

Life Cycle Assessment (AG2800)

Lecture 2

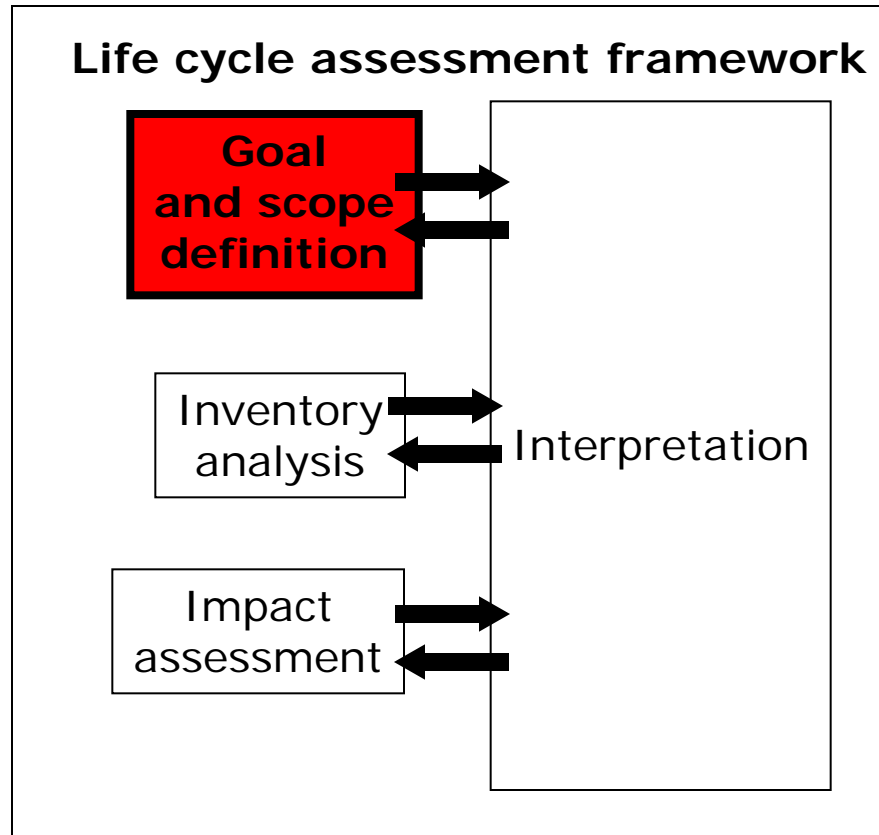
1st hour:

Goal and scope definition (to be continued at L3)

2nd hour:

Project start-up (find topics, form groups)

Goal and scope definition



Source: ISO 14040:2006

Goal definition

Purpose

- What is your research question or hypothesis?
- Rationale (Why is this important?)

Intended application

- Reasons for carrying the study?
- How do you intend to use the results?

Intended audience

- To whom do you intend to present the results?

*Will affect
methodological
choices and
requirements*

Complete Life Cycle Assessment of North American Container Glass

(The Glass Packaging Institute, 2010)

Goal

- Establish a clear understanding of the environmental impact of container glass at all stages of the life cycle
- Develop realistic and tangible targets for improvement.
- Participating in and contributing to LCA discussions with customers, distributors, retailers, industry, regulators and other stakeholders.
- Engendering complete life cycle thinking in the packaging industry.
- Measuring the importance of recycling of glass.



Opportunities for environmentally improved asphalt recycling: the example of Sweden

(Miliutenko et al, 2013)

Goal

Identify and evaluate the potential for improving treatment of reclaimed asphalt pavement in Sweden, from a life cycle environmental perspective

Life cycle assessment of a novel hybrid glass-hemp/thermoset composite

(La Rosa et al, 2013)

Goal

- To determine if the use of a hybrid composite, using natural fibres has reduced environmental impacts compared to the standard glass fibre composite
- To identify key parameters and phases in the whole life cycle of the elbow-fittings in order to suggest measures to improve the ecological efficiency of the product
- To perform various disposal scenarios of the elbow-fittings (incineration, landfill and recycling) in order to find ways to optimise this part of the life cycle

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Single system or comparative (not in ISO)

Single system vs. comparative LCA

Single system (stand-alone) LCA

- **Type of questions:** Establish baseline of a single product/service. Identify "hot spots" and improvement opportunities.
- **Analysed unit:** Precise (quantified) definition of product/process.
- **Scope:** Entire life cycle must be included

Comparative LCA

- **Type of questions:** Compare different products or services providing the same (or similar) function.
- **Analysed unit:** Quantified measure of *function* of product/process. Must take into account differences in properties of compared products/services.
- **Scope:** Similar processes or life cycle phases can be omitted.

Scope definition

- **Precise definition of product or service**
- **Functional unit**
- Initial flow chart
- System boundaries
- Impacts and impact assessment model
- Data requirements
- Assumptions, limitations, allocation methods
- Peer review procedure

Functional unit according to ISO and ILCD

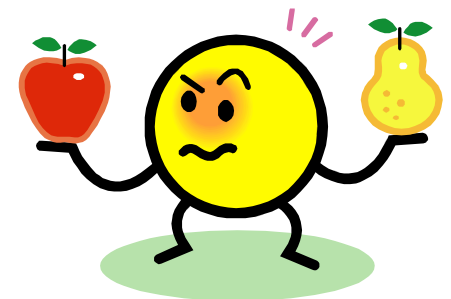
ISO 14040

- Necessary to ensure comparability of LCA results.
- Quantified measure of the function(s) of the product/service system.
- Requires precise definition of product/service
- Reference to which the inputs and outputs are related.

