

# Life Cycle Analysis



## INTRODUCTION

Life Cycle Analysis (LCA) is defined as a technique to assess the environmental impacts associated with all the stages of a product's life from raw material extraction (mining or logging) through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling. The process, the materials, the product and its recycling all create an impact on the environment.

There are several types of for different products and a could be done for products which provides and insight into:-

- Cradle-to-Grave: The full life cycle of a product from raw materials (cradle) to the disposal phase (grave).
- Cradle-to-Gate: A partial product life cycle assessment that investigates a product from raw materials (cradle) to the gate of the manufacturing facility before transportation to the consumer.
- Cradle-to-Cradle: A product life cycle assessment, where the end phase includes recycling of the product into a new product. The recycled product can be identical or different to the original product.

The lesson plan encourages students to do a system thinking analysis.

### Objectives:

Students will be able to

- explain how demand affect the development of products, services and processes.
- analyze the environmental implications of the products on environment, health and safety.
- assess life cycle and list the inputs and outputs of packet of chips.
- make an inventory of the different materials which go into the making of a product.

**Eco-Schools Steps:** Environmental Review, Curriculum linkages, Inform and Involve  
**Curriculum linkage:** Environmental science, Social science



### Time required/ Duration:

- **Classroom Session:** 45 minutes for doing a desk research of the product

### Resources Required:

- Writing material
- Computer with speaker and screening facility.
- Packet of potato chips in aluminum foil packet.
- Photos bauxite, alumina, aluminum and packaging, potatoes, salt, oil.



# Activity

## Classroom session **1**

- Start the discussion about the life cycle of a plant. You can ask them questions about the input and output of the plant as it grows from a seed and also what happens when the plant dies?
- Screen the movie 'Lifecycle of a t-shirt' using this link.  
[https://www.youtube.com/watch?v=BiSYoeqb\\_VY](https://www.youtube.com/watch?v=BiSYoeqb_VY)
- Divide groups into teams of 7-8 students. Give them commonly used products such a packet of potato chips.
- Ask them to discuss and draw a flowchart of the life cycle of a packet of potato chips.
- Facilitate the thinking of the children so that they will be able to come up with all contents like potatoes, oil, salt; as well as the packaging contents such as aluminium (made from mined bauxite and coal), plastic, inks and dyes.
- Ask the students to answer the following questions and document it in a worksheet.
  - a) What is the product made from?
  - b) Where did the components come from?
  - c) Who made it?
  - d) Where was it made?
  - e) How is it packaged?
  - f) How is it transported to market?
  - g) What are all the inputs and the outputs of the product?
  - h) What will happen to the product at the end of its life?
- Ask students to investigate an alternative way to meet the same need or want using fewer resources.
- It is also important to make students understand that in the process of manufacture of products
  - Resources are utilised (which are depleting and because we are not recycling, it is further adding to depletion).
  - Different forms of energy used (some renewable and others non-renewable).
  - Waste in the form of emissions is produced - affecting soil, water and air.
  - Waste is generate in terms of the items disposed and now a crisis of how and where to dispose these products.
- Ask the students to work on one of their favorite products and conduct the LCA at home.

### Evaluation:

Check for the depth of life cycle analysis to identify the resources used in every step of the processes and suggest ways to reduce the wastage.

## Resource 1

### Food Packaging and More....

#### Story of the Mumbai dabbawala's:

“The 5,000 or so dabbawalas (Tiffin/Lunch Boxes Carriers) in the city have an astounding service record. Every working day they transport more than 130,000 *daabas* or lunch boxes throughout Mumbai, the world's fourth-most-populous city. That entails conducting upwards of 260,000 transactions in six hours each day, six days a week, 52 weeks a year (minus holidays)”

“On any given day, a dabba changes hands several times. In the morning a worker picks it up from the customer's home and takes it (along with other dabbas) to the nearest train station, where it is sorted and put onto a wooden crate according to its destination. It is then taken by train to the station closest to its destination. There it is sorted again and assigned to another worker, who delivers it to the right office before lunchtime. In the afternoon the process runs in reverse, and the dabba is returned to the customer's home” . Excerpts from a study by Stefan Thomke, professor from the Harvard Business school, Source: <https://hbr.org/2012/11/mumbais-models-of-service-excellence>).

Professor Thomke's study was to analyse the amazing delivery system of the Mumbai dabbawala's which has been almost flawlessly executed for over a century now (since 1890). Beyond the excellent delivery system in place is the fact that these dabbawala's have been using reusable tiffin boxes for the delivery of lunch. Just imagine the volume of waste which will be generated each day, if instead of the reusable lunch boxes, food was transported around in disposable packaging material?!

#### Innovations and Technologies to deal with Packaging Food Waste

##### Plate bank:

Functions, parties and get togethers at home have increasingly become a large source of waste generated, especially disposable plastic cutlery. Some individuals and organisations have now come up with innovative techniques as well as technologies to deal with this problem. The eco-friendly plate bank, initiated and maintained by Adama Chetana, is one of the largest of its types in the city of Bangalore, India. The plate bank has close to 10,000 sets of steel plates, spoons, glasses, cups, etc and can be borrowed by individuals, organizations and educational institutions for events at zero cost. The article by a leading newspaper, Hindu <http://www.thehindu.com/news/cities/bangalore/plate-banks-try-to-reduce-disposables-by-lending-utensils/article22454225.ece> covered other such initiatives in the city of Bangalore. The idea behind the plate bank in most of these cases is to bring down the volume of waste generated during such events and celebrations.

### **Edible solutions to packaging waste?**

Edible spoons and forks manufactured from products including millets (jowar), rice, wheat and different types of spices for the flavouring (<http://www.bakeys.com/india-innovates-episode-4-edible-cutlery/>); edible sachets (for beverages, instant mix for noodles) made from sea weed (Source: <http://www.evoware.id/>); bacteria to produce cellulose which is in turn used to manufacture edible food wrapper (<https://www.natureasia.com/en/nindia/article/10.1038/nindia.2012.11>) are some of the solutions different innovators are finding to problems associated with packaging of food items. These are smaller steps in the direction of reducing packaging waste... what needs to be seen is how soon we are able to contain the problem in the times to come.

### **Traditional waste-free solutions:**

Traditionally in leaves from different plants, especially Sal (*Shorea robusta*) and banana (*Musa* species) have been in use in India and many other cultures in Asia plates and bowls for serving food, especially during functions and festivals. It is such a fantastic way to eat food on these leaves as both the leftover food on the leaf and the leaf itself are not just biodegradable but also consumed by cattle, completely doing away with the problem of disposal of waste also.

### **Technology interventions:**

MIWA (<http://www.miwa.eu/about-us>), based in the Czech Republic has initiated various technological interventions to take care of the generation of packaging waste in the first place, by encouraging “pre-cycling”, they have approached the packaging problem in a different perspective.

Study the article “These 11 innovations will tackle the causes of ocean plastic pollution, not just the symptoms” (<https://www.weforum.org/agenda/2018/01/these-11-innovations-will-tackle-the-causes-of-ocean-plastic-pollution-not-just-the-symptoms>)