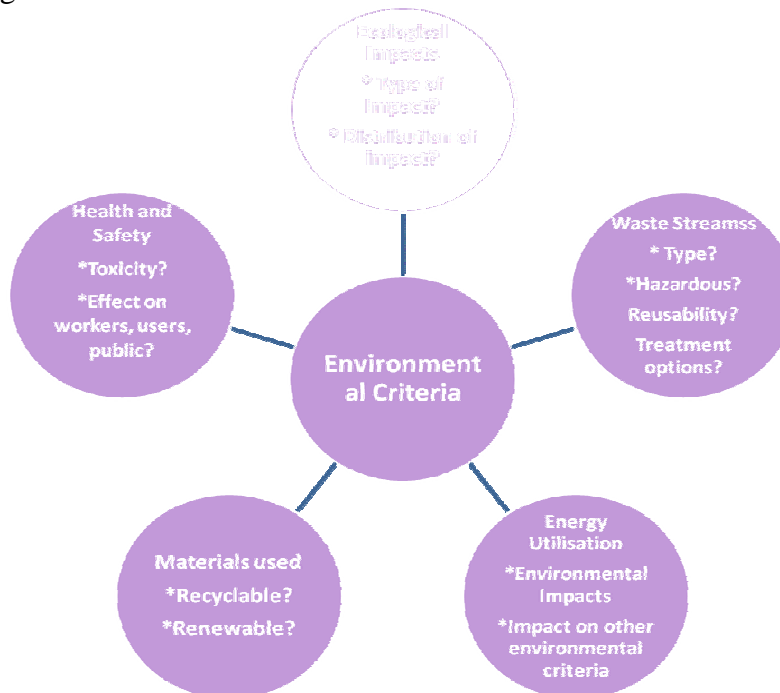


### **Parameter: Recycling (*Weightage: 20%*)**

The life of automobile includes different phases beginning with the extraction of raw materials and ending with the disposal of vehicle. In all life phases, processes transform energy or material from one phase to another. After usage, the Vehicle is subjected to disposing and recycling. But recycling is not always the best strategy. Some factors should be considered to find out the impact of recycling. The environmental criteria for recycling are given as follows:



The overview of the work done on recycling in many countries, organizations, institutions is given below:

1. Japan: Further inputs are expected
  - a. USA: The Mercury law is put forward and signed in April 2002, which prohibits mercury switches on vehicle manufactured on or after 1 Jan 2003.
    - Vehicle manufacturer should establish a system to remove & collect mercury-containing switches.
    - Manufacturers are required to pay \$1 per switch.
    - After 15 July 2002, vehicle manufacturers should have label indicating the components containing mercury.
    - By 1 July 2004, vehicle manufacturers are required to report on no. of mercury switches removed and recycled.

2. China: ISO 22628:2002 Standard specifies method of calculating the recyclability. Project on End of Life vehicles is formulated that states that
  - Min 85% recovery rate for M2, M3 and N2, N3 including 80% recycle rate for materials. And Min 80% recovery rate for M1 and N1, incl. Min 75% recycle rate by Year 2010
  - Min 90% recovery rate for all vehicles incl. 80% recycle rate for materials by Year 2012
  - Minimum 95 % recovery rate for all vehicles, incl. min 85% recycle rate for material by 2017
3. EU and UNECE: emphasized mainly on ELV (End of Life Vehicles and recyclability, recovery, reuse. Still further inputs are expected.
4. India: Inputs are expected.
5. OKO Trend Institute: Recycling contributes by 9% in overall rating. Criteria are usage of recycled materials in new cars, usage of renewable raw material in new cars.
6. Life cycle Assessment: It is a concept and methodology to evaluate the environmental effect of a product or activity, by analyzing the whole life cycle of the particular product, process or activity. Mercedes and VW used LCA to compare their latest models with their predecessors. These are based on ISO 14020, 14021, 14040 and 14062 and examined areas are:
  - Vehicle Production
  - Fuel properties
  - Operation (covered distance: 150 000 km in NEDC)
  - Recycling

Opel, VW, BMW, Mercedes are the manufacturers that are continuously working on the recycling and concept known as Design for Environment.
7. Volvo Car's LCA in Recycling:
 

Use of recycled material is one important method of reducing the consumption of finite elemental resources. It is estimated that in best case 30kg recycled non-metallic material could be used in a new car. Volvo is using 10kg of recycled non-metallic material in the new car.

**Suggested Approach:**

The rating therefore should be based on some parameters. Recycling holds a good importance in Green Engineering and should have 20% weightage in Green rating of the vehicle.

Rating Parameters	Weightages Assigned
Provision of recycling strategy during vehicle design	2 %
Use of Environmentally friendly material	2 %
Development of product's recycling/reuse/scrapping manual and coding of recyclable parts in vehicle	1 %
Extent of Recyclability of vehicle	15 %

At very first of the vehicle design, the recycling strategy at the end of life should be developed in order to ensure the complete disposal of the scrap without leaving any burden on the environment. Environmentally sound scrapping only happens to the material, which can be recycled. The non-recyclable material in the automobile remains in the atmosphere. Therefore, the strategy for recycling should be developed in advance.

The primary responsibility of the manufacturer is to provide the scrapping, reuse or recycling manual of the product so as to facilitate the scrapping process at the end of the product's life. It is necessary for the environmentally sound product disposal.

The uses of materials that cause less environmental damage are a popular measure when performing design for Environment. Since most of the products today are cost optimized, a change in the materials composition of a product potentially increases the cost of that product.

The Recyclability level is the percentage of the total weight of the vehicle, which can be recycled easily, economically and in environmentally sound manner. Higher the recyclability levels of the vehicle, better it is and higher marks are awarded to it.

Sr. No.	Recyclability level in % [(Weight that can be recycled *100)/total weight of vehicle]	Score awarded to vehicle in %
1	Less than 60	0
2	From 60 up to 74	4
3	From 75 up to 84	8
4	From 85 up to 95	12
5	Above 95 %	15

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