LCA - Life Cycle Assessment.

- LCA measures the environmental impact of product through every phase of its life.

from production → Waste. (or recycling)

It involves countless factors:

Which raw materials involved in process?

Where they came from about soil, seeds

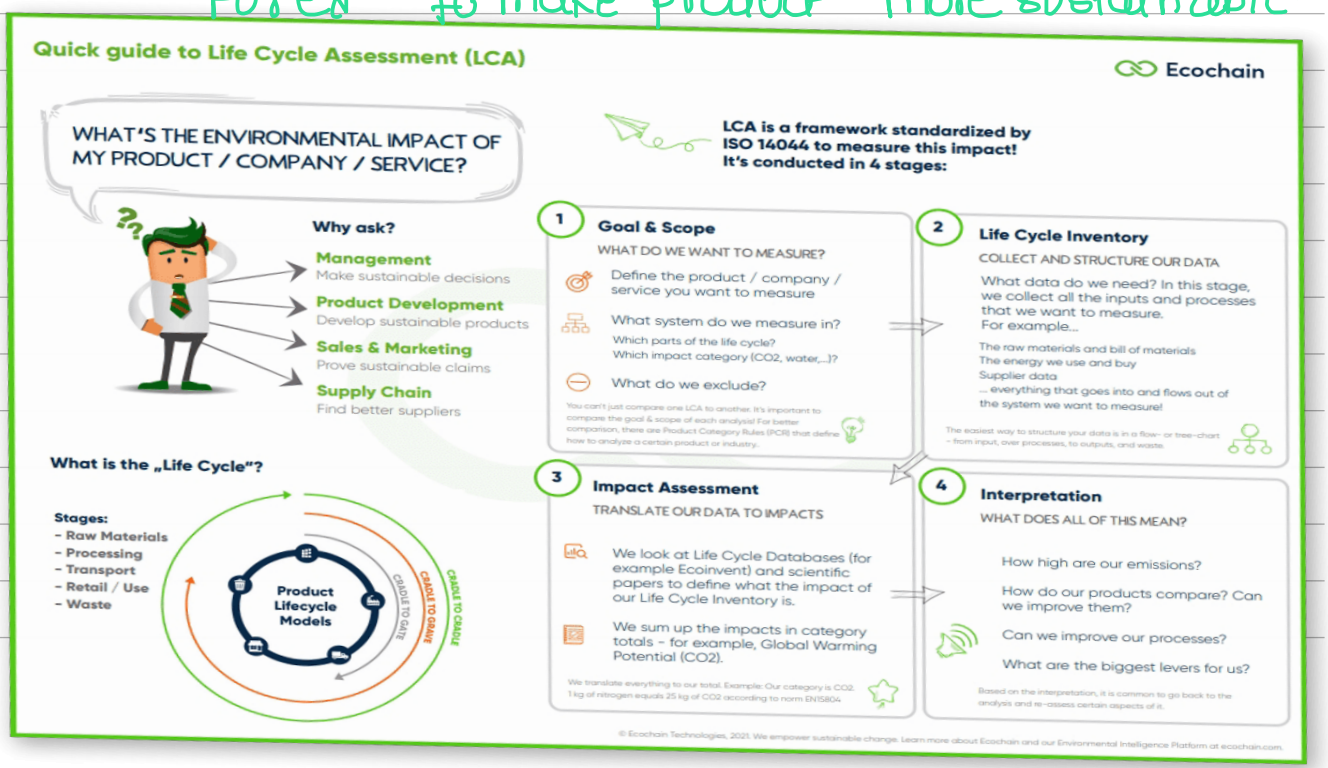
How do goods get produced

what about heating, water, ventilation.

And how it get transported via truck, rail ship

The goal of an LCA is to not only create data but also to facilitate

forex - to make product more sustainable.



Life Cycle Assessment (LCA) Explained Simply:

1. What is LCA?
   - It's a way to measure the environmental impact of a product, company, or service.
   - It follows rules set by ISO 14044 to ensure consistency.
2. Why do we use LCA?
   - To make sustainable decisions in management
   - To develop eco-friendly products
   - To back up claims about sustainability in marketing
   - To find suppliers who are better for the environment
3. The Four Stages of LCA:

a) Goal & Scope:

   - Decide what you want to measure and why
   - Choose which parts of the product's life to look at
   - Pick what kind of impact to focus on (like CO_2 or water use)
   - Decide what to leave out

4. b) Life Cycle Inventory:
   - Collect all the data about your product or service
   - Include things like raw materials, energy use, and supplier info
   - Organize this data in a chart showing inputs, processes, and outputs
5. c) Impact Assessment:
   - Use scientific databases to figure out the environmental impact
   - Add up all the impacts in categories (like global warming potential)
   - Convert different impacts into a common unit (e.g., CO_2 equivalent)
6. d) Interpretation:
   - Analyze what the results mean
   - Compare products or processes
   - Identify areas for improvement
   - Often leads to going back and rechecking parts of the analysis
7. The "Life Cycle" includes:
   - Raw Materials
   - Processing
   - Transport
   - Retail / Use
   - Waste
8. Important Notes:
   - You can't directly compare LCAs unless they have the same goals and scope
   - There are special rules (Product Category Rules) for analyzing specific products or industries

