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## Performing Life Cycle Assessment and Zero Waste Application for Palm Oil Processing in Indonesia

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### Abstract

Palm oil which is a crucial raw material for foods and energy is one of the leading industries in Indonesia. With a yearly production of more than 19.4 million tons of crude palm oil, it is an industry to be reckoned with, also when it comes to environmental impacts. This assessment aims to perform Life Cycle Assessment on crude palm oil production in Indonesia including the stages of plantation, transport and milling. The data for the assessment was collected from different places in Kalimantan and Sumatra as main sites for palm oil production. The impact processes related to the plantation are the on-site energy use and production of artificial fertiliser. Pesticide use contributes a minor impact due to widely used integrated biological management. For transportation the only impact is from combustion of diesel and at the mill the boiler is the sole significant contributor through electricity production and negatively by emissions from the boiler. The results show that fertiliser production is the most polluting process in the system followed by transportation and the boiler emissions at a tie. The most significant impacts from the system are respiratory inorganics and depletion of fossil fuels, of which the boiler emission is the main responsible for the prior and fertiliser production and transportation are responsible for the latter. Alternative scenarios revealed that there are significant impact savings to be made by introduction of environmental investments, both regarding the overall impacts and in particularly regarding CO<sub>2</sub> emissions. Alternatives such as optimised use of organic fertiliser, approved filters at the mill boiler stack and biogas harvest from Palm Oil Mill Effluent digestion should be promoted in the industry.

**Keywords:** Artificial fertiliser, CO<sub>2</sub> emissions, life cycle assessment, mill effluent, palm oil