

ANSOLE

WAITRO

WORLD ASSOCIATION of INDUSTRIAL & TECHNOLOGICAL RESEARCH ORGANIZATIONS

# ANSOLE´s 14th Anniversary International Online Conference (A²IOC 2025)
# &
# 1st WAITRO SDG7 Working Group Online Conference (WAITRO-WG7-25)

**21st –22nd (Fri–Sat) February 2025**



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ANSOLE´s 14th Anniversary International Online Conference (A²IOC 2025)
&
1st WAITRO SDG7 Working Group Online Conference (WAITRO-WG7-25)

21st -22nd (Fri-Sat) February 2025

***In partnership with:***

Riga Photonics Centre, Riga, Latvia

Institute of Polymeric Materials and Testing (IPMT), Johannes Kepler University Linz, Austria

World Conference on Photovoltaic Energy Conversion (WCPEC-9)

TEA@SUNRISE Network, Swansea University, Wales, UK

+ Impulsouth Community of Practice

***Co-Hosted by:***

MaSIM, North-West University, Mahikeng, South Africa

Multimedia University of Kenya, Nairobi, Kenya

Building on the success of previous editions, ANSOLE successfully marked its 14th anniversary by organizing the ANSOLE 14th Anniversary International Online Conference (A²IOC 2025) in conjunction with the 1st WAITRO SDG7 Working Group Online Conference (WAITRO-WG7-25).

The conference was organized in partnership with the Riga Photonics Centre, Latvia; the Institute of Polymeric Materials and Testing (IPMT) at Johannes Kepler University Linz, Austria; the World Conference on Photovoltaic Energy Conversion (WCPEC-9); TEA@SUNRISE Network, Swansea University, Wales, UK; and the Impulsouth Community of Practice. It was co-hosted by MaSIM, North-West University, Mahikeng, South Africa, and Multimedia University of Kenya, Nairobi, Kenya.

This global event brought together experts, researchers, and policymakers to discuss a wide range of topics, with SDG7—Affordable and Clean Energy—emerging as the dominant theme.
The conference provided a global platform for knowledge exchange and collaboration, reinforcing ANSOLE's commitment to advancing sustainable energy solutions worldwide.

# ORGANISERS

Prof. Dr. Daniel Ayuk Mbi Egbe, Chairperson and CEO of ANSOLE e.V. (Main Organiser)
Prof. Dr. Paul Burrows, Secretary General of WAITRO, Jitri, Nanjing, China
Prof. Dr. Ashmore Mawire, MaSIM, North-West University, Mahikeng, South Africa
Prof. Dr. David Wafula Wekesa, Multimedia University, Nairobi, Kenya
Ms Lei Hou (Holly), Communication, WAITRO Office, China
Mr Vidvuds Beldavs, Riga Photonics Centre, Riga, Latvia
Ms Nnenna Veronica Ebem, Volunteering Coworker, ANSOLE e.V., Jena, Germany

# Logos of organizing & supporting institutions

# ANSOLE´s 14th Anniversary Celebration on 4 February 2025 in Wagnergasse 25, 07743 Jena, Germany



















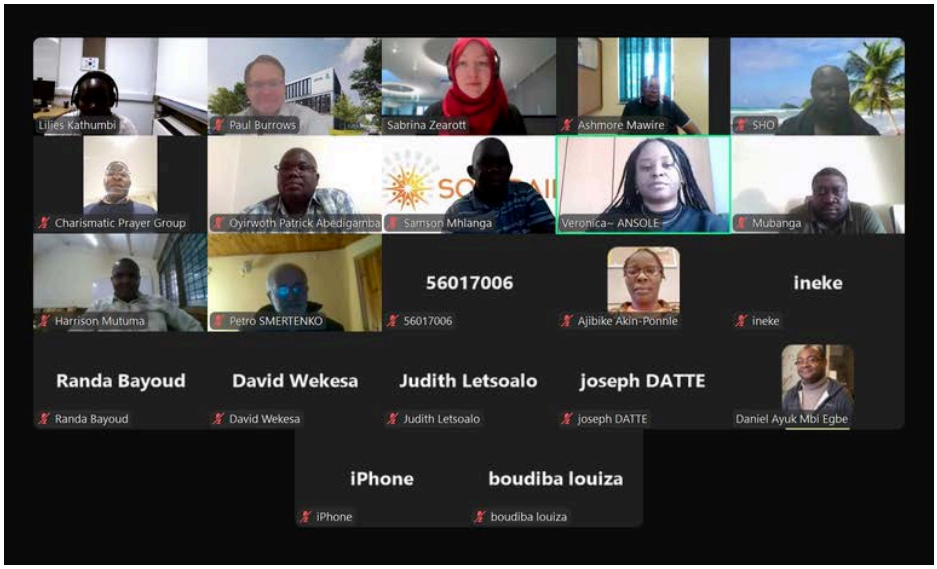


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# About ANSOLE

The African Network for Solar Energy (ANSOLE) promotes research, education and training in the field of renewable energy among Africans as well as non-Africans with a special focus on - and relationships with - Africa.
As outlined in its by-laws, ANSOLE supports non-profit activities in the field of sustainable development and cultural exchange with the aim of strengthening the dialogue between the North and African countries (north-south) and among African countries (south-south) on renewable energy.
It endorses the use of renewable energy to the benefit of the social and economic development of Africa as well as environmental protection through:

- Education and training of African scientists, experts and students
- Exchange of students and visiting scientists
- Workshops, conferences and meetings in Africa
- Organizing and implementing projects and programs on renewable energy
- Promoting capacity building in the use of renewable energy in Africa for all

In addition, ANSOLE is involved since 2018 in facilitating the integration and acceptance of migrants of African origin within the local German society in Jena through the AMAH project (*Anlaufstelle für Menschen afrikanischer Herkunft*-Focal Point for People of African Origin).

ANSOLE has embarked since 2022 in the documentation of the lifestories of people with migration background in Thuringia and beyond by publishing the magazine MIGRANTh (www.migranth.de).

ANSOLE members and those acting in the name of ANSOLE accept and act in accordance with the association's by-laws. The by-laws of ANSOLE can be downloaded here:

https://www.ansole.org/download/2013-11-23-ANSOLE_Satzung_v02.pdf

Mention of conferences, companies, or products in this document does not automatically constitute an endorsement.

**Donations to:** ANSOLE e.V:
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BIC: HELADEF1JEN
ANSOLE e.V.: Register of Associations at the Local Court Jena N°: VR 231505

**To carry out its various activities till February 2025, ANSOLE acknowledges the support from:**

- City of Jena
- Thüringer Ministerium für Migration, Justiz und Verbraucherschutz
- Thüringer Staatskanzlei
- Thüringer Landesverwaltungsamt
- Brot für die Welt
- MigraNetz Thüringen e.V.
- House of Resources
- World University Service Germany e.V.
- Stiftung Nord-Süd-Brücken
- Friedrich Schiller University Jena
- Studierendenwerk Thüringen

# About WAITRO

**About WAITRO**
The World Association of Industrial and Technological Research Organizations is an independent, non-governmental, not-for-profit association founded in 1970 under the auspices of the United Nations Industrial Development Organization. WAITRO brings together innovation, science and technology stakeholders, including research and technology organizations and research universities, and industrial and commercial entities that conduct, foster, and implement scientific and technological innovations on an international scale. WAITRO provides a mechanism for its members and partners to connect, communicate, and collaborate, enabling them to deepen and widen their contributions to solve global challenges and to achieve the United Nations Sustainable Development Goals. In 2023, WAITRO Operations e.V. was set up in Germany.

**The WAITRO Secretariat**
The WAITRO Secretariat is the central coordinating body for WAITRO and WAITRO Operations e.V.'s administrative affairs and strategy, facilitating collaboration and communication among its global members. Established to support WAITRO's mission and vision, the Secretariat was (co-) hosted by international institutions from Canada, the Netherlands, Sweden, Denmark, Malaysia, and Germany. Since 2019, the Secretariat has been (co-) hosted by the Jiangsu Industrial Technology Research Institute (JITRI) in P.R. China and Fraunhofer-Gesellschaft in Germany. In the year of 2023, JITRI become the sole host of the WAITRO Secretariat.

For query, please contact the WAITRO secretariat at info@waitro.org
Or contact Ran Duan, Director of WAITRO Secretariat in China, duanr@jitri.cn

WAITRO
WORLD ASSOCIATION of INDUSTRIAL & TECHNOLOGICAL RESEARCH ORGANIZATIONS

# PROGRAM

**Day 1: Friday, 21. Feb. 2025**

08.30-09:00 Entering the virtual room and networking

09:00-09:05 Welcome and organizational issues by **Prof. Daniel A.M. Egbe**, Chairperson and CEO of ANSOLE e.V.

09:00-09:05 Welcome addresses by the Cohosts **Prof. Ashmore Mawire** and **Dr. David Wafula Wekesa**, and the Secretary General of WAITRO, **Prof. Paul Burrows**

Session 1: Presentation of Institutions & Initiatives

Chairpersons: **Prof. Daniel A. M. Egbe & Nnenna Veronica Ebem**

09:10-09:35 Keynote: Empowering Africa's Energy Future: WAITRO's Role in Achieving SDG 7 by **Dr. Paul Burrows**
JITRI – Jiangsu Industrial Technological Research Institute, Nanjing, China

09:35-09:50 World Conference on Photovoltaic Energy Conversion (www.wcpec-9) in Daejon, Korea by **Prof. Woo Kyoung Kim**
School of Chemical Engineering, Yeungnam University, Yeungnam, South Korea.

09:50-10:05 Durability of hybrid laminates for renewable energy technologies (photovoltaics, wind power & electric vehicles)by **Prof. Gernot Wallner**
Institute of Polymeric Materials and Testing (IPMT), Johannes Kepler University Linz, Linz, Austria

10:05-10:20 Empowering the Global South: The Impulsouth Community of Practice for a Gender-Just Energy Transition by **Mirana Andriarisoa**
Fundación Avina, Calle Evelio Lara, Casa 131b, Ciudad del Saber, Clayton, Ciudad de Panamá, Panamá

10:20-10:35 Advancing the Sustainability of Perovskite Photovoltaics for Energy Access and Circular Economy by **Prof. Matthew Lloyd Davies, Dr. Mark Spratt & Prof. Trystan M. Watson**
Swansea University, SPECIFIC IKC & TEA@SUNRISE, Materials Science and Engineering, Faculty of Science and Engineering, Swansea, UK &
University of KwaZulu-Natal, School of Chemistry and Physics, Durban, South Africa

10:35-10:40 Solar Energy Research at the North-West University (NWU) by **Prof. Ashmore Mawire**
MaSIM, North-West University, Mahikeng, South Africa

10:40-10:45 Identifying the best locations for solar and wind power through energy modelling by Dr. David W. Wekesa Multimedia University of Kenya, Nairobi, Kenya

# PROGRAM

10:45-10:50 Scientists of Kenya Association (ScoKA): Championing the Cause of Kenyan Scientists by **Catherine Nyaruai Njeri** Scientists of Kenya Association- Physical Sciences, Nairobi, Kenya

10:50-11:00 African Network for Solar Energy e.V. (ANSOLE e.V,) International & Local Affairs and Sustainability Practices by **Nnenna Veronica Ebem & Prof. Daniel A. M. Egbe** ANSOLE e.V., Wagnergasse 25, 07743 Jena, Germany

09:10-09:35 Keynote: Empowering Africa's Energy Future: WAITRO's Role in Achieving SDG 7 by **Dr. Paul Burrows**
JITRI – Jiangsu Industrial Technological Research Institute, Nanjing, China

11:00-11:20 **Coffee Break**

09:35-09:50 World Conference on Photovoltaic Energy Conversion (www.wcpec-9) in Daejon, Korea by **Prof. Woo Kyoung Kim**
School of Chemical Engineering, Yeungnam University, Yeungnam, South Korea.

**Session 2: General Topics 1**

Chairpersons: **Prof. Ashmore Mawire & Lilies Kathami Kathumi**

11:20-11:40 Ethical Impacts and Value Conflicts around $H_2$ storage in Salt Caverns in The Netherlands by **Dr. Ineke Malsch** Ethic School & Malsch TechnoValuation, Utrecht, The Netherlands

11:40-11:55 Utilizing Jordan's Wind: Innovative Ways to Achieve SDG 7 Goal and Sustainable Energy by **Omar khazaleh** Royal Scientific Society of Jordan, Amman, Jordan

11:55-12:10 Advancing Solar Energy Deployment in Africa: Challenges, Opportunities, and Pathways for Sustainable Energy Transition, by **Wulfran Fendzi Mbasso et al.** University of Douala, Douala, Cameroon

12:10-12:25 Iridescent Pattern Production from Solid Film Cellulose Nanocrystals Prepared from Coffee Husks by **Catherine Nyaruai Njeri** Dedan Kimathi University of Technology, Kenya & IPMT, Johannes Kepler University Linz, Linz, Austria

12:25-12:40 Celebrating 2 years of MIGRANTh-The Magazine on Migration and Development by **Isabella Schneider & Prof. Daniel A. M. Egbe** ANSOLE e.V., Wagnergasse 25, 07743 Jena, Germany

12:40-12:50 Fostering Astronomy Engagement in Africa through the PACS e-Lab Projects by **Miracle Chibuzor Marcel** Pan-African Citizen Science e-Lab, Federal Capital Territory, Abuja, Nigeria

12:50-13:30 **Lunch Break**

**Session 3: General Topics 2**

**Chairpersons: Dr. David Wafula Wekesa & Nancy Obare**

13:30-13:50 Keynote: Accelerating SDG7 in Sub-Saharan Africa- The Role of ANSOLE and Emerging Technologies by **Vidvuds Beldavs** Riga Photonics Centre, Riga, Latvia

13:50-14:05 Energy Access: Are microgrids the answer? by **A. Meikle & Claudia Bess** Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE), Bridgetown, Barbados.The Technical University of Kenya, Nairobi, Kenya

# PROGRAM

14:05-14:25 Progress in Gasification of Waste: Developments and Challenges by **Lilies K. Kathumbi** School of Computing and Engineering, University of Huddersfield, Huddersfield, United Kingdom

14:25-14:40 The State of Renewable Energy Research in Africa by **Sabrina Zearott** Willy Brandt School of Public Policy, University of Erfurt, Erfurt, Germany

14:40-14:50 Solar powered stove using volcanic stones by **Mariah Kizza** SWEDO Innovations Limited Plot 9912, Bukasa, Wakiso District, Uganda

14:00-15:00 **Coffee Break**

**Session 4: Solar Thermals**

**Chairpersons: Dr. Nadia Hillary Dassi & Catherine Nyaruai Njeri**

15:00-15:15 Fabrication and Experimental Investigation of a Solar Flat Plate Collector for Domestic Water Heating in Cameroon by **Dr. Jerome Ndam Mungwe et al.** Department of Renewable Energy, Higher Technical Teachers Training College, The University of Bamenda, Bamenda, Cameroon

15:15-15:30 Enhancing Thermal Energy Storage Efficiency in Solar Cookers Using HDPE/PLA Blended Phase Change Materials by **Emmanuella Brown Fasinu** Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

15:30-15:45 Integration of Solar-Thermal Energy into Biogas Production by **Eng. Nidal Abdallah & Eng. Omar Saffouri** Royal Scientific Society of Jordan, Amman, Jordan

15:45-16:00 Performance comparison of a wonderbag and Hay basket as thermal insulating materials for domestic cooking by **Dr. Oyirwoth P. Abedigamba, Pius Obia & Prof. Ashmore Mawire** Department of Physics, Kyambogo University, Kyambogo, Kenya & North-West University, Material Science, Innovation and Modelling (MaSIM) Research Focus Area, Department of Physics, Mahikeng, South Africa

16:00-16:15 Development of a new stand-alone indirect solar dryer for apple slices: Thermal profiling, drying characteristics and quality assessment by **Patrick Tsopbou Ngueagni, Prof. Ashmore Mawire & Katlego Diratsagae** Material Science, Innovation and Modelling (MaSIM) Research Focus Area, North-West University, Mahikeng, South Africa

16:15-16:30 Evaluation of Techno-economic Viability of Solar Water Heating System at MMU Executive Hostels by **Harrison Mutuma Muchee, Dr. David Wafula Wekesa, Dr. Solomon Namaswa** Multimedia University of Kenya, Nairobi, Kenya

16:30-16:45 **Closing remarks for the Day 1**

**Day 2: Saturday, 22. Feb. 2025**

9:30-10:00 Entering the virtual room and networking

**Session 5: Photovoltaics 1**

**Chairpersons: Dr. Jerome N. Mungwe & Emmanuella B. Fasinu**

# PROGRAM

10:00-10:20 Advanced organic materials and technologies for solar photovoltaics by **Dr. Petro Smertenko, Dr. Vadym Naumov et al.** Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

10:20-10:40 Functionalization of silicon solar cell back contacts by using carbazole derivatives by **Dr. Petro Smertenko, Dr. Vadym Naumov et al.** Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

10:40-10:55 Techno-Economic Feasibility Analysis of Grid-Connected Solar PV System using Mono-Facial and Bi-Facial Modules in Public Senior High School in Ghana. 'A Case Study of Presbyterian Boys' Senior High School' by **Emmanuel Kengel Dankwa & Dr. Rahimat Oyiza Yakubu.** Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

10:55-11:10 Interface Study and Charge Carrier Dynamics in 2D-3D Heterostructured Mixed-Cation Lead Mixed Halide $FA_{0.75}Cs_{0.25}Pb(I_{0.77}Br_{0.23})_3$ Perovskite by **Dr. Milimo Amos Nalianya et al.** Department of Physics, Masinde Muliro University of Science and Technology, Kenya

11:10-11:25 Impact of front and back contacts on the performances of a-Si:H p-i-n solar cell by Dr. Manelle Hannachi & Prof. Zahir Rouabah Laboratory Physico-Chemistry of Materials, University Amar Telidji, Laghouat, Algeria &Smart materials and renewable energies laboratory, University Mohamed El Bachir El Ibrahimi, Bordj Bou Arreridj, El-Anasser, Algeria

11:25-11:40 **Coffee Break**

**Session 6: Photovoltaics 2**

**Chairperson: Dr. Victor Odari & Judith Letsoalo**

11:40-11:55 The combined effect of thermal treatment and cerium doping on Black Titanium dioxide nanoparticles for perovskite solar cell applications by **Tebogo Selema** Sefako Makgatho Health Science University, South Africa

11:55-12:10 Advancing Perovskite Solar Cells: Optimizing $TiO_2$/Graphene ElectronTransport Layers for Enhanced Performance and Future Standardization by **Tshegofatso Sewela** Sefako Makgatho Health Science University, South Africa

12:10-12:25 Fault Diagnosis in Photovoltaic Systems Using Supervised Machine Learning Models by **Patience Tifuh Taah et al.** Department of Electrical/Electronic Engineering, NAHPI, University of Bamenda, Bamenda, Cameroon

12:25-12:40 Advanced IoT-Based Monitoring System for RealTime Photovoltaic Performance Evaluation: Conception, Development and Experimental Validation by **Dr. Njimboh Henry Alombah et al.** Department of Electrical and Electronics Engineering, College of Technology, University of Bamenda, Bambili, Bamenda, Cameroon

12:40-12:55 Bridging Data Scarcity in Africa: A Novel Synthetic Climatic Model for Machine Learning-Driven Renewable Energy Optimization by **Ambe Harrison, Dr. Njimboh Henry Alombah & Dr. Wulfran Fendzi Mbasso** Department of Electrical and Electronics Engineering, College of Technology (COT), University of Buea, Buea, Cameroon

# PROGRAM

12:55-13:30 Lunch Break

**Session 7: Photovoltaics 3**

**Chairperson: Prof. Louiza Boudiba & Patience Tifuh Taah**

13:30-13:45 Machine Learning Models for Solar PV power Forecasting: A performance Evaluation by **Noel Nkwa Awangum** Department of Electrical/Electronic Engineering, NAHPI, University of Bamenda, Bamenda, Cameroon

13:45-14:00 Numerical Study of RbCsFAPbI1-x$Br_x$ Perovskite for Photovoltaic Application by SCAPS-1D by **Nancy Obare et al.** Department of Physics, Masinde Muliro University of Science and Technology, Kakamega, Kenya

14:00-14:15 Design, Synthesis and Characterization of Conjugated Terpolymers for Photovoltaic Applications by **Rupali Jadhav-Chavan et al.** Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra, India.

