

Circular Economy-Based Business Model in India for Sustainable Industrial Hazardous Waste Management

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Abstract

Industrial waste management, as a major global concern, has drawn significant attention from both researchers and stakeholders. Adoption of circular economy approaches in industrial & municipal waste management is rapidly rising to address the limitations of the traditional linear “take-make-dispose” model. In this context, our organization has developed a scalable business model in India focused on sustainable industrial hazardous waste management through resource recovery. We have established India’s first Treatment, Storage, and Disposal Facility (TSDF) facility in Surat, Gujarat. In 2009, we undertook a strategic shift by initiating the pre-processing of hazardous waste into Alternative Fuel and Raw Material (AFR) for the cement industry, despite significant economic risks. Collaborative trials with leading cement manufacturers and have validated the approach. By 2024, we have established nine Pre-processing Facility (Alternate fuel resource facility) across India. Distillation residues, process sludges, spent organic solvents, oily and tarry residues, phosphate and paint sludges, mixed industrial effluents and various other Schedule I & II category waste. Since 2012 to 2026, we have transformed 1.638 million metric tons of waste into AFR with net saving of 1.017 million metric tons of CO_{2eq} in GHG emission which is equivalent to planting 99,704 number of neem trees. Additional benefits include conservation of 8.85 million metric tons of fossil fuel, 2.45 million metric tons waste was diverted from landfill, and 4063 hundred KL of fresh water was conserved. Our pre-processing units are well designed with zero liquid discharge system (ZLD) to ensure water reuse. With three granted patents, our model demonstrates a viable pathway toward achieving national targets such as a 25% Thermal Substitution Rate by 2030, advancing sustainable industrial development.