Ecodesign Guideline.

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Presentation/Objective of the guideline

The aim of this guide is to introduce companies to the model of circular economy and one of its pillars, the ecodesign methodology. This methodology has the objective to reduce the environmental impact of products during their life cycle, and thus the waste generated at the several stages, both from manufacturing processes and the product it-self.

After introducing the concept and the different benefits, there will be presented the strategies of ecodesign with several demostrative examples, to inspire companies to apply the strategies by themself.

Then, the environmental assessment tools are needed to verify the environmental improvement, explaining several cualitative tools and connecting with other guides where the two of the most useful quantitative ones have been explained.

The final points of the guide concern to the management perspective. There is a step-by-step explanation how to manage an ecodesign project in a company, and the requirements of ISO 14006:2020 to systematize the ecodesign process at the companies.

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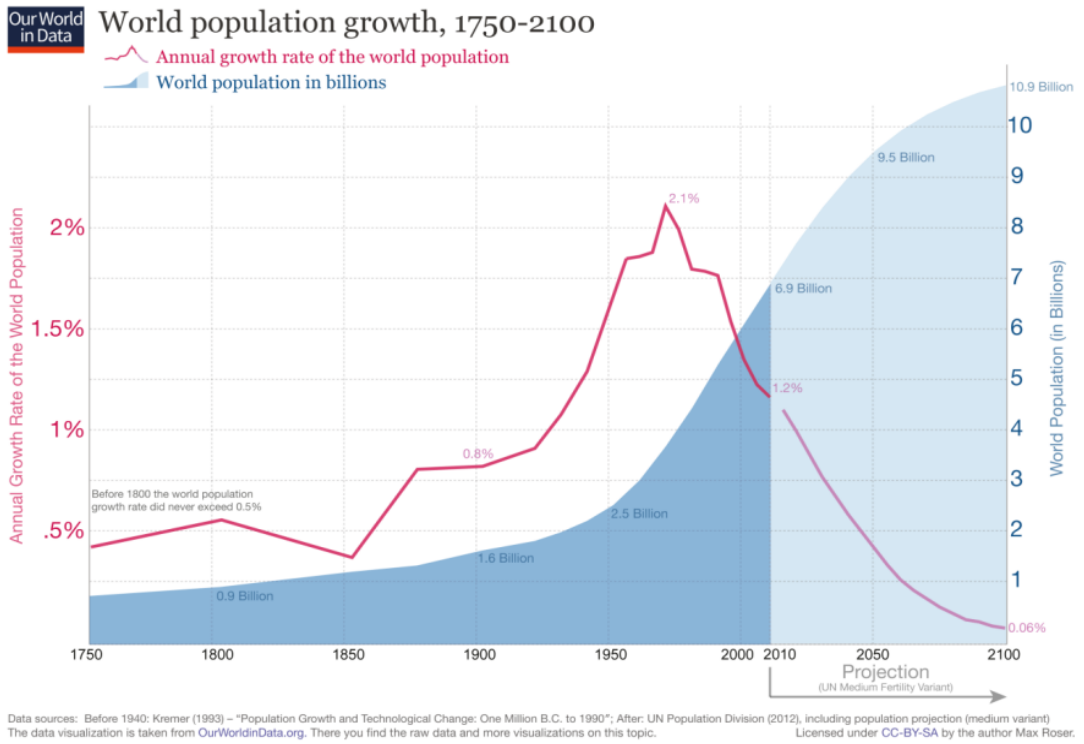
1. What is Ecodesign

1.1 Context: The Circular Economy Model

Currently, we are living into a “consuming” society, and the earth population is growing and growing...
All products and services have an environmental impact. The effects of these impacts are difficult to estimate, even though their consequences are evident: resource depletion, land pollution, atmospheric contamination, water pollution, wastes generation.

The population explosion and the trend of economic growth and the pursuit of prosperity have a significant influence on the production and consumption of products. The result is an unsustainable situation.



Source: https://ourworldindata.org/world-population-growth/

The challenge is to combine this growth of socio-economic well-being with respect for the environment in sustainable development.

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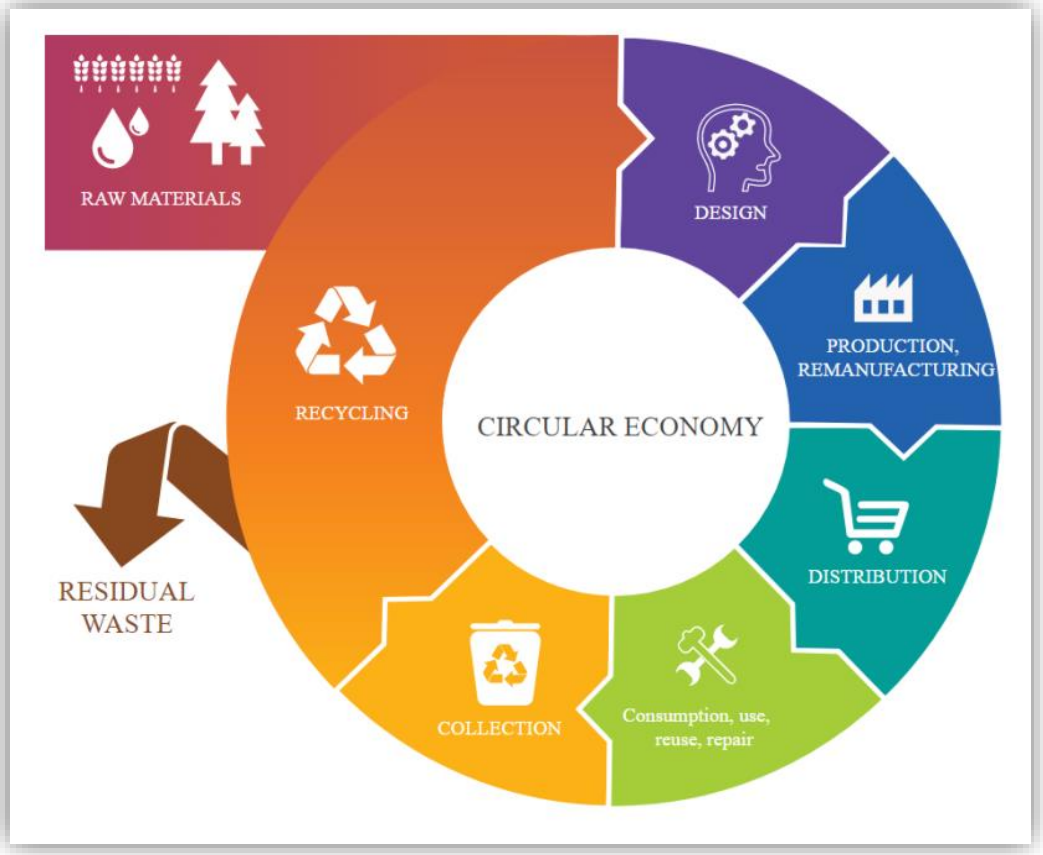
The circular economy is an economic concept interrelated with sustainability, the aim of which is to keep the value of products, materials and resources (water, energy, etc.) in the economy for as long as possible and to minimize the generation of waste.

It is about implementing a new economy based on the principle of "closing the life cycle" of products, services, waste, materials, water and energy.

Designing products applying ecodesign and design thinking methodologies will support the transition from the linear to the circular econommy.



1.2. ECODESIGN DEFINITION AND COMPLEMENTATION WITH DESIGN THINKING.

Ecodesign consists of consideration of environmental criteria during the design and development of products and services, at the same level as other criteria related to quality, legislation, costs, functionality, durability, ergonomics, aesthetics, health and safety, security.

"Design thinking is a human-centered approach to innovation that draws from the designer's toolkit **to integrate the needs of people, the possibilities of technology, and the requirements for business success."**

Tim Brown
CEO OF IDEO

Products with optimised functionality with lower environmental impact along its life cycle.

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1.3 EcoDesign General Benefits to Companies

Ecodesign can not only be benefitial for users and society in general, but also companies that put it into practice, because it responds to the common interest of obtaining more efficient products, both economically and environmentally. The ecodesigned products are innovative, have a better environmental performance and a quality at least as good as its equivalent in the market.

These are the potential benefits to the companies:

- Facilitate the environmental legislation accomplishment
- Improve the product and the company brand,
- Access to new markets (green procurement).
- Is an important innovation and knowledge factor.
- Increase the product quality.
- Improve the product life cycle
- Improve the communication during all the value chain (Design team, providers and clients).
- Potential in cost reduction.
- Resource and energy consumption improvement.
- It aims meeting the customer needs, and improving product functionality.

1.4 ECODESIGN´s RELATED CONCEPTS

ECODESIGN STRATEGIES	A guide to help designers to classify ideas of environmental improvement.
ENVIRONMENTAL ASSESSMENT TOOLS	Different options and methodologies to help designers to check the ecodesign implementation in a product design or even to quantify the potential environmental impact reduction. To prevent negative effects trespasing from one product life cycle stage to another.
ISO 14006	Environemntal management system requirements to systematize the ecodesign process.
ECOLABELLING	Voluntary environmental communication tools. When available, type I ecolabels are also useful to identify environmental aspects.

