



Perspective to Green Manufacturing and Applications

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Abstract : *As energy and environmental concerns are increasing, green manufacturing is becoming a significant research field for the sustainable development of local and global societies. This special issue is the second attempt to find solutions to these concerns from various multidisciplinary fields of green manufacturing by International Journal of Precision Engineering and Manufacturing since 2011. The broad definition of green manufacturing is the process or system which aims to promote sustainability and to reduce the environmental impact by minimizing our dependency on natural resources and driving down pollution by intelligently recycling waste or through developing green products. This paper indicates the various applications. Here we can use green technology as a sustainable process. The aim of this paper is to give a survey on green manufacturing, what is green manufacturing why it is needed and methods of green manufacturing that reduces the waste and even pollution. The report focuses on the green design for environment of green manufacturing system, energy conservation, development of product with less wastage. The report also highlights the use of green manufacturing to form a sustainable product and to reuse the product*

Keywords - *Green technology, Sustainability, Natural resources*

I. INTRODUCTION

Green manufacturing is the renewal of production processes and the establishment of environmentally-friendly operations within the manufacturing field. Essentially, it is the “greening” of manufacturing, in which workers use fewer natural resources, reduce pollution and waste, recycle and reuse materials, and moderate emissions in their processes. Green manufacturers research, develop, or utilize technologies and practices to lessen their impact on the environment. Not only does green manufacturing benefit the environment, but growing numbers of businesses throughout the country are finding that a focus on recycling and the reduction of waste can benefit their business as a whole. Business owners are seeing improved bottom line and employees are seeing an increase in motivation, morale, and public relations. Green manufacturing has also become a vehicle for long-term job creation in the United States. According to a recent Quality Magazine article, green manufacturing currently accounts for 26 percent of all clean energy jobs. What’s more, clean and green manufacturing created 35,382 jobs between the years 2003 and 2010 while the rest of the industry shed in numbers. Because of their specialized skills base, clean economy workers earn 13 percent higher salaries than other workers of the U.S. economy.

II. LITERATURE REVIEW

William Gyasi-Mensah, Hu Xuhua, et.al (2018) [1], The industrial sector of every country, especially the manufacturing sub-sector produces a lot of post manufacturing materials that have a huge negative effect on the environment and human health, especially when conventional methods are used. with a conclusion drawn from empirically conducted research, steps can be taken and recommendations made to the government and to industry actors (manufacturers) based on the best practices towards creating green manufacturing environment and green economy in general.

Y. Nukman, Awais Farooqi, Osama Al-Sultan, Abdul Rahman A.Alnasser, M.S.H. Bhuiyan, et.al (2017) [2], The ideology of GMI has been demonstrated, and how this technique can be implemented at industrial scale is

discussed in this paper. it is most flexible, effective cleaning and cutting solution for much verity of materials for industrial needs as it does not expel heat, toxic fumes, recast layer, hardening effect and thermal stress.

Xu Jie, et.al (2017) [3], Study the composition of green manufacturing innovation system. Scholars at home and abroad have not yet formed a unified definition of traditional manufacturing and new manufacturing industry, especially new manufacturing industry. This paper defines the connotation of the innovation system and analyzes the composition of the green manufacturing innovation system.

Aditya M. Belekar, et.al (2017) [4], This study concluded that there was lot of work carried out in the field of GM and sustainable development but still we need to go further. Green manufacturing is proven very valuable concept for abating industrial waste and emission. Steam Production from solar energy can be considered as ideal example of GM relative to the challenges in GM.

III. PRACTICES IN GREEN MANUFACTURING

Green manufacturers research, develop, or utilize technologies and practices to lessen their impact on the environment. As detailed by the Bureau of Labour Statistics, workers at green companies must have specific manufacturing training in green technologies and practices such as:

1. Energy from renewable sources. Workers may generate electricity, heat, or fuel from renewable sources for use within their establishment. These sources may include wind, biomass, geothermal, solar, ocean, hydropower, landfill gas and municipal solid waste.
2. Energy from renewable sources. Workers may generate electricity, heat, or fuel from renewable sources for use within their establishment. These sources may include wind, biomass, geothermal, solar, ocean, hydropower, landfill gas and municipal solid waste.
3. Pollution reduction and removal, greenhouse gas reduction, and recycling. Workers will use green technologies and practices to:
 - Reduce or remove the creation or release of pollutants in their operations
 - Reduce greenhouse gas emissions
 - Reduce or eliminate the creation of waste materials
 - Collect, reuse, recycle or compost waste materials
4. Natural resources conservation. Workers will use specific technologies and practices to conserve natural resources, such as those related to organic agriculture, land management, and soil, water, or wildlife conservation.

IV. CASE STUDY

CASE STUDY 1

Bharat Heavy Electricals Limited (BHEL)

- Water Conservation Measures: - Reuse of wastewater generated from filter press operation for other miscellaneous uses and recirculation of cooling water.