What is Carbon Foot Print ?

carbon footprint is like a measure of the "mark" we leave on the environment in terms of greenhouse gases, primarily carbon dioxide (CO_2). Here's a breakdown to help you understand it better:

What is it?
It's the total amount of greenhouse gases produced by our activities.
These gases contribute to global warming and climate change.
What does it include?
Direct emissions: Like the CO_2 from your car's exhaust.
Indirect emissions: Like the electricity used to power your home.
How is it measured?
Usually in tons (or kilograms) of CO_2 equivalent per year.
Other greenhouse gases are converted to their CO_2 equivalent for easier comparison.
Examples of what contributes to your carbon footprint:
Transportation (driving, flying)
Home energy use (heating, cooling, electricity)

Reducing environmental impacts through your product design is called ecodesign.
Ecodesign incorporates policy, regulations and customer demand, often

module 1 summary

In this module, you learned what LCA is and why it is valuable to you and your company. You also learned that LCA translates human activities into environmental impact, and that this information can be used in different ways in companies: for ecodesign, making valid sustainability claims, using more sustainable supply chains, and building a sustainability reputation.

LCA-Based on 14040 and ISO 14044 which are leading standard for LCA.

14040 - describes framework and principles underlying LCA, backbone of LCA.

14044 – supplements this backbone by prescribing requirements and guidelines for each phase of LCA framework.

1st phase Goal and scope –
alignment with goal, clearly defined and justified system boundaries.

2nd phase: Life Cycle Inventory Phase (LCI)
collecting all input and output data for lca model.

3rd phase: Lifecycle Impact Assessment phase (LCIA)
- env impact of accessed product or func calculated

4th Interpretation:
→ taken alongside above all three

Product Category Rules (PCRs)
To keep LCA results of products comparable within a product category, Product Category Rules (PCRs) exist. PCRs are usually formulated by a group of industry actors. PCRs are usually additional rules "on top" of other, more general standards: for example, the Dutch asphalt industry needs to comply with the Dutch construction standard (NMD Bepalingsmethode), but also has a PCR for more product-specific

- An EPD is a doc in which LCA study and its outcomes can be shared, the LCA is the study itself.
  → Environmental product declaration used for B2B communicam

- PEF - product env. footprint
  - intiative of EU, provides common methodology for env. impact assesment applies to various product groups

Phase 1: in detail → Goal and scope

- Your goal defines why you do your LCA and what you want to get out of this. Your goal guides your whole LCA process!
- Your scope defines exactly what and how you'll measure, which sets the plan of action for your study.

T
unit in which you are measuring product

1st define product system
2nd make flowchart
3rd decide boundaries

↖ (Goal)

Common reasons for conducting an LCA include:

- Using the LCA as a basis for ecodesign.
- Understanding the environmental impacts of an (existing) product.
- Understanding a company's environmental impact, setting sustainability targets and taking corporate decisions.
- Environmental claims and reporting, including the creation of EPDs and product comparisons.
- Creating a more sustainable supply chain.

The **intended audience for the LCA** should be stated too. This could include product designers, decision-makers inside or outside of the organization, regulatory bodies, customers or the general public. Specifically, **you need to state whether you want to share your results externally.**

Standards and Verification

he next decision you need to make is whether you want to get your LCA study **externally verified**. In the verification process, a **third-party certified verifier** assesses the LCA study according to the chosen standards, and issues a statement of verification if the study is compliant. Going this route is dependent on your goal: if you want to share your LCA results externally, you should probably get it verified.

1st

Define what you want to measure

Recall that LCA **quantifies** the environmental impact of a product or service. For this reason, we must establish a unit in which we want to measure this product or service: **the functional unit**. This concept is further explained in the video below.

Define the functional unit

A functional unit can be anything, as long as it quantifies the function you want to study, and is properly aligned with the goal and scope of the study.

Based on the goal of your LCA study, you might want to compare several **alternatives**. For example, let's say that you work at an orange juice factory, which has three different orange juice production lines. You've been given the assignment to compare the environmental impact of the production lines. This means that you have three alternatives **with the same functional unit**, for example: "The production of 1 liter pack of orange juice".

Alternatives could then be:

- Alternative 1: The production of 1 liter pack of orange juice made at production line A
- Alternative 2: The production of 1 liter pack of orange juice made at production line B
- Alternative 3: The production of 1 liter of orange juice made at production line C

It's important to establish which alternatives you want to include in your LCA study in order to achieve the goals of your LCA. For example, if your goal is to compare your product to more conventional alternatives, you need to make sure all the relevant conventional alternatives are

2nd

Define your product system

Once you have determined your functional unit and alternatives, it is time to define the **product system** of each alternative. This system includes all relevant activities necessary to achieve the alternative. Of course, you can't take the whole world into account in your LCA - this is why you have to set **system boundaries**. These determine what processes and activities are (and aren't) included in the assessment.