1.5 ENVIRONMENTAL COMMUNICATION (ECOLLABELLING).

The overall objective of ecolabels is to encourage the demand and supply of those products with less negative impact on the environment in the life cycle by communicating verifiable, accurate and non-misleading information regarding the environmental aspects of them.

Eco-labeling informs to consumers to choose products and services with the least impact on the environment, so manufacturers are been encouraged to produce these types of products and services.

Eco-labels are voluntary communication tools.

There are regulated eco-labels, issued by an official body, following a standardized verification procedure (type I and some type III). There are also environmental self-declarations that manufacturers make of their own products, without following any certification procedures. However, even them are recommended to be certified or validated by an independent third party to give them greater reliability, although it is not necessary to use any pre-established program.

3.2.2.- Ecolabel. Types according to ISO standards.

The standardization of eco-labels is given by a series of standards made by the International Standarization Organization (ISO), which classifies and regulates the various types of labeling. Specifically, the following standards allow to classify ecolabels in **Type I, Type II and Type III:**

- ISO 14020. "Ecological labels and environmental declarations. General principles".
- ISO 14024. "Eco-labels and environmental declarations. Type I eco-labeling. General principles and procedures ".
- ISO 14021. "Eco-labels and environmental declarations. Environmental self-declarations (Type II eco-labeling) ".
- ISO 14025. Environmental labels and declarations. Type III environmental declarations. Principles and procedures.

Anyway, there are other ecolabels that does not fit exactly with this classification.

Ecolabels. Type I

The Type I eco-labeling schemes identify products which meet the specific meets a series of environmental criteria and suitability to use, established based on analysis results of life cycles and public knowledge, to be considered as environmentally preferable for the environment with respect to another of its same category (that performs the same function).

These are multi-criteria and voluntary programs developed by a third party, which grants that all ecological criteria and features of product functionality are met, both prior to the grant and during its validity period.

There are numerous Type I labeling programs such as:

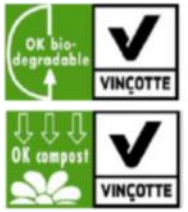
- European Eco-label.
- The Blue Angel (Germany)
- The White Swan (Nordic Countries)

Other certified Eco-labels.

These programs are based on a series of public criteria. The products, which are addressed to must obey them, are certified by a third party, as well as eco-labeling systems type I.

The difference is these types of labels do not take the complete life cycle of a product into account/consideration, but cover certain aspects of some of the life cycle phases.
In a very general way, we can highlight the following categories covered by these systems:

- Ecological agriculture.
- Energy efficiency.
- Sustainable Forest Management.
- Sustainable construction.
- Textile products.
- Biodegradable / compostable materials.
- Indoor air quality.



Self-declarations. Ecolabels Type II.

Environmental self-declarations are of the manufacturer's own declaration, with which the company communicates the environmental characteristics of its products to the market and usually expresses a single environmental improvement.

They can be presented in the form of statements, symbols or graphics on the labels or packaging of products or in the documentation thereof, technical guides or advertising in any type of support.

In order to increase the value of self-declarations and to combat misleading advertising in relation to the advertising of organic products, ISO 14021 standard determines the requirements to be met by them.

The declarant is responsible for ensuring the accuracy of the declaration using reliable and reproducible methods. In any case, the declarant must keep the necessary documentation for the verification of the self-declaration and provide it to any person who requests it.

Environmental Product Declarations. Eco-labels type III.

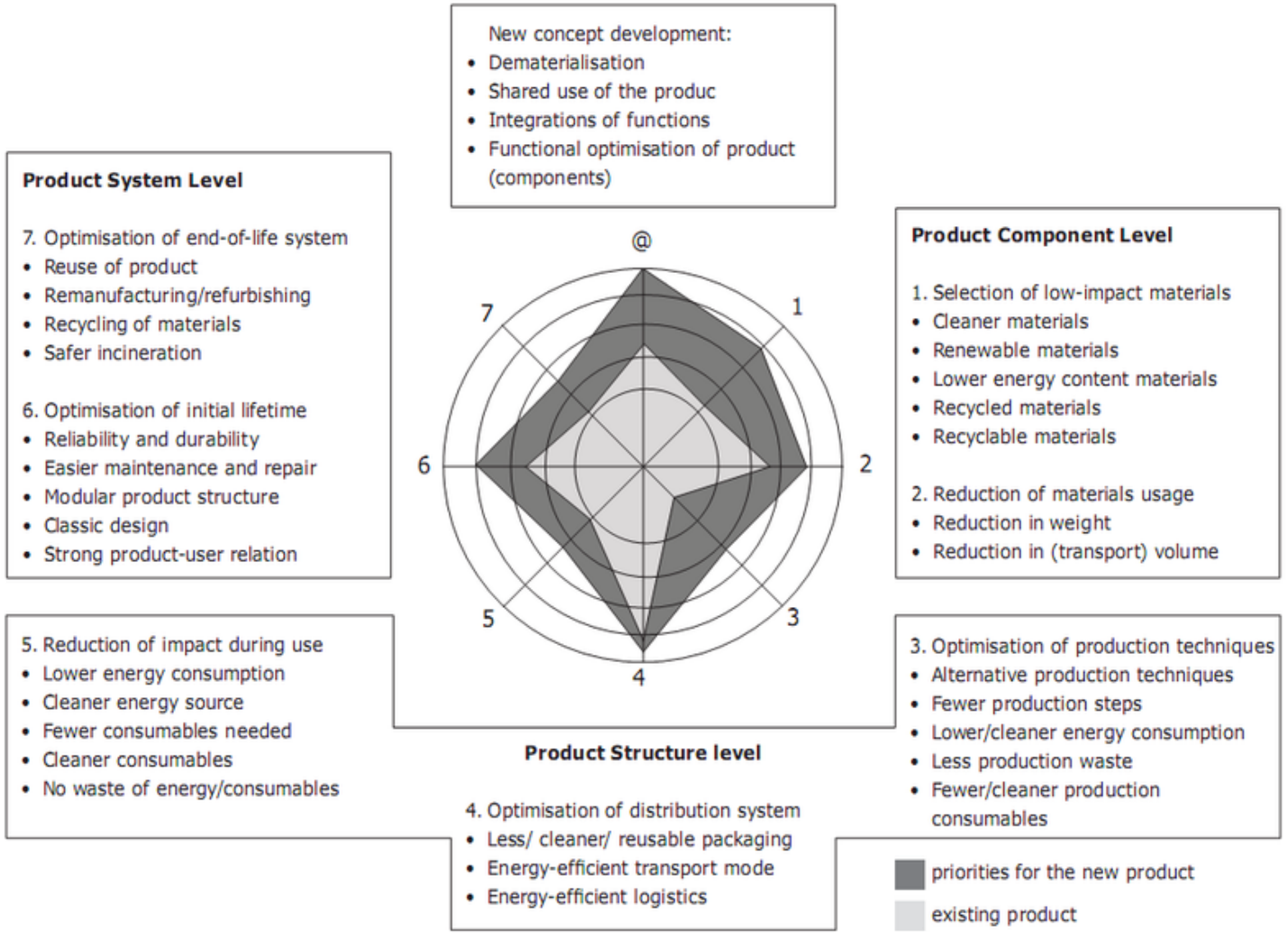
They are, according to ISO 14025, environmental declarations that provide quantified environmental data using predetermined parameters and, where appropriate, additional environmental information.

Type III environmental declarations present quantified environmental information on the life cycle of products to enable comparison between products performing the same function, based on independent verification of Life Cycle Analysis (LCA) data, the life cycle inventory data (ICV) or the information modules. Intended for communication between companies, but not limited to use, and can be used for communication to the market or end user.

Type III ecolabel programs must be managed by an administrator.
The organization that makes use of one of these eco-labels, must make an environmental statement that ensures the independent verification, internal or external, of the data. This may require verification, understood as confirmation by objective evidence of compliance with the requirements, by a third party.

2. Ecodesign Strategies

The Ecodesign strategy wheel (also called Lifecycle Design Strategies) visualizes the strategies that can be followed for Ecodesign, and can be used to select and communicate the ecodesign strategies, classified into eight groups, according the life cycle stages of a product/service:



http://wikid.eu/index.php/EcoDesign_strategy_wheel
Optimization of end-of-life system. The EcoDesign strategy wheel (Brezet y Van Hemel 97)

2.1 NEW CONCEPT DEVELOPMENT.

- Dematerialization.
- Product sharing.
- Integration of functions.
- Functional optimization of the product (components).

2.2.1 General strategies

a) Non-hazardous materials:

For example

- Painting and coatings with less Volatile Organic Compounds (VOC).
- Adhesives for wooden boards fabrication, which contains formaldehyde.
- Avoiding metal covering, specially chromate due to the Cr VI high toxicity. Nickel-tungsten has comparable characteristics to those of hard chrome including corrosion resistance, wear and hardness, even at high temperatures. It is also non-toxic, making it a truly viable alternative. Powder paint could be also an alternative, or polished aluminium.

