Decarbonization through Bioplastic Wall Systems: Life Cycle and Energy Analysis in Residential Buildings in New York State

Presenter: Seyedehniloufar Mousavi

Additional Presenters:

1. Tristan Brown, PhD, Associate Professor, State University of New York, College of Environmental Science and Forestry, trbro100@esf.edu
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Presenter Biographies and Experience:

My journey began studying architecture, where witnessing the environmental impact on a nearby lake fueled my desire to make a calculated change through my work. This drive led me to pursue a master's in engineering, focusing on energy-efficient buildings. I published in esteemed journals on the environmental and economic impacts of different materials. Now, I explore untapped potential in materials science to reduce energy consumption, store carbon, and decarbonize urban buildings.

She holds a Master of Science in Engineering from Tec de Monterrey (ITESM), specializing in energy efficiency and passive building. Currently pursuing a PhD in Sustainable Resource Management at SUNY ESF, her research focuses on 3D printing bioplastic and insulation. With 153 citations, she has published extensively in esteemed journals on energy efficiency, building materials, and passive cooling. She possesses expertise in energy modeling, programming, and life cycle analysis.

She has extensive knowledge in building energy efficiency through architecture and engineering. She has taken courses in Building Science, Energy Efficiency Techniques, Solar Energy Applications, and Advanced Heat Transfer, which she applied in her research and presentations. she has shared her findings at various conferences, including the ASHRAE Winter Conference, where she discussed passive cooling techniques in residential buildings for improved environmental performance.

Abstract:

This presentation explores the role of bioplastics in decarbonizing the construction industry, focusing on their use as sustainable alternatives to fossil fuel-based materials. Bioplastics, such as Polyethylene Furanoate (PEF), Polylactic Acid (PLA), and Polypropylene (PP), offer significant potential as carbon sinks, contributing to net-zero energy building designs. The presentation examines their application in wall cladding and insulation, comparing their performance to conventional materials. Using numerical simulations conducted with EnergyPlus, we evaluate the energy reductions achieved by bioplastics in New York State buildings. Additionally, Life Cycle Analysis (LCA) using the Ecoinvent 3.2 database assesses the 100-year global warming potentials of these materials. Results indicate bioplastics can reduce total energy demand by 5-38%, with bio-PEF and PLA reducing emissions by 1.0 and 1.7 kg CO_2e, respectively, compared to 31.5 kg CO_2e from traditional polystyrene insulation. This research highlights bioplastics' capacity to support sustainable construction practices and mitigate climate change through long-term carbon storage.