**Session 8: Electrochemical Processes**

**Chairpersons: Dr. Rahimat Yakubu & Bernard Wambua**

14:15-14:30 Biosynthesis of silver nanoparticles for electrochemical quantification of sunset yellow by **Dr. Hassan Oriyomi Shoyiga & Prof. Omolola Esther Fayemi** MaSIM, North-West University, Mahikeng, South Africa

14:30-14:45 Electrochemical sensor for the detection of sunset yellow in food using polyaniline/carbon nanopowder nanocomposite modified electrode by **Judith Letsoala** MaSIM, North-West-University, Mahikeng, South Africa

14:45-15:00 Development of green and chemical synthesis routes of Au/MWCNT nanocomposites for the voltammetric detection of methylene blue dye in river water samples by **John Sekele Mokole** MaSIM, North-West University, Mahikeng, South Africa

15:00-15:15 Electrochemical evaluation of ethyl acetate extract of Taxus Baccata as corrosion inhibitor for carbon steel in acidic medium by **Dr. Karima Hanini et al.** Tebessa University, Tebessa, Algeria

15:15-15:30 Electrochemical assessment of the ethanolic extract of an Algerian flora species as an additive in zinc electroplating by **Hadjer Ghalloussi** Tebessa University, Tebessa, Algeria

15:30-15:45 Square Wave Voltammetry Determination of Iron Concentration at Screen Printed Modified- SPEEK-PANI Electrode by **Kabelo S. Banda & Prof. Omolola E. Fayemi** Material Science Innovation and Modelling (MaSIM) Research Focus Area, Faculty of Natural and Agricultural Sciences, North-West University, Mafikeng, South Africa

**Session 9: Other Topics**

**Chairpersons: Prof. Omolola Esther Fayemi & Noel Nkwa Awangum**

15:45-16:00 International Institute of Refrigeration (IIR) Sustainable Cooling Funded Projects by **Dr. Ina Colombo** The International Institute of Refrigeration (IIR), Paris, France

16:00-16:15 Comparison of the Performance of Biodiesel from Jatropha and Castor Oils in an Unmodified Diesel Engine by **Dr. Nadia Hillary Dassi Djoukouo et al.** Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon

# PROGRAM

16:15-16:30 Assessment of Lead Concentration in Surface Soil in the Industrial Areaby **Dr. Mirela Alushllari & Dr. Silvana Mico** University of Tirana, Tirana, Albania

16:30-16:45 Preliminary screening of phytochemicals in a plant species from eastern Algeria by **Randa Bayoud** Tebessa University, Tebessa, Algeria

16:45-17:00 Impact of mining iron dust on the phenolic antioxidants, and biological activities of Atriplex halimus L. by **Prof. Louiza Boudiba et al.** Tebessa University, Tebessa, Algeria

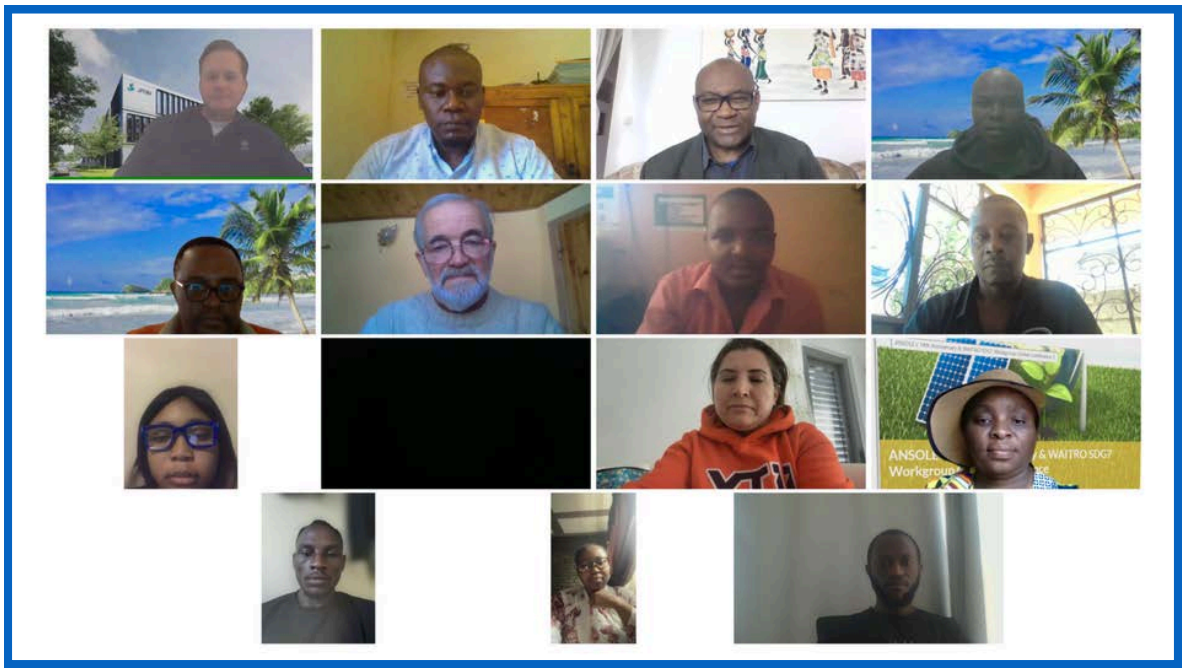
Extraction and characterisation of hibiscus acetosella leaves' dye and its application to cotton and polyester fabrics using mordants by **Bernard Wambua** Dedan Kimathi University of Technology, Kenya & IPMT, Johannes Kepler University Linz, Linz, Austria

17:00-17:15 Design and Synthesis of Anthracene-Based Conjugated Polymers via Horner-Wadsworth-Emmons Polyolefination for Enhanced Photovoltaic Performance by **Prof. Sameh Boudiba et al.** Laboratory of Applied Chemistry and Renewable Energies (LACRE), Echahid Cheikh Larbi Tebessi University, Constantine Road 12002, Tebessa, Algeria.





*Zoom meeting on the 22.02.2025*



***Empowering Africa's Energy Future: WAITRO's Role in Achieving SDG 7***

*Paul Burrows, Vice President,*
*JITRI – Jiangsu Industrial Technological Research Institute, Nanjing, China*

**Abstract**

As the world accelerates its efforts to meet the United Nations Sustainable Development Goal (SDG) 7—ensuring access to affordable, reliable, sustainable, and modern energy for all—WAITRO (World Association of Industrial and Technological Research Organisations) can play a pivotal role. By fostering collaboration among leading research institutions, industry experts, and policymakers, WAITRO can drive innovative solutions tailored to a region's unique energy challenges. These include expanding renewable energy access, improving energy efficiency, and supporting technological advancements that promote sustainable development. For African nations, WAITRO's broad and strong membership could support initiatives that catalyse local capacity-building, stimulate energy research, and strengthen regional partnerships, empowering the continent to leapfrog traditional energy systems and embrace more sustainable, inclusive energy pathways.

**Biography**



Dr Burrows currently serves as the Vice President of the Jiangsu Industrial Research Institute (JITRI) in Nanjing, China, where he is responsible for leading the WAITRO Secretariat (World Association of Industrial and Technological Research Organisations) as Secretary General. JITRI is an independent organisation funded by Jiangsu Province to accelerate development by priming the pump of industrial innovation, which has now expanded to include Shanghai and the entire Yangtze Delta region under the umbrella of a National Innovation Centre (NICE).

Dr Burrows has 35 years of research experience, including both executive government and industry leadership. He served as Senior Vice President for R&D at the Institute of New Energy, Shenzhen, China, which was a private, non-profit technology development organisation. He also worked for KB Science, serving as Chief Research Development Officer. His work there included leading clients on strategy, team science and competitive proposal development for large-scale centre proposals.

Paul obtained a PhD in Physics from Queen Mary College, University of London, in 1989, where he worked on the design and fabrication of molecular electronic devices. He was a research scientist in the Frontier Research Program at the RIKEN Institute in Japan and also held research appointments at the University of Southern California and Princeton University, where he was a research scholar from 1997 to 2000. He contributed to the early days of Universal Display Corporation (Nasdaq listed in 1996) and is a co-inventor of phosphorescent organic light-emitting devices (OLEDs) and stacked, colour-tunable OLEDs. He subsequently joined Pacific Northwest National Laboratory (PNNL) as a Laboratory Fellow in the Energy Science and Technology Directorate, where he managed the successful Nanoscience and Nanotechnology Initiative (funded at over $5 million) and built a research programme in solid-state lighting with the DOE along with a > $1 million/year OLED research group at PNNL. He won a Federal Laboratory Consortium for Technology Transfer award for excellence in technology transfer in 2002 for the thin film encapsulation technology that formed the basis of a second startup, Vitex Systems, sold to Samsung in 2010.
With a professional career that now spans the UK, USA, Japan and China, Paul crosses cultural boundaries and works effectively with a broad range of clients. He has over 110 publications in refereed journals and is a co-inventor of 124 issued U.S. patents (350 worldwide) in the fields of organic semiconductors, thin film technology and solid-state lighting. Email: burrows@jitri.cn

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**World Conference on Photovoltaic Energy Conversion (www.wcpec-9) in Daejon, Korea (https://www.wcpec9-korea.com)**

Woo Kyoung Kim
School of Chemical Engineering, Yeungnam University, Yeungnam, South Korea.

Abstract

The World Conference on Photovoltaic Energy Conversion (https://www.wcpec9-korea.com) will be held in Daejeon, Korea, from Sunday 15 November to Friday 20 November 2026. WCPEC-9 is hosted by the Korea Photovoltaic Society (KPVS), which is leading Korea's photovoltaic research and development, industry-academic research cooperation, and other initiatives. The KPVS has grown to over 2,000 members. KPVS and many Korean researchers have made great contributions to the PV industry. Attending WCPEC-9 is not only an opportunity to interact with world leaders in photovoltaics, but also to discover Korea and in particular the host city of Daejon. African participants are welcome to attend.



**Biography**
Prof. Woo Kyoung Kim is a professor in the Department of Chemical Engineering at Yeungnam University, Korea. He received his B.S. degree in chemical engineering from Sung Kyung Kwan University (1994), his M.S. degree in chemical engineering from Seoul National University (1996), and his Ph.D. degree in chemical engineering from the University of Florida (2006). He also spent a year as a postdoctoral researcher at the Institute of Energy Conversion at the University of Delaware. His current research focuses on thin film photovoltaics, bifacial Si PV modules and their applications. He has been an Associate Editor of the IEEE Journal of Photovoltaics since 2014. He is the main organiser of WCPEC-9 in Daejon, Korea, in 2026. Email: wkim@ynu.ac.kr

***Durability of hybrid laminates for renewable energy technologies (photovoltaics, wind power & electric vehicles) Gernot M. Wallner***

***Christian Doppler Laboratory for Superimposed Mechanical-Environmental Ageing of Polymeric Hybrid Laminates (CDL-AgePol), Institute of Polymeric Materials and Testing (IPMT), Johannes Kepler University Linz, Altenberger Str. 69, A-4040 Linz, Austria. Email: gernot.wallner@jku.at***

***Abstract***
*Advanced polymeric/inorganic multi-layer laminate structures are of prime interest to a range of novel technology fields such as in the renewable energy sector. The near-service conditions in hybrid laminates typically consist of superimposed mechanical stresses and environmental factors. In many of the applications of such polymeric hybrid laminates, debonding between the laminate layers is a common damage and failure mechanism. However, resulting from the multi-layer laminate structure and the overall mechanical-environmental loading conditions, the specific loading conditions at the interfaces are highly complex, and the underlying mechanisms of ageing-induced delamination are as yet poorly understood.*

*Hence, novel environmental fracture mechanics methods allowing for delamination crack growth investigations to determine the kinetics of delamination in hybrid laminates under superimposed mechanical-environmental conditions will be presented and discussed. These methods are applied to a range of laminate materials (electrical steel; silicon; glass; epoxy resins; ethylene-based copolymers), for which the material structure and the processing conditions are varied systematically to deduce structure-processing-property-performance correlations. Regarding the environmental conditions, dry and humidified air as well as aqueous or oleaginous fluids are considered at temperatures below and above the glass transition of the polymeric adhesive layer. For photovoltaic module laminates it is revealed that under hot-humid conditions acetate-based comonomers trigger the formation of acidic degradation products and the diffusion of sodium ions from silicate glass into the fracture process zone, resulting in brittle failure at the glass/polyolefin encapsulant interface. The debonding performance of electrical steel/epoxy laminates, which are of relevance for wind power generators or electric engines, is highly dependent on the epoxy equivalent weight and the OH-functionality of the resin, but also the type of heat carrier fluid.*

***Keywords: hybrid laminates, fracture mechanics, debonding, durability.***
***Acknowledgements: The financial support of the Austrian Federal Ministry for Digital and Economic Affairs, the National Foundation for Research, Technology and Development and the Christian Doppler Research Association is gratefully acknowledged.***



**Biography**
Prof. Dr Ing. Gernot Wallner studied polymer engineering and science at the University of Leoben, where he received his diploma in April 1994 and his doctorate in November 2000. He habilitated on functional polymer materials at the same institution in June 2008. Since January 2010, he has been a member of the Institute of Polymeric Materials and Testing (IPMT) of the Johannes Kepler University Linz, Austria, where he is currently an extraordinary university professor and head of the Christian.
Doppler Laboratory for Superimposed Mechanical-Environmental Ageing of Polymeric Hybrid Laminates. His research interests are polymeric materials and sustainable development, as well as polymer durability and regenerative resources.
Email: gernot.wallner@jku.at URL: www.jku.at/en/institute-of-polymeric-materials-and-testing/
Google Scholar: https://scholar.google.at/citations?user=65ohDOcAAAAJ&hl=de
Orchid ID: https://orcid.org/0000-0002-7431-6679

***Advancing the Sustainability of Perovskite Photovoltaics for Energy Access and Circular Economy***

***Matthew Lloyd Davies[1,2]*, Mark Spratt[1] and Trystan M. Watson[1]***
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***2.University of KwaZulu-Natal, School of Chemistry and Physics, Durban, South Africa***
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***Abstract***
Perovskite solar cells (PSCs) are a promising emerging photovoltaic technology on the brink of commercialisation. With record power conversion efficiencies exceeding 26%, they offer a viable route to low-cost, low-embodied energy photovoltaics. Their development is particularly timely as the world faces urgent climate challenges and the limitations of linear economic models. A transition to a circular economy, underpinned by sustainable and regionally appropriate energy technologies, is critical for long-term environmental and socio-economic stability. However, the widescale deployment of PSCs and other green technologies presents sustainability challenges, including reliance on critical raw materials, environmental impacts of mining and production, and waste generation at end-of- life. 1, 2 Ensuring true sustainability requires a holistic approach that integrates lifecycle optimisation from the outset-minimising production-related environmental impacts, extending device longevity, designing for end-of-life reusability, and substituting high-impact materials with sustainable alternatives. 3

At Swansea University, the UNESCO Chair in Sustainable Energy Technologies and the SPECIFIC Innovation and Knowledge Centre are at the forefront of advancing the sustainability, understanding, and scalable deployment of perovskite photovoltaics. 1, 4, 5 Through the TEA@SUNRISE initiative, we are establishing an international network to explore how next-generation solar technologies can transform energy access in low- and middle-income countries (LMICs), with a focus on developing distributed manufacturing models and integrating circular economy strategies. In parallel, the newly launched REACH PSM project aims to develop sustainable, regionally appropriate photovoltaic materials and manufacturing pathways, addressing critical resource constraints and supporting the localisation of solar energy production.

***[1] Energy Environ. Sci., 2023, 16, 3711-3733.***
***[2] Green Chem., 2021, 23, 2471–2486.***
***[3] Energy Technol., 2021, 9, 2100312.***
***[4] Adv. Mater. 2023, 35, 2208561.***
***[5] ACS Appl. Energy Mater. 2024, 7, 5, 1938–1948.***

**Biography**
Professor Matthew Davies is the UNESCO Chair in Sustainable Energy Technologies, Head of the Applied Photochemistry Group, and part of the Senior Management Team at the SPECIFIC IKC. He is a member of both the Materials Science and Engineering Department and the Chemical Engineering Department at Swansea University. He is also the Principal Investigator of REACH-PSM and TEA@SUNRISE, two major international research initiatives focused on advancing sustainable solar technologies and energy access in low- and middle-income countries (LMICs). Prof. Davies is President of the Royal Society of Chemistry Environment, Sustainability and Energy Community Council and an Honorary Professor at the University of KwaZulu-Natal in Durban, South Africa. His research focuses on the photochemistry of materials for low-cost photovoltaic applications, aiming to improve stability, sustainability, light harvesting efficiency, and performance. His work primarily explores perovskite photovoltaics, with a particular interest in the characterisation of remanufactured devices and developing materials and processes that enable reuse and remanufacture within a circular economy.

As Principal Investigator of REACH-PSM, he leads efforts to develop regionally appropriate, sustainable photovoltaic materials and manufacturing pathways, strengthening supply chains and advancing circular economy principles in solar energy. Through TEA@SUNRISE, he is establishing an international network to support next-generation solar technologies for energy access in LMICs, reporting to the UK Foreign, Commonwealth & Development Office (FCDO) through the Carbon Trust.



**Empowering the Global South: The Impulsouth Community of Practice for a Gender-Just Energy Transition**

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**Abstract**

The Impulsouth Community of Practice (CoP) is an innovative initiative driving capacity-building efforts to foster a gender-just energy transition across the Global South. Energy transition is much more than technology: it's about equity and inclusion, policy and governance, economic transformation, education and awareness, and community empowerment. Achieving all of these requires openness to changing habits, standards, and ways of life. Education is the path to driving these changes. The CoP is a major component of the Impulsouth initiative, supported by Fundación Avina and the United Nations University and funded by the International Development Research Centre (IDRC). The CoP actively strenghtens institutions through peer learning, knowledge sharing, and collaboration. We aim to create shared knowledge, built within the sectors themselves, crossing perspectives from actors often excluded. It unites universities, NGOs, enterprise support organisations, and sectoral associations, as well as regional and international organisations, to address capacity gaps and amplify South-South cooperation related to the energy transition in 9 targeted countries. This presentation will showcase the importance of capacity-building and peer-to- peer learning in energy transition and the CoP's unique approach to bridging institutional and policy gaps, emphasising its role in empowering women within the energy sector. By highlighting its key activities, such as the Train of Trainers programme, small grants for scaling up capacity-building initiatives, and an open- access knowledge repository, the presentation will underline the tangible benefits for members. Participants will also learn how joining the CoP offers access to global dialogue opportunities and fosters collaboration towards innovative solutions for advancing just energy transitions. We aim to inspire new organisations to join this dynamic community and collectively contribute to an equitable and sustainable energy future. Further information about Impulsouth can be found here: https://impulsouth.org/

**Biography**

Mirana Andriarisoa is the programme coordinator for Avina's regional strategy in Africa and the research and learning lead for Phase II of the Impulsouth project. She has over three years of experience in climate transparency with the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. Mirana is deeply passionate about sustainable development, with a particular focus on initiatives that drive meaningful and transformative impact in rural communities. Email: mirana.andriarisoa@avina.net



**Solar Energy Research at North-West University (NWU)**

**Ashmore Mawire1,2**

**1Department of Physics and Electronics, North-West University, Mahikeng, South Africa**

**2Material Science, Innovation anf Modelling (MaSIM) Research Focus Area, North-West University Mahikeng, South Africa**

**Biography**

Prof. Ashmore Mawire holds a PhD in Applied Physics from the North-West University in South Africa which he obtained in 2010. He is a Professor in the Department of Physics and Electronics at the North-West University. He is the Director, and the principal researcher in the solar thermal group of the Material Science, Innovation and Modelling (MaSIM) research focus area. His research interests include electronic instrumentation, renewable energy systems, heat transfer, solar food processing and solar thermal energy storage technology. He has published many high-impact factor ISI journal articles and presented papers at several peer-reviewed international conferences. His research is mainly focused on domestic solar thermal energy storage applications. He is an Associate Editor of the Journal of Energy Storage. He is also an Editor of Scientific African which promotes research endeavours from researchers in Africa. He has received several national and international research grants geared towards Sustainable Energy Technologies. Email: ashmore.mawire@nwu.ac.za



***Identifying the best locations for solar and wind power through energy modelling***

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***Abstract***
In many geographies, energy models are pointing towards sources of variable renewable energy (VRE), mainly solar PV and wind power, as potential backbones of future power systems. However, such models were historically not able to include explicit geospatial aspects around the siting of future VRE power plants in the cost optimisation from the outset. For instance, should one build far from the grid in search of excellent resources or rather stay close to existing infrastructure to keep costs low? Here, we present an OSeMOSYS-FlexTool workflow for capacity expansion and dispatch optimisation that explicitly includes the geospatial dimension of VRE buildout. Applying the model to Kenya, we identify clear but nontrivial links between site characteristics and siting preferences in the optimisation results, which moreover differ markedly for solar PV and wind power. This highly replicable approach has important implications for power system planning, especially in countries whose grids will be VRE-heavy in the future.
Keywords: Energy Models; OSeMOSYS-FlexTool; Solar PV; VRE; Wind Power.

**Biography**



Dr Wekesa is an associate professor of renewable energy technology and a proficient and experienced energy consultant with over fifteen (15) years of experience in research and development. He holds a Ph.D. in renewable energy technology, is a licensed energy auditor by the Energy and Petroleum Regulatory Authority (EPRA) and is a certified energy manager (CEM) by the Association of Energy Engineers (AEE). He is currently the Team Lead of the Renewable Energy Research Consortium (RERC) and Chairman of the Department of Physics at Multimedia University of Kenya. In addition, Dr Wekesa is the Head of Capacity Building, Research and Development Committee at the Association of Energy Professionals Eastern Africa (AEPEA). Email: dwekesa@mmu.ac.ke

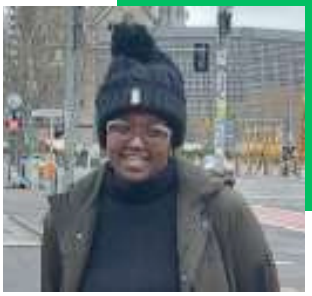
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**Scientists of Kenya Association (ScoKA): Championing the cause of Kenyan Scientists**

**Catherine Nyaruai Njeri**
**Scientists of Kenya Association-Physical Sciences, Nairobi, Kenya.**
**Email: info@scoka.co.ke**

**Abstract**
Identifying the best locations for solar and wind power through energy modelling. SCOKA, a non-profit association built under different science disciplines, was born in 2023 via visionary leader Miss Everlyn Kimathi and other members who shared her dream of providing a platform to voice reason in many science disciplines. Since its establishment in 2023, SCOKA has been a leader in conceptualising science-related matters as a critical community aspect involving different stakeholders from different scientific fields of study. The Association demonstrates how science can build bridges between societies where official relationships are strained, strengthens interactions and partnerships between the scientific and diplomatic communities, and develops the intellectual framework and training to support varying issues affecting the scientific community. Structured to provide a voice of reason to people in the various fields of science, protect their needs, and advocate for better services for members. Our mission is to champion the cause of Kenyan scientists and deliver unwavering support, fostering a thriving scientific community. Whether it is a reassuring conversation, education, professional training, or simply the assurance that they are not alone, we will ensure that everyone gets support that meets them where they are at as quickly as possible. Our vision is to ascend as the foremost scientific association in Kenya and globally by pioneering and supporting aspects of innovative scientific solutions. Our team envisions a Kenya and a world where scientific innovation thrives, benefiting society. We aim to become the leading scientific association, both nationally and internationally, by fostering groundbreaking research and supporting the development of innovative scientific solutions across all fields. We support scientists and scientific advancement in Kenya and globally! We foster collaboration among scientists, promote innovative scientific solutions, and act as a bridge between the scientific community, the government and the public.

