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Reduction of environmental impact of products through Hotspot analysis in LCA

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Abstract
Since past decade, substantial efforts have been made against the depletion of global natural resources by designing and developing sustainable products and energy saving policies. Life cycle assessment (LCA) is an efficient tool, to determine the product sustainability and an also analyze the environmental impacts over the entire life cycle of a product. LCA also tells us how much environmental affect occurs during the various stages of product such as cradle-to-grave and gate-to-gate. Main purpose of this study is to find out the hotspots in LCA analysis and help industries to identify the scope for easy improvements. The practical importance of this study is to reduce the product carbon footprint, consumption of raw materials, energy, reduce wastage of materials, and increase economic benefit.
In this study, we consider a product such as Bathroom tab, a, manufactured by three different companies. We compute the greenhouse gas (GHG) emissions with the help of LCA for each stages of the product that is, raw material extraction, production, transportation to consumption (end of life), reuse, and recycling. In the proposed methodology, some Life Cycle Inventory (LCI) data is collected from companies and remaining analysis is carried out with available LCA databases. Next, we find the lowest possible emission value of each life cycle stages by comparing each stage of all the products manufactured by the four companies. Additionally we also find the values of the average GHGs, economical cost and profit for the same stage. Later we compare these average values with that of the design of a new bathroom tabs and find out the hot spots for improvements. Once hot spots are found, the companies can focus on these only for easy reduction of GHGs. We also present an application of this methodology.
In recent years, the growing concerns for ecological and climate change, together with concerns of poverty, increasing inequality among the public and the pressures brought by social inequalities, have positioned sustainable development under the spotlight. Nationwide and global institutions, policy makers and cross-country initiatives as well as consultants and researchers have increased the attention given to social and environmental sustainability globally.

Keywords: life cycle assessment (LCA), life cycle inventory (LCI), greenhouse gas (GHG)

1. Introduction
In recent years the growing concerns for ecological and climate change, together with concerns of poverty, increasing inequality among the public and the pressures brought by social inequalities, have positioned sustainable development under the spotlight. Thus, national and global institutions, policy makers and cross country consultants and researchers have increased their attention towards social and environmental sustainability. Sustainability means the growth that meets the necessities or desires of current scenarios without compromising the ability of future generations to meet their personal desires. In broad way, sustainability is the endurance of organizations and processes. Sustainability science is the study of sustainable growth and eco-friendly science.
Hale and hearty environments and ecosystems are necessary to the survival of human beings and additional creatures. Techniques of decreasing harmful human effect are eco-friendly chemical engineering, ecological resources management and environmental protection. Worldwide competition in today's global economies has brought significance challenges to many companies that want to meet continuously changing specific requirements of present and potential customers. Some of the critical issues that manufacturing companies should consider to remain competitive in the market are maintaining high quality Products, lowering cost and prices, decreasing product cycle time and protecting environment. It is well known that the requirements for manufacturing operations towards environmental sustainability have become more and more stringent every year.
It is also well known that manufacturers around the world have taken very different approaches to meet these requirements, resulting in very different practices in various countries. In first section we discuss about sustainability and life cycle assessment, while in second section we discuss regarding an objective of thesis and at last section we are doing some discuss regarding thesis outline.

Background information
In reaction to the growing stresses coming from nationwide and worldwide protocols, and from public in general, corporations are increasingly pushed into the direction of accepting the values of both social and environmental responsibility within their strategies, structures and management systems.

Sustainability
By Sustainability means the development that meet the desires of present-day without compromising the ability

of forthcoming generations to meet their own needs. For this sustainable manufacturing (or sustainable development) assumes three dimensions for sustainability (i.e., economic, environmental, and social). In large amount of indicators (tools) is in product manufacturing [4]. Sustainability or sustainable development is a much-discussed and substantial issue of present day in the light of increasing ecological degradation (global warming, reduction or depletion of the ozone layer etc.). Sustainable development is the establishing principle for sustainability, which mainly consist three interconnected area: Economics, Ecology and Social.

Life Cycle Analysis

Life cycle assessment is a tool or method through which we can assess the environmental impacts associated with the whole life cycle of a product from cradle to grave or cradle to cradle i.e. extraction of virgin material to transportation, transportation to manufacturing of product, from manufacturing to customer and till its end of life or may it service also. Life cycle assessment is occurred by following phases: In first phase, they explain not only the objective for performing a precise study, its objective, depth, the arrangement or the arrangements to be analyzed, the standards, but also in more precise aspects.

In second phase, they find out the extractions and emissions, the type of energy and raw materials used. Then combined in the process flow diagram and relate each other on his functional basis. In third phase, they found out how much amount of impact is occurred by the use of this above materials, energy, and services. In fourth phases the results are reported in the most informative way possible and the need and opportunities to reduce the impact which is occurred during whole life cycle product i.e. from cradle to grave or cradle to cradle.

Thesis objective

Today major issue of scientific research, industries, policy makers, some governmental and non-governmental agencies (NGOs) is that the depletion of worldwide natural resources by excess raw material consumption, designing, during manufacturing of product and use of non-renewable source of energy. So, some substantial efforts have been made against the depletion of global natural resources by designing and developing sustainable products and energy saving policies. On the same time researcher and policies maker made some concept. In this study are main purpose of to find out the hotspots by using Life Cycle Assessment and second one is create a general methodology or tool in product level or in process level to minimize the energy emission and Greenhouse gas emissions. So, we can help the industries to identify the scopes for easy improvements.

Significance of study

The practical importance of this study is to reduce the energy consumption during the manufacturing of product, carbon footprint, consumption of virgin materials, reduction of wastage of processed materials, and on the same time an increasing economic benefit. Past work restricted only just to find out the energy consumption, emission and etc. But they didn't tell us which process or gate to gate process has higher capability to reduce the energy consumption, consumption of raw materials, reduce wastage of materials, and increasing economic benefit.

During Life Cycle Assessment we applying this current method during whole product life cycle i.e. from cradle to grave process to find out the way to reduce the above impact. So, our upcoming generation or future generation will also use same resource in better manner which is used by us.

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