CARB 2 COMPLIANT

b) Non-exhaustible materials:

Selection of renewable material: Wood (preferable certified from sustainable forest management), bamboo, agricultural materials…). Vegetal material stores CO_2 thought photosynthesis, reducing the climate change. Besides Chain of Custody systems ensure the traceability of the sustainable origin of forestry materials

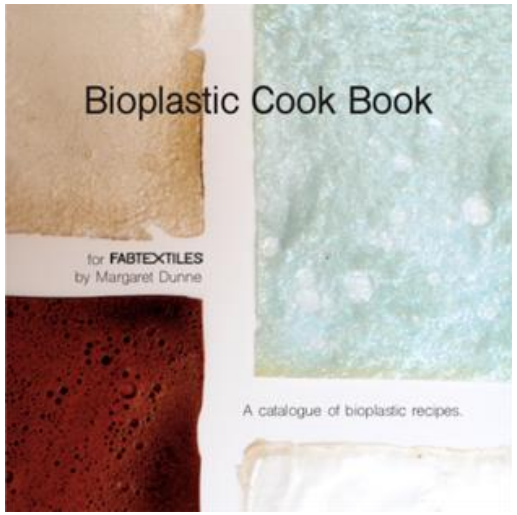
By combining biodegradable-based plastics with natural elements, we can obtain innovative natural materials (algae and plant fibers).

Some of the parts obtained from agricultural waste by 3D printing in the framework of the BIOPLAST project

Simple biomaterials, from elements of nature or organic waste

FABTEXTILES

Bag made from coffee waste



FabLab Bio of the Universidad Católica de Chile where research is being carried out on new materials with fungal components (fungi). Their advances and discoveries are exposed in the appearances of the Museum of the Mushroom of Santiago

c) Low energy content materials:
For example recycled aluminium consumes
17% less energy than virgin aluminium in the production process

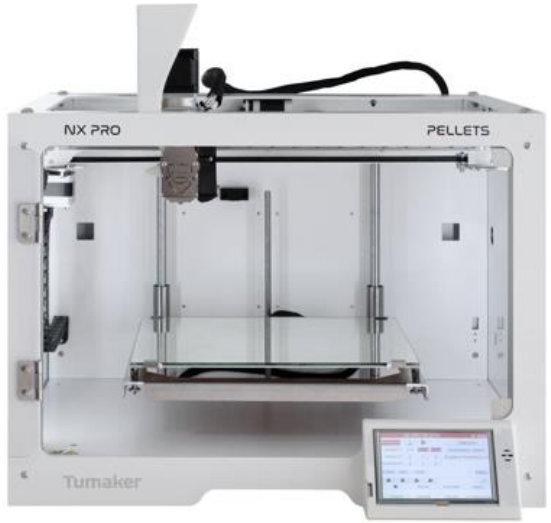
Recycled aluminium chairs from EMECO, (80% recycled distributed as 40% from industrial waste and 40% post-consume).

d) Recycled materials:
They come from a previous use, and can be pre-consume or post-consume

Components for chairs. Syntrewood from Lasentiu (100% post-consume recucled material and 100% reciclable)

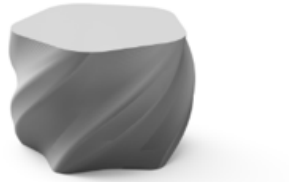
e) Recyclable materials:
They can be re-processed to be use as raw materials in another product.

3D printing with recycled materials



The NX PRO Pellets printer has an extrusion system that allows direct printing with recycled pellets

3R3D Technology Materials (in the Basque Country) or Reclus (Elda, Alicante) are among the first Spanish SMEs to enter the additive manufacturing market with a product obtained 100% from recycled materials



Lowpoly, case on demand: elimination of stock and storage

Cork planter

Precio: 99€

Material: Corcho reciclado
Peso: 1.2Kg
Medidas: 30x30x30cm
Tiempo de impresión: 1h 15m
Diseñado por un algoritmo en Python

Solicita presupuesto

MB vase

Precio: 130€

Material: PLA+PET reciclado
Peso: 1.8Kg
Medidas: 20x20x100cm
Tiempo de impresión: 4h 15m
Diseñado en Berlín

Solicita presupuesto

Fabrique Publique

Fabrique Publique, ligthing products made of 3D printing recycled ceramic

These urban furniture were made with the plastic waste of the inhabitants of the city of Amsterdam (the first proposal has been made in Thessaloniki (Greece), within the framework of the project supported by Coca-Cola Zero Waste Future, which has given rise to Zero Waste Lab. This waste was recycled and transformed into 3D printing filament.

https://www.youtube.com/watch?v=FFoSvp9brUg

The 3D Impact project (2016) arises from the desire to take advantage of the expansion of 3D printing and the rise of DIY (Do It Yourself), to turn it into new social and environmental opportunities. The activity of the company is developed with the installation of a filament factory for 3D printers, starting from the recycling and reuse of plastic recovered from urban waste.

2.2.2 Design and manufacturing products from cutt-off sheet

When a product is made there often are small pieces of left-over material that cannot be used for the main product, but do indeed still have value if they can be used for other products.

This part of the guide aims to provide ideas and guidance on how to design new products that can be made from small pieces left over from the manufacturing of the main product. It is specially focused on sheet materials that can be processed on a laser cutter or a CNC-router. These are machines that will be available in your local makerspace or fabLab.

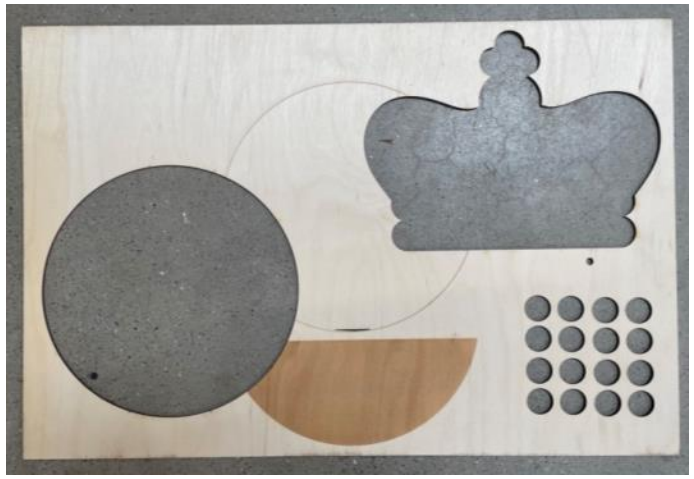
1. Sourcing your material

A popular saying goes like this “One man’s trash, another man’s treasure”. Keep this in mind when brainstorming about where you can find scrap materials for your project. Here are some of the sources that I have had success with.

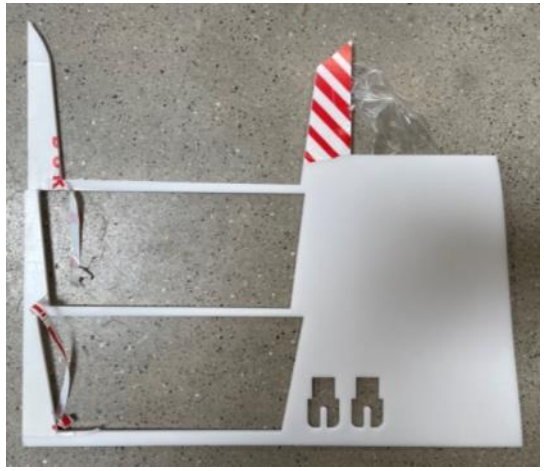
Source	Materials
Framing shops	When creating a “pas partout” the framing shop only needs the frame part and they discard the center part. So here you can find acid free cartons in sizes up to approx. A3 from 1 to 3mm thickness.
Cabinet Makers	Here you can often find nice pieces of different types of hard wood: Oak, Smoked Oak, (Bøg) etc.
Your local makerspace	Since you are here anyway to work on your projects have a look in the trash bin, or recycling area, for leftovers materials.
Your own neighborhood	If you live in an apartment block, there will often be a recycling station where your neighbors leave unwanted items. Sometimes there is even a “upcycling station” where people can leave good items for others to take. Here you can find materials in the raw form or as furniture you can disassemble to use the materials.

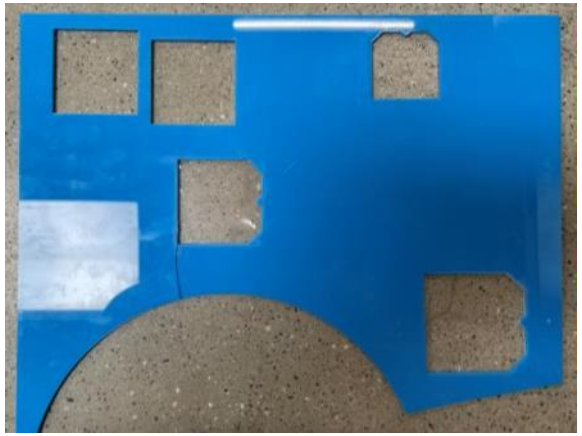
2. Types of materials

WOOD



ACRYLLIC (PMMA)





3. Where to find them

Next to the machines in the wood workshop you will normally find small containers for cut-offs from the saws.