**Biography**



Catherine Nyaruai Njeri is a chemist with a strong background in chemistry, sustainability and ESG analysis. She is currently pursuing an MSc in Sustainable Plastics Management at Johannes Kepler University, Austria, and an MSc in Chemistry from Dedan Kimathi University of Technology, Kenya.
Beyond academics, Catherine is an active leader, having represented Africa in the Erasmus Mobility Exchange and held leadership roles in scientific and community organisations like the Scientist of Kenya Association and African Network for Solar Energy (ANSOLE). Passionate about innovation and sustainability, she aims to drive impactful change in the chemical and environmental sectors. Email: catenyaruai@gmail.com

***African Network for Solar Energy e.V. (ANSOLE e.V.,) International & Local Affairs and Sustainability Practices***

***Nnenna Veronica Ebem & Daniel Ayuk Mbi Egbe***
***ANSOLE e.V., Wagnergasse 25, 07743 Jena, Germany.***
***Email: veronica.ebem@ansole.org***

***Abstract***
The African Network for Solar Energy (ANSOLE) is dedicated to fostering research, education, and capacity building in renewable energy across Africa and beyond. Through its international and local operations, ANSOLE facilitates knowledge exchange, training programmes, and collaborative projects aimed at enhancing energy access and sustainability. Its initiatives support young researchers, promote solar energy solutions, and strengthen partnerships between academia, industry, and policymakers. Locally ANSOLE is engaged, amongst other things, in counselling and support of people of African origin in Jena and its surroundings and publishes a magazine on migration and development MIGRANTh). This presentation will highlight ANSOLE's impact, key activities, and opportunities for stakeholders to engage.

**Biography**



Nnenna Veronica Ebem is an experienced young lawyer with over 6 years of post-call practice and over 5 years of work experience in the renewable energy and electricity industry; she currently works with the African Network for Solar Energy (ANSOLE) as a volunteer (Bundesfreiwilligendienst). One of her numerous achievements includes her contribution to the development of a community paper in partnership with the World Economic Forum. The paper is on mobilising investment for clean energy in emerging economies. The community paper went through a series of consultations with relevant stakeholders in the sector, and it proffers solutions to clean energy financing in Nigeria, which is a developing country and an emerging economy. Nnenna volunteers for a lot of youth organisations on advocacy and clean energy adoption among rural communities. Email: veronica.ebem@ansole.org

**Biography**



Prof. Daniel Ayuk Mbi EGBE is presently the CEO and Chairperson of the African Network for Solar Energy e.V. (ANSOLE e.V.). He was born on 20th May 1966 in Mambanda-Kumba, South-West Region of Cameroon. He obtained a BSc in Chemistry in 1991 at the then University of Yaounde (now University of Yaounde I). He moved to Germany in October 1992, where he obtained an MSc (Diplom) and PhD in Chemistry in 1995 and 1999, respectively, from the Friedrich-Schiller University (FSU) of Jena. He completed his Habilitation in Organic Chemistry at the same institution in 2006. From 2006 to 2008, he was a postdoctoral fellow at the Max Planck Institute for Polymer Research in Mainz, Germany; the Technical University of Eindhoven in the Netherlands; and the Technical University of Chemnitz, Germany. In 2009 he moved to the Johannes Kepler University (JKU) Linz, Austria, where he worked at the Linz Institute for Organic Solar Cells (LIOS) (2009-2016) and then at the Institute of Polymeric Materials and Testing (IPMT) (2016-2020). After the end of his contract at the IPMT, he became a visiting scientist at the Institute of Polymer Chemistry (IPC) of the JKU. From October 2021 to September 2022, he worked as a senior scientist at the Energy Institute of JKU. Since November 2021 he has been Honorary Professor of Organic Chemistry at the College of Science and Technology of the University of Rwanda, Kigali, Rwanda.

Egbe's main research interest is the design of semiconducting materials for organic solar cells and other optoelectronic applications. He is a member of the Organic Electronics Association (OE-A), a board member of the World University Service Germany e.V. (WUS-Germany), a board member of MigraNetz Thüringen e.V. (2020-2022) and a member of the Migration and Integration Council of the City of Jena. In November 2010 he initiated and co- founded ANSOLE (www.ansole.org) in February 2011 and became its international coordinator due to his multilingual skills. In September 2011, he initiated and co-founded ANSOLE e.V., a non-profit association based in Germany that legally represents ANSOLE. In 2012, he initiated the Cameroon Renewable Energy Network (CAMREN), an NGO that represents the interests of ANSOLE in Cameroon. He also initiated and coordinates the research platform BALEWARE (Bridging Africa, Latin America and Europe on Water and Renewable Energies Applications).

From 2015 till 2016 he was part of the team which developed research programmes at the Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES) in Tlemcen, Algeria, an institution of the African Union. Since 2015 he has been an independent evaluator for the World Bank Group and African governments in the selection process of the African Centres of Excellence (ACEs) and African Host Universities (AHUs) with corresponding eligible students in the frame of the PASET (Partnership for Skills in Applied Sciences, Engineering and Technology) – RSIF (Regional Scholarships and Innovation Fund) programme. In 2016 he was appointed the first Distinguished Brian O'Connell Visiting Fellow of the University of the Western Cape, South Africa, in recognition of his outstanding contribution to human capacity building in higher education in Africa. He was the initiator and director of the VolkswagenStiftung-sponsored Summer Schools on "Sustainable Energetics for Africa" (2015-2017). He is presently a visiting lecturer/professor at various African universities. In 2022 he was appointed leader of the SDG7 working group of the World Association for Industrial and Technological Research Associations (www.waitro.org). published to date more than 140 peer-reviewed articles in renowned journals and (co)supervised numerous international students from Africa and elsewhere. He has coauthored 3 books on renewable energy. He is the publisher of MIGRANTh (the Magazine on Migration and Development in Thuringia, Germany – www.migranth.de). He speaks more than 5 languages. He is a believing Christian who enjoys dancing salsa! Contact: Email: Daniel.egbe@ansole.org.

## Session 2: General Topics 1



***Ethical Impacts and Value Conflicts around H2 storage in Salt Caverns in The Netherlands***

***Ineke Malsch***
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***Abstract***
The European Union has the ambition to make Europe the first climate-neutral continent by 2050. The development of a hydrogen economy with green hydrogen is part of the solution. Large-scale storage of hydrogen is needed between production with renewable energy sources and use in industry and households. Salt caverns under land or sea offer promising storage options. The first location for such salt caverns is in the province of Groningen, where natural gas winning has been causing damaging earthquakes and public anxiety for years. In this presentation, I present highlights of an ethical impact assessment of this project. A key dilemma is how to solve the value conflict between risks for social justice and benefits for combating climate change. Options for remediation are proposed. Finally, the audience are asked to comment on how public concerns over the transition to a hydrogen economy are addressed in their country.

**Biography**



Dr. Ineke (N.H.) Malsch has graduated in Physics and holds a PhD in Philosophy. Her thesis was on international multistakeholder governance of nanotechnology. She is the founder and director of Malsch TechnoValuation, a consultancy in technology and society, established in Utrecht since 1999. Under the tradename EthicSchool https://ethicschool.nl/en- gb/home, she offers training in responsible innovation. She has so far contributed to fifteen EU-funded projects related to responsible development and governance of emerging chnologies, including several projects related to renewable energy, water remediation and/or cooperation with developing countries in Africa and other parts of the world. In the International Networking Initiative on Safe and Sustainable Nanotechnology (INISS-Nano), she leads the pillar on "International collaboration on ethical and societal aspects of nanotechnology". Locally, she coordinates a project on Sustainable Utrecht 2030: https://duurzaamutrecht2030.nl/en-gb

She has been the Dutch representative of the African Network for Solar Energy (https://ansole.org/) since 2012. In addition, she was involved in the launch of the BALEWARE (Bridging Africa, Latin America and Europe in Water and Renewable Energies Applications) network in Brazil and was a co-organiser of the first BALEWARE summer school in Arusha, Tanzania in 2016.

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**Utilising Jordan's Wind: Innovative Ways to Achieve SDG 7 Goals and Sustainable Energy**

**Omar KhazalehRoyal Scientific Society (RSS), Amman, Jordan. Email: omar.khazaleh@rss.jo**

**Abstract**

Jordan faces major sustainability problems because its rising energy needs depend primarily on imported fossil fuel products. The international push towards Sustainable Development Goal 7 (SDG 7) requires Jordan to integrate its wind energy resources into its energy sector. This research will investigate the wind energy resources of the country by studying areas with high wind potential as well as analysing technological improvements for optimal energy production. A detailed analysis will cover the financial implications together with existing policies and obstacles Jordan faces while trying to add major wind power to its grid. The research will investigate the modernisation of power grids and financial policy suggestions as well as technical solutions which boost wind energy adoption rates. The analysis will present evidence-based recommendations that stakeholders should implement to strengthen Jordan's renewable energy sector based on proven international models which will support energy stability and promote national growth while reducing climate impact. The results will demonstrate Jordan needs to implement technological solutions along with economic measures and policy action suggestions to establish wind energy as its essential component in sustainable power supplies into the future.

**Biography**



Omar Khazaleh, Omar Khazaleh, born on February 24, 1999, in Amman, Jordan, is a dedicated electrical power engineer with a distinguished academic and professional trajectory. Graduating with a bachelor's degree from Yarmouk University's Electrical Power Engineering Department in 2022, Omar achieved an impressive GPA of 3.72, reflecting his deep commitment to his field. Currently serving as a specialist in studies in wind energy at the Royal Scientific Society (RSS). His role involves intricate tasks such as ensuring the operational efficiency of renewable energy sources, which are directly aligned with sustainable development goals, particularly SDG 7, which advocates for affordable, reliable, sustainable, and modern energy for all.Omar's professional journey also includes substantial experience with the Electrical Distribution Company (EDCO) in Jordan, where his responsibilities spanned across the Maintenance, Metering, Substations, and Installations Departments. This role not only honed his technical skills but also equipped him with the ability to manage and execute complex electrical systems effectively.In addition to his professional endeavours, Omar has contributed to the academic sector as a reviewer for the Journal of Engineering and Applied Science. He has authored several publications focusing on enhancing methodologies for maximum power point tracking (MPPT) in photovoltaic systems and has explored the reliability of speech/speaker recognition systems using deep learning technologies. Omar's technical proficiency is broad and includes skills in Python programming, MATLAB, AutoCAD, and other simulation software. His hands-on experience with Arduino and PIC microcontrollers further complements his theoretical knowledge, making him a versatile and innovative engineer. Email: omar.khazaleh@rss.jo

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**Iridescent Pattern Production From Solid Film Cellulose Nanocrystals Prepared From Coffee Husks**

**Catherine Nyaruai Njeri**

**Dedan Kimathi University of Technology, Kenya & Institute of Polymeric Materials and Testing, Johannes Kepler University Linz, Linz, Austria. Email: catenyaruai@gmail.com**

**Abstract**

The urgent need to practise environmental stewardship has spurred research into novel approaches to produce sustainable and biodegradable materials from natural sources, especially for engineering uses, with cellulose emerging as a top contender. By using coffee husks, a byproduct of making coffee, one can effectively repurpose waste material and turn it into a valuable and economically viable asset. This creates a sustainable reservoir of cellulose. Coffee husks contain cellulose, extracted using an alkaline treatment method and acid hydrolysis to produce cellulose nanocrystals (CNCs), which are used to create iridescent films. This procedure comprises bleaching the coffee husks with sodium hypochlorite after treating them with sodium hydroxide to extract cellulose. The next step is to apply acid hydrolysis to create cellulose nanocrystals using gaseous HCl. The CNC suspension is carefully poured into polystyrene Petri dishes and evaporated at regulated temperatures in an oven to produce a solid CNC film. This process ensures purity and guards against contamination. The CNC suspension-filled Petri dish is set atop an engraved mould with precise patterns to add complex patterns to the film. Heat applied to the mould causes a range of colours to appear on the film. The result of this process is the spontaneous self-assembly of CNCs, which produces a wide variety of colourful and iridescent films with unique optical properties. Moreover, these films exhibit exceptional water resistance, light color variation dependent on viewing angles, and left-handed circularly polarized light fluorescence and reflection, highlighting their versatile application and environmentally conscious design.



**Biography**
Catherine Nyaruai Njeri is a chemist with a strong background in chemistry, sustainability and ESG analysis. She is currently pursuing an MSc in Sustainable Plastics Management at Johannes Kepler University, Austria, and an MSc in Chemistry from Dedan Kimathi University of Technology, Kenya. Beyond academics, Catherine is an active leader, having represented Africa in the Erasmus Mobility Exchange and held leadership roles in scientific and community organisations like the Scientist of Kenya Association. Passionate about innovation and sustainability, she aims to drive impactful change in the chemical and environmental sectors. Email: catenyaruai@gmail.com

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**Fostering Astronomy Engagement in Africa through the PACS eLab Projects**

**Miracle Chibuzor Marcel**
**PACS e-Lab Community Pan-African Citizen Science e-Lab, Federal Capital Territory, Abuja: miracle.c.marcel@gmail.com**

**Abstract**
The Pan-African Citizen Science e-Lab (PACS e-Lab) is an online platform that engages the African public in hands-on activities in space science and astronomy, including those in North Africa and Sub-Saharan Africa. We run five main projects, including exoplanet observations, asteroid searches, deep space image processing, double star research, and ARISS—amateur Radio on the International Space Station. Since its founding in December 2020, we have engaged over 1,000 individuals across 50 countries in Africa and made numerous contributions to astronomy, including the discovery of over 50 asteroids, the publication of over 12 scientific papers, and the generation of several photometric light curves of exoplanets. Our platform is the fastest-growing of its kind in Africa. During ANSOLE´s 14th Anniversary International Online Conference, I will elaborate on these efforts and our achievements.



**Miracle Chibuzor Marcel** is the Founder and Director of the Pan-African Citizen Science e-Lab (PACS e-Lab), an online platform dedicated to promoting hands-on activities in space science and astronomy across Africa. PACS e-Lab boasts the continent's most extensive network of amateur astronomers. Email: miracle.c.marcel@gmail.com

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***Advancing Solar Energy Development in Africa: Challenges, Opportunities, and Pathways for Sustainable Energy Transition.***

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**Abstract**
In Africa, the available solar energy resources are substantial, but these remain untapped due to various technical, economic, and policy issues. This paper attempts to provide an overview of solar energy deployment within Africa, stressing the major challenges and anticipated undertakings. It looks into the adoption of novel photovoltaic (PV) technologies, hybrid renewable energy systems, and new financing approaches which may assist in accelerating solar energy deployment. Also, special attention is given to the participation of artificial intelligence (AI) and optimisation methods in improving PV system performance and grid reliability. In addition, a discussion is provided regarding the exploitation of local policies, inter-regional cooperation, and the African Continental Free Trade Area (AfCFTA) in

relation to the solar energy market policy. The paper focuses on the mobilisation of various stakeholders, including governments, private sector actors, and academic and research institutions, to develop integrated solar energy policies. Untapped opportunities offer African countries the chance to remove barriers to implementation and use new technologies to reach a powerful and all-encompassing energy paradigm. In this regard, this work lays down the foundation for framing the discourse for policymakers, scientists, and industry practitioners aimed at implementing solar energy at scale in Africa.

Keywords: Solar Energy, Photovoltaics, Hybrid Renewable Systems, Artificial Intelligence, Energy Policy, African Solar Market

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**Biography**



Wulfran FENDZI MBASSO received the M.Sc. and M.Res. degrees in electrical engineering from the University of Ngaoundéré and the University of Douala, Cameroon, in 2016 and 2020, respectively. Having obtained a PhD thesis in Electrical Engineering Option Optimisation of Renewable Energy Systems, he is passionate about the field of Electric Engineering and Industrial Informatics. He received several global certifications. My research focuses on power system control, optimisation, automation, and electronics. He is a dedicated PhD holder in renewable energy optimisation. He possesses extensive electronics, electrical engineering, telecommunications, and automation experience. His research is on innovative ways to optimise renewable energy use for a sustainable future. He develops advanced energy efficiency methods due to his expertise in these areas. His collaboration with international researchers has given me a broad view of research in several electrical engineering fields. This partnership has led to articles in Renewable Energy Systems, Energy Control, and Electricity Quality. He acts as a reviewer for IJRER, Heliyon, Hindawi, AJEBA, and Sustainable Energy Research. He is also active on ResearchGate, where he supports science and engineering with his humble perspective. He can be contacted via email at fendzi.wulfran@yahoo.fr or ORCID: https://orcid.org/0000-0002-4049-0716.

***Celebrating two years of MIGRANTh – The Magazine on Migration and Development.***

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***A*bstract**

In order to document the life stories of people with a migration background living in the German state of Thuringia. Offering a variety of perspectives through firsthand accounts, it is a critical examination of attitudes towards and the realities of migration and integration. This presentation aims to introduce and consolidate MIGRANTh's activities and trajectory over the last two years in terms of content, editorial direction and impact. Since its inception and over the course of its five issues, MIGRANTh has chronicled the life stories of people from 20 countries, five continents and nine locations in Thuringia. Moreover, it cooperated with and introduced numerous other organisations and projects related to migration in Thuringia, thus expanding and solidifying its network. In addition to book reviews and educational pieces, it has featured a wide range of articles on pressing and topical issues, such as Prof. Daniel Ayuk Mbi Egbe's speech "We are all migrants: Migration is not a one-way street!" or Yanda Bango's "Unconscious racism? Erfurt Zoo and how it perpetuates the dehumanisation of Black people today". MIGRANTh emphasises the importance of diverse

voices and backgrounds for a democratic Germany, especially in light of the current political shift towards right-wing, xenophobic policies. It is dedicated to breaking down prejudice and promoting acceptance and mutual understanding. Dedicated issues explore overarching themes such as decolonisation and refugee migration routes (MIGRANTh 4 and 5, 12/2024) or women's voices for International Women's Day (MIGRANTh 3, 03/2024). ANSOLE e.V. anticipates the future of this project in 2025 with optimism.



**Biography**

Isabella Schneider studied English and English Literature at the University of Glasgow. She has been working as a volunteer for ANSOLE e.V. in Jena (Germany) since November 2023, primarily focusing on the project MIGRANTh – The Magazine on Migration and Development. Since joining the editorial team, she has been involved in the production of issues 2-5 and the bilingual edition. Email: Isabella.schneider@migranth.de

## Session 3: General Topics 2

***Accelerating SDG7 in Sub-Saharan Africa – The Role of ANSOLE and Emerging Technologies***

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***Abstract***

Universal access to electricity is key to the development of sub-Saharan Africa. Access to electricity enables access to AI. AI is in a period of extraordinary development with the potential to accelerate development that could enable sub-Saharan countries to reach parity in development with Europe over the coming decade, empowered by young populations and vast resources. It is imperative that access to electricity be treated as the key priority by both African states and their partners in Europe and elsewhere. ANSOLE needs to provide leadership for accelerating access to electricity across sub-Saharan Africa by incorporating AI into its Energy Compact with the UN and fostering greater intra-African integration to enable knowledge sharing and co-development between Northern African states and sub-Saharan states through ANSOLE-facilitated programmes.

**Biography**



Vidvuds (Vid) Beldavs is a futurist who developed a career in the US working for the multinational firm Cummins in strategic planning, teaching, leadership of the international Technology Transfer Society, consultant for Hudson Institute, analyst with Wikistrat of future trends and other roles. Vid works in Latvia and is a co-founder of the Riga Photonics Centre, advancing projects in the application of science and technology for sustainable development. Vid also serves on the board of directors of ACES Worldwide, a space policy organisation focused on space science and technology to drive sustainable development and innovation for human development. Vid is active with ANSOLE, providing leadership for engagement with the Science Summit in the framework of the UN General Assembly and specific projects driven by ANSOLE's Energy Compact with the UN.



**Energy Access: Are microgrids the answer?**

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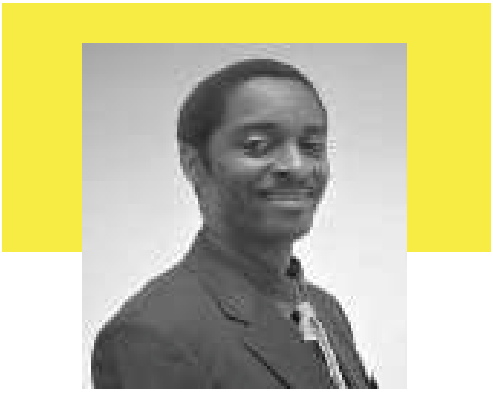
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**Abstract**

According to the Energy Institute, on average, the world energy use per person in 2023 was 21,394 kWh, in comparison to regions such as Africa and low-middle-income countries, where the consumption was 3,969 kWh and 6,067 kWh per person, respectively (US EIA, 2023). This is indicative of the immense disparity in energy access for industrialised/high-income countries compared to that of developing countries. Energy poverty, defined as the "inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read or for other household and productive activities at sunset" (UNDP 2005), has been a key principle to be addressed under facilities such as the

Sustainable Development Goals (SDGs). Concomitantly, in the UNDP's Beyond Access: 1.18 Billion in Energy Poverty Despite Rising Electricity Access Report, it is stated that globally, some 1.18 billion people are energy poor and unable to use electricity. Although reports show that access to electricity since 2020 has reached 90% (Min et al., 2024), it has been recognised that having access is severely undermined when the reliability, sustainability and cost render the access immaterial.

