Carbon Footprint

Learning objectives

1. Explain **what is climate change**, its physical and anthropogenetic causes and the ways for dealing with it:
   - Understand the context of carbon footprint, and what it is important for

2. Describe the different **methodologies, standards and sectoral guidelines** for the carbon footprint assessment

3. Apply and enhance the **tools for carbon footprint** allowing the students to assess any system
   - Conduct a simple measurement of any organization's carbon footprint and identify "hot spots"

Climate change

Weather vs Climate

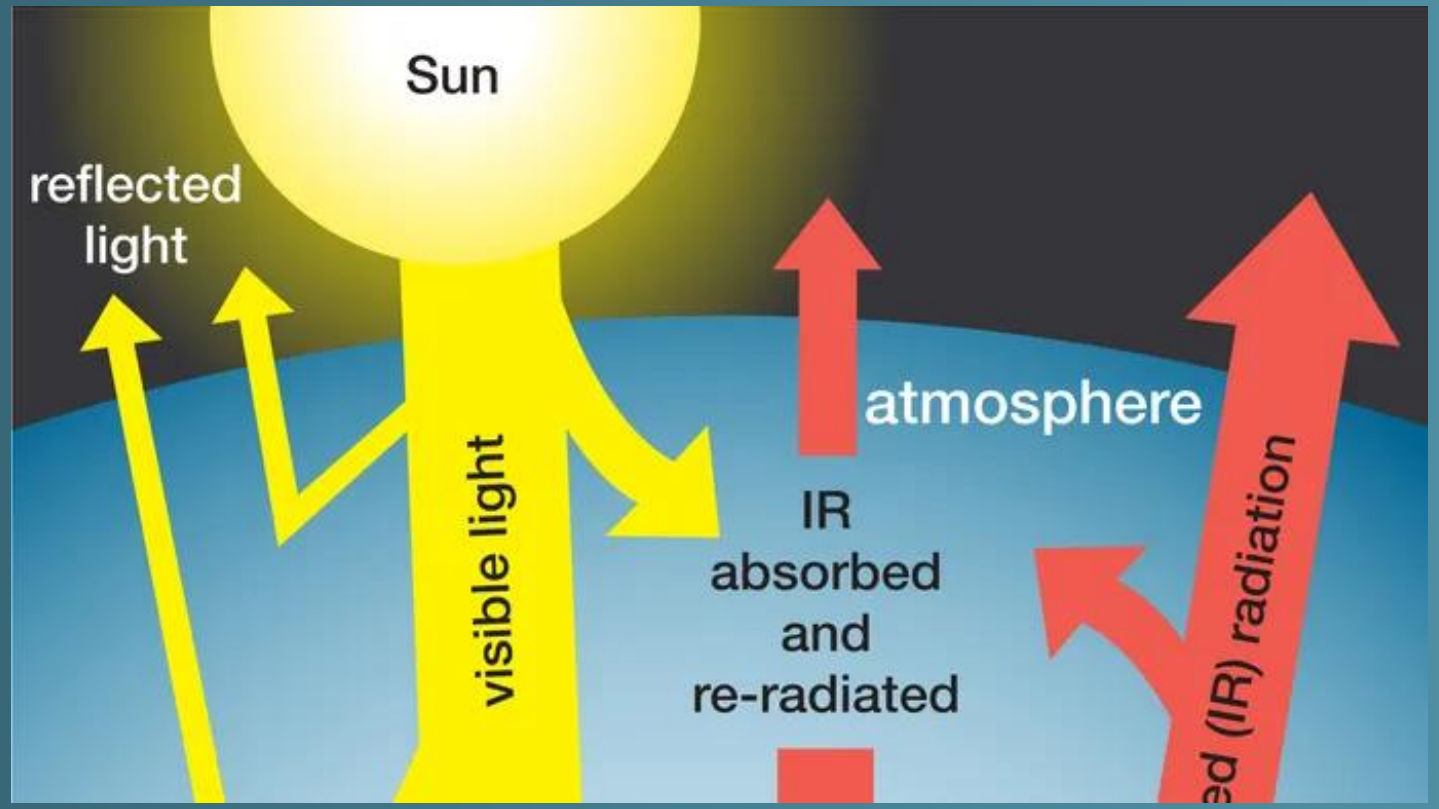
While weather refers to short-term changes in the atmosphere, climate refers to atmospheric changes over longer periods of time, usually 30 years or more.

