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Theme : Materials & electrochemistry for clean energy & environmental sustainability
Online Event

September 24-26, 2026 | LEBANON

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8th International Symposium on Materials, Electrochemistry & Environment. CIMEE'26

- Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
- Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
- Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
- Department of analytical Chemistry, Faculty of Pharmacy, Ankara University, Turkey.
- Laboratory of Electrochemistry, LEIMCR, Faculty of Technology, University of Ferhat Abbas Sétif-1, Algeria
- Faculty of Public Health, Faculty of Science, Doctoral School for Science & Technology, DSST, Lebanese University, Lebanon

June 30, 2026 – Deadline for FP and WP (Second round)

August 31, 2026 – Deadline for FP and WP (Final round)

Key elements & essential information of the session

We warmly invite you to join the CIMEE'26 – the 8th international Symposium on Materials, Electrochemistry and Environment taking place from September 24–26, 2026, in Lebanon, and accessible worldwide through an online platform. https://cimee-science.org/cimee26/ centered around the theme: "Materials and electrochemistry for clean energy and environmental sustainability", the event champions scientific dialogue and real-world application. Through advanced chemical studies and research to investigate and explore rational solutions to global and local environmental problems, new technologies are being developed to combat issues such as air, water, and soil pollution, climate change, waste, and soil contamination. Using analytical techniques and environmental fate modeling, methods for measuring and assessing pollutants released into the environment can determine the persistence time of chemical substances and their transfer through the food chain. Furthermore, new, sustainable, and safe technologies are being developed to improve the energy efficiency of electricity, natural gas, and renewable energy sources. The topics of this conference actively contribute to research aimed at identifying and developing ways to prevent, reduce, and eliminate environmental pollutants for the benefit of humans, plants, and animals. Advances in research and technology are frequently implemented in numerous fields, including industrial processes, waste treatment, and resource management. This effectively contributes to resolving global environmental challenges. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals

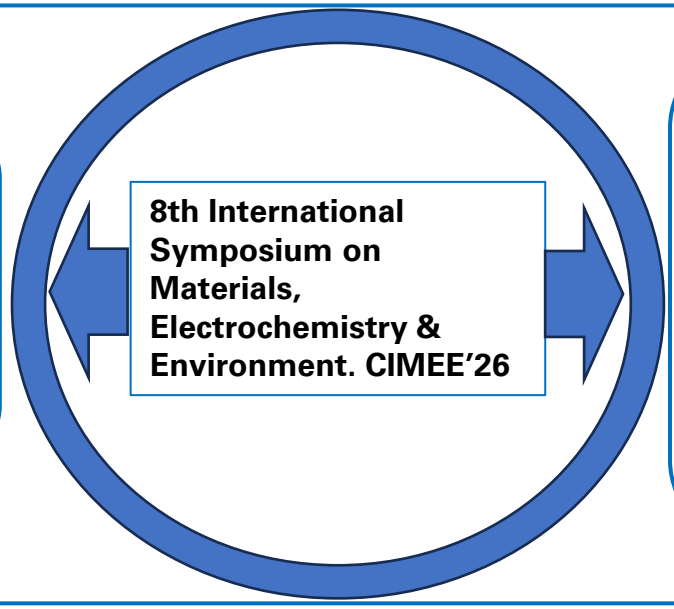
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Keywords: **Materials Chemistry, Electrochemistry, Environmental Analytical Chemistry, clean energy, environmental sustainability, climate change, waste, air, water, soil pollution,** resource management

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Environmental sustainability is being advanced through the intersection of materials chemistry, and electrochemistry, focusing on decarbonization, waste reduction, and renewable energy

Advanced Materials for Sustainability: (i) **Bio-based Materials:** Research focuses on developing biodegradable, bio-sourced polymers from waste or biomass to reduce oil dependence.
(ii) **Smart Materials:** New materials are engineered for improved catalysis, enabling efficient energy conversion and environmental remediation. (iii) **Circular Economy:** Materials are designed for reuse and recycling, aiming to minimize raw material extraction



Sustainable Electrochemistry . (i) **Energy Storage**: Advancements in batteries and electrochemical devices are crucial for storing renewable energy, with researchers tailoring electrode materials for higher energy densities. (ii) **Environmental Remediation**: Techniques like electrocoagulation, electrooxidation, and electroreduction are used to treat wastewater, purify water, and degrade pollutants. . (iii) **Carbon Management:** Electrochemical methods are employed for carbon dioxide reduction, helping to reduce greenhouse gases. . (iv) **Electrocatalysis:** Development of non-toxic catalysts is key to driving green chemical manufacturing and efficient renewable energy storage. The integration of these fields is crucial for tackling global challenges like water scarcity, climate change, and resource shortages.

Key approaches include developing eco-friendly materials, employing green chemistry to minimize hazards, and utilizing electrochemical processes for energy storage, carbon capture, and water purification

Materials chemistry, electrochemistry and their contribution to solving global environmental challenges

Materials chemistry and electrochemistry are foundational to modern sustainability efforts, providing the tools to develop clean energy, manage waste, and remediate pollution. By designing novel materials at the molecular level and utilizing electron transfer processes, these disciplines create "green" chemical synthesis, effective energy storage, and innovative environmental monitoring.

Key Contributions to Global Environmental Challenges:

Renewable Energy Storage & Conversion:

(i) Advanced Batteries: Materials chemistry drives the development of high-capacity, safe, and abundant electrode materials (e.g., sodium-ion, solid-state batteries) to replace conventional lithium-ion, improving energy storage for solar and wind power.

(ii) Fuel Cells & Electrolyzers: Electrochemistry enables the production of green hydrogen from water splitting and the conversion of chemical energy into electricity, crucial for decarbonizing transportation and industry.

Carbon Capture and Utilization (CCU):

Electrochemical reduction technologies are being designed to capture CO_2 and convert it directly into valuable chemicals and fuels, reducing greenhouse gas emissions.