This is compounded by the fact that there is a direct correlation between energy poverty and economic poverty, with people living in rural areas being more likely to be energy-impoverished than those in urban areas (Min et al., 2024; International Crisis Group, 2007; Domenech et al., 2014). Energy systems are designed to address challenges such as energy access, sustainability goals and climate change mitigation, with renewable energy resources currently being deployed on a large scale to meet the requirements of increased energy demand, mitigate the environmental pollutants, and achieve socio-economic benefits for sustainable development. The integration of such distributed energy sources into the utility grid paves the way for microgrids. The microgrid concept is explored as an option to address the issue of access to energy, reliability and sustainability.
Keywords: Microgrid. Energy Access, Renewable Energy.



**Biography**

Algon Meikle: With more than 25 years of experience in the electrical power industry, Mr Meikle has assessed the integration requirements for distributed energy resource projects, including solar PV systems and wind farms and interconnection studies, to ensure reliable connection under fault conditions with works within the Caribbean and North America. A highly skilled electrical engineer, he is adept in using power system analysis, including conducting critical grid assessment studies and developing solutions to ensure grid stability and economic viability. Mr Meikle holds a Bachelor of Science (BSc) degree in Electrical and Computer Engineering from the University of the West Indies (St Augustine), is a Registered Professional Engineer and is a member of several professional bodies.Keywords: Microgrid. Energy Access, Renewable Energy. Email: algon@ccreee.org
Keywords: Microgrid. Energy Access, Renewable Energy.



**Biography**

Claudia Bess has chartered a career centred on sustainable development practice. She has extensive experience in sustainability initiatives, particularly within the water supply, wastewater treatment processes and energy governance sectors. She has worked in Jamaica, Canada, and Kenya in various capacities focused on development project design and implementation. Her areas of expertise in institutional analysis, water and wastewater supply systems, and energy management strategies have been of tremendous benefit to these initiatives. During her career, she has collaborated with bi- and multilateral organisations on projects aimed at enabling efficient institutional structures and environmental management systems. She has over 20 years of professional experience in the environmental sector, with the last six years in academia, honing and influencing the next generation of young minds to be the much-needed positive change makers in the environmental governance field. Claudia holds degrees in chemical and process engineering, project and resource management, and energy and the environment. She is a registered professional engineer and a registered environmental professional. Email: claudiabess@hotmail.com

***Progress in Gasification of Waste: Developments and Challenges.***

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*Abstract*

*The conversion of waste to energy is becoming essential for waste treatment to reduce landfill and associated $CO_2$ emissions. Amongst the different waste-to-energy technologies available, gasification has been reported to be the most suitable method for decentralised electricity generation with the lowest environmental pollution. Gasification has emerged as a promising solution to reduce landfill waste, mitigate environmental pollution and contribute to clean energy generation. However, this technology has not penetrated the market into commercial scales as expected.This review examines the progress and challenges of waste gasification; it explores advancements in gasification technologies, focusing on system designs, operational techniques, syngas purification methods and applications in electricity generation. The challenges of scaling up and achieving economic feasibility are highlighted. The study then points out potential interventions and future directions for advancing waste gasification to enable commercial-scale adoption.*

**Biography**



Lilies Kathami Kathumbi is a dedicated research assistant at the University of Huddersfield, specialising in renewable energy technologies with a focus on biofuels, engine performance, emissions characterisation, and waste-to-energy innovations. With over seven years of experience, she has developed innovative methodologies for biofuel production, including advanced catalysts that enhance biodiesel quality and reduce emissions. Her expertise spans life cycle assessments of energy systems, promoting sustainable and low-carbon fuel alternatives.

L.K.K. has demonstrated leadership in pioneering waste-to-energy projects, notably spearheading a black soldier fly larvae initiative that secured third place in the Africa-ai-Japan Innovation Poster Challenge (2021). She actively collaborates with Kenyan researchers to foster sustainable waste-to-energy solutions for agricultural waste and interdisciplinary partnerships. As a key member of the Energy Integration Lab led by Prof. John Allport at the University of Huddersfield, she contributes to industrial partnership and research in low-carbon fuel technologies.Beyond academia, she is a registered member of the Engineering Board of Kenya and a reviewer for the Nigerian Journal of Technological Development. She also engages in the Kirklees Sustainability Peer Group, bridging research with industry stakeholders to drive emissions reduction and sustainable practices. Her contributions to renewable energy, circular economy and climate change mitigation align with the core themes of the ANSOLE conference, where she aims to share insights and collaborate on innovative solutions for a greener future. Email: L.Kathumbi@hud.ac.uk

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**The State of Renewable Energy Research in Africa**

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**Abstract**

African countries are only somewhat on track to meet SDG7 by 2030, according to the International Renewable Energy Agency (IRENA). This is despite enormous renewable potential on the continent. However, renewables research in the African context shows great promise: African countries and research institutes are leading the way, with the Algerian Centre de Developpement des Energies Renouvelables (CDER) at #1 globally. Understanding the renewables research landscape in Africa – including collaborations and disconnects – is vital because it can point to places where government and private support can help further the energy transition. This talk discusses successes, potential for improvement, and the way in which both R&D and policy are vital for ongoing progress toward SDG7.

This speech was the keynote for ANSOLE's session on SDG7 at the United Nations 79th General Assembly Science Summit (SSUNGA79).

**Biography**



Sabrina Zearott is a Master of Public Policy student at the Willy Brandt School of Public Policy (University of Erfurt, Germany); she earned her AB from Harvard College and an MA in communication from Washington State University. Her research currently focuses on the clean energy transition, particularly regarding renewable energy and critical mineral supply chains. She interned at and volunteers with ANSOLE. She is the award-winning author of two books (under a pen name) and was credited in a technical-writing capacity in a 2019 Science cover article, "Strain-programmable fiber-based artificial muscle." She has several years' experience as a researcher, including at Harvard's Pluralism Project; she assisted with commercialization research on rare earth elements (REEs) at WSU and served as the main writer/editor/producer for WSU's Physics Matters magazine. Long-term, she hopes to work on policy analysis/research related to the clean energy transition and critical minerals in Germany/the EU. Email: sabrina.zearott@migranth.de

**Solar powered stove using volcanic stones**

**Mariah Kizza**
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Our innovation addresses gender disparity and environmental degradation by promoting clean cooking solutions, like solar stoves, to reduce reliance on biomass fuels, improve women's health, and provide sustainable income alternatives, contributing to sustainable development in marginalised communities.
Our solution entails production for our solar stove, a clean cooking solution designed to address the challenges posed by traditional biomass fuels. With over 40 stoves sold under the pilot phase, we recognise the need to enhance the design and pursue certification to ensure quality and credibility.
The solar stove utilises volcanic stones and briquettes/pellets made from organic and agricultural waste, which are carbonised to ensure efficiency and sustainability. By leveraging these materials, we not only provide a cleaner cooking solution but also contribute to waste management and environmental conservation efforts. In line with our commitment to empowering women and youth, we aim to skill an additional 10 women in stove manufacturing and marketing. Establishing a dedicated workshop will enable us to scale up production and make the stoves readily available in the Greater Kampala Metropolitan Area (GKMA). Also, intend to establish a distribution network in five (5) districts: Wakiso, Kampala, Mukono, Lira and Soroti.
Each stove set costs UGX 200,000 / USD 60, and our goal is to reach over 500 restaurants in the GKMA out of over 5,000 target restaurants we intend to serve in our five-year business plan. Through this comprehensive approach, we aim to address the pressing need for clean cooking solutions, empower marginalised communities, and contribute to sustainable development in the region.
Our solar equipment, like the panels, batteries and fans, are imported from China, presenting a business case to connect with that international market, thus our interest to participate in the WAITRO Summit in China.

Our project is committed to fostering inclusivity and empowerment for youth, women, and marginalised groups, recognising their crucial role in social and economic progress. To address youth unemployment, we will provide comprehensive training and employment opportunities in stove manufacturing and distribution, equipping young people with valuable skills. Central to our initiative is women's empowerment, with women trained to manufacture solar clean cooking stoves, achieving economic independence and leadership roles. SWEDO, a women-led social enterprise, ensures active participation of these groups throughout the project.
By focusing on women-led restaurants and youth-led initiatives, we align with SDG 7 (Affordable and Clean Energy) and SDG 5 (Gender Equality), promoting sustainability and inclusivity.

**Biography**





Mariah Kizza is the CEO of SWEDO Innovations Limited (SWEDO), a company dedicated to tackling energy poverty and promoting gender equality through sustainable practices. With over 10 years of experience in the development sector, Mariah is recognised for her expertise in social entrepreneurship, research, innovation, project management, and organisational culture. She holds a Master of Science degree in Development Economics and a Bachelor's degree in Development Studies with a focus on rural development, equipping her with a strong foundation in economic development and sustainability.Mariah began her journey with SWEDO in 2016, when the organisation was founded as 'Smart Women in Environment and Development Organisation'. The organisation, which is 100% women-founded and -managed, reflects Mariah's commitment to empowering women socially, economically, and environmentally.Beyond her work at SWEDO, Mariah is actively involved in various professional networks that amplify her impact in the development and energy sectors. She is a member of the Social Entrepreneurship Forum by Capital Solutions, which fosters innovation and collaboration among social entrepreneurs. Mariah is also affiliated with the Uganda National Clean Cooking Alliance, where she contributes to promoting cleaner, sustainable cooking solutions across the country. Additionally, she is part of the National Renewable Energy Platform (NREP), which focuses on advancing renewable energy initiatives in Uganda. As a member of Mkazipreneur, a platform dedicated to supporting women entrepreneurs, Mariah continues to advocate for women's empowerment and economic development, aligning with her commitment to gender equality and sustainable growth. . Contact: mariahkizza56@gmail.com/swedoprojects@gmail.com, Tel: +256782757919








***Fabrication and Experimental Investigation of a Solar Flat Plate Collector for Domestic Water Heating in Cameroon.***

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***Abstract***
Global hot water demand per person has been on an increase over the years. The hot water demand per person per day is an average of 15 – 20 litres and about 20 m³ per year. Hot water of 40 °C to 43 °C is mostly used for hygienic purposes, i.e., bathing, while hot water of 20 to 60 °C is used for laundry and cleaning of dishes. The residential sector accounts for about 40 % of global energy consumption; thus, reducing energy consumption in this sector will contribute to the reduction of greenhouse gas emissions and its consequent environmental effects of global warming and climate change. Heating water accounts for 25 % of residential energy use worldwide, and this is achieved mostly by burning fossil fuels. The main energy sources used to heat water in households of developing countries, such as Cameroon, are wood, kerosene, gas and/or electricity. The use of these forms of energy is not only very expensive but also has very negative impacts on the environment. Harnessing solar energy for water heating using solar water heaters can reduce household water heating fuel consumption to between 50 % and 70 %. The objective of the study was to fabricate a full-scale Flat Plate Serpentine Solar Domestic Water Heater (FPSSDWH) and to experimentally investigate its thermal efficiency under local environmental conditions. A flat plate serpentine solar domestic water heater was fabricated from carefully selected local materials. The choice and usage of local material ensured the low cost of the final product. The thermal performance of the FPSSDWH, in terms of its thermal efficiency, was investigated under various local conditions on the campus of the University of Bamenda in Bambili. Results showed that the thermal efficiency of the collector varied with solar irradiance. The average solar irradiance recorded was 477 W/m² with the highest value of 915 W/m². The average thermal efficiency of the FPSSDWH was 49.4%, and the highest value was 92.9 %. A difference of 11.5 °C between the inlet and outlet water was attained with the highest outlet temperature of 47 °C. From the foregoing results, it is concluded that locally fabricated FPSSDWH have demonstrated the ability to produce hot water within a temperature range applicable for domestic hot water services.
Keywords: solar energy, flat plate solar collector, warm water services, thermal efficiency

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**Biography**



Jerome Ndam Mungwe is a holder of a PhD in Science Technology Energetics and Nuclear (STEN) from Politecnico di Milano, Italy. Prior to his PhD studies, he obtained an M.Sc. in Energy Systems and Management from the University of Flensburg in Germany. His core professional value/belief is integrity in the applications of engineering.solutions to improve human living standards, especially in the rural areas of developing countries. He has professional experiences as a practitioner, researcher in renewable energy technologies and an academician. As a practitioner, he has designed and supervised the construction of micro hydropower plants in some rural areas of Cameroon and designed and installed several solar PV home systems and domestic biogas systems. His research accomplishments include 10 published articles, a chapter contribution to a book and a technology manual. He is currently researching the experimental investigation of a locally fabricated flat-plate solar water heater, a business model of a plastic biogas digester system for rural and urban applications, and the performance evaluation of mini grids powered by renewable energy sources – solar PV and micro hydropower. He has participated in 7 international conferences.

Professionally, he was a secondary school teacher (1998 - 2006), a technical adviser in renewable energy with an NGO in Cameroon (2008 - 2010), and an assistant lecturer with the School of Engineering at the Catholic University of Cameroon-Bamenda (2010 - 2019). He was an instructor at the National Higher Polytechnic Institute of the University of Bamenda (2019–2020). He is currently a senior lecturer at the Higher Technical Teachers Training College of the University of Bamenda, where he is head of the Department of Renewable Energy Engineering, cum laude, with Head of Service for Training and Internship. He is also a member of the Scientific Committees of the Departments of Renewable Energy, Electrical and Power Engineering, HTTTC and Electrical and Electronic Engineering of the National Higher Polytechnic Institute of the University of Bamenda. He was appointed the ANSOLE National Representative in Cameroon (ANRIC) in August 2024.

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***Enhancing Thermal Energy Storage Efficiency in Solar Cookers Using HDPE/PLA Blended Phase Change Materials***

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***Abstract***
The inconsistent availability of solar energy presents a significant challenge for solar cooking applications, necessitating effective thermal energy storage (TES) solutions. This study investigates the potential of High-Density Polyethylene (HDPE) blended with Polylactic Acid (PLA) as a phase change material (PCM) to enhance TES efficiency in solar cookers. A combination of thermal network modeling and Finite Element Method (FEM) simulations was employed to analyze the thermal behavior of HDPE/PLA composites compared to conventional PCMs such as Polypropylene (PP), Polyoxymethylene (POM), and pure HDPE. Material characterization was conducted using Fourier Transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), and thermal conductivity tests. The results indicate that the HDPE/PLA blend with a 50/40 composition exhibited superior thermal conductivity, improved shape stability, and efficient heat transfer compared to other PCMs. The blend achieved a balanced trade-off between heat storage capacity and conductivity, making it an optimal candidate for sustained thermal performance during off-peak hours. While the study highlights the advantages of HDPE/PLA composites, further experimental validation and optimization are recommended for broader applications in TES systems.
**Keywords**: thermal energy storage, phase change materials, solar cookers, HDPE/PLA blends, thermal conductivity, shape stability, finite element method, material characterization.

**Biography**



**Emmanuella Brown Fasinu** is a first generation female engineering graduate with multidisciplinary background in Renewable and Sustainable Energy, Energy Efficiency, Energy Policy and Planning, Clean Cooking and Materials Engineering. Her strong scholastic devotions right from Mfantsiman Senior High School, granted her an entry into Kwame Nkrumah University of Science and Technology, where she earned a Bachelor's Degree in Materials Engineering.

Born and bred in Ghana, she has unwavering passion in the sustainable development of Ghana and Africa at large. She focuses on environmentally friendly Research and Engineering approaches to solve societal problems, especial ones that affect Women and children through Renewable and Sustainable Energy.

As a result of her passion to become a leading authority advocating a continent-wide shift in distributed renewables for development, climate action, and energy independence, she is currently pursuing a Master's degree in Renewable Energy Technologies at the Kwame Nkrumah University of Science and Technology under the EU-ECOWAS Scholarship Program on Sustainable Energy. Her unflagging diligence facilitated an opportunity to be selected for an ERASMUS Exchange at Johannes Kepler University, Linz in Austria where she is able to leverage on the benefit of being exposed to cross cultural infrastructures, technologies, thinking systems, and approaches to advancing sustainable Energy and climate Actions.

The type of work she enjoys most involves conducting rigorous scientific research, analyzing and visualizing complex data sets, and translating findings into actionable policy recommendations. In the imminent futurity, she visualizes a long life's work that ensures all Africans gain access to affordable, reliable clean energy by 2050.

**Performance comparison of a wonderbag and Hay basket as thermal insulating materials for domestic cooking**

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**Abstract**
Thermal insulating materials are very essential in thermal energy storage. There are both internationally and locally produced thermal insulation materials. However, the internationally made thermal insulation materials are expensive compared to the locally made ones due to the high importation cost and taxes imposed on them. This paper aims to compare a Wonderbag made in South Africa with a hay basket (locally made in Uganda) as thermal insulating materials for domestic solar cooking applications. Two identical cooking pots with a capacity of 1 litre each are separately placed on identical Photovoltaic Direct Current (PV DC) cookers inside a wonder bag and hay basket, respectively. Water heating experiments are performed in the morning, at solar noon, and in the afternoon. Results show that when a 0.5 kg water load is used, the higher maximum temperature of 96.3°C is achieved by the water load in a Wonderbag insulator compared to a water temperature of 94.8°C in a hay basket within 24 minutes of the experiments during solar noon. A slightly higher water heating efficiency is shown when in a Wonderbag compared to when in a hay basket. No significant difference in the maximum water load temperatures and heating efficiencies are observed when using a wonderbag and hay basket as thermal insulating materials for domestic solar cooking applications. The work demonstrates that a cheaply available and locally made heat retention vessel (Hay basket) can substitute the expensive and internationally made/available heat retention vessel (Wonderbag).

**Keywords: Heat retention, thermal insulation, commercial insulation materials, and local insulation materials**



**Biography**

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Dr. Abedigamba completed his PhD in Physics at North-West University (South Africa) – 2016. His research interests lie in the area of Solar Physics with emphasis on theoretical and experimental work. He has collaborated widely with researchers in several other disciplines of Physics especially on the aspects of solar cooking and thermal energy storage. E-mail: oyigamba@kyu.ac.ug

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**Development of a new stand-alone indirect solar dryer for apple slices: Thermal profiling, drying characteristics and quality assessment**

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**Abstract**
Improving the shelf life of fruits and vegetables, extending their drying time, and preserving their nutritional content remain an enormous challenge in Africa. In response to this problem, a light, stand-alone, low-cost, portable and adaptable indirect solar dryer was fabricated and investigated experimentally using two consecutive 8-hour tests and a continuous overnight 32-hour test. The dryer requires minimal technical maintenance and operates both in sunny and cloudy conditions. The drying chamber consisted of four metallic trays and 2 DC fans powered by 12 V batteries charged by a 50 W PV panel to remove moisture continuously. The quality assessment of dried fruits was evaluated using pH, colour, and mineral composition measurements. The average solar radiation ranged from 708 to 762 W $m^{-2}$ throughout the experiment tests, affecting the drying chamber thermal profiles. A maximum temperature of 63.5° C was recorded in the first tray during day 2 of the 8-hour test, whereas a maximum temperature of 66.5 ° C was reported during the 32-hour continuous test. A minimum moisture level of 18 % was achieved at 9 hours in the 16-hour tests, while a minimum moisture value of 14 % was obtained for the 32-hour test. A noticeable variation in colour between the fresh and dried fruit slices was observed, whereas a pH< 6.0 suggested the preservation of nutrients and inhibition of the proliferation of microorganisms. Mineral composition showed that K, Ca, P, and Mg were the most abundant elements in dried apple slices.
Keywords: Portable indirect solar dryer; Apple slices; Drying characteristics; Quality assessment.

**Biography**



**Patrick TSOPBOU NGUEAGNI** is a Doctor of Chemistry in the use of functionalised biogenic materials for wastewater treatment, obtained from the University of Yaoundé I (Cameroon) and Sri Sivasubramaniya Nadar College of Engineering, SSN (India). I have published around 17 research papers, reviews, and book chapters. This research work has significantly contributed to advancing innovative solutions for sustainable resource utilisation, energy efficiency, and environmental conservation. My work is now focused on renewable energy, energy storage solutions, and climate resilience strategies. I am currently a postdoc in materials science and innovation modelling at North-West University in South Africa. Email: **nguetsop.ricks@gmail.com**

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**Evaluation of Techno-economic Viability of Solar Water Heating System at MMU Executive Hostels**

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**Abstract**

The use of electrical heaters in Kenya is getting more expensive every day as electricity costs increase. This study seeks to evaluate the economic viability of replacing instant electric water heaters (IEWH) with an evacuated tube collector (ETC) solar water heating (SWH) system at Multimedia University of Kenya (MMU) Executive Hostels, Nairobi, Kenya. Over a one-month period, data on water and electricity consumption, hostel occupancy, and solar radiation was collected to determine the existing hot water demand per person and the associated energy costs. Results indicate that the executive hostel consumes an average of 35.45 litres of hot water per person daily. With the consolidated cost of electricity being around 0.26 USD cents and estimated energy being 580.4 kWh per day, the corresponding current costs of electricity stand at USD 4454 per month.

The simulation results reveal that the 300-litre ETC system with 30 tubes and an efficiency of 60% can produce approximately 1400 litres of hot water per day, given average solar radiation conditions in Nairobi. The ideal tilt angle for a fixed collector was between 0 and 15 degrees. Solar collectors without storage had higher output than the ones with storage. Although the impact of storage on output was insignificant for high storage collectors, the best storage was above 75 litres/m². As for the solar fraction, the graph tilted between 60% and 65%, translating to 30 collectors. The study findings provide baseline data for performing a techno-economic viability for installing an ETC water heating system at MMU executive hostels.

