

Abstract

With the built environment accounting for about 39% of global energy-related CO₂ emissions, there is a critical need for solutions that surpass conventional sustainability approaches. This keynote delves into embedding regenerative principles into construction materials to create measurable net-positive impacts for both ecosystems and communities. Dr Juliana Calabria-Holley shares advanced material engineering strategies designed not just to minimise harm, but to actively enable restoration and enhance ecological health.

Juliana, leveraging her background in materials science and architecture, will examine innovations in bio-based insulation systems, such as cellulose and mycelium composites. Using hierarchical porosity control, these materials are designed to enhance thermal efficiency, moisture regulation, and indoor air quality. She'll also address carbon-capture methods in cement, supported by quantitative data on CO₂ uptake. The session will further explore advanced surface engineering, such as sol-gel coatings and adsorption-driven porous systems, that increase service life and lower environmental impacts across the product lifecycle.

This keynote presents regenerative principles, exploring topics like reflective governance, interconnectivity, working as nature, prioritising net-positive impacts, cultivating resilience, and knowledge sharing. Attendees will leave with actionable strategies for advancing regenerative design (RENEW's Regenerative Manifesto). Framing materials science as a catalyst for systemic change, the session advocates moving from minimising harm to achieving net-positive results in construction.

Dr. Juliana Calabria-Holley's keynote tackles the vital question: how can construction materials move beyond sustainability to actively regenerate ecosystems and communities? Leveraging her expertise in low-carbon advanced materials, nanotechnology, and bio-based composites like cellulose and mycelium, Juliana outlines innovative methods for embedding carbon capture and regenerative properties into building materials. She shares key findings from interdisciplinary work at the RENEW Centre, illustrating how engineering can evolve in harmony with nature to reduce harm and foster thriving socio-ecological systems. This session encourages architects, engineers, and researchers to look beyond conventional markers of durability and efficiency, embracing materials as powerful enablers for a regenerative built environment.
