Perovskite PV Modules

Peter Pasmans, Stefan Roest
Eternal Sun, The Hague, The Netherlands

VISUAL PRESENTATIONS 4BV.4

15:15 - 16:45 BIPV

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 4BO.5

17:00 - 18:30

PV-Products for Buildings

Chairpersons: Francesco Frontini (*i*)
SUPSI, Mendrisio, Switzerland
Invited

4BO.5.1 Fabrication of a Novel Semi-Translucent BIPV Module Providing High Power Density and Active Daylight Management

Almudena Garcia-Sanchez¹, Guido Vallerotto¹, Jaime J. Hernández², Alejandro García-Cañas², Steve Askins¹, Ignacio Antón¹, Isabel Rodríguez², César Domínguez¹
¹ UPM, Madrid, Spain; ² IMDEA Nanoscience, Madrid, Spain

4BO.5.2 Performance Evaluation of Air-based BIPVT System with a Heat Pump

Sang Myung Kim, Jun-Hee Kim, Jun-Tae Kim
Kongju National University, Cheonan-si, South Korea

4BO.5.3 A Comparative Study of Photovoltaic Shading Devices for Net Zero Energy Buildings across French Climates

Mohammad Nazifard, Erwin Franquet
Université Côte d'Azur, Nice, France

4BO.5.4 Development of PV-Activated Design Façade Elements and Their Long-Term Stability

Kevin Meyer¹, Wiebke Wirtz¹, Iris Kunze¹, Danny Lorenz², Fynn Klopp², Henning Schulte-Huxel¹
¹ ISFH, Emmertal, Germany; ² MN-Metall, Neustadt (Holstein), Germany

4BO.5.5 Impact of Honeycomb Height and Orientation on the Bending Stiffness of Honeycomb Sandwich Backplanes for Solar Modules

Jessica Ruffiner¹, Kléber Nicolet-dit-Félix², Umang Desai², Antonin Faes², Aïcha Hessler-Wyser², Christophe Ballif²
¹ University of Fribourg, Switzerland; ² EPFL, Neuchâtel, Switzerland

4BO.5.6 Technical and Economic Aspects of Adhesives for Integrated Photovoltaics

Sonja Feldbacher¹, Petra Christöfl¹, Suzanne Westerdijk², Andreas Haller³, Pascal Suter³, Jochen Schuermans⁴, Filip Uyttenhoven⁵, Nikoleta Kyranaki⁶, Roland Valckenborg⁷, Gernot Oreski¹
¹ PCCL, Leoben, Austria; ² MAAN Horti Automation, Raalte, The Netherlands; ³ Ernst Schweizer, Zurich, Switzerland; ⁴ Roartis, Genk, Belgium; ⁵ VDL ETG, Eindhoven, The Netherlands; ⁶ Hasselt University, Hasselt, Belgium; ⁷ TNO, Eindhoven, The Netherlands



ORAL PRESENTATIONS 2BO.10

17:00 - 18:30 Advanced Modelling and Characterisation of Perovskite Solar Cells

Chairpersons: Iñigo Ramiro
UPM, Madrid, Spain
Theresa Magorian Friedlmeier
ZSW, Stuttgart, Germany

2BO.10.1 Special Introductory Presentation: Next-Generation Characterisation: Combining Reflectance and Luminescence Hyperspectral Spectroscopy with Statistical Modelling

Arthur Julien, Shuai Nie, Ziv Hameiri
UNSW, Sydney, Australia

2BO.10.2 On Perimeter Losses in Perovskite Top- and Poly-Si-Passivated Silicon Bottom Cells – do Small Area Tandems Reveal the Full Efficiency Potential?

Felix Haase, Lukas Brockmann, Annika Raugewitz, Verena Steckenreiter, Verena Barnscheidt, Roland Clausen, Sara Baumann, Joachim Vollbrecht, Welmoed Veurman, Johannes Löhr, Dongyang Liu, Mircea Turcu, Lasse Nasebandt, Udo Römer, David Sylla, Jessica Strey, Martha Löhning, Larissa Mettner, Renate Winter, Anja Christ, Heike Kohlenberg, Cornelia Marquardt, Emanuel Brueckner, Hossein Rabiei, Michael Rienäcker, Sarah Kajari-Schröder, Tobias Wietler, Robby Peibst
ISFH, Emmerthal, Germany

2BO.10.3 Identifying Performance Limiting Factors in Halide Perovskite Solar Cells: Ionic Effects, Contact Resistance and Inhomogeneities

Davide Moia¹, Ennio Luigi Comi², Mattia Battaglia², Roland Wirth², Daniele Braga¹, Urs Aeberhard¹, Evelyne Knapp², Sandra Jenatsch¹, Beat Rushstaller²

¹ FLUXIM, Winterthur, Switzerland; ² ZHAW, Winterthur, Switzerland

2BO.10.4 Imaging Efficiency of Perovskite Solar Cells via Voltage-Dependent Photoluminescence

Anh Dinh Bui¹, Dang-Thuan Nguyen¹, Andreas Fell², Oliver Fischer², Florian Schindler², Martin C. Schubert², Hieu T. Nguyen¹, Daniel MacDonald¹

¹ ANU, Canberra, Australia; ² Fraunhofer ISE, Freiburg, Germany

2BO.10.5 In-depth Characterization and Simulation Approach for the Understanding of In- and Outdoor Degradation of Perovskite Solar Cells

Jonathan Parion¹, Amit Kumar Harit¹, Elias Peraticos², Vasiliki Paraskeva², Maria Hadjipanayi², Aranzazu Aguirre¹, Filip Duerinckx¹, Hariharsudan Sivaramakrishnan Radhakrishnan¹, Jef Poortmans¹, Johan Lauwaert³, Bart Vermang¹

¹ Hasselt University, Genk, Belgium; ² University of Cyprus, Nicosia; ³ Ghent University, Zwijnaarde, Belgium

ORAL PRESENTATIONS 3BO.15

17:00 - 18:30 Outdoor Performances and Degradation Analysis of PV Modules

Chairpersons: Ebrar Özkalay
SUPSI, Mendrisio, Switzerland
Carolin Ulbrich
HZB, Berlin, Germany

3BO.15.1 Exploring Discrepancies between Indoor Degradation Rates and Outdoor Performance Loss Rates in Photovoltaics

Marios Theristis, Kevin Anderson, Joshua S. Stein, Bruce King
Sandia National Laboratories, Albuquerque, United States of America

3BO.15.2 Performance Characterization of Monofacial and Bifacial Modules in French Polynesia: Case Study of Tahiti

Moira Itzel Torres Aguilar¹, Pascal Ortega¹, Jordi Badosa Franch², Johan Parra²

¹ University of French Polynesia, Faa'a; ² Polytechnic School, Palaiseau, France

3BO.15.3 Spectrally Resolved Energy Yield Prediction of SHJ Modules with UV Downshifting Encapsulant

Maxime Babics¹, Diego Di Girolamo², Vincent Barth¹, Yannick Roujol¹, Jeremie Aime¹, Gabriele Bianca², Antonio Ragonesi², Sandra Desvergne-Bleneau¹, Eszter Voroshazi¹

¹ CEA-INES, Le Bourget-du-Lac, France; ² 3SUN, Catania, Italy

3BO.15.4 Statistical Trends in Nominal vs. Measured Performance of PV Modules and the Impact of Meta-Stability

Daniel Philipp, Martin Kaiser, Ulli Kräling, Paul Gebhardt, Alexandra Schmid
Fraunhofer ISE, Freiburg, Germany

3BO.15.5 Towards Standardized Test Protocol for Evaluating UV Susceptibility in PV Industry

Ting Huang, Ruirui Lv, Liang Wu, Yuanjie Yu, Alan Xu
Canadian Solar, Suzhou, China

3BO.15.6 Fifteen Years Under the Sun: Real-Field Degradation Analysis of Veteran PV Modules

Frédéric Mezzasalma, Alexandre Mignonac, Hervé Colin, Romain Couderc, Lionel Sicot, Philippe Marechal, Guillaume Capron, Ioannis Tsanakas, Jérémie Aimé
CEA INES, Le Bourget-du-Lac, France

VISUAL PRESENTATIONS 1BV.5

17:00 - 18:30 Crystalline Silicon Material: Defects and Recycling | Processes and Concepts for the Manufacturing of Silicon Solar Cells

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.



Wednesday, 24. September 2025

PLENARY PRESENTATIONS 1CP.1

08:30 - 10:00 Si PV Manufacturing: Pushing the Limits of Performance

Chairpersons: Alison Ciesla (*i*)
UNSW, Sydney, Australia
Stefan W. Glunz
Fraunhofer ISE, Freiburg, Germany

CP.1.1 Special Introductory Presentation: Silicon Surface and Interface Study for >27% Efficient SHJ Solar Cell

Guangtao Yang, Haijiang Lu, Cong Guo, Zhan Gao, Kun Zhu, Yongheng Wang, Hongwei Li, Qianqian Jiang, Haiyang Pei, Fangxu Shi, Rui He, Chong Di, Zhigang Xie, Yifeng Chen
Trina Solar, Changzhou, China

CP.1.2 IBC4EU: European Back Contact Technology

Florian Buchholz¹, Daniel Tune¹, Tobias Meßmer¹, Jonathan Linke¹, Manjunath Prasad¹, Valentin Mihailetschi¹, Juras Ulbikas², Arne Dahle³, Martijn Meereboer⁴, Francesca Fabris⁵, Erik Eikelboom⁵, Tom Borgers⁶, Rik Van Dyck⁶, Filip Duerinckx⁶, Hariharsudan Sivaramakrishnan⁶, Timea Bejat⁷, Samuel Harrison⁷, Ashish Binani⁸, Nicolas Guillevin⁸, Jan Kroon⁸, Yevgeniya Larionova⁹, Thorsten Dullweber⁹, Ofer Shochet¹⁰, Isaac Rosen¹⁰, Ingo Röver¹¹, Wolfram Palitzsch¹¹, Yasmin Zaror¹², Johannes Stierstorfer¹², Aurimas Radzevicius¹³, Julius Denafas¹³, Tuomas Vanhanen¹⁴, Tuukka Savisalo¹⁴, Maximilian Pospischil¹⁵, Marian Breitenbücher¹⁵, Ozlem Coskun¹⁶, Melodie de l'Epine¹⁷, Philippe Macé¹⁸, Ian Kenchington¹⁹

¹ ISC Konstanz, Germany; ² Protechnology, Vilnius, Lithuania; ³ Norsun, Ardal, Norway; ⁴ Energyra, Westknollendam, The Netherlands; ⁵ Futurasun, Citadella, Italy; ⁶ IMEC, Genk, Belgium; ⁷ CEA, Le Bourget-du-Lac, France; ⁸ TNO, Petten, The Netherlands; ⁹ ISFH, Hameln, Germany; ¹⁰ Copprint, Jerusalem, Israel; ¹¹ LuxChemTech, Freiberg, Germany; ¹² WIP - Renewable Energies, Munich, Germany; ¹³ Valoe Cells, Vilnius, Lithuania; ¹⁴ Valoe, Mikkeli, Finland; ¹⁵ Highline Technologies, Freiburg, Germany; ¹⁶ Kalyon PV, Ankara, Türkiye; ¹⁷ Becquerel Institute France, Lyon, France; ¹⁸ Becquerel Institute, Brussels, Belgium; ¹⁹ Becquerel Institute, Brussels, Belgium

CP.1.3 Invited Presentation: Challenges and Opportunities in Scaling HJT Manufacturing at GW Level in Europe: Navigating the Path to Large-Scale Solar Success

CP.1.4 Business Model Optimization for European Solar PV: a Study on Costs and Commercial Strategies

Ian Kenchington¹, Philippe Macé¹, Gaëtan Masson¹, Joris Libal²
¹ Becquerel Institute, Brussels, Belgium; ² ISC Konstanz, Germany

PLENARY PRESENTATIONS CP.2 | CP.3

10:30 - 12:30 Perovskite – Silicon Tandems: Towards Commercialisation | PV Stability in the Field

Chairpersons: Eszter Voroshazi
CEA, Le Bourget-du-Lac, France
Teresa M. Barnes (*i*)
NREL, Evergreen, United States of America

CP.2.1 World-Record Industrial Tandem Solar Cells on M10 Wafer Size

Lukas Kegelmann, Dominik Siebert, Felix Frühauf, Hussein Osman, Marco Ruiz, Natasha Hjerrild, Nora Buschmann, Raphael Edem Agbenyeke, Rene Hönig, Saba Gharibzadeh, Stefan Hartnauer, Torben Klinkert, Andre Wirtz, Doreen Foitzik, Fabian Schackmar, Marcus Wolff, Moritz Loy, Jose Garcia Cerrillo, Klaus Duncker, Ralf Niemann, Steffen Geissler, Patrick Mende, Hans-Christoph Ploigt, Axel Schwabedissen, Gregor Zimmermann, Matthias Schütze, Björn Eisenhawer, Adam Pockett, Birte Kressdorf, Kenza Djeghdi, Filipe Martinho, Carsten Baer, Lorenzo Burtone, Olaf Schnelting, Florian Daniel, Alaaeldin Gad, Andy Szpeth, Dirk Wissen, DongJu Jang, Maximilian Kauert, Steffen Laube, Anika Weihrach, Azhar Fakhar Uddin, Eoin Elliott, Friederike Kersten, Hans Köbler, Joel Smith, Martina Gille, Pietro Caprioglio, Sarah Brückner, Sven Wasmer, Henry Weber, Kevin Wachsmuth, Ronny Bakowskie, Ansgar Mette, Max Hendrichs, Enrico Jarzembowski, Robert Bauer, Fabian Fertig
Hanwha Q CELLS, Bitterfeld-Wolfen, Germany

CP.2.2 Technical Considerations for Commercializing Perovskite Photovoltaic Modules – a Review of Observations from the PACT Center

Joshua S. Stein¹, Laura T. Schelhas², Timothy J. Silverman², Bruce H. King¹, Angélique Montgomery¹, Michael Owen-Belini², Nicholas Irvin², Sona Ulicna², Michael Deceglie², Norman Jost¹, Daniel Riley¹, Byron McDanold², Charles Robinson¹, Joseph J. Berry²

¹ Sandia, Albuquerque, United States of America; ² NREL, Golden, United States of America



CP.2.3 Total Cost of Ownership, LCA and LCOE Analysis of Perovskite-Silicon Tandems Compared to Single Junction Crystalline Silicon PV Technologies

Baljeet Singh Goraya, Dilara Maria Subasi, Peter Henri Brailovsky, Henning Nagel, Patricia S.C. Schulze, Martin C. Schubert, Jochen Rentsch, Sebastian Nold

Fraunhofer ISE, Freiburg, Germany

CP.3.4 Outdoor Performance and Reliability of Perovskite-Silicon Tandems: Fifteen Months of Monitoring in the NEXUS Project

Atse Louwen¹, Alexander Astigarraga¹, Juan José Stivanello¹, David Moser¹, Perrine Carroy², Vincent Barth², Delfina Muñoz², Anika Sidler³, Markus Lenz³, Jorge Ferrando⁴, Maximiliano Alejandro Senno⁴, Henk J. Bolink⁴, Talat Özden⁵, Hisham Nasser⁵, Shuaifeng Hu⁶, Xinyi Shen⁶, Henry Snaith⁶

¹ Eurac Research, Bolzano, Italy; ² CEA/ INES, Le Bourget-du-Lac, France; ³ School of Life Sciences FHNW, Muttet, Switzerland; ⁴ University of Valencia, Paterna, Spain; ⁵ ODTÜ-GÜNAM, Ankara, Türkiye; ⁶ University of Oxford, United Kingdom

CP.3.5 Understanding the Root Cause of UV-Induced Degradation in TOPCon and PERC Solar Cells

Muhammad Umair Khan¹, Phillip Hamer¹, Aeron Johns¹, Chandany Sen¹, Ting Huang², Munan Gao², Ruirui Lv², Yuanjie Yu², Haoran Wang¹, Xinyuan Wu¹, Xutao Wang¹, Bram Hoex¹

¹ UNSW, Sydney, Australia; ² Canadian Solar, Suzhou, China

CP.3.6 Enhanced EL Drone Imaging. High Resolution Electroluminescence for Advanced PV Inspections

Mario Martinez Gonzalez, Sergio Suarez, Daniel Villoslada, Raúl Seseña, Jose Manuel Rivas, Sofía Rodríguez-Conde
Enertis Applus+, Madrid, Spain

ORAL PRESENTATIONS 2CO.1

13:30 - 15:00 Perovskite-based Tandems Interfaces and Characterization

Chairpersons: Jan Christoph Goldschmidt

Philipps University of Marburg, Germany

Lili Wang

Technology Innovation Institute, Abu Dhabi, United Arab Emirates

2CO.1.1 Industrial Production of Perovskite-Silicon Tandem Solar Cells: The Characterization Challenge

Martin C. Schubert¹, Christoph Messmer², Alexander J. Bett¹, Oliver Fischer¹, Johannes Greulich¹, Jonas Haunschild¹, David Chojniak¹, S. Kasimir Reichmuth², Florian Schindler¹, Jonas Schön², Jochen Hohl-Ebinger¹, Stefan Rein¹, Stefan W. Glunz², David Sperber³, Gregor Zimmermann⁴, Henry Weber⁴, Nadine Schüller⁵, Viktoriia Nikonova⁵, Christopher Berge⁶, Marc Hemsendorf⁶, Bernhard Mitchell⁷, Lukas Ziegler⁷, Klaus Ramspeck⁸, Jonas Horn⁸, Ivanol Djeukeu⁸

¹ Fraunhofer ISE, Freiburg, Germany; ² University of Freiburg, Germany; ³ Oxford PV Germany, Brandenburg an der Havel, Germany; ⁴ Hanwha QCells, Bitterfeld-Wolfen, Germany; ⁵ Freiberg Instruments, Freiberg, Germany; ⁶ ISRA Vision, Konstanz, Germany; ⁷ Wavelabs Solar Metrology, Münster, Germany; ⁸ halm elektronik, Frankfurt/Main, Germany

2CO.1.2 Continuous-Time Photoluminescence Imaging for Quantification of Degradation Processes in Perovskite-Silicon Tandems

Miha Kikelj¹, Gašper Matič¹, Žan Ajdič¹, Fernando Solorio Soto¹, Lisa Champault², Quentin Jeangros², Christophe Ballif², Benjamin Lipovšek¹, Kristijan Brecl¹, Marko Jošt¹, Marko Topič¹

¹ University of Ljubljana, Slovenia; ² CSEM, Neuchâtel, Switzerland

2CO.1.4 Perovskite and Interface Development for Efficient Fully-Textured Perovskite Silicon Tandem Solar Cells

Patricia S. C. Schulze, Oussama Er-Raji, Christian Schwarz, Bhushan P. Kore, Yashika Gupta, Mohamed Mahmoud, Johanna Modes, Christoph Messmer, Oliver Fischer, Martin Bivour, Jonas Schön, Florian Schindler, Martin Hermle, Martin C. Schubert, Stefan W. Glunz, Juliane Borchert
Fraunhofer ISE, Freiburg, Germany

2CO.1.5 Scalable, Non-Fullerene Electron Transport Layer for Perovskite/Silicon Tandem Solar Cells

Lea Zimmermann¹, Wander Max Bernardes de Araujo¹, Maxim Simmonds¹, Arman Mahboubi Soufiani¹, Julius Petrulavicius², Dorothee Menzel¹, Florian Scheler¹, Tadas Malinauskas², Eike Köhnen¹, Lars Korte¹, Bernd Stannowski¹, Vytautas Getautis², Steve Albrecht¹

¹ HZB, Berlin, Germany; ² Kaunas University of Technology, Lithuania

2CO.1.6 Investigation of Interlayers Electronic Properties for Shunt Reduction in Pk/Si Tandem Solar Cells

Julci Ditsougou¹, Thibaut Desrues¹, Anne Kaminski²

¹ CEA / INES, Le Bourget-du-Lac, France; ² Grenoble Alps University, France



ORAL PRESENTATIONS 5CO.4

13:30 - 15:00 Life Cycle Assessment of Silicon and Perovskite-based Cells and Modules

Chairpersons: Carmen Alonso-García
CIEMAT, Madrid, Spain
Keiichi Komoto
Mizuho Research & Technologies, Tokyo, Japan

5CO.4.1 Towards Low-Impact Triple-Junction Perovskite/Silicon Tandem Modules: LCA of Precursor Materials to Describe the Influence of Background Data Sources

Alejandra Galarza¹, Sebastian Nold², Lars Oberbeck³
¹ IPVF, Palaiseau, France; ² Fraunhofer ISE, Freiburg, France; ³ TotalEnergies OneTech, Paris, France

5CO.4.2 Life Cycle Assessment of Perovskite Single Junction and Perovskite-Crystalline Silicon Tandem PV Modules. A Quick Scan of Preliminary Designs in the LAPERITIVO Project

Mariska de Wild-Scholten¹, Paul de Wild¹, Yinghuan Kuang²
¹ SmartGreenScans, Groet, The Netherlands; ² IMEC, Genk, Belgium

5CO.4.3 Sustainability Assessment of Perovskite/Silicon Tandem Solar Modules: from Laboratory Scale to Industrial Implementation

Elisabetta Brivio, Andrea Danelli, Sofia Spagnolo, Pierpaolo Girardi
RSE, Milan, Italy

5CO.4.4 LCA Learning Curve for Crystalline Silicon Solar Technologies based on Technology Improvements

Julian Reichle, Moritz Fath, Sraisth Sraisth, Gourab Das, Mehul Raval, Wolfgang Jooss, Peter Fath
RCT Solutions, Konstanz, Germany

5CO.4.5 PV Module Energy Payback Time Analysis for Silicon Solar Cell Technologies

Dilara Subasi, Peter Brailovsky, Baljeet Goraya, Sebastian Nold
Fraunhofer ISE, Freiburg, Germany

5CO.4.6 Sustainability Outlook for Leading Silicon Photovoltaic Technologies from 2023-2034

Bethany L. Willis¹, Oliver M. Rigby¹, Sophie L. Pain², Nicholas E. Grant², John D. Murphy², Ruy S. Bonilla³, Neil S. Beattie¹
¹ Northumbria University, Newcastle, United Kingdom; ² Warwick University, Coventry, United Kingdom; ³ Oxford University, United Kingdom

VISUAL PRESENTATIONS 4CV.1

13:30 - 15:00 Advances in Operation, Performance and Maintenance of PV Systems

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

PANEL DISCUSSION PRESENTATIONS

13:30 - 15:00 CO.7 Panel Discussion

ORAL PRESENTATIONS 2CO.2

15:15 - 16:45 High-Performance and Scalable Perovskite-based Multi-Junction Devices

Chairpersons: Invited
Perrine Carroy (i)
CEA, Le Bourget-du-Lac, France

2CO.2.1 Potassium Salt Modulated Perovskite Layer for Perovskite/TOPCon Tandem Solar Cells with Efficiency Exceeding 33.65%

Menglei Xu, Jungan Wang, Xunlei Yan, Chengjun Gu, Ying Xu, Yong Yu, Qin Zou, Chenghao Song, Jie Yang, Xinyu Zhang, Hao Jin
Jinko Solar, Haining, China

2CO.2.2 Lab to Industry: Optimizing Industrial Deposition Methods for Perovskite based Multijunction Solar Cells

Juliane Borchert¹, Yashika Gupta¹, Minasadat Heydarian², Maryamsadat Heydarian¹, Oussama Er-Raji², Bhushan P. Kore², Raphael Effinger¹, Christian Schwarz², Johanna Modes¹, Martin Bivour¹, Florian Schindler¹, Martin Hermle¹, Martin C. Schubert¹, Patricia S.C. Schulze¹, Stefan W. Glunz¹
¹ Fraunhofer ISE, Freiburg, Germany; ² University of Freiburg, Germany

2CO.2.3 Perovskite-Silicon-Based Triple Junction Solar Cells with Enhanced Optoelectronic Design

Kerem Artuk¹, Austin Kuba¹, Deniz Turkey¹, Michele De Bastiani², Mostafa Othman¹, Julian Steele³, Julien Hurni¹, Huagui Lai⁴, Mounir D. Mensi¹, Felipe Saenz², Mohammadreza Golobostanfard¹, Fan Fu⁴, Aicha Hessler-Wyser¹, Quentin Jeangros², Christophe Ballif¹, Christian M. Wolff¹
¹ EPFL, Neuchâtel, Switzerland; ² CSEM, Neuchâtel, Switzerland; ³ University of Queensland, Brisbane, Australia; ⁴ Empa, Dübendorf, Switzerland

2CO.2.4 Developing a Two-Step Sequential Deposition Approach for Wide-Bandgap Perovskite Thin Films and Efficient Tandem Solar Cells

Qian Cui, Zhongshu Yang, Rabin Basnet, Heping Shen, Klaus Weber, The Duong
ANU, Canberra, Australia



2CO.2.5 Optimized Solution-Based Two-Step Process for Perovskite-Based Tandem Photovoltaics

Ronja Pappenberger¹, Roja Singh¹, Alexander Diercks², Tonghan Zhao¹, Ulrich Wilhelm Paetzold¹

¹ IMT, KIT, Eggenstein-Leopoldshafen, Germany; ² LTI, KIT, Karlsruhe, Germany

2CO.2.6 Improving the Quality of Perovskite/Charge Transport Layer Interfaces for Highly Efficient Perovskite/Silicon Tandem Solar Cells

Jann Landgraf¹, Yashika Gupta², Adi Prasetyo³, Stefan Lange⁴, Christoph Messmer², Christian Schwarz², Oliver Fischer², Sithisak Chanthavong¹, Oussama Er-raji², Maria Camarada¹, Stefaan de Wolf³, Patricia Schulze², Anna Fischer¹, Stefan Glunz², Juliane Borchert²

¹ University of Freiburg, Germany; ² Fraunhofer ISE, Freiburg, Germany; ³ KAUST, Thuwal, Saudi Arabia; ⁴ Fraunhofer CSP, Halle, Germany

ORAL PRESENTATIONS 5CO.5

15:15 - 16:45 Life Cycle Assessment of New PV Applications and Recycling

Chairpersons: Vasilis Fthenakis (*i*)
Columbia University, New York, United States of America
Invited

5CO.5.1 Optimizing Agrivoltaics: a Comprehensive Assessment Framework for Sustainable Energy and Agriculture

Ana Patrícia Lopes¹, Bruno Barrionuevo², Daniel P. Albuquerque³, Diogo Cordeiro⁴, Cláudia Fernandes³, Athanasios T. Balafoutis², Rui Castro¹

¹ University of Lisbon, Portugal; ² CERTH, Athens, Greece; ³ EDP NEW, Sacavém, Portugal; ⁴ EDP NEW, Lisbon, Portugal

5CO.5.2 Environmental Sustainability Assessment of Agrivoltaic Systems: a Life Cycle Approach

Maria Anna Cusenza, Andrea Danelli, Pierpaolo Girardi, Sofia Spagnolo
RSE, Milan, Italy

5CO.5.3 LCA of Off-Shore Floating PV System in the North Sea

Ashish Binani¹, Minne M. de Jong²

¹ TNO, Petten, The Netherlands; ² TNO, Eindhoven, The Netherlands

5CO.5.4 Closing the Circle: Integrating the Circular Footprint Formula into Photovoltaic System Life Cycle Assessment

Alexis Barrou, Selin Kandiyoti-Eskenazi, Christophe Ballif, Bertrand Paviet-Salomon
CSEM, Neuchâtel, Switzerland

5CO.5.5 Stepwise Pathways to Decarbonize Emissions of PV Deployment via Green Mounting Systems and Recycled Materials

Sisi Wang, Moonyong Kim, Li Wang, Yuchao Zhang, Nathan Chang, Catherine Chan, Brett Hallam
UNSW, Sydney, Australia

5CO.5.6 ICARUS Project – Environmental Benefits of Silicon Kerf Secondary Products in Pilot Processes Over Conventional Production of Equivalent Products with Primary Raw Materials in China and Europe

Rene Peche, Matthias Seitz, Markus Schönheits, Karsten Wambach
bifa Umweltinstitut, Augsburg, Germany

ORAL PRESENTATIONS 4CO.8

15:15 - 16:45 Soiling and Snow Effects in PV Systems

Chairpersons: Claudia Buerhop-Lutz (*i*)
HI ERN, Erlangen, Germany
Peter Hacke
NREL, Golden, United States of America

4CO.8.1 Maps of Long-Term Soiling Losses in Europe Considering a Partial Cleaning Effect by Rain

Elena Ruiz Donoso¹, Fernanda Norde Santos¹, Álvaro Fernández Solas¹, Natalie Hanrieder¹, Leonardo Micheli², Joaquín Alonso-Montesinos³, Jesús Polo⁴, Luis Zarzalejo⁴, Stefan Wilbert¹

¹ DLR, Almería, Spain; ² Sapienza University of Rome, Italy; ³ University of Almería, Spain; ⁴ CIEMAT, Madrid, Spain

4CO.8.2 Microbiota Present in Soiling Deposited on Photovoltaic Modules in the Atacama Desert

Douglas Olivares¹, Ricardo Ortiz¹, Carlos Portillo¹, Luis Rojas², María Teresa Mata¹, Edward Fuentealba¹, Jaime Llanos², Aitor Marzo³

¹ University of Antofagasta, Chile; ² Catholic University of the North, Antofagasta, Chile; ³ University of Granada, Spain

4CO.8.3 Mapping and Analysis of Soiling Losses in Morocco for PV Performance Optimization

Mounir Abraim¹, Fatima Zahra Ouchani¹, Abdellatif Ghennioui¹, Leonardo Micheli²

¹ Green Energy Park, Ben Guerir, Morocco; ² Sapienza University of Rome, Italy

4CO.8.4 A Tale of Two Dusts: Mimicking Site-Specific Soiling Dynamics and Cleaning Approaches for PV Plants

Josefa Montoya¹, Douglas Olivares¹, Eric Pilat², Jean Patrice Rakotonirainy², Aitor Marzo³, Valeria Del Campo⁴, Edward Fuentealba¹, Martin Gaete¹, Jérémie Aimé², Romain Couderc², Delfina Muñoz², Ioannis (John) Tsanakas²

¹ University of Antofagasta, Chile; ² CEA, Le Bourget-du-Lac, France; ³ University of Granada, Spain; ⁴ Federico Santa María Technical University, Valparaíso, Chile



4CO.8.5 Snow Losses in Four Solar Power Systems of FMI in Finland During 2015 - 2025

Juha A. Karhu¹, Anders V. Lindfors¹, Timo Salola¹, William Wandji Nyamsi¹, Lauri Karttunen², Väinö Anttalainen², Hugo Huerta Medina³, Shuo Wang³, Kati Miettunen²

¹ Finnish Meteorological Institute, Helsinki, Finland; ² University of Turku, Finland; ³ TUAS, Turku, Finland

4CO.8.6 Analyzing and Modeling Snow Loss in Ground-Mounted PV Systems

Mari B. Øgaard, Erling W. Eriksen, Sigrid Rønneberg, Heine N. Riise
IFE, Kjeller, Norway

ORAL PRESENTATIONS 3CO.10

15:15 - 16:45 Advanced Interconnection Technology

Chairpersons: Hamed Hanifi
AESOLAR, Königsbrunn, Germany
Laura Sartore (i)
ECOPROGETTI SRL, Carmignano di Brenta, Italy

3CO.10.1 Ultrasonic Tinning of Aluminum for a Silver-Free Cell Interconnection on the Front Side of Si Solar Cells

Malte Brinkmann, Henning Schulte-Huxel, Christina Hollemann, Byungul Min, Sebastian Junge, Rolf Brendel
ISFH, Emmerthal, Germany

3CO.10.2 Silver Reduction through Direct Wire Bonding for Silicon Heterojunction Solar Cells

Yanxin Liu, Ian Marius Peters, Kaining Ding, Bart Pieters, Karsten Bittkau, Uwe Rau, Mohamed Issifi Yacouba, Henrike Gattermann, Volker Lauterbach, Andreas Lambertz
FZJ, Jülich, Germany

3CO.10.3 Silicon Heterojunction Interconnection using Pb-free & Bi-free Solder: Materials, Process and Equipment Development and Validation

Germain Rey¹, Hugo Forest¹, Remi Monna¹, Jules Clerjon¹, Igor Herrarte², Gorka Garcia², Xabier Hernandez³, Jean-Philippe Aguerre³

¹ CEA, Le Bourget-du-Lac, France; ² Mondragon Assembly, Orange, France; ³ Mondragon Assembly, Aretxabaleta, Spain

3CO.10.4 Towards Enhanced Reliability of Busbar-Free IBC Solar Cell Interconnections by Non-Conductive Adhesive Reinforcement

Tudor Timofte¹, Tobias Messmer¹, Karl Wienands¹, Stephan Grosser², Giuseppe Galbiati³, Tobias Nitsche³, Daniel Buckland³, Nils Kopp⁴, Andreas Halm¹

¹ ISC Konstanz, Germany; ² Fraunhofer CSP, Halle, Germany; ³ Henkel, Duesseldorf, Germany; ⁴ Tamura Elsold, Ilsenburg, Germany

3CO.10.5 Matrix Shingle Solar Modules: Pilot Production for Building-Integrated PV Applications

Torsten Rößler¹, Najwa Abdel Latif¹, Elmar Lohmüller¹, Daniel von Kutzleben¹, Norbert Kohn¹, Jale Schneider¹, Sebastian Birnkammer¹, Martin Wiese¹, Marco Ernst¹, Felix Basler¹, Jacob Forster¹, Laura Stevens¹, John Morello², Gaetan Carrière², Achim Kraft¹, Holger Neuhaus¹

¹ Fraunhofer ISE, Freiburg, Germany; ² Freesuns Solar Roofs, Colombier, Switzerland

3CO.10.6 Contact Resistance Limitations in Conductive Adhesive and Solder Paste Modules

Daniel Tune¹, M. Ignacia Acevedo Devoto¹, Raphael Shanmugam¹, Karl Wienands¹, Nils Kopp², Carina Hallensleben², Rihoko Kizukuri², Matthias Helbig¹, Andreas Halm¹

¹ ISC Konstanz, Germany; ² TAMURA-ELSOLD, Ilsenburg, Germany

VISUAL PRESENTATIONS 1CV.2

15:15 - 16:45 Si Solar Cells | Characterisation & Modelling of Silicon Cells and Their Building Blocks

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.



ORAL PRESENTATIONS 4CO.3

17:00 - 18:30 Floating PV

Chairpersons: Sara Mirbagheri Golroodbari
Utrecht University - Copernicus Institute of Sustainable Development,
The Netherlands
Thomas Reindl (i)
SERIS, Singapore

4CO.3.1 Satellite Analysis of Floating PV Construction and Extreme Weather Resilience

Erlend Hustad Honningdalsnes, Harsha Walpita, Vilde Stueland Nysted, Erik Stensrud Marstein, Josefine Selj, Heine Nygard Riise
IFE, Kjeller, Norway

4CO.3.2 Hydrological and Ecological Effects of Floating PV

Konstantin Ilgen¹, Camila B. Goulart², Stephan Hilgert³, Dirk Schindler⁴, Klaus van de Weyer⁵, Jens Lange⁴
¹ Fraunhofer ISE, Freiburg, Germany; ² University of Paraná, Brazil; ³ imknow, Karlsruhe, Germany; ⁴ University of Freiburg, Germany; ⁵ lanaplan, Nettetal, Germany

4CO.3.3 Assessing the Sustainability of Floating Solar: a Conceptual Framework and Case Study

Josefine Helene Krogh Selj¹, Ingrid Nesheim², Francois Clayer²
¹ IFE, Kjeller, Norway; ² NIVA, Oslo, Norway

4CO.3.4 Explaining the Measured Performance of an Offshore Floating Solar Pilot System at the North Sea

Mirza Khalid Baig¹, Maarten Dörenkämper¹, Danzi Pi², Minne de Jong¹
¹ TNO, Eindhoven, The Netherlands; ² TNO, Petten, The Netherlands

4CO.3.5 Wave-Induced Losses in Offshore Floating Photovoltaic Systems: Modeling Framework, Sensitivity Analysis, and Optimization

Sathya Shanka Vasuki¹, Jack Levell², Rudi Santbergen¹, Olindo Isabella¹
¹ TU Delft, The Netherlands; ² Shell Global Solutions International, Amsterdam, The Netherlands

4CO.3.6 4W Perovskite/Si Tandem System for Combined Underwater Energy Harvesting and Depth Sensing

Nicola Trivellin¹, Noah Tormena¹, Giacomo Peruzzi¹, Jessica Jazmine Nicole Barrantes¹, Matteo Bertocco¹, Tommaso Michelin¹, Marco Migliorini², Francesco Rigo³, Matteo Meneghini¹, Alessandro Pozzebon¹
¹ University of Padova, Italy; ² University of Siena, Italy; ³ University of Florence, Italy

ORAL PRESENTATIONS 5CO.6

17:00 - 18:30

PV Recycling and Circularity

Chairpersons: Claire Agraffail (i)
CEA, Le Bourget-du-Lac, France
Garvin Heath
NREL, Golden, United States of America

5CO.6.1 Photovoltaics Recycling: EU Capacities and Policy Implications

Nieves Espinosa¹, Silvia Bobba², Cynthia Latunussa², Enrica Leccisi²
¹ University of Murcia, Spain; ² European Commission JRC, Ispra, Italy

5CO.6.2 Development of a Digital Product Passport for Recycling in the Solar Industry

Ässia Boukhatmi¹, Cedric Antenen¹, Stefan N. Grösser¹, Tadas Radavičius²
¹ BFH, Biel/Bienne, Switzerland; ² SoliTek, Vilnius, Lithuania

5CO.6.3 A Recyclability Index for Photovoltaic Modules: Methodology and Policy Implications

Davide Polverini¹, Felice Alfieri², Nieves Espinosa³, Jaione Bengoechea⁴, Cristina Pinto⁴
¹ European Commission DG, Brussels, Belgium; ² Viegand Maagøe, Copenhagen, Denmark; ³ Murcia University, Spain; ⁴ CENER, Pamplona, Spain

5CO.6.4 Quantification of Technical Recyclability of PV Modules for Different Recycling Scenarios

Matthias Hämmer, Kerstin Baumann, Karsten Wambach, Markus Schönheits
bifa Umweltinstitut, Augsburg, Germany

5CO.6.5 IEC Technical Report 63525 on the Reuse of PV Modules: Final Result

Arvid van der Heide¹, Serge Noels², Jan Clynckx², Rich Strömberg³
¹ imec, Genk, Belgium; ² PV CYCLE, Brussels, Belgium; ³ University of Alaska, Fairbanks, United States of America

5CO.6.6 Water and Wastewater Streams and Reuse Opportunities in TOPCon Solar Cell Production

Jascha Reich¹, Peter Brailovsky², Dilara Subasi², Tobias Dannenberg³, Martin Zimmer², Sebastian Nold², Sven-Uwe Geißen¹
¹ TU Berlin, Germany; ² Fraunhofer ISE, Freiburg, Germany; ³ Rena Technologies, Gütenbach, Germany



ORAL PRESENTATIONS 4CO.9

17:00 - 18:30 Data-driven and AI-based O&M of PV Systems

Chairpersons: Anne Migan-Dubois (i)
GeePs, Gif-sur-Yvette, France
David Moser
Becquerel Institute Italia, Trento, Italy

4CO.9.1 AI Methods for the Operation and Maintenance of PV Parks with Bifacial Photovoltaic Modules

Dirk Stellbogen¹, Jonas Petzschmann¹, Timo Freund², Jann Wannenwetsch², Elena Pabst¹, Ajka Ockert², Roland Einhaus¹
¹ ZSW, Stuttgart, Germany; ² EnBW, Karlsruhe, Germany

4CO.9.2 A Comprehensive Framework for Accurate Power Degradation Estimation in Large Photovoltaic Systems using Machine Learning

Kak Pong Cheung¹, Stephanie Malik², David Daßler², Carsten Hennig³, Hauke Nissen⁴, Patrick Hennig¹
¹ Kiel University of Applied Sciences, Germany; ² Fraunhofer IMWS, Halle, Germany; ³ saferay, Berlin, Germany; ⁴ Wattmanufactur, Galmsbüll, Germany

4CO.9.3 Use of a Digital Twin to Detect Stalling Tracker Events in Photovoltaic Power Plant with Horizontal Single-Axis Tracking Systems

Riccardo Adinolfi Borea¹, Matthew Muller², Silvana Ovaitt², Vincenzo Cirimele¹, Francesco Melino¹
¹ University of Bologna, Italy; ² NREL, Denver, United States of America

4CO.9.4 Autonomous Multi-AI Agent System for PV Health Monitoring: a Fully Automated O&M Pipeline with Field Robotics Integration

Mousa Sondoqah, Atse Louwen, David Moser
Eurac Research, Bolzano, Italy

4CO.9.5 Predictive Modelling and Analysis of Soiling Losses in PV Plants through a Hybrid Data-Driven Approach

Ioannis (John) Tsanakas¹, Eric Pilat¹, Sebastien Arbaretaz¹, Minh Thong Doi¹, Filipa Monteiro Martins², Jorge Veludo²
¹ CEA INES, Le Bourget-du-Lac, France; ² Galp Energia, Lisbon, Portugal

4CO.9.6 Minimizing Calculation Uncertainty in Photovoltaic Operation and Maintenance Key Performance Indicators

Marios Theristis, Kevin Anderson
Sandia National Laboratories, Albuquerque, United States of America

ORAL PRESENTATIONS 3CO.11

17:00 - 18:30 Innovative Module Design and Characterisation

Chairpersons: Eszter Voroshazi
CEA, Le Bourget-du-Lac, France
Philipp Zahn
M10 Industries, Freiburg, Germany

3CO.11.1 Can We Make Solar Photovoltaic Modules That Last 30+ Years? Is the Industry Doing It?