Some makerspaces have a section for organizing left over scraps that members can take for free.

4. Resources for finding projects and design ideas

When choosing your design think about if it can be used in different materials or maybe even if diferent thicknesses.

Another approach is to think about how one material is suitable for many designs in the same category. Example: Pendances for ear rings or necklace.

Source	Materials
Thingiverse.com	Good site for 3D-print projects, but they also have projects for a laser cutter or a CNC-router. Use the search function to find projects using search woods ”laser” or “CNC”.
Instructables.com	This site has projects in every imaginable category. Using the search function you can find projects for laser cutters, routers.
Pinterest	Here you can not find projects with instructions and design files, like on Thingiverse or Instructables, but Pinterest has by far the biggest collection of design ideas that you can use for inspiration.

Lasercut Puzzles
By koenprincen
in WorkshopLaser Cutting

Laser Cut Wooden Chevron Earrings
By noahw
in CraftJewelry

Design Your Own Molecule Key Holder
By Centas
in WorkshopLaser Cutting

Bee Puzzle
by sahrchitect

Elephant Phone & Pen Holder
by West3DP

Fruit Bowl "Sphere" cnc/laser
by ZenziWerken

5. Resources for graphics

Source	Materials
Freepik.com	(FREE) Comprehensive database of free vector graphics and stock photos.
Shutterstock.com	(PAID) One of the biggest sites in the world for vector graphics and stock photos.
Thenounproject.com	(FREE) This site contains mainly icons to use for websites, but this type of graphic is very useful for cutting and engraving new designs with a laser cutter.

IMPORTANT!
While the above sites offer free graphic resources make sure to read the license for each item you download. Some items are only free for personal use and often you will have to credit the creator if you make your works public. If you want to use graphics for commercial purpose be sure to check that the license allows for this.

2.3 REDUCTION OF MATERIALS USAGE.

a) Reduction in weight:

Chair Aeron by Herman Miller. Avoiding foams. Besides recycled content is 62% (plastic and aluminium structure), metallic parts are powder painted and it is recyclable at 94%.

Lighter plywood

Piling product: NOA chair chair from Mobiliario la Florida SL

b) Reduction of (transportation) volume:

It means higher transport efficiency and less packaging

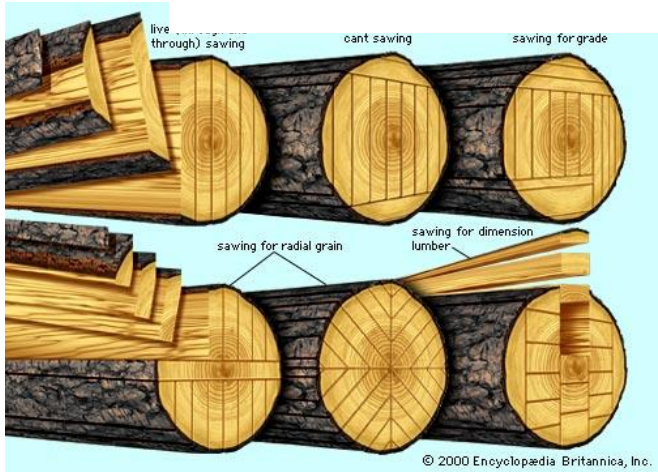
Flexilove sitting.

2.4 REDUCTION OF ENVIRONMENTAL IMPACT DURING MANUFACTURING PROCESS.

a) Alternative production techniques:
For example using more efficient coating application systems, or cutting optimisation software tools

b) Fewer production processes:
Special design saves production processes and minimize material consume

c) Low/clean energy consumption:
Optimization of the energy consumption or using renewable energy sources.



d) Low generation of waste:
Cutting optimization software, internal recycling

e) Few/clean production consumables:
Use fewer and less hazardous consumables during production

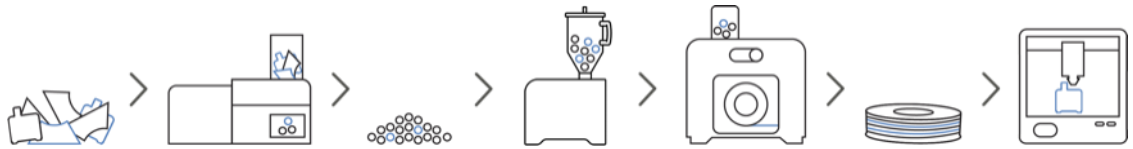
Go to Green Production Guide

Design optimising the raw material use

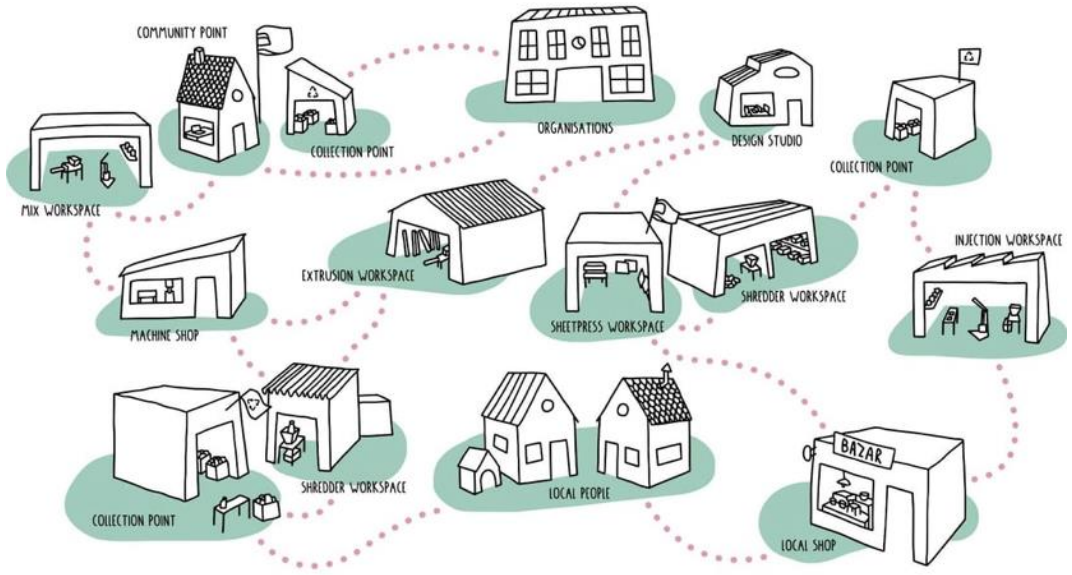
Design to optimise the board use at Chair from the company Studio Lo.

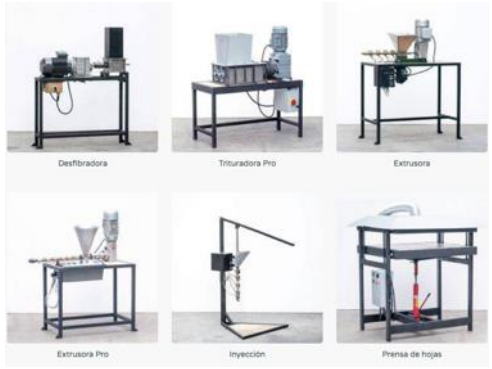
Opendesk, a distributed open design case, develops designs optimizing plywood to the maximum and trying to eliminate fittings and glues

New production management and alternative technologies: Additive manufacturing



Precious Plastic, a production network distributed in recycled plastic with open machine designs.





3devo

3Devo: Combining the capabilities of an industrial grade crusher and granulate

Go to Additive Mannufacturing Guide

2.5 DISTRIBUTION SYSTEMS OPTIMIZATION.

a) Less/clean packaging:

Reduce the use of packaging material or use less harmful materials

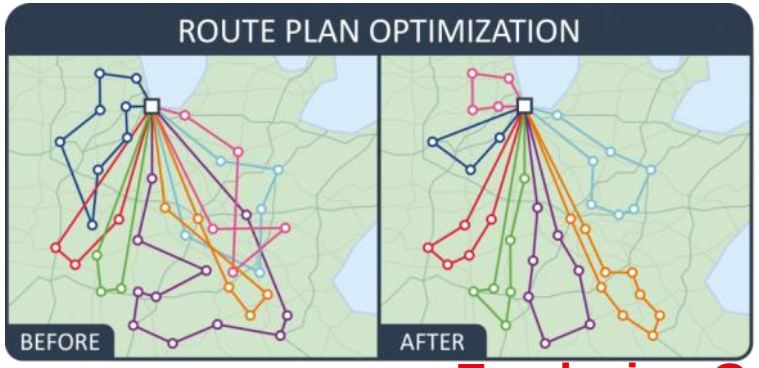
b) Efficient transport mode:

Choose the most efficient mode of transportation for the product

From best to worst: ship, train, truck and plane

c) Efficient logistics:

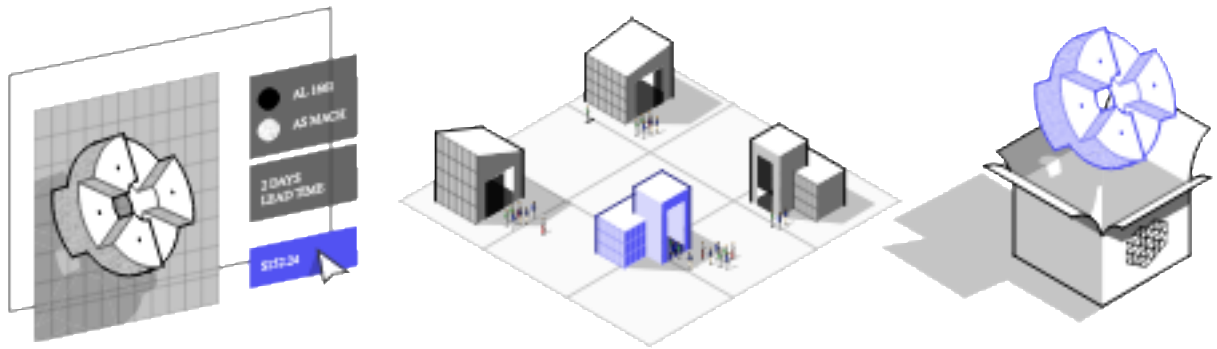
Improve our logistics, for example creating the optimal transport route



d) Distributed manufacturing systems

Distributed manufacturing systems (marketplace type such as Hubs) solve logistics times, quickly finding the producer located near the customer. In addition, the entire process allows it to be connected through the internet, avoiding travel as much as possible, and reducing emissions.

Its speed in quoting any production process during product development also allows considering reducing materials, selecting the most appropriate material and the most optimal and environmentally friendly process.



3D HUBS

2.6 REDUCTION OF IMPACT DURING USE

a) Low energy consumption:
Minimise the product's energy consumption

b) Clean energy source:
Rely as much as possible on the use of cleaner energy sources

c) Few consumables needed during use:
Minimise the use of consumables

d) Clean consumables during use:
If possible to use less harmful consumables

2.7 OPTIMIZATION OF PRODUCT LIFE

a) Reliability and durability:

Improve the overall reliability of the product

b) Easy maintenance and repair:

No need of chemical products for clean and easy assembly systems.
Modular product structure
Facilitate access to the joints and use reversible joining systems.
Use standard components to repair/update the product

c) Timeless design, emotional relationship user-product or customised products

Improve the fashionable lifetime of the product

Use of 3D printing to enlarge the use phase of the product by easy replacement of joint elements or damaged parts, or to customise the producto to the user (ergonomics).

IKEA. The goal is for the client to simply scan their body and receive the chair within two weeks.

Scandinavian design, modified by designer Jon Christie, replacing the gaskets with 3D printed feet

Evolutive products at furniture industry are most related to children

Chair Eva

Craddle Conver Dream of Micuna

Chair SITTI™, of Stokke

2.7 REDUCTION OF THE ENVIRONMENTAL IMPACT AT THE END OF THE LIFE OF THE PRODUCT.

a) Reuse of product:
If possible give the product a second life.

b) Remanufacturing/refurbishing
If possible facilitate the recovery of valuable and no damaged components to be reused in new products. Standardize as much as possible these elements.

c) Recycling of materials:
Inform the consumer about how to manage the product at its end of life in order to recycle the materials.

d) Clean incineration:
Take into account if the materials can be used as alternative fuels and if its incineration creates low or no hazardous emissions and wastes

Think Chair by Steelcase

Potential recyclability: 99%

3. Environmental Assessment Tools.

3.1 NEED OF ASSESSMENT AT ECODESIGN.

- To check the ecodesign implementation in a product design or even to quantify the potential environmental impact reduction.

- To prevent negative effects trespasing from one product life cycle stage to another.

3.2 OVERVIEW OF DIFFERENT TOOLS.

The proposed tools increase the complexity of both management and data acquisition, as the project progresses. This is because in the early stages the goal is oriented to the generation of ideas. Subsequently the possible specific actions are selected until reaching the design of the prototype, and quantitative data can be calculated / estimated to obtain more detailed product environmental evaluations.

+ Quantitative

Environmental assessment tools	Kind of environmental analysis			
	Preliminary analysis	Guidance analysis	Detailed evaluation	Communication
Checklist	X			X
Assessment of the environmental strategy: Ecodesign Strategy Wheel		X	X	X
Life cycle assessment LCA	X	X	X	X

However, the choice of tools at each stage depends on the availability of resources (economic, data, time and qualified staff) that the company wishes to invest in the project.

Following points will explain:

- Ecodesign checklist and
- Ecodesign Strategy Wheel

While two useful quantitative tools Material flow analysis (MFA) and Life Cycle Assessment (LCA) have their own guides.

Go to MFA and LCA guides

3.3. ECODESIGN CHECK-LIST

The tool aims a first overview to verify at the prototyping step if there are considered the ecodesign strategies, and a first check of the planned prototype.

STEPS:

1. Identify an existing reference product to be compared with the prototype under development.

2. Try to identify and quantify in a table:
   2.1 Function.
   2.2 Materials and components.

3. Do the same with the new product (prototype under development).

Ecodesign checklist

4. According to the related questions we propose, try to collect information and answer them comparing with the reference product, including the valoration according if the specific aspect has been improved or worsened. Try to explain/justify your valoration.

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
1. Product function optimisation:					
Before answer, please consider if the following aspects have been included in the new design: - The real needs/expectations of the customers have been considered and the superfluous functions have been eliminated. - The product integrates functions that avoid additional needed products. Which % of the weight of the product can be allocated to these additional functions? - Is planned/designed a service offered together with the product oriented to increase the user satisfaction during the use phase? For example: ergonomic advise, interactive instructions…	Justification of the valoration:				
	Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
2.1 Selection of materials of less environmental impact: origin					
When selecting the raw materials for your product, you have consider that they are: − Recovered or recycled − From renewable sources − With low embodied energy content − With certification of their lower impact: ecolabel tipe I (according ISO 14024) chain of custody (FSC/PEFC…). Try to include the % of these materials in the composition of the product.	Justification of the valoration: Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
2.2 Selection of materials of less environmental impact: reduction of harmful substances					
When selecting the raw materials for your product, you have consider that they are: − Not classified as harmful substance (risk sentence). − They fullfil any regulation related to harmful substances: RHOS Directive, indoor air quality regulations/volatile compounds emission, etc. − They does not contain or has a limited content of harmful substances: heavy metals, halogenated compounds, ftalates, preservatives, etc.	Justification of the valoration: Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
3. Reduction of the quantity of materials consumed: ligthweigth products					
When designing your product, you have consider to reduce the consume of raw materials by: − Weight reduction due to the use of low density materials (maintaining resistance characteristics): bonded boards, mesh seats or backs, light alloys, internal structures, etc. − Reduction in weight (for example in thicknesses) by optimizing the technical characteristics according to the level of demand in use. − Design of hollow pieces, with reinforcing ribs, hollow pieces… − Reduction in weight thanks to a reduction in volume. − Elimination of superfluous components. − Considering alternative production technologies (for example additive manufacturing requirements should be considered when designing the geometry/finishing of the components).	Justification of the valoration:				
	Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
4. Selection of providers					
When selecting the raw materials providers for your product, you have consider that they follow one or several of the following requirements: − The fulfilment of legal requirements regarding your materials (for example EUTR for wood). − Certified management system: environmental, quality, energy efficiency, ecodesign. − Social responsability practices (sustainability report, etc) − They provide environmental information of the materials/components provided, or they are ecolabelled. − Optimisation of the supply transport (local provider, low pollutant vehicles, optimisation of the load capacity…) − Collection of raw materials packaging.	Justification of the valoration: Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
5. Production efficiency					
When selecting the raw materials for your product and the design of your product and components, have you consider to increase the production efficiency? − They contribute to increase the health and safety at the production stage. − They optimise the use efficiency of raw and ancillary materials and water. − They contribute to reduce the energy demand of the production stage. − They contribute to reduce the dangerousness and quantity of waste, wastewater or atmospheric emissions generated. − Use of alternative and more efficient technologies.	Justification of the valoration: Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
6.1 Distribution efficiency: packaging design					
When designing the distribution and the packaging of the product, have you consider the following items? − Reduction of the volume of the product (compact design, disassembled, stackable) − Reduction of the weight of packaging materials (without jeopardize the product protection). − Use of renewable materials − Use of recycled materials − Optimization of the degree of separability of the packaging − Use of recyclable, biodegradable or compostable materials − Reusable packaging (SDDR). This would comprise the reverse logistic system)	Justification of the valoration: Proposal of modifications/design requirements:				
6.2 Distribution efficiency: logistics optimization					
When designing the distribution of the product, have you consider the following items? − Optimization of logistics (routes, shipping management) − Load unit optimization − Reduction of the pollutant load of vehicles (use of biofuels, CO_2 emissions / km) − Reverse logistics practices					

