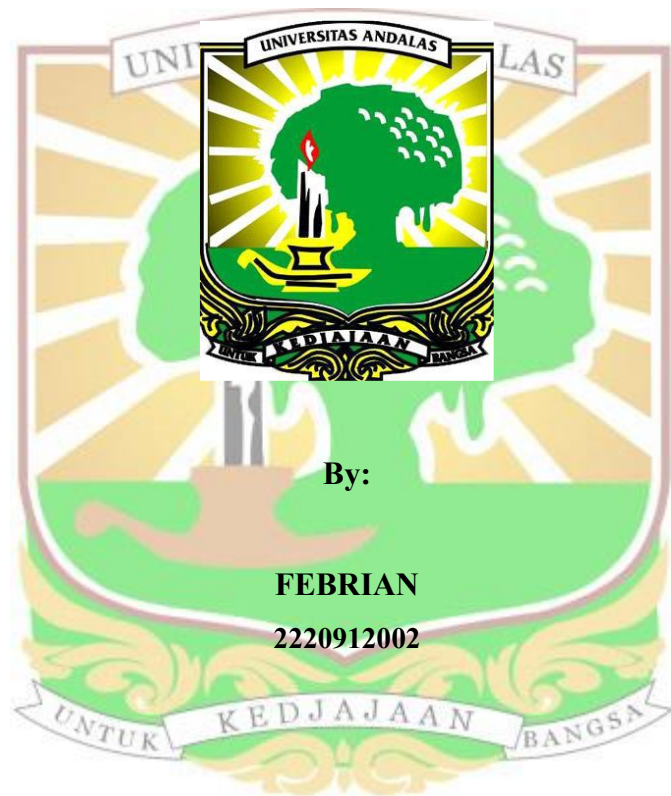


THESIS

DEVELOPMENT OF AN ENERGY MANAGEMENT SYSTEM FOR PALM OIL REFINERY FACILITIES: IMPLEMENTING A SYSTEMS APPROACH



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ABSTRACT

This study aims to develop a proactive Energy Management System (EnMS) for a palm oil refinery using a systems approach implemented during the plant design phase. Unlike conventional methods that rely on historical operational data, this research utilizes engineering design specifications and simulation modeling to estimate energy consumption baselines and formulate an ISO 50001-compliant EnMS. A regression-based analysis is applied to define Energy Performance Indicators (EnPIs), using production and running hours as key variables influencing energy use. The resulting model estimates a Specific Energy Consumption (SEC) of 2.168 MWh/MT—significantly higher than the 0.45 MWh/MT BAT benchmark—due to assumptions of full-capacity, simultaneous operation. To support energy performance improvement, the system incorporates PDCA-based review mechanisms and sets progressive energy-saving targets: an initial 10% reduction, followed by 1–2% annual improvements. Validation through structured feedback from plant management confirmed the system's alignment with operational needs and readiness for phased implementation. This study contributes a novel, simulation-based framework for integrating EnMS during the design stage, offering a scalable model for energy-intensive industries aiming to achieve sustainability from the outset.

Keyword: Palm Oil Refinery, Energy Management System, Energy Performance Indicator, ISO 50001