Alessandro Virtuani¹, Hugo Quest², Ebrar Ozkalay³, Anika Gassner⁴, Gabriele Eder⁴, Gianluca Cattaneo¹, Matthieu Despeisse¹, Christophe Ballif²
¹ CSEM, Neuchâtel, Switzerland; ² EPFL, Neuchâtel, Switzerland; ³ SUPSI, Mendrisio, Switzerland; ⁴ OFI, Vienna, Austria

3CO.11.2 Process and Design Freedom Enabled by Back-contact Solar Cells Minimizing the Inactive Module Area

Andreas Halm, Tudor Timofte, Karl Wienands, Daniel Tune, Tobias Messmer
ISC Konstanz, Germany

3CO.11.3 Techno-Economic Analysis of Suitable Module BOM for Different Climatic Conditions

Sraisth Sraisth, Julian Reichle, Mehul Raval, Hardik Gohil, Gourab Das, Wolfgang Jooß
RCT Solutions, Konstanz, Germany

3CO.11.4 Screening of Commercially Available Layers for Diffusive & Transparent Overhead Agrivoltaics: from Layer Characterization to Prototyping

Jordi Veirman, Alessandro Minini, Marco Memminger, Giovanni Borz, Martina Pelle, Lukas Koester, Alexander Astigarraga, David Moser
Eurac Research, Bolzano, Italy

3CO.11.5 Indoor Characterization and Analysis of Reverse Breakdown Behavior of Solar Cells with Different Cell Architectures

Bengt Jaeckel¹, Jens Froebel¹, Matthias Pander¹, Andreas Maixner², Pouya Pourshafi², Afshin Bakhtiar², Hamed Hanifi²
¹ Fraunhofer CSP, Halle (Saale), Germany; ² AESOLAR, Königsbrunn, Germany

3CO.11.6 Indoor Characterization and Cell-to-Module CTM Evaluation of Photovoltaics Modules made from Glasses with Different Colors of Cell Spacing Colors on the Rear Side Glass

Hamed Hanifi¹, Andreas Maixner¹, Christian Reichel², Max Mittag²
¹ AESOLAR, Königsbrunn, Germany; ² Fraunhofer ISE, Freiburg, Germany

VISUAL PRESENTATIONS 2CV.3

17:00 - 18:30 Perovskite-based Tandems and Multijunctions

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.



Thursday, 25. September 2025

ORAL PRESENTATIONS 4DO.1

08:30 - 10:00 PV Tracking and Simulation

Chairpersons: João M. Almeida Serra
University of Lisbon, Portugal
Mari Øgaard
IFE, Kjeller, Norway

4DO.1.1 PV Tracking Optimization via Machine Learned Dynamic Tracking

Daniel Burkhardt, Maddalena Bruno, Leslie Lydia Kurumundayil, Matthew Berwind, Matthias Demant
Fraunhofer ISE, Freiburg, Germany

4DO.1.2 Bridging the Gap: Insights into Backtracking-Angle Related Discrepancies between Estimates and Actual Performance in Large-Scale Photovoltaic Plants

Juan Santamaría-Sancho, Javier Martín-Rueda, Eduardo Lorenzo Pigueiras, Javier R. Ledesma
UPM, Madrid, Spain

4DO.1.3 Experimental Validation of Horizontal Single-Axis Solar Tracker Algorithms in Terms of Energy Production and Operational Performance

Ildefonso Muñoz, Gregorio Olivares, Sara Díaz, Aritz Legarrea, Ana Gracia CENER, Sarriguren, Spain

4DO.1.4 Modelling, Implementation and Validation of Solar Tracking Algorithms in Horizontal Single Axis Trackers

Nuria López¹, Mathis Pasquier², Nicholas Riedel-Lyngskær³, Sergiu V. Spataru¹

¹ DTU, Copenhagen, Denmark; ² Nordic Solar, Copenhagen, Denmark; ³ European Energy, Copenhagen, Denmark

4DO.1.5 Terrain-Following Single-Axis Tracking PV Systems: Civil Work Reduction, Performance Impact, and Lifetime Financial Analysis

Abhinav Ratnagiri, Shrey Bhatnagar, Angel Velasco, Viktor Kapetanovic, Claire Puttock, Amir Shishavan
Nexttracker, Fremont, United States of America

4DO.1.6 Standardised Assessment of PV Array Simulators

Theo Zwahlen¹, Luciano Borgna¹, David Joss¹, Christof Bucher¹, Christian Messner², Roland Bründlinger²

¹ BFH, Burgdorf, Switzerland; ² AIT, Vienna, Austria

ORAL PRESENTATIONS 2DO.6

08:30 - 10:00 Industrially Scalable Processes to Manufacture Perovskite Solar Cells and Modules

Chairpersons: Invited
Tom Aernouts
imec, Genk, Belgium

2DO.6.1 Spatially Regulated Drying Technique for Homogeneous Perovskite Thin Films within Large Area Slot-Die-Coated Perovskite/Silicon Tandem Devices

Kristina Geistert¹, Ronja Pappenberger¹, Philip Scharfer², Philipp Cavadini², Wilhelm Schabel², Faranak Sadegh¹, David B. Ritzer¹, Ulrich W. Paetzold¹
¹ KIT, Karlsruhe, Germany; ² KIT, Eggenstein-Leopoldshafen, Germany

2DO.6.2 Novel Laser Scribing Strategy for Perovskite Solar Modules without P2 Scribes Enabling High Performance under Indoor Light Illumination

Bahri Eren Uzuner, Konstantin Tsoi, Gorkem Gunbas, Selcuk Yerci
ODTÜ-GÜNAM, Ankara, Türkiye

2DO.6.3 Industrialization of Perovskite Solar Cell Fabrication: Strategies towards High-Throughput PVD Processes

Julian Petry¹, Viktor Škorjanc², Alexander Diercks¹, Thomas Feeney¹, Amedeo Morsa³, Sara Rose Kimmig¹, Jens Baumann⁴, Stefan Auschill⁵, Joshua Damm¹, Daniel Baumann¹, Felix Laufer¹, Jona Kurpiers², Michael Müller³, Lars Korte², Steve Albrecht², Marcel Roß², Ulrich Wilhelm Paetzold¹, Paul Fassl¹
¹ KIT, Karlsruhe, Germany; ² HZB, Berlin, Germany; ³ FZJ, Jülich, Germany; ⁴ von Ardenne, Dresden, Germany; ⁵ M. Braun Inertgas-Systeme, Dresden, Germany

2DO.6.4 Progress in the Research on the Performance, Processing and Reliability of Lightweight and Flexible Thin-Film PV Foils at TU Delft

Govind Padmakumar¹, Federica Saitta¹, Peer Sluijs¹, Reinder Boekhof¹, Lara van der Poll¹, Niels van Silfhout¹, K.P. Sreejith¹, Paula Perez Rodriguez¹, Luana Mazzarella¹, Tom Savenije¹, Hesam Ziar¹, Rudi Santbergen¹, David van Nijen², Ravi Vasudevan², Mohammed El Makkaoui², Herbert Lifka², Edward Hamers², Thierry de Vrijer², Arno H. M. Smets¹

¹ TU Delft, The Netherlands; ² HyET Solar NL, Arnhem, The Netherlands

2DO.6.5 Evaporated Self-Assembled Monolayer (SAM) Hole-Transport Layers for Scalable Perovskite Solar Cells

Joachim Vollbrecht¹, Roland Clausen¹, Johannes Löhr¹, Larissa Mettner¹, Adam Neuba², Annika Raugewitz¹, Jessica Strey¹, Robby Peibst¹

¹ ISFH, Emmerthal, Germany; ² Paderborn University, Germany

2DO.6.6 Advancing Perovskite Solar Module Performance and Stability Through a Novel Protective Strategy for Laser-Scribed Interfacial Regions

Young Yun Kim
KRICT, Daejeon, South Korea



ORAL PRESENTATIONS 5DO.11

08:30 - 10:00 The Road to Massive PV Deployment

Chairpersons: Maria Getsiou
European Commission DG RTD, Brussels, Belgium
Stefan Nowak
NET Nowak Energy & Technology, St. Ursen, Switzerland

5DO.11.1 Integration of Solar PV in the Norwegian Energy System, Navigating the Trade-offs between Land Use and Solar Power Production

Petry Kristine Nøttum Haaland, Ole-Morten Midtgård
NTNU, Trondheim, Norway

5DO.11.2 Legal Aspects of Local Community based PV-Concepts

Michael Frey¹, Rahel Alia Müller¹
University of Applied Sciences Kehl, Germany

5DO.11.3 Evaluating the Impact of Photovoltaics for Lifecycle Global Warming Potential of Buildings According to EN 15978 - a Danish Case Study

Sune Thorsteinsson, Nanna L. Andersen, Markus Babin, Gisele A. D. Reis Benatto
DTU, Roskilde, Denmark

5DO.11.4 Unveiling the Evolutionary Energy Performance of Solar Photovoltaic Systems through Systemwide EROI Perspective

Hasret Sahin¹, A.A. Solomon², Christian Breyer¹
¹ LUT University, Lappeenranta, Finland; ² University of Vaasa, Vaasa, Finland

5DO.11.5 Projections of PV Power Potential Worldwide: an Update using CMIP6 Global Climate Models

Pau Mercade Ruiz¹, Gerardo Guerra¹, Gaetana Anamiati¹, Lars Landberg²
¹ GreenPowerMonitor a DNV company, Barcelona, Spain; ² DNV Denmark, Hellerup, Spain

5DO.11.6 The Cost of Ownership and Minimum Sustainable Price of POLO BJ Cells Produced in Germany

Juan Camilo Gomez Trillos¹, Viswa Harinath Buddana¹, Urte Brand-Daniels¹, Thomas Vogt¹, Byungsung Min², Jan-Dirk Kähler³, Friedrich Schneider⁴
¹ DLR, Oldenburg, Germany; ² ISFH, Hamelin, Germany; ³ Centrotherm International, Hannover, Germany; ⁴ LPKF SolarQuipment, Suhl, Germany

ORAL PRESENTATIONS 3DO.16

08:30 - 10:00 Failure Modes and Degradation in PV Modules

Chairpersons: Timea Bejat (i)
CEA, Le Bourget-du-Lac, France
Ralph Gottschalg
Fraunhofer CSP, Halle (Saale), Germany

3DO.16.1 Reliability Forecasting for New Modules with New Technology and New Problems. How Can You Know If It Will Last?

Dennice M. Roberts¹, Michael Owen-Bellini¹, Clifford W. Hansen², Anubhav Jain³, David C. Miller¹, Martin Springer¹, Jennifer L. Braid², Teresa M. Barnes¹
¹ NREL, Golden, United States of America; ² Sandia National Lab, Albuquerque, United States of America; ³ Berkeley Lab, Berkeley, United States of America

3DO.16.2 Hidden Traces: Insights into How Solar Cell Handling Drives Damp-Heat Failures in HJT and TOPCon Modules

Chandany Sen¹, Haoran Wang¹, Muhammad Umair Khan¹, Xinyuan Wu¹, Xutao Wang¹, Jiaxin Yang¹, Ziruo Zhu¹, Anjie Li¹, Jiexi Fu², Bram Hoex¹
¹ UNSW, Sydney, Australia; ² UNSW, Kensington, Australia

3DO.16.3 Degradation Modes of Low Temperature Soldered Wire Interconnects in PV Modules

Peter Hacke¹, Nick Bosco¹, James Y. Hartley², David C. Miller¹, Soňa Uličná¹
¹ NREL, Golden, United States of America; ² Sandia National Laboratories, Albuquerque, United States of America

3DO.16.4 UV-Induced Degradation: Comparative Analysis of Module Testing and Stabilization Procedures against Outdoor Behavior

Paul Gebhardt, Esther Fokuhl, Angelika Beinert, Mariella Rivera, Christian Reise, Ingrid Hädrich
Fraunhofer ISE, Freiburg, Germany

3DO.16.5 Investigating the Recovery Mechanism of Bifacial PV Modules Affected by Polarization-type Potential-Induced Degradation in the Field

Cecile Molto¹, Dylan J Colvin¹, Ryan Smith², Peter Hacke³, Fang Li⁴, Govindasamy Tamizhmani⁴, Jaewon Oh⁵, Halima Jahan⁵, Hubert Seigneur¹
¹ University of Central Florida, Cocoa, United States of America; ² Pordis, Austin, United States of America; ³ NREL, Golden, United States of America; ⁴ Arizona State University, Mesa, United States of America; ⁵ University of North Carolina at Charlotte, United States of America

3DO.16.6 TOPCON PV Modules UV Exposure: Uncovering Hidden Instabilities

Baloji Adothu¹, Shahzada Pamiir Aly¹, Bengt Jaeckel², Matthias Pandar², Ralph Gottschalg², Vivian Alberts¹
¹ DEWA, Dubai, United Arab Emirates; ² Fraunhofer CSP, Halle, Germany



VISUAL PRESENTATIONS 4DV.1

08:30 - 10:00 Agrivoltaics Approaches, Experiences, Results | Integrated and Innovative PV Applications

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 4DO.2

10:30 - 12:00 Agrivoltaic Technologies

Chairpersons: Alexis Pascaris
NREL, Golden, United States of America
Bas Van Aken (I)
TNO Energy Transition, Petten, The Netherlands

4DO.2.1 Design and Testing of an Innovative Closed Agrivoltaic System: "Algaeoltaics"

Alessandra Scognamiglio¹, Aniello Borriello¹, Carmine Cancro², Paola Delli Veneri², Marcello Diano³, Stefano Mazzoleni⁴, Fabrizio Carteni⁴
¹ ENEA, Portici, Italy; ² ENEA, Naples, Italy; ³ M2M Engineering, Naples, Italy; ⁴ University of Naples Federico II, Naples, Italy

4DO.2.2 Experimental Investigation of an Agrivoltaic Collector with Planar Spectral Beam Splitting

Inga Krasilnikov¹, Abraham Kribus¹, Gur Mittelman², Liad Reshef³, Shay Ozer³, Lavi Rosenfeld³, Helena Vitoshkin³
¹ Tel Aviv University, Israel; ² Afeka Tel-Aviv Academic College of Engineering, Israel; ³ ARO, Volcani Center, Rishon LeZion, Israel

4DO.2.3 Agri-PV Potential in Northern Climates: an Experimental Study on Panel Transparency, and Leafy Vegetable Productivity

Matas Rudzikas¹, Giedrė Samuolienė², Justinas Raginskis³, Piotr Dubravskij⁴, Algirdas Baležentis¹, Skirmantė Baležentienė¹
¹ The Applied Research Institute for Prospective Technologies, Vilnius, Lithuania; ² The Lithuanian Research Centre for Agriculture and Forestry, Kaunas, Lithuania; ³ Kaunas University of Technology, Lithuania; ⁴ Modern E-Technologies, Vilnius, Lithuania

4DO.2.4 Tomato Cultivation in Semitransparent PV Greenhouses in Southeast of Spain

Carlos Toledo, Virginia Hernández, Fulgencio Contreras, Vincenzo Tucci, Elia Molina, Pilar Hellin, Alicia Sánchez, Jose Fenoll, Pilar Flores
IMIDA, Murcia, Spain

4DO.2.5 Coloured Semi-Transparent CdTe PV Modules in Agrivoltaics: a 2-Year Study on Broccoli Growth and System Potential

Silvia Ma Lu, Xiaolin Wang, Arash Khosravi, Pietro Campana
Mälardalen University, Västerås, Sweden

4DO.2.6 Advanced Encapsulant for Agrivoltaic Modules: Enhancing Crop Growth by Means of Stabilized Down-Conversion Dyes

Fabio Silva, Anna Karamysheva, Kristof Proost
IP FAB, Mechelen, Belgium

ORAL PRESENTATIONS 2DO.7

10:30 - 12:00 Insights Into the Stability of Perovskite Solar Cells and Modules

Chairpersons: Nikoleta Kyranaki
Hasselt University, Genk, Belgium
Patricia Schulze
Fraunhofer ISE, Freiburg, Germany

2DO.7.1 Outdoor Performance and Degradation Analysis of Perovskite Solar Cells: A Three-Year Study

Makoto Konagai¹, Hayato Okawa¹, Ryosuke Ishikawa¹, Masatoshi Yanagida², Yasuhiro Shirai²
¹ Tokyo City University, Japan; ² NIMS, Tsukuba, Japan

2DO.7.2 ALD ZnO Films for Improved Stability of Perovskites Solar Cells

Fernando Solorio, Marko Topič, Marko Jošt
University of Ljubljana, Slovenia

2DO.7.3 Seasonality in Single-Junction Perovskite Solar Cells: Insights from 4 Years of Outdoor Data

Marko Remec¹, Mark Khenkin¹, Ulas Erdil¹, Quiterie Emery¹, Rutger Schlatmann¹, Steve Albrecht¹, Marko Topič², Carolin Ulbrich¹
¹ HZB, Berlin, Germany; ² University of Ljubljana, Slovenia

2DO.7.4 Carbon Based Electrode Perovskite Solar Cells: Comparison of Predicted and Measured Performance for Cells Operating in Different Modes, Indoors and Outdoors

Maximilien Var¹, Johan Parra², Anne Migan-Dubois³, Stéphanie Narbey⁴, Yvan Bonnassieux⁵, Frédéric Oswald¹
¹ CEA, Gif-sur-Yvette, France; ² LMD / IPSL, Palaiseau, France; ³ CentraleSupélec, Gif-sur-Yvette, France; ⁴ Solaronix, Aubonne, Switzerland; ⁵ Polytechnic School, Palaiseau, France

2DO.7.5 Unlocking Precursor Interdiffusion: a Key to Stable, Efficient Thermally Evaporated Perovskite Photovoltaics

Ioanna Vareli¹, Huagui Lai¹, Federico De Giorgi¹, Nada Mrkyvkova², Peter Siffalovic², Fan Fu¹
¹ Empa, Duebendorf, Switzerland; ² Slovak Academy of Sciences, Bratislava, Slovakia

2DO.7.6 Advanced Additives for Space Missions: PVDF-HFP's Impact on Perovskite Solar Cell Reliability

Kun-Mu Lee, Seoungjun Ahn, Wei-Hao Chiu
Chang Gung University, Taoyuan City, Taiwan



ORAL PRESENTATIONS 3DO.12

10:30 - 12:00 Innovative Encapsulation Materials

Chairpersons: Marc Köntges *(i)*
ISFH, Emmerthal, Germany
Mónica Lira-Cantú *(i)*
CIN2, Barcelona, Spain

3DO.12.1 Evaluation of Polyolefin Encapsulants for Roll-to-Roll Lamination Applications

Petra Christöfl¹, Casper G.M. van Kessel², Marc M. Koetse², Dorrit Roosen², Gernot Oreski¹

¹ PCCL, Leoben, Austria; ² TNO, Eindhoven, The Netherlands

3DO.12.2 Pre-Laminates: Enhancing Flexibility in Integrated-Photovoltaic (IPV) Manufacturing Lines

Lison Marthey, Hengyu Li, Loann Baume, Letizia Perla, Xavier Denys, Matthieu Despeisse, Alessandro Virtuani, Christophe Ballif
CSEM, Neuchâtel, Switzerland

3DO.12.3 Liquid PV Module Encapsulation to Enable Circular Design

Urvashi Bothra¹, Alberto Poli², Siemen Brinksma², Olindo Isabella¹, Malte Ruben Vogt¹

¹ TU Delft, The Netherlands; ² Biosphere Solar, Rotterdam, The Netherlands

3DO.12.4 Towards Recyclable PV: High-Efficiency Encapsulant-Free Modules with Nanostructured Solar Cells and Glass

Asier Murillo, Cristina Leyre Pinto, Iñaki Cornago, Alicia Buceta
CENER, Sarriena, Spain

3DO.12.5 Effect of Glass Beads on the Solar Optical Properties of Thermoplastic Encapsulants for Colored PV Modules

Martin Huemer¹, Gernot M. Wallner¹, Andreas Brandstätter²

¹ University of Linz, Austria; ² Lenzing Plastics, Lenzing, Austria

3DO.12.6 Near Infrared Spectroscopy for Rapid, Inline Quantification of Encapsulant Crosslinking in PV Modules

Gernot Oreski¹, Marton Bredacs¹, Sonja Feldbacher¹, Petra Christöfl¹, Nikolina Pervan¹, Chiara Barretta¹, Christian Camus², Enno Malguth², Adrian Adrian²

¹ PCCL, Leoben, Austria; ² Laytec, Berlin, Germany

ORAL PRESENTATIONS 4DO.17

10:30 - 12:00 Advanced Inspections and Robotic Solutions for PV O&M

Chairpersons: Cristina Cornaro *(i)*
University of Rome "Tor Vergata", Italy
Thorsten Trupke
UNSW, Sydney, Australia

4DO.17.1 Paving the Way for Large-Scale Daylight Photoluminescence Inspection: Application to Ground-Based Inspection-Robot Combined with Automated Processing Pipeline

Lukas Koester, Mohanad Diab, Atse Louwen, David Moser
Eurac Research, Bolzano, Italy

4DO.17.2 Model Optimization for Multi-Class Real Time UAV Thermal Anomaly Detection in Solar Energy Systems

Ghaem Taghipour Kani¹, Sayyed Majid Esmailifar¹, Amirreza Ghahremani¹, Mohammadreza Aghaei²

¹ Amirkabir University of Technology, Tehran, Iran; ² NTNU, Ålesund, Norway

4DO.17.3 Optimizing Autonomous Aerial Monitoring of Photovoltaic Power Plants via an Integrated Software Package and a Digital Twin Based Simulation Environment

Mohammad Kolahi¹, Sayyed Majid Esmailifar², Amirmohammad Moradi Sizzkouhi³, Mohammadreza Aghaei⁴

¹ University of Isfahan, Iran; ² Amirkabir University of Technology, Tehran, Iran; ³ Concordia University, Montreal, Canada; ⁴ NTNU, Ålesund, Norway

4DO.17.4 Advancing Drone Infrared Thermography for Photovoltaic Defect Detection: Influence of Altitude and Environmental Conditions

Rodrigo del Prado Santamaría, Rizal Friansyah, Gisele A. dos Reis Benatto, Mahmoud Dhimish, Thøger Kari, Aysha Mahmood, Peter B. Poulsen, Sergiu V. Spataru

DTU, Roskilde, Denmark

4DO.17.5 Advanced Detection of Anomalies: Synergy between Monitoring Data and Aerial Inspections

Julien Deckx¹, Maitheli Nikam¹, Karel De Brabandere¹, Giuliano Luchetta Martins², Gofran Chowdhury¹

¹ 3E, Brussels, Belgium; ² Statkraft UK, London, United Kingdom

4DO.17.6 Strategy for Simple, On-Site Failure Analysis: Investigating Bubbles and Burn Marks in Backsheets of PV Modules

Claudia Buerhop-Lutz¹, Aline Vidal de Oliveira², Oleksandr Mashkov¹, Lucas Nascimento², Ricardo Rütther², Ian Marius Peters¹

¹ HI ERN, Erlangen, Germany; ² Solar Energy Research Laboratory Fotovoltaica/ UFSC, Florianópolis, Brazil



VISUAL PRESENTATIONS 5DV.2

10:30 - 12:00 Life Cycle Analysis and PV Recycling | Citizens Participation and Awareness

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

ORAL PRESENTATIONS 4DO.3

13:30 - 15:00 PV System Design and Assessment

Chairpersons: Kari Lappalainen
Tampere University, Finland
Sara Bouguerra
imo-imomec, Diepenbeek, Belgium

4DO.3.1 A Case Study: Quantifying the Impact of Minor Design Changes on Large-Scale Solar PV Plants

Ayesha Jacobs¹, Paul Nel², Keanu Damon²
¹ Zutari, Cape Town, South Africa; ² 7SecondSolar, Cape Town, South Africa

4DO.3.3 Measures to adapt the Power Output on Demand by System Design on Rooftop Systems

Hartmut Nussbaumer, Lona Tulinski, Markus Klenk
ZHAW, Winterthur, Switzerland

4DO.3.4 Prospects and Competitiveness of Vertical Solar Photovoltaics in Global Arctic and Sub-Arctic Regions

Geethike V. Arachchi, Dominik Keiner, Christian Breyer
LUT University, Lappeenranta, Finland

4DO.3.5 Site Suitability Assessment of Ground-Mounted Photovoltaic Systems through Combining Techno-Economic and Environmental Dimensions

Poomisub Manonukul, Victor Arturo Martinez Lopez, Miro Zeman, Olindo Isabella, Hesam Ziar
TU Delft, The Netherlands

4DO.3.6 Assessment of Personal Safety Concerns of Plug and Play Photovoltaic Inverters using a Black Box Approach and Laboratory Measurements

Alexander Erber, David Joss, Christof Bucher
BFH, Burgdorf, Switzerland

ORAL PRESENTATIONS 2DO.8

13:30 - 15:00 Multiple Aspects of Perovskite PV Research

Chairpersons: Invited
Sjoerd Veenstra (i)
TNO Energy Transition, Eindhoven, The Netherlands

2DO.8.1 Augmenting In Situ Monitoring of Perovskite Thin-Film Formation Using Deep Learning

Felix Laufer, Ulrich Wilhelm Paetzold
KIT, Karlsruhe, Germany

2DO.8.2 Strategies for Quasi-2D Perovskite Integration in p-i-n Solar Cells

Anna Capitaine¹, Iwan Zimmermann¹, Marion Provost¹, Anyssa Derj¹, Alexandra Levchenko¹, Mirella Al Katrib¹, Daniel Ory², Jean Rousset²
¹ IPVF, Palaiseau, France; ² EDF, Palaiseau, France

2DO.8.3 Defects Passivation Using Mixed Methoxy-Phenethyl-Ammonium Halides in Chloride-Iodide Perovskite Solar Cell

Ashraful Hossain Howlader, Yin Yao, Rhiannon Kuchel, Ashraf Uddin
UNSW, Sydney, Australia

2DO.8.4 High-Throughput Combinatorial Synthesis and Characterization of Halide Perovskites

Alessia Romio, Huagui Lai, Damien Terebenec, Fan Fu
EMPA, Dübendorf, Switzerland

2DO.8.5 Co-Evaporated Perovskite Absorbers for Textured Monolithic Silicon Tandem Solar Cells: Composition Analysis and Process Optimization

Marcel Roß, Stefanie Severin, Aleksandra Miaskiewicz, Viktor Škorjanc, Angelika Harter, Jona Kurpiers, Bernd Stannowski, Lars Korte, Steve Albrecht
HZB, Berlin, Germany

2DO.8.6 Ab-Initio Approach to Guide the Optimization of Inorganic Halide Perovskites

Antoine Gissler¹, Philip Schulz², Philippe Baranek¹
¹ EDF R&D, Palaiseau, France; ² IPVF, Palaiseau, France



ORAL PRESENTATIONS 5DO.18

13:30 - 15:00 PV Recycling and Material Demand

Chairpersons: Paula Sanchez-Friera
Solkeys, Gijón, Spain
Karsten Wambach
Wambach-Consulting, Petersdorf, Germany

5DO.18.1 Final Results from the H2020 ICARUS Project – Innovative Eco-Efficient Processing and Refining Routes for Secondary Raw Materials from Silicon Ingot and Wafer Manufacturing for Accelerated Utilization in High-End Markets

Martin P. Bellmann¹, Anne-Karin Søliland², Arne Kristian Dahle³, Christian Landaas⁴, Victorien Iwaszko⁵, Rene Peche⁶, Wolfram Palitzsch⁷, Philippe Lenain⁸, Iratxe Meatza⁹, Theodora Kyratsi¹⁰, Huiping Liu¹¹, Emanuele Milani¹², Guy Chichignoud¹³, Stefan Fischer¹⁴, Almut Schwenke¹⁵, Eirik Nordboe¹⁶, Marco Pieterse¹⁷, Roland Riva¹⁸

¹ SINTEF, Trondheim, Norway; ² ReSiTec, Kristiansand, Norway; ³ NorSun, Oslo, Norway; ⁴ Northern Silicon, Meråker, Norway; ⁵ ROSI Solar, Saint-Martin-d'Hères, France; ⁶ bifa Umweltinstitut, Augsburg, Germany; ⁷ LuxChemtech, Freiberg, Germany; ⁸ benkei, Lyon, France; ⁹ CIDETEC, San Sebastián, Spain; ¹⁰ University of Cyprus, Nicosia, Cyprus; ¹¹ GRANGES, Finspång, Sweden; ¹² Marelli Europe, Venaria Reale, Italy; ¹³ Grenoble Institute of Technology, Grenoble, France; ¹⁴ SGL Carbon, Meitingen, Germany; ¹⁵ SGL Battery Solutions, Meitingen, Germany; ¹⁶ Fiven Norge, Lillesand, Norway; ¹⁷ Chemconserve, Bussum, The Netherlands; ¹⁸ CEA, Le Bourget-du-Lac, France

5DO.18.2 Integrated System for High-Value Recycling of Photovoltaic EoL Panels

Claire Agraifeil¹, Kerstin Baumann², Wim Merket³, Wolfram Palitzsch⁴, Danny Timmers³, Matthias Seitz², Ingo Rover⁴, Nicolas Defrenne⁵, Juan Alzate⁵, Fabrice Coustier¹, Roland Riva¹, Karsten Wambach²

¹ CEA / INES, Le Bourget-du-Lac, France; ² bifa Umweltinstitut, Augsburg, Germany; ³ Maltha, Lommel, Belgium; ⁴ LuxChemtech, Freiberg, Germany; ⁵ Soren, Paris, France

5DO.18.3 LARS: Laser-Assisted Recycling of Silicon Solar Modules

Mirjam Theelen¹, Remi Aninat¹, Toon IJzermans¹, Joao Morais Gomes¹, Monique van den Nieuwenhof¹, Maarten Dörenkämper¹, Fallon Colberts², Anne Biezemans¹, Bas Raaijmakers³, Johan Bosman¹, Henri Fledderus¹, Bart Geerligs³, Ando Kuypers¹, Maarten Van der Vleuten¹

¹ TNO, Eindhoven, The Netherlands; ² Zuyd University of Applied Sciences, Heerlen, The Netherlands; ³ TNO, Petten, The Netherlands

5DO.18.4 Mechanical Glass-Backsheet PV Modules Delamination towards Materials Recycling

Fabrice Coustier¹, Roland Riva¹, Xavier Mackré Delannoy¹, Jérémie Aime¹, Romain Duwald², Youcef Karar²

¹ CEA / INES, Le Bourget-du-Lac, France; ² CEA, Grenoble, France

5DO.18.5 Evaluation of Polymer Encapsulants as Feedstock for Advanced Recycling

Caroline Grand¹, Adriana Ferreira², Guy Beaucarne³, Wolfram Palitzsch⁴

¹ Dow Iberia, Tarragona, Spain; ² Dow Benelux, Terneuzen, The Netherlands; ³ Dow Silicones Belgium, Seneffe, Belgium; ⁴ LuxChemtech, Freiberg, Germany

5DO.18.6 Assessing III-V Material Availability: Can Supply meet Future Multi-GW Photovoltaics Demand?