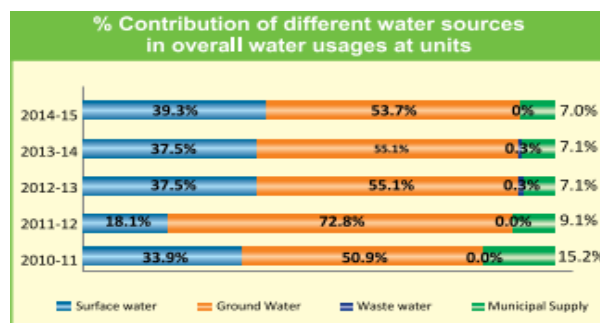


Fig 4.1:- Contribution of different water resources

- Utilization of water and its conservation. As the World Business Council for Sustainable Development (WBCSD) puts it, water is cheap, scarce and, wasted. Protecting the available water resources is our shared responsibility. As can be seen from the figure, the average water drawal from different resources at our units stands at 15.68 Million Cubic Metre. Further the contribution of different water sources is also shown in figure. As evident from the figure, ground water is the major source of water in our units followed by surface water and municipal supply. Further it may also be noted that at our EPD Bangalore unit, rainwater is collected and being used inside the premise

- Water Conservation Activities in various units of BHEL.
 - Development of rain water harvesting potential at all premises.
 - In Jhansi, water recycling is done within the process, steam is condensed into water, which is recycled back into the boiler
 - During the reporting period a total volume of 3.33 Million M3 of effluent was discharged from various units of BHEL, which is nearly 19.92 % of water withdrawal for the same period. All the water quality related parameters were within the prescribed limit of discharge as specified by the respective state pollution control board at the locations of our units.
 - Further, water recycling / reuse is being practiced at our unit in a big way. The water is mainly being recycled in the processes and reused for horticulture purposes. As can be seen from the figure, there has been a significant increase in recycling / reuse of water in the reporting period.

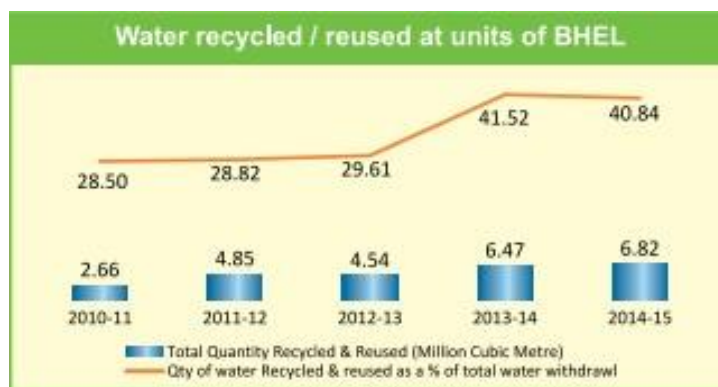


Fig 4.2: Water recycled in million Cubic Meter

CASE STUDY 2

Panasonic ECONAVI

High-precision sensor technology allows efficient, automatic operation to match the room conditions. This keeps everyone comfortable while saving energy. ECONAVI Intelligent Sensors detect unconscious waste of energy using the Human Activity Sensor and Sunlight Sensor. It is able to monitor human location, movements, absence and sunlight intensity. It then automatically adjusts cooling power to save energy efficiently with uninterrupted comfort and convenience.

- Energy Saving Technology.
- Econavi + Inverter

ECONAVI sensors and INVERTER technology work together to moderate the temperature according to room usage. By adapting to the way you live and optimizing operation, this unique feature makes the air conditioning in your home more energy efficient and keeps you comfortable throughout the day and night.

- **The Sensors**

ECONAVI Intelligent Sensors detect unconscious waste of energy using the Human Activity Sensor and Sunlight Sensor. Using high-tech sensors and precise control programs, it analyses room conditions and adjusts cooling power accordingly. Econavi is smart enough to locate and operate in all the right places to give you better energy savings. It is able to monitor human location, movements, absence and sunlight intensity. It then automatically adjusts cooling power to save energy efficiently with uninterrupted comfort and convenience.

- **ECONAVI saves you energy because it senses**

Area Search (Where you are?)

ECONAVI detects changes in human movements and reduces the waste of cooling the unoccupied area of the room.



Fig 4.3: Area Search Technique

- **Activity Detection (When you are less active?)**

ECONAVI detects changes in activity levels and reduces the waste of cooling with unnecessary power.

Fig 4.4: Activity Detection



Fig 4.5: Absence Detection

Adjusts cooling and heating power to changes in sunlight intensity. Rhythmic temperature-controlled pattern to save energy without sacrificing comfort



Fig 4.6:- Sunlight Detection.

V. CONCLUSION

The industrial sector of every country, especially the manufacturing sub-sector produces a lot of post manufacturing materials that have a huge negative effect on the environment and human health, especially when conventional methods are used. The alarming environmental consequences suffered by industrialized countries has pushed, the government, environmentally concerned organizations, civil society groups, as well as development partners to begin finding effective strategies to educate firms, enact regulation and collaborate with stakeholders to adopt and integrate green manufacturing practices into their operations. The aim is to help contain and end the negative impact of manufacturing activities on the environment. With a conclusion drawn from empirically conducted research, steps can be taken and recommendations made to the government and to industries manufacturers based on the best practices towards creating green manufacturing environment and green economy in general. A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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