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Editorial Note

Reimagining the Built Environment: A Paradigm Shift Towards Sustainable Urban Development

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The built environment encompasses all human-made structures where we live, work, and play, including homes, schools, hospitals, offices, historical landmarks, and city parks. This environment integrates essential infrastructure that distributes power, water, food, and facilitates the movement of people. As it expands, it increasingly impacts the environment. Transforming the built environment is crucial to a nation's response to climate change and represents one of the most challenging yet rewarding engineering tasks in the transition to net zero. To effectively tackle emissions, a systems approach is essential. This approach provides a clear understanding of the interactions among various systems like buildings, transport, and energy, helping identify effective policy levers and actions to decarbonize comprehensively. Without this holistic perspective, isolated changes in specific areas may result in unintended consequences (Ramakrishna et al., 2023).

The task of decarbonizing materials and tools used in building is daunting due to two main challenges. Firstly, the electrification of heavy construction machinery like large cranes and pile drivers is complex because these require high power outputs. Secondly, a significant issue is the large amount of carbon embodied in construction materials, particularly concrete. Concrete, the most utilized material globally after water, contributes to 5-7% of global carbon emissions (Griffiths et al., 2023; Olsson et al. 2023). Its strength, versatility, and low cost have made it indispensable, particularly in projects crucial for enhancing global living standards, such as low-cost housing. However, producing concrete involves heating limestone to 1400°C, initiating a chemical reaction that creates clinker and releases carbon dioxide (Liu et al., 2024; Stefaniuk et al., 2023). The high temperatures required to initiate the chemical reactions in concrete production could be powered by hydrogen, provided it is produced in a low-carbon manner. Notably, half of the CO2 emissions from concrete are from the chemical reaction itself, making the physical capture and storage of these gases a complex challenge. Decarbonizing concrete requires multiple steps, including new resources, designs, and machinery, and ultimately depends on zero-carbon energy and transport systems (Al-Yaseri et al., 2023; Chan and Zhang, 2023).

In the meantime, an evaluation to substitute concrete with alternative materials is conducted. Cross-laminated lumber is robust and potentially carbon-neutral; yet, it necessitates deforestation, which adversely affects ecosystems. This material, like others, necessitates additional invention

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and extensive testing to offer a viable alternative to commonly utilized and economically effective concrete (Bhandari et al., 2023; Shin et al., 2023).

One effective strategy to reduce concrete demand is by reusing existing buildings instead of demolishing them. For example, a major engineering project at Oxford's Wolfson College is repurposing an old building to extend its usefulness. Founded in the 1960s and constructed in the early 70s, the building and its surrounding estate have aged significantly. Recognizing its high emissions, the college has embarked on an ambitious retrofit as part of its goal to achieve net zero by 2030, aiming for a 75% reduction in emissions (Perrier, 2021). The project aims to replace the original single-glazed windows with ultra-thin triple glazing, anticipated to decrease the building's yearly space heating requirements by 80%. Furthermore, the antiquated gas boilers are being substituted with contemporary air-source heat pumps, which are generally effective in generating heat at low temperatures.

The takeaway from the retrofit project at Wolfson College is that achieving significant environmental improvements is entirely feasible, though it requires commitment, time, and some disruption. This project illustrates a message of hope rather than despair in facing the climate challenges of the 21st century. It shows that with the right governmental frameworks and financial support, and the expertise of engineers and technicians who can clearly communicate solutions to policymakers, substantial change is possible (Berawi et al., 2020)

Engineers globally are investigating techniques to repurpose concrete from deconstructed buildings, with the objective of integrating these materials into new residential and infrastructural projects, thereby promoting sustainable construction practices. Widespread misunderstandings assert that recovered aggregates possess inferior strength and quality; although quality control poses difficulties, significant expenditure is necessary for recycling processes (Imjai, et al., 2023). Dr. Kim, a structural engineer at Plymouth University, spearheads a project advocating for the increased utilization of recycled concrete aggregate, especially in swiftly growing areas. Currently, 50% of the global population resides in urban areas, a statistic anticipated to increase to 68% by 2050, hence escalating the demand for new infrastructure in cities, particularly in Southeast Asia (Neupane et al., 2023). Urban expansion frequently entails the substitution of low-rise structures with high-rise edifices, resulting in significant quantities of construction debris, which is generally classified as industrial waste. This signifies a considerable missed opportunity.

