Sustainability and Waste

Before you Begin

Over the past three hundred years, technology has unquestionably enhanced the life and wellbeing of a greater portion of humanity than in all of the human history that went before. Ordinary people can now live longer, healthier and more fulfilling lives than even the mightiest people of earlier times.

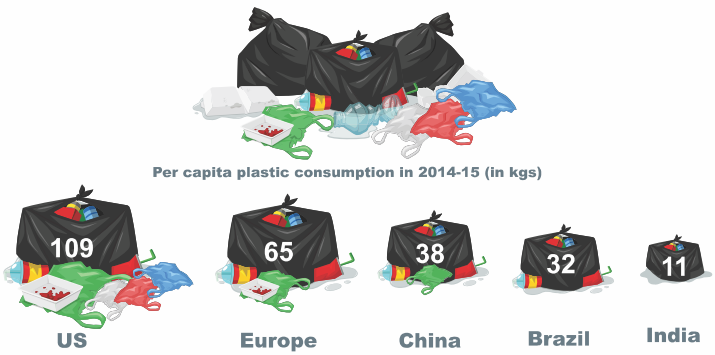
One with the greatest promise, comparable to that of the coal and oil which fueled the industrial revolution, and the Green Revolution which saved so many from starvation, is the wide spectrum of materials called Plastics. Life today, whether in the richest or poorest communities, is unthinkable without these materials. They pervade every activity, every nook and corner, of human existence. From materials to build houses, through buckets to carry and store water, to automobiles and appliances for mobility and productivity, finally to packaging for preserving food – human survival is hard to imagine today without the use of plastics.

Unfortunately, the very properties that make them valuable – versatility, durability, multiple uses, resistance to degradation – have, within a century after their introduction into the market, made them into a life-threatening menace.

Plastics now also pervade every habitat and every nook and corner of the planet's environment. In the home, tiny particles of plastic ("micro-plastics") pervade the indoor air and settle on food and eating utensils, creating health hazards that are only now beginning to be recognized, but already thought to be quite dangerous.

In the streets and landfills of cities and villages, remnants of plastic bags get eaten by animals, only to strangulate their internal organs. In the oceans, from the surface to the bottom of the deepest trenches, pieces of plastic testify to the presence, possibly far away, of human "civilization". The Pacific Gyre, a (continent-sized) island made entirely of waste plastics 1.6 million sq. km – three times the size of France – floats aimlessly feeding sea-birds, fish and whales with an indigestible diet of non-degradable plastic. No sea life can survive such poisoning.

The solution is not to ban all plastics all of a sudden. That was necessary and possible in the case of DDT, CFCs and leaded petrol. What is now needed is an immediate stoppage of plastics use that is either not essential or is substitutable by other more environmentally benign materials. And, of course, urgent support must be given to research and innovation to develop alternatives that bring the same benefits but do no harm.



Life Cycle Analysis

Lesson 1 Plan

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.

Eco-Schools

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

13-16 Years

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.

4 QUALITY EDUCATION

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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
- 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.
- As 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 Harward 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 Adamya 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 inturn 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 itmes. 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)

Plastic a boon or bane?!

Lesson 2 Plan

INTRODUCTION:

Plastics have become omnipresent and essential part of our life due to its properties like being light weight requires less energy to transport, cheaper then alternatives and conserve metal and wood resources, very durable and inert nature finds usage in many industries and storage but the same properties make it undesirable as they remain forever and choke up natural systems especially water ways and are killing wild animals both on land and in ocean.

The problem associated with plastics is more to do with our bahviours of littering. The lesson encourages children to research the issues with plastic and develop an Eco Code.

Objective:

Students will be able to

- observe the omnipresence of plastic.
- explain the negative impact of plastic on the environment.
- develop an attitude of thoughtful buying leading to waste reduction.
- reflect on whether plastic is really needed and what are the alternatives to plastic use.

Eco-Schools Steps: Environmental review, Curriculum linkages, Inform and Involve, Eco-Code

Curriculum Linkage: Science/ Environmental

Eco-Schools

13-16 Years

Time required/ Duration:

- **Classroom session 1:** 45 minutes (for screening two documentaries, 'Plastic Ocean' and 'You Can Live Without Producing Trash').
- **Home Assignment:** Two days for auditing personal plastic use.
- **Classroom Session 2:** 45 minutes for wrap and for preparing the Eco-Schools bulletin board for display.

Resources Required:

- Student stationery including notepads and writing material.
- Internet
- Laptop/ Projector
- Video links - Film “Plastic Ocean” and “ You can Live Without Producing Trash”

Activity

Classroom session 1

- Screen the two documentaries. Make it sure that the documentary on Plastic ocean is screened first.
- Facilitate a classroom based interaction with students discussing various uses of plastic in their daily lives, including their advantages and disadvantages.

Home Assignment 1

- Ask the students to document the different types of plastic they use over two days with details of the purpose of use, including advantages, disadvantages and alternatives.

