Lab1 – Define the scope and model the carbon footprint of Aluminum cans of carbonated water

Lab objectives:

- Get familiar with basic concepts of LCA
- Quantify reference flows, intermediate flows and elementary flows of a simplified product system
- Calculate by hand (or using Excel) the inventory of a simplified product system as well as the associated environmental impacts
- Briefly interpret study case results
- Model a “cradle-to-grave” system for cans of carbonated water on OpenLCA (Lab1 case study)
- Introduce the process to obtain lifecycle impact assessment results in OpenLCA

Context: cans of carbonated water

You want to **calculate the cradle-to-grave carbon footprint of cans of carbonated water** produced in the United States (Portland, Maine). You have access to information (primary data) on the production processes of aluminium cans and on the filling process. You also have access to aggregated data for a series of products (electricity, aluminium, water, etc.)

Context and LCA hypotheses

- Your objectives are to:
  - Calculate the cradle-to-grave carbon footprint of cans of carbonated water produced in the United States
  - Identify areas of improvement
- The scope of the study is as follows:
  - Function: to drink a can of carbonated water
  - Functional unit: Drinking 1 can of carbonated water refrigerated of 355ml
- Here only CO2 and CH4 emissions will be considered in the calculation of the carbon footprint
- The global warming potentials (GWP) considered in the calculation of the carbon footprint are as follows (IPCC, 2013):
  - GWP CO_2: 1 kg CO_2e/kg CO_2
  - GWP CH_4: 29,7 kg CO_2e/kg CH_4

Data available

The following tables provide data on the production, filling, use and end-of-life of cans as well as data on the production of the various inputs for these processes. Here are a few additional pieces of information:

- The emission factor related to the combustion of natural gas is 1.9 kg CO_2/Nm^3 natural gas.
- We assume that the cans are 100% virgin aluminium.
- We assume that there are no aluminium losses during the production of the empty cans.

- We assume that all of the filled cans will be consumed.
- We suppose that all of the cans at the end-of-life will be landfilled.
- The cans are refrigerated for one week during the use phase.
- The volume of the refrigerator is 290 litres and the lifespan of the fridge is 15 years. A refrigerator consumes 288 kWh/year.
- The transport between the production of the can and the use of the can is assumed to be 30 km.
- Other inputs (lubricants, solvents, etc.) are assumed to be environmentally negligible.

Unit processes	Flow type	Flow	Quantity	Unit
Filling of cans of carbonated water	Intermediary flows - Outputs	Can of carbonated water	1	Can
	Intermediary flows – Inputs	Electricity	9	Wh
		Tap water	0.355	L
		Pressurized CO_2	0.2	G
		Empty aluminium can	1	Can
Production of an aluminium can (including rolling)	Intermediary flows - Outputs	Empty aluminium can	1	Can
	Intermediary flows – Inputs	Electricity	30	Wh
		Natural gas	0.003	Nm3
		Aluminium	13	g
	Elementary flows	CO_2	**Tbd**	gCO2
Use of a can of carbonated water	Intermediary flows - Outputs	Can of carbonated water used	1	Can
	Intermediary flows – Inputs	Can of carbonated water	**Tbd**	Can
		Can at end-of-life	**Tbd**	Can
		Refrigerated can	**Tbd**	Can
		Transport	**Tbd**	tkm
Refrigeration	Intermediary flows - Outputs	Refrigerated can	**Tbd**	Can
	Intermediary flows – Inputs	Electricity	**Tbd**	kWh
		Fridge	**Tbd**	fridge
End-of-life of can	Intermediary flows - Outputs	Can at end-of-life	1	Can
	Intermediary flows – Inputs	Transport	3.9 E-04	tkm
		Aluminium landfilled	13	g

