CIMEE'26

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

September 24-26, 2026 | LEBANON

CALL FOR ABSTRACTS & MANUSCRIPTS

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Celebrating 10 years



Celebration

10TH Anniversary CIMEE conference celebration

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VIII International Symposium on Materials, Electrochemistry & Environment

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Sustainable wastewater management: From AI innovations to technological treatment solutions

- 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

Call for paper

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

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

Freely accessible

Keywords: Wastewater treatment, Resource Recovery, Circular Economy, Electrochemical Oxidation, Membrane Bioreactors, Advanced Oxidation Processes, Nature-Based Systems, Predictive Maintenance, Machine Learning, Digital Twins, Advanced Monitoring

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Key elements & essential information of the session

Due to increasing pressure from population growth, urbanization, and climate change, sustainable access to water has become a crucial issue. Consequently, the need for innovative solutions in integrated water resource management necessitates innovative approaches to ensure effective planning, monitoring, and optimization of water supply systems. Artificial intelligence and deep learning are revolutionizing sustainable wastewater management by enabling real-time monitoring, predictive maintenance, and autonomous control. These technologies optimize energy use, improve effluent water quality, and maximize resource recovery, paving the way for climate-resilient water systems. **Main Applications in Wastewater Treatment:** (i) Predictive Maintenance: AI transforms plant maintenance from reactive to proactive by forecasting equipment failures. This prevents costly, unplanned downtimes and extends the lifespan of critical infrastructure like pumps and blowers. (ii) Biological Process Control: Advanced algorithms identify and monitor microorganisms and bacteria in incoming water, allowing for precise control of biological nutrient removal (BNR) processes. (iii) Real-Time Process Optimization: Deep learning models, such as Long Short-Term Memory (LSTM) networks, analyze dynamic influent data and historical weather patterns to autonomously adjust treatment parameters (e.g., aeration rates and chemical dosing). This prevents over-treatment, reducing energy consumption by 15% to 30%. (iv) Water Quality Forecasting: By leveraging Internet of Things (IoT) sensors, deep learning models can predict chemical oxygen demand (COD), total suspended solids (TSS), and nutrient concentrations. (v) Circular Economy Integration: By optimizing water reuse, reducing greenhouse gas emissions, and enhancing energy recovery processes to achieve net-zero wastewater treatment facilities. This session explores the crucial role of artificial intelligence (AI) in modern wastewater management and highlights the importance of integrating these technologies to achieve sustainable and efficient wastewater treatment practices. It focuses on modern technologies and various advanced techniques, such as IoT sensors and other methods, that effectively improve real-time monitoring, predictive maintenance, and optimal coagulant dosing, thereby significantly improving water quality. The session will delve into machine learning algorithms and IoT technologies to address global water resource challenges and promote environmental sustainability. 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.

CIMEE'26

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Scientific Sessions

1. Advancing Environmental sustainability: the potential role of Machine learning and algorithms
2. Sustainable wastewater management: From AI innovations to technological treatment solutions
3. Bio-based materials: the role of the transition to environmental sustainability
4. Electrochemical Energy Conversion and Storage: Current Perspectives and Future Horizons
5. Nano-materials based sensors and environmental monitoring: Emerging Applications & Benefits
6. Carbon Dioxide Removal (CDR) innovations technologies: from nature-based approaches to technological solutions

Scientific Sessions

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Keywords: environmental sustainability, real-time environmental monitoring, renewable energy, reduce emissions, Precision Agriculture, Resource Management, accelerate climate research, interdisciplinary work

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Key elements & essential information of the session