Global warming vs Climate Change

Global warming is the long-term heating of Earth's surface observed since the pre-industrial period (1850-1900), Climate change is a long-term change in the average weather patterns that define Earth's local, regional and global climates (because of global warming as main cause)

Climate change

Global warming is the result of an increase in the greenhouse effect, caused by the presence of carbon dioxide, methane, nitrous oxides, and other greenhouse gases.



Climate change

The IPCC's Sixth Assessment Report (AR6), published in 2021, noted that the best estimate of the increase in global average surface temperature between 1850 and 2019 was 1.07 °C.

Now, we are at 1.1-1.2 ºC

They predicted future emissions based on different scenarios for the period between 2015 and 2100:

- **The lowest-emissions scenario**, + 1.0-1.8 °C
- **The intermediate-emissions scenario**, + 2.1-3.5 °C
- **The highest-emissions scenario**, + 3.3-5.7 °C

Climate change

Climate scientists agree that if the global average temperature rose by more than 1.5 °C in such a short time, the consequences would include:

- The extinction of many plant and animal species
- Shifts in patterns of agriculture
- Rising sea levels

Why does global warming rise sea level?

Density (mass/volume) is a physical property that depends on temperature. So on, if temperature grows, water atoms (and consequently, its volume) expands.

What do we do as a society?

On a global scale, the climate-change policy is guided by two major treaties:

- The United Nations Framework Convention on Climate Change (UNFCCC) of 1992. It sets the long-term objective of stabilizing greenhouse gas concentrations. It establishes that the world's countries have common but differentiated responsibilities.

What do we do as a society?

- The Kyoto Protocol of 1997. Regulates six greenhouse gases released through human activities: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF6). It sets individual reduction targets per country.
  https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/kyoto-protocol-targets-for-the-first-commitment-period

- The Paris agreement of 2015. This is a legally binding treaty to limit the global temperature increase in this century to 2 ºC while pursuing efforts to limit the increase even further to 1.5 ºC

What apples are you buying?

Carbon footprint is a good indicator to measure Climate Change impact. But it is not the only impact we should assess to measure environmental impact or sustainability impact…