Jessica Yajie Jiang, Ausrine Bukauskaite, Ned Ekins-Daukes
UNSW, Sydney, Australia

VISUAL PRESENTATIONS 5DV.3

13:30 - 15:00 Grid Integration and Flexibility Enablers | Global, Country- and Application-Specific Analysis of PV Deployment Aspects | Costs, Economics, Finance and Markets

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

PANEL DISCUSSION PRESENTATIONS

13:30 - 15:00 DO.13 Panel Discussion

ORAL PRESENTATIONS 4DO.4

15:15 - 16:45 Agrivoltaics, PV Noise Barriers and Floating PV

Chairpersons: Anatoli Chatzipanagi
European Commission JRC, Ispra, Italy
Giovanni Borz (I)
Eurac Research - Institute for Renewable Energy, Bolzano, Italy

4DO.4.1 Boosting Profitability: The Power of Vertical Bifacial PV in Modern Agrivoltaics

Marc Andre Schüller, Peter Bendix, Simon Lahr, Aysim Schäfer, Anna Morales Vilches
Next2Sun Technology, Dillingen, Germany

4DO.4.2 Benefits of an Agrivoltaic Installation in an Ecological Vineyard in Southern Spain

Álvaro Fernández Solas¹, Natalie Hanrieder¹, Anna Kujawa¹, Sergio González Rodríguez¹, Marleen Landes¹, Aitor Castillo², Estefanía Sánchez Vizcaíno³, Stefan Wilbert¹

¹ DLR, Almería, Spain; ² Bettergy, Málaga, Spain; ³ Cortijo El Cura Eco-Bodega, Laujar de Andarax, Spain

4DO.4.3 Case Study of Bifacial PV based Noise Barriers in Lithuania

Paulius Laurikėnas¹, Julius Denafas¹, Povilas Lukinskas¹, Tadas Radavičius¹, Saulius Rudys², Rimvydas Aleksiejūnas²

¹ SoliTek, Vilnius, Lithuania; ² Vilnius University, Lithuania



4DO.4.4 Energy Yield Analysis and Performance Monitoring of Three Photovoltaic Noise Barriers in Belgium and the Netherlands

Sara Bouguerra¹, Richard de Jong², Santhosh Ramesh², Tine Engelen¹, Marta Casasola Paesa¹, Jan Mertens², Fallon Colberts³, Ismail Kaaya², Patrizio Manganiello¹, Arnaud Morlier², Michael Daenen¹

¹ Hasselt University, Diepenbeek, Belgium; ² imec, Genk, Belgium; ³ Zuyd University, Heerlen, The Netherlands

4DO.4.5 Model Tests on Waterlily Shaped Offshore PV System

Linda Kemp, Naman Baderiya, Patrick Schrijvers, William Otto
MARIN, Wageningen, The Netherlands

4DO.4.6 Modelling Yearly Wave-Induced Loss for Floating Photovoltaics Using Realistic Weather Conditions

Nils E. C. Taugbøl¹, Vilde Stueland Nysted², Josefine Selj²

¹ University of Oslo, Norway; ² IFE, Kjeller, Norway

ORAL PRESENTATIONS 5DO.14

15:15 - 16:45 PV Forecasting and Grid Planning

Chairpersons: Pierre-Jean Alet
CSEM, Neuchâtel, Switzerland
Marion Perrin
Energy Pool, Le Bourget-du-Lac, France

5DO.14.1 Pan-European Climate Database v4.2: Recent Advancements in Regional PV Modelling and Data

Rodrigo Amaro e Silva¹, Yves-Marie Saint-Drenan², Giovanni Aldrigo³, Riccardo Bortolami³, Stefano Cordeddu³, Letizia Lusito³, Andrea Perbellini³, Elena Restivo³, Susanna Strada³, Alberto Troccoli³, Nube Gonzalez-Reviriego⁴, Aron Zuker⁵, Laurent Dubus⁶, Augustin Touron⁶, Laurens Stoop⁷
¹ University of Lisbon, Portugal; ² PSL Research University, Sophia Antipolis, France; ³ Inside Climate Service, Padua, Italy; ⁴ ECMWF, Bonn, Germany; ⁵ ENTSO-E, Brussels, Belgium; ⁶ RTE, Paris, France; ⁷ TenneT TSO, Arnhem, The Netherlands

5DO.14.2 Regional PV Modelling 101: the Devil is in the Details

Rodrigo Amaro e Silva¹, Yves-Marie Saint-Drenan², Elke Lorenz³, Tobias Zech³, Matthias Zech⁴, Wilfried van Sark⁵, Guadalupe Sánchez-Hernández⁶, David Pozo-Vazquez⁶, Marco Pierro⁷, Cristina Cornaro⁸, Elena Collino⁹, Dario Ronzio⁹, Laurent Dubus¹⁰, Augustin Touron¹⁰
¹ University of Lisbon, Portugal; ² PSL Research University, Sophia Antipolis, France; ³ Fraunhofer ISE, Freiburg, Germany; ⁴ DLR, Oldenburg, Germany; ⁵ Utrecht University, The Netherlands; ⁶ University of Jaen, Spain; ⁷ Eurac Research, Bolzano, Italy; ⁸ University of Rome Tor Vergata, Italy; ⁹ RSE, Milan, Italy; ¹⁰ Réseau de Transport d'Électricité, Paris, France

5DO.14.3 Empirical Analysis of Zero-Shot Cross-Frequency Forecasting for Missing Data Prediction in Real-time PV Management

Issei Suemitsu, Toru Kono, Ryo Wakabayashi, Jun Tsunoda, Yosuke Yamaguchi, Wenpeng Wei
Hitachi, Kokubunji, Japan

5DO.14.4 From PV Potential to Grid Impact: an Estimation of the Future PV Penetration in the South Tyrolean Electricity Grid

Azim Heydari¹, Enrico Dalla Maria¹, David Moser¹, Davide Prando², Alessandro Donadello², Grazia Barchi¹

¹ Eurac Research, Bolzano, Italy; ² Edyna, Bolzano, Italy

5DO.14.5 Assessing the Economic Value for Grid Operators of Quantified Smoothing Effects from PV Systems with Varying Orientations

Johan Lindahl
Becquerel Sweden, Knivsta, Sweden

5DO.14.6 Managing Minute-Scale Variability in Gigawatt-Scale PV Systems: a Techno-Economic Perspective

Harry Apostoleris¹, Ansari Aadil Shahzad², Juan David Barbosa Ramirez², Sgouris Sgouridis²

¹ EPRI, Dubai, United Arab Emirates; ² DEWA, Dubai, United Arab Emirates

ORAL PRESENTATIONS 3DO.19

15:15 - 16:45 Mechanical Load Testing and Insights into Glass Breakage

Chairpersons: Guy Beaucarne
Dow Silicones Belgium, Seneffe, Belgium
Veronica Bermudez Benito
QEERI, Doha, Qatar

3DO.19.1 PV Glass Breaks More because of Design, Material, and Quality Changes

Timothy J. Silverman, Elizabeth C. Palmiotti, Martin Springer, Michael G. Deceglie, Ingrid Repins, E. Ashley Gaubling
NREL, Golden, United States of America

3DO.19.2 Recent Insights into Glass Breakage: Findings from Factory Production Oversight, On-Site Inspections, and Laboratory Testing

Thomas Weber¹, Abdullah Abu Sayed¹, Roman Joziak¹, Eduardo Tellez Rodriguez¹, Nattapark Pongthanacharoenkul¹, Sören Rindert¹, Benjamin Lippke¹, Craig Wong¹, Steven Xuereb¹, Claudia Buerhop-Lutz²
¹ Kiwa PI Berlin, Germany; ² HI ERN, Erlangen, Germany

3DO.19.3 Understanding Glass Breakage in Field-Operated PV Modules: Learnings from Inhomogeneous Mechanical Load Tests

Jochen Markert, Aditya Girish Belawadi, Pascal Romer, Enzo Job, Ingrid Hädrich, Daniel Philipp
Fraunhofer ISE, Freiburg, Germany

3DO.19.4 Determining the Glass Strength of Solar Glass - Test and Evaluation Methods

Hannah Reichart¹, Matthias Pander², Ruth Kasper¹

¹ University of Applied Sciences Cologne, Germany; ² Fraunhofer CSP, Halle, Germany



3DO.19.5 Enhanced Mechanical Load Testing of PV Modules for Cold and Snowy Climates

Anika Gassner¹, Gabriele C. Eder¹, Ebrar Özkalay², Gabi Friesen², Markus Feichtner³, Vasiliki-Maria Archodoulaki⁴

¹ OFI, Vienna, Austria; ² SUPSI, Mendrisio, Switzerland; ³ Sonnenkraft, St Veit an der Glan, Austria; ⁴ TU Wien, Austria

3DO.19.6 Uniform Mechanical Loading Can Test for Non-Uniform Loading Durability

Nick Bosco, Martin Springer
NREL, Golden, United States of America

VISUAL PRESENTATIONS 4DV.4

15:15 - 16:45 PV System Engineering

Detailed information on this session is presented in the section entitled 'EU PVSEC 2025 Visual Presentations'.

OTHER PRESENTATIONS

15:15 - 16:45 Late News Session

ORAL PRESENTATIONS 4DO.5

17:00 - 18:30 Modelling and Optimisation of Agrivoltaic Systems

Chairpersons: Alessandra Scognamiglio
ENEA, Portici, Italy
Invited

4DO.5.1 Special Introductory Presentation: Assessing and Applying Light Modelling Tools for Agrivoltaics: Validation, Benchmarking, and Practical Use from SYMBIOSYST

S Prithivi Rajan¹, Shu-Ngwa Asaa², Alexandros Katsikogiannis³, Jesus Robledo¹, Jonathan Leloux¹, Ismail Kaaya², Yingyu Zhang⁴, Maarten Hertog⁴, Pieter Verboven⁴, Giacomo Bosco⁵, Giovanni Borz⁶, David Moser⁶

¹ LuciSun, Brussels, Belgium; ² Imec, Leuven, Belgium; ³ TU Delft, The Netherlands; ⁴ KU Leuven, Belgium; ⁵ Fotoniq, Delft, The Netherlands; ⁶ EURAC, Bolzano, Italy

4DO.5.2 Optimizing Crop Irradiance Distributions in AgriPV Systems: PV Cell Layouts and Materials Diffusivity Influence on AgriPV Systems using BSDF and Ray Tracing Simulations

Alvaro de Gruijter, Laura Maturi, Giovanni Borz, Jordi Veirman, David Moser
Eurac Research, Bolzano, Italy

4DO.5.3 Modelling the Micro-Climate Cooling Effect of Open Agri-PV: Impact on Performance, Reliability, and Environment

Ismail Kaaya¹, Zoe Scheerlinck², Yingyu Zhang², Bram Van de Poel², Pieter Verboven², Arnaud Morlier¹

¹ Imec, Genk, Belgium; ² KU Leuven, Belgium

4DO.5.4 Development and Evaluation of an Agrivoltaic System in Olive Groves based on a Novel Smart Tracking Algorithm

Iñaki Cornago¹, Gregorio Olivares¹, Gillen Abrego², Eusebio Gainza², Ildefonso Muñoz¹

¹ CENER, Sarriguren, Spain; ² ALLOTARRA, Allo, Spain

4DO.5.5 Adoption and Optimisation Analysis of Agri-Voltaic Systems for Horticultural Production and Energy Autonomy in Lubumbashi

Eddie Bilitu¹, Shu-Ngwa Asaa², Sara Bouguerra¹, Nikoleta Kyranaki¹, Ismail Kaaya³, Yannick Useni⁴, Michael Daenen¹

¹ Hasselt University, Belgium; ² Hasselt University, Genk, Belgium; ³ imec, Genk, Belgium; ⁴ University of Lubumbashi, Congo (DRC)

ORAL PRESENTATIONS 4DO.10

17:00 - 18:30 PV O&M Insights, Direct Uses of PV Electricity and Batteries

Chairpersons: Dirk Stellbogen (i)
ZSW, Stuttgart, Germany
Tsvetelina Merdzhanova
Forschungszentrum Jülich, Jülich, Germany

4DO.10.1 Developing a Novel Sensor Health KPI for Evaluating Irradiance Sensor Performance

Sascha Lindig, Spyros Theocharides, Julián Ascencio-Vásquez
Univers, Courbevoie, France

4DO.10.2 Measurement and Analysis of Bifacial Gain for Commercial & Industrial PV Systems: Impact of Building Structure and Environmental Factors

Pierre Besson¹, Jean-Francois Lelievre¹, Antoine Dizier¹, Ismael Lokhat², Benoit Lelong³

¹ INES, Le Bourget-du-Lac, France; ² Trace Software, Saint-Romain-de-Colbosc, France; ³ Cythelia Energy, La Motte-Servolex, France

4DO.10.3 Assessing Tracker Availability in Solar PV Power Plants: Methods & Insights

Giuliano Luchetta Martins¹, Lucas Z. Sergio¹, Maitheli Nikam², Gofran Chowdhury², Elena Koumpli¹, Jan Muller¹

¹ Statkraft UK, London, United Kingdom; ² 3E, Brussels, Belgium

4DO.10.4 Beyond Solar-To-Hydrogen Efficiency Limit with Batteries

Uchechi Chibuko¹, Tsvetelina Merdzhanova¹, Uwe Rau¹, Ursula Würstbauer², Oleksandr Astakhov¹

¹ FZJ, Jülich, Germany; ² University of Münster, Germany

4DO.10.5 Degradation of Lithium-Ion Batteries: a Meta-Analysis

Matteo Ligorati, Jerome Geyer-Klingeberg, Andreas Rathgeber
University of Augsburg, Germany

4DO.10.6 From Adoption to Over-Extraction: Evaluation of the Trade-offs of Solar Irrigation in Rajasthan

Vanshika Gupta, S.P. Singh
Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India



ORAL PRESENTATIONS 5DO.15

17:00 - 18:30 Aggregation, Hybridisation, and Storage

Chairpersons: Tara Esterl (i)
AIT, Vienna, Austria
Johannes Stierstofer (i)
WIP Renewable Energies, Munich, Germany

5DO.15.1 Mitigating Grid Impact of Distributed Solar Generation through a VPP-Based firm PV Strategy

Marco Pierro¹, Alessandro Donadello², Davide Prando², David Moser¹, Grazia Barchi¹
¹ Eurac Research, Bolzano, Italy; ² Edyna, Bolzano, Italy

5DO.15.3 Solutions for Optimizing Shared PV Installations at Rural Energy Communities Driven by Citizens: the case of CERCA Energy Community

Laura Palomino, Daniel Sierra, Sergio Morales, Rita Hogan, Luis Miguel Carrasco, Luis Narvarte, Ana Belén Cristóbal
UPM, Madrid, Spain

5DO.15.4 Enhanced Value of Grid-connected PV with Battery Storage in a Negative Price Environment

Djaber Berrian, Gaurang Chhapia, Rene van Baal, Johannes Linder
Belectric, Kollitzheim, Germany

5DO.15.5 A Multi-Objectives Tool for Optimization and Management of Hybrid Energy Storage Systems

Pedro Miguel Sousa, José Silva, Luís Fialho, Pedro Horta
University of Évora, Portugal

5DO.15.6 State of Health Estimation of PV and BESS in the Spanish Power System

Felipe Salinas¹, Biel Roig², Gofran Chowdhury¹, Joan Vinaixa²
¹ 3E, Brussels, Belgium; ² 3E, Barcelona, Spain

ORAL PRESENTATIONS 3DO.20

17:00 - 18:30 Performance of Polymeric Materials

Chairpersons: Chiara Barretta (i)
PCCL, Leoben, Austria
Christian Camus
LayTec, Berlin, Germany

3DO.20.1 Reliable Backsheet / Encapsulant Combinations – Comparative Testing of Mini Modules

Jonathan Kriening¹, Roland Einhaus¹, Maximilian Engel¹, Bengt Jaeckel², Matthias Pander², Anton Mordvinkin², Ralph Gottschlag³, Claudia Buerhop-Lutz⁴, Peter Clawin⁵, Max Köntopp⁵
¹ ZSW, Stuttgart, Germany; ² Fraunhofer CSP, Halle, Germany; ³ Hochschule Anhalt, Köthen, Germany; ⁴ FZJ, Erlangen, Germany; ⁵ Hanwha Q CELLS, Thalheim, Germany

3DO.20.2 Outdoor Backsheet Exposure in Tropical and Desert Climates and Its Correlation to Accelerated Laboratory Testing

Stefan Mitterhofer, Zelin Li, Karissa Jensen, Ashlee Aiello, Song Syun Jhang, Xiaohong Gu
NIST, Gaithersburg, United States of America

3DO.20.3 Environmental Delamination of Colored PV Encapsulants from Glass Substrates

Martin Huemer¹, Gernot M. Wallner¹, Gabriel Riedl¹, Andreas Brandstätter²
¹ University of Linz, Austria; ² Lenzing Plastics, Lenzing, Austria

3DO.20.4 Evaluation of the Moisture Diffusion Characteristics in Contemporary PV Constituents using the Dynamic Vapor Sorption (DVS) Technique

Suraj Ravindrababu, Paul Gebhardt, Birgit Ingrid Hädrich, Daniel Philipp
Fraunhofer ISE, Freiburg, Germany

3DO.20.5 Reliability Studies of UV Downshifting Encapsulants after Damp-Heat and UV Weathering

Jishnu Ramachandran Nair¹, Marius Lüdemann², Paul-Tiberiu Miclea¹, Kai Zhang³, Kaining Ding³, Andreas Lambert³, Ralph Gottschalg¹, Robert Heidrich¹, Anton Mordvinkin¹
¹ Fraunhofer CSP, Halle, Germany; ² Anhalt University of Applied Sciences, Köthen, Germany; ³ FZJ, Jülich, Germany

3DO.20.6 Festina Lente! The Impact of Lamination Duration on Encapsulant Stability

Nikolina Pervan, Jutta Geier, Christian Veas, Gernot Oreski
PCCL, Leoben, Austria

OTHER PRESENTATIONS

17:00 - 18:30 Poster Award Winner Session



Friday, 26. September 2025

ORAL PRESENTATIONS 5EO.1

08:30 - 10:00 **Citizens Participation and Awareness**

Chairpersons: Silvia Caneva
 WIP Renewable Energies, Munich, Germany
 Nigel Taylor
 European Commission JRC, Ispra, Italy

5EO.1.1 Social Housing and Energy Communities: Balancing Affordability and Profitability in Multi-Apartment Buildings

Elena Bosch¹, Caroline Plaza², Melodie de l'Epine², Gaëtan Masson¹
¹ Becquerel Institute, Brussels, Belgium; ² Becquerel Institute France, Lyon, France

5EO.1.2 Study for an Agrivoltaic Based Rural Energy Community in Alentejo Portugal

José Almeida Silva, Vasco Cabecinha, Dorivaldo Duarte, Afonso Cavaco, Luís Fialho, Pedro Horta
 University of Évora, Portugal

5EO.1.3 Innovative Governance Models for Agri-PV in Rural Desert Regions: a Scalable Framework for Sustainable Energy Transitions

Nikita Shah¹, Sofia Saavedra Bruno¹, Myriam El Khoury¹, Geert Palmers², Gofran Chowdhury²
¹ ORG Architecture & Urbanism, Brussels, Belgium; ² 3E, Brussels, Belgium

5EO.1.4 Challenges and Lessons Learned in the Implementation of Regional-Scale PV Energy Community in Spain

Luis Miguel Carrasco, Rita Hogan Almeida, Kiane Alves e Silva, Luis Narvarte
 UPM, Madrid, Spain

5EO.1.6 The Jülich Photovoltaic Research and Education Mobile Laboratory (JuPREMe Lab)

Georgette Udo, Timon Sebastian Vaas, Maurice Nuys, Stefan Haas, Uwe Rau, Buğra Turan
 FZJ, Jülich, Germany

ORAL PRESENTATIONS 4EO.2

08:30 - 10:00 **Vehicle Integrated PV**

Chairpersons: Bonna Newman
 Lightyear, Helmond, The Netherlands
 Invited

4EO.2.1 VIPV Parameter Optimization under Dynamic Shading

Ricardo Moruno, Luis Javier San José, Rubén Núñez, Rebeca Herrero, Ignacio Antón
 UPM, Madrid, Spain

4EO.2.2 Influence of Different Driving Patterns and Electrical Design on VIPV Performance

Judy Jalkh¹, Christian Doppler¹, Philip Caluori¹, Manuel Ruf²
¹ Virtual Vehicle, Graz, Austria; ² Robert Bosch, Stuttgart, Germany

4EO.2.3 Modeling Temperature Dynamics in VIPV Systems using the Extended Faiman Model

Bart E. Pieters¹, Neel Patel¹, Goodfriend Whyte¹, Evgenii Sovetkin¹, Karsten Bittkau¹, Angèle Reinders², Andreas Gerber¹
¹ IMD-3 Photovoltaics, FZJ, Jülich, Germany; ² TU Eindhoven, The Netherlands

4EO.2.4 Curved Glass-Free PV Module Characterization and Fabrication for Electric Vehicles

Kléber Nicolet-dit-Félix¹, Mert Turan¹, Leonardo Panattoni¹, Umang Desai¹, Martin Pérez Chuecos², Gianluca Cattaneo², Bénédicte Bonnet-Eymard², Andreas Hutter², Antonin Faes², Christophe Ballif¹
¹ EPFL PV-LAB, Neuchâtel, Switzerland; ² CSEM, Neuchâtel, Switzerland

4EO.2.5 Dynamic GIS-Based 3D Solar Simulation Framework for Assessing VIPV in Urban Public Transport using GTFS and Driving Cycles

David Pera¹, Christian Braun¹, Philippe Pinheiro¹, Miguel Brito², Ulrich Leopold¹
¹ Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg; ² University of Lisbon, Portugal

4EO.2.6 Optimizing Angular Performance of Curved VIPV Modules

Francisco José Martín, Rebeca Herrero, Ignacio Antón
 UPM, Madrid, Spain

ORAL PRESENTATIONS 5EO.3

08:30 - 10:00 **Markets, Costs and Economics**

Chairpersons: Christian Breyer (*i*)
 LUT University, Lappeenranta, Finland
 Izumi Kaizuka
 RTS Corporation, Chuo-ku, Japan

5EO.3.1 A Snapshot of the global PV Market - 2024

Gaëtan Masson¹, Melodie de l'Epine², Arnulf Jäger-Waldau³, Izumi Kaizuka⁴, Johan Lindahl⁵, José Donoso⁶
¹ IEA PVPS Task 1, Brussels, Belgium; ² IEA PVPS Task 1, Lyon, France; ³ European Commission, Rome, Italy; ⁴ RTS Corporation, Tokyo, Japan; ⁵ Becquerel Sweden, Knivsta, Sweden; ⁶ UNEF, Madrid, Spain

5EO.3.2 The Economic Benefit of Using Photovoltaic Systems to Provide Frequency Containment Reserve

Emil Petkovski, Theo Bosma, Marcel Eijgelaar, Ravi Singh
 DNV, Arnhem, The Netherlands

5EO.3.3 Technoeconomic Modeling for Grid Penetration of Solar Energy Generation and Storage

Jennifer L. Braid, Luke P. McLaughlin, Nathan Schroeder, Jeremy Sment, Clifford Ho, Joshua S. Stein
 Sandia National Laboratories, Albuquerque, United States of America



5EO.3.4 Techno-Economic Analysis of Triple-Junction Perovskite/Silicon Cells and Modules

Lian Duan¹, Sebastian Nold², Lars Oberbeck³

¹ IPVF, Palaiseau, France; ² Fraunhofer ISE, Freiburg, Germany; ³ TotalEnergies OneTech, Paris, France

5EO.3.5 Differences between Economical and Societal Optimal Designs of Solar Parks due to Feed-in Restrictions

Bas B. Van Aken, Ilkay Cesar
TNO, Petten, The Netherlands

5EO.3.6 PV-made-in-Europe: are Proposed Policy Measures Sufficient for Competitive LCOE?

Atse Louwen¹, Sandra Gallmetzer¹, Mohammad Dehghanimadvar², Nathan Chang², Renate Egan², Philippe Macé³, David Moser¹

¹ Eurac Research, Bolzano, Italy; ² UNSW, Sydney, Australia; ³ Becquerel Institute, Brussels, Belgium

PLENARY PRESENTATIONS 5EP.1

10:30 - 12:00 Flexibility and Sustainability

Chairpersons: Cara Libby
EPRI, Palo Alto, United States of America
Venizelos Efthymiou (i)
University of Cyprus, Nicosia, Cyprus

5EP.1.1 Invited Presentation on PV Plus Storage as a Flexibility Enabler of the Energy System

5EP.1.2 Quantifying the Benefits of Hybrid PV-wind Power Plants

Erik Stensrud Marstein¹, Øyvind Sommer Klyve², Magnus Moe Nygård¹, Ville Olkkonen¹, Heine Nygard Riise¹

¹ IFE, Kjeller, Norway; ² Statkraft, Düsseldorf, Germany

5EP.1.3 A Commodity Today, Incompatible Tomorrow: the Paradox of PV?

Bert Herteleer¹, Gernot Oreski², Ian Marius Peters³, Ulrike Jahn⁴, Ralph Gottschalg⁴, Gabriele Friesen⁵

¹ KU Leuven, Gent, Belgium; ² PCCL, Leoben, Austria; ³ HI ERN, Erlangen, Germany; ⁴ Fraunhofer CSP, Halle, Germany; ⁵ SUPSI, Mendrisio, Switzerland

5EP.1.4 Invited Presentation on the Status of PV Recycling and Analysis of Life Cycle Indicators

5EP.1.5 Renewable Energy Communities and Citizen Participation in Technological and Social Innovations

Cristina Sanz-Cuadrado, Kiane Alves e Silva, Luis Narvarte, Ana B. Cristóbal UPM, Madrid, Spain

OTHER PRESENTATIONS

12:00 - 13:00

Closing

EU PVSEC 2025 VISUAL PRESENTATIONS

Monday, 22. September 2025

VISUAL PRESENTATIONS 3AV.1

13:30 - 15:00 PV Module Design and Manufacturing

3AV.1.1 Investigating the 3-Dimensional Structure of Metallic Filler Particles in Electrically Conductive Adhesives

Stephan Großer¹, Alexander Müller¹, Robert Göckeritz¹, Tobias Nitsche², Daniel Buckland², Giuseppe Galbiati²

¹ Fraunhofer CSP, Halle (Saale), Germany; ² Henkel, Dusseldorf, Germany

3AV.1.2 New PV Module Circuit Designs for Improved Shading Tolerance

Kevin Meyer¹, Léo Bourdon², Julian Mattheis³, Thomas Daschinger¹, Iris Kunze¹, Susanne Blankemeyer¹, Carolin Römer¹, Henning Schulte-Huxel¹

¹ ISFH, Emmerthal, Germany; ² Polytechnic School, Palaiseau, France; ³ Independent Researcher, Frankfurt, Germany

3AV.1.3 Photovoltaic Module Technology Trends and Reliability Implications

Elizabeth C. Palmiotti, Martin Springer, Jarett Zuboy, Andy Walker, Teresa Barnes

NREL, Golden, United States of America

3AV.1.4 Solarising Existing Building Rooftops with an Innovative Lightweight Photovoltaic Module Designed and Manufactured in Europe

Julien Gaume¹, Adrien Rivalland¹, Maria Planells Valencia¹, Victor Vareilles¹, Karen Blanc-Jamin¹, Maryline Joanny¹, Yannick Veschetti², Amandine Boulanger², Xavier Leboeuf², Yannick Roujol², Eszter Voroshazi²

¹ Heliup, Le Bourget-du-Lac, France; ² University Grenoble Alpes, Le Bourget-du-Lac, France

3AV.1.5 Bio-Epoxy Composites Material for Lightweight Solar Module

Seohee Hwang, Yohan Noh, Seungah Ur, Jaehyeong Lee
University of Sungkyunkwan, Suwon, South Korea

3AV.1.6 Investigation on Different Bypass Diodes for Shade Resistant PV-Modules

Jens Froebel¹, Matthias Pander¹, Bengt Jaeckel¹, Andreas Maixner², Pouya Pourshafi², Afshin Bakhtiari², Hamed Hanifi²

¹ Fraunhofer CSP, Halle (Saale), Germany; ² AESOLAR, Koenigsbrunn, Germany

3AV.1.7 Optimized Infrared Soldering Process for Silicon Solar Cells to Improve the Temperature Homogeneity using Finite Element Methods

Daniel Christopher Joseph, Angela De Rose, Andreas J. Beinert, Holger Neuhaus

Fraunhofer ISE, Freiburg, Germany

3AV.1.9 Design and Manufacture of Lightweight Hybrid Photovoltaic Thermal Module

Yijiang Xu¹, Paulius Laurikėnas², Pål Tettei¹, Martin Bellmann¹

¹ SINTEF Industry, Trondheim, Norway; ² SoliTEK, Vilnius, Lithuania



3AV.1.10 Performance Analysis of a Novel Photovoltaic Module Design for Vertical Applications: Mitigate Self-Shading of Bifacial Modules

Pouya Pourshafi, Hamed Hanifi
AESOLAR, Königsbrunn, Germany

3AV.1.11 Materials Assessment for PV-T Modules Thermal Performance Improvement

Lucía Cano, Raquel Simón-Allué, Raúl Villén, Yolanda Lara, Isabel Guede
ENDEF, Zaragoza, Spain

3AV.1.12 Evaluating Repair Techniques for c-Si PV Modules: Spot-Welding and Backsheet Patching

Jorge Rabanal-Arabach¹, Sonia Beltran-Condori¹, Ricardo Guzman-Gonzalez¹, Katalina Rojas-Henriquez¹, Andreas Schneider², Edward Fuentealba-Vidal¹

¹ University of Antofagasta, Chile; ² University of Applied Sciences Gelsenkirchen, Germany

3AV.1.13 Thermally Conductive Filler Particle Mixed Silicone Layer to Provide Heat Dissipation Functionality to c-Si Solar Cell Modules without Encapsulants

Yasushi Sobajima¹, Kouzen Wakazono¹, Keisuke Ohdaira²
¹ Gifu University, Japan; ² JAIST, Ishikawa, Japan

3AV.1.14 Development of Transparent Protective Barrier Layers via PECVD for Flexible Thin Film Solar Cells

Paula Perez-Rodriguez, Shreyasi Maitra, Arno H. M. Smets
TU Delft, The Netherlands

3AV.1.15 Curing Conditions Effects on the Volume and Contact Resistivity of Interconnects based on Electrically Conductive Adhesives for PV Modules: Fast versus Slow Curing

Maria Ignacia Devoto Acevedo¹, Stephan Großer², Daniel Buckland³, Tobias Nitsche³, Giuseppe Galbiati³, Matthias Helbig¹, Tobias Meßmer¹, Andreas Halm¹, Daniel Tune¹

¹ ISC Konstanz, Germany; ² Fraunhofer CSP, Halle, Germany; ³ Henkel, Düsseldorf, Germany

3AV.1.16 Ultrasonic Characterization of Ethylene-Vinyl Acetate Crosslinking in Glass-Glass-Modules

Rico Meier, Christopher Bruce Konu
HTW Berlin, Germany

3AV.1.17 Study of the Compatibility of Various Electrically Conductive Adhesives (ECA) for the Interconnection of PK-Si Tandem Solar Cells

Felicia Mouhoubi, Vincent Barth, Solenn Berson
CEA / INES, Le Bourget-du-Lac, France

3AV.1.18 Optimization of Soxhlet Extraction Parameters for Gel Content Determination of Co-Extruded EPE

Aksel Kaan Öz¹, Aaron Trefzer¹, Christine Wellens¹, Meric Caliskan², Cansel Düz²

¹ Fraunhofer ISE, Freiburg, Germany; ² Kalyon PV, Ankara, Türkiye

3AV.1.19 Perovskite Module Development on Glass and Flexible Substrates: Important Steps towards Industrially Relevant Processes

Erik Ahlswede, Jonas Hanisch, Oliver Salomon, Cordula Wessendorf, Tina Wahl, Roland Wuerz, Stefan Paetel, Michael Powalla
ZSW, Stuttgart, Germany

3AV.1.20 Transforming Industrial Facades with Integrated Photovoltaics

Nikolina Pervan¹, Sonja Feldbacher¹, Lukas Geymayer², Gregor Kitzberger², Martin Fleischanderl², Hannes Kurz², Friedrich Füreder-Kitzmüller², Gernot Oreski¹

¹ PCCL, Leoben, Austria; ² voestalpine Stahl, Linz, Austria

3AV.1.21 Evaluation of BASF Lumogen Violet 570 and BASF Lumogen Red 305 as Downshifting Layers for Photovoltaic Applications

Leonardo Sollazzo, Giulio Mangherini, Valentina Diolaiti, Donato Vincenzi
University of Ferrara, Italy

3AV.1.22 Development of Junction Boxes Regarding Modern Wiring Concepts for Future PV Modules

Sadaf Ghasemi, Marc Andre Schüller, Luis Eduardo Alanis, Felix Basler, Li Carlos Rendler, Martin Heinrich
Fraunhofer ISE, Freiburg, Germany

3AV.1.23 Development, Evaluation and Comparison of Different Innovative Shade-Resistant PV Modules Designs

Jens Froebel¹, Sophia Jahreis¹, Matthias Pander¹, Bengt Jaeckel¹, Andreas Maixner², Pouya Pourshafi², Afshin Bakhtiari², Hamed Hanifi²

¹ Fraunhofer CSP, Halle (Saale), Germany; ² AESOLAR, Königsbrunn, Germany

3AV.1.24 Mitigating Performance Losses in Large-Area Perovskite Solar Modules through P4 Transverse Scribing Pattern

Marion Provost¹, Thomas Guillemot¹, Alexandra Levchenko¹, Karim Medjoubi¹, Liam Gollino¹, Jean-Baptiste Puel², Iwan Zimmermann¹, Daniel Ory², Jean Rousset²

¹ IPVF, Palaiseau, France; ² EDF-IPVF, Palaiseau, France

3AV.1.25 Technologies for Interconnection of 3 Terminal Tandem Solar Cells in Standard 2 Terminal Modules

Juan Carlos Jimeno¹, Vanesa Fano¹, Rubén Gutiérrez¹, Eneko Cereceda¹, Aloña Otaegi¹, Nekane Azkona¹, Fernando Hernando¹, Aitor Apraiz², Xabier Hernández², Jean Philippe Aguerre³

¹ UPV/EHU, Bilbao, Spain; ² Koniker S. Coop., Arrasate, Spain; ³ Mondragon Assembly, Aretxabaleta, Spain

3AV.1.26 PV Eco-Design: Chemical and Electrical Properties of TPO-Based Encapsulants

Francesca Menchini¹, Valeria Fiandra², Lucio Sannino², Concetta Andreozzi², Claudia Malerba¹, Massimo Izzi¹, Mario Tucci¹, Paola Delli Veneri²

¹ ENEA Casaccia, Rome, Italy; ² ENEA Portici, Naples, Italy



3AV.1.27 Development of an Optimal Hybrid Technology for Recycling End-of-Life PV Modules

Seunghwan Ryu¹, Hyukgeun Song¹, Ji-Hyun Yoo², Ji-Seob Ahn², Gyeong-Jun Min², Su-Mi Yang²

¹ HS Solar Energy, Cheongju-Si, South Korea; ² Far East University, Eumseong-gun, South Korea

3AV.1.28 High-Efficiency Microwave-Assisted Delamination of End-of-Life Photovoltaic Modules for Sustainable Materials Recovery

Hyukgeun Song¹, Seunghwan Ryu², Jeong-eun Jeon³, Yoon-Sung Lee³, Soo-Rim Choi³, Su-Mi Yang³

¹ HS Solar Energy, Cheongju-Si, South Korea; ² HS Solar Energy, Cheong-Si, South Korea; ³ Far East University, Eumseong-gun, South Korea

3AV.1.29 Flexible, Lab-Scale Soldering and Curing Tool for a Research-Focused Module Assembly Robot

Raphael Shanmugam, Karl Wienands, Matthias Helbig, Andreas Halm, Daniel Tune

ISC Konstanz, Germany

3AV.1.30 Isotropic Conductive Adhesives for R2R Lamination of Flexible PV Modules

Joris de Riet¹, Aldo Kingma¹, Casper van Kessel¹, Marc Koestse¹, Monique van den Nieuwenhof¹, Jochen Schuermans², Piero Spinelli¹, Mirjam Theelen¹, Dorrit Roosen¹

¹ TNO, Eindhoven, The Netherlands; ² Roartis, Genk, Belgium

3AV.1.31 Light-Weight Optimization of Large-area Photovoltaic Module Frames via Structural Analysis and Non-dominated Sorting Genetic Algorithm-II

Yohan Noh, Jaehyeong Lee

University of Sungkyunkwan, Suwon, South Korea

VISUAL PRESENTATIONS 3AV.2

15:15 - 16:45 PV Module Durability and Reliability

3AV.2.1 Reliability of Electrically Conductive Adhesive Joints for PERC and HJT-Based Building-Integrated Photovoltaic Facade Elements

Ringo Koepge, Sophia Jahreis, Nick Schröter, Matthias Pander, Stephan Großer, Bengt Jaeckel

Fraunhofer CSP, Halle (Saale), Germany

3AV.2.2 Unveiling Wavelength Converting Encapsulant Specific Features

Lison Marthey¹, Hengyu Li¹, Matthieu Despeisse¹, Maxime Roten¹, Maeva Thiévent², Jonas Geissbühler¹, Hugo Quest¹, Delphine Petri¹, Jonathan Champlaud¹, Christophe Ballif¹

¹ CSEM, Neuchâtel, Switzerland; ² EPFL, Lausanne, Switzerland

3AV.2.3 Durability and Reliability: A Cross-Technological Stability Analysis of Silicon Photovoltaics

Mengdi Liu¹, Wenhao Xu¹, Yating Zhang¹, Giorgio Bardizza², Christos Monokroussos¹

¹ TÜV Rheinland, Shanghai, China; ² TÜV Rheinland, Cologne, China

3AV.2.4 Silica Coating with Optimized Optical and Mechanical Properties for Anti-Reflection and Dust Resistance in Harsh Desert Environments

Brahim Aissa, Mohammad Hossain, Atef Zekri, Amir Abdallah, Veronica Bermudez Benito

QEERI, Doha, Qatar

3AV.2.5 Plasmonic-Decorated TiO₂ Thin Films as Photocatalytic Anti-Soiling Coatings

Brahim Aissa, Mohammad Hossain, Adnan Ali

QEERI, Doha, Qatar

3AV.2.6 Do We Really Need UV Absorbers in the Encapsulant for Reliable PV Production in the Long Run ?

Hugo Lajoie¹, Frédéric Jay¹, Maxime Babics¹, Sandrine Therias²

¹ CEA Liten, Le Bourget-du-Lac, France; ² CNRS, Clermont-Ferrand, France

3AV.2.7 Investigating the Effect of Solar Panel Frame Sizes and Thickness on Maximum External Mechanical Load Bearing by FEA Analysis

Afshin Bakhtiari¹, Sagarika Kumar², Mauro Pravettoni², Hamed Hanifi¹

¹ AESOLAR, Königsbrunn, Germany; ² TII, Abu Dhabi, Germany

3AV.2.8 The Effect of Photovoltaic Cell Sizes and Cell Quantities on the External Mechanical Load Bearing of Solar Panels by Finite Element Analysis FEA

Afshin Bakhtiari¹, Sagarika Kumar², Mauro Pravettoni², Hamed Hanifi¹

¹ AESOLAR, Königsbrunn, Germany; ² TII, Abu Dhabi, Germany

3AV.2.9 Evaluating Climate-Specific Degradation of PV Modules by Spectral UV-Fluorescence Mapping

Oleksandr Stroyuk¹, Oleksandra Raievska¹, Oleksandr Mashkov¹, Carlos D. Rodríguez-Gallegos², Claudia Buerhop¹, Jens Hauch¹, Ian Marius Peters¹

¹ HI ERN, Erlangen, Germany; ² SERIS, Singapore

3AV.2.10 Identification of Spectral Indicators of Degradation in Tedlar-Type Backsheets: a Case Study of PV Modules Aged in Tropical Climate

Oleksandr Stroyuk¹, Oleksandr Mashkov¹, Carlos D. Rodríguez-Gallegos², Claudia Buerhop¹, Jens Hauch¹, Ian Marius Peters¹

¹ HI ERN, Erlangen, Germany; ² SERIS, Singapore

3AV.2.11 Advanced Analytical Approaches to Unveil Solar Panel Components Degradation

Simone Cailotto

PerkinElmer, Milan, Italy

3AV.2.12 Polyvinylidene Fluoride-Based Solution for Use as a Dielectric Layer in Backsheet Crackings

Carlos González Montes¹, Luis Manuel Ocaña González¹, Benjamín González Díaz², Sara González Pérez², María Elena Larena García¹

¹ ITER, Granadilla de Abona, Spain; ² ULL, San Cristóbal de La Laguna, Spain

3AV.2.13 Combining Physical- and Scenario-based Modelling to Identify Tolerable Degradation Rates for Perovskite Cells in Perovskite/Silicon Tandem Modules

Youri Blom, Rudi Santbergen, Olindo Isabella, Malte Ruben Vogt

TU Delft, The Netherlands



3AV.2.14 Restoring the Functionality of Damaged PV-Backsheets

Yuliya Voronko¹, Gabriele C. Eder¹, Raffael Schifferegger¹, Anika Gassner¹, Sonja Feldbacher², Gernot Oreski²
¹ OFI, Vienna, Austria; ² PCCL, Leoben, Austria

3AV.2.15 UV Stability of Lightweight Silicon Heterojunction Solar Modules with Downshifting Encapsulation Materials

Kai Zhang¹, Rongda Zhang¹, Andreas Lambert¹, Binbin Xu¹, Alexander Eberst¹, Karsten Bittkau¹, Xinjun Li², Henrike Gattermann¹, Uwe Rau¹, Kaining Ding¹
¹ FZJ, Juelich, Germany; ² Cybrid Technologies, Suzhou, China

3AV.2.16 FEM Simulation of Influence of Different Polymeric Module Materials and Layouts in Strings of Shingled Solar Cells under Mechanical and Thermal Loads

Margit Lang, Gernot Oreski, Peter Fuchs
PCCL, Leoben, Austria

3AV.2.17 Critical Analysis of the Protection offered by Bypass Diodes in Current Modules

Eneko Cereceda, Nekane Azkona, Aloña Otaegi, Vanesa Fano, Eneko Ortega, José Rubén Gutierrez, Juan Carlos Jimeno
UPV/EHU, Bilbao, Spain

3AV.2.18 Breakage in Bifacial PV Modules

Rodrigo P. Maruyama, Roberto Zilles, Adnei Melges de Andrade
USP, São Paulo, Brazil

3AV.2.19 Accelerated Stress Tests for Screening Early Field Failures in Metal Halide Perovskite Photovoltaic Modules

Nicholas Irvin¹, Soňa Uličná¹, Timothy Silverman¹, Jackson Schall¹, Dana Kern¹, Rachael Arnold¹, Kent Terwilliger¹, Byron McDanold¹, Joshua Parker¹, Michael Deceglie¹, Xiaoqiang Shi², Chengbin Fei², Muhammad Saeed³, Zhaoning Song³, Jinsong Huang², Joshua Stein⁴, Joseph Berry¹, Laura Schelhas¹, Michael Owen-Bellini¹
¹ NREL, Golden, United States of America; ² University of North Carolina at Chapel Hill, United States of America; ³ University of Toledo, United States of America; ⁴ Sandia, Albuquerque, United States of America

3AV.2.20 Variational Autoencoder for Electroluminescence Solar Cell Image Power Loss Prediction

Norman Jost¹, Ojas Sanghi¹, Rodrigo del Prado Santamaría², Brandon Byford¹, Isaiah H. Deane¹, Sergiu Viorel Spataru², Jennifer L. Braid¹
¹ Sandia National Laboratories, Albuquerque, United States of America; ² DTU, Roskilde, Denmark

3AV.2.21 What Reduction in Degradation can be Expected due to Lower Operating Temperature in Floating PV Systems?

