TEA-driven design for sustainable food systems

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Abstract

The transformation of food systems toward sustainability demands rigorous evaluation of both existing supply chain and emerging innovations. This talk explores how techno-economic analysis (TEA) can guide decision-making in food systems: the valorization of food waste within existing food industry, and the development of novel alternative protein production system. First, to enhance resilience and circularity in existing food system, we evaluate the environmental and economic trade-offs of different food waste valorization pathways, including anaerobic digestion, carbon capture and utilization for construction materials, and composting, using industrial tea leaves waste and beverage wastes as feedstocks. While most pathways offer co-benefits in cost savings and GHG emission reductions, two beverage wastes scenarios reveal trade-offs, with higher costs and negative returns on investment. Second, we shift focus to the rapidly evolving alternative protein sector, where TEA supports the facility design of a novel circular production system. This system leverages microalgae for cost-effective culture medium formulation and nutrient recycling. Together, these case studies highlight the critical role of TEA as a cross-cutting tool in designing sustainable and circular food systems.

Bio

Dr. Minliang Yang is an Assistant Professor in the Department of Food, Bioprocessing, and Nutrition Sciences, and an affiliate faculty member of the Bezos Center for Sustainable Proteins at NC State. Her research focuses on applying technoeconomic analysis (TEA) and life-cycle assessment (LCA) in food systems to enhance resilience of food systems and sustainable alternative protein production. Before joining NC State, Yang received her postdoc training in TEA/LCA at Lawrence Berkeley National Lab and Joint BioEnergy Institute (JBEI). She earned both her Ph.D. and M.S. in Agricultural and Biosystems Engineering from Iowa State University.