Exercise 4b.1: Defining basic steps in a lifecycle assessment

Estimated time requirement: 10 minutes

Introduction

Lifecycle Assessments (LCAs) is a framework for assessing the environmental impacts of product systems and decisions from raw material acquisition through the end of life. A simplified lifecycle of a product typically starts with the extraction of raw materials, followed by production, distribution, consumption/use and the end of life. Typical environmental impacts analysed as part of LCAs can include (but are not restricted to) greenhouse gas emissions (e.g. measured in CO2-equivalents), water requirements (e.g. in m^3), land use requirements (e.g. in km^2) and energy requirements (e.g. in kWh).

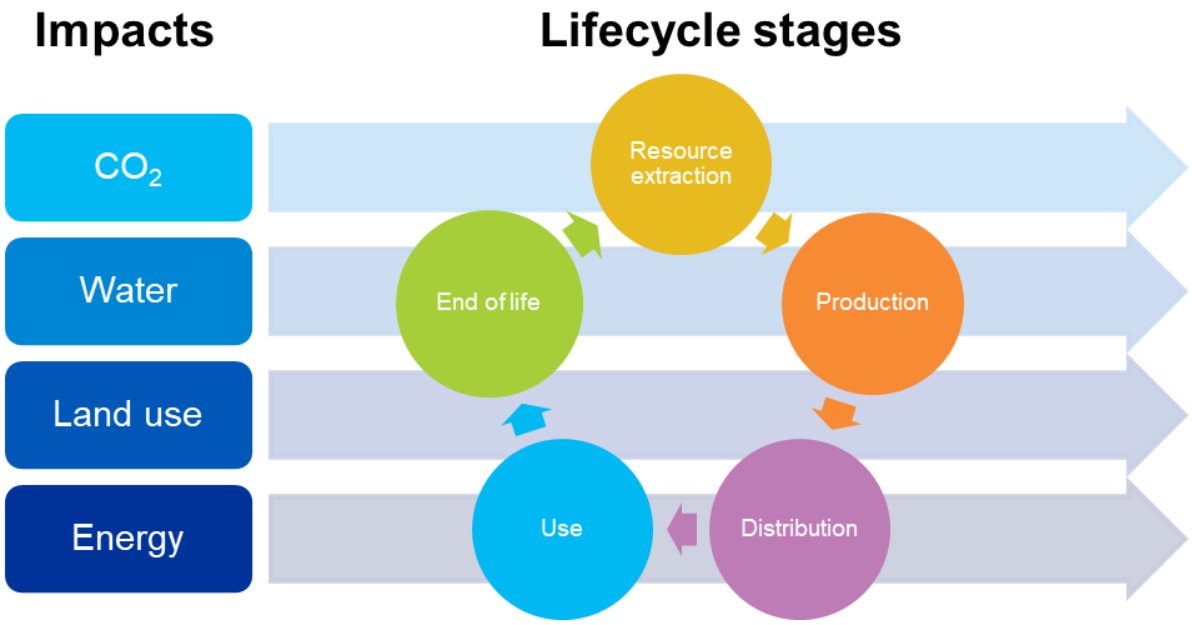

Figure 1: Conceptual framework of a simplified LCA

According to the standard "ISO14044:2006 Environmental management — Lifecycle assessment — Requirements and guidelines", LCAs are conducted in four steps. In step 1, the goal and scope of the LCA are define. In step 2, a lifecycle inventory analysis is conducted. Step 3 comprises the actual lifecycle assessment, followed by interpretation (step 4). Details steps are displayed in the figure below.

