



GREEN MANUFACTURING – A NEW WAY TO INDUSTRIAL DEVELOPMENT

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Abstract: This review paper is to make you familiar with green Manufacturing especially concerning the mechanical application, as it is the need of the hour to address the issues related to the impact on the environment and on the natural assets owed to present-day production. With the help of green manufacturing, these issues can be suitably tended to, and this prepares for down to earth application in the present forceful world.

This paper will give you information about how the green manufacturing practices are being realized in various ventures and what are the incites that ought to be dealt with the objective that the green manufacturing practices can be progressively convincing for the improvement of organizations in a more feasible way.

Index Terms - Green manufacturing, practices, Green methods, impact.

I. INTRODUCTION

Green manufacturing is at the top priority for industries in this period of development. It provides the best solution to the industries for producing more sustainable products for the market meanwhile taking into consideration environmental impact caused due to the manufacturing without hampering innovation. Green manufacturing is considered the best way to reduce undesirable impact on the environment while maintaining the economic edge in the market.

As it is a very new concept and people from industries are not fully aware, making it hard to implement. The idea behind this review paper is to make you fully conversant with the concept of green manufacturing in relation methods and ideas behind it for a sustainable development of the industries. This review paper will cover the present scenario, methods regarding green manufacturing, how industries are taking up the green process and what is the future of green in industry.

This paper will give you a in depth knowledge of green technology, different methods of green manufacturing and how the industries can use green processes for the industrial development in this time when we say that the market is very competitive. In this paper, we present case studies of industries taking green process into their production line and discuss how it help them to grow. The objective of this paper is the gather information, differentiating and presenting an outline of green manufacturing in industrial point of view.

II. OVERVIEW OF GREEN MANUFACTURING

The term Green has come into limelight in '70s as concerns regarding environmental protection increased and in industry at the initial times it was introduced with the aim to decrease the negative impact on environment. But later, the scope of the term Green increased covering both the environmental aspect as well as sustainable growth of the industries with improvised product design and manufacturing keeping in mind those factors in long term scenario which will affect the industries long term goals [1] .

Green Manufacturing is a comprehensive term and can be used for both Green products and Green process. Green products are basically those products which are produced keeping in mind the environment impact due to them. The objective of these products is to lower the negative impact on the environment. These products include paper cups, recyclable carry bags, etc. Green processes are the manufacturing practices carryout in the shop floor with an aim to reduce the environmental impact by altering the traditional practices like optimizing the processes, selecting those materials which have less impact on the environment to reduce the scrap generation and reusing the scrap generated. The aim of green manufacturing is to minimize the utilization natural resources required to manufacture products through efficient manufacturing processes.

II.1. TECHNOLOGIES FOR GREEN MANUFACTURING

Today, there is a plethora of new and emerging technologies that aid in both, making the traditional businesses Greener, as well as creating completely new ones. For example, technologies for reducing GHG can be classified into five broad categories [13]:

- A. Carbon sinks:** This category consists of emergent technologies related to Carbon Capture and Storage (CCS) being developed for use in power plants that are fired by fossil fuels such as coal. These technologies enable capturing and storing CO₂ in ways such that it does not enter the atmosphere. For example, CO₂ from fossil fuels is trapped and stored in underground wells under intense pressure which keeps it in liquefied form.
- B. Efficient fuels:** This category encompasses a class of technologies that use cleaner fuels for generating power. Examples include biomass, hydro power, Integrated Gas Combined Cycle (IGCC), etc.
- C. Consumer Green:** This involves using clean and efficient fuels at the user end and solutions covering demand side management. For example, off-grid solar power applications like solar water heating and building insulation are included in this category.
- D. Green transportation:** Electric vehicles, fuel cells, and bio-diesel are some examples of this category.
- E. Industry efficiency:** This category refers to the use of Green production methods and technologies in traditional industries such as iron and steel, cement, refining, chemicals, etc. Multiple such technologies are emerging in each of these industries.

III. GREEN MANUFACTURING IN INDUSTRY

The Green manufacturing concept in industrial perspective covers supplies, design, manufacturing, distribution, services in general.

- A. INPUT SUPPLY:** Allied firms are generally termed as input supplies, these are those companies which support the production unit externally by providing services and green materials which are used in production. These services generally composed of power, energy, etc. If we talk about green manufacturing the main aim of input supply is to identify those firms which are motivated to reduced scrap in the initial phase of production.
- B. MANUFACTURING:** In green manufacturing, manufacturing involves all the concern people starting from the top management to person who is directly affected by the product. So, green products as so designed that they can be re-used, reproduced and recycled. Therefore, the major wings of production unit which are directly responsible for green manufacturing are design and process planning who decides the manufacturing tools and the methods used for manufacturing. Green manufacturing is not restricted to these two departments but it's a comprehensive effort by every department in the industry.
- C. SUPPLY CHAIN:** The integral part of supply chain in green manufacturing is wholesale distributors. They are responsible for the business transaction between produces and retailers. During wholesale distribution chances of wastage is very high and due to this there is a need of waste management in supply chain component of green manufacturing. With the introduction of this there is saving in cost by reduction in scrap.
- D. DISTRIBUTERS:** Retail outlets or distributors are directly engaged with the end user of the products. These retailers are basically a link between the industry and the customers they create an environment such that there is customer loyalty and repeated business which is of course due to plant quality, service and location which again tries to reduce scrap in green manufacturing.