Classroom session 2

- Divide the class into individual groups.
- Ask the members of the group to share their consolidated lists.
- Engage students in a discussion on different ways plastic products which could be avoided.
- Ask the students to display the list on the Eco-Schools bulletin board as part of inform and involve.
- Ask students to develop an Eco-Code to reduce the generation of plastic waste.
- Ask the students to share the Eco-Code on the Eco-Schools bulletin board and run a signature campaign.

Evaluation

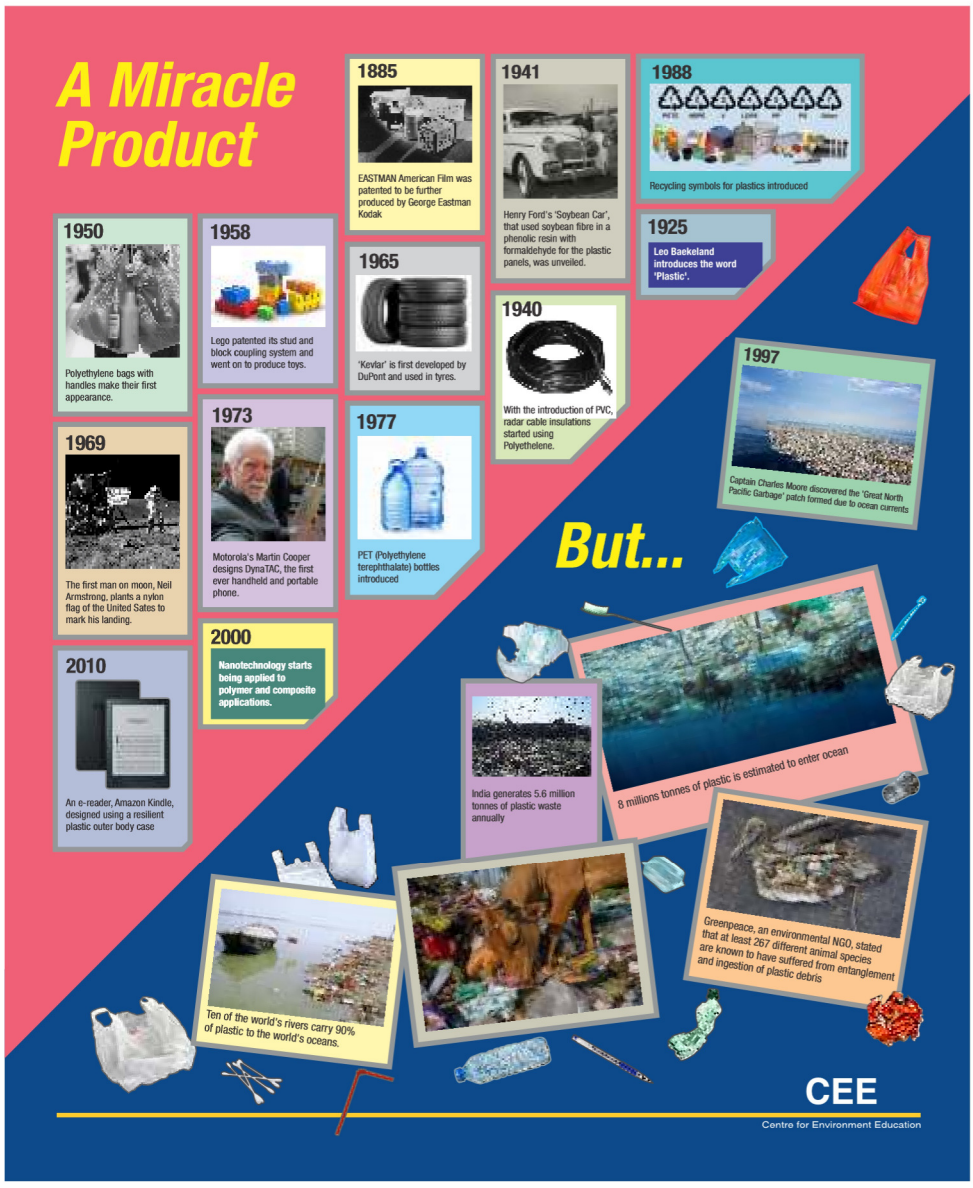
- Teachers should be able to assess student understand based on the following
  - Lists prepared by student groups as part of the home assignment.
  - Eco-Code developed by students.

Resource 2

Video Links:

1. **Plastic Ocean'**
   https://www.youtube.com/watch?v=ju_2NuK5O-E (impacts of plastic on seabirds)

2. **You Can Live Without Producing Trash'** (how to reduce the waste individuals produce)
   https://www.youtube.com/watch?v=nYDQcBQUDpw



Take It Back!