Water Treatment and Environmental Remediation:

(i) Advanced Oxidation Processes (AOPs): Electrochemical methods like electrocoagulation and electrooxidation are used to destroy organic pollutants, pharmaceuticals, and microplastics in wastewater without adding harsh chemical agents.

(ii) Resource Recovery: Electrochemistry allows for the recovery of valuable metals from electronic waste (e-waste) and wastewater streams (e.g., heavy metal removal), supporting a circular economy.

Green Chemical Manufacturing:

(i) Sustainable Materials: Design of non-toxic, biodegradable materials (e.g., bio-based plastics) reduces reliance on fossil fuels.

(ii) Electro-synthesis: Using electrons as clean, low-cost reagents replaces traditional toxic reducing or oxidizing agents, lowering waste generation and energetic costs.

Real-time Environmental Monitoring:

Electrochemical Sensors: Portable devices provide real-time detection of air and water pollutants, enabling rapid identification of contamination sources and effective environmental monitoring.

Through the synthesis of advanced catalysts and electrode materials, these fields ensure technology translation from lab-scale to industrial eco-friendly applications, actively contributing to United Nations Sustainable Development Goals


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Scientific Sessions

1. Achieving a circular economy and mitigating climate change: Key Aspects of Sustainable Catalysis and CO2 Conversion
2. Sustainable catalysis and renewable energy production: Towards a circular economy and climate change mitigation
3. Sustainable catalysis and Biomass conversion: Towards a circular economy and climate change mitigation
4. Achieving a circular economy and mitigating climate change: Sustainable Catalysis Approaches in Water Treatment
5. The global energy crisis: The shift towards renewable energy and storage solutions as a sustainable strategic option
6. Materials Chemistry and Electrochemistry for Bioenergy & Environmental Sustainability
7. Green Hydrogen Production by Dissociating Water Using Solar Energy and Catalysts: The Role of Catalysts and Materials
8. Carbon nanomaterials for electrochemical sensing of pollutants in water and soils sources
9. Biopolymers and their derivatives: Key components of advanced environmental technologies
10. Electrochemical exfoliation as a promising approach for producing high-quality graphene: Recent advances in energy-related and sensing applications
11. Waste management and climate change mitigation: the potential role of Digitalisation in the implementation of the circular economy
12. Advancement in hybrid energy systems (HRES) based on biomass, solar, wind, and hydrogen

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Achieving a circular economy and mitigating climate change: Key Aspects of Sustainable Catalysis and CO2 Conversion