The first step is to **decide which "life cycle stages" of the product to include:** for example, raw material extraction, manufacturing, transportation, use and end-of-life disposal.

Examples of life cycle models:

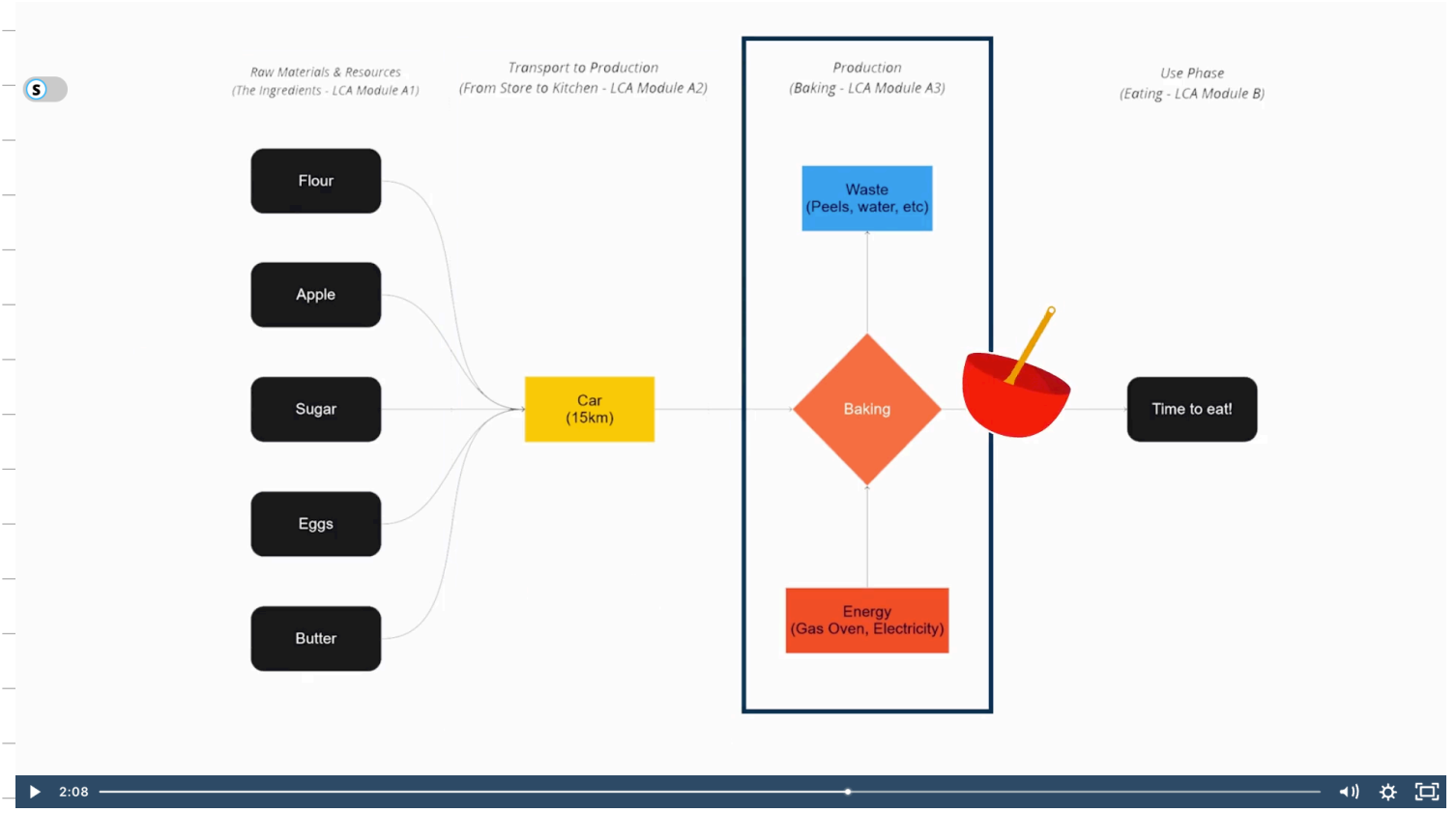
Cradle-to-gate

Cradle-to-gate assesses a product from raw material production until it leaves the factory gate. This means distribution, use and disposal are not included. This can provide valuable insights about the production impact of a product.

Cradle-to-grave (or full life cycle)
A cradle-to-grave model includes the full life cycle of the product, from raw material extraction (the "cradle") until the end of live waste treatment (the "grave").
Cradle-to-cradle

Cradle-to-cradle is a concept originating from the circular economy. It aims to transform traditional cradle-to-grave product systems into circular and regenerative ones, "closing the loop" of the product. Although it's not a life cycle model, it's important to realize that striving for more circular and regenerative product systems is vital to successfully lowering the footprint of a product.

