Achieving Global Benchmarks in Resource Substitution and the Zero Waste Index: A Case Study of Amrita Vishwa Vidyapeetham, Amritapuri

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Abstract

University campuses represent complex, semi-urban ecosystems that generate diverse solid waste streams. Effective waste management in such environments is critical for resource conservation, greenhouse gas mitigation, and sustainable development. The Zero Waste Index (ZWI) is a life-cycle-based performance indicator that quantifies the ability of waste management systems to substitute virgin materials while accounting for energy savings, water conservation, and greenhouse gas (GHG) emission reductions. This study evaluates the waste management system at Amrita Vishwa Vidyapeetham, Amritapuri, by shifting the perspective from waste disposal to resource recovery. Every day, the campus processes 300 kg of inorganic waste through a centralized, conveyor-based system that sorts materials into over 52 specialized categories. The main goal of this research is to use the Zero Waste Index (ZWI) to quantify the environmental "relief" created by this system. By measuring how much energy, water, and greenhouse gas emissions are saved when we substitute new raw materials with recovered ones, we aim to validate this high-granularity sorting model as a practical and scalable blueprint for any large institution aiming for a circular economy. Amrita Amritapuri achieves a high Zero Waste Index (ZWI) by transitioning from a waste-disposal model to a Circular Resource Recovery framework that maximizes the substitution of virgin materials, energy, and water. As established in the study baseline, the campus utilizes a centralized conveyor-based system to sort waste into more than 52 specialized categories, ensuring high-purity material streams that replace virgin raw materials. This systemic evolution includes scaling water circularity to 1.3 million liters per day (MLD), shifting from basic composting to biogas technology for daily energy recovery, and implementing 'plastic- to-brick' upcycling. By combining these infrastructure upgrades with IoT-based auditing and product-level interventions like the Saukhyam initiative, the campus has significantly increased its carbon mitigation impact, solidifying its position as a global leader in SDG 12.

Keywords

Zero Waste Index, Resource Substitution, Sustainability, Circular Economy, Waste Management.