Decarbonizing the built environment is a formidable issue, although it also offers a significant opportunity for transformation within our sector. This transition will facilitate the adoption of more sustainable practices, improve system efficiency, utilize technology, and generate new employment opportunities. By accepting this challenge and dedicating ourselves to swift transformation, our sustainability goals for 2050 will be optimistically achieved (Whulanza and Kusrini, 2023; Whulanza, 2023).

This issue

This volume contains documentation of the investigation of the relationship between technology, energy, and the environment and the well-being of humans within that context. An additional focus of the research that was carried out was the development of a proof of concept that included both the industrial and human health.

The first study, conducted by Atlaskina et al., focuses the catalytic conversion of CO_2 into cyclic carbonates using ionic liquid 1-(2-hydroxyethyl)-3-methylimidazolium bromide as a an ionic liquid catalyst. The research emphasizes optimizing reaction parameters to maximize efficiency. The findings reveals that the highest conversion rate (97%) and selectivity (94%) are achieved under condition of 90°C and 650 kPa (Atlaskina et al. 2025).

The second study, authored by Ismail et al., examines the impact of examines the impact of key process variables—molar ratio, temperature, and extraction duration—on organic sulphur transformation and thermophysical properties in high-sulphur coal. Utilizing a potassium carbonate-ethylene glycol deep eutectic solvent (DES), the research demonstrates the potential of

DES-based coal pretreatment in mitigating sulphur emissions and enhancing fuel performance, aligning with sustainable energy objectives (Ismail et al., 2025).

The third study, conducted by Alianto et al., explores smoke ventilation dynamics in a compartment fire scenario using coconut husks as solid fuel. Through a combination of experimental and numerical analyses employing the Fire Dynamics Simulator (FDS), the research evaluates smoke propagation, temperature variations, and obscuration levels in a scaled-down (1:10) compartment. The study highlights discrepancies between experimental observations and FDS predictions, offering insights into model accuracy. (Alianto et al., 2025).

Anderson and Sudarto, in the fourth study, investigate the Vehicle Routing Problem (VRP) in the context of medical waste collection. The research employs three metaheuristic optimization techniques—Guided Local Search, Simulated Annealing, and Tabu Search—to solve a complex VRP variant: the Heterogeneous Fleet Distance-Constrained Capacitated VRP with Time Windows. Implemented using Google OR-Tools, the study finds that Guided Local Search consistently outperforms the other methods, achieving up to a 35% reduction in travel distance while improving route efficiency (Anderson and Sudarto, 2025).

The fifth study, by Hassan et al., conducts a systematic literature review on mediation practices within the Malaysian construction industry, assessing its development, challenges, and effectiveness. Despite its potential to mitigate conflicts and legal expenses, mediation remains underutilized due to factors such as low awareness, inconsistent procedural frameworks, and a lack of structured guidelines (Hassan et al., 2025).

Kurniasari et al., in the sixth study, present a facile synthesis and characterization of magnetite mesoporous silica nanoparticles derived from locally sourced iron sand at Glagah Beach, Indonesia. The research outlines a four-stage synthesis process comprising magnetite nanoparticle formation, silica coating, surfactant templating, and subsequent surfactant removal, contributing to advancements in nanomaterial fabrication (Kurniasari et al., 2025).

The seventh study, authored by Zahra et al., investigates the role of ultrasound-assisted dehydration in the ring-opening polymerization (ROP) of polylactic acid (PLA). Using response surface methodology (RSM) to optimize dehydration condition. The study reports a final moisture content of 1.9%, achieved with a processing duration of 98.85 minutes at 109.60 W power, underscoring the potential for enhanced PLA synthesis efficiency (Zahra et al., 2025).