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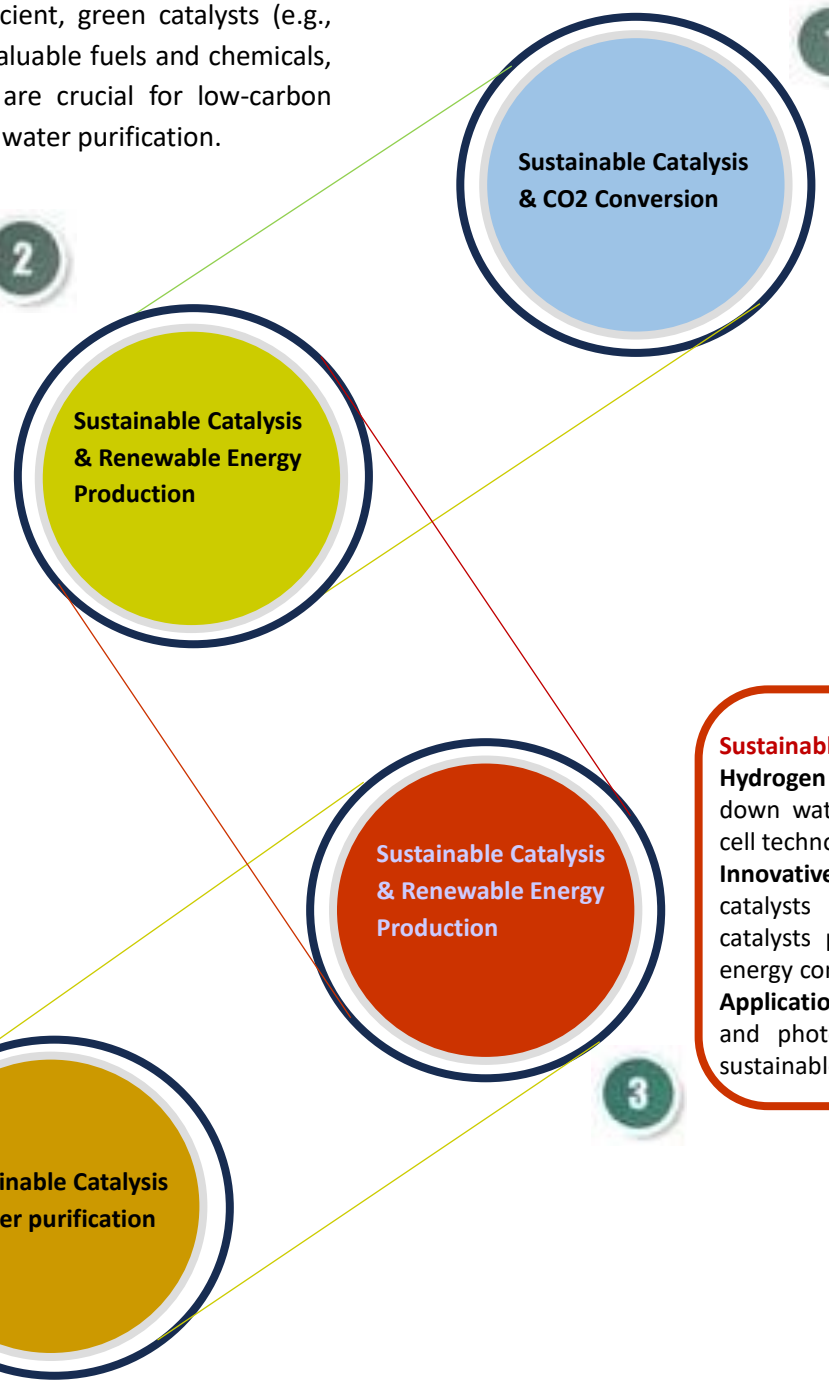
Faced with the problem of climate change and the accumulation of CO2 in the atmosphere, the urgent need for sustainable solutions has placed the conversion of carbon dioxide (CO2) into value-added products at the forefront and has even become a major research focus. Since CO2 is the most abundant greenhouse gas, primarily resulting from the combustion of fossil fuels, innovative approaches are needed to reduce its atmospheric concentration. Catalysis offers promising pathways for transforming CO2 into fuels, chemicals, and other high-value products, thus constituting a viable alternative to conventional carbon capture and storage techniques. Sustainable catalysis for CO2 conversion transforms captured carbon dioxide into valuable products like methanol, methane, and ethylene using renewable energy, creating a circular carbon economy. Key methods include thermal catalytic hydrogenation, electrochemical reduction, and photocatalysis. These processes utilize specialized catalysts (e.g., Cu, Ag, Fe) to break stable CO2 bonds, aiming for high selectivity and low-temperature operation. **Key Aspects of Sustainable Catalysis and CO2 Conversion.** (i) Development of Earth-Abundant Catalysts: To ensure sustainability, research is moving away from scarce, costly noble metals (e.g., Pt, Ru) toward cost-effective catalysts, including metal-free materials, nanomaterials, and transition metals like copper and nickel. These new catalysts are designed to improve selectivity, efficiency, and longevity in industrial environments. (ii) Renewable Energy Integration: Catalytic reactions, particularly electrochemical and photochemical methods, must be powered by renewable energy sources (solar, wind) to make the conversion process sustainable, often utilizing green hydrogen H2 as a co-reactant. (iii) CO2 Utilization and Valorization: Technologies such as thermocatalysis, electrocatalysis, and photocatalysis convert captured CO2 into valuable chemicals and products like urea, carbonates, and synthetic polymers, essentially creating a circular carbon economy. (iv) Hybrid Technologies: Combining technologies, such as non-thermal plasma (NTP) with traditional catalysts, can overcome thermodynamic barriers to CO2 conversion, promising higher efficiency in converting CO2 to syngas or liquid fuels. (v) Biocatalysis: Enzyme engineering and protein engineering, including directed evolution, are used to create highly selective biocatalysts that can operate under mild conditions for CO2 fixation. **Role in Mitigating Climate Change**: Sustainable catalysis acts as a critical link between reducing carbon emissions and providing necessary industrial feedstocks. (i) Carbon Capture and Utilization (CCU): By treating CO2 as a feedstock rather than a waste product, CCU mitigates emissions while creating value, offering economic benefits over simple storage. (ii) Production of E-Fuels: Catalytic processes enable the production of synthetic fuels (e-fuels), allowing for a circular carbon loop where CO2 is captured, converted, used, and emitted again, preventing the release of new fossil carbon. (iii) Waste-to-Resource Conversion: Catalytic chemical recycling of plastics and organic waste minimizes fossil resource use and associated CO2 emissions. . All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Keywords: Climate change, CO_2 conversion Sustainable catalysis, Earth-Abundant Catalysts, thermal catalytic hydrogenation, electrochemical reduction, photocatalysis, thermo-catalysis, electrocatalysis

Achieving a circular economy and mitigating climate change: Key Aspects of Sustainable Catalysis and CO2 Conversion

Sustainable catalysis enables a circular economy by using efficient, green catalysts (e.g., MOFs, enzymes) to convert CO2, biomass, and pollutants into valuable fuels and chemicals, minimizing waste and energy consumption. These advances are crucial for low-carbon industrial processes, renewable energy production, and efficient water purification.



Sustainable Catalysis & CO2 Conversion

Technologies: Catalytic reduction processes are being developed to turn CO2 into valuable chemicals like methanol, formic acid, CH4, and ethylene.

Approaches: Research focuses on photo-, electro-, and plasma-catalysis to convert CO2 using renewable electricity, aiming for high selectivity and low energy consumption.

Challenges: Key hurdles include improving the energy efficiency of electrocatalytic CO2 reduction and increasing the selectivity towards specific, high-value products.

Sustainable Catalysis & Renewable Energy Production

Hydrogen Production: Catalysts are essential for breaking down water molecules into clean hydrogen, supporting fuel cell technologies.

Innovative Materials: Development of non-precious metal catalysts (e.g., nickel or cobalt alloys) and biochar-based catalysts provides cheaper alternatives to noble metals for energy conversion.

Application: These materials improve water splitting, fuel cells, and photocatalytic systems, accelerating the transition to sustainable, cleaner energy sources.

Sustainable Catalysis & Water Treatment

Environmental Remediation: Sustainable catalysts are used to degrade environmental pollutants in water, improving water quality through catalytic oxidation processes.

Waste-to-Resource: Biowastes (agricultural residues) are being converted into functional materials that serve as catalysts, reducing costs and promoting a circular economy.

Efficiency: These systems are designed to operate under mild conditions, making the removal of organic pollutants from water more environmentally friendly.