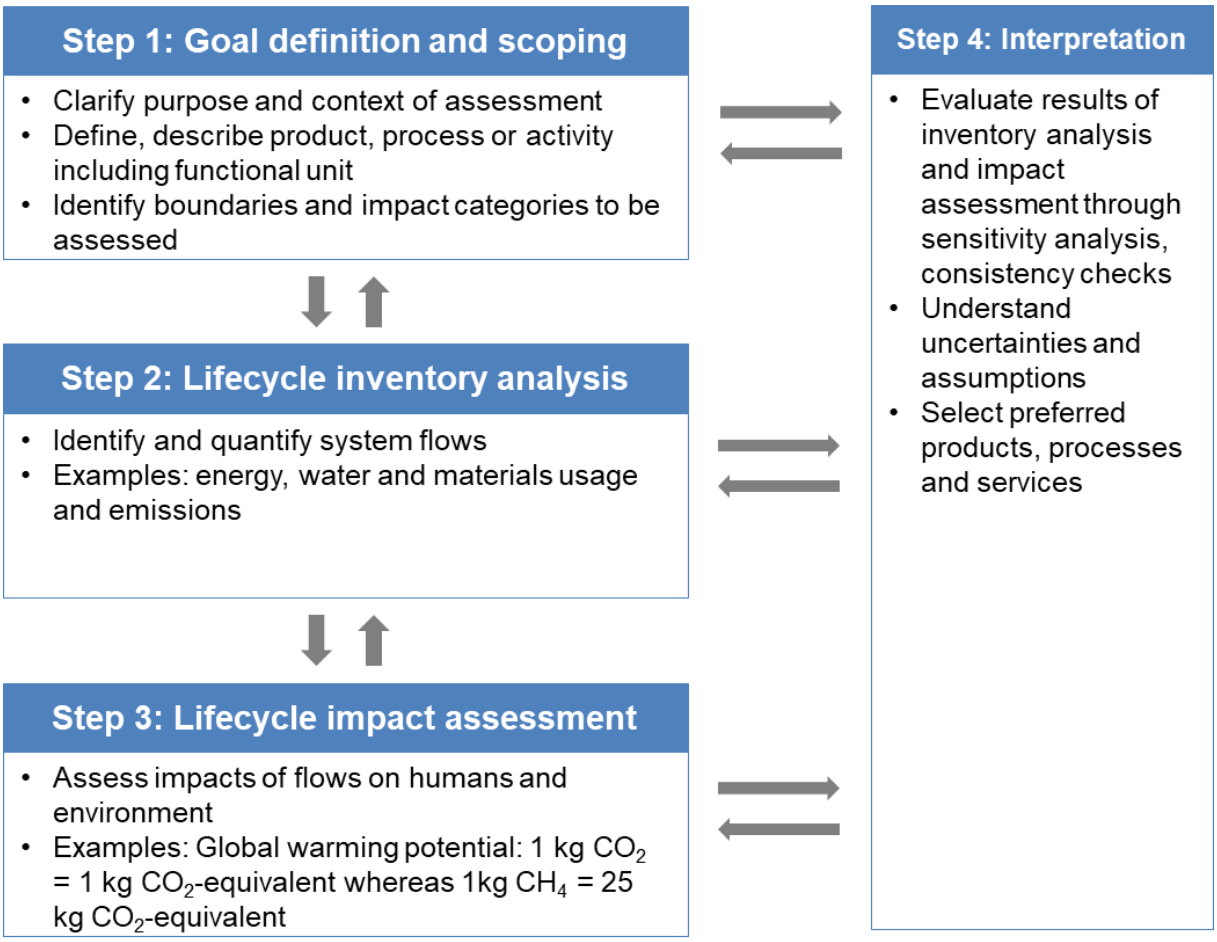

Figure 2: Steps and activities in a simplfied LCA

Task

Please form groups of 2-3 people and examine the template on the next page. Using the example of a comparative LCA for two mobile phones of your choice, please define the activities in steps 1-4 by referring back to the terminology presented earlier (e.g. functional unit, impact categories). Think of fictional examples in each step and capture your thoughts by using the templates displayed in figure 3 below. Note that quantities (e.g. CO2-equivalents) can be entirely fictional and will be discussed with the entire course upon completion. Finally, discuss where you expect the largest impacts to occur.