Aggregated processes	Elementary flows		Unit	Ecoinvent 3.6 process
	CO_2	CH_4		
Tap water (RoW)	9.80E-04	2.30E-06	kg/m^3 potable water	market for tap water | tap water | Cutoff, S - RoW
Pressurized CO_2 (RoW)	5.18E-01	1.15E-02	kg/kg CO_2 (pressurized)	market for carbon dioxide, liquid | carbon dioxide, liquid | cut-off, S
Primary aluminium (US)	1.06E+01	1.72E-02	kg/kg primary aluminium	aluminium production, primary, ingot | aluminium, primary, ingot | Cutoff, S - RNA
Natural gas (US)	1.57E-01	9.79E-03	kg/Nm^3 natural gas	market for natural gas, high pressure | natural gas, high pressure | Cutoff, S - US
Electricity, medium voltage (NPCC, US)	2.22E-01	7.10E-04	kg/kWh electricity	electricity, high voltage, production mix | electricity, high voltage | Cutoff, S – NPCC, US only
Transport (RoW)	1.32E-01	1.83E-02	Kg/tkm	market for transport, freight, lorry, unspecified | transport, freight, lorry, unspecified | Cutoff, S - RoW
Refrigerator (GLO)	1.92E+02	9.43E-01	kg/unit	market for refrigerator | refrigerator | Cutoff, S - GLO
Landfiling (RoW)	9.37E-02	2.91E-02	Kg/kg waste	treatment of municipal solid waste, sanitary landfill | municipal solid waste | Cutoff, S - RoW

1. Goal and scope

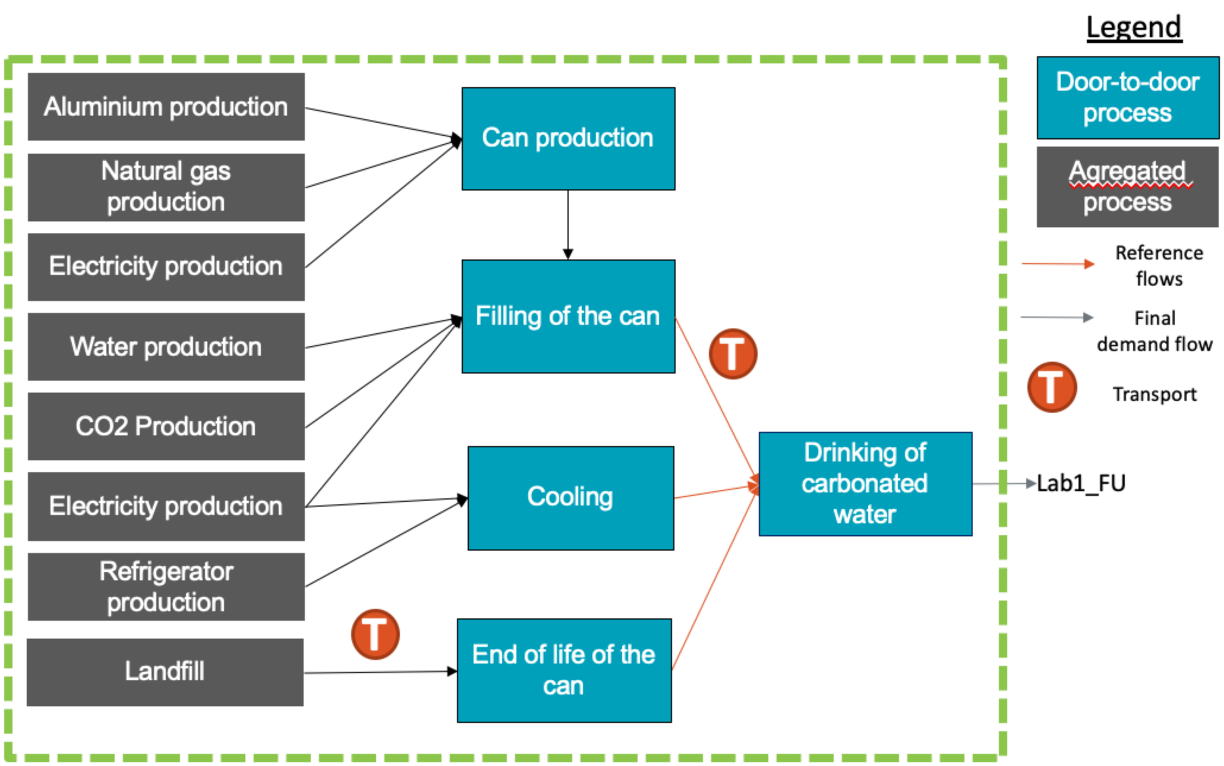
1.1. Create a process tree or flow diagram that represents the cradle-to-grave of the can of carbonated water product system.