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Sustainable catalysis and renewable energy production: Towards a circular economy and climate change mitigation

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Sustainable catalysis is essential for renewable energy, enabling cleaner production of hydrogen, biofuels, and efficient carbon dioxide conversion. By lowering activation energy for reactions like water splitting ($2H_2O \rightarrow O_2 + H_2$) and biomass conversion, it reduces energy consumption in industrial processes and drives the transition toward net-zero emissions. **Key Areas in Sustainable Catalysis.** (i) Green Hydrogen Production: Electrocatalysts like nickel (Ni) and molybdenum disulfide (MoS2)) are replacing costly Platinum (Pt) in water splitting. Photocatalysis uses semiconductor-based materials to directly convert sunlight and water into hydrogen. (ii) Biomass Conversion: Heterogeneous catalysts are essential for converting lignocellulosic biomass into bio-ethanol, bio-butanol, and biodiesel, offering a sustainable alternative to fossil fuels. (iii) CO_2 Utilization: Catalysts (e.g., Cu-based catalysts) enable the conversion of captured CO2 into valuable chemicals and fuels (methanol, syngas) through hydrogenation, effectively recycling carbon. (iv) Fuel Cells: Advanced catalysts are crucial for fuel cells, facilitating efficient hydrogen oxidation ($2H2 \rightarrow 4H^+ + 4$ e-) and oxygen reduction to generate electricity, with water as the only byproduct. **Emerging Catalytic Technologies.** (i) Single-Atom Catalysts (SACs): These offer high atom efficiency and tunable catalytic sites for better selectivity and activity in energy conversion reactions. (ii) Photo- and Electrocatalysis: Utilizing renewable electricity (solar/wind) to drive catalytic reactions directly, replacing energy-intensive thermal processes. (iii) Plasma-Assisted Catalysis: Employs plasma to enhance reaction precision and efficiency, especially in methane conversion. **Challenges and Future Directions.** Catalyst Stability: Ensuring durability against degradation and fouling in harsh environments. (i) Cost Reduction: Developing earth-abundant materials to replace precious metals (e.g., Ir, Ru). (ii) Industrial Scalability: Moving from laboratory-scale catalysts to large-scale, sustainable industrial applications. Sustainable catalysis is crucial for developing greener chemical processes and reducing the environmental footprint of industrial energy systems. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Keywords: Sustainable Catalysis, Renewable energy production, Green Hydrogen Production, Biomass Conversion, CO_2 Utilization, fuel Cells, Plasma-Assisted Catalysis, Plasma-Assisted Catalysis, Single-Atom Catalysts

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Sustainable catalysis enables the transformation of biomass (plant matter, waste) into fuels and chemicals, utilizing heterogeneous catalysts like zeolites to remove oxygen and improve thermal stability. This approach supports a circular carbon economy by producing renewable aromatics, aviation fuel, and bio-based materials while utilizing waste, which reduces reliance on fossil fuels.

Key Aspects of Sustainable Catalysis and Biomass Conversion: (i) Catalyst Types: Solid heterogeneous catalysts (zeolites, metal oxides) are favored for their recyclability. Biocatalysts (enzymes/microbes) are used for selective transformations, while mineral-based catalysts offer low-cost, effective options for upgrading bio-oil. (ii) Conversion Processes: Key processes include catalytic fast pyrolysis (breaking down biomass into aromatics), hydrotreating (removing oxygen for fuel), and gasification to produce syngas.
(iii) Target Products: The goal is to produce biofuels (ethanol, bio-jet fuel), high-value platform chemicals (5-HMF, levulinic acid), and platform molecules (aromatics). (iv) Sustainability Advantages: The process is designed to be carbon-neutral or negative, utilizing renewable feedstocks (lignocellulose, algae) and reducing sulfur/nitrogen oxides. (v) Challenges: Achieving economic competitiveness with existing petroleum refineries and handling complex feedstocks remains a focus for industrial scaling. **Key Technologies:** (i) Catalytic Fast Pyrolysis (CFP): Uses catalysts like H-ZSM-5 to turn biomass vapors into hydrocarbons directly. (ii) Hydrodeoxygenation (HDO): A hydrogen-dependent process to remove oxygen and raise the energy density of bio-oils. (iii) Biocatalysis & Fermentation: Utilizing enzymes for mild conversion of biomass into bio-ethanol and bio-based plastics. Sustainable catalysis is crucial for transforming biomass into green energy and materials, contributing significantly to lowering carbon emissions in the industrial sector. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals. Reference: [1] Suiyi Li, Spotlighting of the role of catalysis for biomass conversion to green fuels towards a sustainable environment: Latest innovation avenues, insights, challenges, and future perspectives, Chemosphere. Volume 318, 2023, 137954. [2]. Francesco Nocito, Catalytic Biomass Conversion into Fuels and Materials: Sustainable Technologies and Applications, Catalysts 2025, 15(10), 948; https://doi.org/10.3390/catal15100948.

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Keywords: Sustainable Catalysis, biomass conversion, Green Hydrogen Production, Biomass Conversion, Biocatalysis & Fermentation, Catalytic Fast Pyrolysis, Hydrodeoxygenation

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Achieving a circular economy and mitigating climate change: Sustainable Catalysis Approaches in Water Treatment

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Sustainable catalysis in water treatment is a critical approach for transitioning to a circular economy—treating water as a resource for reuse, nutrient recovery, and energy generation—while simultaneously mitigating climate change by lowering energy consumption, reducing greenhouse gas emissions, and creating cleaner, safer water. In addition, sustainable catalysis in water treatment uses eco-friendly, recyclable materials—such as biowastes, carbon-based materials, and iron-based catalysts—to break down pollutants. By replacing harsh chemicals, these methods enhance advanced oxidation processes (AOPs), minimize secondary pollution, and improve membrane performance for more efficient, cost-effective water purification. **Key Sustainable Catalysis Approaches in Water Treatment:** (i) Biowastes and Carbonaceous Materials: Biochar and activated carbon derived from agricultural waste act as cost-effective catalysts, providing high surface area for adsorption and pollutant degradation. (ii) Advanced Oxidation Processes (AOPs): Utilization of nanocatalysts, including TiO_2 and iron-based Fenton catalysts, allows for the degradation of contaminants into harmless compounds like CO_2 and H_2O. (iii) Photocatalysis: Uses light to drive reactions, removing micropollutants without adding chemicals. (iv) Catalytic Membranes: Integrating catalysts into filtration membranes strengthens fouling resistance and increases lifespan, improving energy efficiency. **Key Benefits of Sustainable Catalysis:** (i) Eco-Friendly and Cost-Effective: Use of renewable, abundant resources reduces dependence on expensive, precious metal catalysts. (ii) Reduced Environmental Impact: Minimizes the generation of hazardous sludge and secondary pollutants. (iii) Increased Efficiency: Higher degradation rates for persistent organic pollutants in wastewater compared to conventional methods. (iv) Reduced Energy Consumption: Optimizes process conditions, such as lower-temperature operations or using renewable energy sources. Current research focuses on combining these techniques—such as coupling catalytic oxidation with membrane separation—to create comprehensive, energy-efficient solutions for water reuse. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Keywords: Sustainable Catalysis circular economy, climate change ,water treatment, photocatalysis, wastewater , renewable energy Biowastes and Carbonaceous Materials