Machine learning (ML) and algorithms act as powerful catalysts for environmental sustainability by processing complex data to optimize resource use, reduce emissions, and accelerate climate research. Indeed, machine learning and algorithms advance environmental sustainability by processing massive, complex datasets to optimize resource usage, mitigate climate risks, and improve conservation efforts. These technologies drive critical climate action by enabling smart energy grids, precision agriculture, and accurate ecological monitoring across the globe. For example, Machine learning (ML) provides powerful algorithms that process large-scale ecological and sensor datasets. These tools enable real-time environmental monitoring, optimize renewable energy distribution, map deforestation, and boost agricultural efficiency, making them vital to global sustainability strategies. **Key Applications in Environmental Sustainability: (i)** Renewable Energy Optimization: Algorithms predict energy demand and balance smart grids to integrate volatile renewable sources like wind and solar. They adjust output in real-time, reducing reliance on fossil fuels. **(ii)** Climate Modeling & Risk Prediction: Machine learning refines climate models, improving the accuracy of extreme weather forecasting and greenhouse gas emission tracking. **(iii)** Conservation & Deforestation Monitoring: By analyzing satellite imagery and sensor data, models detect illegal logging, track land-use changes, and monitor endangered species habitats. **(iv)** Precision Agriculture: Algorithms analyze soil health, weather patterns, and crop conditions to optimize water usage, reduce fertilizer waste, and maximize yields. **(v)** Supply Chain & Resource Management: Predictive analytics help businesses optimize transportation routes, reduce excess inventory, and minimize waste, lowering overall carbon footprints. While algorithms provide transformative solutions, their own energy consumption and the need for data transparency remain critical areas of focus. Continuous interdisciplinary work is required to ensure responsible AI and ML implementation in environmental engineering. **Current Challenges:** Despite their massive potential, the deployment of ML algorithms for sustainability faces specific barriers, including high data scarcity, algorithmic bias, and the carbon footprint of training the models themselves. To address this, "Green AI" practices prioritize sustainable hardware and algorithmic efficiency. 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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Advancing Environmental sustainability:

the potential role of Machine learning and algorithms

Key Applications in Environmental Sustainability

Renewable Energy Optimization: Algorithms predict energy demand and balance smart grids to integrate volatile renewable sources like wind and solar. They adjust output in real-time, reducing reliance on fossil fuels.

Climate Modeling & Risk Prediction: Machine learning refines climate models, improving the accuracy of extreme weather forecasting and greenhouse gas emission tracking

Conservation & Deforestation Monitoring: By analyzing satellite imagery and sensor data, models detect illegal logging, track land-use changes, and monitor endangered species habitats.

Precision Agriculture: Algorithms analyze soil health, weather patterns, and crop conditions to optimize water usage, reduce fertilizer waste, and maximize yields

Supply Chain & Resource Management: Predictive analytics help businesses optimize transportation routes, reduce excess inventory, and minimize waste, lowering overall carbon footprints.

Although algorithms provide transformative solutions, their own energy consumption and the need for data transparency remain critical areas of interest. Continuous interdisciplinary work is necessary to ensure a responsible implementation of AI and machine learning in environmental engineering. Indeed, interdisciplinary work combining machine learning (ML) and environmental science creates holistic solutions for the planet. The algorithms excel in real-time monitoring, energy network optimization and climate risk prediction.

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Bio-based materials: the role of the transition to environmental sustainability

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Keywords: bio-based material, environmental sustainability, carbon footprints, biodegradability, biocompatibility, Polysaccharides, Polyhydroxyalkanoates, Chitosan and Alginate, Eco-Friendly Packaging, Environmental Cleanup

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Key elements & essential information of the session