Step 1: Goal definition and scoping

- „targetting two new high-end smartphones by Sony (models Z3 and Z5) with accessories but without network usage“
- „funtctional unit is set to life time usage (3 years) for a representative usage scenario“
- „All life cycle stages and processes are included in […] except reconoditioning mobile phone for reuse“
- „the environemtal life cycle assessment indicators are chosen as presented in Table 1“

ELCIA indicators as recommended by ILCD	Unit
Global Warming Potential **(GWP)**	CO_2-eq.
Ozone Depletion Potential **(ODP)**	CFC-11-eq.
Human Toxicity Cancer potential effects **(HumToxCan)**	CTUh
Human Toxicity non-Cancer potential effects **(HumTox)**	CTUh
Particulate Matter (2.5 µm) **(PM)**	G
Photo-Oxidant Creation Potential **(POCP)**	NMVOC-eq.

Step 2: Lifecycle inventory analysis

Raw materials acquisition:

- Primary materials, packaging materials for parts and final delivery, virgin and recycled inputs

Production:

- Parts production, packaging and transportation, assembly, ICT manufacturer support abilities, distribution

Use:

- Smartphone energy consumption based on Sony Data, associated use of networks

End of life:

- Open to explore different scenarios in this section (e.g. 90 % recycled, 10% virgin materials, or 20% recycled materials and 80% virgin materials)

Based on another study: Liebmann, A., 2015 ICT Waste Handling: Regional and Global End-of-Life Treatment Scenarios for ICT Equipment

Step 3: Lifecycle impact assessment

Results of impact category „global warming potential (GWP)“:

- Total GWP of the device based on functional unit (3 years) for model Z5 is 57 kg CO_2-eq and for model Z3 is 50 kg CO_2-eq
- Production stage of dominates GWP
- End of life stage can be carbon-negative if contents are recycled or plastic is incinerated and substitutes fossil fuels

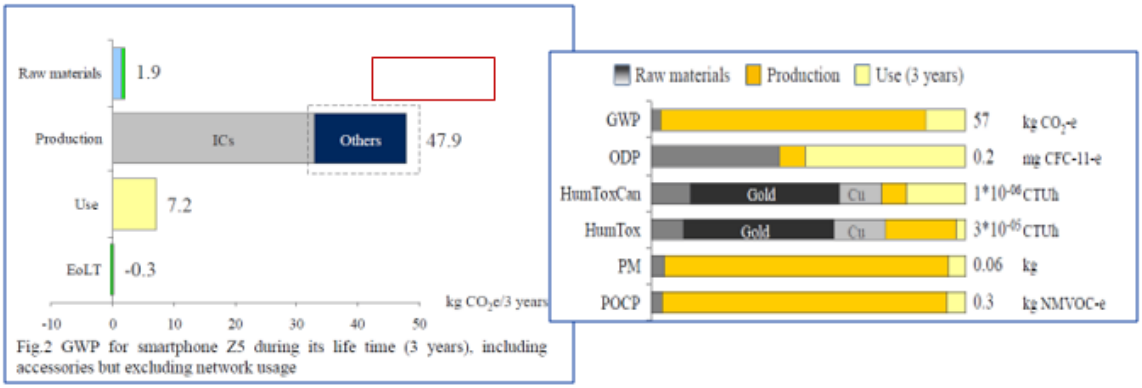

Fig.2 GWP for smartphone Z5 during its life time (3 years), including accessories but excluding network usage

Step 4: Interpretation

Interpretation and sensitivity analysis

- production and use impact influences outcomes to a high degree due to electricity consumption
- raw material toxicity impacts are dominated by gold and copper mining

Impacts from gold modelling depends on data base

- Ecoinvent assumes leakages of metals based on the conditions of one mine in South America for which mining tailings and dams are assumed to constantly leak or even break
- GaBi model represents a modern Northern Europe mine and smelter with no leakages whatsoever

GaBi Product Sustainability Performance

ecoinvent