Marit S. Ulset, Torunn Kjeldstad, Josefine Selj, Dag Lindholm, Gaute Otnes IFE, Kjeller, Norway

3AV.2.22 Impact of Tilt Angle on PV Module Reliability: Lessons Learned from an Indoor UV Irradiation Study

Nikoleta Kyranaki¹, Ismail Kaaya¹, Mohammed Adnan Hameed², Arnaud Morlier¹, Michael Daenen¹
¹ Hasselt University, Genk, Belgium; ² Martin-Luther-University Halle-Wittenberg, Halle, Germany

3AV.2.23 Detection of Transformations in Encapsulants after Module Lamination Process

Vaidvilė Ulbikaitė¹, Jolanta Donėlienė¹, Piotr Dubravskij¹, Algirdas Galdikas¹, Jan Devenson², Viktoras Vaicikauskas², Viktorija Nargelienė², Arūnas Šetkus²
¹ Protech, Vilnius, Lithuania; ² Center for Physical Sciences and Technology (FTMC), Vilnius, Lithuania

3AV.2.24 Improving Ultraviolet Fluorescence Analysis for Photovoltaic Encapsulant Assessment

Zonghan Jiang, Hugo Sanchez, Leila Mortazavifar, Carlos Meza, Ralph Gottschalg
Anhalt University of Applied Sciences, Köthen, Germany

3AV.2.25 Are New PV Modules More Reliable than Old Ones? a Comparison of 13 Years Old vs. 30 Years Old PV Plants

Chiara Barretta¹, Brahim Anis Belferkous¹, Guillermo Oviedo Hernandez², Daniela Maria Godino Arioli², André Augusto³, Emmanouil Psimopoulos³, Lukas Koester⁴, David Moser⁴, Gernot Oreski¹
¹ PCCL, Leoben, Austria; ² BayWa, Rome, Italy; ³ Dalarna University, Falun, Sweden; ⁴ Eurac Research, Bolzano, Italy

3AV.2.26 Non-Destructive and Quantitative Monitoring of Water Ingress in PV Modules by Combination of Karl-Fischer Titration and Near-Infrared Spectroscopy

Daniel Schüsler¹, Oleksandr Mashkov², Michael Wendt¹, Oleksandr Stroyuk², Bengt Jäkel¹, Ian Marius Peters², Claudia Buerhop-Lutz², Anton Mordvinkin¹
¹ Fraunhofer CSP, Halle, Germany; ² FZJ-HI ERN, Erlangen, Germany

3AV.2.27 Novel Encapsulants based on Highly UV-Transparent Polyolefins Tested on PV Mini-Device

Valeria Fiandra, Lucio Sannino, Concetta Andreozzi, Giovanni Flaminio, Antonella De Maria, Antonio Romano, Paola Delli Veneri, Lucia V. Mercaldo
ENEA, Portici, Italy

3AV.2.28 Uncertainty Analysis in Interannual Degradation Assessment of Massive Solar Module Campaigns

Sergio Suarez Sanchez¹, Mario Martinez Gonzalez², Sofia Rodriguez Conde¹
¹ Enertis Applus+, Madrid, Spain; ² Enertis Applus+, Madrid, Spain

3AV.2.29 Naturally Induced Aging of Different C-Si Solar Cell Technologies and Encapsulation Materials by Harsh Environment with High UV Radiation Doses

Valentina Arias Reyes¹, Maria Ignacia Devoto Acevedo², Tudor Timofte², Valentina Navarro³, Felipe Larrain³, Andreas Halm², Rodrigo Barraza³
¹ Federico Santa María Technical University, Santiago, Chile; ² ISC Konstanz, Germany; ³ Adolfo Ibáñez University, Santiago, Chile



- 3AV.2.30 Evaluating Hot-Spot Testing Duration for PV Modules in Shaded Residential Environments: Insights from Real-World and Laboratory Data**
Ebrar Özkalay¹, Anika Gassner², Gabriele C. Eder², Gabi Friesen¹, Markus Feichtner³
¹ SUPSI, Mendrisio, Switzerland; ² OFI, Vienna, Austria; ³ Sonnenkraft Energy, St. Veit a.d. Glan, Austria
- 3AV.2.31 A Hotspot Related Defect Screening Approach in Flexible Amorphous Silicon Solar Foils using Electroluminescence Imaging**
Sreejith Koorthedath Pullayikody¹, Peer Sluijs¹, Niklas Zeiher¹, Vijay Venkatesh¹, Gayathri Mathiazhagan², Ravi Vasudevan², Hesam Ziar¹, Arno H. M. Smets¹
¹ TU Delft, The Netherlands; ² HyET Solar, Arnhem, The Netherlands
- 3AV.2.32 Assessing The Reliability of Commercial Lightweight Photovoltaic Modules**
Olatz Arriaga Arruti, Bénédicte Bonnet-Eymard, Matthieu Despeisse, Christophe Ballif
CSEM, Neuchâtel, Switzerland
- 3AV.2.33 Key Parameters Influencing Hail Impact Resilience in Photovoltaic Modules: Experimental Insights for Robust Module Design and Certification**
Dominika Chudy, Daniele Forni, Mattia Ceretti, Ezio Cadoni, Mauro Cacciavio
SUPSI, Mendrisio, Switzerland
- 3AV.2.34 Salt Spray Corrosion Resistance Testing and Reliability Evaluation of Large-size Solar Modules and Metal Components**
San-Yu Ting, Kuan-Wu Lu, Sih-Hong Chen, Min-An Tsai, Cho Fan Hsieh
ITRI, Hsinchu, Taiwan
- 3AV.2.35 Analysis of Performance Loss in PV Systems due to Cracked Backsheets and Insulation Problems**
Raffael Schifferegger, Anika Gassner, Gabriele C. Eder
¹ OFI, Vienna, Austria
- 3AV.2.36 Research on the Impact of Outdoor Dust Accumulation and Copper-Accelerated Acetic Acid Salt Spray on Solar Photovoltaic Modules**
San-Yu Ting, Yung-Jen Shyong, Min-An Tsai, Cho Fan Hsieh
ITRI, Hsinchu, Taiwan

VISUAL PRESENTATIONS 3AV.3

17:00 - 18:30 PV Modules Characterisation and Performances Assessment

- 3AV.3.1 A New Method for Comprehensive Power Rating and Performance Analysis of PERC Modules based on Half-Cut Cell Technology**
Khadija El Ainaoui¹, Mhammed Zaimi², Imane Flouchi¹, Said Elhamaoui¹, Yasmine El mrabet¹, Abdellatif Ghennioui¹, El Mahdi Assaid²
¹ Green Energy Park, Benguerir, Morocco; ² University of Chouaib Doukkali, El Jadida, Morocco

- 3AV.3.2 Energy Rating Analysis of Heterojunction PV Modules**
Teodora Stoyanova Lyubenova, Ewan D. Dunlop
European Commission JRC, Ispra, Italy
- 3AV.3.3 Trend of Temperature Coefficients of c-Si Module Technologies from the Past 15 Years**
Bengt Jaeckel, Matthias Pander
Fraunhofer CSP, Halle (Saale), Germany
- 3AV.3.4 Overcoming Challenges of Current-Voltage Scans of High-Efficiency Photovoltaic Modules**
Jonas Aleksander Oražem, Marko Topič, Marko Jankovec
University of Ljubljana, Slovenia
- 3AV.3.5 Challenges and Solutions for Measuring Tandem Modules**
Michael Fuß, Dieter Lorenz, Matti Fuchs
MBJ Solutions, Ahrensburg, Germany
- 3AV.3.6 Angle of Incidence Measurements on Bifacial PV Modules**
Frank Weinrich, Stefan Riechelmann, Stefan Winter
PTB, Braunschweig, Germany
- 3AV.3.7 Outdoor IV Curve Measurements for Bifacial Solar Modules: A Reverse Methodology Based on IEC 60904-1-2 for Enhanced Accuracy**
Sergio Suarez Sanchez, Mario Martinez Gonzalez, Sofia Rodríguez-Conde
Enerdis Applus+, Madrid, Spain
- 3AV.3.8 Plug & Play IV-Curve Tracer**
Adrian Jäggi, Matthias Burri, Christof Bucher
BFH, Burgdorf, Switzerland
- 3AV.3.9 Seasonal and Location-Dependent Temperature Coefficients for Thin-Film PV Modules: Enhancing Yield Prediction Accuracy**
Thomas Weber¹, Abdullah Abu Sayed¹, Benjamin Lippke¹, Steven Xuereb¹, Marcus Rennhofer², Bart E. Pieters³
¹ Kiwa PI Berlin, Germany; ² ALT, Vienna, Austria; ³ Forschungszentrum Jülich, Germany
- 3AV.3.10 Standardisation Methods for Bifacial Energy Yield Estimation and PV Module Long-Term Performance Degradation Estimation: Potential Policy Implications**
Jaione Bengoechea¹, Ana María Gracia¹, Stefan Riechelmann², Stefan Winter², Giorgio Bardizza³, Christos Monokroussos⁴, Davide Poverini⁵, Pablo Vicente-Laiglesia⁶, Maria Getsiou⁷
¹ CENER, Sarriena, Spain; ² PTB, Braunschweig, Germany; ³ TÜV Rheinland Italia, Milan, Italy; ⁴ TÜV Rheinland Shanghai, Shanghai, China; ⁵ Directorate General for Internal Market, Industry, Entrepreneurship and SMEs, Brussels, Belgium; ⁶ CINEA, Brussels, Belgium; ⁷ Directorate General for Research and Innovation, Brussels, Belgium
- 3AV.3.11 Shaalke: Development of a MATLAB Software Tool for Advanced Statistical Outdoor Data Evaluation**
Andreas Schneider¹, Julia Chochollek¹, Jorge Rabanal Arabach²
¹ University of Applied Sciences Gelsenkirchen, Germany; ² Universidad de Antofagasta, Chile



3AV.3.12 Degradation and Defect Characterisation of Field-Deployed Silicon PV Modules

Roelof Roodt¹, Ernest van Dyk¹, Jacqueline Crozier McClelland¹, Monphas Vumbugwa¹, Frederik Vorster¹, Oleksander Stroyuk², Claudia Buerhop-Lutz²
¹ Nelson Mandela University, Port Elizabeth, South Africa; ² HI ERN, Erlangen, Germany

3AV.3.13 Architecture for Monitoring PV Degradation in Real Time from EL Images

Tohru Kohno, Jun Tsunoda
Hitachi, R&D Group, Tokyo, Japan

3AV.3.14 Simple Cell Segmentation Routine for Quantitative Electroluminescence Analysis of c-Si Solar Modules

João Victor Oliveira Santos¹, Julien Dupuis¹, Christine Abdel Nour¹, Daniel Ory², Olivier Palais³
¹ EDF R&D, Moret Loing Orvanne, France; ² EDF R&D, Palaiseau, France; ³ IM2NP, Marseille, France

3AV.3.16 Luminescence Measurement with a Cost-Effective and Small-Sized Hood-based Tool under Daylight Condition

Marc Köntges¹, Michael Siebert¹, Michael Fuß²
¹ ISFH, Emmerthal, Germany; ² MJB Solutions, Ahrensburg, Germany

3AV.3.17 Comprehensive Degradation Analysis of Si Solar Cells: I-V, Thermal Imaging, and SEM-Based Investigation

Jae-yeong Jang, Jeong-eun Jeon, Hyun Namgoong, Yoon-Sung Lee, Ja-young Gi, Su-Mi Yang
Far East University, Eumseong-gun, South Korea

3AV.3.18 Electroluminescence-Based Degradation Analysis of Reused and Bifacial PV Modules after one Year of Operation

Jeong-eun Jeon¹, Soo-Rim Choi¹, Jae-yeong Jang¹, Ji-Hyun Yoo¹, Minji Yang¹, Jae-Hyeok Hur², Su-Mi Yang¹
¹ Far East University, Eumseong-gun, South Korea; ² Chungbuk Technopark, Cheongju-Si, South Korea

3AV.3.19 Quality Analysis of Reused and Bifacial PV Modules After One Year of Operation Based on I-V and Thermal Imaging Analysis

Ji-Hyun Yoo¹, Ji-Seob Ahn¹, Jae-Hyeok Hur², Gyeong-Jun Min¹, Hyun Namgoong¹, Ja-young Gi¹, Sang-Hyun Jeong³, Su-Mi Yang¹
¹ Far East University, Eumseong-gun, South Korea; ² Chungbuk Technopark, Cheongju-Si, South Korea; ³ University Convergence, Eumseong-gun, South Korea

3AV.3.20 SELIV based Power Loss Estimation vs. Thermography Inspection of Large-Scale PV Parks

Pascal Koelblin, Liviu Stoicescu, Michael Reuter
Solarzentrum Stuttgart, Germany

3AV.3.21 Limits of Standardised Insulation Measurement Methods for finding the Causes of Insulation Failures on Field Aged PV Modules

Maximilian Engel¹, Jonathan Kriening¹, Roland Einhaus¹, Bernhard Weinreich², Peter Lechner², Ludger Wahlers³, Eckard Tikwinski³, Martin Wilke⁴, Christine Klos⁵
¹ ZSW, Stuttgart, Germany; ² HaWe Engineering, Gauting-Hausen, Germany; ³ ELMED, Heiligenhaus, Germany; ⁴ Buhck Re.Energy, Hamburg, Germany; ⁵ Buhck ReEnergy, Reinbek, Germany

3AV.3.22 Numerical Simulation of Output Characteristics of Photovoltaic Module with Short- and Open-Circuited Bypass Diodes

Ibuki Kitamura¹, Toshiyuki Hamada¹, Ikuo Nanno²
¹ Osaka Electro-Communication University, Japan; ² Yamaguchi Gakuji University, Japan

3AV.3.23 Evaluating the Efficacy of Neutral Density Filters and Camera Lens Aperture for Reducing Sensor Saturation and Image Quality in Daylight EL Imaging

Kabir Paúl Sulca Buitrón¹, Rodrigo del Prado Santamaria², Thøger Kari², Julian Anaya Calvo¹, Gisele Alves dos Reis Benatto², Sergiu Viorel Spataru², Oscar Martinez Sacristan¹
¹ University of Valladolid, Valladolid, Spain; ² DTU, Roskilde, Denmark

3AV.3.24 Design, Manufacturing and Analysis of Aluminium-backed BIPV Facade Modules: Electrical Performance and Outdoor Tests

Sophia Jahreis, Bengt Jäckel, Ringo Köpge, Jens Fröbel, Paul Schenk, Matthias Pander
Fraunhofer CSP, Halle (Saale), Germany

3AV.3.25 Experimental Performance Assessment of Bifacial Modules under Inhomogeneous Rear Irradiance in High Radiation Environments

Robinson Cavieres¹, Felipe Valencia¹, Nicole Torres¹, Edward Fuentealba², Jorge Rabanal-Arabach²
¹ ATAMOSTEC, Antofagasta, Chile; ² University of Antofagasta, Antofagasta, Chile

3AV.3.26 Performance Evaluation of Advanced PV Modules in Horizontal Single Axis Tracker System in Desert Climates

Maulid M. Kivambe¹, Benjamin Figgis², Amir Abdallah², Dhanup Pillai², Mohamed Abdelrahim², Mohamed Elgaili²
¹ HBKU, Doha, Qatar; ² QEERI, Doha, Qatar

3AV.3.27 Performance Monitoring and Stability Analysis of PV Modules with Coloured Encapsulants: a 5-Months Study

Meriç Çalışkan¹, Hatice Duman¹, Ahmet Aksoy², Gernot Oreski³, Gabriele C. Eder⁴
¹ KalyonPV, Ankara, Türkiye; ² METU, Ankara, Türkiye; ³ PCCL, Leoben, Austria; ⁴ OFI, Vienna, Austria



3AV.3.28 Analysis of the Effects of Partial Shading on Cell Performance in a Half-Cut Cell Photovoltaic Module

Poland Michael¹, Monphas Vumbugwa¹, Ernest E. van Dyk¹, Frederik J. Vorster¹, Petja Dobrev²

¹ Nelson Mandela University, Port Elizabeth, South Africa; ² University of Namibia, Windhoek, Namibia

3AV.3.29 Performance and Degradation Analysis of OPV Panels under Different Shadowing Conditions

Mirco Riganti¹, Michele Manca¹, Aleix Alva²

¹ Leitat Technological Center, Terrassa, Barcelona, Spain; ² School of Architecture of Barcelona, Barcelona, Spain

3AV.3.30 Dependence of Photovoltaic Module Performance Indicators on the Operating Temperature

Heidi Kalliojärvi, Kari Lappalainen
Tampere University, Finland

3AV.3.31 Evaluating the Impact of Soiling on Agri-Photovoltaic Systems

Paul Gebhardt, Tannaz Katouli, Ingrid Haedrich
Fraunhofer ISE, Freiburg, Germany

3AV.3.32 A General Approach to Model High-Performance PV Modules for Accurate Energy Yield Simulations

André Mermoud, Auriane Canesse, Bruno Wittmer, Luca Antognini, Michele Oliosi, Robin Vincent
PVsyst, Satigny, Switzerland

3AV.3.33 Comparative Performance Analysis of PERC and TOPCon Technologies: Cell-to-Module Efficiency Simulation Study

Nurgül Polat, Meriç Çalışkan Arslan
Kalyon PV, Ankara, Türkiye

3AV.3.34 Refinement of Exhaustive Search Algorithm for Ideality Factor in Photovoltaic Cell Models: a Mobile Application

Jueli Gomes Marques¹, João Lucas de Souza Silva², Tarcio André dos Santos Barros², Marcel Veloso Campos²

¹ Unimontes, Montes Claros, Brazil; ² Unicamp, Campinas, Brazil

3AV.3.35 Keeping PV Modules Cooler by Thermal Management - Effects on the Energy Yield

Klaus Jäger¹, Jyotirmoy Mandal², Barry P. Rand², Forrest Meggers², Christiane Becker¹

¹ HZB, Berlin, Germany; ² Princeton University, United States of America

3AV.3.36 A Photovoltaic Performance Dataset for the Benchmarking of Failure Detection and Diagnosis Algorithms

Jose Domingo Santos¹, Sandra Riaño¹, Aingeru Lucea¹, Marko Jankovec², Alberto Del Pozo¹, Ricardo Alonso¹, Asier Sanz Martinez¹

¹ TECNALIA, Derio, Spain; ² University of Ljubljana, Slovenia

3AV.3.37 Performance Evaluation of Vertical East-West Bifacial PV Modules Compared to Tilted Bifacial and Monofacial Modules in Coastal Peru

Michael García, José Angulo, Jan Amaru Palomino Töfflinger
PUCP, Lima, Peru

VISUAL PRESENTATIONS 2BV.1

08:30 - 10:00 New Materials, Devices and Conversion Concepts | New Modelling and Characterisation Techniques

2BV.1.1 Evaluation of SnO₂ Thin Film as In-Free Transparent Conductive Oxide Deposited by Low-Temperature ALD

Masaki Ando¹, Yoshio Ohshita², Toshinori Numata², Hyunju Lee³, Hideaki Machida⁴, Takuya Minowa¹, Atsushi Ogura¹

¹ Meiji University, Kawasaki, Japan; ² Toyota Technological Institute, Nagoya, Japan; ³ MREL, Kawasaki, Japan; ⁴ Gas-Phase Growth, Koganei, Japan

2BV.1.2 Analysis of the Influence of Cu₂O Top Cell Transmittance on the Efficiency of Si Bottom Cell

Soichiro Shibasaki, Takashi Yamamoto, Kanta Sugimoto, Naoyuki Nakagawa, Yukitami Mizuno, Atsushi Wada, Sara Yoshio, Motohiro Toyota, Junji Sano, Yuya Honishi, Yasutaka Nishida, Kazushige Yamamoto
Toshiba Corporation, Kawasaki, Japan

2BV.1.3 Zinc-Doped Indium Oxide by Radio-Frequency Magnetron Sputtering: Sheet Resistance and Infrared Characterization

Paolo Strazzullo¹, Daniela De Luca², Marilena Musto¹, Roberto Russo³, Annalisa Bruno²

¹ University of Naples Federico II, Italy; ² Nanyang Technological University Singapore; ³ National Research Council of Italy, Naples, Italy

2BV.1.4 Low-Energy Electron Multiplication on Nanostructured Solar Cells (LEEMONS): A Novel Route to Overcome Si-PV Efficiency Limits

Mikaël Hosatte, Brice Rouffie, Zbigniew T. Kuznicki
SEGTON Advanced Technology, Versailles, France

2BV.1.5 Tailoring CBTSSe Solar Cells for Indoor Photovoltaic Applications

Hitarth Narsi Patel, Bindu Pamula, Deepak Joshi, Vivek Garg
SVNIT, Surat, India

2BV.1.6 Theoretical Insights through DFT into AgBiS₂ Thin Films Absorber for Photovoltaic Applications

Dhruv Singh Thakur, Rajesh Kumar Sharma, Nithin Chatterji, Vivek Garg, Shivendra Yadav
SVNIT, Surat, India

2BV.1.7 Fully Transparent Photovoltaic Devices based on ZnO_{1-x}S_x Absorbers: Study of the MoO_x Hole Transport Layer

Marta Miró-Llorente, Gustavo Alvarez, Alex J. Lopez-Garcia, Victoria Rotaru, Diouldé Sylla, Maxim Guc, Victor Izquierdo-Roca, Alejandro Pérez-Rodríguez, Pedro Vidal-Fuentes
IREC, Sant Adrià de Besòs, Spain

2BV.1.8 Numerical Simulation and Performance Optimization of Barium Zirconium Sulfide (BaZrS₃) Chalcogenide-based Perovskite Solar Cell

Chinedu Ahia, Nicholas Rono, Edson Leroy Meyer
University of Fort Hare, Alice, South Africa



- 2BV.1.9 Graphene Oxide Thin Layer for Silicon Surface Passivation Characterized by Kelvin Probe**
Stepan Staf¹, Branislav Dzumak¹, Tom Markvart²
¹CTU FEE, Prague, Czech Republic; ² University of Southampton, United Kingdom
- 2BV.1.10 Optimization of Luminescent Solar Concentrators based on Peripherally-Doped Polymer Optical Fibers**
Jagoba Barata¹, Jon Arrue¹, Nekane Guarrotxena², Joseba Zubia¹, María Asunción Illarramendi¹
¹ UPV/EHU, Bilbao, Spain; ² Institute of Polymer Science and Technology, Madrid, Spain
- 2BV.1.11 Novel Encapsulant Materials: Radiation Test and Results**
David Lansade¹, Simon Lewandowski¹, Sophie Duzellier¹, Hugues Gasse¹
¹ University of Toulouse, France
- 2BV.1.12 Correlated Disordered Nanostructures for Light Trapping in Ultrathin Solar Cells**
Laura De Almeida¹, Inès Revol¹, Jean-Baptiste Doucet¹, Mathieu Arribat¹, Guilhem Almuneau¹, Stéphane Collin²
¹ LAAS-CNRS, Toulouse, France; ² C2N, Palaiseau, France
- 2BV.1.13 Parametric Optimization of Water-based Synthesis of CIGSe Nanoparticles for Solar Textiles**
João Rodrigues, Pedro Sousa, Neslihan Akcay, Neha Kumari, Sascha Sadewasser, Pedro Anacleto, Juliana P. S. Sousa
INL, Braga, Portugal
- 2BV.1.14 Selective Laser Ablation of Copper Nitride Thin Films for Photovoltaic Applications**
David Canteli¹, Susana Fernandez², Cristina García Muñoz¹, Jose Javier Gandía², Carlos Molpeceres¹
¹ UPM, Madrid, Spain; ² CIEMAT, Madrid, Spain
- 2BV.1.15 Enhanced PEDOT:PSS Electrical Conductivity by Graphene Doping**
Wafa Alnaqbi, Wisnu Hadmojo, Ayman Rezk, Shanavas Shajahan, Yarjan Abdul Samad, Ammar Nayfeh
Khalifa University, Abu Dhabi, United Arab Emirates
- 2BV.1.16 Optical and Electrical Properties of TCO Layers based on Doped ZnO Films Deposited by ALD Technique**
Pau Estarlich¹, Gustavo Alvarez-Suarez¹, Jose Miguel Asensi², Cristobal Voz¹, Joaquim Puigdollers¹, Gerard Masmitjà¹
¹ UPC, Barcelona, Spain; ² University of Barcelona, Spain
- 2BV.1.17 Selective Ablation of WO_x, VO_x, and MoO_x Films using Femtosecond Laser Pulses**
David Canteli¹, David Munoz-Martin², Cristina Garcia-Munoz¹, Eloi Ros², Juan Miguel Lopez-Gonzalez², Cristobal Voz², Miguel Morales¹, Carlos Molpeceres¹
¹ UPM, Madrid, Spain; ² UPC, Barcelona, Spain
- 2BV.1.18 Iron Alloyed SnWO₄ for Si-Based Tandem Solar Cells**
Ingviid Bergsbak, Vegard S. Olsen, Holger von Wenckstern, Kristin Bergum
University of Oslo, Norway
- 2BV.1.19 Lightweight Photonic Cooler with Multi-Layered Thin Film IR Filters and Anti-Dust Properties for PV Applications in Desert Environments**
Brahim Aissa, Mohammad Hossain
QEERI, Doha, Qatar
- 2BV.1.20 Optimizing Dye-Sensitized Solar Cells for Indoor Applications: Enhancing Efficiency through Dye-Lamp Matching and Co-Sensitization**
Giorgia Salerno, Manfredi Norberto, Ottavia Bettucci, Alessandro Abbotto
University of Milano-Bicocca, Italy
- 2BV.1.21 Carbon Substrates as a Promising Component of Organic/Inorganic Hybrids for Photovoltaic Applications**
Sergii Mamykin¹, Nina Roshchina¹, Gennadiy Olkhovik¹, Daria Kuznetsova¹, Volodymyr Romanyuk¹, Petro Smertenko¹, Volodymyr Khomenko², Yaroslav Kuryptia³, Viacheslav Barsukov³
¹ National Academy of Sciences of Ukraine, Kyiv, Ukraine; ² Kyiv National University of Technologies and Design, Kyiv, Ukraine; ³ Institute for Sorption and Problems of Endoecology, Kyiv, Ukraine
- 2BV.1.35 Computational Multi-Objective Grey Box Optimization of the Contact Design for Tandem Solar Cells**
Noor Titan Putri Hartono¹, Dmitry Bogachuk¹, Zhifeng Teng¹, Peter Tillmann¹, Bhaskar Singh¹, Fan Guo¹, Yewei Zhang², Ye Tian², Delin Lu², Haocheng Wang², Christian Peter¹
¹ Solarlab Aiko Europe, Freiburg, Germany; ² Zhejiang Aiko Solar Technology, Yiwu, China
- 2BV.1.36 Inhomogeneities in Tandem PK-Si Solar Cells: A 2-Dimensional TCAD Simulation Study**
Pierre Lottigier, Renaud Varache
CEA LITEN, Le Bourget-du-Lac, France
- 2BV.1.37 Requirements for the I-V Characterization of Perovskite-Based Tandem PV Modules**
Giorgio Bardizza¹, Johannes Stang², Mehdi Azmani², Chayma Jermouni², Torsten Wyssada², Wenhao Xu³, Yating Zhang³, Qi Gao³, Christos Monokroussos³, Werner Herrmann²
¹ TÜV Rheinland, Milan, Italy; ² TÜV Rheinland Solar, Cologne, Germany; ³ TÜV Rheinland, Shanghai, China
- 2BV.1.38 Accelerating Next-Gen Materials Discovery for Photovoltaic Applications using AI-Driven Synthesis and Characterization**
Joseph Chakar¹, Yvan Bonnassieux², Stefania Cacovich¹, James P. Connolly³, Jean-Baptiste Puel⁴, Philip Schulz¹
¹ IPVF, Palaiseau, France; ² LPICM, Palaiseau, France; ³ CNRS, Gif-sur-Yvette, France; ⁴ EDF, Palaiseau, France



2BV.1.39 Towards a Fully Differentiable Digital Twin for Solar Cells: Machine Learning and Optimization

Houssam Metni¹, Marie Louise Schubert¹, Jan David Fischbach¹, Benedikt Zerulla¹, Marjan Krstić¹, Ulrich W. Paetzold¹, Seyedamir Orooji¹, Olivier J.J. Ronsin², Kai Segadlo², Yasin Ameslon², Jens Harting², Sandheep Ravishankar³, Thomas Kirchartz³, Christian Sprau¹, Mohamed Hussein¹, Alexander Colsmann¹, Karen Forberich², Pascal Friederich¹, Carsten Rockstuhl¹

¹ KIT, Karlsruhe, Germany; ² HI ERN, Erlangen, Germany; ³ FZJ, Jülich, Germany

2BV.1.40 Towards a Fully Differentiable Digital Twin for Solar Cells: Simulation Steps

Marie Louise Schubert¹, Houssam Metni¹, Jan David Fischbach¹, Benedikt Zerulla¹, Marjan Krstić¹, Ulrich Wilhelm Paetzold¹, Seyedamir Orooji¹, Olivier J. J. Ronsin², Kai Segadlo³, Yasin Ameslon³, Jens Harting³, Sandheep Ravishankar⁴, Thomas Kirchartz⁴, Christian Sprau¹, Mohamed Hussein¹, Alexander Colsmann¹, Karen Forberich², Pascal Friederich¹, Carsten Rockstuhl¹

¹ KIT, Karlsruhe, Germany; ² HI ERN, Erlangen, Germany; ³ Friedrich-Alexander-Universität Erlangen-Nuremberg, Germany; ⁴ FZJ, Jülich, Germany

2BV.1.41 The Red, White & Blue: Identifying the Dominant Recombination Loss Mechanism in Perovskite Solar Cells

Sander Heester¹, Michele Sessolo², Lidón Gil-Escrig², Henk J. Bolink², Jan Anton Koster¹

¹ University of Groningen, Groningen, The Netherlands; ² University of Valencia, Spain

2BV.1.42 Characterization of Carrier Dynamics in Perovskite Solar Cells using Impedance and Transient Measurements

Ana Kanevce, Hendrik Leutz, Tina Wahl, Theresa Magorian Friedlmeier ZSW, Stuttgart, Germany

2BV.1.43 Role of Random Textures on the Scattering Absorptance Enhancement in Halide Perovskite Layers

Jakub Holovsky, Meng-Hsueh Kuo, Branislav Dzurňák, Lucie Landová, Ivana Beshajová Pelikánová, Neda Neykova
Czech Technical University, Prague, Czech Republic

2BV.1.44 Coupled Optoelectronic Frequency Domain Spectroscopy for Thin Film Device Characterization

Daniel McDermott¹, Baptiste Berenguer¹, Jean-François Guillemoles¹, Frédérique Ducroquet², Daniel Suchet¹

¹ IPVF, Palaiseau, France; ² CROMA, Grenoble, France

2BV.1.45 Phase Segregation Mapping in Perovskite Solar Cells Using Hyperspectral Photoluminescence Imaging

Ivar Loland Råheim, Håkon Holte, Ingunn Burud, Espen Olsen
Norwegian University of Life Sciences, Ås, Norway

2BV.1.46 A Digital Projection System for Combined Spectral, Spatial, Angular and Linearity Response Measurements of PV Devices

George Koutsourakis, Daniel E. Parsons, Lavanya Malarkannan, James C. Blakesley
NPL, Teddington, United Kingdom

2BV.1.47 Exploring the Characteristics Addition Method for Estimating Bifacial Efficiency in Cs3Sb2I9-Based Indoor Perovskite Solar Cells

Rajesh Kumar Sharma, Dhruv Singh Thakur, Deepak Joshi, Vivek Garg, Shivendra Yadav
SVNIT, Surat, India

2BV.1.48 Certainly I-V Measurement of the Perovskite Device under Dim Light Intensity

Yean-San (Mickey) Long, Yung-Tsung Liu, Min-An Tsai, Cho-Fan Hsieh
ITRI, Hsinchu, Taiwan

2BV.1.49 Thermal and Electrical Characterization of Photovoltaic Cells Designed for High Vacuum Photovoltaic-Thermal Collectors

Eliana Gaudino¹, Annalisa Di Napoli¹, Paolo Strazzullo¹, Laura Lancellotti², Eugenia Bobeico², Iurie Usatii², Antonio Caldarelli³, Emiliano Di Gennaro¹, Umberto Scotti Di Uccio¹, Musto Marilena¹, Roberto Russo⁴

¹ University of Naples Federico II, Italy; ² ENEA, Naples, Italy; ³ CNR-SPIN, Naples, Italy; ⁴ National Research Council of Italy, Naples, Italy

2BV.1.50 Improving the Investigation of Defects Properties through Temperature Dependent Modulated Photoluminescence

Hiba Haddara¹, Baptiste Bérenguier², Sylvain Le Gall¹, Jean-François Guillemoles², Jean-Paul Kleider¹

¹ GeePs, Gif-sur-Yvette, France; ² IPVF, Palaiseau, France

VISUAL PRESENTATIONS 2BV.2

10:30 - 12:00

Compound and Organic Semiconductors

2BV.2.1 Investigation of Cd-free Sb2Se3 Thin-Film Solar Cells by ALD-ZnSnO Electron Transport Layer

Victor Bonal¹, Yudania Sánchez², David Payno¹, Umair Razi², Alejandro Pérez-Rodríguez², José Manuel Merino¹, Raquel Caballero³

¹ UAM, Madrid, Spain; ² IREC, Barcelona, Spain; ³ IO-CSIC, Madrid, Spain

2BV.2.2 Numerical Simulation of Cadmium-Free Buffer Layers for Copper-Doped Antimony Selenide Solar Cells

Fabio Buttrichi¹, Maurizio Acciarri¹, Giorgio Tseberlidis¹, Vanira Trifiletti¹, Michele Casappa², Stefano Rampino², Simona Binetti¹

¹ University of Milan, Italy; ² National Research Council, Parma, Italy

2BV.2.3 The Effect of Thickness on the Sb2Se3 Superstrate Solar Cells

Narges Torabi¹, Jose Maria Delgado-Sanchez², Elisa Artegiani¹, Paola Jakuzza³, Matteo Meneghini³, Alessandro Romeo¹

¹ University of Verona, Italy; ² University of Seville, Spain; ³ University of Padova, Italy



2BV.2.4 Transfer of GaAs Solar Cells to Unprecedented Flexible Polymeric Bases of PVC:PMMA:DOP Modified with EG

Graciana Dos Santos De Sousa¹, Luciana D. Pinto², Fabiele C. Tavares³, Guillermo J. N. Soares³, Rudy M. S. Kawabata⁴, Rogério Valaski⁵, Maurício P. Pires², Roberto Jakomin³, Patrícia L. Souza²

¹ Federal University of Rio de Janeiro, Livramento, Brazil; ² Federal University of Rio de Janeiro, Rio de Janeiro, Brazil; ³ Federal University of Rio de Janeiro, Duque de Caxias, Brazil; ⁴ Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil; ⁵ National Institute of Metrology Quality and Technology, Rio de Janeiro, Brazil

2BV.2.5 Photovoltaic Application of GaAsGe Ternary Alloys

Pablo Caño¹, Miguel Ángel Sevillano-Bendezú², Enrique Navarro², Aitana Cano¹, Iván García¹, Raghavendra Juluri³, Ana M. Sánchez³, Alicia Gonzalo Martín⁴, Jerónimo Buencuerpo², Yolanda Gonzalez², José María Ripalda²

¹ UPM, Madrid, Spain; ² IMN-CNM, Madrid, Spain; ³ University of Warwick, Coventry, United Kingdom; ⁴ University Carlos III of Madrid, Spain

2BV.2.6 Development and Characterization of a Glued GaAs/Si Tandem Solar Cell in a Four-Terminal Configuration

Willian Machado¹, Rudy Kawabata¹, Luciana Pinto², Daniel Micha³, Guilherme Torelly¹, Patricia Lustoza de Souza²

¹ PUC-Rio, Rio de Janeiro, Brazil; ² UFRJ, Rio de Janeiro, Brazil; ³ III-V Lab, Paris, France

2BV.2.7 Monolithic 15.7% Efficient InGaP/GaAs/Si Triple-Junction Solar Cell with 1.55 eV n-Al_{0.10}Ga_{0.90}As Buffer

Hyun-Beom Shin¹, Yeonhwa Kim², Eukyo Ju², Tsimafei Laryn², In-Hwan Lee³, Jae-Hyung Jang⁴, Won Jun Choi², Ho Kwan Kang¹, Daehwan Jung²

