BALANCE

green and stable

GREEN POLICIES & FINANCIAL SUSTAINABILITY TRAINING PROGRAM

MODULE 3

Self-assessment of SMEs' Environmental Impacts

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INTRODUCTION

This module helps companies that want to change their business' processes or activities and adapt them to sustainable practices and how to approach them in general terms.

On this path, it is important to know the existing management systems that aim at environmental improvement, as many of the ways of proceeding are easily adaptable to all companies. Therefore, the module will begin with a short introduction to Environmental Management Systems (EMS). The second unit is designed for company managers to identify the sources of pollution from their activities in order to assess their impact and make decisions about them. It explores how to identify the impacts generated by the activity of a particular company in order to assess the damage it causes to the environment, and thus, identify the activities that need to be changed most urgently.

Finally, a brief presentation of the most commonly used tools for quantifying the environmental impacts generated will be presented. The most important of these, due to its widespread use, is Carbon Footprint. Hence, a large segment of the unit will focus on the basics of its calculation.

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ENVIRONMENTAL MANAGEMENT

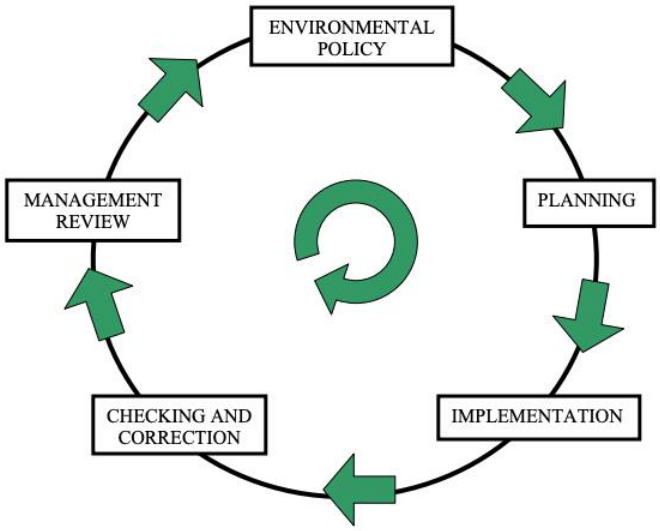
APPLICATION OF ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS) IN SMES

ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) AND CONCEPTS

An Environmental Management System is the framework or working method that an organization follows in order to achieve a certain performance in accordance with the goals it has set for itself and in response to constantly changing social, financial, economic and competitive pressures, regulations and environmental risks.

An Environmental Management System consists of two parts:

1. A descriptive part of the system, which includes procedures, specific instructions, rules and regulations, etc.
2. A practical part composed of two variables:
   a) Physical aspects: premises, machines, computer and control equipment, pollution treatment facilities, etc.
   b) Human aspects: personnel skills, training, information, communication systems, etc.



An EMS, in addition to providing for the necessary measures to comply with existing legislation, must define objectives and commitments aimed at the continuous improvement of its operations from an environmental point of view.

OBJECTIVES OF AN ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The main objectives of EMS are:

1. To ensure compliance with environmental legislation.
2. To establish and promulgate internal policies and operating procedures necessary to achieve the environmental objectives of the business organization.

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3. To identify, interpret, evaluate and prevent the effects that the activity produces on the environment, analyzing and managing the risks that the organization incurs as a result of those effects.
4. To deduce and specify the volume of resources and the qualification of the appropriate personnel according to the level of risks and the environmental objectives assumed by the company's organization, ensuring to the business organization, while ensuring their availability when and where necessary.

These objectives must be coherent with the Environmental Policy defined by the company and take into account the following aspects:

- Environmental Effects
- Economic and Financial Policy
- Commercial Policy
- Available technologies

ROLES AND RESPONSIBILITIES OF THE ORGANIZATION

Depending on the size of the company, it is advisable to create an Environmental Management Committee, an Environmental Management Representative or, failing that, the manager himself/herself, to coordinate the activities of the environmental management system and carry out:

- The definition of the strategy and environmental objectives and targets.
- The achievement of a complete commitment of all managers or middle management.
- The planning of personnel training.
- Ensuring the progressive involvement of employees. Directing the company towards the environmental objectives set.

The success of the implementation of an EMS is based on three main factors:

- Management leadership
- Participation
- Training

DOCUMENTATION OF AN EMS

All Environmental Effects that are considered significant shall be **EVALUATED** in order to:

- Select and define the parameters to be recorded,
- Set Environmental Objectives and Targets.

All environmental effects that are considered significant shall be **RECORDED**. Among the aspects to be considered will be included the relation of:

- Atmospheric emissions, water and sewage discharges,
- Toxic and hazardous solid waste,
- Soil contamination,
- Use of natural resources,
- Noise, odors, dust, vibrations, etc.

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ENVIRONMENTAL AUDITS

An **environmental audit** is an analysis of the effect of an organization's actions on the environment. The audit does not provide answers, it merely collects information and identifies problems.

DEFINITION OF GOOD ENVIRONMENTAL AND QUALITY PRACTICES

GOOD PRACTICES TARGET FOR SMES

The purpose of good housekeeping practices is to reduce systematic or accidental losses of materials and waste or emissions, and thus increase productivity without resorting to changes in technology, raw materials or products, but by focusing mainly on the human and organizational factors of production.

The operational areas common to all industries that best lend themselves to changes in their organizational practices focus on:

- Inventory control or tracking of materials, waste, and emissions: purchasing control, improved warehouse location, shelf-life tracking, etc.
- Improvements in materials handling: employee awareness, reduced likelihood of accidents, etc.
- Improvements in production: planning sequences aimed at reducing cleaning frequencies, recycling, etc.
- Prevention and control of leaks and spills: adopt appropriate procedures, protection against splashes, etc.
- Preventive maintenance: inspection, revision and periodic cleaning.
- Selective separation of waste and emissions: according to their nature and characteristics to facilitate recycling and recovery.
- **Use of guidelines** for the use of materials and equipment, aimed at reducing waste generation and emissions.