The eight study, conducted by Perkasa et al., focuses on the design and simulation of a lower limb prosthetic fabricated from Ramie Fiber-Reinforced Polylactic Acid (RFRPLA) composite. The study employs composite mechanics analysis and finite element analysis (FEA) within ANSYS software to evaluate the prosthetic's mechanical performance under static loading conditions, contributing to advancements in bio-composite prosthetic technology (Perkasa et al., 2025).

In the ninth study, Izra'ai et al. analyse the effects of bonding variations on polymerization shrinkage and stress distribution in resin composites using finite element analysis (FEA). The research highlights the potential of surface displacement measurements as a non-invasive technique for detecting subsurface debonding, ultimately enhancing the durability and longevity of resin composite restorations (Izra'ai et al., 2025).

The tenth study, authored by Viriyawattana and Sinworn, explores advancements in fire suppression technologies, specifically targeting Class B fires. The study synthesizes a methylcellulose (MC) hydrogel derived from water hyacinth extract and evaluates its fire-extinguishing performance in comparison to conventional mono-ammonium phosphate (MAP) agents, demonstrating its potential as a sustainable fire retardant (Sinworn and Viriyawattana, 2025).

The next study, conducted by Athallah et al., explores the role of graphene oxide as a filler and lanthanum nitrate as a salt in improving the ionic conductivity of corn starch-based solid polymer electrolytes (SPE). The research highlights the material's potential for electrochemical energy storage applications, including lithium-ion batteries and supercapacitors (Athallah et al., 2025).

The twelfth study, authored by Le and Loan, investigates the enhancement of white light-emitting diodes (WLEDs) using a trivalent Eu/Tb-co-doped orthophosphate phosphor combined with SiO_2 particles. The phosphor, synthesized via a high-temperature solid-state reaction, achieves a power shift effectiveness of 98.36% through electric dipole-dipole interactions, demonstrating significant potential for advanced lighting applications (Le and Loan, 2025).

The thirteenth study, conducted by Infantono et al., introduces the Target Area Georeference Algorithm (TAGA) for assessing the impact of high-speed weapons in air-to-ground military training exercises. The study demonstrates how TAGA enhances the accuracy of weapon scoring systems (WSS) and contributes to Network-Centric Warfare (NCW) by enabling rapid performance evaluations of pilots, aircraft systems, and weapon effectiveness (Infantono et al., 2025).

The fourteenth study, authored by Ginting et al., focuses on the design improvement of a bitewing holder and support system using the Quality Function Deployment (QFD) methodology. Addressing common patient concerns, the research aims to mitigate nausea caused by pressure on the oral cavity and reduce movement-induced distortions in radiographic imaging, thereby enhancing diagnostic accuracy and patient comfort (Ginting et al., 2025).

The fifteenth study, conducted by Vaiyapuri and Sbai, presents a Bayesian-optimized ensemble machine learning framework for predicting employee attrition within the framework of Green Human Resource Management (GHRM). The study underscores the effectiveness of predictive analytics in HR management, enabling proactive strategies to minimize attrition rates and support sustainable workforce development (Vaiyapuri and Sbai, 2025).

The sixteenth study, authored by Sandoyan et al., examines the influence of digital technologies on capital market development and their subsequent impact on economic growth in developing countries. The findings indicate that market capitalization plays a critical role in shaping GDP growth and attracting foreign direct investment (FDI) inflows. It also highlights the intersection of financial technology and macroeconomic development (Sandoyan et al., 2025).

The seventeenth study, conducted by Verevka and Gao, analyses the key determinants of market valuation for high-tech firms in the IT and automotive industries through regression analysis. Utilizing panel data from 2013 to 2022 for 25 leading companies in each sector, the study applies Ordinary Least Squares (OLS) regression to construct econometric models. The findings reveal that economic value added (EVA) and share price are the most significant factors influencing market capitalization in both industries (Verevka and Gao, 2025).