¹ KANC, Suwon, South Korea; ² KIST, Seoul, South Korea; ³ Korea University, Seoul, South Korea; ⁴ KENTECH, Naju, South Korea

2BV.2.8 Inkjet-Printed Indium Sulfide Buffer Layer for CZTSe Solar Cells

Alessandro Magon¹, Francesco Lodola¹, Jacob Andrade-Arvizu², Pedro Vidal-Fuentes², Michele Melchiorre¹, Victor Izquierdo-Roca², Phillip J. Dale¹, Hasan A. Yetkin¹

¹ University of Luxembourg, Belvaux, Luxembourg; ² IREC, Barcelona, Spain

2BV.2.9 Detailed Characterization of ZnSnxGe1-xN2 Thin Films for Top-Cell Absorbers in Tandem Solar Cells

Snorre Braathen Kjeldby, Vegard Standeren Olsen, Dina Marie Nielsen, Ymir Kalmann Frodason, Simon Phillip Cooil, Lasse Vines, Eduard Monakhov, Kristin Bergum

University of Oslo, Norway

2BV.2.10 Comparison of Flexible Molybdenum Foil and Sputtered Molybdenum Back Contacts for CZTSSe Solar Cells

Ikram Anefnaf¹, Giorgio Tseberlidis², Simona Binetti², Alessandro Veneri¹, Elisa Artegiani¹, Alessandro Romeo¹

¹ University of Verona, Italy; ² University of Milano Bicocca, Italy

2BV.2.11 Impact of Vapor Phase Ge Incorporation and Reaction Pathway on the Performance and Long-Term Stability of Cu₂Zn(Ge, Sn)Se₄ Solar Cells

Talat Khonsor¹, David Nowak², Robert Fonoll-Rubio¹, Maxim Guc¹, Pedro Vidal-Fuentes¹, Levent Gütay²

¹ IREC, Barcelona, Spain; ² Carl von Ossietzky University of Oldenburg, Germany

2BV.2.12 Exploring Picosecond and Femtosecond Laser Ablation for Kesterite-Based Thin-Film Solar Modules

David Canteli¹, Cristina Munoz-Garcia¹, David Munoz-Martin¹, Sara Lauzurica¹, Jacob Andrade-Arvizu², Victor Izquierdo-Roca², Pedro Vidal-Fuentes², Carlos Molpeceres¹, Miguel Morales¹

¹ UPM, Madrid, Spain; ² IREC, Barcelona, Spain

2BV.2.13 Monolithic Interconnection of Thin Film Minimodule Prepared by a CNC Mechanical Scribing

David Payno¹, Jacob Andrade-Arvizu², Marta Miró-Llorente², Pedro Vidal-Fuentes², Raquel Caballero³, Victor Izquierdo-Roca², Alejandro Perez-Rodriguez²

¹ UAM, Madrid, Spain; ² IREC, Barcelona, Spain; ³ CSIC, Madrid, Spain

2BV.2.14 Photovoltaic Properties of Hydroxy Minerals in Polymer Electrolytes on Dye-Sensitized Solar Cells

Mi-Ra Kim, Sungsoo Park
Dong-Eui University, Busan, South Korea

2BV.2.15 Zn_{1-x}Sn_xO Thin Films via ALD as a Cd-Free Alternative for Narrow Gap Cu₂ZnSnSe₄

Umair Razi¹, Jacob Andrade Arvizu¹, Gustavo Alvarez¹, David Rovira², Victoria Rotaru¹, Laura Garcia-Carreras³, Maxim Guc¹, Lorenzo Calvo-Barrio³, Alex Jimenez-Arguijo², Edgardo Saucedo², Alejandro Pérez Rodríguez¹, Yudania Sánchez¹

¹ IREC, Sant Adrià de Besòs, Spain; ² Polytechnic University of Catalonia, Barcelona, Spain; ³ University of Barcelona, Spain

2BV.2.16 Influence of the Deposition Parameters on Structural and Morphological Properties of Single Mo Layer for PV Applications

Rachid Oubaki, Karima Machkih, Hicham Larhlami, Youssef Samih, Jones Alami, Mohammed Makha
Mohammed VI Polytechnic University, Bengueirir, Morocco

2BV.2.17 Buffer Development on Low-bandgap CIGS_{Se} Absorbers for Tandem Applications

Anastasiya Zelenina¹, Dimitrios Hariskos², S. Oueslati¹, Rico Gutzler², Hossam Elanzeery¹, Thomas Dalibor¹

¹ Avancis, Munich, Germany; ² ZSW, Stuttgart, Germany

2BV.2.18 Organic Molecules and Biopolymers as Acceptors and Donors in High Efficiency Organic and Perovskite Solar Cells

Marie Sow¹, Abdoulaye Gassama¹, Diouma Kobor¹, Michael Rivard²

¹ University Assane Seck of Ziguinchor, Senegal; ² Paris-Est Institute of Materials Chemistry, Paris, France

2BV.2.19 Kinetic Morphology Evolution of Non-Fullerene Bulk Heterojunction Blends: The Role of Solvent Additives in Thermal Stability

Tzu-Yen Huang¹, Anton Le Brun²

¹ National Synchrotron Radiation Research Center, Hsinchu, Taiwan; ² Australian Nuclear Science and Technology Organisation, Lucas Heights, Australia



2BV.2.20 Enhancing CIGS Solar Cells Efficiency through Infrared Laser Illumination for Wireless Charging Systems

Jakub Zdzielowski¹, Krzysztof Anders¹, Ryszard Piramidowicz¹, Nicolas Barreau², Pawel Zabierowski¹

¹ Warsaw University of Technology, Poland; ² University of Nantes, France

2BV.2.21 Toward Cu(In,Ga)Se₂ Solar Cells on Textile Substrates

Neslihan Akcay¹, Pedro Sousa¹, João Rodrigues¹, Jorge Padrão², José Abreu², Ana Moura³, Neha Kumari¹, Inês Alves⁴, José Gouveia⁴, Juliana P.S. Sousa¹, Ana Maria Rocha², Sascha Sadewasser¹, Pedro Anacleto¹

¹ INL, Braga, Portugal; ² University of Minho, Guimarães, Portugal; ³ University of Minho, Braga, Portugal; ⁴ Copo Textil, Santo Tirso, Portugal

2BV.2.22 On the Viability of CIGS Technology for Silicon Based Tandem Solar Cells

Juan Carlos Jimeno¹, Vanesa Fano¹, Eneko Cereceda¹, Aloña Otaegi¹, Nekane Azkona¹, Rubén Gutiérrez¹, Federico Recart¹, Velia Rodríguez¹, Carlos Cañizo², David Fuertes²

¹ UPV/EHU, Bilbao, Spain; ² IES-UPM, Madrid, Spain

2BV.2.23 Inline Low-Gap CIGS as Bottom Cell for Tandem Applications

Dimitrios Hariskos, Rico Gutzler, Ana Kanevce, Stefan Paetel
ZSW, Stuttgart, Germany

2BV.2.24 Intentional and Unintentional Doping on a-Ge:H Deposited by PECVD for Multijunction Solar Cells

Paula Perez-Rodriguez, Devansh Sharma, Shubham Litke, Shijie Liao, Arno H. M. Smets
TU Delft, The Netherlands

2BV.2.26 14.2% Efficient and Stable Cu(In,Ga)S₂ Solar Cell on Transparent Back Contact for Top Cell in Tandem Devices

Kulwinder Kaur, Tien Le, Kai Ng, Boaz Koren, Michele Melchiorre, Susanne Siebentritt
University of Luxembourg, Esch-sur-Alzette, Luxembourg

2BV.2.27 Novel Hole-Transporting Materials Based on P-Phenylenediamine Skeleton Functionalized with Sulfur-Containing Moieties for Organic Optoelectronic

Svetlana Sargsyan¹, Mariia Stanitska¹, Melika Ghasemi¹, Rasa Keruckiene¹, Dmytro Volyniuk¹, Narine Durgaryan², Juozas Vidas Grazulevicius¹

¹ Kaunas University of Technology, Lithuania; ² Yerevan State University, Yerevan, Armenia

2BV.2.28 Transport Properties of GaOx Hole Transport Layer Passivated BackContact for Efficient 1.0 eV CuInSe₂ Bottom Cells for Tandem Applications: Cu and Na Doping

Francesco Lodola, Zhuangyi Zhou, Boaz Koren, Michele Melchiorre, Susanne Siebentritt
University of Luxembourg, Belvaux, Luxembourg

VISUAL PRESENTATIONS 4BV.3

13:30 - 15:00

Solar Resource and Forecasting

4BV.3.1 Evaluating the Accuracy of Single-Camera Irradiance Forecasting

Jacob K. Thorning¹, Sergiu V. Spataru¹, Adam R. Jensen², Peter B. Poulsen¹

¹ DTU, Roskilde, Denmark; ² DTU, Kongens Lyngby, Denmark

4BV.3.2 Efficient Reconstruction of Annual Irradiance Using Low-Dimensional Representations of Irradiance Data

Evgenii Sovetkin, Andreas Gerber, Bart E. Pieters
FZJ, Jülich, Germany

4BV.3.3 Short-Term Variability of PV Power Output based on Simulations with Solargis Time Series Data

Martin Opatovsky, Juraj Betak, Konstantin Rosina
Solargis, Bratislava, Slovakia

4BV.3.4 Development of Deep Learning Techniques for Single PV Plant Power Forecasting using Sequence-to-Sequence Models

Jacopo Baldacci¹, Ciro Lanzetta¹, Nabi Taheri², Antonio Piazzi¹

¹ i-EM, Livorno, Italy; ² University of Pisa, Italy

4BV.3.5 New Empirical Model for Backside Irradiance

Kristijan Brecl¹, Emilio Muñoz Cerón², Juan de la Casa Higuera², Marko Topič¹

¹ University of Ljubljana, Slovenia; ² University of Jaén, Spain

4BV.3.6 Real-time Estimation of Cloud Optical Properties from Satellite Imagery Based on Radiative Transfer Modelling and Deep Learning

Yuying Xie, Mengying Li
Hong Kong Polytechnic University

4BV.3.7 Anomaly Detection in a Network of Irradiance Sensor

Gianmaria Tarantino¹, Giorgio Figuera², Giacomo Gorni¹

¹ Eni, San Donato Milanese, Italy; ² Eni Plenitude, Roma, Italy

4BV.3.8 Deep Learning-Based Solar Irradiance Decomposition Models for Nordic Regions

Alfredo Sanchez Garcia, Berhane Darsene Dimd
SINTEF, Trondheim, Norway

4BV.3.9 Uncertainty Analysis in Photovoltaic System Simulations: Validation of Multiple Meteorological Databases with Real-World Data

Rodrigo Maruyama, Rafael Herrero, Julio Martinez
USP, São Paulo, Brazil

4BV.3.10 Evaluation of Some Linear Regression Models for the Prediction for Daily Global Solar Radiation in the Village of Koyli Alpha, District of Linguere, Louga Region, Senegal

Badara Mbow, Amy Sadio, Cheikh Saliou Tourel, Senghane Mbodji
Alioune DIOP University, Bambey, Senegal



4BV.3.11 Applied Solar Energy Modeling to Roof- and Wall-mounted Solar Panels in Longyearbyen, Svalbard

Kim Cholibois¹, Arthur Garreau², Anna Sjoebloom²

¹ Gottfried Wilhelm Leibniz Universität Hannover, Germany; ² University Centre in Svalbard, Longyearbyen, Norway

4BV.3.12 Advancing Very Short-Term Solar Irradiance Forecasting in Africa: A Low-Cost Sky Imaging and Machine Learning-Based Approach

Martin Ansong¹, Bryce Richards²

¹ KIT, Eggenstein-Leopoldshafen, Germany; ² KIT, Karlsruhe, Germany

4BV.3.13 Implementation of an Open-Source Sky Imaging System for Solar Forecasting in a Solar Farm in Burkina Faso

Sami Florent Palm¹, Martin Ansong², Soro Y. Moussa¹, Bryce Richards²

¹ ZIE, Ouagadougou, Burkina Faso; ² KIT, Eggenstein-Leopoldshafen, Germany

4BV.3.14 Lessons Learned in Automating Quality Control: Insights, Challenges, and Innovative Approaches in Real World Ground Measurements

Assa Camara, Katarina Blstak Catlosova, Tomas Cebecauer, Martin Jakubik, Marketa Hulik Jansova, Oliver Osvad

Solargis, Bratislava, Slovakia

4BV.3.15 Machine Learning-Based PV Potential Classification in the EU using Key Parameters

Or Gindi, Sara Golroodbari, Wilfried Van Sark

Utrecht University, The Netherlands

4BV.3.16 Automated Solar Data Quality Reporting Framework

Daniel Perez-Astudillo, Dunia Bachour

QEERI, Doha, Qatar

4BV.3.17 How Complex are Satellite-Based Irradiation Data?

Philippe Malcorps, Anastasia Dagla, Gofran Chowdhury

3E, Brussels, Belgium

4BV.3.18 Blending Short and Medium Term Solar Forecast

Jan Remund, Michael Schmutz, Pascal Graf, Pirmin Neyer

Meteotest, Bern, Switzerland

4BV.3.19 Evaluation of Clear Sky Models under Dusty Conditions

Dunia Bachour, Daniel Perez-Astudillo

QEERI, Doha, Qatar

4BV.3.20 Weather and Air Quality Effects on Photovoltaic System Efficiency: a Modeling Approach

Luis Carrillo Mejía, Elvis Eduardo Gaona García, Johann Alexander

Hernández Mora

District University of Bogotá, Colombia

4BV.3.21 Specialized Irradiation Modeling for Alpine Regions: Clearsky and Diffuse Fraction Estimation

Bernhard Kubicek¹, Marcus Rennhofer¹, Philipp Weihs²

¹ AIT, Vienna, Austria; ² BOKU University, Vienna, Austria

4BV.3.22 Determination of Dark Doldrums based on Meteorological Data: Comparison with PV Yield Data

Philipp Weihs¹, Michael Thon¹, Marcus Rennhofer², Bernhard Kubicek², Sarah Reisenbauer²

¹ BOKU University, Vienna, Austria; ² AIT, Vienna, Austria

4BV.3.23 Updates on the CAMS Radiation Service v4.6: Validation of the Himawari Field of View

Jorge Lezaca¹, Marion Schroedter-Homscheidt¹, Faiza Azam¹, Diego

Miranda¹, Mireille Lefevre², Laurent Saboret³, Antti Arola⁴, Yves-Marie Saint-Drenan²

¹ DLR, Oldenburg, Germany; ² MINES Paris, Sophia-Antipolis, France; ³ Vaisala, Sophia-Antipolis, France; ⁴ FMI, Kuopio, Finland

4BV.3.24 A Novel Implementation of Quality Checks of Spectral Direct Normal Irradiance Measurements

Sergiu Mihai Hategan¹, Jacob K Thorning², Marius Paulescu¹, Sergiu V Spataru²

¹ West University of Timisoara, Romania; ² DTU, Roskilde, Denmark

4BV.3.25 Evaluating the Suitability of Köppen-Geiger Climate Classifications for Photovoltaic Systems: Micro-climate Analysis and Risk Assessment Maps

Pavan Kumar Panda¹, Hugo Sanchez¹, Leila Mortazavifar¹, Ralph

Gottschalg²

¹ Anhalt University of Applied Sciences, Köthen, Germany; ² Fraunhofer CSP, Halle, Germany

4BV.3.26 Satellite-Derived Irradiance Data for PV Performance Assessments in High Latitudes

Hugo E. Huerta¹, Juha Karhu², Anders Lindfors², Shuo Wang¹, Sami

Jouttijärvi³, Samuli Ranta¹, Kati Miettunen³

¹ Turku University of Applied Sciences, Finland; ² Finnish Meteorological Institute, Helsinki, Finland; ³ University of Turku, Finland

4BV.3.27 Optimized Albedometer Height: a Simple Model for Accurate Albedo Measurement

Eneko Ortega, Eneko Cereceda, Nekane Azkona, Alona Otaegi, Vanesa

Fano, Jose Ruben Gutierrez, Juan Carlos Jimeno

UPV/EHU, Bilbao, Spain

4BV.3.28 Open Source Tool for Weather Data Estimation in Photovoltaic Systems Monitoring

Sonia Maria Rodriguez¹, Beatriz Chicote², Eneko Ortega¹, Gerardo

Aranguren³, Juan Carlos Jimeno³

¹ UPV/EHU, Leioa, Spain; ² Mondragon University, Arrasate-Mondragon, Spain; ³ UPV/EHU, Bilbao, Spain

4BV.3.29 Performance Evaluation of CAMS Reanalysis to Enhance a Solar Resource Assessment and Forecasting Service Tool for Qatar's specific Desert Climate

Abdul Wahab Ziaullah¹, Dunia Bachour¹, Daniel Perez-Astudillo¹, Lionel

Menard², Philippe Blanc²

¹ QEERI, Doha, Qatar; ² MINES Paris, Nice, France



4BV.3.30 Advancements in International Radiometric Standards for Solar Measurements

Aron Habte, Manajit Sengupta
NREL, Golden, United States of America

4BV.3.31 Detection of Solar Irradiance Measurements Failures Using Statistical Modeling

Rodrigo S. Queiroz¹, Lucas Silva², Nathianne Andrade¹, Alberto A. Neto¹
¹ Delfos Energy, Fortaleza, Brazil; ² Delfos Energy, Barcelona, Spain

4BV.3.32 How Complex are Satellite-Based Irradiation Data?

Philippe Malcorps, Anastasia Dagla, Gofran Chowdhury
3E, Brussels, Belgium

4BV.3.33 AI-Powered Clear-Sky Detection and Unsupervised Weather Classification for Enhanced PV Monitoring

Hugo Quest¹, Bohan Li², Christophe Ballif², Alessandro Virtuani³
¹ 3S Swiss Solar Solutions, Thun, Switzerland; ² EPFL, Neuchâtel, Switzerland; ³ CSEM, Neuchâtel, Switzerland

VISUAL PRESENTATIONS 4BV.4

15:15 - 16:45

BIPV

4BV.4.1 Time-Resolved Energy Yield Estimation of Residential Photovoltaic Systems: the Impact of Tree Shading

Richard de Jong¹, Patrizio Manganiello¹, Olivier Dupon¹, Sara Bouguerra², Arnaud Morlier¹
¹ imec, Genk, Belgium; ² UHasselt, Genk, Belgium

4BV.4.2 A Comprehensive Analysis of Synergistic Interactions between Bifacial Photovoltaic and Green Roofs

Ammar Tummali, Bruno Bueno
Fraunhofer ISE, Freiburg, Germany

4BV.4.3 Mitigating Fire Hazards in Lightweight Photovoltaic Modules: Performance and Effects of Advanced Flame Retardants

Florian Ollagnon¹, Hengyu Li², Emma Gottis², Olaia Aurrekoetxea-Arrabitel³, Xabier Olano-Azkune³, Matthieu Despeisse², Antonin Faes¹, Christophe Ballif¹
¹ EPFL, Neuchâtel, Switzerland; ² CSEM, Neuchâtel, Switzerland; ³ TECNALIA, Azpeitia, Spain

4BV.4.4 PV System Design with Curtailment in Mind: Cost Comparison at the Prosumer Level

Linda Brodnick¹, Alissa Ganter¹, Giovanni Sansavini¹, Natasa Vulic²
¹ ETH Zurich, Switzerland; ² University of Applied Arts and Sciences Northwestern Switzerland, Muttenz, Switzerland

4BV.4.5 BIPV Simulation with Conventional Tools and Models; Do We Need More Accuracy?

Ana Marcos-Castro, Nuria Martín-Chivelet, Jesús Polo
CIEMAT, Madrid, Spain

4BV.4.6 How does the Color get into the PV Modules?

Joachim Sting, Ralf Haselhuhn
Deutsche Gesellschaft für Sonnenenergie Landesverband Berlin Brandenburg, Berlin, Germany

4BV.4.7 Design Aspects for the Solarization of Façade Components

Bruno Bueno, Frank Ensslen, Martin Heinrich
Fraunhofer ISE, Freiburg, Germany

4BV.4.8 Module Layout for Reliable Aluminum-based Building-Integrated Photovoltaics

Wiebke Wirtz, Kevin Meyer, Henning Schulte-Huxel, Rolf Brendel
ISFH, Emmerthal, Germany

4BV.4.9 Economic Value of Building-Integrated PV Production at High-Latitude Locations

Sami Jouttijärvi¹, Lauri Karttunen¹, Magda Szarek¹, Bergpob Viriyaraj², Samuli Ranta³, Kati Miettunen¹
¹ University of Turku, Finland; ² Aalto University, Espoo, Finland; ³ TUAS, Turku, Finland

4BV.4.10 Towards Sustainable Cities with Integrated Photovoltaic Ceramic Roof Tile

Alicia Buceta¹, Jaime Polo¹, Roberto Diaz², Eugenia Zugasti¹, Jaione Bengoechea¹
¹ CENER, Sarriguren, Spain; ² Asociacion NOTIO, Toledo, Spain

4BV.4.11 Beyond 21% Coloured PV Cell Enabled by Ultra-Stable Perovskite Quantum Dots/ EVA Composite Film

Minya Zhou¹, Yuanxun Liao¹, Hanchen Li¹, Shujuan Huang², Robert Patterson¹, Martin A. Green¹, Jessica Yajie Jiang¹
¹ UNSW, Sydney, Australia; ² Macquarie University, Sydney, Australia

4BV.4.12 Façade Application of Light-Weight Glass-Free Colored PV Modules: Reliability Testing of the Large-Format Modules and Monitoring of the Demonstration Site

Umang Desai¹, Leïla Mazirt¹, Yuliya Voronko², Gabriele Eder², Nikolina Pervan³, Gernot Oreski³, Antonin Faes¹, Christophe Ballif¹
¹ EPFL, Neuchâtel, Switzerland; ² OFI, Vienna, Austria; ³ PCCL, Leoben, Austria

4BV.4.13 Simulation-Based Analysis of Fire Safety for BIPV Cladding Systems

Su-Bin Jeong, Jin-Hee Kim, Jun-Tae Kim
Kongju National University, Cheonan, South Korea

4BV.4.14 Evaluating PVT Module Performance Across Diverse European Climates: A Simulation Study

Angelica Saretti¹, Giuseppe Vero¹, Aissa Chouder², Silvano Vergura¹, Santiago Silvestre³
¹ Polytechnic University of Bari, Italy; ² University of M'sila, Algeria; ³ UPC, Barcelona, Spain



4BV.4.15 Extended KPIs for Decisions-Makers in the Development of BIPV Solutions

Simon Boddaert¹, Olaia Aurrekoetxea², Julieu Jacob³, Simone Germani⁴, Ignas Ceuppens⁵, Hervé Lamblot⁶, Tatjana Vavilkin⁷, Maria Jimenez⁸, Xavier Gauvin⁹, Tonis Eelma¹⁰

¹ CSTB, Sophia Antipolis, France; ² TECNALIA, Saint Sebastian, Spain; ³ METABUILD, Berlin, Germany; ⁴ CEI, Milan, Italy; ⁵ BUILD'UP, Aarschot, Belgium; ⁶ Sunstyle, Paris, France; ⁷ Soltech, Genk, Belgium; ⁸ Onyx Solar, Avila, Spain; ⁹ Bouygues Construction, Saint-Quentin-en-Yvelines, France; ¹⁰ IBS, Tartu, Estonia

4BV.4.16 Fire Safety Evaluation: Assessing Internal Fire Exposure in BIPV/BAPV Systems

Nerea Otano-Aramendi¹, Fabio Parolini², Xabier Olano-Azkune¹, Olaia Aurrekoetxea-Arratible¹, Ainhoa Odriozola-Alberdi¹, Pierluigi Bonomo²

¹ TECNALIA Research & Innovation, Azpeitia, Spain; ² SUPSI – ISAAC, Manno, Switzerland

4BV.4.17 The Use of Life Cycle Assessment to Support Development of an Innovative BIPV System with a Steel Frame

Lea Roulleau¹, Simon Bailache¹, Simon Boddaert², Jean-Pierre Reyat³, Yves Biard³

¹ CSTB, Grenoble, France; ² CSTB, Sophia Antipolis, France; ³ SemperStyl Technologies, Cergy, France

4BV.4.18 A Phase Change Material-Based Passive Air-Based Dual-Purpose Photovoltaic-Thermal System: a CFD Study Analysis and Experimental Performance

Omid Fakhraei, Shiva Gorjian, Barat Ghobadian, Gholamhassan Najafi Tarbiat Modares University, Tehran, Iran

4BV.4.19 Exploring Fire Safety Protocols: Should Photovoltaic Systems be Active During Testing?

Olaia Aurrekoetxea-Arratibel¹, Nerea Otano-Aramendi¹, Daniel Valencia-Caballero², Iñigo Vidaurrezaga³, Xabat Oregi⁴, Xabier Olano-Azkune¹

¹ TECNALIA, Azpeitia, Spain; ² TECNALIA, Donostia, Spain; ³ TECNALIA, Derio, Spain; ⁴ CAVIAR UPV/EHU, Donostia, Spain

4BV.4.20 Technical Analysis of PV/T Systems in Utrecht Primary Schools

Ruben van der Veen, Sara Mirbagheri Golroodbari Utrecht University, The Netherlands

4BV.4.22 Economic Analysis of Building Integration of Flexible PV Modules

Paulo Carmo, José A. Silva, Luís Fialho, Pedro Horta University of Évora, Portugal

4BV.4.23 Customizable Color Foils for Photovoltaic Modules: A New Approach to Aesthetic and Efficient Solar Energy Integration

Ananta Paul¹, Jani Lamminaho¹, Catarina Ferreira², Markus Babin³, Karlis Petersons⁴, Leif Yde⁴, Jan Stensborg⁴, Nanna Lysgaard Andersen³, Peter Behrendorff Poulsen³, Sune Thorsteinsson³, Joel D Cox², Morten Madsen¹

¹ SDU Climate Cluster, Odense, Denmark; ² POLIMA, SDU, Odense M, Denmark; ³ DTU, Roskilde, Denmark; ⁴ Stensborg, Roskilde, Denmark

4BV.4.24 Performance, Operational Data and Stability of Commercial CIGS Thin-Film PV Modules in BIPV Systems

Stefan Grünsteidl, Peter Borowski, Thomas Dalibor Avancis, Munich, Germany

4BV.4.25 Experimental Testing of BIPVT for Arctic Residential Applications

Daniel Baril¹, Andreas Athienitis², Hua Ge²

¹ Concordia University, Dollard-Des-Ormeaux, Canada; ² Concordia University, Montreal, Canada

4BV.4.26 Abstract of Exploring Energy Efficiency Procurement Strategy (ESCO Model) @ Saudi Aramco NJB Plan

Riyadh M. AL-Zahrani Saudi Aramco, Thuwal, Saudi Arabia

VISUAL PRESENTATIONS 1BV.5

17:00 - 18:30 Crystalline Silicon Material: Defects and Recycling | Processes and Concepts for the Manufacturing of Silicon Solar Cells

1BV.5.1 Photovoltaic Waste Recycling for Highly Stable Nano-Silicon Particles in Lithium-Ion Batteries

Jun-Hong Min, Gi-Hwan Kang, Jin-Seok Lee KIER, Daejeon, South Korea

1BV.5.2 Isotopic Analysis for Robust Traceability of Crystalline Silicon Wafers

Bertrand Paviet-Salomon¹, Sylvain Bérail², Julien Barre², Pascale Louvat³, Christophe Pecheyran³

¹ CSEM, Neuchâtel, Switzerland; ² Advanced Isotopic Analysis, Pau, France; ³ UPPA/CNRS, Pau, France

1BV.5.3 Solar Silicon Recycling from End-of-Life PV Silicon Modules via Chemical and Vacuum Refining Techniques

Jonas Låstad, Jafar Safarian NTNU, Trondheim, Norway

1BV.5.4 Novel PV Conversion Mechanisms in Crystalline Silicon Filled with Conditioned Amorphized Grains

Zbigniew T. Kuznicki SEGTON Advanced Technology, Versailles, France

1BV.5.5 Analysis of Cu-Associated Defects in Silicon through Lifetime Spectroscopy

Nerea Dasilva-Villanueva, David Fuertes Marrón, Carlos del Cañizo UPM, Madrid, Spain

1BV.5.6 Oxygen and Carbon Impurity Effects in CZ-Silicon Wafers: Improvement through Thermal Annealing

Nurhayat Yıldırım¹, Sertaç Eroğlu²

¹ KalyonPV, Ankara, Türkiye; ² Eskişehir Osmangazi University, Eskişehir, Türkiye

1BV.5.7 Investigation of Process Parameters on the Distribution of the Material Parameters in Cz-Crystals doped with Antimony

Frank Mosel¹, Nadine Schueler²

¹ PVA TePla, Wetztenberg, Germany; ² Freiburger Instruments, Freiberg, Germany

1BV.5.21 The Bondi Process: LCO-free, Fire through Micro-Contact PERC AL that Outperforms Standard PERC Solar Cells

Alexander Slade¹, Richard Young¹, Matt Edwards¹, Thomas Buck², Mertcan Comak², Dominik Rudolph²

¹ Avalon Solar Technologies, Sydney, Australia; ² ISC Konstanz, Germany



1BV.5.22 Integration of Parallel Dispensing Technology and Tempo Presto Metallization Platform

Nicola Frasson¹, Marco Galiuzzo¹, Maximilian Pospischil², Bernd Steinhäuser²

¹ Applied Materials, San Biagio di Callalta, Italy; ² HighLine Technology, Freiburg, Germany

1BV.5.23 Combination of Silicon Heterojunction and Metal Wrap through Technologies for BIPV Module Realization

Nicola Frasson, Marco Galiuzzo

Applied Materials, San Biagio di Callalta, Italy

1BV.5.24 Sustainable, High-throughput, Industry-ready, Next-generation Technology for European Manufacturing Leadership in Photovoltaics (SHINE PV)

Marco Galiuzzo¹, Sven Kluska², Vincent Barth³, Jonathan Govaerts⁴, Frank Lenzmann⁵, Giovanni Borzi⁶, Betina Debastiani Benato⁷, Matevž Bokalič⁸, Margit Lang⁹, Victor Acinas¹⁰

¹ Applied Materials, San Biagio di Callalta, Italy; ² Fraunhofer ISE, Freiburg, Germany; ³ CEA, Le Bourget-du-Lac, France; ⁴ imec, Genk, Belgium; ⁵ TNO Energy Transition, Petten, The Netherlands; ⁶ Enginsoft, Padua, Italy; ⁷ AMIRES, Prague, Czech Republic; ⁸ University of Ljubljana, Slovenia; ⁹ PCCL, Leoben, Austria; ¹⁰ Applied Materials, Dublin, Ireland

1BV.5.25 Simultaneous Formation of Selective and Blanket Emitters through Ion Implantation for Solar Cell Applications

Mustafa Büyükgözel, Melisa K. Arslan, İlkan Erdem, İrem Nur Manaz, Furkan Çiçek, Batuhan Taş, Murat Aynacıoğlu, Bülent Arıkan, Raşit Turan ODTÜ-GÜNAM, Ankara, Türkiye

1BV.5.26 Evaluation of the Potential of Commercial Pure Copper Pastes for a-Si:H/c-Si Heterojunction Solar Cells: Effects of Inert Gas Annealing, Screen Design Optimization, and Stability

Gustavo Rodrigues Lopes¹, Johann Jourdan¹, Stéphane Bastide², Wilfried Favre¹

¹ CEA / INES, Le Bourget-du-Lac, France; ² CNRS / ICMPE, Thiais, France

1BV.5.27 Beyond Silver: Comparative Performance Analysis of Alternative Metallization Strategies in Silicon Solar Cells

Seda Kilickaya¹, Melisa Korkmaz Arslan¹, Esmâ Alloji², Serdar Akbayrak², Veysel Unsur²

¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² Necmettin Erbakan University, Konya, Türkiye

1BV.5.28 Progress in Screen Printed Hybrid Copper and Silver Metallization for N-Type ZEBRA IBC Cells

Dominik Rudolph¹, Mertcan Comak¹, Justus Carstens¹, Jan Lossen¹, Isaac Rosen², Jonathan Linke¹, Florian Buchholz¹

¹ ISC Konstanz, Germany; ² Copprint, Jerusalem, Israel

1BV.5.29 Interfacial Study of the Pulsed-DC Reactive Sputtered Aluminium Oxide using Electron Energy Loss Spectroscopy for c-Si Solar Cells Application

Meenakshi Bhaisare¹, Chandra Mauli Kumar¹, Anil Kottantharayil²

¹ Premier Energies, Hyderabad, India; ² IIT Bombay, Mumbai, India

1BV.5.30 From Laboratory to Mass Production: Texturing Additive Development for TOPCon and PERC Solar Cells

Mathias Kamp¹, Philipp Schmid¹, Jan Vollmer¹, Benedikt Straub¹, Tobias Dannenberg¹, Caroline Scheiwe¹, Simon Koehler¹, Damian Brunner¹, Katrin Krieg², Martin Zimmer², Tamalika Panda³

¹ RENA Technologies, Freiburg, Germany; ² Fraunhofer ISE, Freiburg, Germany; ³ International Marketing Corporation, Mumbai, India

1BV.5.32 Impact of Doped Polysilicon Process for Mass Production TOPCon Solar Cell

Cheng-Wen Kuo, Ta-Ming Kuan, Yung-Chih Li, Chun-Wei Lee, Li-Guo Wu, Cheng-Yeh Yu

TSEC, Hsinchu, Taiwan

1BV.5.33 Exploring Carbon-Based Pastes for Silver-Free Metallization of Silicon Heterojunction Solar Cells

Mihir Mahajan¹, Bart Reekmans¹, Valerie Depauw¹, Thomas Baumeler², Vaishakh Kedambaimoole², David Martineau², Hariharsudan

Sivaramakrishnan Radhakrishnan¹, Bart Vermang³

¹ imec, Genk, Belgium; ² GraphEnergyTech, Lausanne, Switzerland; ³ Hasselt University, Belgium

1BV.5.34 Analysis of Texture Etching to Reduce Laser-Induced Damage in Boron-Doped Selective Emitters

Bruno Krever Lopes, Adriano Moehlecke, Moussa Ly, Izete Zanesco, Felipe Chini de Freitas

PUCRS, Porto Alegre, Brazil

1BV.5.35 Influence of Reduced Gas Flow Rates on the Sheet Resistance of Boron-Diffused Layers Performed in a Compact Furnace

Izete Zanesco, Adriano Moehlecke, Lucas Caçapietra Pires da Silva, Moussa Ly, João Victor Zanatta Britto, Vitor Gomes de Venuto

¹ PUCRS, Porto Alegre, Brazil

1BV.5.36 Innovations in PERC and TOPCon Solar Cell Metallization: Reduction of Process Steps and Efficiency Improvement

Mert Kahraman, Burcu Gümüş Çiftci

Kalyon PV, Ankara, Türkiye

1BV.5.37 Ultrashort Pulsed Laser Ablation in Photovoltaics: Power Attenuator and Pulse Spacing Effects

Nastaran Hayati-Roodbari¹, Audrey Morisset², Frank Reil¹, Agata Lachowicz², Valentin Satzinger¹, Roman Trättnig¹

¹ Joanneum Research, Weiz, Austria; ² CSEM PV-center, Neuchâtel, Switzerland

1BV.5.38 Reliability of Double-Side Ni/Cu Plated Contacts on Wet Etch Opened TOPCon Solar Cells

Roberto Boccardi¹, Clara Bolette Brendstrup Møller¹, Io Mizushima², Torben Tang², Rasmus Schmidt Davidsen³, Peter Behrendsdorff Poulsen¹, Gisele Alves dos Reis Benatto¹, Sune Thorsteinsson¹

¹ DTU, Roskilde, Denmark; ² IPU P/S, Virum, Denmark; ³ Aarhus University, Denmark



1BV.5.39 Optimization of Cu Metallization in HJT Solar Cell Manufacturing and Investigation of Possible Cu in-Diffusion during Module Reliability Testing

Yu Wu, Lars A. G. Okel, Eric J. Kossen, E. Busra Kucuk, Astrid Gutjahr,
Victor Rosca, L. J. Geerligs
TNO, Petten, The Netherlands

1BV.5.40 Self-Assembled Films of Carbazole Derivatives on the Aluminum Back Contact of Silicon Solar Cells

Sergii Mamykin¹, Nina Roshchina¹, Daria Kuznetsova¹, Vadym Naumov¹,
Petro Smertenko¹, Saulius Grigalevicius², Gintare Krucaite², Raminta
Beresneviciute², Dovydas Blazevicius²

¹ NAS, Kyiv, Ukraine; ² Kaunas University of Technology, Lithuania

1BV.5.41 Luminescent Insulating Intermediate Layer for Thin Film Solar Modules P1 Laser Scribing on Low-cost Galvanized Steel

MariFe Menéndez, Ana Martínez, Pascal Sanchez
Fundación Idonial, Gijón, Spain

Wednesday, 24. September 2025

VISUAL PRESENTATIONS 4CV.1

13:30 - 15:00 Advances in Operation, Performance and Maintenance of PV Systems

4CV.1.1 Adaptive Maintenance Strategies for PV Fleets: Enhancing Profitability and Efficiency Through Optimized Cleaning

Hind Abdulla, Andrei Sleptchenkoa, Ammar Nayfeh
Khalifa University, Abu Dhabi, United Arab Emirates

4CV.1.2 Construction and Comparison of Outdoor PV Test Stands in Different Climate Zones

Rita Ebner¹, Marcus Rennhofer¹, Vassilissa Neussl¹, Bernhard Kubicek¹, Ankit Mittal¹, Gusztav Ujvari¹, Brian Azzopardi², Alexandre Mignonac³, Carlos Meza⁴, Sebastian Dittmann⁴, Ana Gracia Amillo⁵, Juan Manuel Cuadra⁵

¹ AIT, Vienna, Austria; ² FIR, Birkirkara, Malta; ³ CEA, Saint-Paul-Lez-Durance, France; ⁴ HSA, Köthen, Germany; ⁵ CENER, Sarigurren, Spain

4CV.1.3 Intense Mid-Level Wind Speeds and Flat Tracker Tilts during Rear Glass Breakages on Non-Large-Format Bifacial PV Modules on Trackers