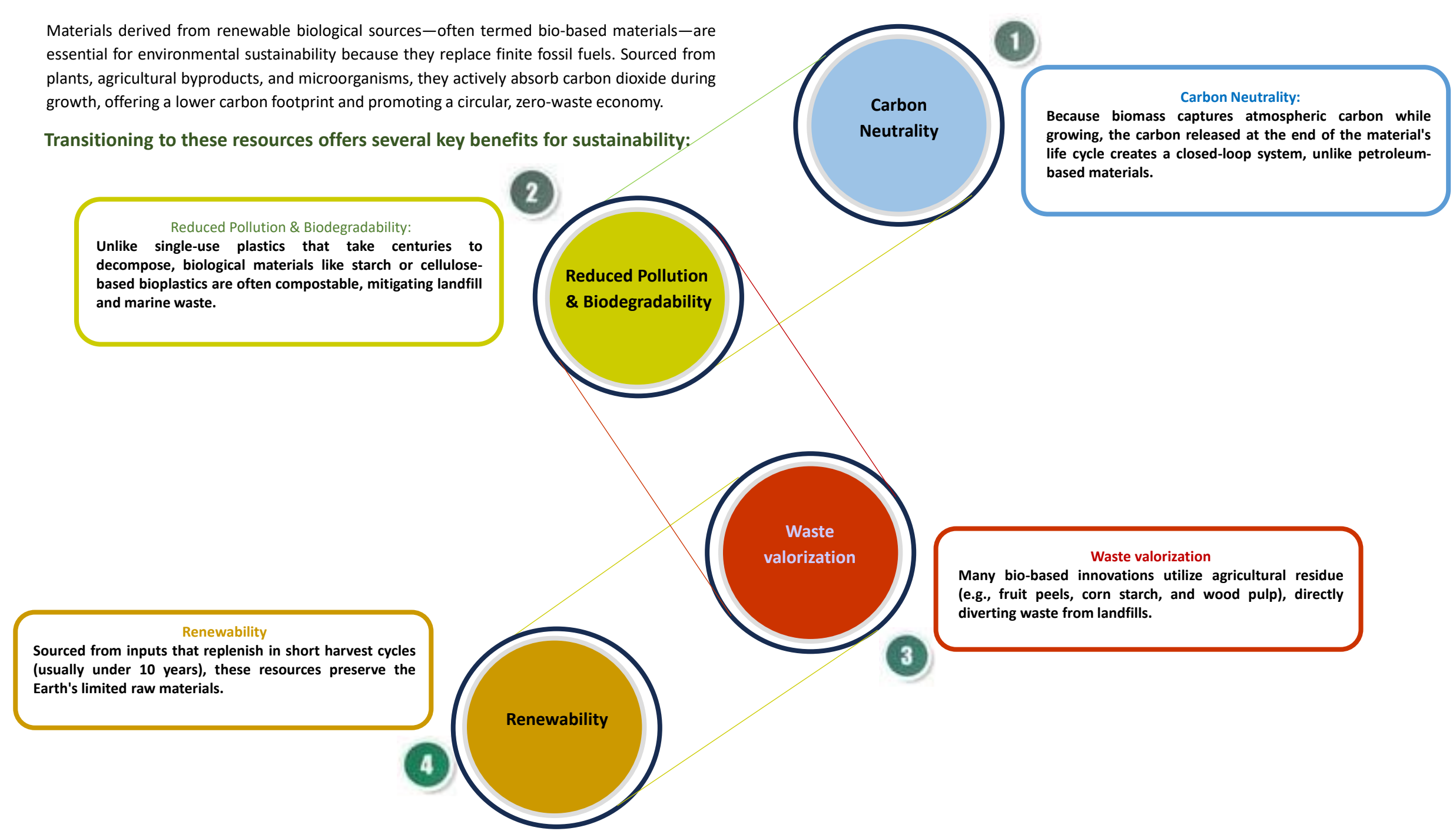
Biomaterials and biopolymers—materials wholly or partially derived from renewable biological sources like agricultural waste, algae, and bacteria—are vital for environmental sustainability. They mitigate plastic pollution, shrink carbon footprints, and replace petroleum-based products through inherent biodegradability and biocompatibility. **The importance of these materials:** Replacing synthetic polymers with bio-based materials offers a critical shift toward a circular economy. Key benefits include: (i) Reduced Fossil Dependence: Decreases reliance on crude oil and minimizes greenhouse gas emissions. (ii) Controlled Lifespans: Conventional plastics take centuries to decompose, whereas properly composted biopolymers can break down completely into organic compounds and biomass within months. (iii) Resource Recovery: Sourcing biopolymers from agricultural or marine waste upcycles materials, preventing landfill accumulation. **Leading Biopolymers in Use**: (i) Polysaccharides (Starch and Cellulose): Sourced from wood pulp, corn, or sugarcane, these are heavily used in sustainable food packaging and green electronics. (ii) Polyhydroxyalkanoates (PHAs): Produced naturally by bacteria via fermentation, PHAs are highly versatile and fully biodegradable, making them ideal for packaging and medical devices. (iii) Chitosan and Alginate: Extracted from marine organisms and agricultural sources, these non-toxic biopolymers provide antimicrobial properties for packaging and environmental cleanup. **Applications Driving Sustainability**: (i) Eco-Friendly Packaging: Biopolymers are rapidly replacing single-use plastics to reduce pervasive waste in oceans and landfills. (ii) Environmental Cleanup: Natural polymer matrices and nanocomposites are employed for wastewater remediation and heavy metal or pollutant capture. (iii) Regenerative Medicine: Biocompatible materials are used for tissue engineering and targeted drug delivery, minimizing ecological toxicity. **Current Industry Challenges:** Despite enormous potential, mass adoption faces hurdles like high production costs compared to traditional plastics, agricultural land-use pressures, and the need for dedicated industrial composting infrastructure. Ongoing research is focused on optimizing microbial biosynthesis to make these materials cheaper and structurally robust. 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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Bio-based materials: the role of the transition to environmental sustainability