1.2. List the aggregated unit processes (cradle-to-gate) and disaggregated (gate-to-gate) processes.

1.3. Identify the reference flows of the system.

1.4. Identify key parameters that could be used to calculate the missing data (Tbd cases in the table)

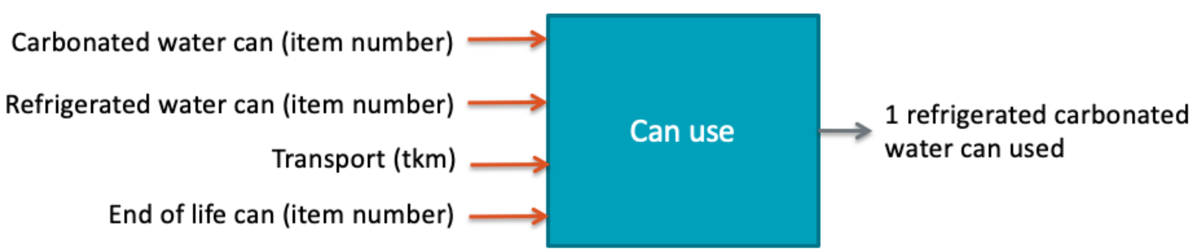
The figure below represents the process tree and distinguishes between aggregated processes (S in ecoinvent database) and disaggregated processes (U in ecoinvent database). The reference flows of this system are necessary flows for producing the functional unit and are identified in red in the figure. The table below will give you an example for different possible key parameters for each reference flow. Reminder: the key parameters are the parameters necessary for quantifying the reference flow.



Reference flows	Unit	Key parameters [unit]
Electricity	kWh/FU	• Time to refrigerate 1 can = 1 week/can • Electricity consumed by 1 refrigerator = 277 Kwh/yr/unit • Volume of 1 can = 0.355 L/can • Volume of 1 refrigerator = 290 L/unit
Refrigerator	unit/FU	• Lifespan of refrigerator = 15 years • Time to refrigerate 1 can = 1 week/can • Volume of 1 can = 0.355 L/can • Volume of 1 refrigerator = 290 L/unit
Transport	t.km/FU	• Transport between factory and use = 30 km • Mass of 1 empty can = 13 g
Can of carbonated water	unit/FU	• Waste rate for 1 can = 0%
Can at end-of-life	unit/FU	• Rate of cans at end-of-life = 100%

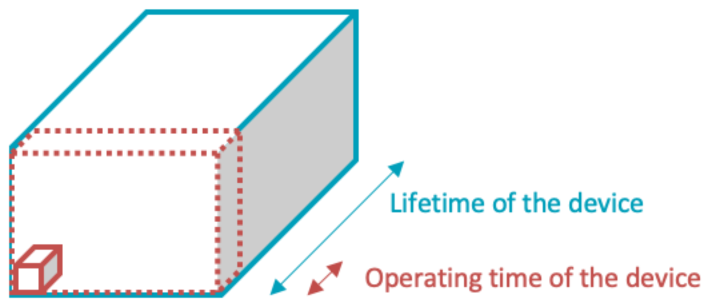
2. Inventory calculation by hand

2.1. Quantify the reference flows



For the use processes of the can, here is some useful information for your calculations:

- *Volume of 1 can = 0.355 L/can*
- *Volume of 1 refrigerator = 290 L/refrigerator*
- *Lifespan of refrigerator = 15 years/refrigerator*
- *Refrigeration time per can = 1 week/can*
- *Electricity consumed per refrigerator = 277 Kwh/year*
- *Transport between factory and use = 30 km*
- *Mass of 1 empty can = 13 g*
- *Waste rate for 1 can = 0%*
- *Rate of cans at end-of-life = 100%*



Be aware the here we only use one part of the refrigerator volume for refrigeration of the can: (Volume of 1 can [L] /volume of 1 refrigerator [L]) = rate of appliance use [%]
Also be aware that we only use the refrigerator for part of its lifespan for the refrigeration of the can: (Time appliance used [an/FU] / Lifespan of appliance [year / appliance])

Theoretical calculation of economic flow for one unit process (FU = 1 unit of product of this process)