Darryl Wang
DNV Singapore

4CV.1.4 Analytical Monitoring of Bypass Diode Short Circuit Signatures in PV Scada Data in Ground-Mounted Solar Farms

Qi Wang, Ju Lim
¹ Sunalytics, Singapore

4CV.1.5 Ray-Tracing Method for Accurate Energy Yield Simulation of Bifacial Module Carport Systems

Sungho Hwang¹, Jung-Dae Kwon², Myunghun Shina³

¹ Korea University, Seoul, South Korea; ² Korea Institute of Materials Science, Changwon, South Korea; ³ Korea Aerospace University, Goyang, South Korea

4CV.1.6 Distance Weighted Irradiance for Performance Monitoring in Large Scale PV Assets with Sparse Irradiance Sensors

Giorgio Fighera¹, Giacomo Gorni², Gino Ferretti², Anna Scaccabarozzi²

¹ Eni Plenitude, Rome, Italy; ² Eni, San Donato Milanese, Italy

4CV.1.7 Comparative Study of Energy Yield in PV Systems Using Different Module Technologies and Inverter Configurations

Matevž Bokalič, Kristijan Brecl, Marko Topič
University of Ljubljana, Slovenia

4CV.1.8 A Highly Adaptable Performance Evaluation Method for PV Systems Using Remote Meteorological Data and On-Site Reference Comparisons

Weizhen Xiong, Jindan Cui, Yuzuru Ueda
Tokyo University of Science, Japan



- 4CV.1.9 Soiling Losses Modeling for PV Modules in the South of Spain**
Joaquín Alonso-Montesinos¹, Enrique García-Campos², Carlos García-Sánchez², Gabriel López-Rodríguez³, Jesús Polo-Martínez⁴, Elena Ruiz-Donoso⁵, Stefan Wilbert⁵
¹ UAL, Almería, Spain; ² CIESOL, Almería, Spain; ³ UHU, Huelva, Spain; ⁴ CIEMAT, Madrid, Spain; ⁵ DLR, Almería, Spain
- 4CV.1.10 Reliability of PV Inverters: PV-Reliability.ch**
Christof Bucher, Matthias Hügi
BFH, Burgdorf, Switzerland
- 4CV.1.11 Maintenance-Free Measurement of Power Losses from Soiling**
Michael Gostein¹, Damien Cosme², Quentin Berthet-Rayne², Lluvia Ochoa³, Dhanup Somasekharan Pillai⁴, Brahim Aïssa⁴
¹ Atonometrics, Austin, United States of America; ² TotalEnergies, Doha, Qatar; ³ TotalEnergies, Paris, France; ⁴ QEERI, Doha, Qatar
- 4CV.1.12 Investigation and Discuss of Failures during Operation and Maintenance in Floating Photovoltaic**
Jieun Lee, Hyunsik Jo, Jungi Jeong, Donggeon Yang
K-water, Daejeon, South Korea
- 4CV.1.13 Study on Power Generation Estimation Model using Inverter Data and Machine Learning**
Suk-Whan Ko, Young-Chul Ju, Hye-Mi Hwang, Jin-Seok Lee, Woo-Gyun Shin
KIER, Daejeon, South Korea
- 4CV.1.14 Application of Multivariate Data Analysis and NIR Spectroscopy in Evaluating PV System Performance and Packaging Degradation**
Brahim Anis Belferkous¹, Chiara Barretta¹, Guillermo Oviedo Hernandez², Daniela Maria Godinho Arioli², Lukas Koester³, David Moser³, Gernot Oreski¹
¹ PCCL, Leoben, Austria; ² BayWa r.e, Rome, Italy; ³ Eurac Research, Bolzano, Italy
- 4CV.1.15 Automated Identification of Open Circuits in Photovoltaic Arrays via Mask-RCNN, Thermographic Signal Processing and Hybridized Region-Growth Algorithms**
Daniel Jason Castillo Patton¹, Lucas Viani¹, Mario Martínez González¹, Sergio Suárez Sánchez¹, Fernando García², Soffa Rodríguez-Conde¹, José Manuel Rivas Rodríguez¹
¹ Enertis Applus+, Madrid, Spain; ² UC3M, Madrid, Spain
- 4CV.1.16 Digital Twin in PV: a Comparison of Physical and Machine Learning Models for PV Systems in High Radiation Environments**
Robinson Cavieres, Felipe Valencia
ATAMOSTEC, Antofagasta, Chile
- 4CV.1.17 Power Generation Performance Analysis of East-West Oriented Bifacial PV Systems on Gabled Roofs**
Ha Yeong Kim¹, Jin Hee Kim¹, Jun Tae Kim¹, Hoon Sim²
¹ Kongju National University, Chungcheongnam-do, South Korea; ² JH Energy, South Korea

- 4CV.1.18 Impact of Soiling and Natural Cleaning Events on Bifacial Photovoltaic Modules in the PSDA**
Abel Taquichiri¹, Douglas Olivares¹, Carlos Portillo¹, Felipe Valencia², Edward Fuentealba¹
¹ University of Antofagasta, Chile; ² ATAMOSTEC, Santiago, Chile
- 4CV.1.19 Underperformance of PV Plants. An Analysis in over 6GW**
Jorge Solorzano, Monica Quiroz
QPV, Madrid, Spain
- 4CV.1.20 New PV Inspection Methodologies using Drones and AI-ML for Early Defect Detection and Risk Mitigation**
Pedro Marques, Alberto Paolillo, Nuno Marques, André Luís
Aeroprotechnik, Viseu, Portugal
- 4CV.1.21 Anomaly Detection for PV Facade Systems Using Neural Networks**
Jonas Petzschmann¹, Dirk Stellbogen¹, Roland Einhaus¹, Alexander Wagner²
¹ ZSW, Stuttgart, Germany; ² Solar-Log, Geislingen-Binsdorf, Germany
- 4CV.1.22 Baseline Efficiency: a new Key Performance Indicator for PV Systems**
Anastasios Kladas, Bert Herteleer, Jan Cappelle
KU Leuven Research Group ELECTA, Ghent, Belgium
- 4CV.1.23 Soiling Forecasts for Cleaning Scheduling Optimization**
Fernanda Norde Santos¹, Stefan Wilbert¹, Carl Becker¹, Elena Ruiz Donoso¹, Laura Campos Guzman¹, Álvaro Fernández Solas¹, Luis Zarzalejo², Anne Forstinger³, David Helten³, Veith Pietsch⁴, Robert Pitz-Paal⁵
¹ DLR, Almería, Spain; ² CIEMAT, Madrid, Spain; ³ CSP Services, Cologne, Germany; ⁴ Aquila Capital, Hamburg, Germany; ⁵ DLR, Cologne, Germany
- 4CV.1.24 Adapting PV Panel Cleaning Strategies to Market Dynamics: the Impact of Variable Pricing and Regulatory Market Participation**
Marta Redondo Cuevas, Carlos A. Platero Gaona
UPM, Madrid, Spain
- 4CV.1.25 Advancing Photovoltaic Performance through Digitalisation in Living Laboratories: Insights from the Promise Project**
Brian Bartolo¹, Brian Azzopardi¹, Carmel Azzopardi¹, Austėja Mockeviciute-Azzopardi¹, Alexandre Mignonac², Marcus Rennohofer³, Bernhard Kubicek³, Rita Ebner³, Carlos Meza⁴, Melodie de l'Epine⁵, Eugenia Zugasti⁶, Steve Zerafa⁷, Kenneth Scerri⁸
¹ The Foundation for Innovation and Research, Birkirkara, Malta; ² CEA, Cadarache, France; ³ AIT, Vienna, Austria; ⁴ Anhalt University of Applied Sciences, Köthen, Germany; ⁵ Becquerel Institute, Brussels, Belgium; ⁶ CENER, Pamplona, Spain; ⁷ PIXAM, Msida, Malta; ⁸ University of Malta, Msida, Malta
- 4CV.1.26 UAV-based Autonomus Monitoring and Real-time Thermal Anomaly Detection of Photovoltaic Modules**
Ghaem Taghipour Kani¹, Sayyed Majid Esmailifar¹, Amirreza Ghahremani¹, Mohammadreza Aghaei²
¹ Amirkabir University of Technology, Tehran, Iran; ² NTNU, Aalesund, Norway
- 4CV.1.27 Accurate Yield Modelling of a Semi-Transparent Facade Agri-PV System**
Lavanya Malarkannan¹, George Koutsourakis¹, Daniel Parsons¹, Martyn Rush², Ollie Cowdall², James Blakesley¹
¹ NPL, Teddington, United Kingdom; ² Polysolar, Cambridge, United Kingdom



- 4CV.1.28 Photovoltaic Power Output Estimation with Digital Visible Cameras**
Verónica Abad Alcaraz, Enrique García Campos, José Domingo Álvarez Hervás, Manuel Pérez García, José Antonio Carballo López, María del Mar Castilla Nieto, Joaquín Alonso Montesinos
University of Almería, La Cañada de San Urbano, Spain
- 4CV.1.29 Dynamic Cleaning Optimization Based on Historical Analysis and Real-Time Soiling Data**
Franco Vicente Clandestino Muñoz, Thore Müller, Kostiantyn Pogorelov
PVRADAR Labs, Ebersberg, Germany
- 4CV.1.30 Machine Learning-Based Prediction of Photovoltaic Power Generation: a Case Study using Two-Year Time Series Amsterdam Weather Data and SAM Simulations**
Guang Hu, Roel Loonen, Angèle Reinders
Eindhoven University of Technology, The Netherlands
- 4CV.1.31 Intercomparison of Soiling Measurement Methodologies**
Nicole Torres¹, Felipe Valencia¹, Robinson Cavieres¹, Douglas Olivares²
¹ ATAMOSTEC, Antofagasta, Chile; ² University of Antofagasta, Chile
- 4CV.1.32 Unsupervised Detection of Anomalies in Large-Scale Photovoltaic Systems Using DBSCAN with Rule-Based Refinement**
João Lucas de Souza Silva, Michelle Melo Cavalcante, Marcel Veloso Campos, Marcelo Vinícius de Paula, Tércio André dos Santos Barros
UNICAMP, Campinas, Brazil
- 4CV.1.33 Automatic Fault Detection and Diagnosis In Photovoltaic Plants based on Convolutional Neural Networks**
Javier Martín-Rueda, Javier R. Ledesma, Celena Lorenzo, Pablo Merodio, Luis Narvarte
UPM, Madrid, Spain
- 4CV.1.34 Enhanced Anomaly Prediction in Photovoltaic Systems**
Raimundo Eider Figueredo, João Lucas de Souza Silva, Marcel Veloso Campos, Marcelo Vinícius de Paula, Tércio André dos Santos Barros, José Cândido Silveira Santos Filho
LEPO/UNICAMP, Campinas, Brazil
- 4CV.1.35 Temporal Graph Neural Networks for Early Anomaly Detection and Performance Prediction via PV System Monitoring Data**
Srijani Mukherjee¹, Laurent Vuillon², Liliane Bou-Nassif³, Stephanie Giroux-Julien⁴, Herve Pabiou³, Denys Dutykh⁵, Ioannis Tsanakas¹
¹ CEA / INES, Le Bourget-du-Lac, France; ² CNRS, Chambéry, France; ³ CETHIL, Lyon, France; ⁴ CNRS, Lyon, France; ⁵ Khalifa University, Abu Dhabi, United Arab Emirates
- 4CV.1.36 Optimization of Maintenance of PV Module Arrays based on Asset Management Strategies: Case of Study**
Luis Cardenas, Fernando Herrera, Ernesto Pérez, Andrés Figueroa
National University of Colombia, Bogotá, Colombia

- 4CV.1.37 CartesiaNet: a Lightweight Neural Network for PV Module Corner Detection**
Thøger Kari, Mahmoud Dhinish, Rodrigo Del Prado Santamaria, Gisele Alves dos Reis Benatto, Aysha Mahmood, Peter Behrendorff Poulsen, Sergiu Viorel Spataru
DTU, Roskilde, Denmark
- 4CV.1.38 Impact of Bird Droppings on Floating Photovoltaic (FPV) Module Performance: Maintenance and Deterrence Methods**
Myenggil Gang¹, Seong Dae Kim¹, Alex Lim¹, Aram Han¹, Young shin Lim¹, Choong sub Won², Hyunsik Jo³, Jieun Lee³, Chang-Sub Won¹
¹ MIRAE, Seoul, South Korea; ² MIRAE, Seoul, South Korea; ³ K-Water Research Institute, Daejeon, South Korea
- 4CV.1.39 A Spatially Resolved Clear-Sky Filter using Photovoltaic Modules as Cloud Detectors**
Elin Dypvik Sødahl, Magnus Moe Nygård, Marie Syre Wiig
IFE, Kjeller, Norway
- 4CV.1.40 Dust, Data, and Decisions: An Integrated Sensor-to-Solver Framework for Maximising PV Output**
Tolga Yalcin¹, J. Luis Domínguez-García¹, Pol Paradell Sola¹, Mònica Aragüés Peñalba²
¹ IREC, Sant Adrià de Besòs, Spain; ² UPC, Barcelona, Spain
- 4CV.1.41 Development of Computational Models for Energy Production Estimation in Bifacial Modules under Different Configurations at the Atacama Desert Solar Platform (PSDA)**
Mauricio Trigo-Gonzalez¹, Abel Taquichiri¹, Jorge Rabanal-Arabach¹, Jorge Vega-Herrera¹, Felipe Valencia², Edward Fuentealba¹
¹ University of Antofagasta, Chile; ² AtamosTec, Santiago, Chile
- 4CV.1.42 Towards a Cost-Priority Number for Module Replacements Informed by Energy Yield Time Series and Infrared Thermography Data**
Bjørn Lupton Aarseth, Magnus Moe Nygård, Gaute Otnes, Marie Syre Wiig, Erik Stensrud Marstein
IFE, Kjeller, Norway
- 4CV.1.43 Assessing PV Module Quality Risks in South Africa: Performance Insights across Utility, Commercial and Industrial, and Residential Sectors**
Jacqueline Crozier McClelland¹, Monphas Vumbugwa¹, Ndumiso Mngomezulu², Frederik J. Vorster¹, Ernest E. van Dyk¹
¹ Nelson Mandela University, Gqeberha, South Africa; ² PVinsight, Gqeberha, South Africa
- 4CV.1.44 Can Regular String IV Measurements Complement MPP Monitoring Data?**
Martin Bartholomäus, Fernando Román Vecino, Peter Behrendorff Poulsen, Mahmoud Dhinish, Sergiu Viorel Spataru
DTU, Roskilde, Denmark
- 4CV.1.45 Tracking the Tracker**
Mitheli Nikam, Julien Deckx, Karel De Brabandere, Gofran Chowdhury
3E, Brussels, Belgium



4CV.1.46 Aggregation Errors based on PV Production Data in the Timescale of Seconds

Bernhard Kubicek¹, Marcus Rennhofer¹, Thomas Hutterer-Tik², Christian Öttl²
¹ AIT, Vienna, Austria; ² Watt Analytics, Vienna, Austria

4CV.1.47 Soiling Loss Estimation in Utility-Scale Plants using the Dynamic Internal Reference Method

Karel De Brabandere, Maitheli Nikam, Julien Deckx, Gofran Chowdhury
3E, Brussels, Belgium

4CV.1.48 In-Field Assessment of Soiling Effects on a Floating Photovoltaic System in a Humid Subtropical Urban Area

Renzo Vargas, Givaldo dos Reis, Rodrigo P. Maruyama, Alex Manito, Marcelo Pinho Almeida, Roberto Zilles
University of São Paulo, Brazil

4CV.1.49 The Panoramic Reconstruction Images to Photovoltaic Modules for Solar Power Plant Management

Chao-Wei Ou¹, Cheng-Yu Peng¹, Han-Chang Liu²
¹ National Chin-Yi University of Technology, Taichung, Taiwan; ² ITRI, Tainan, Taiwan

4CV.1.50 Detection and Clustering of Photovoltaic Faults

Anastasios Kladas, Jarid Van Der Gucht, Bert Herteleer, Jan Cappelle
KU Leuven Research Group ELECTA, Ghent, Belgium

4CV.1.51 Photovoltaic Modules Self-Testing by Junction Box-Embedded Wireless Monitoring Solution

Eneko Ortega¹, Gerardo Aranguren¹, Julius Denafas², Paulius Laurikėnas², Ricardo Alonso³, Juan Carlos Jimeno¹
¹ UPV/EHU, Bilbao, Spain; ² Solitek, Vilnius, Lithuania; ³ Tecalia, Derio, Spain

4CV.1.52 Data-Driven Assessment of Inverter Efficiency Losses and Load Profiles in PV Systems

David Daßler¹, Stephanie Malik², Dharm Patel², Andreas Dietrich³, Jan Spihola³, Kai Kaufmann⁴, Carsten Hennig⁵, Robert Klengel², Carola Klute², Ulrike Jahn¹, Matthias Ebert¹
¹ Fraunhofer CSP, Halle, Germany; ² Fraunhofer IMWS, Halle, Germany; ³ DiSUN Deutsche Solarservice, Werder, Germany; ⁴ DENKweit, Halle, Germany; ⁵ saferay holding, Berlin, Germany

4CV.1.53 Quantifying Uncertainty in Performance Loss Rate Measurements from Timeseries Data

James Blakesley¹, Lavanya Malarkannan¹, Yuhui Luo¹, George Koutsourakis¹, Peter Harris¹, Giuliano Luchetta-Martins², Lucas Sergio Zanicoski², Elena Koumpli², Jan Muller²
¹ NPL, Teddington, United Kingdom; ² Statkraft UK, London, United Kingdom

4CV.1.54 Enhancing Autonomus Aerial Monitoring of Large-Scale Photovoltaic Plants Using a Deep Reinforcement Learning Approach for Multi-Aerial Robot Systems

Amirhossain Aghamohammadi¹, Sayyed Majid Esmaeilifar¹, Mohammad Kolahi², Amir Mohammad Moradi Sizkouhi³, Mohammadreza Aghaei⁴
¹ Amirkabir University of Technology, Tehran, Iran; ² University of Isfahan, Iran; ³ Concordia University, Montreal, Canada; ⁴ NTNU, Aalesund, Norway

4CV.1.55 Machine learning enhanced modeling for floating PV

Marcus Reitz¹, Mirza Khalid Baig², Minne M. de Jong²
¹ TNO, Utrecht, The Netherlands; ² TNO, Eindhoven, The Netherlands

4CV.1.56 AI-Based Estimation of the Levelized Cost of Energy for Industrial Photovoltaic Systems in Korea

Ju-Hee Kim, Min-Jae Oh, Minkook Kim, Young Ah Park, Hyejeong Yang, Yong Hyun Kim
KOPTI, Bukgu, South Korea

4CV.1.57 Preprocessing I-V curve data for enhanced CNN-Based fault diagnosis in Photovoltaic strings

Woo-Gyun Shin, Young-Chul Ju, Hye-Mi Hwang, Jin-Seok Lee, Suk-Whan Ko
KIER, Daejeon, South Korea

VISUAL PRESENTATIONS 1CV.2

15:15 - 16:45 Si Solar Cells | Characterisation & Modelling of Silicon Cells and Their Building Blocks

1CV.2.1 Minimizing Parasitic Optical Losses in Bifacial TOPCon Solar Cells through Laser-Induced Localized Polysilicon Thinning

Ning Song, Yalun Cai, Shuo Deng, Jiliang Huang, Yuhao Cheng, Martin Green
UNSW, Sydney, Australia

1CV.2.2 Laser-Induced Thermal Effect Enhances Polycrystalline Silicon Crystallinity in TOPCon Solar Cells

Zhipeng Liu¹, Jingjia Ji¹, Yusen Qin¹, Meixian Huang², Jianbo Shao²
¹ Jiangsu Xianghuan Technology, Wuxi, China; ² Jiangnan University, Wuxi, China

1CV.2.3 Selective Etching of Doped Polysilicon Layers

Sebastian Mack¹, Viola Neuber¹, Laurent Clochard², Andreas Wolf¹
¹ Fraunhofer ISE, Freiburg, Germany; ² Nines Photovoltaics, Dublin, Germany

1CV.2.4 A TOPCon IBC Solar Cell Architecture with Sputtered Tunnel Oxide and Polysilicon Doped Regions: Design and Process Optimization

Valentin Dan Mihailitchi¹, Vaibhav V. Kuruganti¹, Thomas Buck¹, Volker Linß², Eric Schneiderlöchner²
¹ ISC Konstanz, Germany; ² VON ARDENNE, Dresden, Germany

1CV.2.5 Comparison of Passivation Properties of Phosphorus and Boron Ex-Situ Doped Poly-Silicon on Oxide Layers

Raphael Cabal¹, Clarisse Laurens-Berge¹, Baptiste Marteau², Anis Jouini², Sebastien Dubois¹
¹ University Grenoble Alpes, Le Bourget-du-Lac, France; ² ECM Technologies, Grenoble, France

1CV.2.6 Advanced Passivating Contact Engineering: Ex-Situ Doped p+ Poly-Si/SiOx with Additional Pre-Annealing Step for Efficient TOPCon Single-Junction and Tandem Solar Cells

Yiğit Mert Kaplan¹, Berkay Uygün¹, Seda Kılıçkaya Ünver¹, Sven Kluska², Raşit Turan¹, Hisham Nasser¹
¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² Fraunhofer ISE, Freiburg, Germany



1CV.2.7 Advancements in the Passivation and Screen-Printed Metallization of P+ Poly-Si Layers

Vaibhav Venkat Kuruganti, Haifeng Chu, Thomas Buck, Valentin Dan Mihailetchi
ISC Konstanz, Germany

1CV.2.8 Laser Annealing for the Crystallization of Amorphous Silicon Layers in TOPCon Solar Cells

David Canteli¹, Rocio Barrio², Ignacio Torres², David Munoz-Garcia¹, Jose Javier Gandia², Carlos Molpeceres¹
¹ UPM, Madrid, Spain; ² CIEMAT, Madrid, Spain

1CV.2.9 Overcoming Process Related Limitations in the Context of the Back Contacted polyZEBRA Solar Cell Technology

Jonathan Linke, Lazhar Rachdi, Sebastian Veerman, Jan Hoß, Jan Lossen, Lejo Joseph Koduvelikulathu, Florian Buchholz
ISC Konstanz, Germany

1CV.2.10 Advancing TOPCon Silicon Solar Cells with Laser-Grooved Buried Contact Technology

Mohammad Hossein Mohammadi¹, Roberto Boccardi², Io Mizushima³, Gisele Alves dos Reis Benatto², Peter Behrendorff Poulsen², Sune Thorsteinsson², Rasmus Schmidt Davidsen¹
¹ Aarhus University, Denmark; ² DTU, Copenhagen, Denmark; ³ IPU, Copenhagen, Denmark

1CV.2.11 Elongated Strip Crystalline Si Solar Cells for BIPV Applications

Hitoshi Sai, Takuya Matsui
AIST, Tsukuba, Japan

1CV.2.12 Understanding the Root Causes of UV-Induced Degradation in TOPCon Solar Cells: Insights from Materials and Surface Passivation Characterization

Jonathan Bryan¹, Diego Zubieta Sempertegui², Nicholas Moser-Mancewicz³, Sophia Buffone², Sijia Cheng², Nqobile G. Tshuma², Evan Jones², Carlos Biao¹, Kristopher O. Davis⁴, Mariana I. Bertoni³, Laura S. Bruckman², Ina T. Martin²
¹ GAF Energy, San Jose, United States of America; ² Case Western Reserve University, Cleveland, United States of America; ³ Arizona State University, Tempe, United States of America; ⁴ University of Central Florida, Orlando, United States of America

1CV.2.13 QUOKKA3 Simulation of Topcore Solar Cells: Investigating Front-Side Hole-Selective Layer

Eni Muka, Hisham Nasser, Raşit Turan
ODTÜ GÜNAM, Ankara, Türkiye

1CV.2.14 Hybrid c-Si Solar Cells Incorporating MoOx and n-type poly-SiOx Transport Layers

Yingwen Zhao, Yifeng Zhao, Yi Zheng, Liqi Cao, Paul Procel Moya, Engin Ozkol, Miro Zeman, Luana Mazzarella, Olindo Isabella
TU Delft, The Netherlands

1CV.2.15 Local Edge Passivation of Laser Scribed Shingle Cells for Compensating Cut Losses

Dheeraj Sah¹, Karolis Parfeniukas², Roberto Boccardi³, Narendra Bandaru¹, Benjamin Borie², Mira Baraket², Maksym Plakhotnyuk², Sune Thorsteinsson³, Peter B. Poulsen³, Rasmus Schmidt Davidsen¹
¹ Aarhus University, Denmark; ² ATLANT 3D, Taastrup, Denmark; ³ DTU, Copenhagen, Denmark

1CV.2.16 Ultra-thin biPolyTM Solar Cells with Front Selective n-type TOPCon and Rear Blanket p-type TOPCon Layers

Yuchi Lan¹, John Derek Arcebal², Gabby De Luna², Pradeep Padhamnath³, Armin Gerhard Aberle², Aaron Danner¹
¹ National University of Singapore, ² SERIS, Singapore, ³ AGH UST, Krakow, Poland

1CV.2.17 SiLEAN Project – Development of Silicon Heterojunction Solar Cells with Low Environmental Footprint and Advanced Interfaces

Karsten Bittkau¹, Muhammad Ainul Yaqin¹, Binbin Xu¹, Giuliano Vescovi², Valerie Depauw³, Mihir Mahajan³, Bart Reekmans³, Hamed Javanbakht Lomeiri³, Yi Zheng⁴, Engin Özkol⁴, Olindo Isabella⁴, Malte R. Vogt⁴, Miro Zeman⁵, Thomas Baumeler⁶, David Martineau⁶, Giuliana Giuliano⁷, Anna Molinari⁸, Kaining Ding¹
¹ FZJ, Jülich, Germany; ² Nexwafe, Freiburg, Germany; ³ imec, Genk, Belgium; ⁴ TU Delft, The Netherlands; ⁵ PV Works, Delft, The Netherlands; ⁶ GraphEnergyTech, Lausanne, Switzerland; ⁷ 3SUN, Catania, Italy; ⁸ Uniresearch, Delft, The Netherlands

1CV.2.19 Boron Doped Nanocrystalline Silicon as a Rear-Emitter in Silicon Heterojunction Solar Cells

Amanda Merino Leiva¹, Tristan Gageot¹, José Alvarez², Jean-Paul Kleider², Delfina Muñoz¹
¹ CEA / INES, Le Bourget-du-Lac, France; ² Paris-Saclay University, Gif-sur-Yvette, France

1CV.2.20 Thermally Evaporated Indium Oxide as TCO for Fully-Evaporated Silicon-Based Heterojunction Solar Cells

Francesca Menchini, Claudia Malerba, Luca Martini, Luca Serenelli, Mario Tucci
ENEA, Roma, Italy

1CV.2.21 Optimization of Phosphorus Doped nc-Si:H Emitter Layers for High-Efficiency SHJ Solar Cells

Arghavan Salimi¹, Valerie Depauw², Milad Ghasemi¹, Shankha Mukherjee³, Hariharsudan Sivaramakrishnan Radhakrishnan², Hisham Nasser¹, Rasit Turan¹
¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² imec, Genk, Belgium; ³ imec, Leuven, Belgium

1CV.2.23 A Comprehensive Study on the Aging of RF Sputtered AZO for Heterojunction Solar Cells

Claudia Malerba, Luca Serenelli, Francesca Menchini, Luca Martini, Glauco Stracci, Enrico Salza, Alberto Mittiga, Mario Tucci
ENEA, Rome, Italy

1CV.2.24 Advancements in Amorphous Silicon Heterojunction (SHJ) Solar Cells through the Use of Plasmonic Nanoparticles

Brahim Aissa, Mohammad Hossain, Alessandro Sinopoli
QEERI, Doha, Qatar



- 1CV.2.25 Precision UV Laser Scribing for Amorphous Silicon Solar Cells: Layer-Specific Analysis and Optimization**
Narendra Bandaru¹, Asbjørn Moltke², Ole Bang², Rasmus Schmidt Davidsen¹
¹ Aarhus University, Denmark; ² DTU, Lyngby, Denmark
- 1CV.2.26 Innovative Approach for the Industry-Compatible Cu Plating Metallization of Silicon Heterojunction Solar Cells**
Bülent Arıkan¹, Melisa Korkmaz Arslan¹, Seda Kılıçkaya Ünver¹, Raşit Turan²
¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² METU, Ankara, Türkiye
- 1CV.2.27 Mitigating Contaminant-Induced Degradation in TOPCon Solar Cells via Copper Plating**
Xutao Wang, Chandany Sen, Xinyuan Wu, Yuan-Chih Chang, Haoran Wang, Muhammad Umair Khan, Bram Hoex
UNSW, Sydney, Australia
- 1CV.2.28 Impact of Pre-Oxidation Treatment on Al₂O₃ Layers for High-Performance Silicon Solar**
Kyung Taek Jeong, Minsoo Jeong, Yong-Jin Kim, Hee-eun Song, Min Gu Kang
KIER, Daejeon, South Korea
- 1CV.2.42 High Efficiency SHJ Silicon Bottom Cell with IWO/SiO₂ Stack Layer for III-V/Si Tandem Photovoltaics**
Yoshio Ohshita¹, Kyotaro Nakamura¹, Hyunju Lee², Atsushi Ogura²
¹ Toyota Technological Institute, Nagoya, Japan; ² Meiji University, Kanagawa, Japan
- 1CV.2.43 Exploring the Use of Heated ITO Depositions for Large-Area TOPCon-Based Perovskite/Silicon Tandem Solar Cells on Industrial Wafers**
Erik M. Spaans¹, Gabby De Luna¹, John Derek Arcebal¹, Yu Jin Yang¹, Jinhyun Kim¹, Yong Ryun Kim¹, Selvaraj Venkataraj¹, Pradeep Padhamnath², Armin Aberle¹
¹ SERIS, Singapore; ² AGH University of Krakow, Poland
- 1CV.2.44 Design and Fabrication of EU Project Nexus Industrial PERC/TOPCon Bottom Cell with Enhanced Performance for Perovskite-Si Tandem Solar Cells**
Hisham Nasser¹, Yigit Mert Kaplan¹, Eni Muka¹, Melisa Korkmaz Arslan¹, Berkay Uygun¹, Gokhan Altiner¹, Ozan Aydin¹, Delfina Munoz², Perrine Carroy², Henry Snaith³, Rasit Turan¹
¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² CEA-INES, Le Bourget-du-Lac, France; ³ University of Oxford, United Kingdom
- 1CV.2.45 Passivation of TOPCon Bottom Cell for Perovskite/Si Tandem Devices via RF-Sputtered ITO:H₂**
Francisco José Pérez-Zenteno¹, Reyu Sakakibara², Thibault Schaller², Julien Hurni², Franz-Josef Haug², Eric Garcia-Hemme¹, Enrique San Andrés Serrano¹
¹ UCM, Madrid, Spain; ² EPFL, Neuchâtel, Switzerland
- 1CV.2.60 On the Mechanism Behind the Improved Passivation Performance at the TiO_x/c-Si Heterointerface Through Forming Gas Annealing**
Yuto Michishita¹, Shohei Fukaya¹, Kazuhiro Gotoh², Yasuyoshi Kurokawa¹, Noritaka Usami¹
¹ Nagoya University, Japan; ² Niigata University, Japan

- 1CV.2.61 Temperature Distribution in c-Si PV Modules Unraveled by Detailed Thermal Modeling**
Špela Tomšič, Benjamin Lipovšek, Matevž Bokalič, Marko Topič
University of Ljubljana, Slovenia
- 1CV.2.62 Reverse Analysis of Constitutive Properties of Screen-Printed Silver of Silicon Heterojunction Solar Cells from Nanoindentations**
Pei-Chieh Hsiao¹, Jack Colwell², Daniel Chen², Chris Huang², Vince Allen², Alison Lennon¹, Renate Egan¹
¹ UNSW, Sydney, Australia; ² SunDrive Solar, Kurnell, Australia
- 1CV.2.63 A Reactive Molecular Dynamics Simulation of Silicon Nanocrystal Growth in Silicon Oxide Nanolayers**
Genta Tamura¹, Kazuhiro Gotoh², Noritaka Usami³, Takashi Tokumasu¹
¹ Tohoku University, Sendai-shi, Japan; ² Niigata University, Japan; ³ Nagoya University, Japan
- 1CV.2.64 Status and Prospects of Solar Cell Characterization**
Klaus Ramspeck, Jonas Horn, Michael Meixner
halm elektronik, Frankfurt am Main, Germany
- 1CV.2.65 Assessment of Silicon Heterojunction and TOPCon Solar Cells Technologies at Low Illuminations**
Rupendra Kumar Sharma
Czech Technical University, Prague, Czech Republic
- 1CV.2.66 Assessment of the Applicability of Non-Contact Quantum Efficiency Measurements to Various Solar Cell Architectures**
Hedayatullah Karimy, Stefan Eiternick, Marko Turek
Fraunhofer CSP, Halle (Saale), Germany
- 1CV.2.67 Surface Passivation Study of Industrial Grade Gallium Doped P-Type c-Si Wafer Using Plasma-Enhanced ALD Deposited Al₂O₃ Layer**
Rajesh Maurya, Rajesh Kanakala, Namitha Dsouza, Somnath C. Roy, Jatindra K. Rath
IIT Madras, Chennai, India
- 1CV.2.68 Quality Activation Maps: Estimation of Spatially Resolved IV-Parameter Maps for Solar Cells based on Inline Measurements**
Philipp Kunze, Wolfram Kwapil, Stefan Rein, Matthias Demant
Fraunhofer ISE, Freiburg, Germany
- 1CV.2.69 High-Throughput Contactless Imaging of Series Resistance in Solar Cells using Line-Scanning Technique**
Tanushree J. B. Nath, Yan Zhu, Lucas Ehret, Shuai Nie, Ziv Hameiri
UNSW, Sydney, Australia
- 1CV.2.70 Applying Materials Characterization Methods to Reveal Defects in and Configuration of Commercial Silicon Solar Cells**
Theresa Magorian Friedlmeier¹, Wolfram Hempel¹, Clementine Warres², Roland Einhaus¹
¹ ZSW, Stuttgart, Germany; ² Naturwissenschaftliches und Medizinisches Institut, Reutlingen, Germany



1CV.2.71 Study for Decay Trend of the Solar Cell under Varied Radiation Dose
Yean-San (Mickey) Long¹, Cheng-Wen Kuo², Yung-Tsung Liu¹, Min-An Tsai¹,
Ta-Ming Kuan², Cheng-Yeh Yu²
¹ ITRI, Hsinchu, Taiwan; ² TSEC Corporation, Hsinchu, Taiwan

1CV.2.72 Work Function Investigation for Electron-Selective (Dopant Free) Back Contact for C-Si Heterojunction Solar Cells
Laura Lancellotti¹, Eugenia Bobeico¹, Marco Della Noce¹, Ilaria Maticena²,
Giuseppe Nasti¹, Elena Santoro¹, Pietro Scognamiglio¹, Iurie Usatii¹, Paola
Delli Veneri¹, Lucia Vittoria Mercaldo¹
¹ ENEA, Portici, Italy; ² University Federico II, Naples, Italy

1CV.2.73 Analysis of Series Resistance Effects in Current Solar Cell Technologies
Yeray Mateos, Alona Otaegi, Eneko Cereceda, Vanesa Fano, Nekane
Azkona, Eneko Ortega, José Rubén Gutiérrez, Juan Carlos Jimeno
UPV/EHU, Bilbao, Spain

1CV.2.74 Analyzing Reverse I-V Curve Characteristics across Solar Cell Technologies
Ahmad Hashem¹, Hugo Sanchez¹, Leila Mortazavifar¹, Bengt Jaeckel², Ralph
Gottschalg²
¹ Anhalt University of Applied Sciences, Köthen, Germany; ² Fraunhofer CSP, Halle (Saale),
Germany

VISUAL PRESENTATIONS 2CV.3

17:00 - 18:30 Perovskite-based Tandems and Multijunctions

2CV.3.1 Overview and Perspective of Hybrid Si Tandem Solar Cells and Modules
Masafumi Yamaguchi¹, Patrick Schygulla², Ivona Kafedjiska³, Frank Dimroth²,
Rutger Schlatmann³
¹ Toyota Technological Institute, Nagoya, Japan; ² Fraunhofer ISE, Freiburg, Germany; ³ HZB,
Berlin, Germany

2CV.3.2 Impact of Self-Assembling Molecules in Efficient Fully-Textured Perovskite/Silicon Tandem Solar Cells
Christian Schwarz¹, Patricia S. C. Schulze¹, Oliver Fischer¹, Jann B. Landgraf¹,
Oussama Er-Raji¹, Georgios Loukeris², Juliane Anna Borchert¹
¹ Fraunhofer ISE, Freiburg, Germany; ² University of Freiburg, Germany

2CV.3.3 Degradation and Total Lifetime Energy Yield of Perovskite/Silicon Tandem Solar Cells
Seyedamir Orooji, Ulrich Wilhelm Paetzold
KIT, Karlsruhe, Germany

2CV.3.4 Co-Evaporated Perovskite Absorbers for Textured Monolithic Perovskite/Silicon Tandem Solar Cells
Lars Korte, Viktor Škorjanc, Matthew Leyden, Marcel Roß, Stefanie Severin,
Aleksandra Miaskiewicz, Angelika Harter, Dorothee Menzel, Suresh
Maniyarasu, Bernd Stannowski, Steve Albrecht
HZB, Berlin, Germany

2CV.3.5 Lamination of Tandem Perovskite Silicon 4T Modules: a Step toward Industrialization
Alessandro Lanuti, Elisa Nonni, Mattia Della Monaca, Aldo Di Carlo,
Francesco Di Giacomo
Solertix, Rome, Italy

2CV.3.6 Highly-Efficient Textured Three-Terminal Perovskite/Silicon Tandem Solar Cells
Mohammad Gholipour¹, Michael Rienäcker², Xuzheng Liu¹, Paul Fassl¹,
Renjun Guo¹, Robby Peibst², Ulrich Wilhelm Paetzold¹
¹ KIT, Karlsruhe, Germany; ² ISFH, Hamelin, Germany

2CV.3.7 Laminated All-Perovskite Tandem Photovoltaics with Transparent Conductive Adhesives
Hang Hu, Ting Pan, Roja Singh, Bahram Abdollahi Nejand, Ulrich Paetzold
KIT, Karlsruhe, Germany