3rd Create flowchart of system:
- input and output of product sys
ex 2. - show relation



- Summary of Phase 1:

In this module, you learned that you start your LCA with defining your goal and scope. Defining the **goal** involves documenting what you want to achieve and who your intended audience is. Setting the **scope** involves defining what you want to measure, what you'll include and exclude, and what your product system looks like. It is virtually impossible to set the perfect goal and scope at the start of the study. For this reason, you **can always adapt it** as you progress with your LCA.

Phase 2: Life Cycle Inventory (LCI)

The end result of this phase is the life cycle inventory (LCI), which is essentially a list of all the interactions of your product system with the environment. Think about resource extraction, and also any emissions to

Foreground and background data

In LCA, two types of data exist - foreground data and background data. **Foreground data** describes your product system in a technical way, while **background data** describes the environmental aspect of the system.

Foreground data

Remember the flowchart that we talked about in the goal and scope phase? Essentially, your studied product or service results from a system of inputs and outputs. Of course, if we want to calculate the environmental impact of a product or service, we need to quantify this system.

For example:

- How much electricity (kWh) do you need, and from which electricity source?
- How much material is used, and is this material produced?
- How much waste arises from your production process, and how is it treated?

You can best tackle this data collection per life cycle phase in your model. You can see the life cycle of your product as a stack of "building blocks" or processes. For each of these processes, you should make a table with the quantity of every input and output related to it. This comprises the foreground data of your LCA.

Background data

Background data is information on the environmental impact coming from a process or material. You might think: "Where am I supposed to get this data? I have no clue how my processes affect the environment!".

There are two potential sources of env. data-

Supplier data

Data from your own suppliers is of course the most representative for your situation. You should therefore ask your suppliers if they have **(verified) LCA results** (or EPDs) for their materials that you can use.

Even if your suppliers do not have any LCA results available, you can still use their data to create a more representative LCA. If the supplier is willing to share **foreground data** on their production process, such as electricity usages and amounts of material required, you can model their processes as part of your foreground system. This often requires a non-disclosure agreement (NDA), as this is likely confidential information.

Background data from LCI databases

If your suppliers are not able to provide you with any data, you can obtain secondary background data from databases. **LCI databases** can contain thousands of datasets, also called references, that represent average products from a certain geographical market. An example is **Ecoinvent,** a database based in Switzerland that has more than 18 000 datasets.

In some LCA software, the subscription to an LCI database is included (as is the case at Ecochain). For other software, you need to get a subscription yourself. There are also free databases available online, but these often contain limited amounts of datasets.

While collecting foreground and background data, document uncertainties, e.g., alternative numbers, number ranges, alternative datasets, and insecurities about which aspects to include or exclude. These notes are important for the interpretation phase of your LCA.

Making assumptions

Unfortunately, in virtually every LCA, you will encounter data gaps. For example, if you're a production company, and you want to do a full LCA, it is likely that you won't have a lot of information about the life of your product after it leaves the factory gates. This means that you need to make (educated) assumptions, sources such as industry averages or waste treatment policies, or some other (trustworthy) numbers you find the internet.

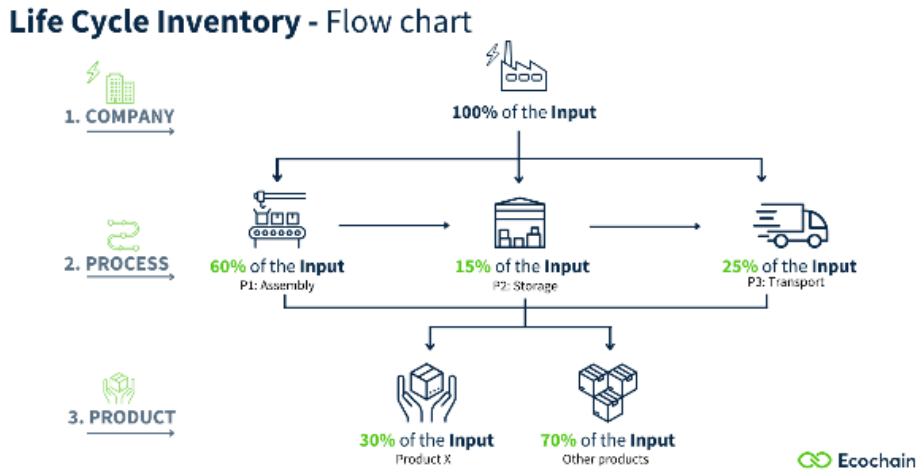
When making assumptions, it's important to always take a **worst-case approach.** Your LCA should rather than understate the impact of things you aren't certain of.

Always document the decisions and assumptions you make!

The role of LCA software

The LCI-phase is also the phase where LCA software usually comes into play. Simply put, all data needs to entered into the software, and foreground and background data need to be connected. Once this process has completed, you're well on your way to calculate your final environmental impact!

- Working with multifunctionality



This figure helps visualize multi functionality, which is in the third step (product) - 30% of the input goes into creating product X and 70% into other products.

The image shows a flow chart of a company's life cycle inventory. This means it tracks the resources used and waste produced throughout the company's operations.