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
7. Lifespan extension:					
- The design is conceived to be inherently durable and safe? - Do you plan to offer a free extended warranty period (>3 years)? - The structure of the product is simply and minimises and facilitates the need of maintenance/update/repair - The product is designed for the easy dissasembly/reassembly (specify by who user/professional)? - You provide detailed and easy to understand instructions and addional communication chanels manufacturer-user to make the propper use and maintenance of the product. - There are ensured spare parts (at least for 10 years) - Have you consider at the conception of the product to be combined with the offer of services aimed to increase the lifespan of the product? For example: maintenance or repair service.	Justification of the valoration: Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
8. Reduction of the environmental impact during the use:					
- In the case the product consumes energy, this consume is reduced/avoided. - The quantity of needed consumables (materials or replacement components) are reduced.	Justification of the valoration:				
	Proposal of modifications/design requirements:				

Ecodesign strategy	Much better	Something better	Equal	Something worse	Much worse
9. End of life:					
Regarding the end of life of the product the following considerations are included: - Information to the user for dismantling and improving waste management - There are specific collection infrastructures of used product (or this is a service offered by the manufactured) for recycling and recovery. - There is planned the remanufacture / use of product components - The products is designed for the easy separation of materials - Reduce the number of different materials - Use of recyclable materials - Use of energy-valuable materials avoiding halogenated compounds or other harmful substances that prevent energy recovery processes.	Justification of the valoration: Proposal of modifications/design requirements:				

3.5. ECODESIGN STRATEGY WHEEL

Ecodesign Strategy Wheel is a versatile tool or methodology. There are many variants and can (or should) be customised to each type of product to more focused assessment.

It does not need any expensive and specific software, and it could be structured in difficulty levels or becoming from more qualitative aspects to include more quantitative ones depending on the design step.

It can be developed to provide useful indicators to communication (Type II ecolabelling: environmeltal self-declarations).

General steps:

1. If it is not made previously, **identify and classify the environmental aspects** of the product´s life cycle **by ecodesign wheel AXISs** (they could be redefined when needed but Brezet & Van Hemel is recommended). Consider ecodesign goals when defining.

2. To be more objective in the assessment of different products or design alternatives, identify (when necessary) the **parameters to measure** the degree of sucess in **each aspect**, **and the diferent levels of environmental preference**.

3. Decide the direction of the scale (usualy less poins=less impact) and establish an **scale from 1 to 10 points to each level of parameter preference**.

Sometimes a reference value will be necessary: for example a medium weigth of this kind of products to measure the % of mass reduction.

4. Stablish a **ponderation system** of the different parameters and aspects involved in each AXIS (relative importance), to be able to achieve a unique puntuation. **It must be coherent with the strategy and goals.**

5. **Once fixed the assessment rules, put them into practice.** This tool is specially useful to compare alternatives or in a redesigning process.

   5.1. Put all the aspects and parameters into a table (first columne or row) and fill following ones with the achieved points by each design alternative.

   5.2. Ponderate the parameters puntuation to obtain the AXIS values and draw an spider diagram with them (one serie to each product).

Conclussions of the assignment can get feedback to design (iterative process) until achieve expected goals.

EXAMPLE OF APPLICATION OF ECODESIGN STRATEGY WHEEL

After analising in a qualitative way inputs and oputputs the life cycle of the office table, the traditional wheel has been customised. In this case, the furniture manufacturing company decided to substitute “USE AXIS” by “TRANSPORT of RRMM AXIS”)

Model to be redesigned:
TRINEO 2

Ecodesigned model:
UNO 2

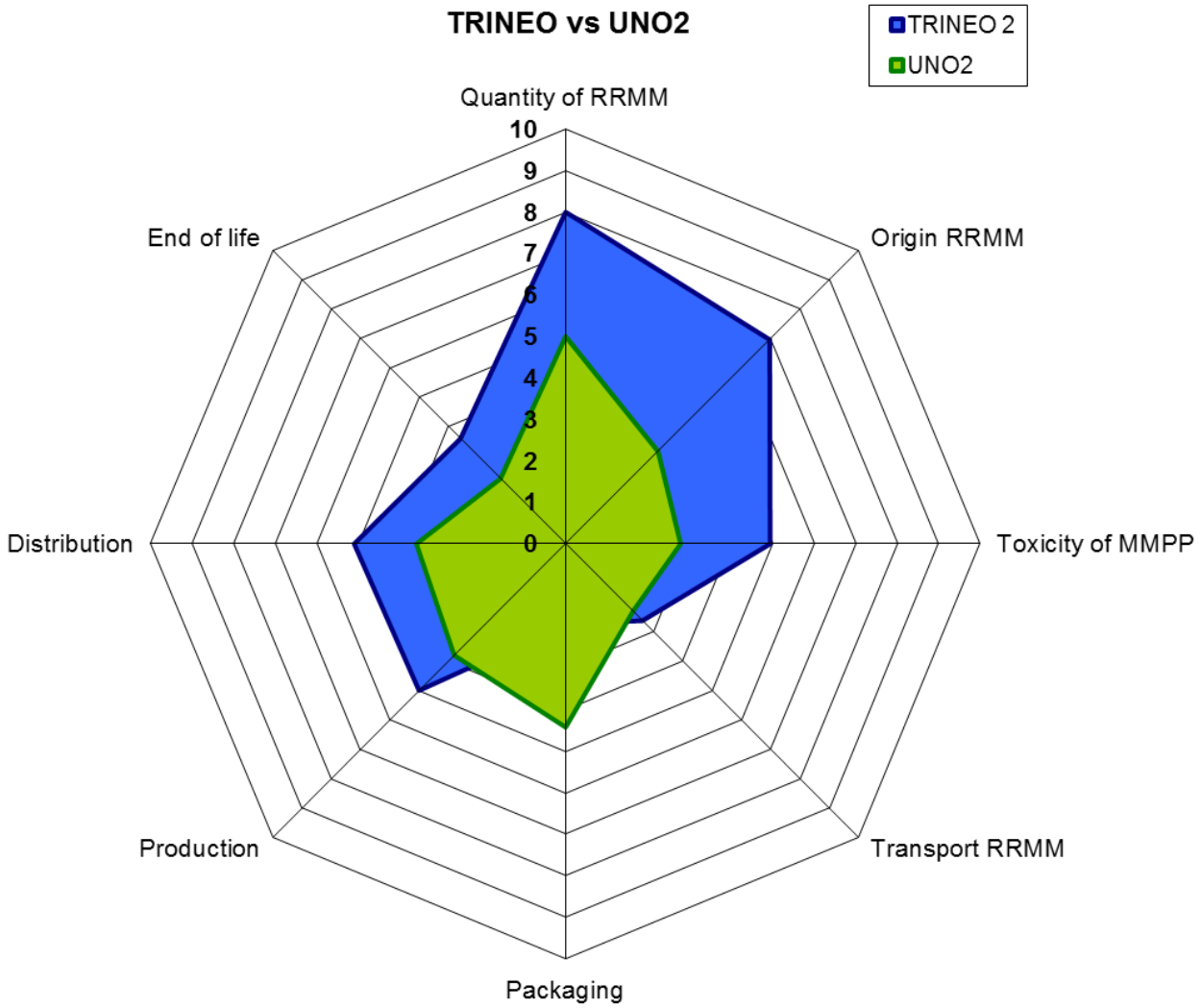
To stablish the assessment rules:

Raw materials	Parameter	Valoration (always from 1 to 10)
AXIS 1. ORIGIN	%x1 weigth x value related to the origin of the material	Recicled, sustainable forest management. Renovable Virgin non renovable
AXIS 2. TOXICITY OF RRMM	Classified substances as dangerous or content on specific substances	There could be stablish different ranges depending on the quantity and the degree of harmfulness of the substance
AXIS 3. TRANSPORT OF RRMM	Distance	There could be ponderate the distance by the % of the raw material at the product
	Type of vehicle	There could be assigned a value to each vehicle (depending on their contamination potential) and then ponderate it by the % of the raw material at the product
AXIS 4. REDUCTION OF RAW MATERIALS (QUANTITY)	% of reduction related to the total weigth of the reference product (o media of the representative family of products)	From 1 to 10, different reduction % can be assigned
AXIS 5. PACKAGING	Quantity of packaging material	From 1 to 10, different reduction % of the indicator (Kg packaging/Kg product) can be assigned
	Origin of the packaging materials	Ponderated media of origin values of materials (idem axis 1 applied to packaging)
	End of life of packaging materials	Once fixed a value to each expented end of life (recycling, energy valorisation, or landilling7incineration), it can be calculated the ponderated media of end of life values of materials

At the productive process relative indicators use to be based on annual production. They should be calculated and adjusted to the product funtional unit and compared with the related reference product.