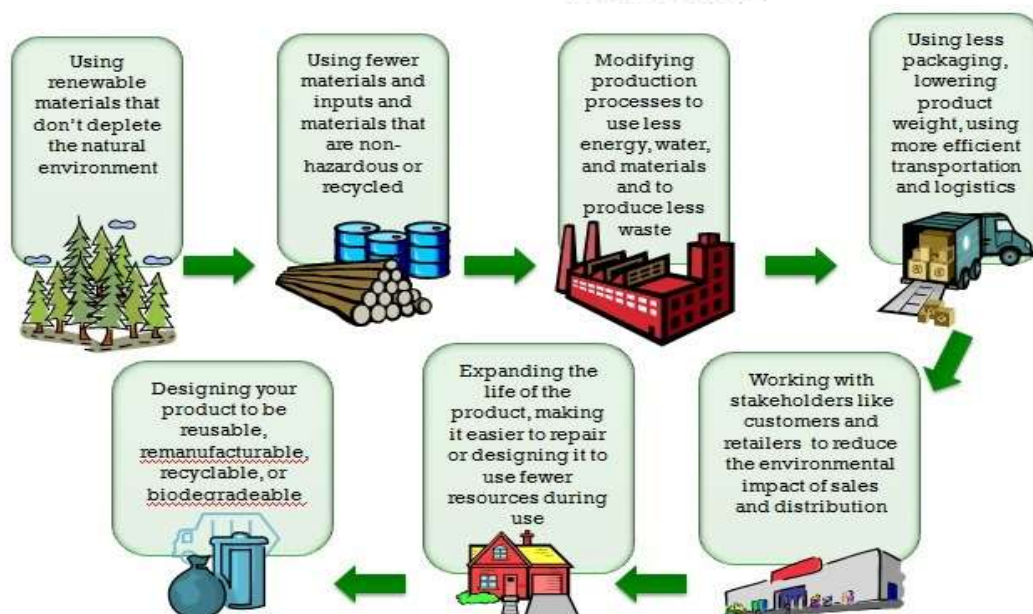


Fig. Block Diagram of Green Manufacturing in Industry (Courtesy: U S D.O.C)

IV. GREEN PROCESSES IN TRADITIONAL INDUSTRIES

How Green manufacturing is being implemented in the existing traditional or conventional industries can be viewed by taking up some examples where it has been applied and it led to the industrial development sustainably

A. POWER PLANT

The major green manufacturing practices in power plants includes various parameters to be handled according to environmental aspect [4] such as

- Air quality preservation measure which utilises low sulphur and nitrogen fuel, exhaust de-gasifier, High quality fuel, electric dust collectors Indoor coal storage and sprinkler system to reduce the ecological impact.
- Water quality preservation measures which include the control of drainage, hot waste water and oil leakage.
- Waste disposal measures include control of ash generation and its effective reuse such as landfills, bricks, etc.

B. FMCG (FAST MOVING CONSUMER GOODS)

The idea behind FMCG is that in this segment those products are included which are quickly sold and relatively cheaper than other products. The products which come into this category are soft drinks, toiletries, over-the-counter drugs, toys, processed foods and many other consumables. Technologies which reduce the environmental impact like use of paper, biodegradable plastics and other materials in the production of FMCG category of products are implemented to initiate green manufacturing.

V. SNAGS WITH INDUSTRIAL DEVELOPMENT

Even in tough market conditions, the business case for Green remains compelling. There is greater recognition of the imperatives of becoming Green and understanding that Green must address all three areas – Green energy, Green products and Green processes. However, companies face challenges on various fronts, most critically in providing leadership for such an effort. Companies must transition from [13] -

- Approaching Green as limited, often isolated initiatives with narrow focus to a more holistic approach,
- Meeting regulatory compliance to developing eco-advantage, and
- Viewing initiatives as cost centres to assessing them as business opportunities.

VI. SCOPE AND CONCLUSION

In this review paper we discussed various green manufacturing technologies how green manufacturing can be implemented to various units of any industry to have a sustainable development of industry keep environmental impact in mind. Further, it paves a path for the development of green manufacturing methodologies which are industry specific so that it can cater the requirement as per the need of the industry in long term basis. For better utilization of green manufacturing, involvement of all the departments in the industry should be there.

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