Sustainable materials innovations and novel technologies for clean energy generation

Materials science for sustainability

Key Sustainable Catalysis Approaches

Biowaste-Derived Catalysts: Agricultural residues, food waste, and biomass are converted via pyrolysis or hydrothermal carbonization into efficient catalysts (e.g., biochar) that remove heavy metals and emerging pollutants.

Heterogeneous Catalysts in AOPs: Advanced Oxidation Processes (AOPs), such as photocatalysis, Fenton-like reactions, and persulfate activation, use solid catalysts that are easier to separate and reuse than liquid ones, reducing secondary pollution.

Catalytic Ozonation/Reduction: Heterogeneous catalytic reduction converts toxic inorganic compounds into non-toxic ones using renewable hydrogen, while catalytic ozonation increases the efficiency of organic pollutant degradation.

Catalyst Immobilization on Membranes: Catalysts integrated into membranes (membrane bioreactors) increase fouling resistance, improving membrane longevity and reducing the need for chemical cleaning.

Circular Economy and Climate Mitigation Benefits

Resource Valorization: Technologies such as anaerobic digestion and thermal methods generate energy, while catalytic treatment allows for nutrient recovery from wastewater.

Reduced Carbon Footprint: Sustainable catalysts often operate under milder conditions, reducing the energy-intensive nature of traditional water treatment.

Waste Valorization: Converting biowastes and industrial by-products into catalysts for water treatment reduces waste disposal pressures and supports "waste-to-resource" initiatives.

Efficient Pollutant Removal: Catalytic processes enable the efficient degradation of refractory organic pollutants (e.g., antibiotics) and the removal of emerging contaminants.

Challenges and Future Directions

Stability and Reusability: Ensuring that catalysts remain active over many cycles is crucial for economic feasibility.

Scalability: Translating laboratory-scale results to large-scale wastewater treatment plants requires overcoming logistical hurdles.

Life Cycle Analysis: Future research needs to prioritize the environmental impact of catalyst production, ensuring that "green" catalysts do not cause excessive land use.

Cost Efficiency: Using earth-abundant materials (like iron-based catalysts) is essential to replace precious metals and reduce

Converting carbon dioxide (CO2) into value-added products: sustainable solutions to the problem of climate change

Carbon capture and Utilization (CCU), the conversion of carbon dioxide (CO2) into value-added products, has indeed become a major research focus, transforming an atmospheric pollutant into a valuable resource, thus addressing the climate emergency. This approach is crucial for achieving carbon neutrality goals, particularly for sectors that are difficult to decarbonize, such as air and maritime transport.
Here are the most recent research areas and technological advances (2025-2026):

In summary, the research focuses on catalyst efficiency, reducing energy requirements, and integrating processes to scale up from pilot to industrial production by 2030.

1. Conversion and Valorization Technologies

E-fuel (synthetic fuel) production: This is the most mature pathway, particularly the conversion of CO2 with low-carbon hydrogen to produce methanol or hydrocarbons
Solar reactor: Researchers are developing solar flux reactors capable of directly converting CO2 into fuels (diesel, methanol) without using fossil fuels.
Plasma discharge: Using plasma technology to convert CO2 into carbon monoxide (CO2), which can then be used to produce syngas.
Industrial applications: The transformation into high-value molecules finds applications in cosmetics or the synthesis of active pharmaceutical ingredients.

2. Scientific Innovations and Integration (2026)

Integrated Carbon Capture and Utilization (ICCU): A major advancement involves combining CO2 capture and conversion in a single reactor, eliminating energy-intensive steps such as solvent regeneration.
New Catalysts: Research is underway to develop high-activity, low-cost catalysts using non-rare metals (iron, cobalt) to make the process more economical.
Artificial Photosynthesis: Biological pathways are being explored to shorten value chains by 2040-2050.

3. Challenges and Perspectives

Energy Efficiency: The main challenge remains the energy required for carbon capture and conversion, necessitating coupling with renewable energy sources.
Costs and Scale: Scaling up to industrial production requires reducing operating costs and increasing the durability of catalysts.
Regulatory Context (2026): In Europe, the Carbon Border Adjustment Mechanism (CBAM) and rising carbon quota prices are making CO2 capture and utilization increasingly competitive.

Sustainable solutions to the problem of climate change

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The global energy crisis: The shift towards renewable energy and storage solutions as a sustainable strategic option

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August 31, 2026 – Deadline for FP and WP (Final round)

