ABSTRAK

Daniel, Analisis Kelayakan Tekno-Ekonomi Pembangkit Listrik Tenaga Sampah (PLTSa) Jenis Teknologi Insinerasi 10 MW TPA Terjun Kota Medan. Peningkatan timbulan sampah di Kota Medan menyebabkan TPA Terjun berada pada kondisi kritis dan tidak lagi mampu menampung beban sampah yang terus bertambah. Penelitian ini bertujuan menganalisis kelayakan teknis dan finansial pembangunan Pembangkit Listrik Tenaga Sampah (PLTSa) 10 MW di TPA Terjun menggunakan tiga alternatif teknologi insinerasi: *moving-grate, fluidized-bed, dan rotary-kiln*. Analisis teknis dilakukan melalui evaluasi timbulan sampah, karakteristik komposisi, dan estimasi potensi energi. Analisis finansial dilakukan menggunakan indikator *Net Present Value* (NPV), *Benefit-Cost Ratio* (B/C), *Internal Rate of Return* (IRR), dan *Payback Period* (PP), serta uji sensitivitas terhadap variabel pendapatan dan biaya investasi. Hasil penelitian menunjukkan bahwa suplai sampah Kota Medan, dengan rata-rata timbulan tahunan lebih dari 628.000 ton, yang memadai untuk mendukung operasi PLTSa secara berkelanjutan. Teknologi *moving-grate* menghasilkan energi tertinggi sebesar 2.216.798 MW/tahun, diikuti *fluidized-bed* dan *rotary-kiln*. Secara finansial, *moving-grate* memberikan NPV sebesar Rp1,63 triliun, B/C Ratio 1.16, IRR 32%, dan PP 23 tahun 9 bulan. *Fluidized-bed* juga layak dengan NPV Rp1,01 triliun dan PP 24 tahun 6 bulan. *Rotary-kiln* menunjukkan NPV tertinggi, namun efisiensi teknisnya paling rendah dan asumsi CAPEX-nya tidak realistis untuk skala PLTSa kota. Analisis sensitivitas menunjukkan bahwa pendapatan merupakan variabel paling kritis yang dapat mengubah kelayakan proyek secara signifikan. Penelitian ini menyimpulkan bahwa PLTSa TPA Terjun layak secara teknis dan finansial, dengan teknologi *moving-grate* sebagai pilihan paling realistis. Diperlukan studi lanjutan terkait karakteristik sampah primer dan dukungan kebijakan daerah untuk menjamin keberlanjutan implementasi PLTSa di Kota Medan.

Kata Kunci: CAPEX, Finansial, PLTSa, Teknis, *Waste-to-Energy*,

ABSTRACT

Daniel. Techno-Economic Feasibility Analysis of a 10 MW Waste-to-Energy Power Plant (WPP) at the Terjun Landfill in Medan City. The increasing waste generation in Medan City has caused the Terjun Landfill to reach a critical condition and is no longer able to accommodate the increasing waste load. This study aims to analyze the technical and financial feasibility of constructing a 10 MW Waste-to-Energy Power Plant (WPP) at the Terjun Landfill using three alternative incineration technologies: moving-grate, fluidized-bed, and rotary kiln. The technical analysis was conducted through an evaluation of waste generation, composition characteristics, and energy potential estimates. The financial analysis was conducted using Net Present Value (NPV), Benefit-Cost Ratio (B/C), Internal Rate of Return (IRR), and Payback Period (PP) indicators, as well as sensitivity tests for income and investment cost variables. The results indicate that Medan City's waste supply, with an average annual generation of over 628,000 tons, is sufficient to support the sustainable operation of the WPP. Moving-grate technology produces the highest energy output of 2,216,798 MW/year, followed by fluidized-bed and rotary-kiln. Financially, moving-grate provides an NPV of IDR 1.63 trillion, a B/C ratio of 1.16, an IRR of 32%, and a PP of 23 years and 9 months. Fluidized-bed is also feasible with an NPV of IDR 1.01 trillion and a PP of 24 years and 6 months. Rotary-kiln demonstrates the highest NPV, but its technical efficiency is the lowest, and its CAPEX assumptions are unrealistic for a city-scale waste-to-energy plant. A sensitivity analysis indicates that revenue is the most critical variable that can significantly alter project feasibility. This study concludes that the waste-to-energy plant at the Terjun landfill is technically and financially feasible, with moving-grate technology being the most realistic option. Further studies are needed on the characteristics of primary waste and regional policy support to ensure the sustainability of waste-to-energy plant implementation in Medan City.

Keywords: CAPEX, Financial, Waste-to-Energy Plant, Technical, Waste-to-Energy,