Original Research Paper

Volume - 11 | Issue - 01 | January - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Environmental Science

# Environmental Design & Life Cycle Analysis

**Ms. Payal S. Pawar*** Assistant Professor, VVPIET, Solapur, Maharashtra, India. *Corresponding Author

**Ms. Bhagyashri R. Teli** Student, VVPIET, Solapur, Maharashtra, India.

**Mr. Bhimashankar Ghodke** Student, VVPIET, Solapur, Maharashtra, India.

**ABSTRACT** This paper presents the basic knowledge of Environmental Design and Life cycle assessment process. The environmental design is an important factor to improve the ecological quality of the products/processes. In this paper, the various government policies regarding environmental design and life cycle analysis are explained. This paper concludes the importance of life cycle assessment and environmental design of a product/processes.

**KEYWORDS :** environmental design, life cycle assessment, government policies

**INTRODUCTION –**

environmental design is the process of ordering the surrounding environmental parameters when devising the plans, products, processes etc. It helps us to enhance the natural, social, cultural and physical environment of certain area. Life cycle analysis is a technique to assess all the environmental parameters of the particular product or area.

**Principles of ED**

The plan of a task, cycle or item should fuse natural goals, notwithstanding different targets, for example, monetary proficiency and reasonableness.[1]

**Benefits of ED**

- reduces environmental impact of products/processes
- optimizes raw material consumption and energy use
- improves waste management/pollution prevention systems;
- encourages great plan and drives advancement; reduces expenses; addresses client issues/needs by surpassing current desires for cost, execution and quality; expands item attractiveness.
- Increased innovation
- Become more cost-effective

**Motivation for ED**

Within the company itself, referred to as ***internal drives.***
Within the immediate surroundings, referred to as ***external drives.***

**Internal drivers**

1. **Need for increased product quality:** An elevated level of ecological quality will bring item quality up as far as usefulness, dependability in activity, toughness and reparability.
2. **Image improvement:** Communicating an item's ecological quality to clients through a natural seal of value, for example, the Environmental Choice Label or a decent report in buyer tests, can improve an organization's picture fundamentally.
3. **Need to reduce costs:** Companies can combine ED strategies with financial benefits by:

- purchasing fewer materials for each of its products;
- using energy and auxiliary materials more efficiently during production;
- generating less waste and lowering disposal costs;
- disposing of hazardous waste. [2]

4. **Need to stimulate innovation:** ED can lead to radical changes at the product system level – the combination of product, market and technology. Such innovations can provide entry into new markets.
5. **Employee motivation:** Employee morale, generally, increases when employees are empowered to help reduce the environmental impact of the company's products and processes. ED can also boost employee motivation by improving occupational health and safety.
6. **Sense of responsibility:** A growing awareness that business must play an important role in working towards sustainable development can provide a strong incentive for implementing ED.

**External drivers**

1. **Government policies:** Product-oriented environmental policy

- Legislation on extended producer responsibility and take-back obligation.
- Introduction of eco-labelling programs for products or product groups.
- Requirement to provide environmental information on products and processes, requiring businesses to pursue more proactive environmental communication policies.

2. **Market demand/competition:** The necessities/needs of providers, merchants and end-clients are ground-breaking drivers for natural improvement.
3. **Trade/industrial organizations:** These organizations often encourage member companies to take action on environmental improvement and/or may impose penalties on companies that do not take the required action. Too, normalization associations are growing all current standards and principles to incorporate ecological issues.
4. **Waste charges:** Waste-processing charges such as land-fill and incineration costs are likely to increase, based on the principle of polluter pays. The counteraction of waste and emanations, re-use and reusing will thus turn out to be more monetary.

**Life cycle assessment and its purpose -:**

Life cycle appraisal (LCA) is an instrument to assess the natural impacts of an item or cycle all through as long as its can remember cycle. A LCA involves looking at the item from the extraction of crude materials for the assembling cycle, through the creation and utilization of the thing, to its final disposal, and thus encompassing the entire ***product system***[3]

A schematic representation of a product life cycle is given in Figure 1:

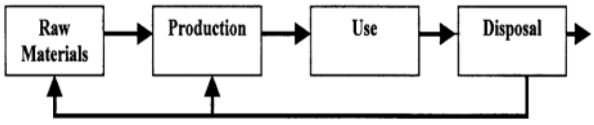


**Figure 1: Product Life Cycle**

The appraisal cycle incorporates recognizing and measuring vitality and materials utilized and squanders delivered to nature, surveying their ecological effect and assessing open doors for development as delineated in Figure

The unique feature of this sort of appraisal is its attention on the whole life cycle, instead of a solitary assembling step or natural discharge.The theory behind this approach is that operations occurring within a facility can also cause impacts outside the facility's gates that need to be considered when evaluating project alternatives.