Abstract

The global energy crisis, driven by geopolitical tensions and fossil fuel reliance, has accelerated the strategic shift toward renewable energy (solar, wind, biomass, hydro) and storage solutions, which are now the cheapest, most secure energy options, projected to provide over 90% of electricity by 2050. This transition increases energy independence, stabilizes markets, and addresses climate change by reducing emissions. **Key Aspects of the Strategic Shift:** (i) Technological Integration: The integration of AI and smart grids is becoming vital for managing decentralized energy generation and optimizing storage for a sustainable future. Moreover, scaling up energy storage systems is vital. These systems manage, store, and distribute excess energy, ensuring reliability during peak consumption. (ii) Economic Opportunity: Renewable energy serves as a catalyst for economic growth, job creation, and fostering innovation, often providing the most cost-effective solution for new electricity generation. (iii) Environmental Necessity: Decarbonizing the energy sector is crucial to meeting international climate goals, as fossil fuel combustion currently drives the vast majority of global emissions. (vi) Security and Stability: Renewables, combined with storage (batteries, hydrogen), reduce reliance on volatile imported fuels, enhancing energy independence. **Challenges and Long-term Strategy:** (i) Intermittency Solutions: Massive investment in energy storage is critical to manage the variable nature of solar and wind power, enabling consistent energy supply. (ii) Supply Chain Management: The shift changes dependencies from oil and gas to new critical mineral and technology supply chains. (iii) Resilience Building: Building a secure, resilient energy system requires diversifying energy sources and strengthening international cooperation. This strategic pivot involves not just building generation capacity but also heavily investing in storage and grid modernization to create a sustainable, resilient energy landscape. (Figure 1). All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Keywords: energy crisis, renewable energy, storage solutions, sustainable strategies, decentralized energy generation, batteries, electricity generation, hydrogen, Long-term Strategy

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Materials Chemistry and Electrochemistry for Bioenergy & Environmental Sustainability

• Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
• Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
• Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
• Department of analytical Chemistry, Faculty of Pharmacy, Ankara University, Turkey.
• Laboratory of Electrochemistry, LEIMCR, Faculty of Technology, University of Ferhat Abbas Sétif-1, Algeria
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Call for paper

June 30, 2026 – Deadline for FP and WP (Second round)

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Keywords: Materials Chemistry, Bioenergy, Electrochemistry, Environmental Sustainability, batteries, Advanced Electrodes, Fuel Cells, Electrolyzers, Bioelectrochemical Systems, microbial fuel cells, microbial electrolysis cells, Water Remediation, wastewater Waste-to-Resource.

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Key elements & essential information of the session

Materials chemistry and electrochemistry are foundational to developing sustainable energy solutions and addressing environmental degradation. By designing advanced, eco-friendly materials and leveraging electrochemical processes, researchers are creating technologies for renewable energy storage, green hydrogen production, and waste remediation. Key areas of focus include: **Sustainable Materials Design**: (i) Bio-derived Materials: Development of carbon-rich materials from biomass (like green tea waste or tree bark) to create hard carbon anodes for sodium-ion and lithium-sulfur batteries. (ii) Advanced Electrodes: Engineering nanostructured materials and bio-inspired electrodes to improve the energy density and durability of energy storage devices. (iii) Biodegradable Electronics: Creation of eco-friendly, soft energy storage systems that reduce electronic waste. **Electrochemical Energy Storage and Conversion**: (i) Next-Generation Batteries: Advancing lithium-sulfur and sodium-ion batteries, which often use biochar-derived electrodes, to replace traditional, resource-intensive batteries. (ii) Fuel Cells & Electrolyzers: Developing non-toxic catalysts for water electrolysis to produce green hydrogen and enhancing fuel cell membranes for efficient energy conversion. (iii) Supercapacitors: Using lignin-based porous carbon nanofibers to improve high-performance energy storage. **Bioenergy and Environmental Sustainability**: (i) Bioelectrochemical Systems (BES): Using microbial fuel cells (MFCs) and microbial electrolysis cells (MECs) to convert organic waste/wastewater directly into electricity or high-value products like hydrogen. (ii) CO2 Utilization: Utilizing electrochemistry to convert carbon dioxide into fuels and chemical feedstocks (microbial electrosynthesis). (iii) Water Remediation: Applying electrocoagulation, electrooxidation, and electrodialysis to treat polluted water and remove hazardous dyes. **Key Methodologies** (i) Green Chemistry: Ensuring that materials manufacturing reduces waste and uses sustainable starting materials. (ii) Process Optimization: Utilizing AI-assisted design and, for example, metal-organic frameworks (MOFs) to optimize electrode efficiency. (iii) Waste-to-Resource: Utilizing animal waste, sewage, and biomass to produce functional materials for environmental applications. These advancements are frequently highlighted at interdisciplinary collaboration (CIMEE series), which emphasize the critical role of these technologies in achieving global sustainability goals. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Green Hydrogen Production by Dissociating Water Using Solar Energy and Catalysts: The Role of Catalysts and Materials

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Keywords: Green Hydrogen Production, Dissociating Water, Solar-driven hydrogen production, noble-metal catalysts, hydrogen evolution reactions Photocatalytic Materials, Titan dioxide, Advanced Materials, Metal-Organic Frameworks

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Key elements & essential information of the session