In most cases, these are measures that require hardly any technical changes to the equipment, but only in people's attitudes and the organization of operations following a review of existing

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procedures. Good practices can therefore be implemented quickly, with a low investment, so their cost-effectiveness is usually high, they have high profitability and very low risk.

ADVANTAGES AND OPPORTUNITIES FOR SMES IN THE IMPLEMENTATION OF AN ENVIRONMENTAL MANAGEMENT SYSTEM

The Potential Advantages resulting from the introduction of Environmental Improvements can be direct or indirect.

Among the direct advantages are the reduction of costs by reducing waste and effluent treatment, energy consumption, use of water and raw materials, etc. On the other hand, costs are avoided since the cost of insurance is reduced, property is protected, maintaining the value of the real estate and avoiding accidents; fees are reduced, cleaning operations are reduced, and in general the risks of sanctions are minimized. In addition, competitiveness is improved, since the environmental image is valued by suppliers and clients, which avoids commercial barriers and at the same time becomes an element of innovation.

Among the Indirect Advantages we will highlight the motivation of the staff, since the implementation of environmental management in SMEs can be integrated as a dynamic element of work habits and as an element of cohesion. Another indirect advantage is that it improves the relationship with the community, and proves the company's willingness to commit to the future. At the same time it facilitates relations by enriching the public image and becomes a good indirect publicity, increasing the knowledge of the company in the market.

GOOD PRACTICES EXAMPLES

"GUIDE OF GOOD PRACTICES FOR SMES AND FREELANCERS IN TIMES OF PANDEMIC"

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ENVIRONMENTAL ASPECTS & IMPACTS

ENVIRONMENTAL ASPECTS. DEFINITION AND IDENTIFICATION

WHAT EXACTLY IS AN ENVIRONMENTAL ASPECT?

The **environment** can be defined as the natural surroundings in which the organization operates to carry out its activity and where its facilities are located. Within the environment are included the natural resources, flora, fauna and human beings with which it interacts, there are also aspects such as air, water or soil that, although of great relevance, are usually seen as more **general and intangible aspects** that can be organized according to ISO 14001 2015.

According to this definition it can be stated that an environmental aspect is defined as an element of all **activities, services or products of the organization** that interacts or may come to interact in some form or degree since the environment has been identified.

The environmental impact is any change that occurs in the environment as a result of the action of all or part of the **environmental aspects of your organization**. It should be clarified that an environmental impact can be beneficial or adverse to the environment.

There are **hazardous wastes** such as batteries and batteries, which cause the following impacts:

- Soil and groundwater contamination.
- Damage to the natural environment such as flora and fauna of the area.
- Damage to human health.
- Loss of economic value of the soil.
- Damage related to products, equipment and services related to the soil.

We can also encounter **non-hazardous waste** such as wooden pallets, which give rise to environmental impacts such as the following:

- Local or forest fires with their consequent damage within the natural habitat.
- Landscape damage.
- Bad odors.
- Damage to human health.

In the case of **daytime and nighttime noise**, the following are associated:

- Damage to human health, such as alterations in character, irritability or aggressiveness, among others.
- Changes in fauna and their behavior.
- Damage to the natural habitat adjacent to the organization.

With respect to **energy and diesel consumption**, we will find linked others such as:

- Gradual depletion of resources.
- Damage to the natural environment.

IDENTIFICATION OF ENVIRONMENTAL ASPECTS

The methodology used to identify the environmental aspects of an organization will be decisive to ensure that the process of analyzing them is not "unmanageable" in the future and ends up generating more confusion than clarity within the operation of an Environmental Management System. That is why, before undertaking such identification, some elements must be defined, such as

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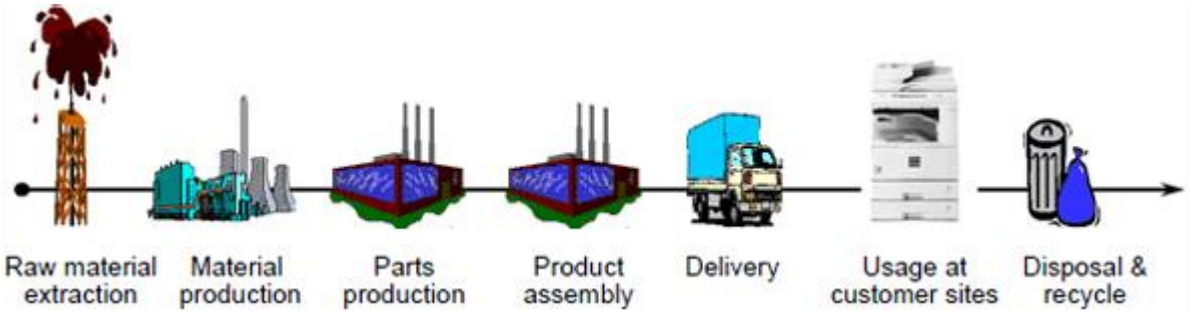
the limits of the aspects to be identified and the level of detail with which the activities, products or services contained within these limits will be evaluated.

1. DEFINING THE SYSTEM BOUNDARIES

The first question an organization should ask itself in order to identify its environmental aspects is the scope or boundaries of the analysis; at what stage of its life does the product generate the greatest environmental impacts? A product has a life cycle, from the exploitation of the natural resources necessary for the production of raw materials and energy, through its manufacture, use and final disposal. In each of these stages there is a consumption of resources and a generation of waste, as is shown schematically in Figure 1.

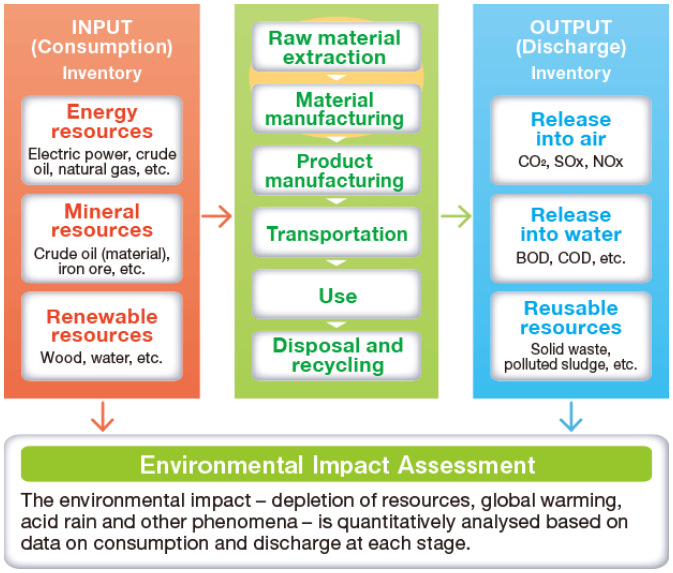


The life cycle analysis has been included as a standard in ISO 14040, and is an extremely useful tool to determine the importance or not of evaluating the environmental aspects in the different stages of the product. The strict application of this analysis is very costly due to the high demand of time, expert personnel and information, and for this reason it is carried out in groups of companies.