Materials derived from renewable biological sources—often termed bio-based materials—are essential for environmental sustainability because they replace finite fossil fuels. Sourced from plants, agricultural byproducts, and microorganisms, they actively absorb carbon dioxide during growth, offering a lower carbon footprint and promoting a circular, zero-waste economy.

Transitioning to these resources offers several key benefits for sustainability:



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Electrochemical Energy Conversion and Storage: Current Perspectives and Future Horizons

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Keywords: rechargeable batteries, fuel cells, electrolyzers, mitigating climate change, Fuel Cells, sustainable hydrogen economy, Supercapacitors, Nanomaterials, Circular Economy and Recycling

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Key elements & essential information of the session

Electrochemical energy conversion and storage (EECS) drives the global clean energy transition by transforming chemical energy into electricity and vice versa. Key technologies like rechargeable batteries, fuel cells, and electrolyzers are critical for mitigating climate change, stabilizing electrical grids, and decarbonizing transportation. EECS technologies encompass several critical devices, each serving a distinct role in the energy landscape: (i) Rechargeable (Secondary) Batteries: Devices like lithium-ion (LIBs), sodium-ion, and solid-state batteries store electrical energy as chemical bonds and release it through reversible redox reactions. (ii) Fuel Cells: Systems that continuously generate electricity and heat as long as a fuel (such as hydrogen) is supplied, offering high-efficiency power for heavy-duty transportation and stationary grids. (iii) Electrolyzers: Devices that use electricity to split water (H_2O) into hydrogen and oxygen, creating a vital link for seasonal energy storage and a sustainable hydrogen economy. (iv) Supercapacitors: Devices that store electrostatic energy at the electrode-electrolyte interface, providing ultra-fast charging capabilities and massive bursts of power. **Current Perspectives and Future Horizons**: (i) Beyond Lithium-Ion: As demand rises, the industry is accelerating the development of post-lithium alternatives to avoid supply-chain and sustainability concerns associated with raw materials like lithium and cobalt. Sodium-ion and potassium-ion batteries are rapidly expanding from research into commercialization for stationary power grids. (ii) Solid-State Architectures: Solid-state batteries replace flammable liquid electrolytes with solid materials, aiming to drastically improve energy density, safety, and longevity in electric vehicles. (iii) Green Hydrogen Economics: Future horizons rely on integrating electrolyzers with renewable energy (solar, wind) to produce green hydrogen. This allows the capture of excess intermittent renewable generation for load-balancing and peak-shaving across the power grid. (iv) Interfacial Engineering & Nanomaterials: Current research heavily focuses on enhancing the electrode-electrolyte interface to prevent degradation, improve ion transport, and increase power output across all electrochemical devices. (v) Circular Economy and Recycling: Developing efficient hydrometallurgical recycling frameworks for end-of-life batteries is a rapidly growing necessity to recover valuable metals and ensure long-term supply chain sustainability. 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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Nano-materials based sensors and environmental monitoring: Emerging Applications & Benefits

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Keywords: 2D Nanomaterials, gas sensors, Carbon Nanotubes, Metal-Organic Frameworks, volatile organic compounds, Quantum Dots, smart monitoring, AI-Assisted Sensing, Pollutants, Detection Technologies

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Key elements & essential information of the session

