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Evaluating the Financial, Technical, and Sustainability Performance of Fire Briquette Produced from Tea Waste

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Abstract

Sri Lanka is a leading tea exporter, contributing significantly to its export income. However, the tea industry faces many challenges such as rising production costs, managing wastes, rising environmental concerns, and rising labor concerns. Under numerous costs of production, the energy costs are a major highlight in the sector. The cost of steam generation using boilers is at the top among all the energy related costs. As a solution, many industries utilize biomass as a cost-effective energy source. But heavy reliance on biomass has raised concerns over long-term sustainability of the biomass supply. Moreover, tea waste resulting from the tea production process poses many challenges with regards to the environmental management in the sector. Therefore, this study evaluates the financial, technical, and sustainability feasibility of producing fire briquettes using tea waste to address the above challenges. The data were gathered from a major tea producer in Sri Lanka's up-country region. The financial feasibility was assessed through primary and secondary data, focusing on initial, operational, and labor costs. Key financial indicators: Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and Net Present Value (NPV) were used in the study. Each indicator was calculated for two discount rates (10% and 5%). The computed results of the indicators [BCR (1.17/1.01), IRR (5.07%/0.28%), and NPV (LKR 121,102/LKR 6,224)] were falling short of favorable levels, with a lengthy payback period of nearly five years. From a technical perspective, the calorific value of the tea waste briquette (18.3 MJ/kg) is comparatively similar to the calorific value of other options (wooden briquettes: 16-22 MJ/kg, sugarcane bagasse:17-19 MJ/kg). Hence, tea waste briquettes are technically viable for boiler use. In terms of sustainability, the shift towards tea waste briquettes would reduce dependency on firewood, minimize waste, generate employment opportunities, prevent open dumping, protect natural habitats and re-aligning with environmental objectives. Although tea waste briquettes offer technical and sustainability advantages, financial viability remains a challenge if the facility serves only the organization's needs. Based on the findings, scaling up production to meet broader organizational or regional demand may improve financial feasibility, but re-assessing the financial, technical, and environmental performance is recommended.

Keywords: *Biomass and sustainable energy, Cost-benefit analysis, Fire briquettes, Tea waste, Waste management*