Here's a breakdown:

1. **Company:** The company starts with 100% of the input (resources).
2. **Process:** The input is divided into three processes:
   - Assembly (60%): This is where the main product is made.
   - Storage (15%): Some resources are stored for later use.
   - Transport (25%): Resources are moved around for different processes.
3. **Product:** The final output is:
   - Product X (30%): The main product created by the company.
   - Other products (70%): Other products or byproducts created during the process.

Multifunctionality is when the same resources are used to create multiple products. In this case, 70% of the input is used to create both Product X and other products.

Allocation is the process of deciding how to allocate the resources used for multiple products. It can be subjective and should be avoided if possible.

Phase 2 summary:

In this module, you learnt that the life cycle inventory phase is about quantifying the product systems defined in the goal and scope phase. For this, you need to collect two types of data: foreground data, describing the technical aspect of your system, and background data, describing the environmental aspect of your system. Collecting this data can be a rocky road, and often leads to new insights. For this reason, it is important to document all decisions and assumptions that

3rd Phase: LCIA → Lifecycle Impact Assesment

The third phase of LCA is the life cycle impact assessment (LCIA). In this phase, the impact of the product or service you're assessing will finally be assessed!

Remember the **LCI** results from the last phase? The software will translate this list into **impact category** results. In this way, the data becomes meaningful – the numbers obtained reveal your product's **environmental footprint** in categories like climate change

In the LCI, all interactions with the environment in the studied system are summarized and listed. So far, so good. But this list usually contains thousands of lines, and it doesn't tell us anything about *how* these items affect the environment. This is where **impact categories** come in. These categories translate the LCI into the impacts that the emissions and extractions have on the environment. For example, in the impact category **climate change**, all emissions causing climate change are summed up into **one result with a common unit** (in this case kg CO_2-equivalent). This climate change result then tells you how big the climate change impact of your studied product

As you probably know, there are many more impact categories than just climate change.
We could start throwing around various impact category examples such as "eutrophication", "acidification", or "resource depletion"

The good thing is you don't have to become an expert on all of these categories. Doing LCA is not about knowing exactly how "eutrophication" or "acidification" works, but more about assessing impact category scores and comparing alternatives to find the most sustainable option.

LCIA methods provide collections of impact categories as well as the way these categories should be calculated. Luckily, our LCA software will do this calculation for you; all you need to do is select the method that fits your purpose.

The methods differ in three ways:

- The number and types of impact categories assessed
- How emission types are grouped ("**classified**" in LCA-lingo) into impact categories
- The way the impact category indicators are calculated ("characterized" in LCA-lingo – we'll get to this in a bit)

Let's take two LCIA methods as an example. **CML 2001**, one of the earliest LCIA methods, has 11 impact categories. Of those 11, one of the impact categories is eutrophication, which is about excess nutrients affecting the natural environment. The Environmental Footprint 3.0-method has 28 impact categories, of which three categories are on eutrophication: terrestrial eutrophication (eutrophication of land), freshwater eutrophication (eutrophication of lakes/rivers), and marine eutrophication (eutrophication of oceans/seas). This shows the difference in eutrophication classification between these two methods.

Table 1. Environmental impacts

Impact Category / Indicator	Unit	Description
Climate change – total, fossil, biogenic, and land use	kg CO_2-eq	Indicator of potential global warming due to emissions of greenhouse gases to the air. Divided into 3 subcategories based on the emission source: (1) fossil resources, (2) bio-based resources, and (3) land use change.
Ozone depletion	kg CFC-11-eq	Indicator of emissions to air that causes the destruction of the stratospheric ozone layer
Acidification	kg mol H+	Indicator of the potential acidification of soils and water due to the release of gases such as nitrogen oxides and sulfur oxides
Eutrophication – freshwater	kg PO_4-eq	indicator of the enrichment of the freshwater ecosystem with nutritional elements, due to the emission of nitrogen or phosphor-containing compounds
Eutrophication – marine	Kg N-eq	Indicator of the enrichment of the marine ecosystem with nutritional elements, due to the emission of nitrogen-containing compounds.
Eutrophication – terrestrial	mol N-eq	Indicator of the enrichment of the terrestrial ecosystem with nutritional elements, due to the emission of nitrogen-containing compounds.
Photochemical ozone formation	kg NMVOC-eq	Indicators of emissions of gases that affect the creation of photochemical ozone in the lower atmosphere (smog) catalyzed by sunlight.
Depletion of abiotic resources – minerals and metals	kg Sb-eq	Indicator of the depletion of natural non-fossil resources.
Depletion of abiotic resources – fossil fuels	MJ, net calorific value	Indicator of the depletion of natural fossil fuel resources.
Human toxicity – cancer, non-cancer	CTUh	Impact on humans of toxic substances emitted to the environment. Divided into non-cancer and cancer-related toxic substances.
Eco-toxicity (freshwater)	CTUe	Impact on freshwater organisms of toxic substances emitted to the environment.
Water use	m3 world eq. deprived	Indicator of the relative amount of water used, based on regionalized water scarcity factors.
Land use	Dimensionless	Measure of the changes in soil quality (Biotic production, Erosion resistance, Mechanical filtration).
Ionizing radiation, human health	kBq U-235	Damage to human health and ecosystems linked to the emissions of radionuclides.
Particulate matter emissions	Disease incidence	Indicator of the potential incidence of disease due to particulate matter emissi

How LCA results are calculated?