2CV.3.8 Spatial Atomic Layer Deposition of Aluminium doped Zinc Oxide as Recombination Junction for Tandem Solar Cells
Floor Souren¹, Jons Bolding¹, Hindrik De Vries¹, Perrine Carroy², Paul Fassl³,
Joshua Damm³, David McMeekin⁴, Sam Teale⁴, Seongrok Seo⁴
¹ SALD, Eindhoven, The Netherlands; ² CEA, Grenoble, France; ³ KIT, Karlsruhe, Germany; ⁴
University of Oxford, United Kingdom

2CV.3.9 Consensus Statement Regarding Reliability Testing of Perovskite-Based Tandems
Daniel Tune¹, Ivona Kafedjiska², Erkan Aydin³, Delfina Muñoz⁴, Mark
Khenkin², Ulrich Paetzold⁵, Quentin Jeangross⁶, Solenn Berson⁴, Carolin
Ulbrich², Kaining Ding⁷, Ivan Gordon⁸, Juliane Borchert⁹, Stefan Glunz⁹,
Michael Saliba¹⁰
¹ ISC Konstanz, Germany; ² HZB, Berlin, Germany; ³ LMU, Munich, Germany; ⁴ CEA, Le
Bourget-du-Lac, France; ⁵ KIT, Karlsruhe, Germany; ⁶ CSEM, Neuchâtel, Switzerland; ⁷ FZJ,
Jülich, Germany; ⁸ imec, Leuven, Belgium; ⁹ Fraunhofer ISE, Freiburg, Germany; ¹⁰ IPV,
Stuttgart, Germany

2CV.3.10 Exploring Novel Oxide-Perovskites for Tandem PV Applications
Anjali Choubey, Holger von Wenckstern, Ola Nilsen, Henrik Hovde Sønsteby
University of Oslo, Norway

2CV.3.11 Stability of Silicon/Perovskite Tandems under Outdoor Conditions: the Importance of Considering Packaging and Architecture Variations
Helen Bristow, Yannick Roujol, Amandine Boulanger, Nathalie Nguyen,
Vincent Barth, Noella Lemaitre
CEA, Le Bourget-du-Lac, France

2CV.3.12 Exploring the Potential of Two-Terminal Voltage-Matched Perovskite-CIGSe Tandem Solar Cells for Improved Energy Yield
Yokozuna Schirmer¹, Nicolas Otto¹, Guillermo Farias-Basulto², Rutger
Schlatmann², Klaus Jäger³, Bert Stegemann¹, Christof Schultz¹
¹ HTW, Berlin, Germany; ² PVcomB / HZB, Berlin, Germany; ³ HZB, Berlin, Germany



2CV.3.13 Perovskite/ Silicon Tandem Solar Cells with Dopant Free Silicon Heterojunction Bottom Cell

Laura Lancellotti¹, Eugenia Bobeico¹, Maria Federica Caso¹, Marco Della Noce¹, Giuseppe Nasti¹, Gennaro Vincenzo Sannino², Elena Santoro¹, Pietro Scognamiglio¹, Iurie Usatii¹, Paola Delli Veneri¹, Lucia Vittoria Mercaldo¹
¹ ENEA, Portici, Italy; ² University of Naples Federico II, Italy

2CV.3.14 Physical Vapor Deposition Processes for Scaling Monolithic Perovskite Silicon Tandem Solar Cells

Jona Kurpiers, Arman Mahboubi Soufiani, Hajar Moumine, Stefanie Severin, Tobias Bertram, Viktor Skorjanc, Marlene Härtel, Jannik Niels Kleesiek, Alexandros Cruz, Marcel Roß, Angelika Harter, Steve Albrecht, Rutger Schlatmann, Bernd Stannowski
HZB, Berlin, Germany

2CV.3.15 Bifacial 2T Large Area Perovskite-Silicon devices: From Processing to Modules and Outdoor Measurements

Marcel Simor¹, Ryley Ratnasigham¹, Yu Wu², Melvin ten Kate², Hande Ciftipinar², Victor Rosca², Petra Manshanden², Bart Geerligs², Sjoerd Veenstra¹, Valerio Zardetto¹
¹ TNO, Eindhoven, The Netherlands; ² TNO, Petten, The Netherlands

2CV.3.16 Optimizing Interconnection Strategies for Two-Terminal Perovskite-CIGSe Tandem Solar Modules: 3-Step vs. 4-Step Laser Patterning

Nicolas Otto¹, Christof Schultz¹, Tadeus Ranisch¹, Guillermo Farrias-Basulto², Rutger Schlatmann¹, Bert Stegemann¹
¹ HTW, Berlin, Germany; ² PVcomB / HZB, Berlin, Germany

2CV.3.17 Toward Two-Terminal Perovskite/(Ag,Cu)(In,Ga)Se₂ Tandems with Open-Circuit Voltage >2 Volt

Rico Gutzler, Tina Wahl, Erik Ahlswede, Cordula Wessendorf
ZSW, Stuttgart, Germany

2CV.3.18 Optimizing the Hybrid Deposition Method for Ultra-Wide Bandgap Perovskite Designed for Pk/Pk/Si Triple Junction Solar Cells

Selin Seyrek, Cristian Villalobos Meza, Valerie Depauw, Yinghuan Kuang, Hariharsudan Sivaramakrishnan Radhakrishnan, Jef Poortmans, Bart Vermang
imec, Genk, Belgium

2CV.3.19 Elucidating the Process of Accurate Spectral Calibration for Tandem I-V Measurement using Multi-Lamp Light Sources

Antoine Bourgeois¹, Stella Hadiwidjaja², Zoltan Nicot-Senneville², JiaYi Ye², Kwan Bum Choi², Qilin Zhou², Yi Hou²
¹ École Polytechnique, Palaiseau, France; ² SERIS, Singapore

2CV.3.20 Lower Decay and Toward 17.89% Efficiency of n-TOPCon Solar Cell Filtered by the Semitransparent Perovskite Absorber

Yung-Tsung Liu, Yean-San Long, Min-An Tsai, Cho-Fan Hsieh
ITRI, Hsinchu, Taiwan

2CV.3.21 Comprehensive Energy Yield Simulations for Bifacial All-Perovskite Tandem Modules

Urs Aeberhard¹, Vasileios Georgakopoulos-Paltidis¹, Andreas Schiller¹, Roger Häusermann¹, Roman Hiestand¹, Balthasar Bluelle¹, Markus Kohlstädt², Mehrdad Najafi³, Sjoerd Veenstra³, Beat Ruhstaller⁴
¹ Fluxim, Winterthur, Switzerland; ² Fraunhofer ISE, Freiburg, Germany; ³ TNO, Eindhoven, The Netherlands; ⁴ ZHAW, Winterthur, Switzerland

2CV.3.22 Achieving Superior Light Trapping in Perovskite/CIGS Solar Cells with Grating-Enhanced Bilayer Heterojunctions

Mohammad Hossein Mohammadi, Narendra Bandaru, Rasmus Schmidt Davidsen
Aarhus University, Denmark

2CV.3.23 Development of Flexible Monolithic All-Perovskite Tandem Minimodules within the SuperTandem Project

Amina Labiod, Jules Allegre, Polyxeni Tsoulka, Solenn Berson
CEA-INES, Le Bourget du Lac, France

2CV.3.24 Fabrication of Bendable Perovskite/ Silicon Heterojunction Bifacial Tandem Solar Cells

Kimihiko Saito, Kanji Takahashi, Hirotaka Shishido, Ryouyuke Ishikawa, Makoto Konagai
Tokyo City University, Setagaya, Japan

2CV.3.25 Surface Reactions and the Impact of Ions During Aging in Tandem-related High-efficiency Perovskite Solar Cells with 1.68 eV Bandgap

Florian Scheler, Sebastian Berwig, Marcel Roß, Dorothee Menzel, Phillipe Holzhey, Arman Mahboubi Soufiani, Lea Zimmerman, Eike Köhnen, Lars Korte, Steve Albrecht
HZB, Berlin, Germany

2CV.3.26 Improved Optical and Electronic Properties for Highly Efficient All-perovskite Tandem Solar Cells

Philipp Tockhorn, Sebastian Berwig, Yeonghun Yun, Isabella Taupitz, Kevin Prince, Philippe Holzhey, Florian Riesebeck, Stepan Demchysyn, Christiane Becker, Steve Albrecht
¹ HZB, Berlin, Germany

2CV.3.40 Fabrication of FACsPbI₃ Perovskite Solar Cells: Ethylammonium Bromide Both as an Additive and Surface Passivation

Amalraj Peter Amalathas¹, Tereza Staňková², Lucie Landová², Neda Neykova², Jakub Holovský²
¹ University of Jaffna, Sri Lanka; ² Czech Technical University, Prague, Czech Republic

2CV.3.41 Fluorene-Based Passivation Strategy for Enhancing the

NiOx/Perovskite Interface in Inverted Perovskite Solar Cells
Zeynep Gözükar Karabağ, Bahri Eren Uzuner, Aliakber Karabağ, Selçuk Yerci, Görkem Günbaş
ODTÜ-GÜNAM, Ankara, Türkiye



- 2CV.3.42 25.2 % Efficient EDAl₂-Passivated Single Junction Perovskite Solar Cells with Negligible Hysteresis**
Johannes Löhr, Annika Raugewitz, Felix Haase, Larissa Mettner, Verena Steckenreiter, Joachim Vollbrecht, Robby Peibst, Jan Schmidt
ISFH, Emmerthal, Germany
- 2CV.3.43 Self-Assembled Monolayers as Hole Selective Contacts for Perovskite Solar Cells: Surface Charge versus Dipole Moment**
Meng-Hsueh Kuo¹, Naini Jain¹, Neda Neykova¹, Rupendra Kumar Sharma¹, Zhivko Velkov², Chih-Yu Chang³, Jakub Holovsky¹
¹ Czech Technical University, Prague, Czech Republic; ² South-West University, Blagoevgrad, Bulgaria; ³ National Taiwan University of Science and Technology, Taipei, Taiwan
- 2CV.3.44 Improving Perovskite Solar Cell Efficiency through Tailored SAM Blends**
Elshan Asadi, Mustafa Yaşa, Selçuk Yerci
ODTÜ-GÜNAM, Ankara, Türkiye
- 2CV.3.45 Heat Stability of Perovskite Solar Cells with Self-Assembled Electron Transport Layer**
Ryusei Emura¹, Takashi Funaki¹, Kohei Yamamoto¹, Naoyuki Nishimura¹, Hiroyuki Yaguchi², Takuro N. Murakami¹
¹ AIST, Tsukuba, Japan; ² Saitama University, Japan
- 2CV.3.46 Thermal Stability of Perovskite Solar Cells Effected by Amorphous Indium Zinc Oxide**
Kohei Yamamoto, Takuro Murakami
AIST, Tsukuba, Japan
- 2CV.3.47 Long-Term Degradation Analysis of Perovskite Solar Cells Over Three Years**
Mohammad Istiaque Hossain, Yongfeng Tong, Brahim Aissa
QEERI, Doha, Qatar
- 2CV.3.48 Enhancing Semi-Transparent Perovskite Solar Cell Efficiency in Harsh Environments with SiO₂/ITO Transparent Contacts and Anti-Soiling Coatings**
Mohammad Istiaque Hossain, Atef Zekri, Brahim Aissa
QEERI, Doha, Qatar
- 2CV.3.49 Front and Rear Illumination Effects on Bifacial Perovskite Solar Cell Performance**
Mustak Ahmed Ansary¹, Shweta Pal², Gaurav Siddharth¹
¹ National Institute of Technology Calicut, Kozhikode, India; ² IIT Delhi, New Delhi, India
- 2CV.3.50 Homogeneous FA:Cs Cationic Distribution Assisted Humidity Stability and Efficiency Boost in Perovskite Solar Cells**
Muhammed P.U. Haris¹, Chaorong Guo², Yansheng Chen², Peng Huang², Amir Al-Ahmed¹
¹ KFUPM, Dhahran, Saudi Arabia; ² Southwest Jiaotong University, Chendu, China

- 2CV.3.51 The Role of Tetraoctylammonium Chloride in Suppressing Photoinduced Phase Segregation in Mixed-Halide Perovskite Solar Cells**
Amalraj Peter Amalathas¹, Neda Neykova², Archchana Rajavinayagam¹, Lucie Landová², Tereza Staňková², Milan Dopita³, Jakub Holovsky²
¹ University of Jaffna, Sri Lanka; ² Czech Technical University, Prague, Czech Republic; ³ Charles University, Prague, Czech Republic
- 2CV.3.52 How to Tame your Bromine (in a Gas Phase Transport Perovskite Deposition Process)**
Roland Clausen, Joachim Vollbrecht, Robby Peibst
ISFH, Emmerthal, Germany
- 2CV.3.53 Effect of Composition and Exposure to Air on Crystal Structure and Electronic Properties of CsSnI₃ Combinatorial Thin Films**
Marin Rusu, Fatima Akhundova, Susan Schorr, Thomas Unold
HZB, Berlin, Germany
- 2CV.3.54 The Influence of Air and Photons on MAPbI₃ Absorber Materials Measured with In-Situ Time-Resolved Photoluminescence and Photoelectron Spectroscopy**
Philine Stötzner¹, Markus Müller¹, Hannah Schmidt¹, Tobias Schulz¹, Paul Pistor², Roland Scheer¹, Stefan Förster¹
¹ MLU, Halle (Saale), Germany; ² Pablo de Olavide University, Sevilla, Spain
- 2CV.3.55 Innovative Approach to Bismuth-Antimony-Iodide Double Perovskite PV Absorbers via Anion Exchange and Solide-State Reactions**
Oleksandr Stroyuk¹, Oleksandra Raievska¹, Sachin Kinge², Jens Hauch¹, Christoph Brabec³
¹ HI ERN, Erlangen, Germany; ² Toyota Motors Europe, Brussel, Belgium; ³ FAU, Erlangen, Germany
- 2CV.3.56 Study of the Influence of Pb Substitution by Zn²⁺ Ions on the Properties of CsPbBr₃-xI_x Thin Films**
Gerardo Gordillo¹, Oscar Torres¹, Julian Peña²
¹ Universidad Nacional de Colombia, Bogotá, Colombia; ² Universidad del Caribe, Santo Domingo, Dominican Republic
- 2CV.3.57 Measuring the Temperature Coefficients of Perovskite Solar Cells**
Blago Mihaylov, Harald Müllejan, Ewan D. Dunlop
European Commission JRC, Ispra, Italy
- 2CV.3.58 In-Depth Theoretical Study of FAGel₃-Based Novel Perovskite Solar Cells**
Imama Ibrar, Fahd S. Khan
Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Topi, Pakistan
- 2CV.3.59 The Effect of Reduced Graphene Oxide (RGO)-Contacted Cell on the Heat Generation and Thermal Distribution of Lead-Free Cs₃Sb₂I₉ Perovskite Solar Cells: a Simulation Study using COMSOL**
Ali T. Hajjiah, Aliaa Hajjiah
Kuwait University, Safat, Kuwait
- 2CV.3.60 Role of Contact Barriers Height, Charge and Dipole Moment on the Thin-film Solar Cells Performance: Theoretical Insights**
Naini Jain, Meng-Hsueh Kuo, Rupendra Kumar Sharma, Jakub Holovsky
Czech Technical University, Prague, Czech Republic



- 2CV.3.61 Facile Energy Level Tunable Hole-Transporting Layer for Efficient Inverted Perovskite Solar Cells**
Sungjun Hong, Hung Tran, Sejin Ahn, Inyoung Jeong, Junseop Byeon, Donghyeop Shin, Kihwan Kim
KIER, Daejeon, South Korea
- 2CV.3.63 Fabrication of Inverted Multi-Cationic Perovskite Solar Cells by Electrostatic Spraying**
Koichi Yamamoto, Tetsuo Soga, Shinya Kato
Nagoya Institute of Technology, Japan
- 2CV.3.64 Enhancing the Efficiency of Perovskite Solar Cells via Chemical Bath Deposition of SnO₂ on Mesoporous TiO₂ Electrodes**
Wei-Hao Chiu¹, Ying-Kai Huang¹, Min-An Tsai², Cho-Fan Hsieh², Kun-Mu Lee¹
¹ Chang Gung University, Taoyuan City, Taiwan; ² ITRI, Hsinchu City, Taiwan
- 2CV.3.65 Enlarging the Bandgap of Co-Evaporated MapbI₃ with Simple Treatments toward Tandem Application**
Lucia V. Mercaldo, Manuela Ferrara, Anna De Girolamo Del Mauro, Carmen Serpico, Maria Federica Caso, Gennaro V. Sannino, Paola Delli Veneri
ENEA, Portici, Italy
- 2CV.3.66 Wrinkles-Free Surface Morphology and Enhanced Performance of Wide Bandgap Perovskite Film using Double Anti-Solvent Technique**
Owais Ahmad, Jonghoon Han, Jincheol Kim, Shujuan Huang
Macquarie University, Sydney, Australia
- 2CV.3.67 Spatially Non-Uniform Degradation in Perovskite Solar Cells after Indoor and Outdoor Aging**
Ulas Erdil¹, Mark Khenkin¹, Lars Bergenholtz², Marko Remec¹, Guillermo Farias Basulto¹, Quiterie Emery¹, Andreas Bartelt², Antonio Abate¹, Eugene A. Katz³, Rutger Schlattmann¹, Carolin Ulbrich¹
¹ HZB, Berlin, Germany; ² HTW Berlin, Berlin, Germany; ³ Ben-Gurion University of the Negev, Israel
- 2CV.3.68 SCAPS-1D Simulation and DFT Study of Lead-Free BaXSe₃ (x = Zr, Ti, Hf) Chalcogenide Perovskite Solar Cells with Efficiency Exceeding 30%**
Mohamed ALLA, Salma Daim, Hicham Zalrhi, Lahoucine Atourki
Mohammed V University, Rabat, Morocco
- 2CV.3.69 Holistic Performance Optimization of Perovskite Solar Cells via Enhanced Photon Utilization, Retarded Nucleation Kinetics, and Improved Thermal Robustness**
Shuyan Chen, Zhaoyun Jin, Chang Yan
The Hong Kong University of Science and Technology, Guangzhou, China

Thursday, 25. September 2025

VISUAL PRESENTATIONS 4DV.1

08:30 - 10:00 Agrivoltaics Approaches, Experiences, Results | Integrated and Innovative PV Applications

- 4DV.1.1 An Analysis of Agrivoltaics Farms in the Netherlands**
Sebastian Haile, Sara Mirbagheri Golroodbari¹, Wilfried van Sark¹
Utrecht University, The Netherlands
- 4DV.1.2 Beyond Agri PV and Into Climate Resilience**
Gofran Chowdhury¹, Sofia Saavedra Bruno², Yves Rochebeuf¹, Shorouq Sallam¹, Geert Palmers¹, Nikita Shah²
¹ 3E, Brussels, Belgium; ² ORG Architecture & Urbanism, Brussels, Belgium
- 4DV.1.3 Developing a European Cooperation for Agrivoltaics Development: The Experience of the Symbiosyst Project**
Paolo Picchi, Angela Grassi, Giulio Poggiaroni, Maurizio Cocchi, Lucia Montoni
ETA-Florence Renewable Energies, Florence, Italy
- 4DV.1.4 A Techno-Economic Analysis of the Potential of Agrivoltaics in Olive Groves in Jaén, Spain**
João Gabriel Bessa, Pedro J. Perez-Higueras, Fredy A. Sepúlveda-Velez, Diego Lopez Talavera¹
University of Jaén, Spain
- 4DV.1.5 Maximizing Economic Performance of Agrivoltaic Systems through Module Array Design**
Habeel Alam¹, Jenny Nelson², Alona Armstrong¹, Duncan Whyatt¹, Nauman Butt³
¹ Lancaster University, United Kingdom; ² Imperial College London, United Kingdom; ³ Lahore University of Management Sciences, Pakistan
- 4DV.1.6 Unveiling the Specificities of Energy Yield Estimations in Agrivoltaic Tracker Projects: Insights from the French Market**
Khalil Sfar
enoé, Marseille, France
- 4DV.1.7 Bifacial Factors of Agri-Photovoltaics Systems**
Keith McIntosh, Solomon Freer, Malcolm D. Abbott, Bastien J. J. Ardissonne, Benjamin A. Sudbury
PV Lighthouse, Coledale, Australia
- 4DV.1.8 Microclimate and Biodiversity Measurements in Norway's First East-West Tilted Agrivoltaic System**
Erlend Hustad Honningdalsnes¹, Erik Stensrud Marstein¹, Anne Catriona Mehlhoop², Astrid Brekke Skrindo², Heidi Solstad², Heine Nygard Riise¹
¹ IFE, Kjeller, Norway; ² Norwegian Institute of Nature Research, Trondheim, Norway



- 4DV.1.9 A Microclimate Assessment between Photovoltaics Rows: Opportunities for Biodiversity and Agricultural Integration**
Hugo Sánchez Ortiz¹, Sebastian Dittmann¹, Carlos Meza¹, Ralph Gottschalg²
¹ Anhalt University of Applied Sciences, Köthen, Germany; ² Fraunhofer CSP, Halle, Germany
- 4DV.1.10 Performance Analysis of Agrivoltaic System Configurations in Nordic Conditions**
Magda Szarek¹, Sami Jouttijärvi¹, Samuli Ranta², Kati Miettunen¹
¹ University of Turku, Finland; ² TUAS, Turku, Finland
- 4DV.1.11 Irradiance Management for the First Significant Agrivoltaics Demonstration Project in Finland**
Shuo Wang¹, Soroush Moradi Zavie Kord², Antti Lajunen², Hugo E. Huerta Medina¹, Samuli Ranta¹
¹ TUAS, Turku, Finland; ² University of Helsinki, Finland
- 4DV.1.12 An Innovative Agrivoltaic System for Desert Climates with Anti-Soiling, Irradiance Control, and Water Management**
Sagarika Kumar¹, Min Hsian Saw¹, Suniti Singh¹, Shilpi Shital¹, Carlos G. Parrilla², Francois M. Tsombou², Fouad Lamghari², Mauro Pravettoni¹
¹ Technology Innovation Institute, Abu Dhabi, United Arab Emirates; ² Fujairah Research Centre, United Arab Emirates
- 4DV.1.13 Impact of Crop Shading on Electrical Yield of Vertical Bifacial Agri-Photovoltaics**
Simon Lahr¹, Yannick Kloos¹, Lisa-Marie Bieber², Matthew Berwind²
¹ Next2Sun Technology, Dillingen, Germany; ² Fraunhofer ISE, Freiburg, Germany
- 4DV.1.14 Optimizing Light Transmission for Crop Growth: The Innovative Voltiris Agrivoltaic System**
Jacques Levrat¹, Delphine Petri¹, Matthieu Despeisse¹, Christophe Ballif¹, Jonas Roch², Dominik Blaser², Lauriane Gugnot²
¹ CSEM, Neuchâtel, Switzerland; ² Voltiris, Epalinges, Switzerland
- 4DV.1.15 Review of Sensor Technologies for Monitoring Agrivoltaic Systems**
Sara Pereira, José Silva, Luís Fialho, Pedro Horta
University of Évora, Portugal
- 4DV.1.16 Commercially Viable Solar Parks with Improved Soil Quality**
Antonius R. (Teun) Burgers¹, Bas B. van Aken¹, Koen M. de Groot¹, Gertjan J. de Graaf¹, Benjamin W.J. Kikkert¹, I. (Kay) Cesar¹, Friso F. van der Zee², Sander Leone³
¹ TNO, Petten, The Netherlands; ² Wageningen University and Research, The Netherlands; ³ NOVAR green energy systems, Rotterdam, The Netherlands
- 4DV.1.17 Symbiosyst Growing Greener 2.0: the Monitoring Campaign**
Giovanni Borz¹, Enrico Dalla Maria¹, David Moser¹, Gofran Chowdhury²
¹ Eurac Research, Bolzano, Italy; ² 3E, Brussels, Belgium
- 4DV.1.18 Power Output Modelling of a Single-Axis Backtracking Bifacial Module in an Agrivoltaic System in Palaiseau, France**
Moirá Itzel Torres Aguilar¹, Shusen Yu², Anne Migan-Dubois¹, Jordi Badosa Franch², Bouchra Mekhaldi², Johan Parra², Vincent Bourdin³
¹ CNRS, Gif-sur-Yvette, France; ² Polytechnic School, Palaiseau, France; ³ CNRS, Orsay, France

- 4DV.1.19 Agrivoltaics Experimental Case: Growth of Lettuce Crops Inside Pilot Installations with Semi-Transparent PV Materials**
Alejandro Cruz Escabias, João Gabriel Bessa, Jesús Montes Romero, José Luis Lombardo García, Genoveva Carmen Martos de la Fuente, Ana María Fernández Ocaña, Pedro Jesús Pérez Higuera, Florencia Marina Almonacid, Eduardo Fernández Fernández
University of Jaén, Spain
- 4DV.1.20 Modeling of Luminescent Solar Concentrators with Front-Facing Solar Cells for Agrivoltaic Applications**
Marinela Gjestila¹, Leonardo Sollazzo², Giulio Mangherini², Valentina Diolaiti², Nazim Aslam², Donato Vincenzi²
¹ Western Balkans University, Tirana, Albania; ² University of Ferrara, Italy
- 4DV.1.21 Reduced-Order Models for Bifacial PV and Ground Insolation in Agrivoltaics Applications**
Jennifer L. Braid, Isaiah Deane, Norman R. Jost
Sandia, Albuquerque, United States of America
- 4DV.1.22 Yield and PR Estimation for Vertical Agrivoltaics Systems**
Guillermo Moreda Cantero¹, Miguel-Ángel Egido¹, Valero Pascual Gallego¹, Delia Rodríguez Lucas², Miguel-Ángel Muñoz-García¹
¹ UPM, Madrid, Spain; ² Ekilabs, Boston, United States of America
- 4DV.1.23 Biodiversity in Open-Space Photovoltaic Installations: Measures and Examples**
Immanuel Schäfer
Lake Constance Foundation, Radolfzell, Germany
- 4DV.1.24 Semi-Transparent Organic Photovoltaic Cells Integrated in Photosynthetic Cultivation Systems**
David Burrueco-Subirá¹, Thibault Combroux², Pierre Albrand², Jeremy Pruvost², Helene Marec², Mariana Titica², Michele Manca¹
¹ Leitai Technological Center, Terrassa, Spain; ² Nantes University, Saint-Nazaire, France
- 4DV.1.25 Agrivoltaic - Study of Potential in Portugal**
Jeremias dos Santos, José Silva, Luís Fialho, Pedro Horta
University of Évora, Portugal
- 4DV.1.26 Innovative Suspended Cable Agri-PV System: a Cost-Effective Solution for Highly Mechanized and Efficient Agriculture**
Imanol Olaskoaga
Powerfultree, Durango, Spain
- 4DV.1.27 Soil Radiation in Vertical Agrivoltaics for Different Latitudes and Azimuths**
Yannick Kloos, Simon Lahr
Next2Sun Technology, Dillingen, Germany
- 4DV.1.28 Simulation-Based Optimization of Vertical AV to Minimize the Levelized Costs of Electricity**
Fabian Spera, Simon Lahr
Next2Sun, Dillingen, Germany



4DV.1.29 Development of a Simple Tool for Estimating Irradiation Reduction in Agrivoltaic Greenhouses

Paula Sanchez-Friera¹, Guillermo Correa², Luis Pérez²

¹ Solkeys, Gijón, Spain; ² GONVARRI SOLAR STEEL, Corvera - Asturias, Spain

4DV.1.40 Integrating PV into Urban Cycling Infrastructure: Freiburg's Solar Bicycle Path

David Melgar, Christian Braun, Christian Schill

Fraunhofer ISE, Freiburg, Germany

4DV.1.41 Investigating Spectral, Thermal and Positional Effects on the Performance of 5-Junction CPV Cells

Elizabeth M. Hagemann¹, Frederik J. Vorster¹, E. Ernest Van Dyk¹, Ruediger F. Loeckenhoff²

¹ Nelson Mandela University, Port Elizabeth, South Africa; ² AZUR SPACE, Heilbronn, Germany

4DV.1.42 Epoxy Resin and Fiberglass to Integrate PV into Terrestrial Electric Vehicles

Fernando Castro-Gallardo, Jorge Rabanal-Arabach, Sebastián Rodríguez-Romero, Sonia Beltran-Condori, Edward Fuentealba-Vidal

University of Antofagasta, Chile

4DV.1.43 Design, Sizing, and Sensorization of an FPV Power Plant at the Monte Novo Dam, Portugal

Dorivaldo Duarte, José Silva, Luis Fialho, Sara Pereira, Pedro Horta

University of Evora, Portugal

4DV.1.44 Validation of VIPV Modules: Experimental Performance under Atacama Desert Operational Conditions

Fernando Castro-Gallardo, Jorge Rabanal-Arabach, Sebastián Rodríguez-Romero, Sonia Beltran-Condori, Mauricio Trigo-González, Edward Fuentealba-Vidal

University of Antofagasta, Chile

4DV.1.45 Vehicle Integrated PV Potential for Europe - An Energy Measurement Campaign

Christian Braun¹, Alexander Kleinhans¹, Lenneke Sloff², Anna J. Carr³, Bart Kramer⁴, Ali Naweed⁵, Ramakrishnan Kalyanasundaram⁶

¹ Fraunhofer ISE, Freiburg, Germany; ² TNO, Den Haag, The Netherlands; ³ TNO, Petten, The Netherlands; ⁴ Lightyear, Venray, The Netherlands; ⁵ Sono Motors, Munich, Germany; ⁶ IM Efficiency, Helmond, The Netherlands

4DV.1.46 Mobile E-bike Sharing Systems with Integrated Photovoltaics: Electric Mobility Solutions for Large Events in Évora, Portugal

Helena Oliveira, Paulo Carmo, José A. Silva, Luís Fialho, Paulo Infante, Pedro Horta

University of Évora, Portugal

4DV.1.47 Mismatch Losses for Road-Integrated Photovoltaics: Large-Scale Simulations in North Rhine-Westphalia, Germany

Carina Schmitt, Evgenii Sovetkin, Andreas Gerber, Bart E. Pieters
FZJ, Jülich, Germany

4DV.1.48 The Solar Potential of the Railway at Varied Spatial Scales: Portugal as a Case Study

Margarida Luís, Miguel Centeno Brito

University of Lisbon, Portugal

4DV.1.49 Ribbons/Wires lengthening in Photovoltaic Assemblies Exposed to Large Amplitude Thermal Cycling

Jean-Baptiste Charpentier, Julien Gaume, Philippe Voarino

CEA / INES, Grenoble, France

4DV.1.50 The Viability of Bifacial Modules in Floating Photovoltaic Installations: a Target Costing Analysis

Leonardo Micheli¹, Diego Lopez Talavera²

¹ Sapienza University of Rome, Italy; ² University of Jaén, Spain

4DV.1.51 Performance Analysis of Non-Isolated DC-DC-Boost Converter Topologies in VIPV Systems under Variable Irradiance

Sebastián Rodríguez-Romero¹, Jorge Rabanal-Arabach¹, Christian A. Rojas², Mauricio Trigo-Gonzalez¹, Gino Mondaca-Cuevas¹, Fernando Castro-Gallardo¹, Edward Fuentealba-Vidal¹

¹ University of Antofagasta, Chile; ² Federico Santa María Technical University, Valparaíso, Chile

4DV.1.52 Experimental Study on Solar Irradiance Variations of a Vehicle-Integrated Photovoltaics Based on Driving and Module Conditions on Urban Roads

Minji Kim, Jieun Baek

Pukyong National University, Busan, South Korea

4DV.1.53 Monitoring System for Vehicle Integrated Photovoltaics

Jaša Vid Meh Peer, Marko Topič, Marko Jankovec

University of Ljubljana, Slovenia

4DV.1.54 Development of Video Processing Technology for Continuous Analysis of Power Generation on Vehicles

Naoki Mukai, Nobuteru Takeshita, Kenji Araki, Kensuke Nishioka, Yasuyuki Ota

University of Miyazaki, Japan

4DV.1.55 3D Integrated Photovoltaic Surfaces for Portable Applications

Thomas M. Kraft, Riikka Suhonen, Kaisa-Leena Väisänen, Kyösti Heikkinen, Mari Ylikunnari

VTT Technical Research Centre of Finland, Oulu, Finland

4DV.1.56 Assessing the Floating Photovoltaic Potential of the Netherlands

Annanta Kaul, Sara Mirbagheri Golroodbari, Wilfried van Sark

Utrecht University, The Netherlands

4DV.1.57 Fuel Savings Potential of Solar-Assisted City and Intercity Buses in Turkey: A VECTO-Based Simulation Approach

Mirosław Wendeker, Łukasz Grabowski

Lublin University of Technology, Poland

4DV.1.58 Design and Proposal for a Pilot Project of PV-Covered Cycling Lane in Évora, Portugal

Joana Correia, Helena Oliveira, José A. Silva, Luis Fialho, Pedro Horta

University of Évora, Portugal



4DV.1.59 A Research Platform for Evaluating Solar Tracking in CPV Applications Featuring a Custom Control Unit for Precision and Performance Optimization

Imane Ourraoui, Ali Ahaitouf
FST, Fes, Morocco

4DV.1.60 Empirical Study of Establishing Floating Substation Standards for Floating Photovoltaics

Hyunsik Jo, Jieun Lee, Jungi Jung, Donggun Yang
Korea Water Resources, Daejeon-Si, South Korea

4DV.1.61 Quantifying Thermal Dynamics: Measured Data Analysis of FPV Systems in Lake Beilen

Annanta Kaul, Niek van den Nobelen, Sara Golroodbari, Wilfried van Sark
Utrecht University, The Netherlands

4DV.1.62 Development of a Large Knitted Textile Solar Panel

Parvin Ebrahimi, Arash Moghadassian Shahidi, Demosthenes Koutsogeorgis, Carlos Oliveira, Jake Kaner, Tilak Dias, Theodore Hughes-Riley
Nottingham Trent University, United Kingdom

4DV.1.63 Modelling of Marine Assembly Logistics for an Offshore Floating Photovoltaic Plant subject to Weather Dependencies

Lu-Jan Huang¹, Simone Mancini², Minne M. de Jong²
¹ TNO, Leiden, The Netherlands; ² TNO, Eindhoven, The Netherlands

4DV.1.64 Internal Inspection of 3D-Curved PV Modules Using Non-Destructive Techniques

Kaiki Matsubayashi, Kenji Araki, Daisuke Sato, Yasuyuki Ota, Kensuke Nishioka
University of Miyazaki, Japan

4DV.1.75 Sizing Strategy for Green Hydrogen Production: Maximizing PV Utilization and Electrolyzer Efficiency

Carlos Meza¹, Mohammad Nabipour¹, Matthias Ebert²
¹ Anhalt University of Applied Sciences, Köthen, Germany; ² Fraunhofer CSP, Halle, Germany

4DV.1.76 Retrofitting Shipping Containers into Positive Energy Bus Stations with Photovoltaic LVDC Microgrids for Sustainable Transport in Renewable Resource-rich, Harsh Environments

Mohammad Nazifard¹, Erwin Franquet¹, Ahmad Sedaghat², Mohammad Salem², Mohammad Farhat²
¹ Côte d'Azur University, Nice, France; ² Australian University, Kuwait City, Kuwait

4DV.1.77 Comparative Study of Solar PV Water Pumping Systems in India: Transforming Agriculture

Richa Parmar¹, Anmol Ratan Saxena², Prashant Misra¹, Jai Prakash¹
¹ NISE, Gurugram, India; ² NIT, Delhi, India

4DV.1.78 Partial Load Efficiency of Photovoltaics in Direct Coupling to Hydrogen Electrolysis

Marcus Rennhofer, Philipp Mayer-Ullmann, Diana Maria Krainer, Gusztav Ujvari, Janine Lichtenberger, Konrad Kainz, Vassilissa Neussl
AIT, Vienna, Austria

4DV.1.79 Quick Assessment of Solar-to-Chemical Efficiency in Photovoltaic-Driven Electrolyzers: Bridge between Electrochemistry and Photovoltaics

Oleksandr Astakhov, Thérèse Cibaka, Lars Wieprecht, Uwe Rau, Tsvetelina Merdzhanova
FZJ, Jülich, Germany

VISUAL PRESENTATIONS 5DV.2

10:30 - 12:00 Life Cycle Analysis and PV Recycling | Citizens Participation and Awareness

5DV.2.1 The Utilisation of Building Integrated Photovoltaics (BIPV) in the Context of Environmental Labelling

Momir Tabakovic¹, Sune Thorsteinsson², Manuel Trampert¹
¹ University of Applied Sciences Technikum Wien, Austria; ² DTU, Roskilde, Austria

5DV.2.2 Utilisation of High Purity Silicon based Scrap PV Materials in the Production of Advanced Ballistic Technology Materials

Hatice Duman¹, Mehmet Engür², Dilara Akdağ², Çağrı Taha Delikanlı¹, Özlem Coşkun¹, Meriç Çalışkan Arslan¹, Ümit Yurdagül², Murat Sert²
¹ KalyonPV, Ankara, Türkiye; ² KİM Technologies, Kayseri, Türkiye

5DV.2.3 A Prospective Life Cycle Assessment of Silicon-Perovskite Tandem Photovoltaics

Mitchell Van der Hulst¹, Mirjam Theelen², Dorottya Magoss¹, Yiri Massop¹, Sjoerd Veenstra², Niels Van Loon², Ilker Dogan², Gianluca Colletti³, Mark Huijbregts¹, Rosalie Van Zelm¹, Mara Hauck⁴
¹ Radboud University, Nijmegen, The Netherlands; ² TNO, Eindhoven, The Netherlands; ³ FuturaSun, Cittadella, Italy; ⁴ Technical University Eindhoven, The Netherlands

5DV.2.4 Synthesis and Analysis of Polyaniline Properties with Various Counterions for Silver Recovery from Technological Solutions after Silicon PV Cells Leaching

Hanna Rodziejewicz, Anna Kuczynska-Lazewska, Agnieszka Witkowska
Gdansk University, Poland

5DV.2.5 Heat Debonding for Efficient Layer Separation in Photovoltaic Modules with Different Encapsulants