2. IDENTIFICATION OF ENVIRONMENTAL ASPECTS

a. Analysis of inputs and outputs

The unit processes of the activities, products or services (A/P/S) of an organization must be identified, and then define for each of these, what are the inputs and outputs, as shown in the following figure.



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b. Analysis of chemical inputs used

In many cases the consumption of chemicals, compared to the consumption of other raw materials, is minimal, but their potential for contamination and toxicity requires them to be independently analyzed. A fundamental tool to have the necessary information for the analysis of the dangerousness of the chemicals is their safety data sheet. Suppliers are obliged to provide them, but it has been found that the information provided is often not sufficient.

c. Analysis of incidents of environmental relevance

Collecting historical information on incidents or accidents of environmental relevance that have occurred in the company will provide evidence to support decisions on the importance of controlling, improving or responding to the emergency caused by an environmental aspect. Most of the time these events are not written down and remain only in the memory of the company's experienced employees. Some examples are:

- Accidental leaks of fuels or lubricants falling into a body of water.
- Toxic or non-toxic gas leaks due to poor handling or lack of maintenance.
- Improper operation of a process due to inadequate controls or lack of operator training.
- Inability to control the incident due to lack of minimum safety equipment.
- Complaints from neighbors about an unnoticed activity within the company.

MAIN ENVIRONMENTAL IMPACTS TO ASSESS

ENVIRONMENTAL IMPACT ASSESSMENT

The methods are divided into qualitative and quantitative. The following table shows their characteristics.

The choice of assessment method is related to:

- *The degree of complexity that the organization has in environmental terms*: When it is desired to implement an EMS in a company in the chemical sector, the analysis will have to be deeper and more detailed. When you want to implement an EMS in a chemical company, the analysis will have to be more in-depth and objective than for a bakery, since the laws are stricter for the former, and the processes are more complex.
- *Information available in the environment*: This can simplify the analysis of these aspects. For example, many studies have already been carried out on the environmental impacts of milk and milk packaging. Although these impacts vary from country to country, it does allow the milk producer to know the methodology of analysis, as well as to adjust the indices to find one's own results.
- *Impact of the product throughout its life cycle*: There are products whose impact on the environment is mostly in their manufacture, while others generate a large impact in their use. In the case of vehicle parts manufacturers, wheel rim producers generate an impact in their manufacture, but when they are used in a car the impact on the environment is very small: their influence on gasoline consumption is minimal, their duration is very long, and when replaced, there is a large market for their recycling. Vehicle engines, on the contrary, have an enormous impact on their use, since their efficiency, duration and adjustment depend on their

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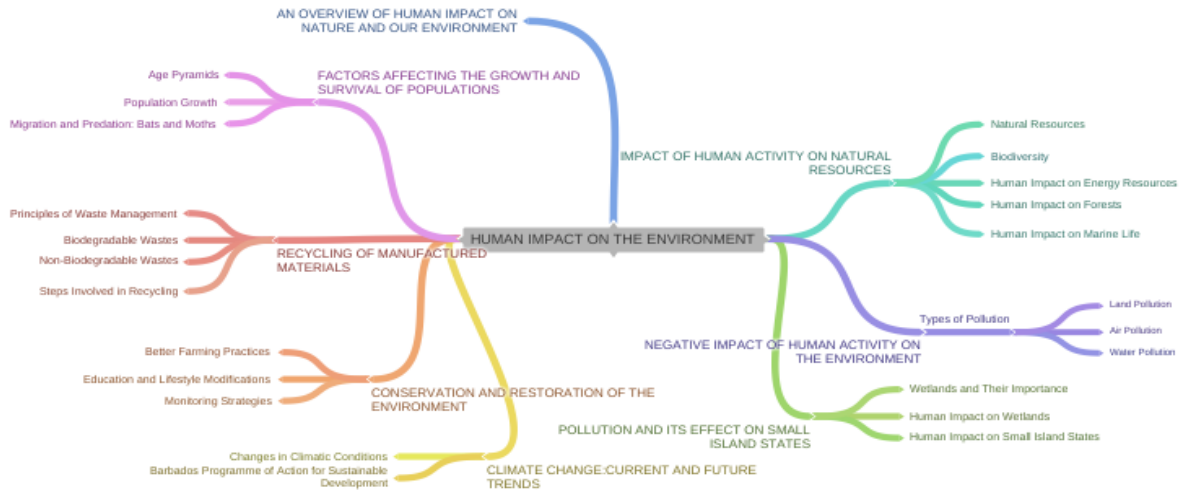
consumption of large quantities of gasoline and oil in their long life, and the environmental impacts generated in their manufacture are insignificant.

HOW TO ASSESS ENVIRONMENTAL IMPACTS

A relevance matrix provides an overview of the environmental behaviors to which a company's processes or units are related to.



The evaluation of the relevance should be made regardless of whether the aspect has equipment for its control or not, i.e., if a process is highly polluting water, it does not matter if the company has a wastewater treatment plant, its impact is significant in the environment. This is because the process, being significant, will require that the EMS guarantees its control, i.e., that the treatment plant operates correctly and that the necessary instructions are available so that the company knows what to do (operational control).