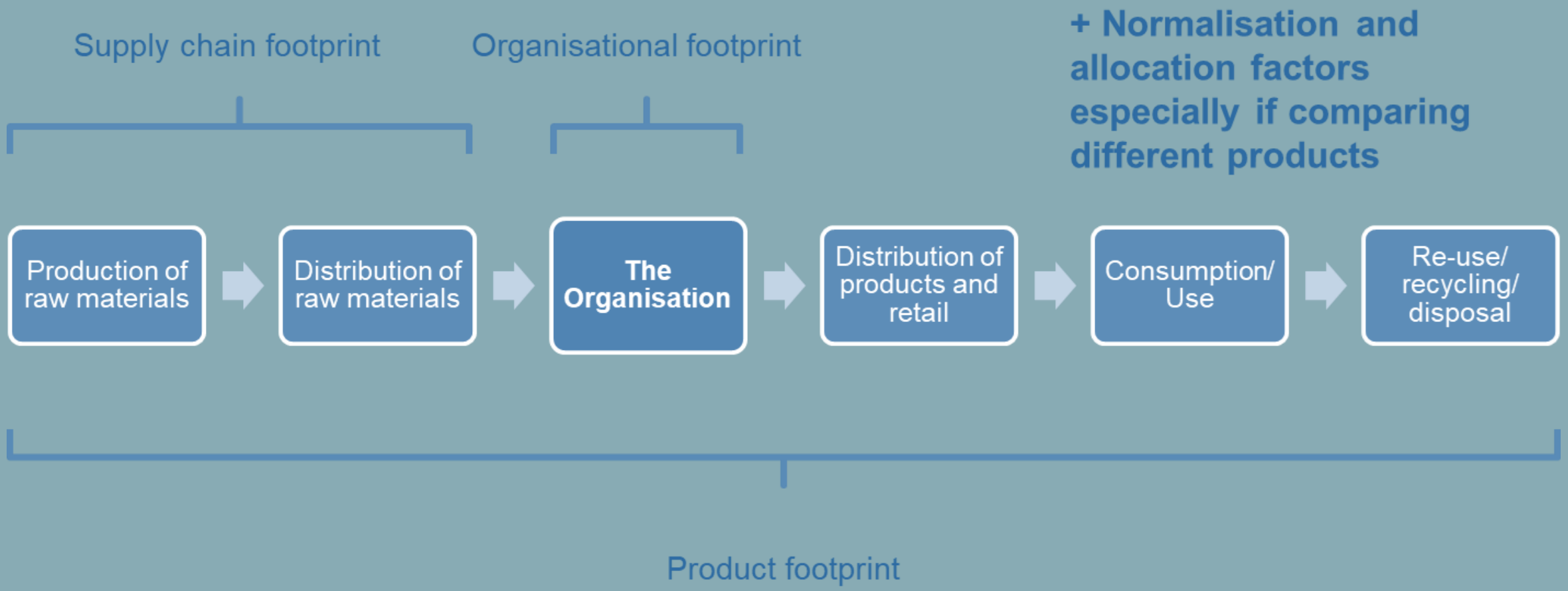
Carbon footprint

A carbon footprint is the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO2e).

Categorisation factors (kg CO2e/kg emitted) according to AR5 (Cumulative forcing over 100 years):

- Carbon dioxide (emitted): 1
- Methane (emitted): 28
- Nitrous oxide (emitted): 265
- Carbon tetrafluoride (emitted): 6630
- Refrigerant HFC-152a (emitted): 138

Carbon footprint



Cutlery case study

FU = Production of cutlery for service of 1 menu in a restaurant in Barcelona in 2016

FU = The service of 1 tourist class menu on Iberia flights that landed in Madrid in 2016

The steel cutlery has the lower carbon footprint after reusing it several times

	Production	Transport	Flight	Washing	End of life	Total kg CO2 eq.
Steel cutlery	14,33%	0,35%	79,37%	5,61%	0,34%	119,46
Wood cutlery	50,56%	0,15%	35,24%	0,00%	14,05%	10,77
Plastic cutlery	69,45%	0,13%	28,65%	0,00%	1,77%	3,42

	Production	Transport	Flight	Washing	End of life	Total kg CO2 eq.
Steel cutlery	17,119	0,418	94,815	6,702	0,406	119,46
Wood cutlery	5,445	0,016	3,795	0,000	1,513	10,77
Plastic cutlery	2,375	0,004	0,980	0,000	0,061	3,42

The weight of the cutlery has a significant impact on the fuel consumption when using it in flights.

Gonzalo Blanca-Alcubilla, Alba Bala, Nieves de Castro, Rosa Colomé, Pere Fullana-i-Palmer, Is the reusable tableware the best option? Analysis of the aviation catering sector with a life cycle approach, Science of The Total Environment, Volume 708, 2020, 135121, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2019.135121

What is your carbon footprint?

Calculate the emissions factors used by the calculator and apply normalization / allocation factors.

