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FOREWORD

SGEM Conference Proceedings-Energy and Clean Technologies, Vol 25 / Issue 4.2

Clean Energy Systems and the Hydrogen Transition · Recycling, Waste Management and Circular Economy · Air Quality, Pollution Control and Climate Change Mitigation · Ecology, Biodiversity and Environmental Protection · Economics of Sustainability and Environmental Policies · Education, Training and Capacity Building in Geosciences

It is a privilege to present 25th edition of the *SGEM GeoConference Proceedings 2025 and its Issue 4.2 - Energy and Clean Technologies* — an interdisciplinary scientific volume dedicated to advancing the green sciences through rigorous research, applied innovation, and responsible environmental governance. In a time marked by accelerating climatic shifts, energy transition pressures, and complex ecological risks, green science is increasingly defined not by isolated disciplines, but by integrated solutions that connect technology, policy, ecosystems, and society.

This Issue 4.2 - Energy and Clean Technologies reflects precisely this integrated perspective. The volume brings together contributions that span the full cycle of sustainable transformation—from clean-energy pathways and hydrogen systems, through circular-economy strategies and pollution control, to biodiversity protection, sustainability economics, and the educational frameworks required to build long-term capacity.

Clean energy systems and transition technologies (Hydrogen)

A major thematic core of this volume addresses **clean energy systems, storage, and transition technologies**, with a strong emphasis on **hydrogen** as a vector for decarbonization across multiple sectors. The contributions explore hydrogen production and utilization scenarios, modeling and simulation approaches, techno-economic and policy-related assessments, system integration in maritime and offshore environments, and the interplay between renewable generation, storage, and grid frameworks. This section demonstrates how the hydrogen transition is not a single technology question, but a systems challenge—combining safety, efficiency, infrastructure readiness, regulatory context, and lifecycle thinking.

Recycling, circular economy, and resource efficiency

A second major axis focuses on **recycling, waste management, and circular economy**, presenting research that transforms waste streams into resources, evaluates material and process impacts, and strengthens circular strategies through life-cycle assessment and systems thinking. The papers span biological and chemical approaches to wastewater and sludge treatment, adsorption studies, process optimization, materials recovery pathways, and circular manufacturing analyses. Together, they illuminate the practical mechanisms through which circularity can be achieved—not as a slogan, but as a measurable improvement in resource efficiency and environmental performance.

Air quality, pollution control, and climate change mitigation

The volume also addresses **air quality and pollution control** as essential domains of environmental and public-health resilience. Contributions in this section investigate contaminant dynamics, particulate matter generation, and prospective capture/conversion materials, emphasizing that climate mitigation strategies must be accompanied by robust monitoring and control of pollutants that directly affect communities. The research highlights the importance of spatial analysis, environmental risk evaluation, and technology-assisted mitigation strategies that translate scientific understanding into actionable measures.

Ecology, biodiversity, and environmental protection

A particularly rich segment of Issue 4.2. is dedicated to **ecology, biodiversity, and environmental protection**, reflecting green science as an ethical and biological imperative. Studies explore biodiversity education, invasive species dynamics, antimicrobial and antioxidant activity of plant extracts, nature-based solutions in urban contexts, environmental risk methods for crisis management, and conservation-linked community awareness. These contributions reinforce a central scientific principle: sustainability is ultimately constrained by ecological integrity, and policy success depends on the ability to measure, protect, and restore living systems across scales.

Economics of sustainability and environmental policies

Sustainability is not only a technological or ecological challenge—it is also a question of **economic design and policy coherence**. The economics and policy section addresses financing of green investments, sustainable procurement, cross-border energy communities, workforce and organizational practices, break-even analysis for disaster impacts, and economic inequality in access to infrastructure. This body of work demonstrates that environmental progress requires institutional frameworks that translate science into incentives, governance mechanisms, and long-term societal value.

Education, training, and capacity building

Finally, the volume highlights **education, training, and capacity building** as decisive drivers of sustainability outcomes. The contributions emphasize research literacy, curriculum integration, interdisciplinary frameworks, digital tools (including AI-supported analysis), and innovative communication formats (e.g., comics vs text) that strengthen environmental education across diverse contexts. This section underscores a strategic truth: green transformation depends not only on technologies and policies, but on the development of scientific competence, public understanding, and future-ready skills.

Editorial standards and academic integrity

All manuscripts included in this volume underwent **rigorous peer review** by independent experts. The editorial process prioritized scientific integrity, methodological clarity, originality, and relevance. The resulting collection aims to support long-term academic traceability and practical usefulness through structured publication standards and durable scientific record-keeping.

On behalf of the Editorial Board and the scientific community supporting SGEM Vienna Green, we express our sincere gratitude to all authors for their valuable scholarly contributions and trust. We also thank the reviewers for their careful evaluations and for safeguarding academic quality. The collective effort behind this conference proceedings strengthens international scientific dialogue and supports the shared mission of advancing sustainability through knowledge.

We wish readers an inspiring and fruitful engagement with the research presented in **SGEM Conference Proceedings Energy and Clean Technologies / Vol 25, Issue 4.2**, and we hope the insights and methods gathered here will contribute meaningfully to scientific progress, responsible practice, and long-term impact in the green sciences.

Sincerely,

Prof. Dr. hab. oec. Baiba Rivza

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