- *Quantity of carbonated cans required for the use of 1 can:*
  - *Quantity of cans / FU [# cans filled/FU] = (1+ Waste rate of cans [%]) * number of cans used [# cans utilised/FU]*
- *Quantity of cans used with an end-of-life:*
  - *Quantity of cans / FU [# cans filled/FU] = (Rate of cans at end-of-life [%]) * number of cans used [# cans used/FU]*
- *Transport:*
  - *Tonnes.kilometres travelled / FU [tkm/FU] = Mass carried during transport [t/FU] * Travelled distance [km]*
- *Electricity:*
  - *Quantity electricity / FU [kWh/FU] = Power of appliance [W] / 1000 [W/kW] * Time appliance used [h/FU] * Rate appliance use [%]*
- *Appliance:*
  - *Quantity appliances / FU [# appliance/FU] = Time appliance used [year/FU] / Lifespan of appliance [an / appliance] * Rate appliance use [%]*

➢ *You must determine the quantity of carbonated cans required for the use of one can*

*(1+ Waste rate of cans [%]) * number of cans used [# cans used/FU] = Quantity of cans / FU [# cans filled/FU]*

(1+0%) / 1 can used = 1 can filled for 1 can used

➢ *You must determine the quantity of cans used with an end-of-life*

*(Rate of cans at end-of-life [%]) * number of cans used [# cans used/FU] = Quantity of cans / FU [# cans en end-of-life/FU]*

(100%) / 1 can used = 1 can at end-of-life for one can used

- *You must determine the tonnes.kilometres (tkm) required for transporting one can*

*(Mass of aluminium for one can [kg/can] + Mass carbonated water contained in 1 can [kg/can])/1000 * Distance travelled between production and use [km] = tkm for the transport of 1 can used [tkm/can]*

*(0.013 kg + 0.355 kg) / 1000 * 30 km = 1.1 E-02 tkm for the transport of 1 can used*

- *You must determine the fraction of a refrigerator required for the use of one can. Only a portion of the volume of the refrigerator is used for la refrigeration of one can:*

*(Volume of 1 can [L] /volume of 1 refrigerator [L]) * (Time of refrigeration of 1 can [week/can]) / (Lifespan du refrigerator [year/refrigerator] * number of weeks per year [week/an]) = fraction of refrigerator required for 1 can used [refrigerator/can]*

*(0,355L/290L) * 1/ (15*52) = 1,56E-06 number of refrigerators required for 1 can used*

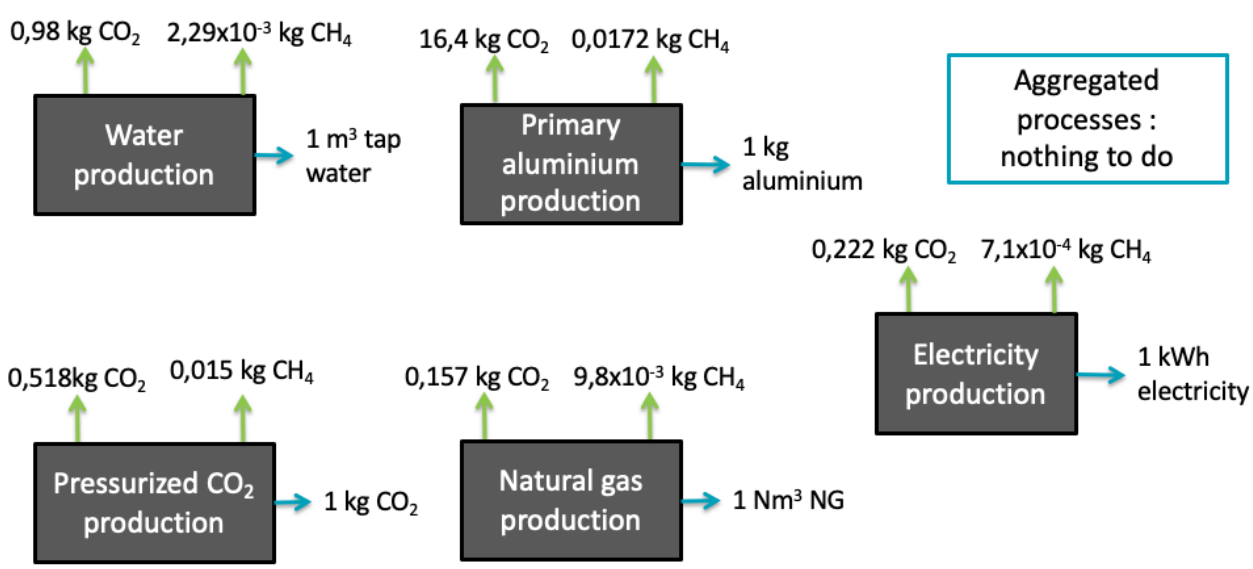
- *You must determine the quantity of electricity required for refrigerating one can for one week:*