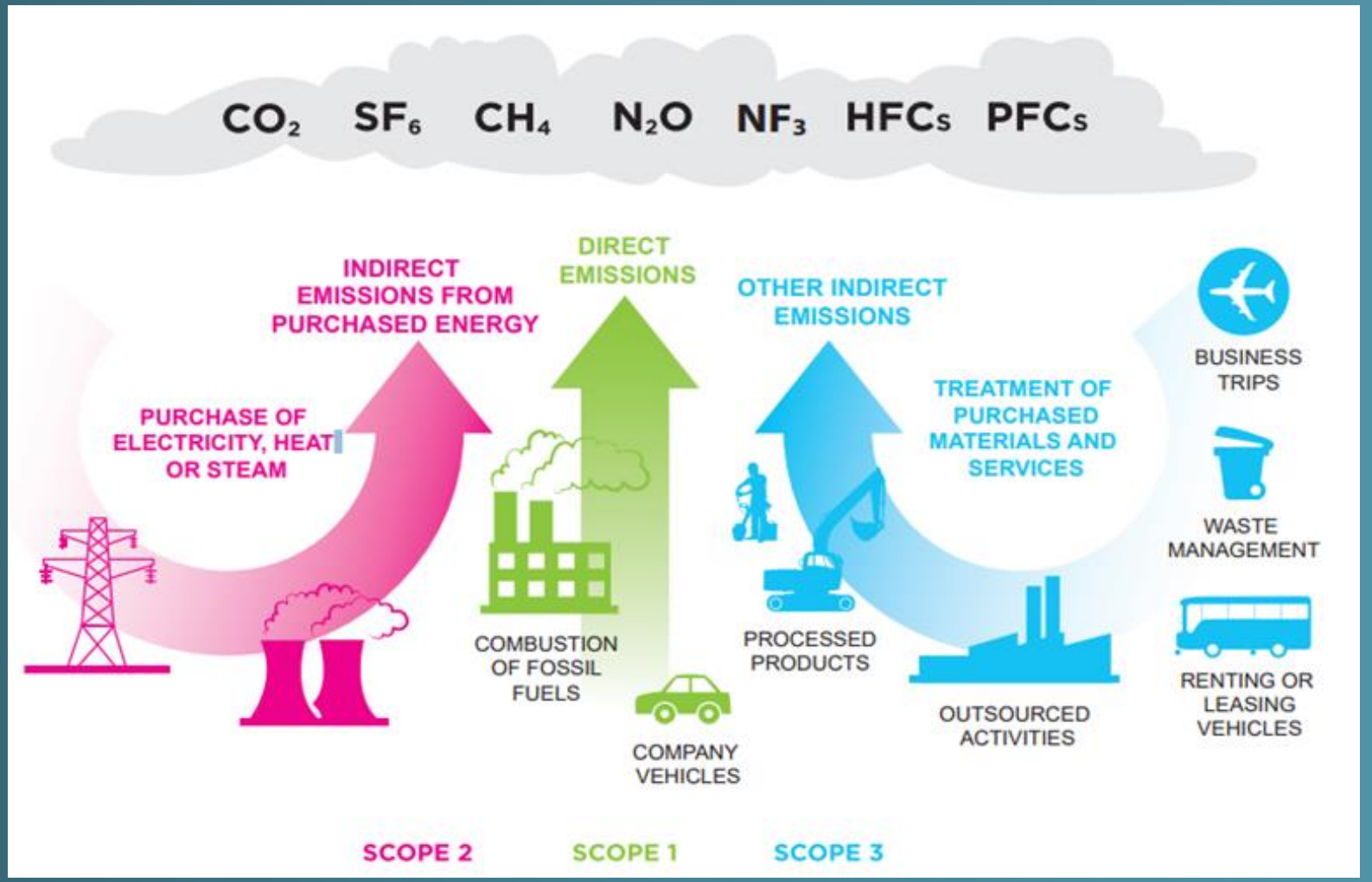
Carbon footprint methods

The organizational CF provides a result that can be used as a global environmental indicator of the activity carried out by the organization.

The carbon footprint is thus configured as a basic point of reference for the initiation of actions to reduce energy consumption and for the use of resources and materials with better environmental performance.

When comparing organization CF from different years we need to have in mind the activities of the company (for example, the years from covid period might be difficult to compare with the other years).

GHG protocols



Carbon footprint methods

Greenhouse Gas Protocol Corporate Standard (GHG Protocol)
ISO 14064-1 (ISO 14065: 2012 & ISO 14069: 2013)

IPCC 2006 GHG Workbook – previous to GHG Protocol

Bilan Carbone method (under GHG protocol and ISO 14064)
Global Reporting Initiative (GRI): Best practices
ISAE 3410: Assurance Engagements on Greenhouse Gas Statements

This international methodologies are based on the next principles: RELEVANCE, INTEGRITY, CONSISTENCY, ACCURACY AND TRANSPARENCY

Carbon footprint methods

RELEVANCE: The level of coincidence between the content of data and the user's areas of interest (Goal and scope).

INTEGRITY: Maintenance of, and the assurance of, data accuracy, completedness and consistency over its entire life-cycle (trustfulness of data sources used in the inventory).

CONSISTENCY: Refers to whether the same data kept at different places do or do not match (use of data sources according to location, temporality and level of technology in the inventory).

ACCURACY: Error-free records that can be used as a reliable source of information.

TRANSPARENCY: The ability to easily access and work with data no matter where they are located or what application created them.

Carbon footprint methods

Carbon FootPrint (kg CO_2e) = Activity Data (u) x Emission Factor (kgCO_2e/u)

- **Activity data**:
  It defines the grade or level of GHG being emitted by an activity (i.e. kg of diesel consumed by an engine).

- **Emission factor**:
  Quantity of GHG emitted per each unit of the activity data parameter (i.e. kg CO_2e/kg diesel).

- **CO_2eq**:
  Unit which is used to quantify the emissions of GHG. According to Kyoto Protocol, the GHG are the carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF_6), and since COP 18 in Doha (2012), the nitrogen trifluoride (NF_3).