Emma Gottis¹, Florian Ollagnon², Antonin Faes¹, Matthieu Despeisse¹, Hengyu Li¹, Christophe Ballif¹
¹ CSEM, Neuchâtel, Switzerland; ² EPFL, Neuchâtel, Switzerland

5DV.2.6 Recycling Strategies to Valorize EVA Recovered from PV Panels

Raquel Rodriguez, Beatriz Perez, Maialen Chapartegui, Olatz Ollo, Sonia García
TECNALIA, Donostia-San Sebastian, Spain

5DV.2.7 Comparative LCA Analysis of Delamination Methods for Photovoltaic Modules Made of CdTe

Anna Kuczynska-Lazewska
Gdansk University of Technology, Poland



- 5DV.2.8 Design for Repair of PV Modules - a Meaningful or Crazy Idea?**
Gernot Oreski¹, Sonja Feldbacher¹, Anika Gassner², Gabriele Eder², Ioannis Tsanakas³, Timea Bejat³
¹ PCCL, Leoben, Austria; ² OFI, Vienna, Austria; ³ CEA, Le Bourget-du-Lac, France
- 5DV.2.9 European Silicon Light Weight PV System: a Game Changer for Building Decarbonization**
Nouha Gazbour¹, Julien Gaume², Yannick Veschetti²
¹ CEA / INES, Le Bourget-du-Lac, France; ² HELIUP, Le Bourget-du-Lac, France
- 5DV.2.10 Advancing Solar Energy Sustainability: Tackling Photovoltaic Cell Upcycling through Metal Recovery**
Alejandra Vázquez Adán¹, Juan Manuel López Cuéllar¹, Lucía Ríos Moral¹, Luis Jaime Caballero², Nerea Dasilva Villanueva², David Fuertes Marrón², Carlos del Cañizo Nadal², Eduardo Díez Alcántara¹, Araceli Rodríguez Rodríguez¹
¹ Complutense University of Madrid, Spain; ² UPM, Madrid, Spain
- 5DV.2.11 Integrated Carbon Emissions and Production Costs of Metallurgical Grade Silicon Manufacturing**
Le Uyen Kha Doan¹, Nathan Chang², Michelle Vaqueiro Contreras², Rabin Basnet¹, Daniel Macdonald¹
¹ ANU, Canberra, Australia; ² UNSW, Sydney, Australia
- 5DV.2.12 Waste 2 Energy and Commodities – an Offbeat use of Silicon Kerf Loss and other Silicon-Based Waste with Amazing Side Effects**
Wolfram Palitzsch, Arvid Killenberg, Ingo Röver
LuxChemtech, Freiberg, Germany
- 5DV.2.13 DEM-based Machine Learning Method for Particle Separation in Photovoltaic Panel Recycling**
Mariye Jahannoush, Zhouzun Xie, Yansong Shen
UNSW, Sydney, Australia
- 5DV.2.14 Sustainability Strategies for Optimising the use Phase of Photovoltaics: an Overview**
Ana Rosa Gamarra, Yolanda Lechón, Daniel Garraín
CIEMAT, Madrid, Spain
- 5DV.2.15 New Thermomechanical Test Developed to Assess the Recyclability Index of PV Modules**
Cristina Leyre Pinto¹, Asier Murillo¹, Ana María Gracia¹, Felice Alfieri², Nieves Espinosa³, Davide Polverini⁴
¹ CENER, Sarriena-Navarra, Spain; ² Viegand Maagøe, Copenhagen, Denmark; ³ University of Murcia, Spain; ⁴ European Commission DG, Brussels, Belgium
- 5DV.2.16 Efficient Method for Separation and Valorization of Materials from End of Life PV Panel**
Romain Duwald¹, Youcef Karar¹, Fabrice Coustier², Roland Riva², Xavier Mackre-Delannoy²
¹ CEA LITEN/DTNM, Grenoble, France; ² CEA LITEN/DTS, Le-Bourget-du-lac, France
- 5DV.2.17 Innovative Approach for Recycling of End-of-Life Solar Panels via Atmospheric Plasma Pyrolysis**
Kalpana Lodhi, Sushil Kumar
National Physical Laboratory, New Delhi, India

- 5DV.2.18 Towards Zero-Waste Solar Energy: Eco-Friendly Recycling and Reuse Strategies**
Tejendra Kumar Gupta, Richa Kasana, Lekhanshu Singh
Amity University, Noida, India
- 5DV.2.19 Assessing the Impact of Possible Lead Leaching from Perovskite Solar Cells Realistically**
Anika Sidler¹, Bastien Vallat¹, Andreas Schäffer², Markus Lenz¹
¹ FHNW, Murttenz, Switzerland; ² RWTH Aachen University, Germany
- 5DV.2.20 Life Cycle Assessment of Recycling Processes for Desmetallisation of PV Cells: Preliminary Results**
Daniel Garraín¹, Juan-Manuel López-Cuéllar², Eduardo Díez-Alcántara², Araceli Rodríguez-Rodríguez², David Fuertes-Marrón³, Carlos del Cañizo³, Ana-Rosa Gamarra¹
¹ CIEMAT, Madrid, Spain; ² UCM, Madrid, Spain; ³ UPM, Madrid, Spain
- 5DV.2.21 From Waste to Wealth: Linking End-of-Life Photovoltaic Panel Management to the Sustainable Development Goals**
Tayfun Hiz
ODTU-GUNAM, Ankara, Türkiye
- 5DV.2.22 Optimizing Material Recovery from End-of-life Photovoltaic Modules: a Multi-Step Approach**
Aistis Rapolas Zubas¹, Dmitri Goljandin², Remigijus Ivanauskas¹, Egidijus Griškonis¹, Gintaras Denafas¹, Jolita Kruopienė¹
¹ Kaunas University of Technology, Lithuania; ² Tallinn University of Technology, Estonia
- 5DV.2.23 Environmental Benefits of Reusing and Repairing Photovoltaic Modules via Life Cycle Assessment Approach**
Nouha Gazbour¹, Luc Federzoni²
¹ CEA / INES, Le Bourget-du-Lac, France; ² SOLREED, Bourgoin-Jallieu, France
- 5DV.2.24 Material and Social Footprint of Rooftop Photovoltaics in the Basque Country**
Alex Tro-Cabrera, Estitxu Villamor, Rosa Lago-Aurrekoetxea, Leire Urkidi, Gorka Bueno
UPV/EHU, Bilbao, Spain
- 5DV.2.25 Pulsed Laser Induced Silicon Module Delamination for Solar Panel Recycling**
Matthew Murphy, Zibo Zhou, Rong Deng
UNSW, Sydney, Australia
- 5DV.2.26 Europe in 2050 – Material Challenges of Scaling up Photovoltaics**
Olga Kanz, Petra Zapp, Christina Wulf
FZJ, Jülich, Germany
- 5DV.2.27 Delamination of EoL PV Panels due to Temperature Treatment**
Josefina Ottitsch¹, Anika Gassner², Ferozan Azizi³, Gabriele C. Eder², Christoph Einspieler¹, Friedrich Bleicher¹
¹ TU Vienna, Austria; ² OFI, Vienna, Austria; ³ Montan University Leoben, Austria
- 5DV.2.28 Hyperspectral Imaging for Advanced Material Identification and Quantification of processed PV Materials**
Lukas Neumaier¹, Martin De Biasio¹, Gabriele C. Eder², Anika Gassner²
¹ Silicon Austria Labs, Villach, Austria; ² OFI, Vienna, Austria



- 5DV.2.29 Social LCA of Perovskites: Initial Findings and Paths for Improvement**
Anna Barguès¹, Philippe Macé², Melodie de l'Epine¹, Damien Gautier²
¹ Becquerel Institute France, Lyon, France; ² Becquerel Institute, Brussels, Belgium
- 5DV.2.30 Life Cycle Assessment of Photovoltaic Recycling Strategies: Chemical and Thermal-Mechanical Processes**
Juan Antonio Saura, Nieves Espinosa
University of Murcia, Spain
- 5DV.2.31 The Landscape of PV Recycling: Challenges to Make PV an Example of Circular Economy**
Carlos del Cañizo, David Fuertes Marrón
UPM, Madrid, Spain
- 5DV.2.32 Recovery of Metal Contacts and Reutilization of Silicon Substrates from Recycled Solar Cells**
Nerea Dasilva-Villanueva¹, David Fuertes Marrón¹, Luis Jaime Caballero¹, Araceli Rodríguez², Eduardo Díez², Marcos Tierno², Jesús Ángel Muñoz², Alejandro F. Braña³, José Luis Plaza Canga-Argüelles³, Enrique Cánovas⁴, Mariela Menghini⁴, Carlos del Cañizo¹
¹ UPM, Madrid, Spain; ² UCM, Madrid, Spain; ³ Autonomous University of Madrid, Spain; ⁴ IMDEA Nanoscience Institute, Madrid, Spain
- 5DV.2.33 Critical Review of Environmental LCA Methods and their Representation of Current PV Market**
Cristina Polacchi, Atse Louwen, David Moser
Eurac Research, Bolzano, Italy
- 5DV.2.34 Life Cycle Assessment of Building-Integrated Photovoltaics in Europe: Swedish Case Study**
Ilham Ihoume¹, Michiel van Noord², André Augusto¹
¹ Dalarna University, Falun, Sweden; ² RiSE, Stockholm, Sweden
- 5DV.2.35 A Multi-Modal Machine Learning Framework for Improved Health Assessment of End-of-Life PV Modules**
Berhane Darsene Dimd¹, Martin Bellmann¹, Christine Klos²
¹ SINTEF, Trondheim, Norway; ² Buhck Re.Energy, Hamburg, Norway
- 5DV.2.36 Remote Assessment of PV Panel Recyclability using UAV Imagery correlated to Electroluminescence Images**
Christoph Waibel¹, Pieter-Jan Baeck¹, Elias Hafidi²
¹ Flemish Institute for Technological Research (VITO), Mol, Belgium; ² Inflight BV, Brussels, Belgium
- 5DV.2.37 Life Cycle Carbon Footprint Assessment of a Low-Carbon Solar PV Tracker**
André Martins Silveira, Henrique Leonardo Maranduba, Mohit Gupta
Nexttracker, Fremont, United States of America
- 5DV.2.38 Development of a PV Module Leach Testing Database**
Fang Li¹, Sai Tatapudi¹, Stephanie Shaw², Cara Libby², Bulent Bicer¹, Govindasamy Tamizhmani¹
¹ Arizona State University, Tempe, United States of America; ² EPRI, Palo Alto, United States of America

- 5DV.2.39 Cost and Material Estimations for Decommissioning and Repowering Utility-Scale PV Plants**
Cara Libby, Alberto Pico, Robin Bedilion, Anand Kumar
EPRI, Palo Alto, United States of America
- 5DV.2.40 Recent Trends in PV Module Recycling Technologies R&D**
Keiichi Komoto¹, Claire Agraffel², Andrea Danelli³, Marco Tammaro⁴, Carmen Alonso-García⁵, Nieves Espinosa⁶, Anika Gassner⁷, Yansong Shen⁸, Garvin Heath⁹
¹ Mizuho Research & Technologies, Tokyo, Japan; ² CEA, Le Bourget-du-Lac, France; ³ RSE, Milan, Italy; ⁴ ENEA, Portici, Italy; ⁵ CIEMAT, Madrid, Spain; ⁶ University of Murcia, Spain; ⁷ OFI, Vienna, Austria; ⁸ UNSW, Sydney, Australia; ⁹ NREL, Golden, United States of America
- 5DV.2.41 Enabling Innovation Through ESG: A Roadmap for the European PV**
Abeer Ali Khan¹, Paula Sanchez-Friera², Sebastien Lizin³, Samira Aden⁴, Pinar Derin Gure⁵, Jan Clyncke⁶, Ioannis (John) Tsanakas⁷, Marcello Passaro⁸, Perine Fleury⁹
¹ First Solar, Mainz, Germany; ² Solkeys, Gijón, Spain; ³ UHasselt, Belgium; ⁴ HZB, Berlin, Germany; ⁵ METU, Ankara, Türkiye; ⁶ PV Cycle, Brussels, Belgium; ⁷ CEA, Le Bourget-du-Lac, France; ⁸ Sunzest Solar, Rotterdam, The Netherlands; ⁹ Biosphere Solar, Delft, The Netherlands
- 5DV.2.54 Rooftop Solar Explorer: Mapping the Rooftop Solar Potential of 100+ Cities in India**
Shantanu Roy¹, Mahesh Kalshetty², Saptak Ghosh²
¹ CSTEP, Noida, India; ² CSTEP, Bengaluru, India
- 5DV.2.55 Generating Equity, Nurturing Diversity, Energising Resilience for Power against Energy Poverty**
Olgu Birgi, Rita Mergner, Rainer Janssen, Dominik Rutz
WIP - Renewable Energies, Munich, Germany
- 5DV.2.56 Interactive Learning for PV Systems: a Board Game-based Teaching Strategy for Operations and Maintenance**
Melodie de l'Epine¹, Carlos Meza², Brian Azzopardi³
¹ Becquerel Institute, Brussels, Belgium; ² Anhalt University of Applied Sciences, Köthen, Germany; ³ The Foundation for Innovation and Research, Valletta, Malta
- 5DV.2.57 Model for Renewable Energy Education and Career Development**
Jayaprasad Arumughan, Monika Sarkadi, Radovan Kopecek, Kristian Peter
ISC Konstanz, Germany
- 5DV.2.58 Bridging Agriculture and Renewable Energy: European Higher Education Insights**
Henny Grewe¹, Ana María Barrena², Luis Hernandez², Juan Sebastian Eastman³, Carlos Meza¹, Luis E. Tobon³, José Luis Villa⁴
¹ Anhalt University of Applied Sciences, Anhalt, Germany; ² UPV, Valencia, Spain; ³ Xavierian Pontifical University, Cali, Colombia; ⁴ UTB, Cartagena, Colombia



5DV.2.59 Women in Photovoltaics: Experiences and Support Mechanisms

Chiara Busto¹, Hande Eryılmaz², Nikoletta Fodor³, Ivan Gordon⁴, Pinar Derin Gure⁵, Perine Fleury⁶, Ulrike Jahn⁷, Sebastien Lizin⁸, Delfina Muñoz⁹, Paula Sanchez-Friera¹⁰, Ioannis (John) Tsanakas⁹, Büşra Yılmaz¹¹

¹ Eni, Novara, Italy; ² ODTÜ-GÜNAM, Ankara, Türkiye; ³ SolarPower Europe, Brussels, Belgium; ⁴ imec, Genk, Belgium; ⁵ METU, Cankaya, Türkiye; ⁶ Biosphere Solar, Delft, The Netherlands; ⁷ Fraunhofer CSP, Halle (Saale), Germany; ⁸ UHasselt, Belgium; ⁹ CEA, Le Bourget-du-Lac, France; ¹⁰ Solkeys, Gijón, Spain; ¹¹ Kameleon Solar, Roosendaal, The Netherlands

5DV.2.60 AI-Driven Urban Solar Solutions for Energy Communities: Policies, Financing Models, and Social Acceptance

Mahdiyeh Tabatabaei, Ernesto Antonini, Jacopo Gaspari
University of Bologna, Italy

5DV.2.61 Advanced Machine-Learning-Based Analysis of Critics and the Silent Majority regarding the Energy Transition and Photovoltaics on TikTok

Marc Gabriel Schneider, Janek Gehrlein, Jannik Achenbach, Anne Maren Feldhof, Valérie Varney, Eva-Maria Grommes

¹ University of Applied Science Cologne, Cologne, Germany;

VISUAL PRESENTATIONS 5DV.3

13:30 - 15:00 Grid Integration and Flexibility Enablers | Global, Country- and Application-Specific Analysis of PV Deployment Aspects | Costs, Economics, Finance and Markets

5DV.3.1 Polynomial Surface Model-Based Balancing Market Bid Planning and Evaluation for Multi-Site PV Plants

Jindan Cui¹, Xue Fang¹, Takashi Oozeki², Yuzuru Ueda¹

¹ Tokyo University of Science, Japan; ² AIST, Koriyama, Japan

5DV.3.2 Integration of Solar Energy into Electric Mobility Infrastructure

Diego Julián Rodríguez, Jaime Pantoja, Johann Hernández

Francisco José de Caldas District University, Bogota, Colombia

5DV.3.3 Estimating Photovoltaic Power Ramp Rates Using Single Point Irradiance Measurement

Micke Talvi¹, Jan Kleissl², Kari Lappalainen¹

¹ Tampere University, Finland; ² University of California, San Diego, United States of America

5DV.3.4 Photovoltaic Energy Forecasting for a Microgrid using Machine Learning Techniques

Edward Julian Rojas Ortega, Mario Joaquin Illera Bustos, Sergio Basilio

Sepúlveda Mora

UFPS, Cúcuta, Colombia

5DV.3.5 Infinity, a Small-Scale Prototype for Firm-PV Generation

Federico Andreozzi¹, Gianluigi Bovesecchi¹, Richard Perez², Marco Pierro³, Cristina Cornaro¹

¹ University of Rome Tor Vergata, Italy; ² University at Albany, United States of America; ³ EURAC, Bolzano, Italy

5DV.3.6 Optimizing Hybrid Wind-Solar Plants in Brazil: Addressing Curtailment and Constrained-Off Challenges

Letícia Vasconcelos, Luiz Filipe Reis, Lúcio Paiva, Luis Guilherme Castro, Rodrigo Santos

Casa dos Ventos, Fortaleza, Brazil

5DV.3.7 Comparing Approaches for Estimating Residential PV System Orientations

Johan Lindahl¹, Joakim Munkhammar²

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5DV.3.8 Advanced Energy Management System for Solar-Plus-Storage Systems

Demetris Marangis, Panayiotis Herodotou, Andreas Livera, Georgios

Makides, George E. Georghiou

University of Cyprus, Nicosia, Cyprus

5DV.3.9 An Open Virtual Power Plant for Renewable Energy Communities - Strategies for Centralized Batteries

Rita Hogan Almeida, Luis Miguel Carrasco, Javier Ramírez Ledesma, Javier

Martín Rueda, Ana Belén Cristóbal, Laura Palomino, Kiane Alves e Silva,

Luis Narvarte

UPM, Madrid, Spain

5DV.3.10 Reactive Power Optimization in Photovoltaic Systems for Grid Voltage Stability: Comparing the Performance of the PSO and Jaya Algorithms

Sabri Murat Kısakürek¹, Ahmet Serdar Yılmaz², Yusuf Uras²

¹ Kahramanmaraş İstiklal University, Türkiye; ² Kahramanmaraş Sütçü İmam University, Türkiye

5DV.3.11 Validation of a Multistrategy Energy Management System for Battery in PV Plants

Celena Lorenzo¹, Laura Barrutia¹, Luis Narvarte¹, Jesús Heras², Carlos

Awadallah²

¹ UPM, Madrid, Spain; ² Wattkraft, Madrid, Spain

5DV.3.12 Quantifying the Gap: Rule-based vs. Smart Energy Management of Residential PV Self-Consumption with Storage

Carolina Crespo, Rodrigo Amaro e Silva, Miguel Centeno Brito

University of Lisbon, Portugal

5DV.3.13 Cyber-Physical Security of Photovoltaic Inverters: Evaluating Risks to the Electrical Grid from a European Perspective

Stefan Übermasser

AIT, Vienna, Austria

5DV.3.14 Photovoltaic Hosting Capacity in Nordic Distribution Grids

Lauri Aaltonen, Kari Lappalainen

Tampere University, Finland

5DV.3.16 Maximizing Market Value in Solar Power Plants Using Battery Storage Systems

Hossein Rafiee, Sebastian Schäfer, Rasoul Manocherhian

Frankfurt University of Applied Sciences, Frankfurt am Main, Germany



5DV.3.17 Unlimited Pumped Hydro Energy Storage to Support 100% Renewable Energy in Europe

Andrew Blakers
ANU, Canberra, Australia

5DV.3.19 Dynamic Assessment of Energy Flexibility in Italian Residential Buildings: Enhancing Photovoltaic Integration through Smart Thermal Load Management

Paolo Zangheri¹, Silvia Erba², Roberto Armani², Lorenzo Pagliano²
¹ ENEA, Milan, Italy; ² Polytechnic University of Milan, Italy

5DV.3.31 Road to Ecological Transition: the Italian Perspective of the Agrivoltaics Development

Celeste Mellone¹, Giulia Guidetti², Valeria Viti³, Alessandra Scognamiglio⁴, Fabio Salis⁵

¹ Green Horse Advisory, Rome, Italy; ² Green Horse Advisory, Milan, Italy; ³ Legance, Milan, Italy; ⁴ ENEA, Naples, Italy; ⁵ Iberdrola, Rome, Italy

5DV.3.32 Potential of Agrivoltaics in the EU under Different Regulation Scenarios

Julien Van Overstraeten¹, Caroline Plaza², Philippe Macé¹, Elina Bosch¹, Mélodie de l'Epine²

¹ Becquerel Institute, Brussels, Belgium; ² Becquerel Institute France, Lyon, France

5DV.3.33 On the Changing Role of Solar Photovoltaics in Energy Transition Scenarios – Celebrating 50 Years of 100% Renewable Energy Systems Research

Christian Breyer¹, Siavash Khalili¹, Dennis Bredemeier², Dominik Keiner¹
¹ LUT University, Lappeenranta, Finland; ² Leibniz University Hannover, Germany

5DV.3.34 Are We Ready to Handle PV Waste? A Review of PV Recycling Regulations in Europe, US, China, and India

Umer Shahzad, Ian Peters Marius
FZJ, Erlangen, Germany

5DV.3.35 PVGIS 6: a Modern Software for a Future-Proof Public Service to Support the Energy Transition

Nikos Alexandris¹, Olympia Gounari², Alba Santos Rodrigues³, Alexandros Falangas²

¹ European Commission JRC, Ispra, Italy; ² TRASYS International, Brussels, Belgium; ³ Former trainee in the JRC, Ispra, Italy

5DV.3.36 Projected Technical Innovations could solve Silver Demand Crisis in the Terawatt-Scale Photovoltaics Era

Chengjian Xu, Olindo Isabella, Malte Ruben Vogt
TU Delft, The Netherlands

5DV.3.37 Smart Energy System Integration of Photovoltaic: from Strategic and Research Innovation Agenda to EU Project Use-Cases

Pierre-Jean Allet¹, Grazia Barchi², Venizelos Efthymiou³, Gofran Chowdhury⁴, Marion Perrin⁵, Maximilian Schönau⁶, Elham Shirazi⁷, Ioannis (John) Tsanakas⁸

¹ CSEM, Neuchâtel, Switzerland; ² EURAC, Bolzano, Italy; ³ UCY, Dhali, Cyprus; ⁴ 3E, Brussels, Belgium; ⁵ Energy Pool, Le Bourget-du-Lac, France; ⁶ smartblue, Munich, Germany; ⁷ University of Tehran, Belgium; ⁸ CEA, Le Bourget-du-Lac, France

5DV.3.38 Fostering Collaboration of Research Infrastructures and Stakeholders in Europe and Latin America towards Climate-resilient PV Systems: The CACTUS Project

Ioannis (John) Tsanakas¹, Delfina Muñoz¹, Romain Couderc¹, Aitor Marzo², Asier Sanz Martinez³, Atse Louwen⁴, David Moser⁴, Felipe Valencia⁵, Nicole Torres Silva⁵, Luis Alejandro Cardenas Garcia⁶, Fernando Augusto Herrera Leon⁶, Thu Nhi Tran Caliste⁷, Mark Robert Johnson⁸, Sarah Essam T. Mohammed⁹, Jose Vega de Seoane¹⁰

¹ CEA INES, Le Bourget-du-Lac, France; ² University of Granada, Spain; ³ Tecnalia, Bilbao, Spain; ⁴ Eurac Research, Bolzano, Italy; ⁵ ATAMOSTEC, Santiago, Chile; ⁶ National University of Colombia, Bogota, Colombia; ⁷ European Synchrotron Radiation Facility (ESRF), Grenoble, France; ⁸ Institut Laue-Langevin (ILL), Grenoble, France; ⁹ EU SOLARIS, Almería, Spain; ¹⁰ Becquerel Institute, Brussels, Belgium

5DV.3.39 Photovoltaic Solar Energy Integration in the Basic Education Curricula in Brazil

Amanda Mendes Ferreira Gomes¹, Daniel Odilio dos Santos¹, Aline Cristiane Pan², Ricardo Rütther¹

¹ UFSC, Florianopolis, Brazil; ² UFRGS, Tramandaí, Brazil

5DV.3.40 Analysis of the Photovoltaic Systems Construction Capacities and Conditions on the Residential Rooftops in Serbia

Iva Batic
University of Belgrade, Serbia

5DV.3.41 Photovoltaic Development and Landscape Conflicts in Taiwan: Status and Resolutions

Tzuya Wang, Chia-Chen Wang
ITRI, Hsinchu, Taiwan

5DV.3.42 Breeze Project: Advancing PV Implementation in Building Renovations

Duygu Celik¹, Johannes Stierstorfer¹, Claire Morin², Thomas Garabetian², Cristian Pozza³, Francesco Babich³, Akshit Gupta³, Laura Maturi³, Ulrich Filippi Oberegger³, Daniele Antonucci³, Simone Ciuffi³, Pawel Wargocki⁴, Andrei Vladimir Lițiu⁵, Nicolandrea Calabrese⁶, Giovanni Murano⁶, Francesca Caffari⁶, Jerzy Kwiatkowski⁷, Katarzyna Rajkiewicz⁷, Olivier Greslou⁸, Dominique Caccavelli⁸

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5DV.3.43 Integrating Energy Policy into Spatial Planning Frameworks: A Study of Taiwan's Approach

Tzu Han Hung
Industrial Technology Research Institute, Taipei City, Taiwan

5DV.3.58 Revenues at Risk and Mitigation Strategies for Solar PV Plants in Times of Negative Electricity Prices

Philippe Macé¹, Elina Bosch¹, Caroline Plaza², David Moser³, Gaëtan Masson¹

¹ Becquerel Institute, Brussels, Belgium; ² Becquerel Institute France, Lyon, France; ³ Becquerel Institute Italia, Trento, Italy



- 5DV.3.59 The Impact of Photovoltaic Module Recycling on Silver Market Dynamics: Analysis and Projections**
Michael Straub-Mück, Amelie Schischke, Andreas Rathgeber
University of Augsburg, Germany
- 5DV.3.60 Utilization of Small-Scale Solar Power Production in Finnish Grid-Balancing Markets through a Virtual Power Plant**
Eino Kujansivu¹, Aleksi Ojala¹, Juho Ylipaino², Juha Koskela³
¹ Solarigo Systems, Pirkkala, Finland; ² TUAS, Tampere, Finland; ³ Tampere University, Finland
- 5DV.3.61 The Optimal Azimuth and Tilt Angle of BIPV Panels Considering the Prices at Electricity Spot Market**
Iva Batic
University of Belgrade, Serbia
- 5DV.3.62 Supporting EU PV Manufacturing Market through PV Module Recycling**
Elisa Veronese¹, Cristina Polacchi¹, Rama Sharma², Atse Louwen¹, Jan Clyncke³, David Moser¹
¹ Eurac Research, Bolzano, Italy; ² UNSW, Sydney, Australia; ³ PV Cycle, Brussels, Belgium
- 5DV.3.63 Techno-Economic Analysis of Solar Cell Manufacturing in Türkiye**
Hande Karakan Cankul¹, Burak Demir¹, Bülent Arikan¹, Raşit Turan²
¹ ODTÜ-GÜNAM, Ankara, Türkiye; ² METU, Ankara, Türkiye
- 5DV.3.64 Economics on Various Operation Strategies of Grid Supporting Powerplants combining PV+ Batteries**
Gerhard Mütter¹, Diana Julia², Dennis Beckmann³
¹ Gerhard Mütter, Waldneukirchen, Austria; ² Renercor Energy, Ilfov County, Romania; ³ Vensys Elektrotechnik, Diepholz, Germany
- 5DV.3.65 Market Uptake Role of Colored PV: A Stakeholder-Centric Analysis of Facilitating and Restraining Forces**
Bilge Senturk, Pinar Derin-Gure, Gunes Kurtulus
METU, Ankara, Türkiye
- 5DV.3.66 Rooftop PV on Apartment Buildings: Business Models and Experiences**
Christoph von Friedeburg
CF Energy Research-Consulting-Operation, Berlin, Germany
- 5DV.3.67 Techno-Economic Modeling of Industrial-Scale Single-Junction Perovskite Module Manufacturing**
Ian Kenchington¹, Anna Barguès², Melodie de l'Epine², Philippe Macé¹, Gaëtan Masson¹, Akhildev Pillai²
¹ Becquerel Institute, Brussels, Belgium; ² Becquerel Institute France, Lyon, France;
- 5DV.3.69 Photovoltaic Systems as Building Blocks in Highly Electrified Households: Impacts on Self-Consumption and Energy Bills**
Maarten Dörenkämper, Andrei Roncea, Minne de Jong
TNO, Eindhoven, The Netherlands
- 5DV.3.70 An Overview of Patent Application Data in the Field of Photovoltaics, Modern Trends and Emerging Fields**
Mauro Boero, Christian Soltmann
European Patent Office, Rijswijk, The Netherlands

- 5DV.3.71 Quality over Quantity: the Economic Value of High-Quality Energy Storage System in the Renewable Energy Transition**
Anna Ponomarenko, Konstantin Rozanov
CF Energy, Vienna, Austria
- 5DV.3.72 Grid-Scale Battery Energy Storage for Energy Arbitrage Purposes in Chile**
Jorge Saavedra, Francisco Moraga, Maylin Moraga
Fraunhofer Chile Research, Santiago de Chile, Chile
- 5DV.3.73 Decarbonizing Solar PV: Evaluating the Role of Critical Mineral Supply Chains**
Engin Deniz
ENERTRAG SE, Neuville sur Oise, France
- 5DV.3.74 A Financial Model for the Deployment of Korean Farm-Based Photovoltaic System**
Hye-mi Hwang, Seok-whan Ko, Woo-gyun Shin, Young-chul Ju, Jin-Seok Lee
KIER, Daejeon, South Korea
- 5DV.3.86 Driving Global Leadership in the Solar PV Module Value Chain: The Role of Early Adoption and Implementation of IEC Standards**
Deepti Deepti¹, Saurabh Kumar², Sushma Sharma¹, Gaurav Kumar³
¹ SRM University, Sonapat, India; ² PTB, Braunschweig, Germany; ³ MERI College of Engineering and Technology, Bahadurgarh, India

VISUAL PRESENTATIONS 4DV.4

15:15 - 16:45

PV System Engineering

- 4DV.4.1 Durable Bonding of Lightweight Crystalline Silicon PV Modules**
Guy Beaucarne¹, Tobias Hopp², Dominique Culot¹, Jonathan Curon¹
¹ Dow Silicones Belgium, Seneffe, Belgium; ² Sunman Energy EU, Frankfurt, Germany
- 4DV.4.2 Development and Evaluation of New Backtracking Strategies (N-BT and IRR-BT) for Horizontal Single-Axis Solar Trackers**
Gregorio Olivares, Ildefonso Muñoz, Sara Díaz, Ana Gracia
CENER, Sarriena, Spain
- 4DV.4.4 Backtracking 3D: a Novel Approach to Conventional Backtracking Algorithms for Improved PV Performance in Complex Terrains**
Joan Tomás Villalonga Palou, Daniel López Dalmau, Haritz Mirandona Lopez, Carlos Javier Lopes Gomes, Carlos Rossa
Sólida Renewable Energies - Genergia, Madrid, Spain
- 4DV.4.5 Efficient Assessment of Glare Mitigation Techniques near Residential Areas and Land Transportation Infrastructure**
Marta Irena Murkowska, Jon Kobberup, Karina Bredelle
EMD International, Aalborg, Denmark
- 4DV.4.6 PV Off-Grid Systems for Cascade Refrigeration of Pharmaceutical Products, Cooling of Food and Tap Water Treatment in Africa**
Lukas Omlin¹, Kilian Kälin¹, Andreas Reber¹, Paul Gantenbein¹, Mihaela Dudita¹, Kirsten Laaks², Ina Colombo³, Oliver Schmid³, Michael Kauffeld³
¹ OST – University of Applied Sciences, Rapperswil, Switzerland; ² Everflo, Cape Town, South Africa; ³ International Institute of Refrigeration, Paris, France



- 4DV.4.7 Evaluation of Front Eave Load Caused by Snow Accumulation on Photovoltaic Array**
Tadanori Tanahashi¹, Takahiro Chiba², Satoru Adachi³, Hayato Arakawa³, Yuki Tsuno¹, Kazuaki Ikeda¹, Takashi Oozeki¹
¹ AIST, Koriyama, Japan; ² Hokkaido University of Science, Sapporo, Japan; ³ NIED, Shinjo, Japan
- 4DV.4.8 Flexible and Centralized Digital Solution to Support the Energy Assessment Across the Whole Lifecycle of Utility-Scale Solar PV Plants**
Stefano Latella¹, Valerio Sabatini¹, Orazio Privitera², Matteo Carbone¹
¹ ENEL Green Power, Rome, Italy; ² ENEL Green Power, Catania, Italy
- 4DV.4.9 Experimental Set-up for Validation of Maximum Power Point Tracking Algorithms for Photovoltaic Arrays**
Laura Sanchez¹, Gorka Torre¹, Jesus Sanchez², Alexander Maiz², Alain Sanchez-Ruiz², Josu Jugo¹, Eneko Ortega¹
¹ UPV/EHU, Leioa, Spain; ² UPV/EHU, Vitoria-Gasteiz, Spain
- 4DV.4.10 Integration of Supercapacitors in a Solar Photovoltaic Water Pumping System: Case of Koyli Alpha Village, in Ferlo, Senegal**
Badara Mbaw, Serigne Ndiangue Leye, Cheikh Saliou Toure, Senghane Mbodji
Alioune DIOP University, Bambey, Senegal
- 4DV.4.11 Sizing Photovoltaic Self-Consumption Systems through Mismatch Index and Profitability Analysis**
Kiane Alves e Silva, Luis Miguel Carrasco, Eduardo Lorenzo
UPM, Madrid, Spain
- 4DV.4.12 Predicting Shading Losses in Photovoltaic Plants: a Novel Approach**
Daniel López Dalmau, Haritz Mirandona López, Carlos J. Lopes Gomes, Joan Tomás Villalonga Palou, Carlos Rossa
Sólida Renewable Energies - Genergia, Madrid, Spain
- 4DV.4.13 Methodology for the Design of Off-Grid Photovoltaic Systems for Residential Electric Vehicle in Shared Transportation Services**
David Leonardo Rodríguez Salazar, Johann Alexander Hernández Mora
District University of Bogotá, Colombia
- 4DV.4.14 On-Site Quality Control Plan for Battery Energy Storage Systems (BESS) in Renewable Energy Applications**
Sergio Suarez Sanchez, Mario Martinez Gonzalez, Daniel Villoslada Fontán, Jonathan Vilela de la Fuente, Gustavo Navas, Sofia Rodriguez Conde
Enertis Applus+, Madrid, Spain
- 4DV.4.15 Independent Structural Reviews of PV Tracker**
Max Dinkelaker, Fabian Gross, Matthis Bohn, Alf Oschatz
sbp sonne, Stuttgart, Germany
- 4DV.4.16 Performance Evaluation of Installed Bifacial PV Modules: Towards the Ground Albedo Enhancement**
Dounia Dahlioui¹, Anne Gerd Imenes¹, Ingar Alvaro Høye²
¹ University of Agder, Grimstad, Norway; ² Solkraft Sør, Øyslebø, Norway

- 4DV.4.17 Field-Based Evaluation of Small-Scale PV Systems: Compliance and Installation Practices in Finland**
Juho Ylipaino¹, Aki Kortetmäki¹, Marko Ylinen², Kari Kallioharju¹, Juha Koskela³
¹ TUAS, Tampere, Finland; ² Satakunta University of Applied Sciences, Pori, Finland; ³ Tampere University, Finland
- 4DV.4.18 The Impact of Virtual Net-Metering Allocation on Self-Consumption Ratios in Multi-Dwelling Building Photovoltaic Systems**
Aki Kortetmäki¹, Juho Ylipaino¹, Kari Kallioharju¹, Juha Koskela², Pertti Järventausta²
¹ TUAS, Tampere, Finland; ² Tampere University, Finland
- 4DV.4.19 IAM Models and Photovoltaic Energy Yield Simulations**
Felipe Ríos-Ledesma, Laura Barrutia, Javier Ledesma, Luis Narvarte, Eduardo Lorenzo
UPM, Madrid, Spain
- 4DV.4.20 Design and Multi-Objective Optimization of a Photovoltaic System by a Genetic Algorithm**
Khadidjatou Thiaw¹, Amadou Diao², Ami Sadio¹, Senghane Mbodji¹
¹ Alioune DIOP University, Bambey, Senegal; ² UCAD, Bambey, Senegal
- 4DV.4.21 Estimations of a PV Performance Tool Compared against Measured Data**
Katherine Alvino Saavedra¹, Nicolas Zalachas², Maroun Nemer¹
¹ Mines Paris, Palaiseau, France; ² BBS Slama, Clermont-Ferrand, France
- 4DV.4.22 Minimizing the Load Loss Probability (LLP) in a Dairy Sheep Farm Powered by an Isolated Photovoltaic System**
Eduardo Fernández Cabal¹, Ignacio Garcia-Ruiz², Cristina Alonso-Tristán¹
¹ UBU, Burgos, Spain; ² Public University of Navarre, Pamplona, Spain
- 4DV.4.23 Examination of Optimal Design Methods for Large-Scale Photovoltaic System Installed on Sloping Land**
Koshi Matsunaga, Kenji Araki, Yasuyuki Ota, Kensuke Nishioka
University of Miyazaki, Japan
- 4DV.4.24 Estimating Future Soiling Losses using Climate Change Models**
Gerardo Guerra¹, Pau Mercade Ruiz¹, Gaetana Anamati¹, Lars Landberg²
¹ GreenPowerMonitor a DNV company, Barcelona, Spain; ² DNV Denmark, Hellerup, Denmark
- 4DV.4.25 Maximum Power Point Tracking Method for Grid-Connected Photovoltaic Systems Using Maximum Power Line**
Hyoung-Kyu Yang¹, Seok Won Kim¹, Dongmyoung Joo¹, Yong-Su Noh¹, Jin-Hong Kim¹
¹ Korea Electronics Technology Institute, Wonmi-gu, South Korea