DETERMINING THE STATUS OF A COMPANY WITH RESPECT TO THE CIRCULAR ECONOMY

THE CIRCULAR ECONOMY CONCEPT

According to the european commission (ec), in a circular economy,

> **the value of products and materials is maintained for as long as possible. The use of resources and waste is minimized, and when a product reaches the end of its useful life, it is used again to create more value. This can bring significant economic benefits, contributing to innovation, growth and job creation.** [1]

The concept is presented as an alternative to the current economic model of linear production, which extracts raw materials to make more and more products that are used and disposed of. On a planet of finite resources, environmental impacts are becoming more evident every day:

[1] 2015, European Commission. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_15_6204

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overexploitation of natural resources, climate change, pollution, increasing waste, loss of biodiversity... the economic model based on "use and throw away" is unsustainable for both the environment and the economy.

The circular economy is not something abstract nor something solely in the hands of institutions and companies. Citizens can also incorporate it into their daily lives by consuming only the products they really need; avoiding the purchase of disposable or poor quality products (cheap often turns out expensive), or by making a sustainable consumption of products that can later be repaired to extend their useful life. You can also choose to share products, buy them second-hand, or even exchange them or give them away so that you can make the most of them.

BENEFITS AND CHALLENGES OF THE CIRCULAR ECONOMY

The European Commission points out the following benefits of implementing a circular economy model:

- It promotes long-term sustainability and competitiveness.
- Preserves resources, including some that are increasingly scarce or subject to price fluctuations.
- Reduces greenhouse gas emissions, which are implicated in climate change.
- Saves costs for european industries.
- Offers new business opportunities.
- Creates a new generation of innovative and resource-efficient European companies: manufacturing and exporting clean products and services worldwide.
- Generates local low-skilled and high-skilled jobs.
- Produces opportunities for social integration and cohesion.

The European Commission estimates savings of up to 600 billion euros for European businesses through better eco-design, waste prevention and reuse. By reducing costs, companies become more competitive and better able to cope with crises.

The circular economy is also good for employment: according to a report by the UK Waste and Resources Action Programme (WRAP), the expansion of the circular economy could create three million jobs and reduce the number of unemployed in EU Member States by 520,000 by 2030.

For its part, the European Environment Agency (EEA) points out that improving the benefits will also depend on how well and how quickly the right training and skills for the circular economy can be developed and applied.

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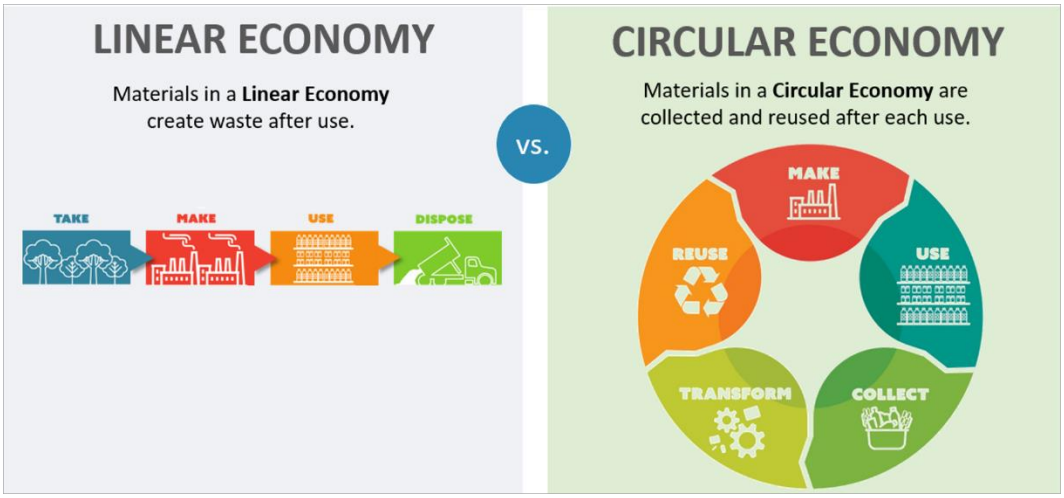
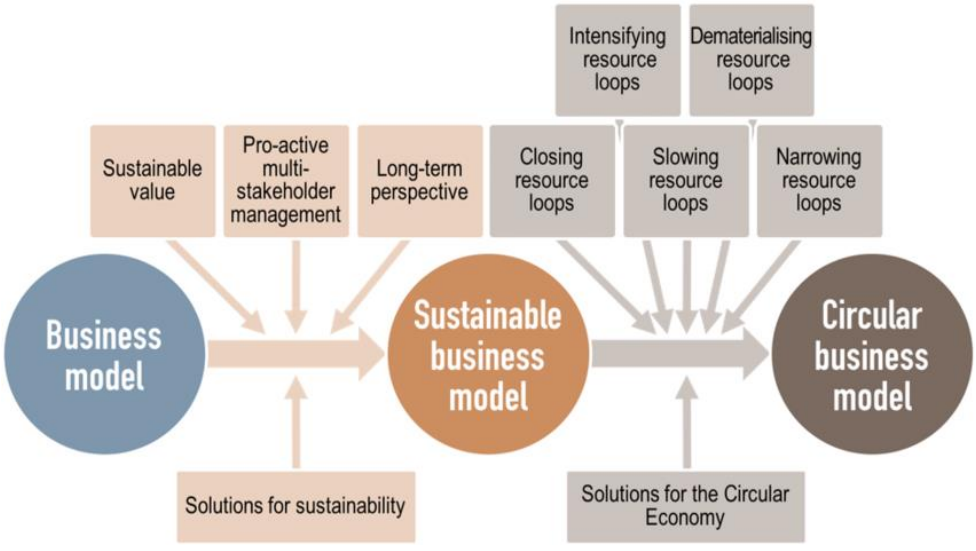
FROM LINEAR TO CIRCULAR ECONOMY



The transition from a Linear Economy to a Circular Economy requires changes in all phases of the system. These changes include:

- A change in business and management models towards sustainability and extended producer responsibility.
- An evolution from traditional product design to eco-design.
- Improvements in production processes to achieve cleaner industries.
- Efficiency in transportation and distribution.
- A change in consumption patterns towards responsible consumption and use.
- A technological evolution in waste recovery infrastructures (separation and recycling plants, etc.) for greater efficiency.