In the LCI, all elementary flows occurring in the studied system are summarized and listed. These elementary flows can be classified into different impact categories. For example, methane and carbon dioxide are both greenhouse gases, so these emissions are included in the impact category **climate change.** From the previous lesson, you might remember that at the end of the LCIA phase, you end up with **one climate change result with a common unit** (in this case kg CO2-equivalent).
Characterization

You might be wondering how these different elementary flows are translated into one impact category result? This is done through a process called **characterization**. Let's take the example above: we have both methane and carbon dioxide (CO_2) emissions to air, and we want to translate these into **a climate change result in kg CO_2-equivalent**. This means that we need to know how many kg CO_2-eq we need to calculate per kg of each emission. This is called a **characterization factor**. In this case, the characterization factor of carbon dioxide is 1 kg CO_2-eq per kg CO_2. Methane has a higher characterization factor, as it is a stronger greenhouse gas: 1 kg of methane is counted as 34 kg CO_2-eq.*

In short, characterization factors are conversion factors: they convert elementary flow data into the unit of the impact category. Characterization factors take the form of i

- Phase 3 summary:

In this module, you learned about the LCIA phase. You found that LCA results are divided into **different impact categories** and that they are calculated from the LCI. As a bonus, you might have learned how **characterization** of the **elementary flows** in the LCI works.

Apart from the total impact category results, LCA results have way more insights to offer. That's why we're telling you all about analyzing and interpreting your results in the next module!

Phase 4: Interpretation

Rather, the objective is **answering the questions related to the goal that you defined in the goal and scope phase**. Phase 4 of LCA, the **interpretation phase**, is meant to answer these questions.

For example:

- Looking at my environmental footprint, which parts of my product most affect its climate impacts?
- What materials are causing the most impact across my company's portfolio?
- Would switching to another supplier make a significant improvement?
- Are there environmental tradeoffs in switching to a more energy-efficient production technology?

The interpretation phase is also the opportunity to **look at your LCA model critically**.

For example:

- Is your model based on uncertain assumptions?
- What happens if these assumptions change?
- How do data quality issues affect the reliability of your interpretations?
- Are you satisfied with the quality of the model, or do you want to go back and improve certain aspects?

→ Interpretation is an Iterative Process.

While it's an important step at the end of your LCA, the interpretation phase is also an **iterative** process that takes place alongside all the other LCA phases. Throughout every LCA phase, you should critically consider what you're doing, and if everything until that point makes sense with the goal you want to achieve. If you notice any need for changes to your model, you might need to **revisit previous steps**.

With each iteration, your LCA gets better, and you'll gain reliable and relevant insights.

Analyze LCA results:

You don't need to know exactly what every impact category means to interpret LCA results. Instead of looking at the absolute numbers, LCA is meant for comparative use, allowing you to assess the environmental implications of different choices, designs, or competitor

Trade-offs between impact categories

Often, people have the ambition to improve on every impact category. However, LCA often uncovers trade-offs between different environmental impact categories. For example, switching from fossil electricity to solar reduces the impact in most categories, but it will increase the result for the depletion of minerals and metals, as solar panels require rare earth metals. This means that you need to make a decision about what you find more important: reduction in most categories, or an increase in resource depletion? Also, you could look into ways to mitigate the resource depletion effects. Maybe there are solar panels available that use less rare earth materials, or that use recycled material?

Find impact hotspots with contribution analysis

With **contribution analysis,** you asses which elements of your product system drive the biggest impact. These can include processes, materials and certain emissions. The elements causing large impacts are also called **impact hotspots**.

It makes sense to start your contribution analysis on a high level and work towards more detailed results. You can, for example, start by making a contribution analysis of the life cycle stages. If you, then, discover that the production and use stages make up the biggest part of the product impact, you could zoom in on the elements in these stages.

Depending on the goal of your LCA, you might also investigate other questions:

- Which **product life cycle stages** (or which Modules in the EN15804+A2) have the highest contribution to a specific impact category?
- Which **aspects** (materials or processes) **of your product system** have the highest contribution to a specific impact category? This is especially relevant for product designers because these aspects are where you can effectively improve your product

Check assumptions with sensitivity analysis

Throughout this course, we've stressed the importance of writing down decisions or assumptions. **In the interpretation phase, especially during sensitivity analysis, it's all about revisiting and critically reviewing these decisions and assumptions**. Unfortunately, in LCA, data is sometimes uncertain or lacking, and you might need to use numbers you found in some corner of the internet.

Draw conclusions

After all this analysis, your head is likely full of insights that you'd like to share with your intended audience. When it's time to report your findings, there are essentially two options in LCA: LCA study documentation and reporting for the intended audience.

