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Summary of the dissertation

VIABILITY OF REFUSE-DERIVED FUEL (RDF) FROM MUNICIPAL SOLID WASTE (MSW) AS A SUSTAINABLE ALTERNATIVE FUEL FOR THE CEMENT PLANT IN CITEUREUP, WEST JAVA, INDONESIA.

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Indocement, a cement producer in Indonesia, aims to replace 50% of its coal with alternative fuels by 2030. This study explores the use of Refuse Derived Fuel (RDF) from Municipal Solid Waste (MSW) as fuel in the cement plant to enhance waste management and sustainability in the sector. Analysis of 1,265 Mg of MSW from Jakarta, Bogor, Depok, and Bekasi revealed that the MSW was unsuitable for RDF production due to high moisture (55%) and low LHV (5.4 MJ/kg). However, with 80-90% combustibility, RDF shows significant potential.

The study evaluated four RDF production pilot projects. Strategy 1 used a 16-day bio-drying process, reducing moisture to 30%. Strategy 2 employed both solar and bio-drying, achieving similar RDF quality to Strategy 1 in 13 days. Strategy 3, using only mechanical treatment, produced RDF with high moisture (47-61%). Strategy 4 combined mechanical treatment with a belt dryer, achieving 34% moisture. These results indicate that drying processes are crucial for enhancing RDF quality.

The RDF from the pilot project was utilised by the cement plant. Strategy 1 achieved the highest net energy production at 7259 GJ and the greatest CO_2 reduction of 334 Mg. Strategy 2 followed closely with 7256 GJ of net energy and a CO_2 reduction of 331 Mg. Strategy 3 produced 4969 GJ of net energy and reduced CO_2 by 217 Mg, while Strategy 4 generated the least net energy at 4457 GJ and had a CO_2 reduction of 159 Mg. Overall, strategies 1 and 2 were the most effective in both energy production and CO_2 reduction.

Four modelling scenarios, each processing 500 Mg/day of MSW, were evaluated. The RDFP-3 model, which involves drying RDF and low-grade RDF in the cement plant, was found to be the most cost-effective with the shortest payback period of 6 years, requiring 186.8 million euros and additional land. To achieve a 50% substitution rate, processing 6,500 Mg/day of MSW would yield 3,100 Mg/day of RDF, potentially reducing coal consumption by 608,000 Mg/year and CO_2 emissions by 586,000 Mg/year. Compliance with Indonesian standards is feasible, but adhering to stricter German regulations would require improved Cl bypass systems and enhanced scrubbing and filtering technologies.