Lesson 3 Plan

INTRODUCTION:

Extended Producer Responsibility (EPR) is a strategy designed to promote the integration of environmental costs associated with goods throughout their life cycles into the market price of the products. Extended producer responsibility focuses on the end-of-use treatment of consumer products and has the primary aim to increase the amount and degree of product recovery and to minimize the environmental impact of waste materials. The EPR has its roots in concerns about scarce landfill space and potentially hazardous substances in component parts.

EPR encourages take-back with an aim to:-

1. encourage producer to design products for reuse, recyclability, and materials reduction.
2. incorporate waste management costs into the product's price.
3. promote innovation in recycling technology.

Objective:

Students will be able to

- define the concept of extended producer responsibility.
- Identify corporate/products that encourage Take – It – Back.
- resolve to support EPR products.

Eco-Schools Steps: Environmental review, Curriculum linkages, Inform and Involve

Curriculum Linkage: Science/ Environmental Studies/Social Science

Eco-Schools

13-16 Years

Time required/ Duration:

- **Home Assignment:** Research for the advantages and disadvantages of EPR from different stakeholders' perspective.
- **Classroom session 1:** 45 minutes for the EPR discussion.

Resources Required:

- Student stationery including notepads and writing material
- Internet

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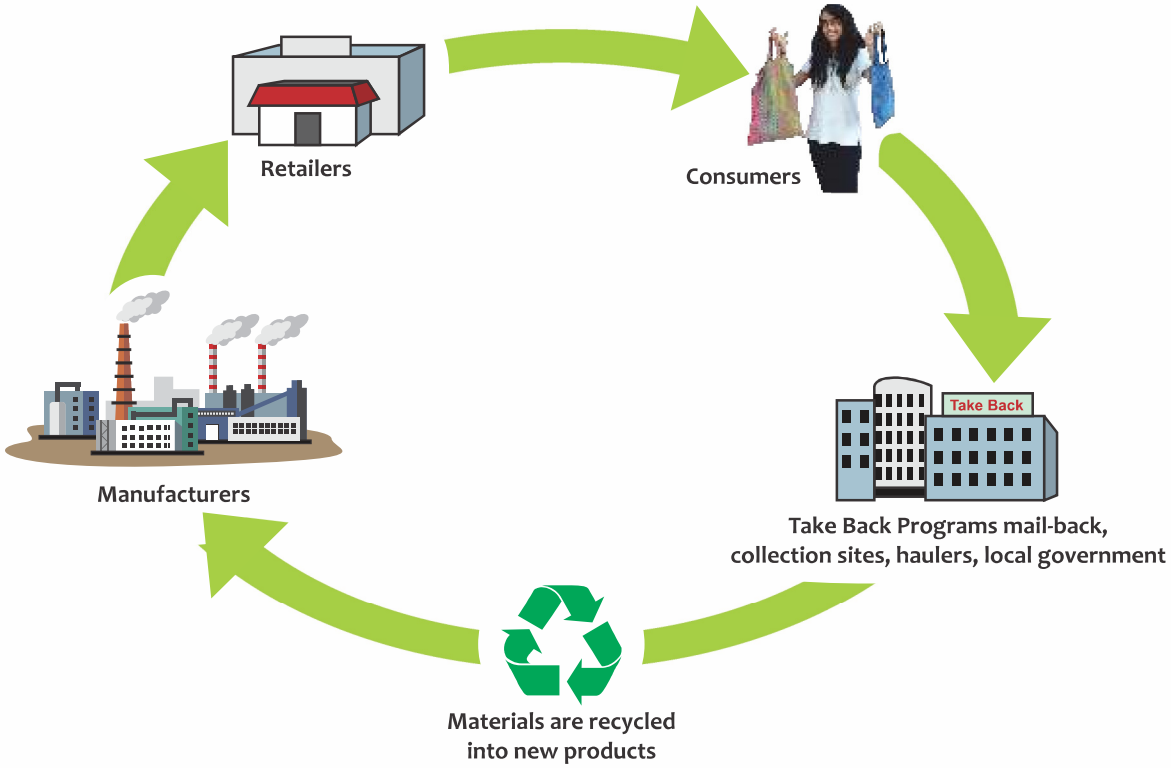
Activity

Divide the class into two groups. Ask them to research and prepare for a debate for and against EPR being made mandatory. Encourage them to look for case studies to substantiate their arguments.

Classroom session 1

- Ask the groups to suggest a panel of 3 persons who would represent them in panel discussions on 'for and against' motion of EPR being made mandatory.
- Ask students by raise of hands and count how many of them agree or disagree to the proposal. Take the count.
- Ask the panels to present their arguments for and against the motion. Teacher should act as moderator for the panel discussion.
- After the discussion, again take the vote of students in the audience.
- Ask the children to list the advantage and disadvantage of EPR.
- Ask the students to prepare a list of five products that should have mandatory EPR with the reasons.



Evaluation

The list of products would give an idea to what extent students have understood the concept of EPR.

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