Advances in Energy Research, Materials Science and Built Environment (EMBE) – 1st Edition

A Book of Abstracts

IEREK
RESEARCH & KNOWLEDGE ENRICHMENT

COEUS INSTITUTE GmbH
INQUIRE, RESOLVE & FORESEE

This abstracts book was printed by IEREK and, by all means, IEREK is responsible for this complimentary copy of the book. Research papers within this book will be considered for publication in a book series by Springer Nature. The publication will be supervised by highly professional members of an International Editorial Board to ensure high-quality publication material. The series is indexed in Scopus. All Author participants are expected to write their manuscripts / papers using the IEREK template provided in the author instructions tab of the respective conference. Once, and if, your paper is selected for publication, you will be contacted and asked to use the template of the selected journal/ series accordingly, if any.

Advances in Energy Research, Materials Science & Built Environment

A Book of Abstracts submitted to the 1st edition of the international conference on **Advances in Energy Research, Materials Science & Built Environment (EMBE)** 03 – 04 Oct 2023

Acknowledgements

IEREK would like to express its appreciation to all members of the staff and scientific committee for their tremendous efforts and contribution to the growth of this institution and for making the first edition of the international conference on Advances in Energy Research, Materials Science & Built Environment (EMBE). IEREK takes pride in being an institution that amasses a highly qualified and competent team who restlessly worked for months to make this conference what it is today in hopes of creating a well-rounded society. Last but not least, we cannot neglect the prominent role undertaken by our editors and reviewers who made it their duty to help this institution in spreading knowledge to the masses.

Foreword

With technology advancing, helping humanity to discover, create and innovate, advancements in technology became a focal point for research, ignoring the rising costs and the lack of sustainable approaches. With extreme reliance on non-renewable sources of energy to power our cities and communities, we are contributing to the increase in greenhouse gases emissions and to the significant changes in our cities caused by climate change. These rising changes, forces us to discover alternative sources of renewable, efficient and affordable forms of energy, where it will promote sustainable, healthy and diverse ecosystems through enabling technologies that can offer promising solutions.

An overhaul is needed to our approach to designing cities, for a sustainable, resilient and eco-friendly future. In this abstract book, we discover the impact of more innovative approaches towards materials, that emphasize sustainable construction, smart energy, and more durable designs for our cities will be thoroughly investigated, while additionally exploring multiple disciplines where applying innovation can better help advancing with energy research, material science, and built environment.

In this abstracts book, which is an assortment of the highest quality research which was submitted to the 1st edition of the international conference on Advances in Energy Research, Materials Science & Built Environment (EMBE), from the 3rd of October, 2023 – 4th of October, 2023, we investigate research on sustainability and development, green urbanism, modern construction management practices, and material efficacy in climate change mitigation.

This abstracts book Addresses many challenges and approaches, such as climate change, green urbanism's role in resilient communities and environmental efficiency, opportunities and challenges in coastal areas, evolving architecture and rethinking cities, materials for renewable and sustainable energy, the role of advanced technologies in sustainable architecture, and studies & practical applications. It will also provide an opportunity for exploration where not only new technologies in the Architecture, Engineering, and Construction (AEC) industry are highlighted, but also a guide to practical application is made available. It offers a comprehensive approach covering fundamentals, technologies, and applications through real-world examples.

Word from the Chairman of the Board of IEREK

In this book of abstracts, we are reminded of the urgent need to address the critical challenges facing our cities and the environment. I am deeply grateful for the opportunity to bring together some of the world's brightest minds to explore solutions that can make a meaningful difference at the 1st edition of the Advances in Energy Research, Materials Science & Built Environment (EMBE) conference. It has been an absolute honor to arrange this event, and host the brilliant minds and passionate experts who have come together to tackle some of the most pressing issues facing our world today.

When I first launched IEREK – International Experts for Research Enrichment and Knowledge Exchange – in 2013, I had ambitions of establishing an institution that pursues excellence in the field of research, and connects the world's scholars, providing them with platforms that advance their academic endeavors. To see my ambition come to life, is quite an honor indeed. Ever since its conception, IEREK has remained committed to its goal of scientific dissemination by building international relationships with prestigious universities and academic institutions around the world. Our journey has been one of great privilege, for we do not walk it alone. The contribution that we attain from our partners is invaluable to us, whether it be the book editors, publishers, hosting universities, conference chairs, keynote speakers, authors, or attendees, I would like to personally thank you for contributing to the furtherance of knowledge and research.

Like with every conference that we organize here at IEREK, we hope that everyone involved in the 1st edition of the *EMBE* conference has gleaned something valuable from the experience, and walked away with a positive and memorable experience. We hope that the conference left a good impression on the scholars, who aim to deliberate upon challenges and opportunities for the issues at hand. I am confident that the message conveyed at this conference will aid in leading the world toward becoming a more sustainable, and livable place.

Mourad S. Amer

Architect, BSc, DSc, MSc, PhD

IEREK CEO

Table of Contents

Part I:
Materials for Renewable and Sustainable Energy

Regeneration, Resilience and Metamorphosis of the Building Envelope: Analysis of The High-Rise and Skyscraper Types

Massimiliano Nastri

Department ABC – Architecture Built Environment and Construction Engineering, Politecnico di Milano (Italy)

Abstract:

The study contemplates the resilience characteristics of buildings with vertical development in the current context, according to the processes of "self-adjustment" and as a capacity for performance "re/production", "absorption" and "reaction" towards the "perturbative pressures" caused by the incidence of degradation phenomena, obsolescence or accidental and catastrophic events. The analysis considers the "adaptive", "selective" and "mediation" methodologies, acquired and expressed by vertical architectures, to metabolize and "mitigate" the stresses and conditions of physical, environmental and technical-economic stress, in a combined manner with the processes of innovation (design, executive and functional) and the "eco-efficient" use of energy resources.