Solar-driven hydrogen production from water is a sustainable technology that uses photocatalysts to convert water into clean energy, mitigating fossil fuel reliance and carbon emissions. Key advancements include noble-metal catalysts (platinum, iridium) and earth-abundant materials (nickel, iron), which drastically improve production efficiency by lowering activation energy. Recent breakthroughs include triple-layer sunlight catalysts that boost output by 800% and direct seawater photocatalysis for sustainable production. **Key Catalysts and Materials:** (i) Photocatalytic Materials: Titan dioxide TiO2, graphitic carbon nitride (g-C3N4), and graphene are widely used as photocatalysts to split water using sunlight. (ii) Noble-Metal Catalysts: Iridium, Platinum, and Palladium are highly effective for hydrogen evolution reactions (HER) in electrolysis. (iii) Earth-Abundant Catalysts: Nickel (Ni) and Iron (Fe)-based catalysts are key for cost-effective, high-yield hydrogen production. (iv) Advanced Materials: Layered bimetallic catalysts (like Ni/Mo) and ternary photocatalysts are developed to boost sunlight absorption and prevent corrosion, particularly in seawater. **Fundamental Role of Catalysts:** (i) Lowering Activation Energy: Catalysts provide an alternative pathway for water splitting, reducing the energy barrier required. (ii) Light Absorption: Materials like TiO2 act as semiconductors, capturing photons to generate electron-hole pairs that split water. (iii) Stability and Efficiency: Catalysts are crucial to prevent electrode corrosion (especially in seawater) and enhance the long-term stability of the photo-electrochemical system. **Key Technologies:** (i) Photocatalytic Water Splitting: Utilizing sunlight to directly split water over a catalyst. (ii) Solar-Driven Seawater Splitting: A direct method using specialized catalysts to skip desalination. (iii) Atmospheric Water Harvesting-Solar Hydrogen (AWH-SHWC): Produces hydrogen and pure water from atmospheric moisture. **Main Challenges and Prospects:** Although promising, this technology faces obstacles to scaling up to industrial production. (i) Stability: Photocatalysts often degrade rapidly in water. (ii) Solar-hydrogen efficiency: The percentage of solar energy converted into hydrogen remains low. (iii) Cost: There is a need to develop materials based on "abundant terrestrial" elements (Cu, Fe, Ni) to reduce costs compared to using platinum. The challenge lies in moving from laboratory prototypes to large-scale production. (iv) Innovative Materials: Metal-Organic Frameworks (MOFs) are being explored for their large specific surface area, ideal for catalysis. The future of green hydrogen hinges on optimizing these materials for high efficiency and scalability. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Carbon nanomaterials for electrochemical sensing of pollutants in water and soils sources

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Keywords: Carbon nanomaterials, electrochemical sensing, pollutants in water, soils sources, real-time monitoring, Carbon Nanotubes, Graphene-based materials, Carbon Dots, Mesoporous Carbon, high-performance sensors.

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Key elements & essential information of the session

Carbon-based nanomaterials (CNMs)—specifically graphene, carbon nanotubes (CNTs), carbon dots, and mesoporous carbon—enhance electrochemical sensors for detecting water and soil pollutants, such as heavy metals and pesticides, by improving electron transfer, increasing surface area for analyte adsorption, and providing high sensitivity and selectivity. These sensors commonly use glassy carbon electrodes modified with CNMs for real-time monitoring. **Key Carbon Nanomaterials for Sensing:** (i) Carbon Nanotubes (CNTs): Single-walled (SWCNTs) and multi-walled (MWCNTs) are used to enhance electron transfer for detecting heavy metals and pesticides. (ii) Graphene and Derivatives: Graphene-based materials are excellent for sensing due to high carrier mobility and electrical conductivity.(iii) Carbon Dots & Mesoporous Carbon: These provide high adsorption and catalytic capacity for detection. **Applications in Pollutant Detection:** (i) Heavy Metals: Carbon nanotubes and graphene modified electrodes are efficient for identifying toxic metal ions Pb2+, Cd2+, As3+, Hg2+ in water using anodic stripping voltammetry. (ii) Pesticides and Organics: CNT-based biosensors are highly sensitive to pesticides, utilizing the high surface area for immobilizing biological components. (iii) Pharmaceuticals: 2D carbon materials are applied for detecting organic compounds in wastewater. **Advantages and Limitations:** (i) Advantages: High conductivity, wide electrochemical potential window, strong adsorption capability, and low-cost production for portable applications. (ii) Challenges: The need for better stability in complex environmental matrices and scaling up the production of high-performance sensors. CNMs are frequently functionalized with -COOH or -OH groups, or combined with metal nanoparticles (e.g., Fe/C), to improve their sensitivity and selectivity for specific environmental pollutants. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Biopolymers and their derivatives: Key components of advanced environmental technologies

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• Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
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Keywords: Biopolymers, advanced environmental technologies, water remediation, sustainable agriculture, plastic pollution, Agricultural and Functional Materials, nanocellulose, carbon dots, food preservation, circular economy.

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Key elements & essential information of the session

Biopolymers and their derivatives—including polysaccharides (cellulose, starch, chitosan) and microbial polyesters (PLA, PHA)—are sustainable, biodegradable alternatives to synthetic materials, serving as critical components in advanced environmental technologies. They enable advanced water remediation (adsorbing heavy metals/dyes), sustainable agriculture, and eco-friendly packaging, offering a low-carbon, renewable alternative to petro-based plastics. **Key Applications in Environmental Technologies** (i) Water and Soil Remediation: Natural polymers like chitosan, alginate, and cellulose are highly effective at adsorbing heavy metals, dyes, and organic pollutants from contaminated wastewater due to their abundant functional groups (hydroxyls, carboxyls, amino groups). (ii) Biodegradable Packaging & Films: PLA (polylactic acid) and PHA (polyhydroxyalkanoates) are widely used to create biodegradable films and coatings, reducing conventional plastic pollution. (iii) Advanced Materials (Hydrogels/Aerogels): Biopolymers are engineered into porous structures, such as aerogels and hydrogels, which offer high-efficiency filtration, water retention, and separation of organic/inorganic contaminants in air and water purification. (iv) Agricultural and Functional Materials: Biopolymer nanocomposites (e.g., chitosan/Ag) and agricultural films provide enhanced durability, antimicrobial properties, and controlled release of fertilizers. **Advantages and Future Trends:** (i) Environmental Impact: These materials are derived from renewable resources (corn starch, sugarcane, biomass) and often break down safely into water and CO2. (ii) Innovation: Future trends involve using nanocellulose, carbon dots, and modified biopolymers to enhance functionality in UV screening, food preservation, and oil recovery. (iii) Challenges: Current research focuses on overcoming high production costs and improving mechanical strength to match conventional plastics. These materials are transforming waste management and pollution control, driving the transition toward a circular economy. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Electrochemical exfoliation as a promising approach for producing high-quality graphene: Recent advances in energy-related and sensing applications

• Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
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Keywords: Electrochemical exfoliation, producing high-quality graphene, sensing applications, Novel electrode encapsulation strategies, supercapacitors, batteries, non-toxic electrolytes, exfoliation process

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Key elements & essential information of the session