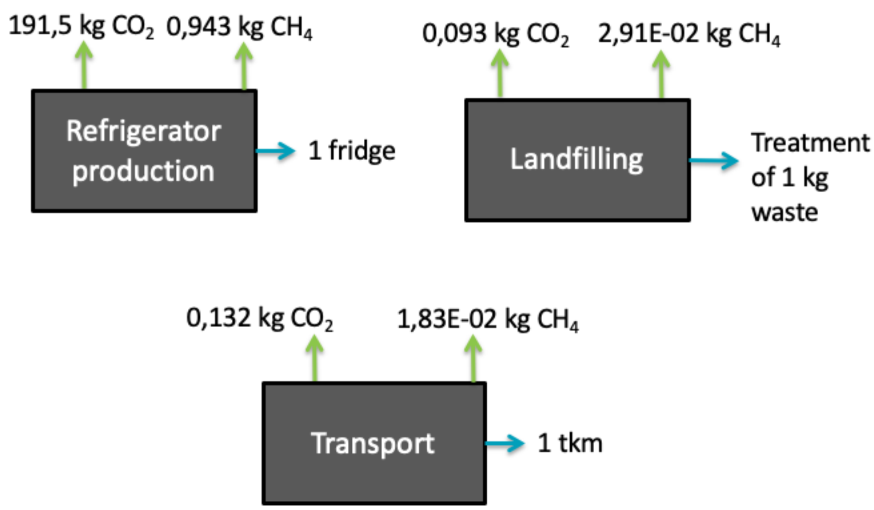
*(Volume of 1 can [L] /volume of 1 refrigerator [L]) * (Time of refrigeration of 1 can [week/can]) * electricity consumed per 1 refrigerator for 1 year [kWh/year] / number of weeks par year [week/year] = electricity consumed for 1 can used [kWh/can]*

*(0,355L/290L) * 1 * 277 / 52= 0,00652 KWh electricity consumed for 1 can used*

2.2. Calculate the intermediary flows (scaled to the functional unit) corresponding to all the remaining processes of the system.

For the aggregated processes, the quantities of CO_2 et CH_4 per unit of product are already supplied.

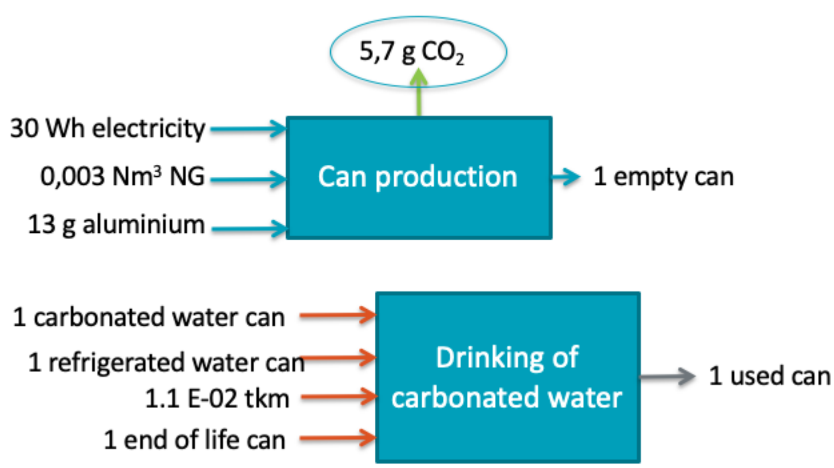


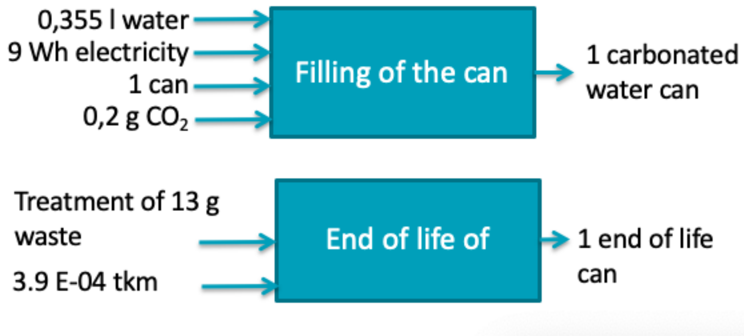


For the disaggregated processes only the production processes for one can has a direct CO_2 associated with it that is due to the combustion of natural gas used in energy generation at the factory. The emission factor related to the combustion of natural gas must be multiplied by the quantity of natural gas required such to total CO_2 associated with its use. There are no direct emissions associated with the can filling process, the use phase and the end-of-life.

