OPTIMIZATION OF RAW MILL OPERATING PARAMETERS TO MINIMIZE SEEC WHILE MAINTAINING RAW MIX FINENESS LEVEL AT PT XYZ

FINAL PROJECT

This Final Project Submitted to Fulfill One of the Requirements for Obtaining Bachelor Degree in Industrial Engineering, Faculty of Engineering, Universitas Andalas

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2025

ABSTRAK

Industri semen di sektor manufaktur Indonesia merupakan salah satu industri yang harus terus meningkatkan efisiensi operasional dan biaya. Optimasi konsumsi energi menjadi strategi utama bagi perusahaan semen untuk meningkatkan efisiensi sekaligus mempertahankan harga produk yang kompetitif. Biaya energi mencakup 47,05% dari total Cost of Goods Manufactured (COGM) *dalam industri semen, yang terdiri dari listrik dan energi termal. PT XYZ menghadapi tantangan dalam mengoptimalkan konsumsi listrik. Di pabrik PT XYZ, biaya listrik terdistribusi pada* raw mill *sebesar 40,26%.*

Penelitian ini berfokus pada optimasi parameter operasional raw mill untuk meminimalkan Specific Electrical Energy Consumption (SEEC) *dengan mempertahankan kualitas kehalusan* raw mix. *Variabel faktor yang dianalisis dalam penelitian ini mencakup* Airflow *(X_1),* Separator Speed *(X_2),* Hydraulic Ratio *(X_3), dan* Differential Pressure (DP) Mill *(X_4). Data yang diperlukan dalam penelitian ini dikumpulkan dari Technical Information System PT XYZ. Pendekatan* Design of Experiments (DOE) *diterapkan dengan menggunakan* Response Surface Methodology (RSM) *yang dikombinasikan dengan* Box-Behnken Design (BBD) *dalam perancangan eksperimen. Optimasi dilakukan menggunakan* overlaid contour plot *dan* desirability function.

Hasil optimasi parameter operasi raw mill yang didapatkan, yaitu Airflow *(X_1) sebesar 340 Nm^3,* Separator Speed *(X_2) sebesar 1250,5 rpm,* Hydraulic Ratio *(X_3) sebesar 0,127 bar/tph, dan* Differential Pressure (DP) Mill *(X_4) sebesar 39 mBar. Kemudian, untuk variabel respons didapatkan nilai SEEC (Y_1) sebesar 15,6 kWh/ton dan Fineness Level (Y_2) sebesar 4%. Potensi penghematan biaya energi listrik dari penerapan hasil optimasi ini mencapai Rp1.677.503.968,12/bulan atau sebesar 20% dari konsumsi energi listrik bulanan Raw Mill.*

Kata Kunci: *Efisiensi Operasional, Perancangan Eksperimen (DOE),* Raw Mill, Response Surface Methodology (RSM), Specific Electrical Energy Consumption (SEEC)

ABSTRACT

Cement industry in Indonesia's manufacturing sector must continuously improve operational and cost efficiency. Energy consumption optimization is one of key strategy for cement companies to enhance efficiency while maintaining competitive product prices. Energy costs account for 47.05% of total Cost of Goods Manufactured (COGM) in the cement industry, including electricity and thermal energy. PT XYZ faces challenges in optimizing electricity consumption. At PT XYZ's plant, electricity costs are distributed, with the raw mill consuming 40.26%.

This study focuses on optimizing raw mill operating parameters to minimize Specific Electrical Energy Consumption (SEEC) while maintaining raw mix fineness quality. Factor variables analyzed include Airflow (X_1), Separator Speed (X_2), Hydraulic Ratio (X_3), and Differential Pressure (DP) Mill (X_4). Data for this research was collected from PT XYZ's Technical Information System. Design of Experiments (DOE) approach was applied using Response Surface Methodology (RSM) combined with Box-Behnken Design (BBD) for experimental design. Optimization was performed using overlaid contour plots and the desirability function.

Optimized raw mill operating parameters are Airflow (X_1) at 340 Nm^3, Separator Speed (X_2) at 1250.5 rpm, Hydraulic Ratio (X_3) at 0.127 bar/tph, and Differential Pressure (X_4) at 39 mBar. Response variables obtained are SEEC (Y_1) at 15.6 kWh/ton and Fineness Level (Y_2) at 4%. Potential electricity cost savings from implementing these optimized parameters reach Rp1,677,503,968.12/month or 20% of the total cost of electrical energy consumed by the Raw Mill.

Keywords: Operational Efficiency, Design of Experiments (DOE), Raw Mill, Response Surface Methodology (RSM), Specific Electrical Energy Consumption (SEEC)