CIRCULAR BUSINESS MODELS



Within the concept of a circular business model, different approaches can be thought of:

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a) **Business models based on a circular value chain**. They aim to reshape the use of resources, moving towards a design that results in a longer service life, greater repairability and promoting the use of renewable energy and biogenic or fully recyclable materials. The key life cycle stages for this business model are the raw material extraction phase and the manufacturing phase.
b) **Collaborative models** aim to optimize product usability through changes in product access or ownership mechanisms. An example would be the use of virtual platforms to access products. In this case the key stages of the life cycle would be the sales phase and partially the usage phase.
c) **Servitization** is another possible business model. In this case it is about increasing the use of a product by offering the customer the service they want, without the need to purchase the product. The ownership of the product remains with the company that offers the service and in this way the use of the product can be optimized. This model can cover all stages of the product life cycle. According to estimates by the European Commission, these models can represent a new source of stable income and growth of between 25 and 50% in one out of every 4 companies in the next 5 years.
d) Another possibility is to apply a **business model focused on extending the useful life of a product through repair, maintenance, upgrading, the second-hand market and remanufacturing**. This would take place during the use phase or during the end-of-life phase of a product. This model is compatible with servitization. The European Commission estimates that the remanufacturing business in 2030 would generate up to €98.9 billion/year and employ 587,000 people (European Commission, 2015).
e) Finally, one could think of a **business model focused on recovering value from waste at the end of the product life cycle, including both materials and energy**.

The development of these business models requires expanding knowledge in areas related to new processes to close cycles while conserving resources, with innovative remanufacturing technologies, with systems that facilitate reverse logistics, with industrial ecology and with the perception and culture of a consumer more accustomed to owning products than using them.

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TOOLS, INDICATORS AND CARBON FOOTPRINT

LIFE CYCLE ANALYSIS

Life cycle analysis is a type of study that calculates the environmental aspects and potential impacts throughout the life cycle of a product or activity. It thus makes it possible to know where the most critical stages or elements of the process are and thus to focus on them and look for alternative solutions. Life cycle assessment contributes to the promotion of a more sustainable production from an environmental approach.

WHAT IS LIFE CYCLE ASSESSMENT (LCA)?

Life Cycle Assessment (LCA) is a tool used to study the environmental impacts throughout the entire life cycle of a product, process or activity. Life Cycle Assessment (LCA) considers the entire history of the product or activity to be studied, starting from its origin until it ends up as waste.

The **life cycle analysis of a product** allows the identification of the main environmental impacts (discharges, waste, atmospheric emissions, consumption of raw materials and energy) taking into account all the stages of its life cycle, from its origin, i.e. the extraction and processing of raw materials, through production, transport and distribution, to use, maintenance, reuse, recycling and disposal in landfill at the end of its useful life. Once the main impacts throughout its life cycle have been identified, it allows the analysis of alternatives in production processes and the implementation of environmental criteria in strategies.

STAGES OF LIFE CYCLE ASSESSMENT (LCA)

Carrying out a Life Cycle Assessment is a laborious and complex process that requires specialized environmental technicians. Given its complexity, it is necessary to approach the work in different stages:

- **Definition of objectives and scope**. It is necessary to know the objectives that we pursue with the study before approaching it. We must state the reasons why the life cycle analysis is being carried out and establish its scope. What are we looking for when carrying out an LCA?

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- **Life Cycle Assessment Inventory**: All inputs (consumption of resources and materials) and all outputs (emissions to air, soil, water and waste generation) that can potentially cause an impact during the Life Cycle Assessment are identified and quantified. In this phase we must collect data and establish calculation procedures to identify and quantify all adverse environmental effects associated with the process or product under study.
- **Life Cycle Impact Assessment**: A list of inputs and outputs in the inventory is established with the possible impacts on the environment, human health and resources, in order to classify, characterize and evaluate how significant the potential impacts are. Impact categories are established and data inventory is assigned to each impact category according to the type of environmental effect expected.
- **Interpretation of results**: After performing the life cycle analysis, we will have identified in which phases or elements of the product life cycle the main environmental burdens are generated, and therefore these elements will be key when implementing improvements, since they are the ones causing the greatest environmental impact, depending on the objectives established, conclusions and recommendations are obtained that contribute to decision making. This is probably the critical and most important part of the whole Life Cycle Assessment. If the objective is to compare different products, we will be able to know which one has the best environmental performance.

WHAT IS A LIFE CYCLE ANALYSIS (LCA) FOR?

Life Cycle Analysis offers the possibility to calculate the environmental profile of a given product or service, which has multiple applications:

- An identification of opportunities to improve the environmental performance of the product in the design and development phases.
- Comparing products and selecting the most sustainable alternatives.
- The establishment of priorities in the strategic planning of the product.
- The choice of environmental performance indicators, including measurement techniques.
- Carrying out green marketing strategies.

Life Cycle Assessment is a key tool in the transition to **a circular and sustainable economy** model as it provides valuable information on the environmental profiles of products and services.

CAN SOFTWARE BE USED TO PERFORM A LIFE CYCLE ANALYSIS?

Given the complexity of the calculations of a life cycle analysis, it is usual to rely on software based on LCA methodology that facilitates the calculations. Most of these programs include databases that can vary in the extent and quality of the data, as well as the price.

These tools are used to enter the data to configure the inventory for the calculations of the Life Cycle Assessment phase, obtaining the results for the different impact categories chosen.