Combustion emission factor: 1,9 kg CO_2/Nm^3 natural gas
x
Natural gas combustion : 0,003 Nm^3 natural gas/empty can
= 5,7 g CO_2/empty can

Disaggregated processes :
A calculation to do

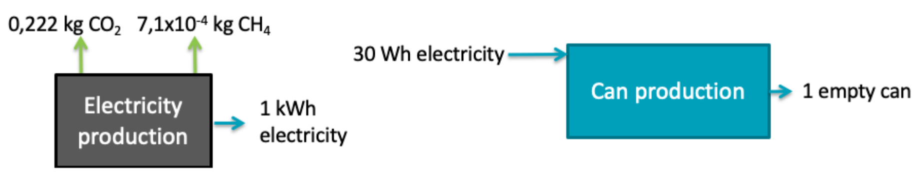




2.3. Calculate the quantities of elementary flows included in the carbon footprint for the entire product system (scaled to the functional unit).

*We calculate the quantity of elementary flows (CO_2 and CH_4) for each of the unit processes of the product system (**related to the functional unit**).*

Example: Calculation for electricity



Example: calculation for electricity

Intermediary flow	Quantity	Unit	Elementary flow CO2 production elec. (kg/kWh electricity)	Elementary flow CH4 production elec. (kg/kWh electricity)	Elementary flow CO2	Elementary flow CH4
Electricity production	3,00E-02	kWh	2,22E-01	7,10E-04	6,66E-03	2,13E-05

We do this calculation for each processes

It can be useful to make small diagrams to make sure you don't forget anything!

PROCESSES	Intermediary flows			Elementary flows	
				CO2 (kg)	CH4 (kg)
Drinkink of carbonated water	Carbonated water can	1	item		
	Refrigerated water can	1	item		
	End of life can	1	item		
	Transport	1.10E-02	tkm	1.45E-03	2.01E-04
Can production	Electricity production	3.00E-02	kWh	6.66E-03	2.13E-05
	Natural gas production	0.003	Nm3	4.71E-04	2.94E-05
	Aluminium production	1.30E-02	kg	1.38E-01	2.24E-04
	Elementary flow link to NG combustion			5.70E-03	
Filling	Electricity production	9.00E-03	kWh	2.00E-03	6.39E-06
	Tap water production	3.55E-04	m3	3.48E-04	8.13E-07
	Pressurized CO2 production	2.00E-02	kg	1.04E-02	2.30E-04
	Can production	1	item		
Cooling	Electricity production	0.00652	kWh	1.45E-03	4.63E-06
	Fridge production	1.57E-06	frigo	3.01E-04	1.48E-06
End of life can	Transport	3.90E-03	tkm	5.15E-04	7.14E-05
	Landfill Aluminium	1.30E-02	kg	1.21E-03	3.78E-04
				1.69E-01	1.17E-03

3. Impact assessment

3.1. Calculate the carbon footprint for the entire product system (scaled to the functional unit)

Impact evaluation allows one to consider the elementary flows that contribute the same impact do not necessarily have the same effect on this impact. In the case of the carbon footprint we seek to evaluate the climate change impacts that are due to greenhouse gas emissions (GHGs). In our example, we only consider CO2 and CH4, but here are several other GHGs. The effect of GHGs on climate change is determined by their global warming potential (GWP), which is expressed in CO2 equivalents (CO2e), with CO2 being the reference for this impact. TO calculate the carbon footprint, you must multiply each GHG emission by its associated GWP. We obtain a CO2e results for each GHG, which can be summed to obtain the carbon footprint of the entire product system in terms of CO2e.