Firstly, everything you have done while going through the phases of LCA needs to be documented in an **LCA background report**. Based on this report, somebody else should, in theory, be able to **replicate your entire LCA study.** If you're getting your LCA study verified, this report is critically assessed.

As you can imagine, the LCA background report contains confidential information, and it's lengthy and scientific. For this reason, it makes sense to share your results with your intended audience in a different way. For internal stakeholders, you could, for example, create a presentation or write a management summary. For external sharing you could create EPDs.

Phase 4 summary:

In this module, you learnt that the **interpretation phase** is an **iterative process**, that runs alongside the other phases of the LCA. It also is an important step at the end of the LCA to obtain insights in the impact of your LCA, and to check the quality and sensitivity of your model. You also learnt about **contribution** and **sensitivity analysis**.

Maybe you haven't realized it yet, but this was the last module of this course!

→ CSRD - Corporate Sustainability Reporting Directive.

CSR - Corporate Social Responsibility.

NFRD - Non-Financial Reporting Directive

SFDR - Sustainability Accounting Standard Board

- CSRD first founded in 2021 by EU laid groundword by proposing CSRD.
- Construction plans (April 2022)

EFRAG - European Financial Reporting Advisory Group published first draft

- The European Parliament adopted CSRD in NOV 2022.

The Goal of CSRD.

This directive is essentially creating a standardized way for companies to report their environmental and social impact, just like how restaurants must display standardized health ratings. The goal is to make sustainability reporting as normal as financial reporting.

Content Requirements (Think of it like a Restaurant's Operations):

1. **Double Materiality Assessment**
   - Like considering both:
     - How your restaurant impacts the environment (using plastic vs. biodegradable containers)
     - How environmental changes affect your restaurant (rising food costs due to climate change)
2. **Business Models & Strategy**
   - Like your restaurant's menu planning and cooking methods
   - Example: Using local ingredients, reducing food waste
3. **Transition Plans & Targets**
   - Like having a plan to:
     - Switch to solar power by 2025
     - Reduce water usage by 30% in two years
4. **Business Operations & Value Chain**
   - Like tracking everything from:
     - Where you source your ingredients
     - How you store them
     - How you dispose of waste
5. **Due Diligence Processes**
   - Like checking if your suppliers follow ethical practices
   - Example: Ensuring farmers use sustainable methods

Scope (Who needs to report?):

- More businesses need to report, including smaller companies (SMEs) and non-EU companies
- Like how even small food trucks need to follow health regulations, not just big restaurant chains

New Addition:

- Proper auditing and verification processes
- Like having health inspectors regularly check restaurants

Imagine a Farmers' Market Story:

Think of CSRD like creating new rules for a huge farmers' market where:

- Big supermarket chains (large companies)
- Local farm stands (SMEs)
- International food vendors (non-EU companies) All need to report how "green" and sustainable their practices are.

The Key Challenges (Current Problems): Imagine three common problems at the market:

1. **No Standard Labels**: Every vendor uses different ways to show if their products are organic (Like lack of harmonized standards)
2. **Hidden Information**: Some vendors don't share where their produce comes from (Like lack of transparency)
3. **Communication Gaps**: Farmers don't know what customers want, customers don't know farmers' methods (Like gaps in data flows)

The Solution (CSRD Objectives): Now imagine the market manager introduces new rules:

1. **Common Language** (Convergence and harmonization):
- Like creating standard labels that all vendors must use
- Example: A universal "eco-friendly" rating system from 1-5 stars
2. **Clear Information** (Strengthen data availability):
- Like requiring all vendors to display detailed information boards
- Example: Must show water usage, pesticide use, food miles
3. **Money Flow** (Reduce systemic risks):
- Like creating a special section for sustainable vendors
- Example: Giving prime spots to vendors who use eco-friendly practices

- NFRD (Old System):
  - Like basic health inspections checking:
    - Kitchen cleanliness (Environmental protection)
    - Staff treatment (Social responsibility)
    - Fair wages (Human rights)
    - No under-table dealings (Anti-corruption)
    - Kitchen staff diversity
- CSRD (New System) adds:
  - Complete business plan (Strategy & targets)
  - Impact tracking (How your restaurant affects local farmers and how climate affects your supplies)
  - Detailed documentation of all processes

2. Coverage (Scope)

- NFRD: Covered 11,700 restaurants (like only checking major chains)
- CSRD: Expanded to 49,000 restaurants (including smaller restaurants and food trucks)

Think of it like expanding food safety rules from just big chains like McDonald's to including local diners too!

3. Reporting Standards

- NFRD: Like each restaurant using their own way to report cleanliness
- CSRD: Standardized reporting system (ESRS) - like having a universal hygiene rating system

4. Quality Check (Audit/Assurance)

- NFRD: Optional inspections
- CSRD: Mandatory regular inspections with detailed reports

5. Report Location

- NFRD: No specific place for reports
- CSRD: Reports must be in the main business document (like posting health ratings at the front entrance)

6. Format

- NFRD: PDF files (like paper records in a folder)
- CSRD: Digital format (like a modern app tracking everything)

TECHNICAL DEFINITIONS:

1. EU Taxonomy → ex: what makes product sustainable?

- Definition: A classification system establishing a list of environmentally sustainable economic activities with clear criteria for "substantial contribution" and "Do No Significant Harm" (DNSH) principles.
- CSRD Connection: Built to align with these classification criteria and Article 8 reporting requirements.

