Design for Environmental Impact Reduction

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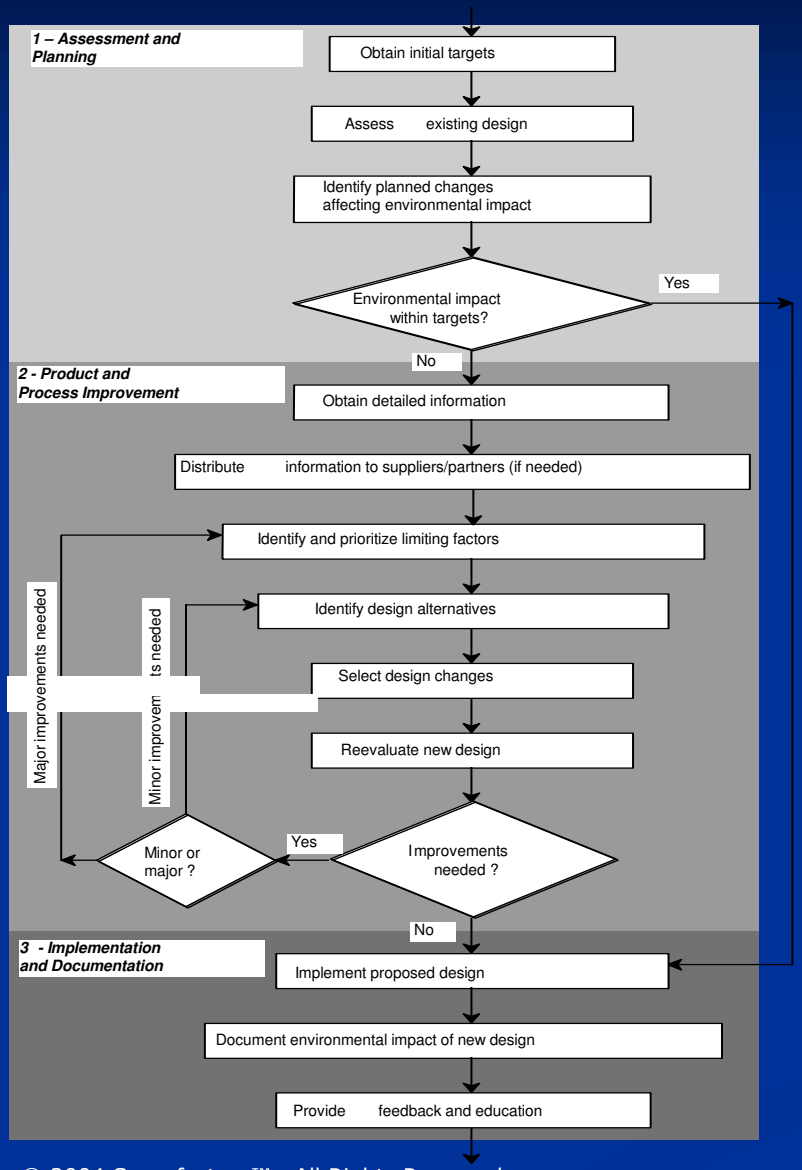
Outline

- Assessment and Planning
- DFE Product and Process Improvement Guidelines
- Design Strategies
- Trade Offs

A Generic Design Approach for Reducing Environmental Impact



Basic phases are:

- Assessment of current design/state
- Improvement/redesign (if needed)
- Implementation and documentation of new design/state

Assessment and Planning

Issues

- *What needs to be assessed?*
  - Whole life-cycle or a specific aspect (e.g., recyclability)?
- *How are we going to assess it?*
  - Is a method available?
- *How accurate do we need to be?*
  - Relative versus absolute assessment?
  - Simple versus sophisticated tools?
- *How do we verify our results?*

Characteristics of Efficient and Effective Assessment Metrics

- An efficient and effective assessment metric (and associated models) should ideally have the following characteristics:
  - simple – it should be easy to use,
  - easily obtainable – at a reasonable cost,
  - precisely definable – it is clear as to how the metric can be evaluated,
  - objective – two or more qualified observers should arrive at the same value for a metric,
  - valid – the metric should measure (correctly) the property it is intended to measure,
  - robust – relatively insensitive to changes in the domain of application, and
  - enhancement of understanding and prediction – good metrics should facilitate the development of models that will assist us in predicting process and product parameters.