Keywords: Collector storage; Economic viability; Evacuated tube collector; IEWH; SWH



**Biography**

Harrison is a Master of Science in Renewable Energy & technology student at Multimedia University of Kenya. He is currently an intern at Renewable Energy Research Consortium (RERC) of the Department of Physics at Multimedia University of Kenya. Email: harrisonmuchee@gmail.com

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## Session 5: Photovoltaics 1

**Advanced organic materials and technologies for solar photovoltaics**

**Petro SMERTENKO[1], Sergii MAMYKIN[1], Vadym NAUMOV[1], Daria KUZNETSOVA[1], Vidvuds BELDAVS[2]**
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**[2]Riga Photonics centre, University of Latvia, Riga, Latvia**

**Abstract**

Organic photovoltaics (OPV) is a fast-growing segment of solar photovoltaics nowadays [1, 2]. The main R&D expectations from OPV are related to the prospects of creating more flexible, lightweight and low-cost solar cells [3]. The advantage of OPV is the potential of using inexpensive production technologies such as inkjet printing and roll-to-roll manufacturing [4]. OPV materials can be classified into several categories based on their structure and optoelectronic properties: (i) conjugated polymers (P3HT, polythiophene, polyfluorene); (ii) low molecular organics (e.g., copper phthalocyanine, perylene derivatives); (iii) fullerenes (C60, C70) and their derivatives (e.g., [6,6]-phenyl-C61-butyric acid methyl ester, PCBM); (iv) perovskites (e.g., methyl-ammonium lead iodide, $CH_3NH_3PbI_3$); (v) dye-sensitised materials (ruthenium, squaraine, rhodamine, porphyrins); (vi) organic-inorganic hybrids (hybrid perovskites like $MAPbI_3$ and nanocomposites). The performance of OPV is determined by the composition of functional donor and acceptor materials. The best PV efficiency (up to 20%) is demonstrated by non-fullerene-based acceptors (NFAs). They form better and more stable structures in the blend with polymer donors, facilitating charge transfer and reducing undesirable phase separation [5]. Carbazole-based acceptors (CBAs) are another important group of materials in the realm of non-fullerene OPV cells. They are attractive due to their unique functional properties, which makes them very promising for improving the performance of OPV [6]. The advantages of CBA materials are as follows: (i) broad absorption spectrum, (ii) good thermal stability, (iii) efficient charge transport, and (iv) tunable electronic properties that can be easily modified by introducing different functional groups to control their spectral absorption, energy levels and crystallinity. By carefully adjusting the conjugation length, electron affinity and molecular packing, these materials offer a promising route toward improving the overall efficiency of organic PV cells. Thus, our review confirms the great potential of using advanced organic PV materials and technologies in the near future.

Keywords: photovoltaic solar cells, thin-film nanotechnology, organic materials, heterocyclic amines, carbazole derivatives, polymer donor materials, non-fullerene acceptor materials

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**Biography**



Dr. Vadym Naumov (born 1952, Loksa, Estonia) is a Senior Researcher at the Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine in Kyiv, and also an associate fellow at the Photonics Research Centre, University of Latvia in Riga. He is the member of APS, IEEE, SPIE and EMRS/Ukraine. He has over 300 scientific publications and 19 patents for inventions. His research interests are modeling, diagnostics and analysis of non-equilibrium and non-linear phenomena in atomic-molecular systems including nanoparticles and nanostructures, in particular, related to hybrid organic-inorganic photovoltaic cells. Contact: vadym.naumov@gmail.com

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**Functionalization of silicon solar cell back contacts by using carbazole derivatives**

**Petro SMERTENKO[1], Nina ROSHCHINA[1], Vadym NAUMOV[1], Daria KUZNETSOVA[1], Saulius GRIGALEVICIUS[2], Gintare KRUCAITE[2], Raminta BERESNEVICIUTE[2], Dovydas BLAZEVICIUS[2], Vidvuds BELDAVS[3]**
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**Abstract**

The back contacts play an important role in the overall efficiency and performance of solar cells. Functionalisation of back contacts can solve problems associated with surface recombination, energy level mismatch and resistance, making it very promising for improving the efficiency of solar cells, especially the injection performance [1]. Functionalisation typically involves modifying the backside contact surface to improve the charge injection from the

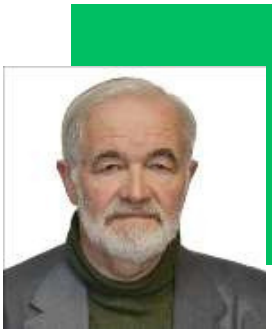
contact surface to the semiconductor. This can be achieved by: (i) passivating the back contact surface with a thin insulating layer or material that reduces surface recombination, (ii) modifying the chemical composition or structure of the surface to create energy levels more favorable for carrier injection, (iii) introducing nanomaterials or thin coatings at the contact interface, e.g., graphene or carbon nanotubes, metallic organic frameworks, chemical doping or alloying of the contact layer, (iv) use of organic or hybrid materials, (v) optimizing the back contact morphology, e.g., creating rough or textured contacts, optimizing the contact geometry; (vi) using chemical vapour deposition (CVD) and atomic layer deposition (ALD) [2-4]. Depending on the nature of chemicals and their solubility, there are a number of deposition methods for surface functionalisation, such as spin-coating, drop-casting, sublimation or vapour deposition. Regarding the coating layer thickness, too thick a layer may produce an insulating effect, while too thin a layer may be insufficient to modify the interface. We used thin layers of carbazole derivatives with a thickness of about 70 nm, deposited by spin-coating on Al back contacts to patterned Si(100) n-type substrates with a resistivity of 2.7 Ohm*cm. The morphology of the functionalised surfaces, studied by optical microscopy, has shown fibrous morphology (sample B-58), square-like morphology (sample DB-74) and network-like morphology (samples DB-70, DB-72, and DB-73). As a result of the functionalisation, the current decreases from three (samples DB-58, DB-74) to ten (samples DB-72, DB-73) times at low bias and even 100 times (sample DB-58) at medium bias in the forward direction. At high bias, the currents are almost the same. This illustrates the functionalisation of the interface itself. In the reverse direction, the situation is different: the curves of samples DB-58 and DB-70 are almost identical at low bias, whereas the current of samples DB-72 and DB-73 is ten times lower. Thus, carbazole derivatives can be effective functional materials for the backside contact functionalisation in various PV structures, including silicon solar cells.

Keywords: Si solar cell, Al back contact, carbazole derivatives, self-assembly, functionalisation

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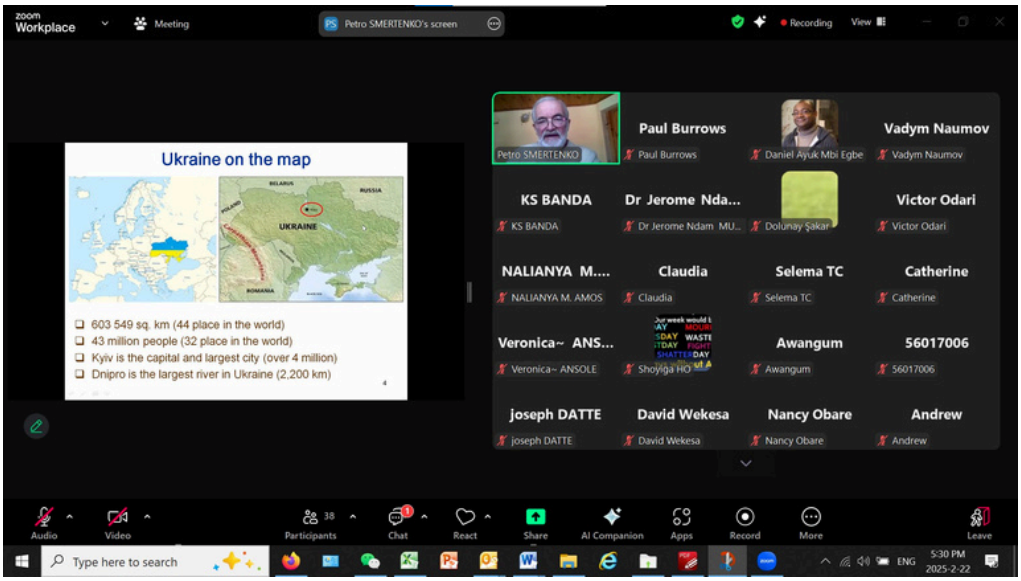
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**Biography**



Dr. Petro SMERTENKO (born 1948, Kyiv, Ukraine) is a Senior Researcher at the Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine in Kyiv, and also an Associate Fellow at the Photonics Research Centre, University of Latvia in Riga. He was the National Coordinator of the EUREKA program in Ukraine in 1999-2011, and he is the executive editor of the international journal “Semiconductor Physics, Quantum Electronics & Optoelectronics” since 2017. He is the member of MRS/Ukraine. He has over 300 scientific publications and 31 patents for inventions. His research interests are electronic and electrophysical processes in hybrid semiconductor structures and devices including photovoltaic solar cells, as well as diagnostics, analyzing and modeling of functional characteristics in complex optoelectronic systems. Additional expertise are R&D eurointegration and innovations. Contact: petrosmertenko@gmail.com

## *Presentation by Petro Smertenko*



**Techno-Economic Feasibility Analysis of Grid-Connected Solar PV System using Mono-Facial and Bi-Facial Modules in Public Senior High School in Ghana. 'A Case Study of Presbyterian Boys' Senior High School'**

**Emmanuel Kengel Dankwa, Dr. Rahimat Oyiza Yakubu.**
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**Abstract**

This study presents a techno-economic analysis of grid-connected solar photovoltaic (PV) systems for public senior high school in Ghana, evaluating both monofacial and bifacial panels to determine their performance and economic and technical viability. The Presbyterian Boys' Senior High School in Accra, Ghana, was used as the case study. The school's daily and monthly energy consumption, along with historical weather data from the project site and PV specifications, were modeled and simulated using PVSYST software version 7.3. The results indicate that the monofacial solar system has an annual energy production capacity of 293 MWh, with a payback period of 7.4 years, a performance ratio of 83.4%, and a levelized cost of electricity (LCOE) of $0.28/ kWh. In contrast, the bifacial system produced 324 MWh annually, with a shorter payback period of 6.9 years, a higher performance ratio of 94.4%, and a lower LCOE of $0.22/ kWh. The study concludes that while both monofacial and bifacial PV systems are technically and economically feasible, the bifacial system offers superior performance and enhanced financial returns, making it a more attractive option for public senior high schools in Ghana. Furthermore, it highlights how factors such as electricity tariffs, emission levies, and subsidies on PV products significantly impact the economic performance of both PV technologies.

**Biography**



Emmanuel Kengel Dankwa is an electrical engineer and researcher specialising in renewable energy technologies. He holds a Bachelor of Science in Electrical and Electronics Engineering from the University of Energy and Natural Resources, Sunyani, and a Master of Philosophy in Renewable Energy Technologies from Kwame Nkrumah University of Science and Technology. His research focuses on photovoltaic system optimisation, energy efficiency, and sustainable energy solutions, with a strong emphasis on decarbonisation and climate change mitigation.

He is passionate about advancing renewable energy solutions and optimising photovoltaic systems to enhance their efficiency and economic viability. He currently works as an electrical planner and quantity surveyor at EAC Electrical Solutions Limited, where he is involved in electrical system design, project planning, and cost analysis.

Since 2022, he has also been serving as a Sales and Installation Advisor at Solacon Energy Limited, contributing to the deployment of solar energy systems for various applications. Additionally, he is an affiliate teacher at Elite College, where he shares his knowledge and expertise with students, inspiring the next generation of engineers and energy professionals.

Emmanuel is dedicated to promoting sustainable energy solutions that drive the transition to a cleaner and more resilient energy future. His work integrates technical, economic, and environmental perspectives to support the widespread adoption of renewable energy technologies.

**Biography**

Dr. Rahimat Oyiza Yakubu is a wife, mother, and a distinguished researcher/consultant in renewable energy technologies, energy policy, and power system analysis. She holds a PhD in Sustainable Energy Technologies from Kwame Nkrumah University of Science and Technology (KNUST), Ghana, an MEng in Electrical and Electronics Engineering, and a BEng in Electrical and Computer Engineering from the Federal University of Technology, Minna, Nigeria.

With extensive experience in renewable energy systems and project management, Dr Yakubu has contributed significantly to advancing clean energy solutions. Her research focuses on renewable energy integration, solar PV systems, wind energy, waste-to-energy, green hydrogen, and carbon markets. She has worked on numerous projects, including the establishment of a solar PV assembly plant at the National Centre for Energy Research and Development (NCERD), Nsukka, and a barefoot renewable energy college in Nigeria.



Dr. Yakubu's achievements have earned her several accolades, including the L'Oréal-UNESCO For Women in Science Sub-Saharan Africa Young Talent Award and the Vice-Chancellor's Excellence Student Award. She has also received competitive research grants, such as the World Bank KEEP Scholarship and the Utrecht-ANSOLE Sur-Place Grant. Beyond research, she is an active contributor to knowledge dissemination through conference presentations, panel discussions, and mentorship programmes. She has served as a judge for renewable energy innovation challenges and participated in global forums on sustainable development. Dr. Rahimat Oyiza Yakubu remains dedicated to advancing Africa's renewable energy transition through innovative research, policy advocacy, and sustainable energy solutions.

**Interface Study and Charge Carrier Dynamics in 2D-3D Heterostructured Mixed-Cation Lead Mixed Halide $FA_{0.75}Cs_{0.25}Pb(I_{0.77}Br_{0.23})_3$ Perovskite**

**Milimo Amos,* Shatsala Miller, Wanyonyi Stella, Mwimali Babra, Isoe Wycliffe, Machiri David, Awino Celline, and Odari Victor.**
**Department of Physics, Masinde Muliro University of Science and Technology, Kenya.**
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**Abstract**
This study establishes that incorporating binary ligands as two-dimensional (2D) perovskite spacer cations significantly enhances the crystallization, morphology, charge-carrier generation, transport, and stability of 2D-3D perovskite films, particularly for a specific mixing ratio of ethylenediammonium diiodide ($EDAI_2$) and n-butylammonium iodide (BAI). To investigate the influence of binary cation ratios on the optoelectronic properties and stability of 2D-3D perovskites, films were fabricated using varied cation mixing ratios {(1.5 mg $EDAI_2$ + 0.5 mg BAI), (1 mg $EDAI_2$ + 1 mg BAI), and (0.5 mg $EDAI_2$ + 1.5 mg BAI) in 1 mL isopropanol (IPA)} to functionalize the 2D perovskite layers atop 3D perovskite layers [$FA_{0.75}Cs_{0.25}Pb(I_{0.77}Br_{0.23})_3$] via spin coating. Initial characterization of the films was performed using photoluminescence (PL) spectroscopy, transient photoluminescence (TRPL), ultraviolet-visible (UV-Vis) spectroscopy, and X-ray diffraction (XRD). PL spectroscopy confirmed the successful formation of the 2D perovskite layer for all mixing ratios. Notably, the films with the optimal organic spacer ratio (1 mg $EDAI_2$ + 1 mg BAI) exhibited enhanced photoluminescence quantum efficiencies (PLQE), smooth, pinhole-free morphology (verified through scanning electron microscopy, SEM), and improved crystallinity over a storage period exceeding 1700 hours. Thus, keeping the same deposition parameters, optimal ratio 1:1 gives the best results for PLQE and stability. These results elucidate the critical role of the binary organic cation ligand ratio in influencing the crystallization, passivation, optoelectronic properties, and self-healing effects of 2D/3D perovskite heterostructures.

**Biography**



Milimo Amos Nalianya completed B.Ed (Physics major & Mathematics) at Kenyatta University (KU), Kenya and M. Sc in Physics at the School of natural Sciences, Department of Physics of Masinde Muliro University of Science & Technology (MMUST) and, recently, enrolled for PhD in Physics at the same institution. Part of his PhD research work was done at the University of Oxford, Department of Physics, Advanced Functional Materials and devices (AFMD) group under Prof. Moritz Riede in collaboration with prof. Henry Snaith with support from Africa-Oxford initiative (AfOx Scholarship). His PhD thesis is related with Two-dimensional (2D) on Three-dimensional (3D) perovskite semiconductor materials and their application in photovoltaic devices, such as solar cells. He spent more than 6 years in the research and development field. During this time, he was involved in several research projects. Email: amuoso@gmail.com



**Biography**

Dr. Benjamin Victor Odari [B.Ed (Sci), MSc (Physics), PhD (Physics)] is a senior lecturer in Materials Science in the Department of Physics, School of Natural and Applied Sciences at Masinde Muliro University of Science and Technology. He graduated with a degree in Bachelor of Education in Science (Physics and Mathematics) in 2009 and Master of Science in Physics in 2013 both from Masinde Muliro University of Science and Technology. He obtained his PhD in Renewable Energy in September 2019 at University of Nairobi, Kenya. Part of his PhD research work was done at the Institute of Energy and Climate Change (IEK5), in Forschungszentrum Jülich, Germany under the scholarship of DAAD. Dr. Odari is involved in research infrastructure development and capacity building in the area of Materials Science. He is a member of the African Network for Solar Energy (ANSOLE) & the country representative for Kenya and a number of scientific networks in the area of energy in Kenya. Dr Odari is also a co-founder and the chairman of the Materials Research Society of Kenya (MRS-K). His current research focuses on characterization of materials and devices for solar energy conversion. Email: vodari@mmust.ac.ke or odarivyc@gmail.com

## Session 5: Photovoltaics 1

**Impact of front and back contacts on the performances of a-Si:H p-i-n solar cell**

**Manelle HANNACHI[1], Zahir ROUABAH[2]**

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**[2]Smart materials and renewable energies laboratory, University Mohamed El Bachir El Ibrahimi, Bordj Bou Arreridj, 34030El-Anasser, Algeria.**

**Abstract**

Hydrogenated amorphous silicon (a-Si:H) solar cell is simulated by using the unidimensional computer code SCAPS-1D (Solar Cell Capacitance Simulator-1D). The objective of the present contribution is to investigate the influence of the front and back work functions on the performances of (a-Si:H) solar cells. The simulation was done under the illumination of 1000 W/m², at 300 K and an air mass of AM 1.5G. However, the work functions of the front and back contacts were varied from 4.95 eV to 5.755 eV and from 3.8 eV to 4.8 eV, respectively. The results of the simulation showed that the performances of a-Si:H p-i-n solar cells increase with the front contact work function ($\eta$ = 11.8131% for $W_{TCO}$ = 5.755 eV) and decrease with the back contact work function ($\eta$ = 5.4835% for $W_{FBC}$ = 4.8 eV). This work shows that the TCO work function strongly affects the solar cell performances. Therefore, it is most important to take the front and back work functions into account in order to achieve the best device performances.

Keywords: solar cell, simulation, conversion efficiency, SCAPS-1D, a-Si:H, work function.

**Biography**



Dr. Manelle HANNACHI obtained her PhD in process and environmental engineering from University of Mohammed El Bachir El Ibrahimi, Bordj Bou Arreridj, Algeria, in 2016. Currently works as a professor at Process Engineering Department, University of Laghouat, Algeria. She is the author and the co-author of 4 international journal publications and 3 international conferences. Her research focuses on renewable energy resource and technologies, photovoltaic systems and materials. Email: hannachi_manelle@yahoo.com

## Session 6: Photovoltaics 2



**The combined effect of thermal treatment and cerium doping on Black Titanium dioxide nanoparticles for perovskite solar cell applications**

**T**ebogo Selema: Sefako Makgatho Health Science University, South Africa.

Abstract

In this paper, cerium-doped black titanium dioxide (Ce-Black-$TiO_2$) was successfully synthesised through the hydrogenation method and was used to study the structural, morphological, and optochemical properties using X-ray diffraction (XRD), photoluminescence (PL), ultraviolet-visible spectroscopy (UV-Vis), Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), transmittance electron microscopy (TEM), and energy dispersive spectroscopy (EDS). Additionally, Ce-Black-$TiO_2$ was used in the fabrication of perovskite solar cell devices to investigate the combined effect of cerium doping and thermal treatment on the power conversion efficiency (PCE) of the material. The diffraction peaks depicted from XRD showed an improvement in the crystallinity of the material as a result of an increase in annealing temperature. UV-vis showed an enhancement in the strength of the absorption peak and also a red shift as a result of the new electronic states. Band-gap extrapolation revealed a decrease from 2.89 eV to 2.48 eV, suggesting that the synthesised material can potentially harvest more sunlight. Furthermore, FTIR showed the stretching vibration of the Ti-O-Ti bond in the TiO and the bonding vibration and the stretching vibration of the O-H bond. A clustered/agglomerated structure was depicted by SEM, and finally, solar cell devices were fabricated, and an increase in the PCE was observed.



**Biography**

I go by the name of Tebogo Selema, born and bred in a village called Sekgosese situated in the Limpopo province. I did both my primary and secondary levels in the village and later moved to Gauteng to pursue my tertiary education at the Sefako Makgatho Health Science University. This is where I completed my undergraduate degree in BSc Mathematical Science, having majored in mathematics and physics. I then furthered my studies and enrolled for honours in physics. Upon completion, I further enrolled in a master's programme, and now I am on the verge of completing my MSc (Physics) degree. Throughout my postgraduate studies, I have attended two conferences, namely, the collaboration symposium hosted by the University of Witwatersrand and the South African Institute of Physics (SAIP) hosted by the University of Zululand. Email: selematebogo53@gmail.com

**Advancing Perovskite Solar Cells: Optimizing $TiO_2$/Graphene Electron Transport Layers for Enhanced Performance and Future Standardization**

**Tshegofatso Sewela,**
**Sefako Makgatho Health Sciences University, South Africa.**

**Abstract**

Perovskite solar cells (PSCs) have emerged as a promising alternative in photovoltaic technology due to their high power conversion efficiency (PCE) and cost-effective fabrication. However, their commercialisation remains limited by stability concerns and inefficient charge transport. This study explores the potential of graphene-enhanced titanium dioxide ($TiO_2$) as an electron transport layer (ETL) to address these challenges. By optimising the composition of $TiO_2$/graphene composites, significant improvements in electron mobility, charge collection efficiency, and interfacial stability were achieved. A detailed morphological analysis was conducted to investigate the synergy between anatase $TiO_2$ and graphene, revealing enhanced structural integrity, reduced recombination losses, and improved charge transport pathways. The results highlight the potential of these hybrid ETLs in boosting PSC efficiency while paving the way for future standardisation in next-generation solar cell technologies. Further research will focus on refining synthesis methods, ensuring long-term stability, and developing scalable fabrication techniques for commercial implementation.