Data in carbon footprint

1990 — — — — — — — — — — — — — — — — — — 2100

Data gaps inconvenient

- Some emissions are not even considered

Data overflow inconvenient

- Some emissions are being counted twice *(i.e, natural gas and diesel counted in energy source and in direct emissions in the same EPD)*

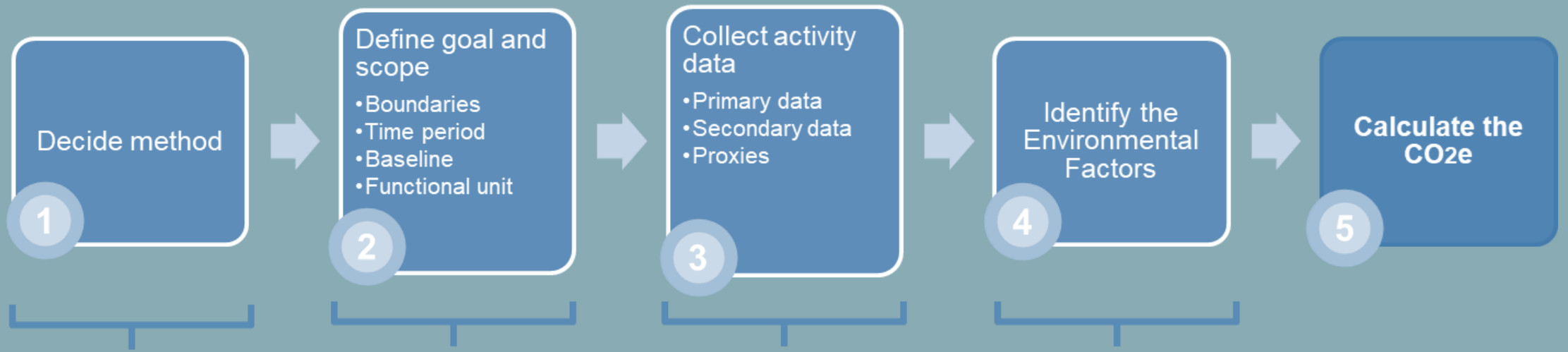
What is the sense of carbonfootprinting?

- **Fighting against climate change**

- Identifying hotspots and reducing them > Energy and materials efficiency > Economic savings
- Access to subventions and European funds
- Improve corporate reputation and company positioning
- Identify new business opportunities: attract investors and clients who are aware of climate change and the environment (i.e. Heura Food, Freshly Cosmetics)

- MANDATORY: Certifications, labelling, legislation (sector specific)

Carbon footprint calculation steps



i.e. MITECO calculator tool, GHG Protocol, ISO 14064, PEF, ISO 15804 (construction products)...

i.e. all the activity of the company during 2022-2023-2024 with 2019 as a baseline. **FU=kg CO2e/year**

i.e. primary data of heating system (natural gas consumption), electric consumption, and vehicles (fuel consumption).

i.e. environmental factors from MITECO

https://www.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/calculadoras.aspx

https://canviclimatic.gencat.cat/es/actua/calculadora_demissions/

After calculation

https://www.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/calculadoras.aspx

https://canviclimatic.gencat.cat/es/actua/calculadora_demissions/

After calculation

Check the work of SDGcompass in sustainability management for companies aligning their strategies with he SDG

https://sdgcompass.org/

Recommendations to reduce emissions

- Improve the insulation materials
- Lighting
  - Natural light when possible (optimize it with light sensors)
  - Use lower consumption lamps
- Air-Conditioning System
  - Use a highly eficient boiler
  - Heat recovery system
  - Zoning of areas to be air-conditioned
  - Biomass or natural gas better than carbon or gas-oil
  - Geothermal or other renewable energies for buildings
  - Use of awnings and blinds
  - Regulation of air conditioning to 26ºC in summer and 21ºC in winter
- Transport
  - Public transport or bike if possible
  - Optimizing routes
  - Avoid unnecessary cargo

Reporting

The carbon footprint report allows you to publicly report the results of your GHG emissions inventory. The information contained in it must be relevant, complete, consistent, accurate and transparent (GHG Protocol).

MINIMUM CONTENT OF THE REPORT

- Brief description of the organisation. Why are you performing a CFP?
- Description of the boundaries of the organisation
- Calculation period covered, time baseline, and evolution of emissions in relation to the selected time baseline.
- Assumptions made, if any, in making the calculations. Explanation of the reasons for the exclusion of the quantification of any GHG sources, if any.
- Total emissions, distinguishing Scope 1, Scope 2, and Scope 3 (if calculated).
- How you are managing your impacts. Setting targets. Risk and opportunities.
- Reference of methodologies used.

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