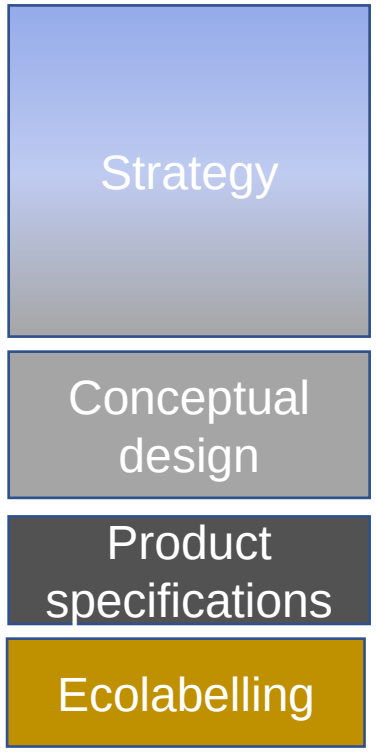
	Parameter	Valoration (always from 1 to 10)
AXIS 6. PRODUCTION PROCESS	Consume of energy / production unit	5 can be used when the parameter value is more or less the same regarding the reference product (+- %), and stablish upper values to increases and lower ones to reductions.
	Non Hazardous Waste (NHW)/ production unit	
	Hazardous Waste (NHW)/ production unit	
	Consume of auxiliary chemicals/production unit	
AXIS 7. DISTRIBUTION	Tons per km (tkm)	The estimated distance in km is multiplied by the weigth of the product in tonnes. Values from 1 to 10 are correlated proportionally with the most realistic tkm range. This parameter considers both, routes optimisation and mass reduction of the product.
	Type of vehicle	There could be assigned a value to each vehicle (depending on their contamination potential)
	Load efficiency (%) (real load/load capacity) x 100	Values from 1 to 10 are correlated proportionally with the most realistic load efficiency range.
AXIS 8. END OF LIFE OF PRODUCT	EnD of life of materials	Once fixed a value to each expented end of life (recycling, energy valorisation, or landilling7incineration), it can be calculated the ponderated media of end of life values of materials

Summary table	TRINEO 2	UNO2	Comments and stategy followed
Quantity of RRMM	8	**5**	Reference value Trineo 42,814 kg; UNO 34,41kg (reduction 20%)
Origin RRMM	6,96	**3,15**	Mainly due to the purchasing certified wood PEFC and increase of recicled material
Toxicity of MMPP	4,93	**2,77**	High reduction of PVC quantity
Transport RRMM	2,62	**2,30**	Same providers, so no significant change (only due to kg material reduction)
Packaging	1,93	**4,42**	kr/kp was yet very optimised and there is a significant increase. They keep basic materials but proportion of plastics is reduced and it achieves a reduction in origin indicator.
Production	5	**3,8**	The energy demand and HW generation are the same, but it is reduced the NHW (17%) by optimising the mechanising of boards
Distribution	5,1	**3,6**	No stategy applied. They are supposed equivalents
End of life	3,59	**2,22**	When reducing % of board and steel (both are recycled) increases % of non separable plastic pieces that are suppose go to landfill. It is compensed when multiplying by the kg of materials related to TRINEO table.


TRINEO vs UNO2
TRINEO 2
UNO2
Quantity of RRMM
10
9
8
7
6
5
4
3
2
1
0
Origin RRMM
Toxicity of MMPP
Transport RRMM
Packaging
Production
Distribution
End of life

4. Manage and Develop an Ecodesign Project.

HOW TO MANAGE AN ECODESIGN PROJECT.



1. Ecodesign project organization: team, motivating factors
2. Product Selection.
3. Set ecodesign strategies.
4. Generation and selection of ideas
5. Detailed design.
6. Communication and product launch.
7. Evaluation of project results.

Traditional process of product design and development	New elements introduced by ecodesign
1 2 Preparation of the new design / redesign: select product, determine motivating factors,... (ESTRATEGY)	← Selection of the project team (multidisciplinary, also including an environmental expert)
	← Determination of the motivating factors to perform Ecodesign

1. PLANNING THE ECODESIGN PROJECT.

Motivating factors:

Every project should start finding out what goals you would like or need to achieve:

- What are your motives to take up sustainable design? Analyse the external an internal factors.
- Assess what specific impact your motives have on your future designs and set your goals.

Working team:

It should be small, organized, with capacity of decision and multidisciplinar. Areas to be involved (depending on the structure of each company):

- General manager (to ensure suppor and allocation of resources needed).
- Technical office.
- Production Dep.
- Purchasing Dep.
- Sales Dep.
- Environmental expert (internal and/or external)

Once stablised the team, **the project is planned**: planning, responsabilities and resources.

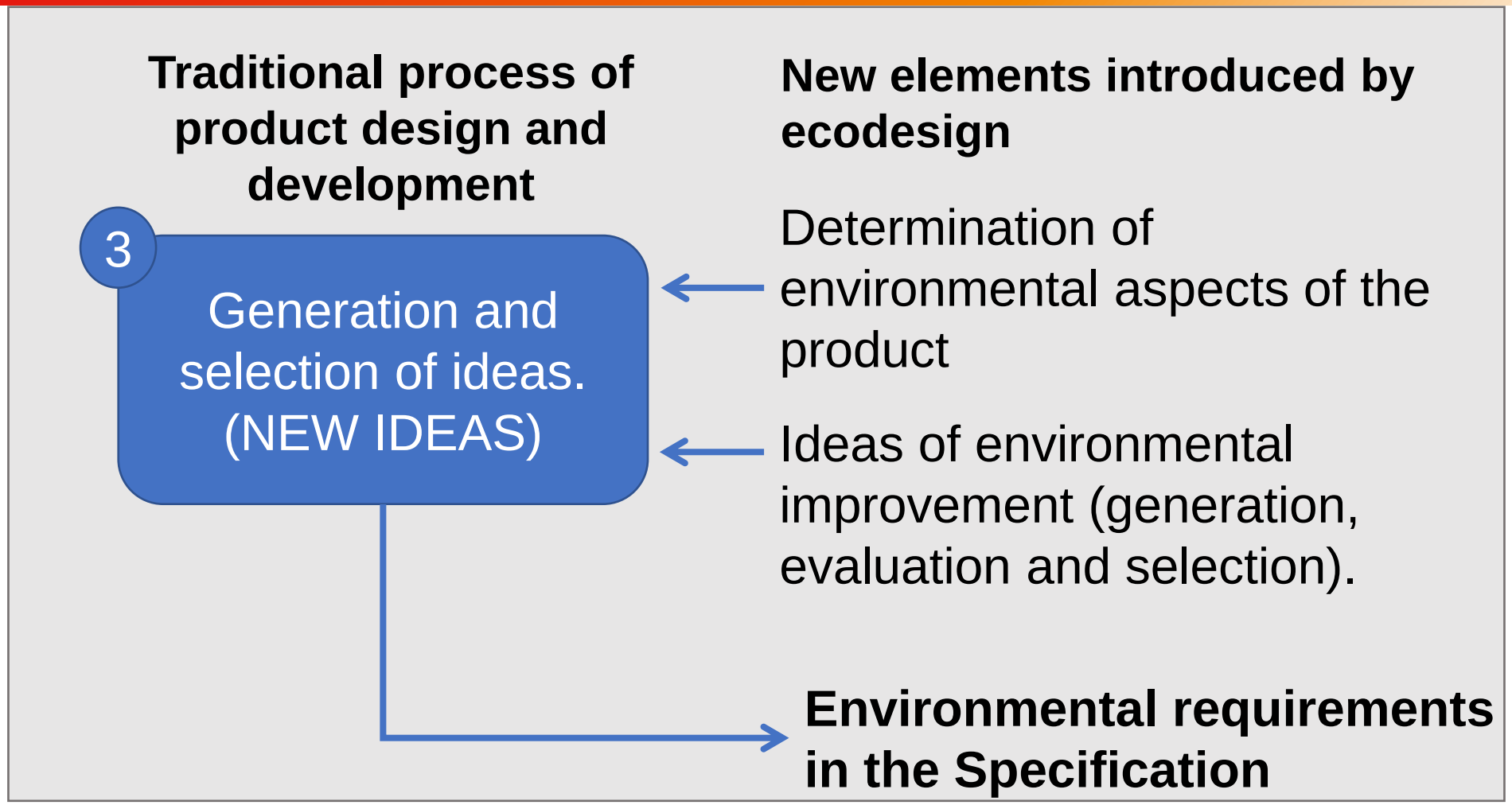
2. PRODUCT SELECTION.

It is interesting that the selected product should be:

- a new one that the company wanted to launch into the market
- or and existing product that needs to be redesigned.

The first time, it is convenient that the product be:

- **simply**
- with enough **freedom** degrees **to** be able to **innovate** and implement important modifications in its design.
- **afected by** the higher number of **motivant factors** of the company to implement ecodesign.


Traditional process of product design and development
New elements introduced by ecodesign
3
Generation and selection of ideas. (NEW IDEAS)
Determination of environmental aspects of the product
Ideas of environmental improvement (generation, evaluation and selection).
Environmental requirements in the Specification

3. TO STABLISH THE ECODESIGN STRATEGIES.

Determine which strategies are feasible and most effective.

A global environmental analysis of the product will allow to **determine the main environmental aspects of the product's lifecycle**. There are several alternatives from lower to higher difficulty.

- Specially in a new product without previous references will be quick to apply **the Ecodesign checklist.**

- When any previous product is there (redesign), Ecodesign strategy wheel or even Life Cycle Assessment (LCA) on an existing or competitive product can help you assess the focus of your efforts.