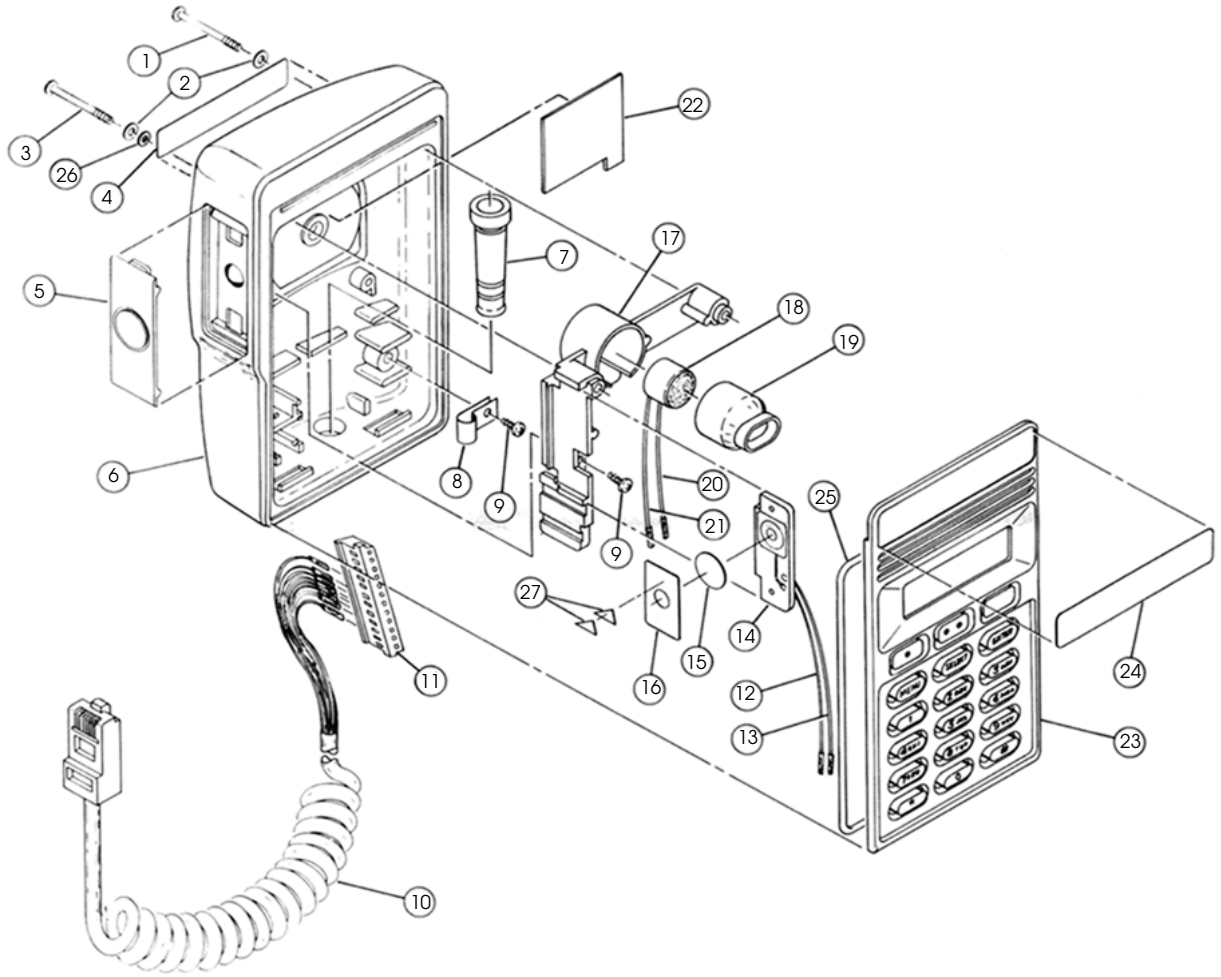
Life-Cycle Analysis/Assessment

- Life cycle analysis/assessment (LCA) is a method in which the energy and raw material consumption, different types of emissions and other important factors related to a specific product are being measured, analyzed and summoned over the products entire life cycle *from an environmental point of view*.
- LCAs started in the early 1970s and are the most comprehensive approach to assessing environmental impact.
- In principle, LCAs could be used:
  - in the design process to determine which of several designs may leave a smaller "footprint on the environment", or
  - after the fact to identify environmentally preferred products in government procurement or eco-labeling programs.
- LCAs are extremely complex and time consuming.

Focused Assessments

- Assessments focused on a specific aspect of a life-cycle are often easier to do.
- Examples:
  - Recyclability and disassembly assessments (ranging from USCAR rating procedure to Activity-Based Cost models for product demanufacture)
  - Remanufacturability assessments (ranging from spreadsheet based assessments to plant simulations)
- Also, energy and material consumption and waste amounts are good indicators
  - Energy consumption during use.
  - Amount of waste during manufacture
- *However, it is important to know which life-cycle aspect is most critical and WHY!*

Product Example
Motorola Display/Keypad Microphone



ITEM NO.	DESCRIPTION
1	SCREW
2	WASHER (2 req'd)
3	SCREW
4	LABEL
5	LEVER, PTT (part of item 6)
6	ASSEMBLY, Housing (includes item 5)
7	STRAIN RELIEF
8	CLAMP
9	SCREW (2 req'd)
10	CORD, Coil
11	HOUSING, Header
12	WIRE, Receptacle
13	WIRE, Receptacle
14	PRINTED CIRCUIT BOARD, PTT
15	CONTACT, Snap
16	SEAL, Dome
17	FRAME
18	MICROPHONE
19	BOOT, Microphone
20	WIRE, Receptacle
21	WIRE, Receptacle
22	PAD
23	ASSEMBLY, Display Cover
24	LABEL, Nameplate
25	O-RING
26	WASHER, Insulator
27	INSULATOR