The eighteenth study, authored by Indartono et al., presents an experimental investigation into the effects of multi-staging and check valve integration on the performance of Savonius wind rotors with modified-Bach blades. The research evaluates the impact of these modifications on the power coefficient, static torque fluctuations, and self-starting capabilities, contributing to the optimization of vertical-axis wind turbine efficiency (Indartono et al., 2025).

The nineteenth study, conducted by Parlindungan et al., presents a numerical analysis of the aerodynamic and structural response of a tandem-wing high-altitude long-endurance (HALE) unmanned aerial vehicle (UAV) under gust load conditions. The research emphasizes the importance of understanding aeroelastic interactions in flexible tandem wings to enhance UAV stability and operational efficiency (Parlindungan et al., 2025).

The twentieth study, authored by Farihin et al., investigates the effects of Y_2O_3 dispersion on the microstructure and residual stress of $FeNiCrY_2O_3$ oxide dispersion-strengthened (ODS) cast alloys, designed for high-temperature applications in advanced nuclear reactors. The findings indicate that a 1.0 wt.% Y_2O_3 nano-dispersion results in the lowest strain and residual stress, positioning the alloy as a strong candidate for further fabrication and deployment in extreme environments (Farihin et al., 2025).

The twenty-first study, conducted by Napitupulu et al., investigates the impact of HIV-1 infection and antiretroviral therapy (ARV) on male fertility, specifically examining oxidative stress, DNA fragmentation, and caspase-3 expression in sperm before and after sperm preparation. The

study suggests its potential in fertility treatment for HIV-positive men undergoing ARV therapy (Napitupulu et al., 2025).

The next study, conducted by Wulandari et al., introduces a rapid colorimetric detection method for SARS-CoV-2 based on gold nanoparticles (AuNPs) functionalized with o-hydroxybenzoic acid. The research demonstrates that AuNPs conjugated with SARS-CoV-2 antibodies can detect viral antigens through a visible colorimetric shift, offering a promising alternative for rapid and accessible COVID-19 diagnostics (Wulandari et al., 2025).

The twenty-third study, authored by Muthi'ah et al., investigates the interaction between a recombinant YebF-Cas9 fusion enzyme derived from thermophilic Geobacillus kaustophilus and single guide RNA (sgRNA) through in silico molecular docking analysis. The findings provide valuable insights into optimizing CRISPR-Cas9 genome-editing tools, particularly for applications requiring enhanced stability and efficiency in high-temperature environments (Muthi'ah et al. 2025).

The twenty-fourth study, conducted by Dharmawan et al., presents a highly selective and sensitive spectrophotometric method for cholesterol detection utilizing a β-cyclodextrin (BCD)/Fe_3O_4 composite as the recognition agent. The study highlights the potential of this non-enzymatic detection technique as a cost-effective and reliable alternative to conventional enzymatic cholesterol assays, with implications for biomedical diagnostics and healthcare applications. (Dharmawan et al., 2025).

The twenty-fifth study, authored by Asih et al., explores the antiviral properties of Tetragonula sapiens propolis from Indonesia through in vitro and in silico methodologies. The research assesses the bioactive compounds within the propolis, demonstrating its potential as a natural antiviral agent against SARS-CoV-2. The study contributes to the growing interest in natural product-based therapeutics for emerging infectious diseases (Asih et al., 2024).

The twenty-sixth study, conducted by Manjupriya and Leema, proposes an advanced epileptic seizure detection framework employing an optimized channel selection approach integrated with a deep learning model. The study introduces the Linear Memory Controlled Water Wave Optimization (LMC-WWO) algorithm for optimal EEG channel selection, reducing computational complexity while preserving data integrity. The analysis reveals that the proposed framework surpasses existing deep learning models, achieving reduced training time and enhanced classification accuracy (Manjupriya and Leema, 2025).

The incorporation of modern technologies and recent advances has resulted in the creation of new prospects for addressing complicated challenges in a variety of fields. Because of the rapid advancement of scientific knowledge, it is quite probable that innovation will play an increasingly important part in determining the course of our future. With the intention of bringing your research endeavors to the attention of our audience, Ijtech extends a warm invitation to you to submit your articles, and we will gladly make them available to you.

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