Keywords: Perovskite Solar Cells (PSCs), Titanium Dioxide ($TiO_2$), Graphene, Electron Transport Layer (ETL), Renewable Energy, Stability, Charge Transport, Morphology.

**Biography**



I am Tshegofatso Sewela, an MSc Physics student at Sefako Makgatho Health Sciences University, specialising in renewable energy research with a focus on perovskite solar cells. My research explores the synthesis and characterisation of graphene/$TiO_2$ composites as an electron transport layer to improve the efficiency and stability of perovskite solar cells. In addition to my academic work, I am a junior data analyst, where I integrate technology with physics to enhance research methodologies and data-driven decision-making.

Beyond my current studies, I have a strong passion for sustainability and green technologies, particularly in advancing renewable energy solutions. My future aspirations include pursuing an MBA in Environmental Science and Sustainability and also a PhD in physics to bridge the gap between scientific innovation and practical implementation. I aim to contribute to the development of clean energy technologies, with a focus on scalability and accessibility in the Global South. Through research, data-driven insights, and strategic planning, I hope to drive meaningful progress toward a more sustainable energy future. Email: tshegofatsosewela5@gmail.com

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**Fault Diagnosis in Photovoltaic Systems Using Supervised Machine Learning Models.**

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**Abstract**

A critical challenge in large-scale photovoltaic (PV) systems is the failure of solar modules, which can severely impact system efficiency and power output. These failures necessitate a reliable fault diagnosis tool to ensure optimal performance. The complexity of PV system data has traditionally posed challenges for fault diagnosis, but advancements in machine learning (ML) offer promising solutions. This research investigates fault diagnosis in PV systems using five ML models and their variants. A 7.5 kW PV system was simulated under various operating conditions, generating a comprehensive dataset used for training and testing the ML models. Both hold-out and cross-validation methods were employed to validate the models' performance. Results demonstrate that medium neural networks achieved the highest accuracy, with 98.57% during training and 99.59% during testing using hold-out validation. Wide neural networks followed closely, achieving 96.30% and 98.39% accuracy for training and testing, respectively, under cross-validation. Among ensemble methods, the bagged tree algorithm yielded 93.73% and

94.06% accuracy for training and testing. These findings underscore the potential of ML models for accurate and efficient fault diagnosis in PV systems, enhancing system reliability and reducing downtime in real-world applications.
Keywords: Machine learning, fault diagnosis, photovoltaic systems, neural networks, PV faults.
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**Biography**



Taah Patience Tifuh is a dynamic electrical and electronic engineer dedicated to fostering renewable energy solutions. She holds a Master of Science in Electrical and Electronics Engineering from the National Higher Polytechnic Institute, University of Bamenda. Her research focuses on renewable energy and applications of machine learning. With hands-on experience in designing and installing renewable energy systems, Tifuh has worked on solar lighting, solar-powered pumping, and micro-hydro projects across rural and urban communities.
She was a participant in the African Young Energy Fellowship; she has honed her technical, financial, and leadership skills in clean energy. She is passionate about gender inclusion, and she actively supports initiatives that empower women in clean tech.
Tifuh currently serves as an instructor at the Department of Electrical and Electronic Engineering at the National Higher Polytechnic Institute, University of Bamenda.
Keywords: Machine learning, fault diagnosis, photovoltaic systems, neural networks, PV faults.

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**Advanced IoT-Based Monitoring System for RealTime Photovoltaic Performance Evaluation: Conception, Development and Experimental Validation**

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**Abstract**

This study examines a developed "Trio-PV System-Monitor," which is an intelligent Internet of Things (IoT)-based device used for monitoring solar photovoltaic (PV) systems. The novel instrument with a data resolution of less than 1 minute is designed to measure six important operating variables of PV systems: irradiance, panel temperature, ambient temperature, humidity, PV current, and voltage. The device has the capability to execute statistical operations on the sample data, enabling real-time monitoring of the PV plant's condition. The device exhibits a high level of adaptability in order to monitor PV plants with a maximum rating of up to 90 kW. The device is equipped with weather-resistant sensors, enabling efficient operation in various weather conditions throughout the year. Moreover, the Internet of Things (IoT) functionality allows for the remote monitoring and data collection of a PV system from any location on the globe. The device has undergone testing on a prototype PV system with a power rating of 30W. The testing took place in Dschang, a location situated in the Western Region of Cameroon. Data was collected over two climatic seasons and the device's various capabilities were presented. One of its notable features is its intuitive user interface, which allows for real-time graphical representation of monitored parameters through a desktop application. This newly developed

device is anticipated to function as a comprehensive solution for collecting data from photovoltaic system installations in developing nations, specifically targeting Cameroon. In Cameroon, information regarding PV systems is currently excessively costly and unreliable. The comprehensive findings from a week-long uninterrupted assessment of the PV monitoring device and its applications in harsh environmental conditions demonstrate its reliability and cost-efficiency as a solution for PV system monitoring.

Keywords: Trio- PV system monitor, PV system monitoring, PV parameters, PV data, IoT-based PV system monitoring

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**Biography**



Njimboh Henry Alombah PhD is an engineer and researcher affiliated with the Department of Electrical and Electronics Engineering at the College of Technology (COLTECH), University of Bamenda, Cameroon. He holds postgraduate diploma in Electronics, Electrotechnics and Control Engineering from the University of Dschang, Cameroon. He is also a master trainer in Solar energy technologies with training gained from the National Institute of Solar Energy (NISE, Gurugram-India). Dr. Alombah's research interests encompass design and monitoring of PV plants, energy management and audit, nonlinear control, power electronics, optimization algorithms, photovoltaic emulation, PV monitoring, solar energy resources, and solar irradiance estimation. Dr Alombah has published or co-published over 30 articles in reputable journals. He is actively involved in the peer review process and the advancing of scholarly. Alombah has reviewed numerous papers for high-standing academic journals. He heads the department of electrical and electronics engineering of the University of Bamenda. He is a member of the Indian Society of Lighting Engineers (ISLE), an AEE certified energy auditor and a consultant.

**Bridging Data Scarcity in Africa: A Novel Synthetic Climatic Model for Machine Learning-Driven Renewable Energy Optimization**

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**Abstract**

Renewable Energy Systems (RESs), such as solar Photovoltaic (PV) systems, are highly dependent on climatic factors like solar irradiance and temperature. However, in many developing regions, particularly in Africa, limited access to high-quality, representative climatic data hinders the deployment of machine learning models for optimisation and prediction. To address this challenge, we propose a synthetic data generation model that emulates realistic climatic conditions using sinusoidal patterns and Gaussian noise to capture daily and seasonal variations with real-world fluctuations. This model was employed to train a machine learning framework for predicting the maximum power of a 200 W standalone PV system. With two inputs (irradiance and temperature) and one output (maximum power), the trained model achieved an impressive mean square error (MSE) of $3.1685 \times 10^{-5}$. Experimental validation demonstrated a strong correlation between predicted and measured power outputs. Compared to a baseline machine learning model trained on random data, the proposed approach significantly reduced experimental MSE and RMSE, reinforcing its robustness and real-time applicability. This novel synthetic data generation framework addresses the data scarcity challenge in African energy systems, paving the way for more accurate machine learning applications and enhancing the efficiency of renewable energy deployment under dynamic climatic conditions.

**Keywords**: Renewable Energy Systems (RESs), solar Photovoltaic (PV), Machine learning, Synthetic climatic model.

## Machine Learning Models for Solar PV power Forecasting: A performance Evaluation

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**Abstract**

Fossil fuels, which constitute the major source of power generation across the globe today, contribute enormously to the emission of greenhouse gases, leading to climate change. The adverse effects of power generation from fossil fuels have led to the development and deployment of renewable energy power systems, including solar PV power, whose deployment around the world has witnessed a significant increase in recent years. Solar PV power is dependent on changing weather conditions, which poses a great challenge in managing demand and supply of electrical power. Solar PV power forecasting is essential to guaranteeing better management of PV systems. Traditionally performed using statistical techniques that are proven to have low accuracy and are less reliable, machine learning techniques have been developed because of their capability to manage large amounts of data and yield more accurate results. The objective of this research was to evaluate and compare the ability of different machine learning models to forecast PV power in the NW region of Cameroon. Using data from PVGIS, 24 machine learning models were trained and tested. Two performance evaluation metrics, $R^2$ and RMSE, were used to assess the performance of each model. Among the machine learning models, wide neural networks performed better than the other models, yielding an RMSE of 9.377 W and an $R^2$ of 0.999. Thus, the wide neural network demonstrated its ability to forecast PV power better than the other machine learning models. This model was then used to perform a short-term solar PV power forecast in Bamenda, North West Region of Cameroon.

Keywords: fossil fuel, renewable energy, solar PV power, machine learning, solar PV forecasting.

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**Biography**



Awangum Noel Nkwa is a Cameroonian, who holds Master of Engineering and Master of Science degrees in Electrical and Electronic Engineering from the National Higher Polytechnic Institute of The University of Bamenda. He is passionate about developing engineering solutions to societal challenges, with a strong focus on renewable energy. With extensive experience in solar energy, he has designed and installed numerous photovoltaic (PV) systems, bringing electricity to homes in both rural and urban communities. His research interests align with sustainable energy solutions, and he has published a research article titled "Low- Cost Automated PV Panel Dust Cleaning System for Rural Communities." Currently, he serves as an Electrical Engineering and Renewable Energy Instructor at The University of Bamenda, where he contributes to academic and technical advancements in renewable energy. Email: noelnkwa@gmail.com

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**Numerical Study of RbCsFAPbI1-xBr$_x$ Perovskite for Photovoltaic Application by SCAPS-1D**

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**Abstract**

Perovskite solar cells (PSCs) have attracted the attention of researchers owing to their continually increasing power conversion efficiency (PCE). The present research focuses on comprehensive exploration and detailed optimization using various strategies for designing a tandem device using SCAPS-1D. Numerical analysis has been carried out for RbCsFAPbI1-xBr$_x$ using the device architecture of ITO/$SnO_2$/RbCsFAPbI$_{1-x}$Br$_x$/Spiro-OMeTAD/Au. The thicknesses of the electron transport layer (ETL), hole transport layer (HTL), and absorber layer were varied, also defect density of the photoactive layer was investigated. After optimizing the thickness, defect density, and carrier density, the efficiency of the configuration is increased from 13.01 to 27.40%. The optimal thickness for the electron transport layer was found to be 50 nm for the electron transport layer, 700 nm for the absorber layer, and 100 nm for the hole transport layer (HTL), achieving a power conversion efficiency (PCE) of 27.40%.

**Biography**



Hello, I am Nancy. I am a student at Masinde Muliro University of Science and Technology, pursuing a doctorate in physics. I completed my master's degree from the same university in the year 2022. I have published the following papers: Obare N, Odari V, Mageto M. Effect of Antimony Concentration on Optical, Electrical and Structural Properties of Copper Antimony Sulphide Thin Films Deposited by Spray Pyrolysis. Iranian Journal of Physics 2022.22(3):1-6. Obare N, Isoe W, Nalianya A, Mageto M, Odari. Numerical study of copper antimony sulphide ($CuSbS_2$) solar cell by SCAPS-1D. Heliyon 10 (2024) e26896.

Currently, I am working under the Teacher Service Commission in Kenya, and I have also attended conferences and presented the following paper: Obare N. Effect of Substrate Temperature on Optical, Electrical and Structural Properties of Copper Antimony Sulphide Thin Films Deposited by Spray Pyrolysis Technique. MSSEESA Conference at Nairobi, Kenya. Obare N. Numerical Study of Chalcostibite-Based Photovoltaic Cell by SCAPS-1D. Kabarack University Conference, Nakuru, Kenya, July 2022. I am interested in material for solar energy conversion, solar energy modelling, thin film fabrication, and characterisation: optical, electrical and structural properties for thin films for photovoltaic applications. Email: nancymoraamonantia@gmail.com

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**Design, Synthesis and Characterization of Conjugated Terpolymers for Photovoltaic Applications**

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**Abstract**

Renewable energy sources hold promise as environmentally benign sources of energy for the sustainability of our

ecosystem since the traditional sources, such as fossil fuels, have damaged our planet by releasing toxic byproducts; they are now exhausting. Solar energy is one of this kind which is abundantly available and has the potential to replace the conventional energy sources. Organic electronics, or organic photovoltaics, are of great importance in this context due to the possibility of processing organic semiconductors (conjugated polymers or small molecules) from solution at low temperature for large-area devices at low cost. Moreover, they can be deposited on flexible plastic substrates and can find convenient applications in products such as organic solar cells (OSCs), organic field effect transistors (OFETs), and organic light-emitting diodes, with lower cost, flexibility and lighter weight. The most interesting feature of organic electronics is the fine-tuning of the final properties of the device by slight variation in the molecular structure of organic semiconductors. The last four decades have been marked by intensive research in the field of OSCs.
The present research work deals with the design, synthesis and characterisation of conjugated terpolymers with enhanced solar light absorption and exhibits appropriate band gap engineering. The structure-property relationship was established. These new polymers were investigated for their performance in organic solar cells.

**Biography**



Dr Rupali Jadhav-Chavan is currently working as an assistant professor in the Department of Chemistry at Dr Vishwanath Karad MIT World Peace University, Pune, India. She is an experienced researcher and academician; Rupali completed her PhD at CSIR-National Chemical Laboratory, Pune, India. Her research work involves the design, synthesis and characterisation of conjugated polymers and their applications in organic solar cells. Rupali carried out a part of her research study at TU-Ilmenau, TU-Chemnitz, Germany, and Johannes Kepler University Linz, Austria. Her expertise includes the synthesis characterisation of difunctional monomers for polymer synthesis by metal-catalysed C-C bond formation reactions (Stille coupling, Heck coupling, Suzuki coupling, etc.); the synthesis of conjugated copolymers, terpolymers, and random and block copolymers using polycondensation and ring-opening polymerisation. Rupali also has hands-on experience in the fabricati on and characterisation of solar cell devices. Rupali holds a diploma in patent law and knows patentability and patent draughting. Emails: rupali.chavan@mitwpu.edu.in/rupalijc12@gmail.com. Mobile: +91-9975714798

## Session 8: Electrochemical Processes



**Biosynthesis of silver nanoparticles for electrochemical quantification of sunset yellow**

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**Abstract**
Food safety issues have been known to be a threat to socio-economic stability as well as public health. Despite their sensitivity and accuracy, traditional detection techniques often incur high costs, require significant time, and demand considerable labour. Based on this premise, we developed an electrochemical sensor using biosynthesised silver nanoparticles (BAg NPs) obtained from the Vernonia amygdalina (VA) plant. The morphology of the synthesised nanoparticles was examined using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The micrographs obtained indicate that the nanoparticles exhibit a spherical morphology and show minimal aggregation. The voltammogram of the modified gold-BAg NPs electrode displayed apparent oxidation and reduction peaks associated with the sunset yellow (SSY) analyte. The modified gold-BAg NPs electrode exhibited significant electrocatalytic activity for SSY detection, achieving a low limit of detection (LOD) of $1.3 \times 10^{-3}$ nM and a limit of quantification (LOQ) of $6.4 \times 10^{-9}$ nM, utilising the Square Wave Voltammetry (SWV) technique. Thus, highlighting the enhanced selectivity and stability of the proposed sensor. Hence, the BAg NPs sensor is well-suited for electroanalytical methods for identifying food additives.
**Keywords**: Vernonia amygdalina, electrochemical sensor, silver nanoparticles, biosynthesis

**Biography**



Dr. Hassan Oriyomi Shoyiga is a distinguished researcher and academic who holds a PhD in Chemistry from the University of KwaZulu-Natal (UKZN) in South Africa. His area of expertise is inorganic and materials chemistry. Renewable energy, photovoltaics, flexible electronic devices, materials computation, catalysis, and sensor development constitute his research interests. Dr Shoyiga has published extensively in high-impact journals, with a focus on graphene-based nanocomposites, electroconductive inks, and smart electronic devices, and has over five years of research experience. Dr Shoyiga is currently a research fellow at North-West University and Material Science Innovation and Modelling (MaSIM) in South Africa, where he is involved in the synthesis of biomediated nanoparticles for electrochemical sensor applications and the mentoring of graduate students. Additionally, he has delivered presentations at numerous international conferences, garnering recognition such as the Best Poster Presenter award at the RSC 5th Commonwealth Chemistry Posters in 2024. Dr Shoyiga is a seasoned educator who has taught chemistry and ICT at a variety of institutions and supervised numerous student projects, in addition to his research. He is proficient in computational modelling, advanced instrumentation, and IT tools and is a member of professional organisations such as the South African Chemical Institute (SACI), the Royal Chemical Society (RSC) and the American Chemical Society (ACS).

Electrochemical sensor for the detection of sunset yellow in food using polyaniline/carbon nanopowder nanocomposite modified electrode

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**Electrochemical sensor for the detection of sunset yellow in food using polyaniline/carbon nanopowder nanocomposite modified electrode**

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**Abstract**

Food items frequently face the risk of adulteration, resulting in serious health effects. An example of food fraud is the addition of the synthetic azo dye Sunset Yellow for Colouring Food (SY-FCF). This study reports the developed electrochemical sensors for direct detection of sunset yellow at glassy carbon electrodes modified with polyaniline (PANI) and carbon nanopowder (CNP) nanocomposite. The individual components of the sensor and the nanocomposite were characterised with FT-IR, UV-visible, XRD, SEM and TEM. Determine the limit of detection, limit of quantification and percentage recovery of the electrochemical sensors using square wave voltammetry. The electrochemical analysis of sunset yellow (SSY) using a glassy carbon electrode (GCE) modified with a polyaniline/carbon nanoparticle (PANI/CNP) nanocomposite demonstrated optimal detection at approximately 0.8 V. The detection limit for this GCE/PANI/CNP sensor was calculated to be 1.81 nM, with a broad linear detection range spanning from 1 to 194 nM. From the results obtained, it is concluded that the designed sensor can be a great tool for detecting sunset yellow in food samples.

**Keywords:** Electrochemical sensor; food adulterants; sunset yellow; square wave voltammetry; nanocomposite

**Biography**



Judith Letsoalo is an emerging researcher in the field of chemistry, currently pursuing her MSc in chemistry at North-West University, South Africa, where she is also a part of Material Science Innovation and Modelling (MaSIM). Her research focuses on the synthesis, characterisation, and application of nano-based materials, particularly for electrochemical sensors in biological and environmental analyses, as well as for wound dressing applications. She has hands-on experience in both chemical and green-mediated synthesis of nanomaterials. Judith has served in various academic support roles, including as a student researcher, lab assistant, supplementary instructor, and student assistant at North-West University, where she facilitated study sessions, provided course content clarification, and supported laboratory experiments. She also contributed as a regional judge and mentor for the Eskom Expo for Young Scientists, evaluating science projects from high school students. Her academic journey includes a BSc in Chemistry and Geography and a BSc Honours in Chemistry (with distinction), both from North-West University. Judith has demonstrated exceptional academic performance, earning the Golden Key Certificate as a top 15% high achiever in 2019/20. She is also a published author, with her work on polyaniline/carbon quantum dot nanocomposites featured in Materials Research Express in 2024. She has attended various conferences and workshops, including the 5th International Conference on Nanomaterials, Nanofabrication & Nanocharacterization and Exhibition (NANOMACH 2024), where she presented her paper. She is a member of the South African Chemical Institute (SACI).

**Development of green and chemical synthesis routes of Au/MWCNT nanocomposites for the voltammetric detection of methylene blue dye in river water samples.**

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**Abstract**

**T**his study reports the development of Au/MWCNT nanocomposites for the detection of methylene blue, employing both green and chemical synthesis routes. The synthesised nanomaterials, comprising green synthesised gold nanoparticles ($Au_{grn}$), chemically synthesised gold nanoparticles ($Au_{chm}$), and their respective nanocomposites with multiwalled carbon nanotubes (MWCNT), were characterised using a suite of analytical techniques, including scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), UV-visible spectroscopy (UV), and X-ray diffraction (XRD). The XRD analysis revealed particle sizes of 8.69, 21.26, 5.36, 17.09, and 18.73 nm for $Au_{grn}$, $Au_{chm}$, MWCNT, $Au_{chm}$/MWCNT, and $Au_{grn}$/MWCNT, respectively. The electrochemical properties of the synthesised nanomaterials were investigated using cyclic voltammetry and square-wave voltammetry (SWV). The limits of detection (LOD) and quantification (LOQ) were calculated to be 20.62 nM and 62.51 nM for the $Au_{chm}$/MWCNT electrode and 20.23 nM and 61.30 nM for the $Au_{grn}$/MWCNT electrode, respectively. These results indicate that $Au_{grn}$/MWCNT exhibits slightly superior sensitivity. The practical applicability of the synthesised electrodes was demonstrated through real-sample analysis, where the recovery percentage for $Au_{chm}$/MWCNT ranged from 90% to 99% (n = 3), and $Ag_{grn}$/MWCNT showed a recovery percentage ranging from 97% to 107% (n = 3). The remarkable recovery rates achieved by both electrodes attest to their dependability and sensitivity in methylene blue detection.