Once identified the main environmental aspects, evaluate their importance, the level of complexity and the probable level of improvement. Also you should consider other product requirements (quality, ergonomy, costs, etc).

Traditional process of product design and development

New elements introduced by ecodesign

4 Propose conceptual solutions of product design. (PRODUCT CONCEPTS)

Environmental requirements in the functional assessment of the alternatives

Selection and development of the best concept.

5 (DETAILED DESIGN)

4. GENERATION AND SELECTION OF PRODUCT DESIGN IDEAS.

Once pre-established the main ecodesign strategies, stablish:

1. Specific product ideas oriented to reduce the environmental aspects and impacts of the product life cycle are proposed. You can use creativity technics such us Brainstorming.

2. Their possible incidence on the improvement product environmental performance.

3. The compatibility between the different proposed actions.

Conceptual design alternatives

Once again, several tools can be applied to the product conceptual design alternatives. Since only partial information is available (and few of it is quantitative), **checklist or semi-quantitative tools are recommended**, but usually not LCA.

The objectives of the utilisation of these methods are:

- To obtain a general perspective of the main environmental aspects of the product throughout its Life Cycle.
- To identify the environmental priorities which will be dealt with during the Ecodesign process.
- You can complement the Ecodesign Check-list to do not forget to consider any strategy with the following table developed by AIDIMME including a preliminar feasibility evaluation.

Table to draft and select potential ecodesign strategies.

BESIDES a short description in each evaluation area (environment benefits, viability and complementing synergies), there **can be used a qualitative or numeric scale** to give points and help the team **to select and priorise the ecodesign actions** to be developed.

Ecodesign strategies	Potential actions to implement in my design	Potential environmental benefit	Viability		Sinergies with other strategies/actions motivating factors
			Technical	Economical	
Structured by life cycle phase	One raw by each action *(Yet completed in previous stage)*				**Positive:** **Negative:**

Example numerical scale

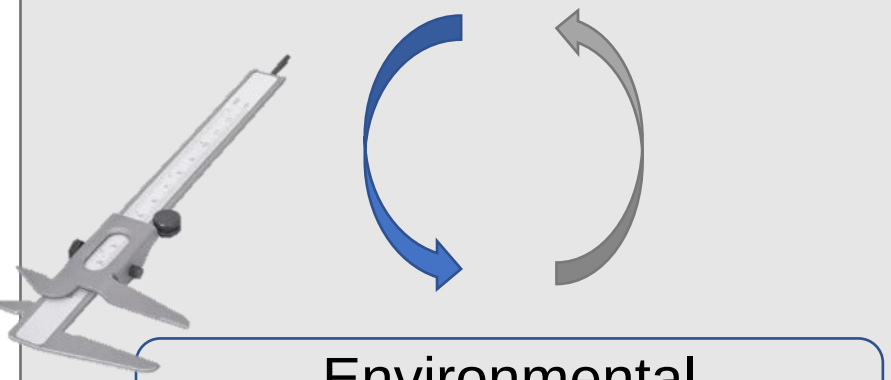
2	Very positive score/very feasible
1	Positive score/feasible
0	Neutral score
-1	Negative score/almost unfeasible
-2	Very negative score/ completely unfeasible

When all the selected ecodesign actions for improvement have been assessed, we shall proceed to prioritise them.

Traditional process of product design and development

5

DETAILED DESIGN



Environmental assessment

New elements introduced by ecodesign

Plan of new environmental improvements to the product in the medium and long term.

General concepts become into detailed product specifications allowing to quantify environmental aspects.

New tools derived from this new approach, anchoring of Ecodesign ...

5. DETAILED DESIGN.

Once the best product ideas have been selected, they are converted into **design specifications**, evaluating their feasibility in detail.

The **result** of this stage should be the **prototype** of a new **product with lees environmental impact.**

A standard approach is to **constantly evaluate your results**. Only when comparing the new design with the initial situation, you will know if your efforts have had the result you were aiming for.

Consider which strategies were effective, which were not so effective and try to assess where more improvements can be made in the next design cycle. Sustainable design is a continuous process.

At this step quantitative data is available, and even information from potential providers**, so detailed assessment on both environmental aspects and impacts can be performed**. Depending on company´s resources two options are recommended:

- **Ecodesign Strategy Wheel**
- **LCA (explained in LCA guide)**

Traditional process of product design and development	New elements introduced by ecodesign
6 Product production, distribution, marketing and sales plan. (PRODUCT IN THE MARKET)	Analysis of the environmental results, green marketing, internal and external environmental training and information.
7 Project evaluation	Feedback on the ecodesign process to improve the methodology/steps, etc.

6. COMUMNICATION AND LAUNCH OF PRODUCT TO THE MARKET

This stage is common to all the products of the company.

It is the promotion of the new product, both internally and externally to the possible customers. Usual marketing tools of the company could be used.

Anyway, as **differentiation factor**, is reccommendable **to communicate the environmental improvement achieve**. To do that, any of the existing ecolabelling types should be used (better not only one, because they are complementary).

Ecolabelling systems and green marketing are described in other parts of this course.

7. EVALUATION OF PROJECT RESULTS.

It is interesting to carry out a **complete evaluation of the ecodesign project**:

- at **product** level and
- of the **design process** itself.

It should be colected information related to:

- Incidences during porject development.
- Benefits achieve with the changes introduced in the new design.
- The consequences in the marketing promotion.
- Customs oppinions.

8. ECODESIGN SISTEMATIZATION: ISO 14006:2020
ENVIRONMENTAL MANAGEMENT SYSTEMS - GUIDELINES FOR INCORPORATING ECODESIGN

An step forward is to implement the ISO 14006. This ISO gives guidelines for assisting organizations in establishing, documenting, implementing, maintaining and continually improving their management of ecodesign as part of an environmental management system (EMS).

Note: In Spain this standard is certifiable.

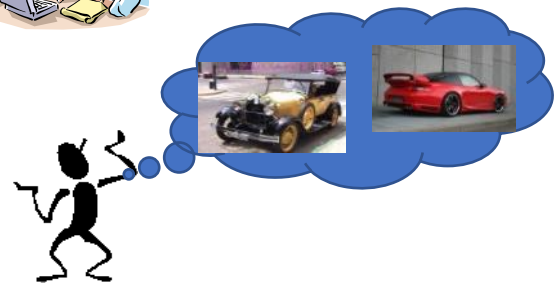
- Current version adapts the structure to the ISO 14001: 2015 and ISO 9001: 2015.
- It only applies to aspects on which the company can act or influence.
- It does not establish specific environmental performance criteria.

It is not a standard on eco-labeling, but the continuous environmental improvement of products facilitates compliance with eco-labeling criteria.

SUMMARY

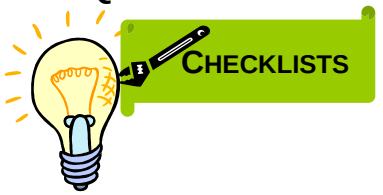
1. ECODESIGN PROJECT ORGANIZATION.
   - MANAGEMENT SUPPORT
   - WORKING TEAM
   - MOTIVATING FACTORS (INTERNAL AND EXTERNAL)

2. PRODUCT SELECTION.
   - NEW PRODUCT
   - PRODUCT REDESIGN



3. ESTABLISH ECODESIGN STRATEGIES
   - PRELIMINAR ENVIRONMENTAL ANALYSIS.
   - ESTABLISH LEGAL REQUIREMENTS, QUALITY, ETC TO DETERMINE DEGREES OF FREEDOM OF DESIGN).
   - GENERATION OF IMPROVEMENT OPTIONS.
   - SELECTION OF ECODESIGN STRATEGIES (GLOBAL OBJECTIVE).

Qualitative

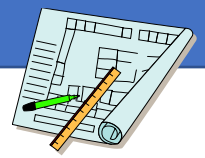


4. GENERATION OF PRODUCT IDEAS.
   - GENERATION OF PRODUCT IDEAS
   - EVALUATION OF THE ENVIRONMENTAL ASPECTS.
   - SELECTION OF THE BEST IDEAS.

Semi-quantitative

5. DESIGN IN DETAIL OF THE PRODUCT.

- TURN IDEAS IN DESIGN SPECIFICATIONS
- EVALUATE THEIR TECHNICAL AND ECONOMIC VIABILITY.



6. COMMUNICATION AND RELEASE OF THE PRODUCT.

- INTERNAL PROMOTION OF THE NEW PRODUCT.
- EXTERNAL PROMOTION: MARKETING AND ENVIRONMENTAL COMMUNICATION (ECO-LABELING SYSTEMS).

Semi-quantitative

ECODESIGN STRATEGY WHEEL

Quantitative

LIFE CYCLE ASSESSMENT

ECOLABELING

EU Ecolabel www.ecolabel.eu

DER BLAUE ENGEL

NORDIC ECOLABEL

EPD® THE INTERNATIONAL EPD® SYSTEM

THIRD PARTY VERIFIED EPD

Please, avoid green washing

PRODUCE

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