Costing, Energy Optimization and Benchmarking Energy Performance in Chemical Manufacturing Plant

Dinesh Ralkar
Mechanical Engineering Department, Goa College of Engineering, Farmagudi, Ponda, Goa

Dr. Jagannath B. Hirkude
Mechanical Engineering Department, Goa College of Engineering, Farmagudi, Ponda, Goa

Abstract

The project titled "Costing, Energy Optimization and Benchmarking Energy Performance in a Chemical Manufacturing Plant" focuses on improving process efficiency and reducing overall production costs through data-driven optimization and benchmarking techniques. The study was undertaken in a chemical manufacturing facility with the aim of analyzing raw material costs, utility consumption, and manpower requirements to identify potential areas for cost and energy savings.

A detailed analysis of plant operations was conducted by collecting data related to raw materials, utilities (electricity, steam, cooling water, chilled water, nitrogen, and air), and labor costs. Using this data, a Linear Programming (LP) model was developed to minimize the total energy cost and optimize resource utilization. The model considered production capacity, time, and material constraints to determine the most efficient allocation of energy resources. Results showed that the minimum optimized energy cost was ₹1,546,900 per month, while the maximum optimized profit achievable through efficient utilization of resources was ₹130,654,761 per month at a production level of 300,000 kg.

Further, the project incorporated energy performance benchmarking using the Energy Efficiency Benchmarking Methodology (E2BM). Energy Performance Indicators (EnPIs) were established to evaluate the plant's baseline energy performance. Significant Energy Uses (SEUs) such as power and chilled water systems were identified as major contributors to energy consumption. Based on comparative analysis over four years, the plant achieved a 4% improvement in total energy performance against a targeted saving of 1% through focused optimization and implementation of energy-saving initiatives.

This study concludes that integrating costing, optimization, and benchmarking tools enhances the operational efficiency of chemical manufacturing plants. The findings emphasize that systematic energy management not only reduces production costs but also promotes sustainable industrial practices, providing a model framework for continuous improvement in the process industry.