**Biography**

Mokole Seleke John is a PhD candidate in Chemistry at North-West University (NWU) in South Africa, where he is pursuing research in analytical chemistry with a focus on the development of electrochemical sensors, catalysis, and material science. Currently, Mokole is affiliated with the Material Science Innovation and Modelling (MaSIM) research group at NWU, where he serves as a postgraduate
student representative. His research endeavours involve thesynthesis
of nanomaterials using eco-friendly and chemical methods for applications in electrochemical sensor technology, specifically for
the detection of dyes in river water. Mokole has established a notable research trajectory, having published three articles since commencing his Ph.D. journey. Additionally, he has presented his research at various conferences, earning recognition for his outstanding contributions, including the Best Poster Presenter award at the Climate and Weather Symposium held at NWU in December 2024. Beyond his research pursuits, Mokole has accumulated valuable experience as a laboratory assistant at the Chemistry Department since 2021. In this capacity, he has provided instrumental support to undergraduate students, assisting with experiments and fostering a deeper understanding of chemical principles among first-, second-, and final-year students.



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**Electrochemical evaluation of ethyl acetate extract of Taxus Baccata as corrosion inhibitor for carbon steel in acidic medium.**

**Karima HANINI[1,2],Sameh BOUDIBA[1], Habiba SOLTANI [1,3], Louiza BOUDIBA[1], Merzoug BENAHMED[2] and Hocine LAOUER[4].**
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**[2]Laboratory of Bioactive Molecules and Applications, Tebessa University, Tebessa, Algeria**
**[3] Laboratory of Organic Materials and Heterochemistry, Tebessa University, Tebessa, Algeria**
**[4]Laboratory for the Valorization of Natural Biological Resources / Ferhat Abbas University, Setif**

**Abstract**

**T**he aim of this work is the evaluation of ethyl acetate (EAE) obtained from the aerial part of ‘‘Taxus baccata’’ as a corrosion inhibitor for API 5LX60 carbon steel in hydrochloric acid solution (1N) using electrochemical techniques (potentiodynamic polarisation, electrochemical impedance spectroscopy, SIE). The SIE plots showed an increase in the size of the impedance spectrum and hence an increase in charge transfer resistance (which is inversely proportional to the corrosion current) according to the increasing inhibitor concentration, proving the formation of a protective layer. The polarisation curves revealed that the EAE acted as a mixed-type (anodic/cathodic) inhibitor. The experimental results show that the EAE is a good corrosion inhibitor, and increasing its concentration leads to an increase in the corrosion inhibition effectiveness of carbon steel, which reached 82.08% for a concentration of 800 ppm at 20 °C.

Keywords – Ethyl acetate extract; Corrosion inhibition; Plant; Adsorption.

**Biography**



My name is Karima HANINI, And I am currently a lecturer in chemistry at the University of Echahid Chikh Larbi-Tebessi (Tébessa, Algeria), team leader in the research laboratory of the Laboratory of Active Molecules and Applications (LMBA), member in the laboratory of Applied Chemistry and Renewable Energies (LACRE) located in the same university, and director of a national research project (PNR) entitled Development of Industrial Phosphate for Solar and Thermal Applications. I obtained my bachelor's degree in exact sciences at the Saadi-sedik high school in Tebessa in 1998. I obtained my graduate diploma in chemistry at Echahid Chikh Larbi-Tebessi University, Tebessa (Algeria), in 2002 and my Magister's degree in materials science at Mohamed Khaider University, Biskra (Algeria), in 2005. I did my PhD in organic chemistry at the University of Tebessa in 2020 and my university habilitation in 2022, working on plant extracts used as corrosion inhibitors and used as additives in electroplating. Email: karima.hanini@univ-tebessa.dz

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**Electrochemical assessment of the ethanolic extract of an Algerian flora species as an additive in zinc electroplating**

**Hadjer Ghalloussi[1], Sameh Boudiba[1*], Ibtissam Saouli[1], Karima Hanini[1], Habiba Soltani[1], Baya Berka[2] Louiza Boudiba[1], and Khaled Rais[1].**

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**Abstract**

Electroplating is an effective method for preventing metal corrosion because it forms a protective layer on the metal surface, enhancing both durability and corrosion resistance. The corrosion resistance of E24-2 carbon steel was tested by coating it with zinc while different concentrations of an ethanolic extract from Algerian plants were added. Potentiodynamic polarisation was employed to assess corrosion resistance in a marine environment. The results indicated that adding 1.6 g/L of the ethanolic extract at room temperature during the electroplating process improved the quality of the deposited layer. The layer had strong adhesion, a bright semi-gloss finish, and a thick coating of 11.73 µm. Furthermore, these results showed an inhibitory efficiency of 89.88%, suggesting that the studied additive significantly enhances the corrosion resistance of the coated steel and could potentially substitute conventional corrosion inhibitors.

Keywords – Corrosion; coating; electroplating; additives; inhibitory effectiveness; deposit quality.

**Biography**



Ghalloussi Hadjer is a PhD Student (3rd year) in Applied Chemistry at Larbi Tebessi University. She had a Master's Degree in Organic Chemistry (2021) and a Bachelor's degree in Nursing. Her research focuses on electrodeposition and nanoparticles, as well as their effects on the environment. I am particularly interested in their ecological impact and their applications in depollution. Email: hadjer.ghalloussi@univ-tebessa.dz| hadjerghalloussi96@gmail.com

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**Square Wave Voltammetry Determination of Iron Concentration at Screen Printed Modified- SPEEK-PANI Electrode**

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**Abstract**

The presence and accumulation of heavy metals in water is a severe threat to human health and the environment. In this study, PANI, SPEEK and SPEEK-PANI composites were synthesised and used to fabricate screen-printed carbon electrode-based sensors. Multiple spectroscopic and microscopic techniques were used for the characterisation of the nanomaterials; these include ultraviolet-visible spectroscopy (UV/Vis), Fourier transform infrared spectroscopy (FTIR), X-ray diffractogram spectroscopy (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and cyclic voltammetry (CV) for the electrochemical characterisation of the bare, PANI, SPEEK, and SPEEKPANI modified screen-printed carbon electrodes. Characterisation of the electrodes in 5 mM K $[Fe(CN)_6]$

demonstrated that the PANI-modified electrode had a better electron transfer compared to other electrodes due to its polymeric and conducting properties. Square Wave Voltammetry was used to determine the concentration of iron at the SPEEK-PANI nanocomposite-modified screen-printed carbon electrode. An LOD and LOQ of 0.081 µm and 0.245 µm were calculated. This study suggests the use of SPEEK-PANI nanocomposite for iron determination in real samples.

**Keywords: SPEEK, PANI, Iron, Screen-printed electrode, Square wave voltammetry**

**Biography**



Kabelo Samuel Banda is a passionate and driven young scientist in the field of chemistry, born on November 10, 2000, in Bakenberg, Mokopane, South Africa. Kabelo's academic journey began with his matriculation in 2019 from Bakenberg High School. He then pursued higher education at the North-West University, where he earned a Bachelor of Science degree in Biochemistry and Chemistry (2020-2023). Building on his undergraduate success, Kabelo enrolled in the Bachelor of Science Honours programme in Chemistry at North-West University, completing his degree in 2024. Currently, Kabelo is furthering his academic pursuits as a Master of Science in Chemistry candidate at the North-West University, a programme he began in 2025 and expects to complete in 2026.

Kabelo's research focuses on the detection of heavy metals in water using Electrochemical sensors. His work aims to develop innovative solutions for monitoring water quality, addressing a critical issue affecting communities worldwide. Throughout his academic career, Kabelo has demonstrated a passion for scientific inquiry, a commitment to excellence, and a drive to make a positive impact on society. As he continues to advance in his field, he is poised to become a leading expert in environmental chemistry and a champion for sustainable solutions.

**Biography**



Professor Omolola Esther Fayemi is an Analytical Chemistry Professor in the Department of Chemistry, of the North-West University, Mafikeng, South Africa. She has her expertise in synthesis, characterization and application of nano-based materials through both chemical and green mediated synthesis. The synthesized nanomaterials are applied in electrochemical sensors for analytes in biological and environmental medium and for wound dressing. She is very passionate about her work. She has postgraduates under her leadership. She has both local and international collaborators and published more than 100 articles in accredited Journals. Email: Omolola.Fayemi@nwu.ac.za

## Session 9: Other Topics



**International Institute of Refrigeration (IIR) sustainable cooling funded projects**
**Dr Ina COLOMBO-YOULA**
**One of the directors of the Association For BME Engineers (AFBE-UK) and the INWIC President-Elect (International Network of Women in Cooling) i.colombo@iifiir.org**

**Abstract**

Empower in Africa Sustainable Cooling development through innovative projects

The International Institute of Refrigeration is a key consortium partner in many projects. Funded at national, European and international levels, these projects support the IIR's core mission of disseminating knowledge about refrigeration to improve the quality of life in a cost-effective and environmentally sustainable way.

The IIR is currently in involved in 2 EU projects for Africa:

•SophiA enables African countries to pursue sustainable pathways of development through a low-carbon, climate resilient and green growth trajectory, leapfrogging fossil fuels and high global warming potential refrigerant technologies.

•AGRI-COOL aims to empower African rural communities and industries by enhancing food security, reducing waste and fostering economic growth, while contributing to achieve African countries' targets under the Paris Agreement. To achieve this, a containerised solution in which food can be stored and cooled will be sought.

The presentation will focus on the progress and outcomes of the 2 projects.

**Biography**



Dr Ina COLOMBO-YOULA, graduated from a PhD in Engineering (Carbon Dioxide refrigeration for retail applications), a Master's Degree in Sustainable Energy Systems, Bachelor's Degree in Building Services Engineering from London South Bank University. She has studied also in French where is obtained a Higher Diploma in Thermal Engineering.

She has joined the IIR in 2013 and is in charge of the project management of national, regional and international funded projects. She is the project manager of the EU funded project SophiA and Agri-Cool. She is the secretary of the IIR working group on Cold Chain in Hot Countries and Careers in Refrigeration "CaRe". She is an advocate of the Diversity in Engineering. She is one of the directors of the Association For BME Engineers (AFBE-UK) and the INWIC President-Elect (International Network of Women in Cooling).

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**Comparison of the Performance of Biodiesel from Jatropha and Castor Oils in an Unmodified Diesel Engine**

**Vicky Nyles Ngouane Momo[1], Nadia Hillary Dassi Djoukouo[1], Daniel A. M. EGBE[23], Martin Tchoffo[4]**

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**Abstract**

The use of non-edible oilseeds for biofuel production provides a sustainable alternative to avoid competition with food crops.

This study compares the performance of biodiesels derived from jatropha and castor oils, implementing a technical, economic, and environmental assessment.

Jatropha and castor seeds were harvested from various locations in Cameroon, dried, and processed into oil using hydraulic pressing. The obtained oil yields were 17% and 27%, respectively. Transesterification resulted in biodiesel yields of 79.4% for jatropha and 83.3% for castor. Physico-chemical analyses indicate that jatropha biodiesel (Jb) has a lower acidity (0.53 mg KOH/g) compared to castor biodiesel (4.77 mg KOH/g), a lower iodine index (35.86 gI/100g vs. 45.56 gI/100g), lower viscosity (2.307 mm²/s vs. 6.194 mm²/s), and a higher cetane index (63.15 vs. 58.49). In terms of calorific value, jatropha biodiesel exhibits a higher value (39.91 MJ/kg vs. 38.78 MJ/kg), suggesting better energy potential. Diesel engine tests revealed that jatropha biodiesel generates higher output power than castor biodiesel but remains lower than fossil diesel.

The noise measured during biodiesel use was lower than that of diesel, indicating quieter operation. Furthermore, tests showed that jatropha biodiesel produces fewer pollutant emissions than castor biodiesel, making it a more environmentally friendly option.

From an economic perspective, the production cost of 1 L of biodiesel is 725 FCFA for jatropha biodiesel and 1550 FCFA for castor biodiesel, highlighting the better cost-effectiveness of jatropha biodiesel. In conclusion, jatropha biodiesel emerges as a more viable alternative than castor biodiesel due to its engine performance, superior physico-chemical properties, and lower production cost. However, further research is needed to optimise the production process and evaluate gas emissions.

Keywords: Biodiesel, Jatropha, Castor, Yield, Diesel Engine, Energy Performance.

**Biography**



Vicky Nyles Ngouane Momo studied and obtained her Masters at the Faculty of Agronomy and Agricultural Sciences of the University of Dschang, Cameroon. She is a seasoned Agricultural Engineer with a strong background in agricultural engineering, boasting over 4 years of experience in designing and implementing irrigation systems and renewable energy solutions. His areas of expertise include the utilization of local materials for energy generation in rural communities, as well as the recycling of biomass for sustainable, economic, and financial applications. Email: vickymomo13@gmail.com

**Biography**



Young Cameroonian aged 29, Dr. Nadia Hillary DASSI D. is a Rural Engineering Engineer, holds a Master's degree in Agricultural Energy and Machinery, and has already obtained her PhD. Besides being the CEO and Co-founder of the startup Power Green, she is the winner of several national and international awards, including the 1st and 5th prize for innovation at the startup week Cati2-Uds 2019, the 2nd national prize at the Youth Entrepreneurship Innovation Challenge UNDP 2019, and the 2nd African prize at the RFI Challenge App. Recently, she was ranked among the 1000 young emerging entrepreneurs of the African continent.

She is not only a successful entrepreneur but also a recognized researcher in the field of agronomic and energy valorization of waste. She has published more than three articles in reputable journals and has also won the Cameroon Biosciences Society 2020 Best Female Presentation Award.

**Assessment of Lead Concentration in Surface Soil in the Industrial Area**

**[1]Mirela Alushllari, Silvana Mico[2]**
**[1]Institute of Applied Nuclear Physics, Department: Instrumental Analytical Methods University of Tirana, Albania**
**[2]Faculty of Natural Sciences, University of Tirana, Albania**
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**Abstract**
Lead is a non-essential element and is found in natural conditions in the form of ores on the surface of the earth at low levels. The presence of high lead concentration in the environment is caused by anthropogenic sources. The lead present in the soil under the influence of atmospheric conditions and physico-chemical parameters also can move and contaminate other parts of the environment, such as water, air or vegetation. The object of this study was the area around the former battery production factory, Uznove, Berat. The current study reports the verification of lead concentration in topsoil samples, distribution of lead concentration at a distance from the factory and comparison of lead concentration found in the samples with the Maximum Concentration Level (MCL) specified by the EEC. Lead is widely used in industry for building construction, lead-acid batteries, bullets, shot, etc. Lead poisoning is an important environmental pollutant that can have lifelong adverse health effects. Lead causes symptoms ranging from the loss of neurological function to death depending upon the extent and time of exposure. The main ways of lead exposure in humans and in animals are food, respiratory processes, and skin. Aspiration of lead from plants through the root system passes it together with nutrients in plants to the food chain. We have selected 21 sampling points at a distance of 80-600 m around the Former Factory Production of Batteries, Berat, Albania. We have collected a total of 21 soil samples. All the representative soil samples were analysed using atomic absorption spectrometry for their lead content. The lead concentrations found in the analysed soils were compared with the Maximum Contaminant Levels (MCL) recommended by Directive 86/278/EEC. Also, is calculated Hazardous Quoted (HQ) for each point sampling. HQ in representative surface soil samples is 0.4 - 80.7 times higher than normal. Analysis of this study was performed at the Institute of Applied Nuclear Physics, University of Tirana, Albania.

Keywords: lead, surface soil samples, industrial area, acid batteries, Atomic Absorption Spectrometry (AAS).

**Biography**



Mirela Alushllari: Mirela is a scientific researcher with extensive expertise in instrumental analytical methods, with a particular focus on the use of atomic emission and absorption techniques for the detection of heavy metals in various fields. Her passion is the development and application of these methods in different scientific studies, including those related to human safety and environmental protection, focusing on the analysis of the impact of heavy metals.
One of her areas of specialisation involves the application of non-destructive testing methods based on the ISO 9712 standard, aimed at evaluating the integrity and characteristics of materials. These methods are essential for maintaining the quality of materials used in various industries and for the conservation of cultural heritage objects, as well as for environmental protection.
Her work is focused on developing new analytical methods and supporting scientific research in the area of instrumental techniques. She aims to advance efforts in sustainable development and improve processes and strategies that contribute to the preservation of natural resources and the conservation of cultural heritage.
Mirela holds a PhD in chemistry and works as a lecturer and scientific supervisor for Master's students, contributing to the education and development of future generations of researchers.
In addition to her technical and scientific skills, Mirela is a self-motivated, adaptable, and passionate individual, deeply committed to scientific research. She is also a responsible professional who continuously seeks challenging tasks and responsibilities, looking for opportunities for growth and career advancement as a successful achievement.

**Preliminary screening of phytochemicals in a plant species from eastern Algeria**

**Randa Bayoud, Louiza Boudiba*, Kawther Chabbi, Karima Hanini, Sameh Boudiba and Khaled Rais.**
**Laboratory of Applied Chemistry and Renewable Energies (LACRE), Echahid Cheikh Larbi Tebessi University, Constantine Road, 12002, Tebessa-Algeria randa.bayoud@univ-tebessa.dz**

**Abstract**
Phytochemicals are secondary metabolites known for their therapeutic effects against various human ailments, explaining the traditional use of medicinal plants in disease treatment. These compounds contribute to a plant's colour, aroma, and flavour while offering numerous health benefits. Algeria, with its vast territory and diverse climatic conditions, harbours rich flora that serves as an abundant source of medicinal resources. The pharmacological potential of a plant can be assessed through the identification of its phytochemicals. This study aims to develop extraction methods and qualitative techniques for the preliminary screening of phytochemicals in a plant species from eastern Algeria. Aqueous and ethanolic extracts were analysed using multiple methods to ensure accurate identification. The screening revealed the presence of flavonoids, saponins, tannins, glycosides, phenols, and terpenoids in both leaves and flowers, while anthocyanins, steroids, terpenoids, and alkaloids were detected exclusively in the flowers. Overall, these results highlight the plant's ethnopharmacological potential and emphasise the need for further studies on its isolated active compounds.
Keywords – Phytochemicals, Medicinal plants, Ethnopharmacology, Extraction methods, Secondary metabolites.

**Biography**



Randa Bayoud is a PhD student specialising in applied chemistry, focusing on natural sources of chemicals, particularly plants, and their applications in corrosion protection and biological activities. Her research aims to explore sustainable and effective natural alternatives to address industrial and environmental challenges. She obtained her diplome, a secondary education teaching certificate, and a qualification certificate for teaching both physics and chemistry from the École Normale Supérieure (ENS) in Kouba in 2013. Since then, she has worked as a high school physics teacher, combining her passion for research and education to bridge the gap between academic knowledge and practical teaching. Beyond her core research, she has also delved into ethnobotanical studies and participated in the ANSOLE conference last year, where she presented a study in this field.
Her work reflects a strong interest in integrating traditional knowledge with modern scientific advancements. Through her academic and professional journey, she strives to contribute to the development of sustainable solutions based on natural resources, whether in corrosion protection or biological applications. She is also committed to knowledge dissemination and actively engages in scientific forums to exchange ideas and expertise. Contact: randa.bayoud@univ-tebessa.dz or randa.byd1@gmail.com

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**Impact of mining iron dust on the phenolic antioxidants, and biological activities of Atriplex halimus L.**

**Khaled Rais[1], Louiza Boudiba[1*], Karima Hanini[1], Sameh Boudiba[1] and Alfred Ngenge Tamfu[2, 3].**
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**Abstract**
Mining activities in Eastern Algeria, particularly in Ouenza, release significant iron dust, affecting plant metabolism and ecosystem stability. This study examines the impact of iron dust exposure on Atriplex halimus L., comparing samples from Ouenza and Tebessa. HPLC-DAD analysis revealed a decline in p-hydroxybenzoic acid and taxifolin levels, while oxidative stress induced a compensatory increase in antioxidant phenolics. Functional assays demonstrated strong inhibition of AChE, BChE, and α-glucosidase, suggesting therapeutic potential, while α-amylase exhibited minimal interaction. Additionally, the extracts displayed robust antibacterial and antifungal activities, highlighting their bioactive properties in polluted environments. These results underscore the role of Atriplex halimus L. in adapting to metal stress and suggest its potential for bioremediation. Understanding plant resilience in contaminated environments contributes to sustainable ecosystem management and pollution mitigation strategies in mining regions.
Keywords – Mining iron dust, Atriplex halimus L.; phenolic antioxidants; antibacterial; antifungal tests.

**Biography**



Professor Louiza BOUDIBA obtained a Diploma of Higher Studies in Chemistry in 1995, her Doctorate in 2005 and her Habilitation in 2007. She has been a teacher since 2012, a member of the National People's Assembly from 2012 to 2017 and seconded to the school Normal Superior of Kouba from 2017 to 2020. She was a member of the expert committees (Magister, License, Master and doctoral schools of chemistry), member of national research projects, international programs and supervised several end-of-study projects, Masters, Magisters, and doctorates. Member of ANSOLE (African Network for Solar Energy) since 2012. Her contribution to scientific research has focused on Organic Materials and their Applications (particularly in electrical conduction and renewable energies), Desalination of Seawater and Brackish Water, treatment of wastewater, treatment of waste (particularly plastic waste, and manufacturing of new materials based on waste), Valorization of synthetic and natural bioactive molecules in several biological and environmental fields.