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ENVIRONMENTAL FOOTPRINT

DEFINITION

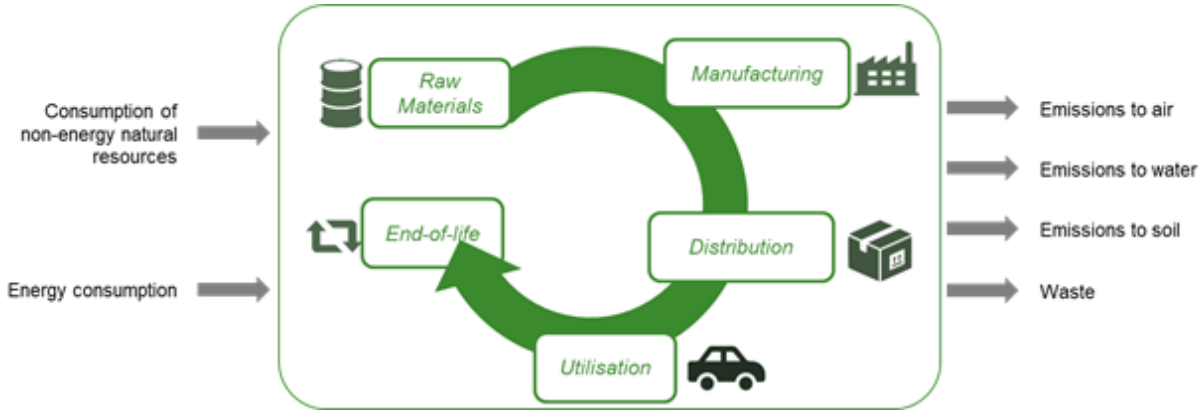
The European Union has proposed two methodologies for measuring environmental performance throughout the life cycle of products and organizations:

Product Environmental Footprint (PEF) is a multi-criteria measure of the environmental performance of a good or service throughout its life cycle.

It aims to try **to reduce the environmental impact of goods and services** by taking into account the activities in the supply chain, from the extraction of raw materials through production and use to the management of final waste.

All product environmental footprints are based on **Product Environmental Footprint Category Rules** (PEFCR), which provide detailed technical guidance on how to conduct an Environmental Footprint study on a particular product category. PEFCRs complement the general methodological guidance for environmental footprinting by providing further specifications at the product level, ensuring the reproducibility and consistency of Product Environmental Footprint studies.

The **Organization Environmental Footprint (OEF)** is a multi-criteria measure of the environmental performance of an organization providing goods or services, with a life cycle perspective.



The objective of the organization environmental footprint is to **reduce the environmental impact of the organization's activities**, taking into account the activities of the entire life cycle. It is applicable to companies, public administration entities, non-profit organizations and other bodies.

All organizational environmental footprints are based on **Organizational Environmental Footprint Sectoral Rules (OEFSR)**, which provide detailed technical guidance on how to conduct an environmental footprint study in a particular sector of activity. The OEFSRs complement the general methodological guidance for environmental footprinting by providing further specifications at the sector level, ensuring consistency.

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OBJECTIVES OF THE ENVIRONMENTAL FOOTPRINT CALCULATION

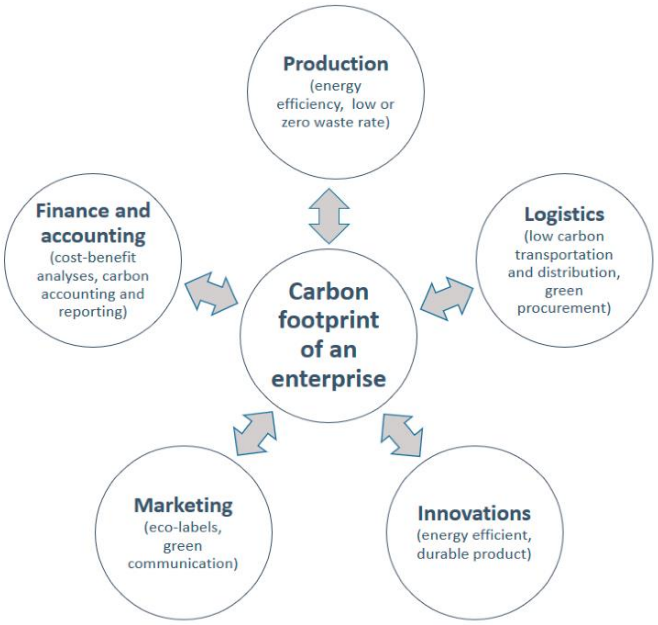
These methodologies provide **information** that can be used for a **variety of purposes**:

- Determining critical points from an environmental point of view.
- Environmental benchmarking of products (own or against competitors)
- Responding to customers and consumers
- Developing marketing plans
- Environmental assessment over time
- Supply chain management at the lowest environmental cost
- Adopting measures to reduce the environmental footprint
- Participation in voluntary or mandatory programs
- Responding to the requirements of environmental policies at European or Member State level
- ….

ENVIRONMENTAL FOOTPRINT COMPONENTS

- While the environmental footprint presents a global vision of the environmental impact of a product or organization, the **carbon footprint** focuses on climate change by quantifying GHG (greenhouse gas) emissions.
- The **water footprint** analyzes and quantifies water use using different methodologies.
- Finally, the **ecological footprint** is a concept developed some time ago by the Global Footprint Network to indicate the area of ecologically productive air, land and water needed to produce the resources consumed by a population or group and assimilate their waste.

BENEFITS OF IMPLEMENTING ENVIRONMENTAL FOOTPRINT



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ENVIRONMENTAL IMPACT STATEMENT

Environmental Product Declarations (EPD) are documents that provide, in a transparent and verifiable manner by an independent third party, information on the environmental performance of the product or service certified on the basis of a Life Cycle Assessment (LCA) of the product or service.

They are regulated by ISO 14025 (Environmental labels and declarations. Type III environmental declarations. Principles) and the standard itself indicates that the objective of EPDs is to present quantified environmental information on the life cycle of certified products or services to allow comparison between products, services or activities that fulfill the same function.

An EPD can therefore be classified as an "Ecolabel", although its main difference compared to the other systems regulated by the ISO 14020 family of standards (ecolabels and environmental self-declarations) is that an EPD does not define environmental requirements or minimum values to be met (there is no list of environmental requirements that the product must meet in order to be certified), but rather shows the results of the LCA study carried out on the certified product to provide an image of its environmental performance.

Therefore, the fact that a product has an EPD does not mean that it is environmentally better or worse than another product that does not have one, because the purpose of an EPD is not to identify environmentally friendly products: its purpose is to provide information on the environmental performance of the product to allow comparisons with other similar products. It is a detailed report with highly technical information, not simply a symbol or logo.

WHY MAKE AN EPD AND HOW TO USE THEM FOR DECISION MAKING?