Advances in nanomaterials have revolutionized environmental monitoring, enabling the rapid, in-situ detection of trace-level pollutants with unprecedented sensitivity. By replacing bulky laboratory equipment, nanoscale sensors provide real-time, low-cost tracking of air, water, and soil hazards, seamlessly connecting data directly to monitoring networks. **Key Nanomaterial Breakthroughs:** Several advanced materials are driving this shift, each offering unique properties tailored for specific environmental challenges: (i) Two-Dimensional (2D) Nanomaterials: Graphene, MXenes, and transition metal dichalcogenides (TMDs) offer high surface-to-volume ratios and tunable electronic structures, ideal for highly responsive gas sensors and field-effect transistor (FET) platforms. (ii) Carbon Nanotubes (CNTs): Renowned for their exceptional electrical conductivity and mechanical strength, CNTs enhance signal transduction in biosensors, allowing for the rapid detection of heavy metals and toxic industrial chemicals.
(iii) Metal-Organic Frameworks (MOFs): These highly porous structures act like molecular sieves, capturing and concentrating specific volatile organic compounds (VOCs) or greenhouse gases in ambient air. (iv) Quantum Dots (QDs): These nanoscale semiconductor particles have tunable optical properties, enabling the use of fluorescent optical sensors for rapid on-site water analysis**. Sensor Integration & Real-World Use: (i)** IoT & Wireless Networks: Modern nanoscale sensors are integrated with Internet of Things (IoT) frameworks to establish dense, city-wide environmental monitoring grids that stream continuous air and water quality metrics. (ii) Smart Monitoring Platforms: Recent innovations combine nanomaterial biosensors with smartphone-compatible platforms, allowing everyday users and field researchers to conduct on-site point-of-use (POU) testing for drinking water contamination and pesticide exposure. (iii) AI-Assisted Sensing: Machine learning (ML) algorithms are increasingly applied to nanoscale sensor data to reduce background noise, automatically identify complex pollutant mixtures, and predict environmental hazards before they peak. **Emerging Applications & Benefits:** (i) In-Situ Water Analysis: Researchers deploy lab-on-a-chip devices to test water sources continuously in the field, eliminating the risk of sample degradation that occurs when transporting water to traditional laboratories. (ii) Personal & Wearable Tech: Flexible substrates coated with nanomaterials are paving the way for wearable chemical sensors that monitor personal exposure to air pollutants in real-time. (iii) Durability: Incorporating robust nanomaterials helps prevent biofouling and degradation, allowing sensors to operate reliably in harsh, unpredictable environments
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Carbon Dioxide Removal (CDR) innovations technologies: from nature-based approaches to technological solutions

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Keywords: Carbon Dioxide Removal , climate change, nature-based solutions, Soil Carbon Sequestration, Biochar, pyrolysis, carbon-rich charcoal, Carbon Capture and Storage, Direct Air Capture, carbon-neutral fuels

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Key elements & essential information of the session

Carbon Dioxide Removal (CDR) methods represent a vital toolkit to counteract climate change by actively pulling legacy greenhouse gases from the atmosphere. This innovation spans from cost-effective, biodiversity-boosting nature-based solutions to highly scalable, durable technological interventions. The CDR innovation spectrum progresses along a continuum of human intervention, moving from biological land management to highly engineered geological storage. **Nature-Based Solutions (NbS):** These methods rely on natural, self-regulating ecosystems to sequester carbon in biomass and soils. (i) Soil Carbon Sequestration & Peatland Restoration: Adjusting agricultural practices (e.g., no-till farming, cover cropping) and re-wetting peatlands to trap carbon in the earth. (ii) Afforestation and Reforestation: Planting trees to expand forests and restore degraded land. Innovations here include using advanced drones for aerial planting and deploying AI-driven satellites to monitor tree growth and measure impact. (iii) Blue Carbon: Restoring coastal and marine ecosystems like mangroves, seagrasses, and salt marshes. These ecosystems are highly efficient at capturing carbon and storing it in deep underwater sediments. **Hybrid and Biological-Engineered Solutions:** These approaches combine natural processes with engineered interventions to overcome the permanence and risk limitations of pure nature-based methods. (i) Biochar: A process where biomass is heated in a low-oxygen environment (pyrolysis) to create stable, carbon-rich charcoal. When buried in soil, it locks carbon away for hundreds of years while improving soil health. (ii) Bioenergy with Carbon Capture and Storage (BECCS): Burning biomass to generate renewable energy while capturing the resulting CO_2 emissions and storing them deep underground, creating net-negative emissions. (iii) Biomass Carbon Removal and Storage (BiCRS): The intentional cultivation of rapidly growing biomass (such as certain fast-growth woods), followed by burial in engineered, airtight, and dry subterranean chambers to prevent decay and CO_2 release. **Technological Solutions**: These fully engineered systems actively pull CO_2 from ambient air and secure it permanently in the geosphere. (i) Direct Air Capture (DAC): Large industrial machines that use fans, liquid solvents, or solid sorbents to capture CO_2 from ambient air. The CO_2 is then separated and permanently injected into deep geological formations or used to create synthetic, carbon-neutral fuels. (ii) Enhanced Rock Weathering: Speeding up natural geochemical cycles by crushing and spreading reactive silicate minerals (like basalt or olivine) over land or ocean water. When these rocks dissolve, they bind with CO_2 to form stable carbonates, effectively neutralizing acidity and storing carbon. (iii) Ocean Alkalinity Enhancement: Adding alkaline substances (like lime) to the ocean surface to increase the ocean's natural capacity to absorb and store atmospheric CO_2 safely. 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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Sustainable wastewater management is shifting from static infrastructure to adaptive, data-driven systems. By integrating Artificial Intelligence (AI) and cutting-edge technologies, utilities are proactively optimizing treatment processes, reducing energy consumption, recovering resources, and minimizing the discharge of pollutants into delicate ecosystems