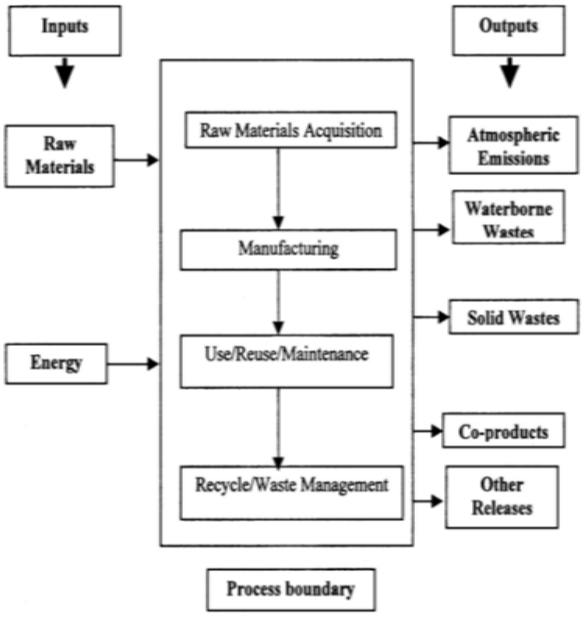


**Figure 6.2: LCA Process**

**Purpose of LCA:**
Government and customers who purchase products from different sectored companies are keen on environmental properties of all the products. EMAS and ISO 14000 are demanding continual improvement in the process of production and in the environmental management system. At this stage there is a need for a tool like LCA that helps organizations meet the demand to improvise process/ product.

**STAGES IN PRODUCT LCA**
LCA is split into five stages that include:

1. **Planning** -: Includes Statement of objectives, Definition of the product and its alternatives, Choice of system boundaries, Choice of environmental parameters, Choice of aggregation and evaluation method and Strategy for data collection
2. **Screening -:** Includes preliminary execution of LCA and adjustment of plan
3. **Data collection and treatment:** Incorporates estimations, interviews, writing search, hypothetical counts, information base pursuit, qualified speculating and furthermore calculation of the stock table
4. **Evaluation -:** Includes classification of inventory table into impact categories, aggregation within category, normalization and weighting of different categories
5. **Improvement assessment** -: Includes sensitivity analysis and improvement priority and feasibility assessment.

It is commonly perceived that the principal stage is critical. The consequence of the LCA is intensely subject to the choices taken in this stage.

The screening LCA is a helpful advance to check the objective definition stage. Subsequent to screening it is a lot simpler to design the remainder of the venture.

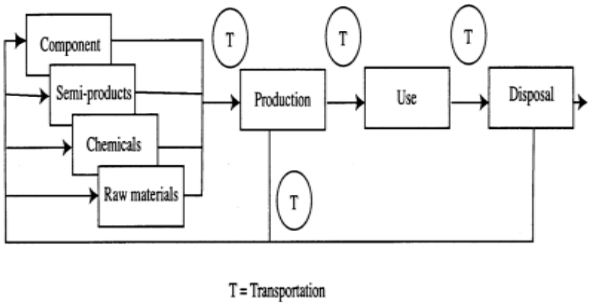


**Figure 6.3**: **Product Life Cycle Stages**
Note that Figure 6.3 supplements Figures 6.1 and 6.2. As portrayed in these figures, each phase of the existence cycle gets materials and vitality as sources of info and produces: yields of material or items to resulting life cycle stages; emanations to nature [4]

**6. Extraction of crude materials: -** This phase in the existence cycle incorporates the extraction of all materials associated with the whole life pattern of the item. Run of the mill instances of exercises remembered for this stage are woodland logging and yield gathering, fishing and mining of metals and minerals. The stock for the extraction of crude materials ought to incorporate crude materials for the creation of the apparatus (i.e., capital hardware) associated with assembling the item and different phases of the item life cycle.