Today EPDs are being widely used to show the consumer, customer or any interested party the environmental impact of products, services and/or activities of companies. The objective of showing this environmental profile varies from one company to another, but in all cases the basic objective is clear: to increase the competitiveness of the company and the positioning of its products in the market by developing a clear and transparent strategy to show the environmental profile of its activity to all interested parties.

Stakeholders are often the companies' own customers, who are interested in acquiring more environmentally friendly products. On other occasions it is the customers of the company's customers who are interested in obtaining information on the environmental profile of the products in their purchases, so that the requirement for this information to flow through the supply chain extends to the early stages of transformation of materials and components.

Being able to bid for contracts that would otherwise not be possible due to the environmental requirements that are demanded or to show the end consumer an image of environmental transparency in order to improve the company's image are also often determining factors.

In conclusion, companies can obtain important benefits from the development and verification of EPDs:

- It improves the company's competitiveness at the international level.
- It allows access to markets that previously had no entry.
- It provides the opportunity to describe quantitatively and verifiably the environmental performance of your products/services from a full life cycle perspective and in an objective manner.

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- It is used as an informative tool for the procurement and purchase of other products and services.
- Its classification into groups allows comparisons to be made between functionally equivalent products.
- It can be checked and validated by an independent third party to ensure the credibility and veracity of the information contained in the EPD.

CARBON FOOTPRINT CALCULATION FOR SMES

The concept of Carbon Footprint (CF) arises from the concept of Ecological Footprint, of which it is arguably a subset. The Carbon Footprint measures the total greenhouse gases (GHG) emitted by direct or indirect effect of an individual, organization, event or product.

In reality, the concept of CF goes beyond the single measurement of CO2 emitted, as it takes into account all GHGs that contribute to global warming, and then converts the individual results of each gas to CO2 equivalents. Therefore the correct term would be CF equivalent or CO2 equivalent emissions, although in practice and for convenience the term carbon is individually used.

In reality, the LCA is a simplified version of a Life Cycle Assessment in which, instead of considering several environmental impact categories at the same time, only one of them is considered, the one related to Global Warming.

This environmental vision that takes into account only one impact category may cause problems in the interpretation of the results obtained, since the rest of the environmental impacts have been omitted. In other words, the system under analysis may not have a special environmental problem in terms of CO2 equivalent emissions, but in another environmental impact category it does.

The clearest example of this problem is the production of electricity in a nuclear power plant. The fission and electricity generation process does not generate CO2 emissions, but generates a large amount of hazardous nuclear waste. From the point of view of an LCIA methodology that measures only CO2 eq emissions, such as CF, the process would not be polluting, when in fact it is not. This comprehensive view of all impact categories is facilitated by LCA.

In short, a lower CF is not always synonymous with better overall environmental performance. It is therefore advisable to complement the use of the CF with other types of tools with a global vision, such as the LCA.

However, the current importance of the environmental problems associated with global warming has led different associations and administrations to develop strategies, requirements and sometimes specific GHG reduction legislation (such as those derived from compliance with the Kyoto Protocol).

CARBON FOOTPRINT MEASUREMENT METHODOLOGIES

Practically all projects that arise from the need to measure the CF of a product or system not only aim to calculate GHG emissions, but also to establish measures to reduce or offset these emissions. Therefore, the usual steps in CF measurement projects are usually as follows:

- Measuring GHG emissions or CO2 eq: An inventory of GHG emissions or an assessment of such emissions is required. Different methodologies are used to measure the carbon footprint in

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relation to the estimated emissions for a specific activity, which have been simplified in tools such as carbon footprint calculators.

- Limitation and reduction of GHG emissions: Through the implementation of cleaner technologies or other emission reduction strategies.
- Offsetting GHG emissions: To neutralize the impact generated. The concept focuses on participation in emission compensation projects (ECP) to offset the GHG emissions generated in the system under analysis (this stage is described in more detail in a specific point of this document).
- Communication of the results: both internally and externally. On the one hand to motivate the environmental awareness of workers, and on the other hand to improve the corporate image.

CALCULATING THE ENVIRONMENTAL FOOTPRINT OF A COMPANY

There are both mandatory methodologies (such as the one established by Directive 2003/87/EC in relation to the European GHG Emission Allowances Scheme, for those companies affected by it) and voluntary methodologies (such as the Greenhouse Gas Protocol-GHG Protocol). Among the methodologies for calculating GHG emissions, the most widely used and implemented are listed and detailed below:

Methodology/ initiative	1) Scope 2) Supply chain	3) GHG	4) Characterisation factors	5) Offsets
GHG Protocol Corporate Standard	▪ Scope 1, 2 ▪ Including scope 3 emissions is optional, further specifications are given in GHG Protocol Scope 3 standard	▪ Kyoto gases ▪ GHG emissions not covered by the Kyoto Protocol, e.g. CFCs, NO_x, etc. shall not be included in scope 1 but may be reported separately ▪ For different sectors possible scope 1, 2 and 3 emission sources are listed. Regarding ICT: semiconductor production, scope 1 ○ Process emissions (C_2F_6, CH_4, CHF_3, SF_6, NF_3, C_3F_8, C_4F_8, N_2O used in wafer fabrication, CF_4 created from C_2F_6 and C_3F_8 processing)	▪ A list of IPCC values is given, but it is not mentioned that these are mandatory	▪ Project reductions that are to be used as offsets should be quantified using a project quantification methodology, such as the GHG Protocol Project Quantification Standard, that addresses the following accounting issues: ○ Selection of a baseline scenario and emissions ○ Demonstration of additionality ○ Identification and quantification of relevant secondary effects ○ Consideration of reversibility ○ Avoidance of double counting ▪ Offsets may be converted into credits when used to meet an externally imposed target
GHG Protocol Scope 3 Standard	▪ Scope 3: focus on supply chains and use phase of the products produced by the company	▪ Kyoto gases ▪ Reporting can be given as aggregated CO_2 equivalents, the reporting of segregated values and emissions of additional GHG is optional	▪ 100-year time horizon ▪ Companies may either use the IPCC GWP values agreed to by UNFCCC[114] or the most recent GWP values published by IPCC. The most recent values are preferred, but for consistency with older assessments, the 1995 values can be used too ▪ Companies should use consistent GWP values across their scope 1, 2, and 3 inventory	▪ GHG offsets can be taken into account to achieve reduction targets (but reported separately)