ILCD Handbook

The functional unit shall be specified across the following:

- Function provided (what)
- In which quantity (how much)
- For what duration (how long)
- To what quality (in what way and how well is the function provided)



Complete Life Cycle Assessment of North American Container Glass (The Glass Packaging Institute, 2010)

Product

North American container
glass

Type of LCA

- Single system LCA (the current system)

Functional unit

1 kg container glass

Unquantified aspects

- Aesthetics
- Durability



Opportunities for environmentally improved asphalt recycling: the example of Sweden

(Miliutenko et al, 2013)

Service

Handling and treatment of reclaimed asphalt pavement (RAP)

Type of LCA

- Comparative LCA (various technologies)

Functional unit

- Treatment of 1 ton of RAP

Unquantified aspects

- Convenience of process

Life cycle assessment of a novel hybrid glass-hemp/thermoset composite

(La Rosa et al, 2013)

Product

- bio-based composite

Functional unit

- One elbow fitting used in the sea water cooling pipeline of a Sicilian chemical plant, with an estimated life of 20 years.

Unquantified aspects

- Ease of manufacturing

Type of LCA

- Comparative LCA (different materials for piping)



Work in pairs

Define possible goal & scope of an LCA concerning either

- **Residential house**
- **Renewable fuel**



Purpose

Intended application

Intended audience

Single system/comparative

Attributional/consequential

Functional unit

- What function?
- How much?
- How long?
- To what quality?

Unquantified aspects

Goal: Residential building LCA

Determine:

- relationship between material fabrication/ construction energy, and use phase energy in a “standard” residential home.
- how total life cycle energy and GWP of a “standard” residential home varies with changes to various home systems (walls, roof, floor, appliances, etc.).
- which home system improvements provide the greatest reductions in life cycle energy and GWP.
- how home maintenance and improvement projects impact the life cycle energy and GWP of such a building.



FU: Residential building LCA

Functional unit

- Stand-alone: A specified building
- Comparative: No and size of apts, no of floors, indoor climate and light, life time

Unquantified aspects

- aesthetics
- noise



Goal: Renewable fuel LCA

Comparison of the energy and GHG emission impacts of bio-based diesel and gasoline relative to those of petroleum-based diesel and gasoline.



FU: Renewable fuel LCA

Functional unit

- Stand-alone: 1 litre of bio-diesel from Brazilian sugar cane.
- Comparative: Fuel to drive a compact car 100 km

Unquantified aspects?

- Driving distance before refuelling.
- Engine functioning in cold weather.
- Employment in fuel producing country



Goal definition

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Single system or comparative (not in ISO)

Attributional or consequential (not in ISO)

Attributional vs. Consequential LCA

Attributional (accounting, book keeping)

Describes system as it can be observed (historical, current, or future)

- **Type of question:** Determine potential environmental impacts of a product/service.
- **Scope:** Data and system boundaries describe the system *as it is* (or *was*, or *will be*).
- **Data:** Average data (representing average environmental burden from total production volume).

Consequential (Change-oriented)

Describes consequences of a change

- **Type of question:** Determine *consequences* of choosing alternative A instead of alternative B.
- **Scope:** Data and system boundaries describe the changes
- **Data:** Marginal data (representing environmental burdens when production volumes change).

About projects

1. **4 supervision meetings** (all compulsory!)
2. **6 computer labs** (5 compulsory)
3. **Report**
4. **Pre-seminar**
5. **Final seminar**
6. **Work load:** in total about 3.5 weeks full time work
7. **More info about projects in Canvas**
 - Course memo
 - Instructions for supervision meetings
 - Instructions for report
 - Project group agreement

Project topics

Examples:

- **Specific question** related to the life cycle of a product/service.
- **Product/service** that you are interested in (no specific question)
- **Topic area** that you are interested in

Last year's topics

- Attending a meeting in Copenhagen
- Providing Milk to Customers
- Comp. LCA of bio-based caps from sugar cane and petrochemical caps
- Comp. LCA of bioethanol from cane molasses in Indonesia and seaweed in Sweden for Swedish transport sector
- Comp. LCA of cotton vs. synthetic T-shirts
- Comp. LCA of biogas vs. diesel buses
- Comp- LCA of wall: 3D-printed vs. in-situ
- Comp. LCA of curbstones: concrete vs. granite
- Comp. LCA of end-uses of biogas from Henriksdal

Brain storm for project ideas and form groups

1. Students present one idea at a time
2. Ideas are clustered in topic areas
3. Select topic (write name on white board)
4. Anna will split in groups of 4, assign group number and supervisor
5. Hand in: topic, group number, group members
6. Fill in "Project group agreement"

**Do not leave the room until
you belong to a project group!!!**

Computer lab (C1)

- Instructions in Bilda
- Work in pairs from your project group