A Review of TRNSYS Model in Building-Integrated Microalgae Photobioreactor Facades for Thermal Performance Simulation

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Abstract:

Microalgae photobioreactor (PBR) facades offer innovative solutions for addressing climate change by integrating CO2 sequestration, thermal regulation, and bioresource production into building systems, addressing climate change and advancing sustainable practices. The thermal performance of these facades plays a critical role in reducing building energy demands while optimizing CO2 capture. TRNSYS, a dynamic simulation tool, offers significant potential in modeling the thermal behavior of building-integrated PBR systems, allowing for detailed analysis and optimization. The review consolidates findings from recent studies on TRNSYS applications in building energy simulations, focusing on its role in enhancing the thermal performance of microalgae PBR facades. The paper highlights TRNSYS's advantages in simulating complex interactions between building systems and environmental factors by identifying research gaps, limitations, and advancements. Key challenges, including process integration and data accuracy, are also addressed. The study underscores TRNSYS's potential to support the development of zero-emission architecture and sustainable building practices. By bridging existing research gaps and optimizing methodologies, TRNSYS-based simulations can contribute to more efficient, scalable, and cost-effective PBR systems, fostering innovation in climate-responsive architectural designs

Keywords:

Microalgae, Photobioreactor facades, TRNSYS, Thermal performance.