AI Innovations in Wastewater Management
AI and the Internet of Things (IoT) transform treatment plants from reactive, manual facilities into intelligent, interconnected ecosystems.

Predictive Maintenance: Machine Learning (ML) models analyze vibration and thermal data from motors and pumps to detect anomalies before equipment fails, lowering repair costs and eliminating downtime.

Digital Twins: Utilities utilize accurate virtual replicas of physical plants to experiment with new processes safely, which has been shown to reduce operational expenses by up to 15%.

Advanced Monitoring: Algorithms (such as ANN and LSTM) process raw chemical and biological inputs in real-time, accurately predicting Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) to dynamically adjust aeration and chemical dosing.

Blockage Forecasting: AI models (e.g., SIWA) evaluate rainfall, network usage, and chemistry to provide early warnings for potential sewer blockages and flood risks.

Technological Treatment Solutions
Innovative physical, chemical, and biological technologies work in tandem with AI to extract contaminants and ensure water can be safely repurposed for agriculture or potable use.

Electrochemical Oxidation: Uses electricity to degrade stubborn, emerging contaminants (like pharmaceuticals and synthetic dyes) where traditional biological methods fall short.

Membrane Bioreactors (MBR): Combines biological waste degradation with membrane filtration to produce exceptionally high-quality effluent, perfect for water reuse and recycling.

Advanced Oxidation Processes (AOPs): Technologies utilizing UV irradiation and ozonation to neutralize harmful pathogens and toxic micro-pollutants.

Nature-Based Systems: Engineered or constructed wetlands integrate bio-electrochemical systems to decompose organic materials, providing a highly cost-effective, low-energy tertiary treatment.

Resource Recovery & Circular Economy
Modern wastewater treatment facilities are no longer just disposal hubs; they are emerging as vital nodes in the circular economy.

Nutrient Mining: Technologies selectively extract phosphorus and nitrogen from sewage, converting these pollutants into valuable agricultural fertilizers.

Energy Co-generation: Sludge digestion captures biogas (methane) to power the treatment plant itself, offsetting operational energy demands and lowering carbon emissions.

Decentralized Systems: Small-scale, modular AI-powered treatment systems allow for localized sewage recycling, reducing the need for massive, centralized pipeline infrastructure

Scientific Sessions

Advancing Environmental sustainability: the potential role of Machine learning and algorithms

Sustainable wastewater management: From AI innovations to technological treatment solutions

Bio-based materials: the role of the transition to environmental sustainability

Electrochemical Energy Conversion and Storage: Current Perspectives and Future Horizons

Nano-materials based sensors and environmental monitoring: Emerging Applications & Benefits

Carbon Dioxide Removal (CDR) innovations technologies: from nature-based approaches to technological solutions