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ASSESSMENT OF MANUFACTURING PROCESSES ECO-EFFICIENCY BASED ON MFA-LCA-MFCA METHODS

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Abstract

The objective of this paper is to investigate eco-efficiency in a durable goods manufacturing system. It is intended to apply a method used in a company producing heating devices within the boiler sector. A hybrid methodology is used to assess the eco-efficiency of manufacturing processes, based on combining Material Flow Analysis, Life Cycle Assessment, and Material Flow Cost Accounting. This provides an effective approach to evaluate environmental and economic performance in the context of process improvement. To demonstrate the method, it is used a case study for comparing the eco-efficiency for baseline and improvement scenarios in a company producing central heating boilers.
All of the suggested improvements were directed toward reducing the overall environmental impact of the plant without sacrificing in-process quality and increasing eco-efficiency. The results indicate higher eco-efficiency for cutting measured in terms of energy use. For the manufacturing processes, the greatest benefits came from eco-efficiency improvements in the cleaning phase. Eco-efficiency analysis revealed that the total cost of material losses could be reduced by 2% against current processes. Unfortunately, due to the high cost of processing fuel, painting creates the highest utilities costs. It illustrates a significantly less eco-efficiency (3%) compared to the current process.
This method may serve as a useful foundation for enterprises to make viable decisions regarding material selection, whilst considering environmentally beneficial technologies and greater financial benefits at the same time.

Keywords: eco-efficiency, life cycle assessment, manufacturing processes, material flow analysis, material flow cost accounting

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