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**Extraction and characterisation of Hibiscus acetosella leaves' dye and its application to cotton and polyester fabrics using mordants**

**Bernard Wambua Makau**
**Dedan Kimathi University of Technology, Kenya & Institute of Polymeric Material and Testing (IPMT), Johannes Kepler University Linz, Linz, Austria. bernardwambua0463@gmail.com**

**Abstract**

Colour significantly improves the environment in which we live. Dyes are compounds that add colour to objects by absorbing and emitting light only in certain wavelengths. It is estimated that 7 × 107 tonnes of synthetic dyes, which are thought to be persistent pollutants, are produced and used annually. Natural dyes are generally non-toxic and non-allergenic, and generated wastewater can be treated by biodegradation. The Hibiscus acetosella plant belongs to the Malvaceae family and genus Hibiscus, which has over 200 species. This plant is a potential source of natural dyes. It contains anthocyanins responsible for the pink, red, blue and purple colours in parts of the plant. Synthetic dyes have been in existence, extensively used in several industries, poisonous and potentially carcinogenic and mutagenic. They lead to water pollution and increased BOD and COD levels. In this research, H. acetosella leaf samples were collected from Kisii County, Kenya, and Eucalyptus globulus bark samples from Dedan Kimathi University of Technology farm.
The extraction was carried out upon sample preparation. The 80%, 100% cotton and 100% polyester fabrics were obtained from Gakwanja Uniforms, Nyeri Town. The dye and tannins were characterised using chemical tests. Physical tests such as LC-MS, GC-MS and FT-IR were carried out on the dye. The yield of the dye obtained using the cold extraction method (80% ethanol and 0.1% HCl) was 65.44 ± 1.53 mg/g. The main anthocyanin found in H. acetosella leaves was cyanidin-3-O-glucoside, which eluted at a retention time of 22.52 min and with an m/z of 449.0. Besides, some non-polar compounds present were recorded based on the GC-MS data obtained. The fabrics of the size 100 mm × 40 mm were dyed, and their colour fastness was carried out as per the ISO 105-CO3 method. The present study provides reliable information on dye extraction, stabilisation, percentage yield, phytochemical constituents and dyeing suitability of H. acetosella leaves.

**Biography**



Bernard Wambua Makau is a committed scientist and chemist who has demonstrated both academic achievement and scientific expertise in both industrial and research settings. Bernard graduated from Dedan Kimathi University of Technology (DeKUT) with a First-Class honours in Industrial Chemistry. He has completed an internship program in Sustainability and Plastics Management at Johannes Kepler University Linz (JKU), Austria and he is finishing a Master of Science in Chemistry at DeKUT. He performs a variety of responsibilities as a Graduate Assistant at DeKUT, including supervising lab work, undertaking research, and conducting tutorials. During his internships at Highlands Drinks Ltd and New Kenya Cooperative Creameries, he gained skills in chemical analysis and quality control and while in JKU, he gained exemplary skills in polymer processing, analysis, structures and properties. Beyond his responsibilities at work and school, Bernard devotes his enthusiasm to research in materials chemistry, polymer science, and electrochemistry.

As vice secretary of the DeKUT Catholic Chaplaincy Alumni Association, Bernard leads the group and focuses his efforts on charity and environmental conservation.Bernard will significantly advance chemical sciences and sustainable development with his commitment to laboratory experience, analytical skills, and innovative strategies.

**Design and Synthesis of Anthracene-Based Conjugated Polymers via Horner-Wadsworth-Emmons Polyolefination for Enhanced Photovoltaic Performance.**

**Sameh Boudiba[1,2*], Shahidul Alam[3], Christoph Ulbricht[2,4], Louiza Boudiba[1], Oliver Brüggemann[2] and Daniel A. M. Egbe[5,6]**

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**[6]Material Science Innovation and Modelling Research Focus Area. Faculty of Natural and Agricultural Sciences, North-West University, Mahikeng Campus, South Africa**

**Abstract**

In this study, novel anthracene-based polymers with varied side-chain distributions were synthesised using the transition metal-free Horner-Wadsworth-Emmons (HWE) polyolefination reaction. The HWE reaction facilitates the formation of alkenes from carbonyl compounds and alkylphosphonates, typically yielding E-alkenes. The synthesised polymers' purity and structural integrity were confirmed through nuclear magnetic resonance (NMR), size exclusion chromatography (SEC), and X-ray diffraction (XRD). Electrochemical and optical bandgaps were determined via cyclic voltammetry (CV) and absorption measurements, respectively. Photovoltaic performance was assessed using various optoelectrical characterisations. Notably, the optoelectronic properties, as evidenced by IV and EQE measurements, significantly enhanced the performance of solar cells based on the newly synthesised polymers. This improvement was particularly pronounced when additives such as methanol and L-arginine dissolved in methanol were incorporated. The newly developed polymers, AnE-PVaa/bb-aa, bb, and AnE-PVstat, exhibit promising photovoltaic properties.

Keywords: organic semiconducting polymers; photovoltaic application; molecular structure, material-property correlations.

**Biography**



Professor Sameh Bouiba is a distinguished chemist currently serving as a Professor of Chemistry at the University of Echahid Cheikh Larbi-Tebessi (Tebessa, Algeria). She is also the head of the Laboratory of Applied Chemistry and Renewable Energies (LACRE) at the same institution. Her academic journey began at Saadi-Sedik High School in Tebessa, where she earned her bachelor's degree in natural sciences and life in 1994. She then obtained a midwife diploma from the National Institute of Public Health in Constantine, Algeria, in 1997. In 2006, she earned her graduate degree in physical chemistry from Larbi-Tebessi University, followed by a Magister degree in applied organic chemistry from the École Normale Supérieure in Algiers in 2010. Dr Boudiba completed her PhD in organic chemistry at the University of Tebessa under the supervision of Prof. Daniel A. M. Egbe at the Linz Institute for Organic Solar Cells (LIOS), Johannes Kepler University Linz, Austria. Her PhD research focused on the synthesis, characterisation, and applications of polymers in organic solar cells. Following her PhD, she expanded her research to include plant extracts for corrosion inhibition and electroplating additives, which formed the basis of her habilitation, successfully defended in July 2019. In 2024, she obtained her professorship in chemistry, and her work continues to contribute to the advancement of renewable energy and applied chemistry. Email: sameh.boudiba@univ-tebessa.dz

## Session 10: Biographies of other participants

**Biography**

Mrs Dr. Eng. Ajibike Eunice Akin-Ponnle received a PhD in Electrical Engineering from the University of Aveiro, Portugal. She obtained a Master of Engineering Degree in Control Engineering and a Bachelor of Engineering (Electrical and Electronic Engineering) from the Federal University of Technology, Akure, FUTA, Nigeria, in 2014 and 2003, respectively. She was an associate researcher with the Informative Nanomechanics laboratory in the Department of Mechanical and Aerospace Engineering, Tohoku University, Japan, in 2011. Ajibike is a registered engineer with the Council for the Regulation of Engineering in Nigeria, COREN; she is a member of IEEE, the Nigerian Institute of Electrical and Electronics Engineers (NIEEE), IEEE-Women in Engineering (WIE), the Nigerian Society of Engineers (NSE), and some other professional organisations. She is published with a growing number of citations; she is a



participant and speaker in many local and international conferences. Ajibike has a special interest in promoting STEM to young professionals. She is a smart city advocate and sustainability enthusiast with working experiences in academia, research, institutions, government, and industries, spanning across different continents. Her research interests are in energy harvesting (vibration/wind/solar), green technologies, IoT/IIoT, B5G-RAN, smart cities, micro/nano electromechanical (MEMS/NEMS) instrumentation/devices/sensors, and sustainability. ORCID: https://orcid.org/0000-0002-7150-8069, Email: ajibikeakinponnle@gmail.com



**Biography**

Cynthia Muthoni Weis is a finance professional who works as a young client advisor within the S-Future team at Sparkasse Jena. In this role, she focuses on financial education for young people and leads various projects to improve financial literacy. She is also actively involved in leadership development and project management within the bank, promoting innovation and networking opportunities. In addition to her work in finance, Cynthia is a board member and treasurer of ANSOLE e.V., where she contributes to the organisation's sustainability initiatives, particularly in securing funding for various projects. Email: Cynthia.weis@ansole.org

**Biography**

Daria Kuznetsova (born 1995, Dolynska, Kirovograd region, Ukraine) is a PhD student at the V. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine in Kyiv from November 2023. She holds a MS Diploma in Electrical Engineering, speciality: Micro- and Nanoelectronics from the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Electronics, Department of Microelectronics in 2018. She has 6 scientific publications. Her research interests include thin organic film deposition technology, including spin coating and drop casting; characterisation and application of photovoltaic solar cells; electronic and electrophysical processes in hybrid semiconductor structures and devices; IT engineering and robotics. Contact: dahsa.kuznetsova@gmail.com





**Biography**

Chrispen Gumunyu is a Global Communications student at the University of Erfurt in Germany. He earned his bachelor's degree at Midlands State University in Gweru, Zimbabwe. His research currently focuses on discrimination perception among Muslim and Arab communities in Thüringen. He was nominated for DAAD's best international student awards at the University of Erfurt in 2024. He is passionate about research and has experience working in journalism and media marketing. In the long term, he hopes to work in the field of communication with regards to discrimination and racism. He is presently an intern at the African Network for Solar Energy e.V. (ANSOLE e.V.), where he works on a special issue of MIGRANTh magazine focusing on foreign students at various higher education institutions in Thuringia. Email: chrispen.gumunyu@migranth.de



**Biography**

Nigerian-born Assumpta Chidinma Ezeh is a dedicated accountant with a strong background in finance and caregiving who travelled to Germany to pursue a Master's degree in economics. During her studies, she welcomed her first child, now an inquisitive three-year-old, and despite the challenges of balancing motherhood and education, she completed her degree with determination and grace. After graduating, she took a part-time job to support her family, which grew with the arrival of her twin babies, now nine months old. Currently on parental leave, she's navigating the delicate balance of raising three young children while maintaining her career aspirations, approaching each day with patience, resilience and hope. She is an active member of ANSOLE. Email: Assumptaeze37@gmail.com

## Session 10: Biographies of other participants

**Biography**



Mr Koffi Joseph DATTE, is a Doctor of Physics from the University Félix Houphouët Boigny, Cocody-Abidjan, Côte d'Ivoire, after having obtained a master's degree in Electrical and Electronic Systems. He holds a degree in educational sciences from École Normale Supérieure Abidjan, Côte d'Ivoire. In 2017, he attended an ANSOLE summer school at 2IE in Burkina Faso. In 2018, he was a member of the scientific meeting of ANSOLE in Côte d'Ivoire (ASMCI). In August 2019, he participated in the photovoltaic summer school on metrology and failure analysis of solar panels at the Institut National Polytechnique Félix Houphouet-Boigny (INP-HB). He was a participant in the 77th and 78th United Nations meetings with the ANSOLE network. He is currently a lecturer and researcher at the École Normale Supérieure Abidjan. His field of research is photovoltaic material conversion, and he is interested in optoelectronics, organic solar cell construction and thin films. Email: dattjos73@gmail.com



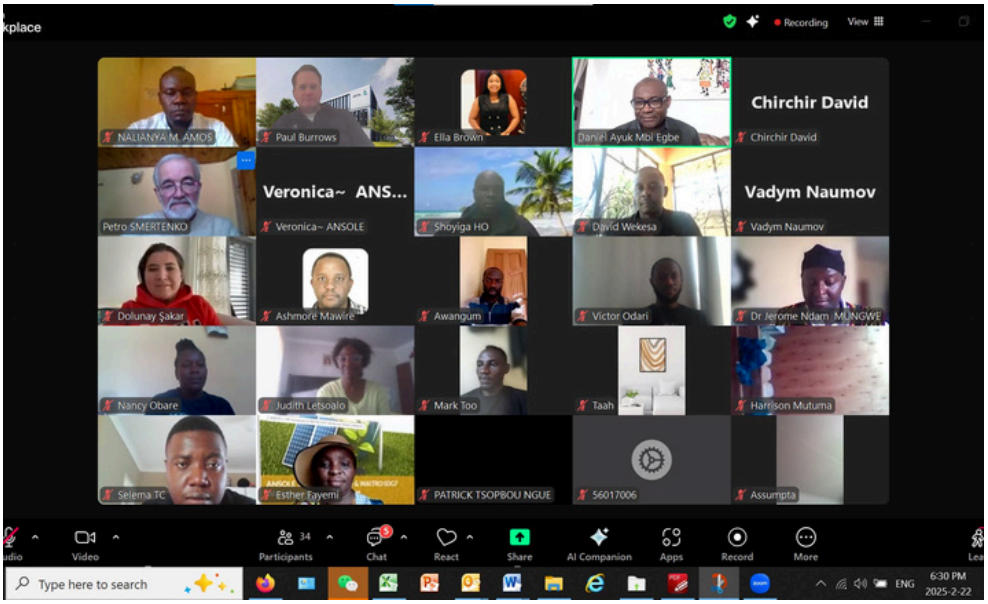
**Biography**

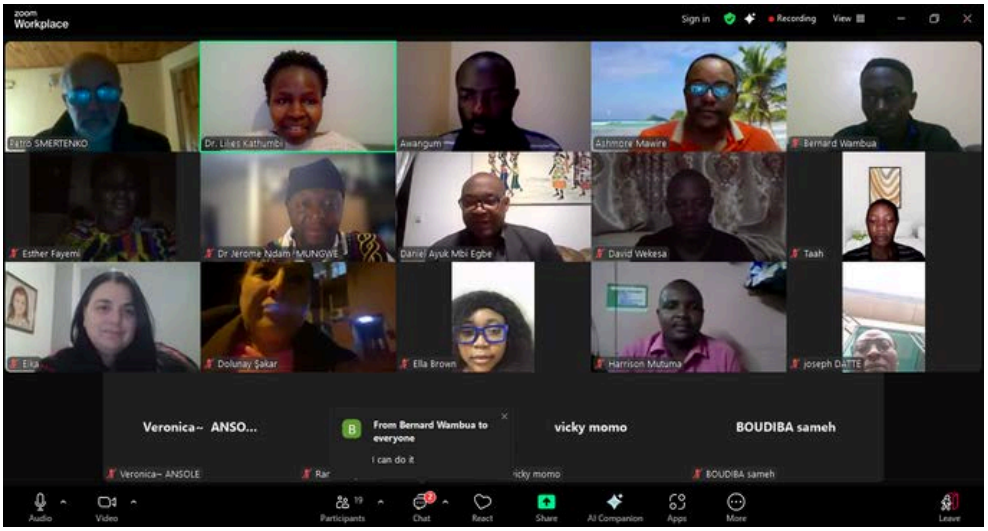
Ms Lei Hou (Holly) is the communication officer of WAITRO at the general secretariat at Jitri in Nanjing, China. Email: leihou.holly@gmail.com

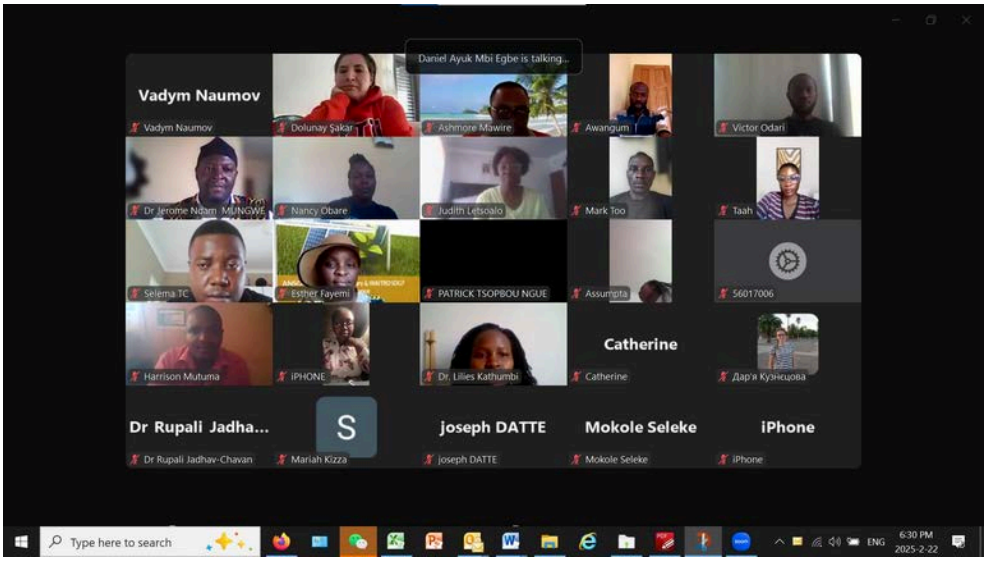


***Rounds of discussion***

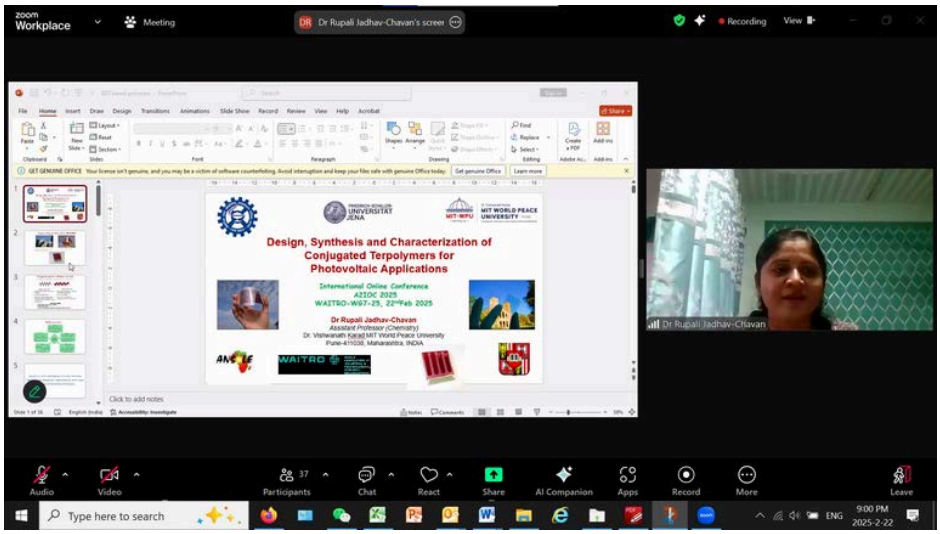


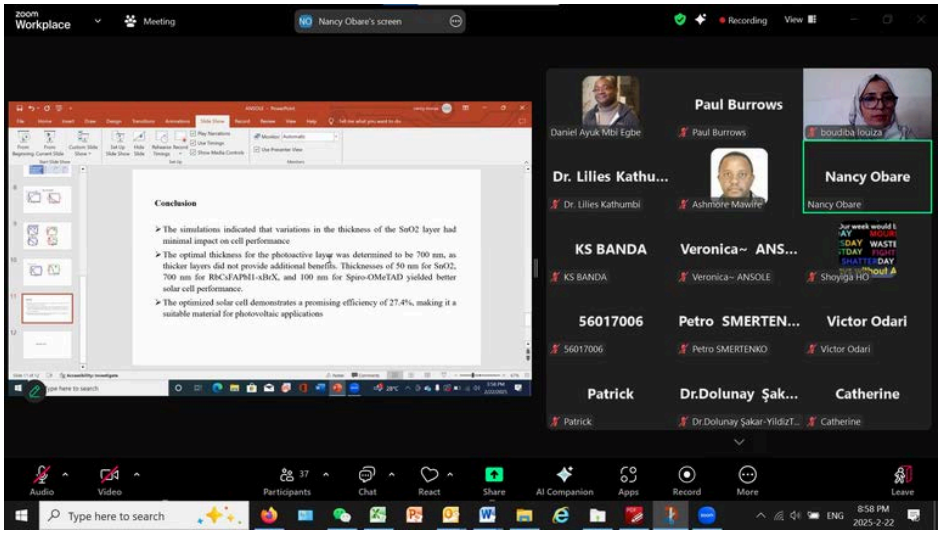

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Veronica~ ANS...
Vadym Naumov
Participants
Chat
React
Share
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Daniel Ayuk Mbi Egbe is talking...
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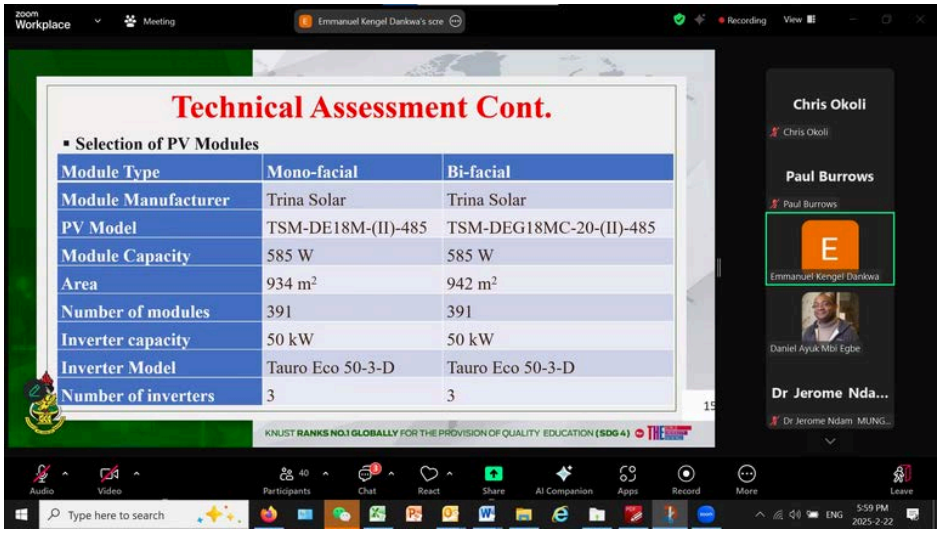
***Presentation of Dr. Rupali Jadhav-Chavan***




***Presentation of Nancy Obare***

***Presentation of Emmanuel Kengel Dankwa***




| Module Type | Mono-facial | Bi-facial |
|---|---|---|
| Module Manufacturer | Trina Solar | Trina Solar |
| PV Model | TSM-DE18M-(II)-485 | TSM-DEG18MC-20-(II)-485 |
| Module Capacity | 585 W | 585 W |
| Area | 934 $m^2$ | 942 $m^2$ |
| Number of modules | 391 | 391 |
| Inverter capacity | 50 kW | 50 kW |
| Inverter Model | Tauro Eco 50-3-D | Tauro Eco 50-3-D |
| Number of inverters | 3 | 3 |

# Impressum

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**&**
**1st WAITRO SDG7 Working Group Online Conference (WAITRO-WG7-25)**
**ISSN 2976 - 2022**

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