

Accepted Manuscript

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PII: S0959-6526(16)31228-8

DOI: [10.1016/j.jclepro.2016.08.078](https://doi.org/10.1016/j.jclepro.2016.08.078)

Reference: JCLP 7870

To appear in: *Journal of Cleaner Production*

Received Date: 11 May 2016

Revised Date: 30 July 2016

Accepted Date: 17 August 2016

Please cite this article as: Lacasa E, Santolaya JL, Biedermann A, Obtaining sustainable production from the product design analysis, *Journal of Cleaner Production* (2016), doi: 10.1016/j.jclepro.2016.08.078.

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Obtaining Sustainable Production from the Product Design Analysis

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Abstract

Sustainability has become a requirement for competitive companies, which increasingly make conscious decisions with regard to the impact caused by the development of their products. To be sustainable, product design should contemplate a triple bottom line in which environmental protection, social expectations and distribution of profits should be considered. In this work, a product development methodology that brings together traditional design criteria such as operative principles or mode of use and sustainability requirements is proposed. Three phases denominated respectively, production inventory, sustainability assessment and product redesign are carried out to its implementation.

The material flows exchanged by the industrial installation throughout the production process are analyzed according to a life cycle assessment approach. A set of engineering metrics and indicators are selected to assess each sustainability aspect. Environmental impact is evaluated by means of both, the global warming indicator and the aggregated and particularly useful for designers, EI99 indicator. Economic dimension is addressed through the calculus of the net operating profit of the company. Finally, the social aspects associated to the stakeholder category of company workers are evaluated by the working hours and hourly wage. Environmental improvement strategies based mainly on the selection of low impact materials and the reduction of materials are applied in the product redesign process.

Sustainable product development methodology is used to obtain an improved design of two different products, a solar tracker and an isothermal container. In both cases, a lower environmental impact and higher company benefit are achieved. In addition, an improvement of the social indicators is obtained in the case of the isothermal container. At the same time, the selected indicators are considered suitable to quantitatively assess each sustainability dimension, analyze and compare results.

Keywords: Sustainability indicators, product design, life cycle assessment, material flows.

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