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Methodology/ initiative	6) Other environmental impacts	7) Comparability of results	8) Reduction targets
GHG Protocol Corporate Standard	▪ No	▪ Comparisons over time	▪ Guidance part: o Effective GHG management involves setting a GHG target o Different possibilities are described (absolute/relative, long-/short-term, advantages / disadvantages), but it is not mandatory to set a target ▪ Offsets can be used to meet reduction targets
GHG Protocol Scope 3 Standard	▪ No	▪ Standard should enable comparison over time, but not comparison between companies ▪ The accounting of scope 3 emissions leads to double counting between different companies accounting, e.g. direct emissions (scope 1) of a supplier are scope 3 emissions for its client ▪ Three consolidation approaches are possible: o Equity share o Financial control o Operational control Depending on the chosen approach, it can vary if emissions are calculated as scope 1 or scope 3. Therefore the results are less comparable, if companies chose different consolidation approaches for their assessment.	▪ When companies choose to track performance or set a reduction target, companies shall: o Choose a scope 3 base year and specify the reasons for choosing that particular year o Develop a base year emissions recalculation policy that articulates the basis for any recalculations o Recalculate base year emissions when significant changes in the company structure or inventory methodology occur ▪ Companies may set a variety of scope 3 reduction goals, including: o A single target for total scope 1 + 2 + 3 emissions o A single target for total scope 3 emissions o Separate targets for individual scope 3 categories o A combination of targets, for example a target for total scope 1 + 2 + 3 emissions as well as targets for individual scope 3 categories o It should be decided whether offsets should be taken into account when achieving reduction targets ▪ Reduction targets can be absolute or intensity based ▪ Offsets can be used to meet reduction targets
ISO 14064-1	▪ No	▪ A historical baseline year has to be defined by the organisation. If not enough information exists about a historical baseline year, the first year of reporting can be set as such ▪ The baseline year can be changed, but the decisions have to be explained ▪ The baseline year has to be recalculated in case of: o Changes of the organisational boundaries o In- or outsourcing o Methodological changes	▪ A baseline year for comparisons over time should be defined, but reduction targets are not explicitly mentioned

CARBON FOOTPRINT MEASUREMENT TOOLS

The following is a description of the main tools currently available for GHG estimation, as they are the most widely used and implemented.

They have been classified according to the emissions focus/s on which they are focused. Thus, the tools are oriented to:

- Organizations, if emissions derived from the organization's own activity are being considered.
- Projects, if emissions derived from projects undertaken by organizations or end users are being considered. These projects may also include those that reduce GHG emissions.
- Activities, if emissions from end-user actions are being considered.

For these reasons, CF measurement tools can have a generic, sectoral approach to their application or consist of simple and intuitive to use online tools.

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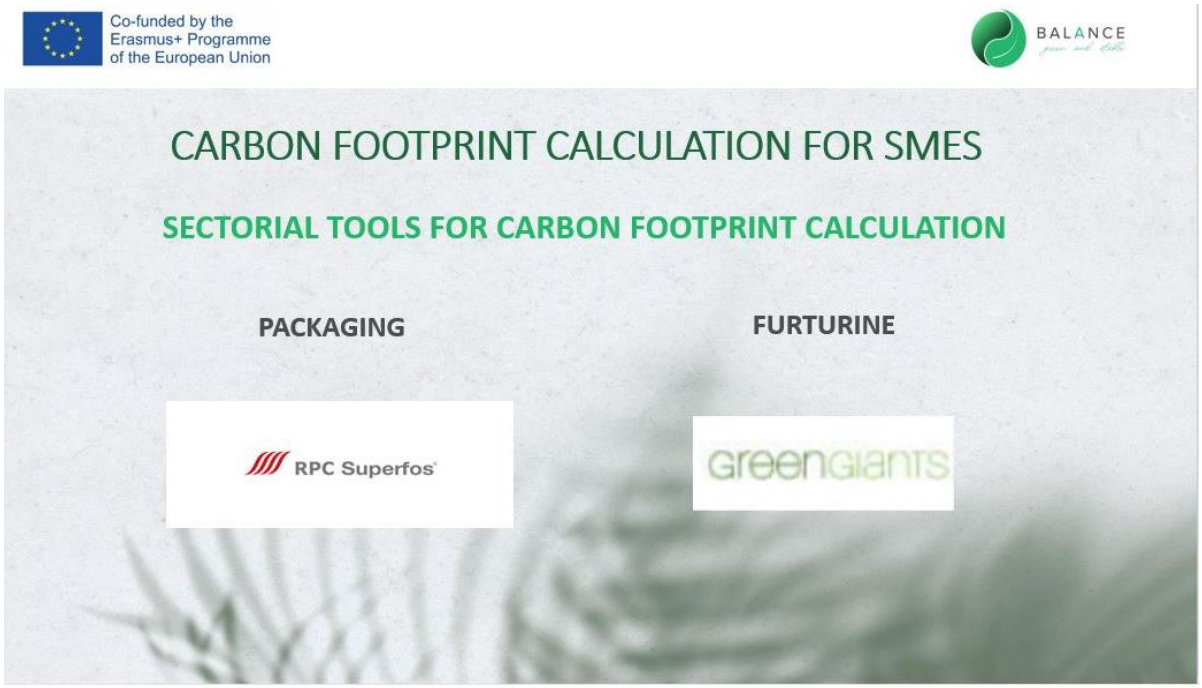
GENERAL TOOLS

The following are tools designed for any sector of activity:

SECTORAL TOOLS

There is another group of tools developed with a specific approach and covering the specific needs of a given industrial sector. More specific than the previous ones, they allow a better approach in case of having a sectorial tool. Among them, we can highlight the following:



ONLINE CALCULATORS

A last group is made up of the so-called "online calculators", small applications accessible through the Internet that allow a first approach to the concept of Carbon Footprint. Their results are not as exhaustive as those that can be obtained with the previous tools, although they are a good starting point for understanding the implications of the Carbon Footprint. Among the most important, we can highlight the following:

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