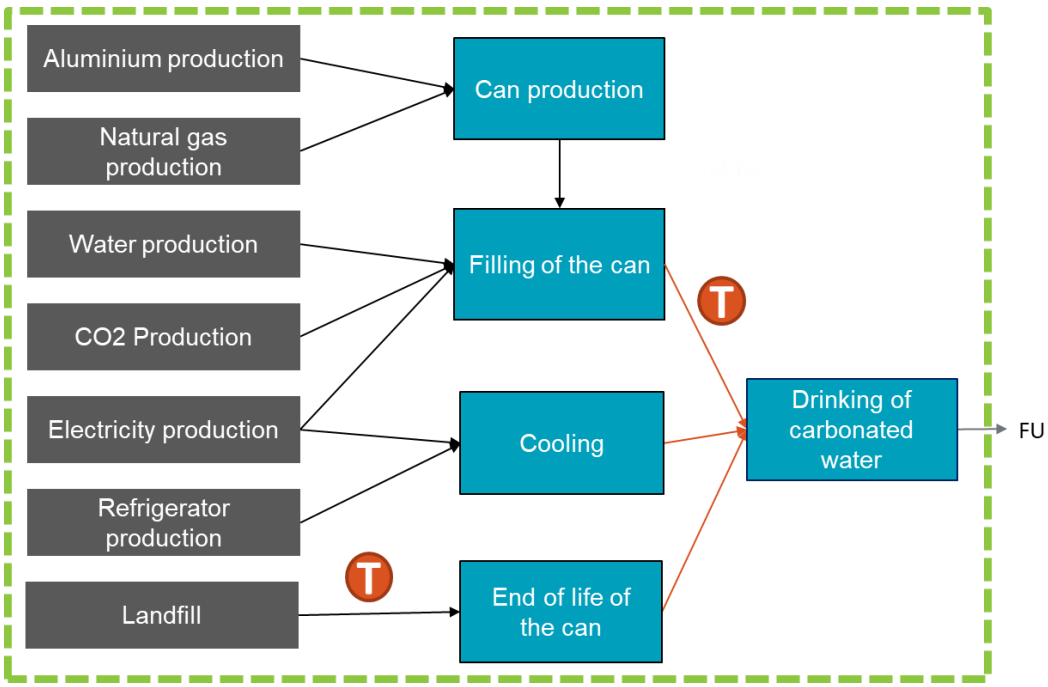
Lab3 – Modeling the recycling

Context: Carbonated water can

During the first lab, we have calculated and modeled on openLCA the carbon footprint of a carbonated water. In the second lab, we have adapted the aluminium production process to a more realistic process (Quebec and China) and compared the new results to the old one. So far, we assumed that the can was simply landfilled

During this lab, we will calculate and model recycling of the aluminum can according different scenarios and approaches (end of life recycling / recycled content).



Data

- The mass of an empty can is 13 g
- The yield of the collecting sorting and cleaning process is 80%
- The yield of the recycling process is 99%
- The GWP of CH_4 is 29.7 kg CO_2e / kg CH4

Environmental data are grouped in next table:

Processes	Elementery flow		Unit
	CO2	CH4	
Primary aluminium	1.06E+01	1.72E-02	kg/kg aluminium
Collecting, sorting and cleaning of aluminium scrap	0.29623	0.00924	kg/kg aluminium
Aluminium recycling	9.58 E-01	2.21 E-02	kg/kg aluminium
Landfill	2.32 E-02	9.8 E-04	kg/kg waste

Results from lab 1 are represented in the next table :

Stage	Flow	kg COeq	Total
Can production	aluminium, primary, ingot	1.45E-01	
	natural gas, high pressure	1.34E-03	
	electricity, high voltage	7.31E-03	
	Carbon dioxide, fossil	5.70E-03	1.59E-01
Filling of the can	Tap water	3.72E-04	
	electricity, high voltage	2.19E-03	
	carbon dioxide, liquid	1.72E-02	
	transport, freight, lorry, unspecified	7.43E-03	2.72E-02
Cooling of the can	Refrigerator	3.45E-04	
	electricity, low voltage	1.60E-03	1.94E-03
End of life	transport, freight, lorry, unspecified	2.64E-03	
	municipal solid waste	1.24E-02	1.51E-02
		Total	**0.203453**

Question 1: Calculation by hand (100% primary / 75% recycling)

Adapt the process tree to integrate the recycling of the can (100% primary / 75% recycling and calculate the new carbon footprint according to:

I. End of life recycling approach
II. Recycled content approach

Question 2: Calculation by hand (60% primary / 75% recycling)

Adapt the process tree to integrate the recycling of the can (60% primary / 75% recycling) and calculate the new carbon footprint according to:

I. End of life recycling approach
II. Recycled content approach

Question 3: Results comparison

Compare results with previously carbon footprint from lab1? Which approach is the most appropriate for each scenario?

Question 4: openLCA (60 % primary / 75% recycling)

Model both approaches on openLCA by adapting lab 1 system and using those specific flows and processes:

aluminium, wrought alloy	treatment of aluminium scrap, post-consumer, prepared for recycling, at remelter | aluminium, wrought alloy | Cutoff, S - RoW
aluminium scrap, post-consumer, prepared for melting	treatment of aluminium scrap, post-consumer, by collecting, sorting, cleaning, pressing | aluminium scrap, post-consumer, prepared for melting | Cutoff, U