Crude materials utilized in the creation of power and vitality utilized in the distinctive life phases of the item ought to likewise be thought of. Gathering information for the crude materials extraction stage may end up being an unpredictable assignment. It might likewise lead into iterative cycles, for example, evaluating the sources of info and yields identified with extraction of the crude materials that is utilized in the creation of finished results. Regularly, the most genuine natural issues of the item life cycle related with this first stage. It is a typical mistake to forget about pieces of the crude materials stage from the LCA. Basically, the choice of what to incorporate or prohibit in the LCA ought to be founded on an affectability examination.

**7. Assembling of an item :-** The assembling stage envelops all the cycles engaged with the transformation of crude materials into the items considered in the LCA. Aside from the assembling measures at the plant where the item is made, this stage considers creation of auxiliary materials, synthetic substances and explicit or general parts at different plants, regardless of where they are.

**8. Transportation: -** As is shown in Figure 6.3, transportation is truly not a solitary life stage in itself. Or maybe, it is a vital aspect of all phases of the existence cycle. Transportation could be depicted as development of materials or imperativeness between different exercises at various regions. Associated with this stage, beside the vehicle cycle itself, is the formation of packaging materials for the transportation of the item.The transport stage would perhaps at the same time incorporate a fitting portion of the ecological loadings and utilizations related with the development and support of the vehicle framework, regardless of whether this is street, rail, water or air transportation**.**

**9. Utilization of item: -** The utilization phase of the item happens when it is placed in administration and worked over its valuable life. This starts after the circulation of the item and closures when the item is spent or disposed of to the waste administration framework. Remembered for the utilization stage are deliveries and asset utilizations made by the utilization or support of the item.

**10. Waste management: -** Wastes are created in each period of the existence cycle, and they should be appropriately figured out how to secure the earth.

(i) **Reuse:** This means the use of the product or parts thereof in new units of the same product or in different products.
(ii) **Recycling:** This means the use of materials in the product for manufacture of the same or other products.
(iii) **Incineration:** This refers to the combustion of the product, generating heat that may be used for electricity production or heating.
(iv) **Composting:** This refers to the microbial degradation of biological materials yielding compost for improvement of agricultural soils.
(v) **Waste water treatment:** This refers to the organic matter degradation and nutrients removal from sewage water, creating sludge that is deposited on agricultural land.
(vi) **Land filling:** This means the deposition of the product in landfills.[5]

**CONCLUSION-**
this paper explains the concept of environmental design and life cycle assessment. The main principle of life cycle assessment is to assess the product life according to its surrounding ecological conditions. The environmental design help us to improve the environmental parameters and also reduces the cost of product/process. Environmental design and life cycle assessment is the most important factors of EIA (environmental impact assessment).

## REFERENCES –

[1] M. A. van Eldik, F. Vahdatikhaki, J. M. O. dos Santos, M. Visser, and A. Doree, "BIM-based environmental impact assessment for infrastructure design projects," Autom. Constr., vol. 120, no. January, p. 103379, 2020, doi: 10.1016/j.autcon.2020.103379.

[2] F. Rossi, M. Heleno, R. Basosi, and A. Sinicropi, "Environmental and economic optima of solar home systems design: A combined LCA and LCC approach," Sci. Total Environ., vol. 744, p. 140569, 2020, doi: 10.1016/j.scitotenv.2020.140569.

[3] Z. Chen, Z. Luan, and K. Jiang, "Research on life cycle assessment and design methods of mechanical products based on simapro software," IET Conf. Publ., vol. 2010, no. 576 CP, pp. 104–110, 2010, doi: 10.1049/cp.2010.1269.

[4] ISO/IEC/IEEE© Std. 4201:2011, "INTERNATIONAL STANDARD ISO / IEC / IEEE Systems and software engineering — agile environment," ISO/IEC/IEEE 26515 First Ed. 2011-12-01; Corrected version 2012-03-15, vol. 2012, 2011.

[5] A. Stenhoff, L. Steadman, S. Nevitt, L. Benson, R. White, and B. Hill, "Quadrangle Jo ur na l P re," J. Context. Behav. Sci., p. 105398, 2020, doi: 10.1016/j.jclepro.2020.124591.