2. SFDR (Sustainable Finance Disclosure Regulation) → ex- what materials used potential harms.

- Definition: A regulation requiring financial market participants to disclose how they integrate sustainability risks and consider adverse sustainability impacts.
- CSRD Connection: Provides the ESG data points necessary for Principal Adverse Impact (PAI) assessments under SFDR. Environme Social Governance

3. CSDDD (Corporate Sustainability Due Diligence Directive) ex- where materials resour came from, impact of transportation

- Definition: A directive establishing rules for companies to identify, prevent, and mitigate human rights and environmental impacts in their value chains.
- CSRD Connection: Works in parallel with CSRD, both following UN Guiding Principles on Business and Human Rights and OECD Guidelines.

4. EU Benchmark → various impact factors, quality

- Definition: Standards for measuring and comparing sustainability performance across financial products and organizations.
- CSRD Connection: Aligns sustainability reporting standards with EU Benchmark disclosure requirements.

5. EBA Pillar III → social responsibility, env. practices.

- Definition: Banking sector requirements for disclosure of ESG risks as part of prudential reporting.
- CSRD Connection: Follows the same EU Taxonomy alignment approach.

6. EU Green Bonds Standards → use recycle resources, minimize waste

- Definition: A voluntary standard for high-quality green bonds financing sustainable projects.
- CSRD Connection: Uses the same EU Taxonomy alignment approach for sustainability criteria.

These regulations work together like different aspects of a comprehere sustainable product development, each focusing to spectfic areas but all contributing to same goal of sustainability and transparency.

The main components of CSRD:

→ Who is subject to CSRD? When do they need to comply and where.

CSRD Implementation Timeline:

Phase 1 (2024):

- Scope: EU large public-interest companies (NFRD companies)
- Criteria:
  - 500 employees AND
  - Either €40M turnover OR €20M balance sheet

Phase 2 (2025):

- Scope: Large EU companies (listed and non-listed)
- Criteria (need 2 of 3):
  - 250 employees
  - €40M turnover
  - €20M balance sheet

Phase 3 (2026):

- Scope: Listed SMEs
- Criteria (need 2 of 4):
  - 50 employees
  - €8M turnover
  - €4M balance sheet
  - Optional opt-out until 2028

medium sized enterprises (SME's)

Phase 4 (2028):

- Scope: Non-EU companies
- Criteria:
  - €150M+ EU turnover AND
  - EU branch with €40M+ turnover OR
  - Qualifying subsidiary

PRACTICAL EXAMPLE:
Imagine a European retail corporation structure:

ParentCo (Major Retail Group)

- Headquarters in Paris
- 1000 employees
- €100M turnover

SubsidiaryCo (Local Store Chain)

- Based in Germany
- 300 employees
- €45M turnover

Reporting Requirements:

1. ParentCo must:
   - Submit full CSRD report from 2024
   - Include SubsidiaryCo's data in consolidated report
2. SubsidiaryCo must only:
   - State "ParentCo, 123 Retail Street, Paris" in their report
   - Provide link to ParentCo's consolidated report
   - Reference their exemption status

Subsidiary Exemption Rules:

- Definition: A provision that allows subsidiary companies to be exempt from individual CSRD reporting if their parent company includes their data in a consolidated management report.

Required Management Report Elements:

1. Parent Company Information:
   - Full registered name
   - Official registered office location
2. Documentation Requirements:
   - Weblinks to consolidated management report
   - Explicit reference to the exemption being used

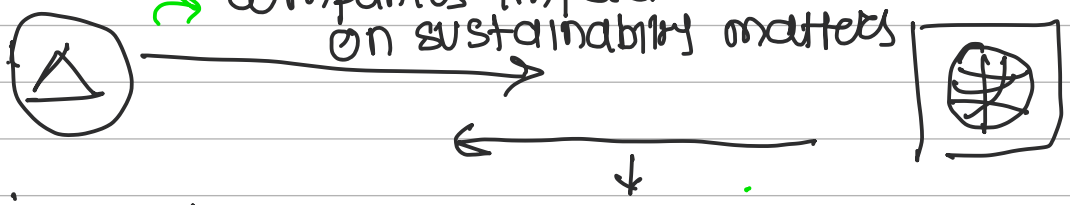
→ Where do companies need to report sustainability info and in which format?

under NFRD	under CSRD
No reference as to where to report	→ to be included in management report - in digital machine readable format. - to be made available on company website free of charge.

→ What is covered by CSRD.

Double Materiality core concept of the CSRD

↷ Companies impact on sustainability matters



environmental → impact on comp. development performance and position.