Electrochemical exfoliation is a cost-effective, scalable, and environmentally friendly method for producing high-quality graphene with low defect densities, utilizing ion intercalation to delaminate graphite. Recent advances focus on optimizing electrolytes and voltages to produce few-layer graphene (FLG) with high conductivity, essential for supercapacitors, batteries, and sensitive, eco-friendly sensors. **Key Advances in Electrochemical Exfoliation:** (i) High Quality and Yield: The method produces high-quality graphene, with studies reporting that over 90% of flakes are three layers or fewer, featuring a low oxidation level (C:O ratio ~15). (ii) Two-Step/Optimized Processes: Utilizing specific DC voltages (e.g., +3V followed by ±10V) allows for high-yield, rapid production of high-quality, large-size, and fewer-layer graphene. (iii) Scalability & Efficiency: Novel electrode encapsulation strategies and optimized electrolyte systems can increase graphene yield by up to 20%. (iv) Environmentally Friendly: Use of non-toxic electrolytes and rapid, eco-friendly procedures (e.g., using coffee as a green electrolyte) shows potential for sustainable production. **Energy-Related Applications:** (i) Supercapacitors: EEG provides high capacitance due to its high surface area and high electrical conductivity. (ii) Batteries: It is used as an electrode material, improving conductivity and structural stability. **Sensing Applications:** (i) Electrochemical Sensors: Nitrogen-fluoride co-doped graphene produced via this method is used for rapid, sensitive detection in environmental and biological applications. (ii) Conductive Inks: Low-defect graphene is crucial for high-performance conductive inks, though managing its hydrophobic nature for water-based solutions is a current challenge. **Current Challenges & Future Directions:** (i) Degradation of Graphite: The process can suffer from low yield due to rapid degradation of the graphite electrode. (ii) Scale-up Bottlenecks: Proper heat management and electrode distance control are essential for industrial-scale reactors. (iii) Defect Engineering: Further improving the quality by reducing defects generated during the intercalation/exfoliation process. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Waste management and climate change mitigation: the potential role of Digitalisation in the implementation of the circular economy

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Keywords: Waste management. climate change mitigation, Digitalisation, circular economy implementation, global greenhouse gas, decarbonization, sorting, recycling, Traceability and Analysis, biowaste, landfilling, preserving resources

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Key elements & essential information of the session

Digitalization and circular economy principles are essential for sustainable waste management, offering a pathway to reduce global greenhouse gas (GHG) emissions from waste, through optimized flows (prevention, reuse, recycling), improved energy efficiency, and eco-design assisted by AI and sensors, while simultaneously reducing dependence on primary resources and shifting the sector from a source of emissions to a significant contributor to decarbonization. **Role of Digitalization in the Circular Economy:** (i) Waste Stream Optimization: Sensors and AI enable automatic sorting and improved recycling, making processes more efficient. (ii) Prevention and Reuse: Digital platforms facilitate connections for reuse and reduce losses, particularly food waste. (iii) Traceability and Analysis: Material tracking for better recovery, using technologies such as blockchain and digital twins. **Contribution to Climate Change Mitigation:** (i) GHG Emission Reduction: Transitioning biowaste (methanization) and landfilling towards circularity significantly reduces emissions. (ii) Reduced raw material production: Less extraction and processing thanks to recycling, reducing the carbon footprint associated with production. (iii) Energy efficiency: Optimization of industrial and logistical processes related to waste. **Impact on decarbonization:** (i) From problem to solution: The sector shifts from being a source of emissions (3-5% of global GHGs) to having the potential to reduce total emissions by 20%. (ii) Resource conservation: Reduced demand for fossil fuels related to the extraction and manufacturing of new products. In short, digitalization applied to the circular economy allows us to rethink waste management, no longer as an environmental constraint, but as a strategic tool for decarbonization, creating efficient recovery loops that minimize climate impacts while preserving resources. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Advancement in hybrid energy systems (HRES) based on biomass, solar, wind, and hydrogen

• Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
• Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
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Keywords: hybrid energy systems, biomass, solar, wind, hydrogen, Solar-Biomass Hybridization, thermochemical processes, gasification, pyrolysis, seawater, wastewater, fuel cells, Waste-to-Energy, sewage, municipal solid waste.

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Key elements & essential information of the session

Advancement in hybrid energy systems (HRES) based on biomass, solar, wind, and hydrogen aims to mitigate renewable intermittency, offering consistent, high-efficiency power through optimized hybridization. Key advancements include solar-biomass thermochemical systems, biomass-integrated CSP (Concentrated Solar Power), and polygeneration for heat, electricity, and clean water. **Key Technological Advancements:** (i) Solar-Biomass Hybridization: Solar energy acts as the primary heat source during the day, while biomass provides controllable base-load power at night, reducing dependency on fossil fuels. (ii) Biomass Conversion Improvements: Advanced thermochemical processes, such as gasification and pyrolysis, are being integrated into hybrid systems to improve resource use, with fluidized bed technology showing high potential. (iii) Polygeneration Systems: Modern systems are designed to simultaneously produce electricity, space heating/cooling, and potable water, increasing overall efficiency and economic feasibility. (iv) Hydrogen Integration: The incorporation of biomass with electrolyzers (seawater/wastewater) and fuel cells (SOFCs) serves as a storage solution, providing long-term reliability and green hydrogen production. **Key Benefits & Future** Trends: (i) Cost-Efficient Rural Energy: Hybrid solar-biomass systems offer a reliable, cost-effective power solution for rural, off-grid areas, particularly in developing regions. (ii) Waste-to-Energy: The incorporation of waste management, such as sewage and municipal solid waste, enhances sustainability, with projects in India and Europe demonstrating high energy recovery rates. (iii) Optimization: Advanced techniques like Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) are used to manage complex, multi-resource systems for maximum sustainability. (iv) Environmental Impact: These systems significantly reduce environmental impacts, with some studies showing over 94% primary energy savings compared to conventional systems. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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