Keywords:

Resilience method and thinking processes; Regeneration of architecture; High-rise and skyscraper buildings; Advanced building envelope technologies and systems

References

1. Ali, M. M. and Armstrong, P. J. (2012). *The Role of Systems Integration in the Design of Sustainable Skyscrapers*, Taylor & Francis, Abingdon.
2. Al-Kodmany, K. and Ali, M. M. (2013). *The Future of the City. Tall Buildings and Urban Design*, Wit Press, Southampton-Boston.
3. Antoniucci, V., D'Alpaos, C., Marella, G. (2015). "Energy Saving in Tall Buildings: from Urban Planning Regulation to Smart Grid Building Solutions", *International Journal for Housing Science*, Vol. 39, No. 2, pp. 101-110.
4. Binder, G. (Ed.) (2002). *Sky High Living. Contemporary High-Rise Apartment and Mixed-Use Buildings*, The Images Publishing Group, Mulgrave.
5. Clark, N. and Price, B. (2016). *Tall Buildings. A Strategic Design Guide*, 2nd ed., RIBA Publishing, Newcastle upon Tyne.
6. Eisele, J. and Kloft, E. (Ed.) (2002). *High-Rise Manual. Typology and Design, Construction and Technology*, Birkhäuser, Basel-Boston-Berlin.
7. Faroldi, E. *et alii* (2008). *Verticalità. I grattacieli: linguaggi, strategie, tecnologie dell'immagine urbana contemporanea*, Maggioli, Santarcangelo di Romagna.
8. Fortmeyer, R. and Linn, C. D. (2014). *Kinetic Architecture. Designs for Active Envelopes*, The Images Publishing Group, Mulgrave.
9. Hamid, A. A. (2012). *Design and Retrofit of Building Envelope*, Bookbaby, Pennsauken, NJ.
10. Hausladen, G., de Saldanha, M., Liedl, P. (2008). *ClimateSkin. Building-skin Concepts that Can Do More with Less Energy*, Birkhäuser, Basel.
11. Lay, S. (2007). "Alternative Evacuation Design Solution for High-Rise Building", *The Structural Design of Tall and Special Buildings*, No. 16, pp. 487-500.
12. Knaack, U. *et alii* (2007). *Façades. Principles of Construction*, Birkhäuser, Basel.
13. Sarkisian, M. (2016). *Designing Tall Buildings. Structure as Architecture*, 2nd ed., Routledge, New York-London.
14. Saroglou, T. *et alii* (2017). "Towards energy efficient skyscrapers", *Energy and Buildings*, Vol. 149, pp. 437-449.
15. Savitch, H. V. (2008). *Cities in a Time of Terror. Space, Territory, and Local Resilience*, Routledge, New York-London.
16. Short, M. J. (2012). *Planning for Tall Buildings*, Taylor & Francis, London.
17. Simmonds, P. (2015). *ASHRAE Design Guide for Tall, Supertall, and Megatall Building Systems*, ASHRAE, Atlanta.
18. Sloman, P. and Edwards, A. (2012). "Retrofit and Refurbishment of Existing Tall Buildings", *Council on Tall Buildings*

and Urban Habitat, 9th World Congress, Shanghai, pp. 194-200.

19. Southwick, S. M. and Charney, D. S. (2012). *Resilience. The Science of Mastering Life's Greatest Challenges*, Cambridge University Press, New York.
20. Taranath, B. S. (2017). *Tall Building Design. Steel, Concrete and Composite Systems*, CRC Press, Boca Raton.
21. Trabucco, D. (2010). *Costruire in altezza. Una sfida per la sostenibilità: il service core e il bilancio energetico di un edificio alto*, Edicom, Monfalcone.
22. Trapani, M. (2008). "Innovazione tecnica e immagine urbana", in Faroldi, E. *et alii* (2008), *Verticalità. I grattacieli: linguaggi, strategie, tecnologie dell'immagine urbana contemporanea*, Maggioli, Santarcangelo di Romagna, pp. 141-177.
23. van Uffelen, C. (2012). *Skyscrapers*, Braun, Salenstein.
24. Yeang, K. (2002). *Reinventing the Skyscraper*, Wiley-Academy, Chichester.
25. Yeang, K. (Ed.) (2011). *Eco Skyscrapers*, Vol. 2, The Images Publishing Group, Mulgrave.

Advances in Energy Research, Materials Science and Built Environment (EMBE) - 1st Edition

A Book of Abstracts

Unlock the potential of a sustainable tomorrow at the International Conference on Advances in Energy Research, Materials Science & Built Environment (EMBE). This virtual gathering brings together leading experts, researchers, and innovators from across the globe to explore groundbreaking advancements in energy, materials science, and the built environment. Dive deep into the latest sustainable technologies, discover eco-friendly materials, and delve into the future of smart urban planning and resilient architecture. EMBE 2023 is where collaboration meets innovation to shape a world that's not just sustainable, but thriving.

In this comprehensive compilation, we embark on a journey toward a sustainable and resilient future. By merging advancements in energy research, materials science, and the built environment, we aim to inspire transformative change and foster a global community committed to tackling the challenges that lie ahead.

Discover the latest advancements in energy research, materials science, and the built environment as we pave the way toward a sustainable future.

IEREK RESEARCH & KNOWLEDGE ENRICHMENT

COEUS INSTITUTE GmbH
INQUIRE, RESOLVE & FORESEE