Carbon footprint [kg CO2e/FU] = Quantity of CO2 [kg CO2/FU] x GWP of CO2 [kg CO2e/kg CO2] + Quantity of CO2 [kg CH4/FU] x GWP of CO2 [kg CO2e/kg CH4]

PROCESSES	Intermediary flows			Elementary flows CO2 (kg)	CH4 (kg)	Total CO2 CO2e (kg)
Drinkink of carbonated water	Carbonated water can	1	item			
	Refrigerated water can	1	item			
	End of life can	1	item			
	Transport	1.10E-02	tkm	1.45E-03	2.01E-04	7.43E-03
Can production	Electricity production	3.00E-02	kWh	6.66E-03	2.13E-05	7.29E-03
	Natural gas production	0.003	Nm3	4.71E-04	2.94E-05	1.34E-03
	Aluminium production	1.30E-02	kg	1.38E-01	2.24E-04	1.45E-01
	Elementary flow link to NG combustion			5.70E-03		5.70E-03
Filling	Electricity production	9.00E-03	kWh	2.00E-03	6.39E-06	2.19E-03
	Tap water production	3.55E-04	m3	3.48E-04	8.13E-07	3.72E-04
	Pressurized CO2 production	2.00E-02	kg	1.04E-02	2.30E-04	1.72E-02
	Can production	1	item			0.00E+00
Cooling	Electricity production	0.00652	kWh	1.45E-03	4.63E-06	1.58E-03
	Fridge production	1.57E-06	frigo	3.01E-04	1.48E-06	3.45E-04
End of life can	Transport	3.90E-03	tkm	5.15E-04	7.14E-05	2.63E-03
	Landfill Aluminium	1.30E-02	kg	1.21E-03	3.78E-04	1.24E-02
				1.69E-01	**1.17E-03**	**2.03E-01**

3.2. How would the results evolve if the functional unit was changed for "Consume 1000 can of carbonated water"?

For a functional unit of 1000 cans.
We just multiply the result by 1000 because LCA is linear!
So, 184 kg CO_2 eq.

4. Interpretation

4.1. Calculate the contribution of each unit process.

To calculate the contribution of each unit process, you must take the masse as CO2e as a fraction of the total carbon footprint. E.g. for the production process of a can: 5,70 E+00 kg CO2e / 1,84 E+01 kg CO2e

PROCESSES	Intermediary flows			Elementary flows CO2 (kg)	CH4 (kg)	Total CO2 CO2e (kg)	Contribution	Total per process CO2e (kg)	Contrib per process
Drinking of carbonated water	Carbonated water can	1	item					7.43E-03	3.65%
	Refrigerated water can	1	item						
	End of life can	1	item						
	Transport	1.10E-02	tkm	1.45E-03	2.01E-04	7.43E-03	3.65%		
Can production	Electricity production	3.00E-02	kWh	6.66E-03	2.13E-05	7.29E-03	3.58%	1.59E-01	78.28%
	Natural gas production	0.003	Nm3	4.71E-04	2.94E-05	1.34E-03	0.66%		
	Aluminium production	1.30E-02	kg	1.38E-01	2.24E-04	1.45E-01	71.24%		
	Elementary flow link to NG combustion			5.70E-03		5.70E-03	2.80%		
Filling	Electricity production	9.00E-03	kWh	2.00E-03	6.39E-06	2.19E-03	1.08%	1.98E-02	9.71%
	Tap water production	3.55E-04	m3	3.48E-04	8.13E-07	3.72E-04	0.18%		
	Pressurized CO2 production	2.00E-02	kg	1.04E-02	2.30E-04	1.72E-02	8.45%		
	Can production	1	item			0.00E+00	0.00%		
Cooling	Electricity production	0.00652	kWh	1.45E-03	4.63E-06	1.58E-03	0.78%	1.93E-03	0.95%
	Fridge production	1.57E-06	frigo	3.01E-04	1.48E-06	3.45E-04	0.17%		
End of life can	Transport	3.90E-03	tkm	5.15E-04	7.14E-05	2.63E-03	1.29%	1.51E-02	7.41%
	Landfill Aluminium	1.30E-02	kg	1.21E-03	3.78E-04	1.24E-02	6.12%		
				1.69E-01	**1.17E-03**	**2.03E-01**	100.00%	**2.035E-01**	**100.00%**

4.2. Identify areas for improvement in the carbon footprint of cans of carbonated water.

Priorities for improving the quality of the carbon footprint:

- *Assure that the Production aluminium data is of good quality*
- *Assure that the quantity of primary aluminium per can is correct*
- *Assure that the assumption 100% primary is correct*

Areas for reducing the carbon footprint:

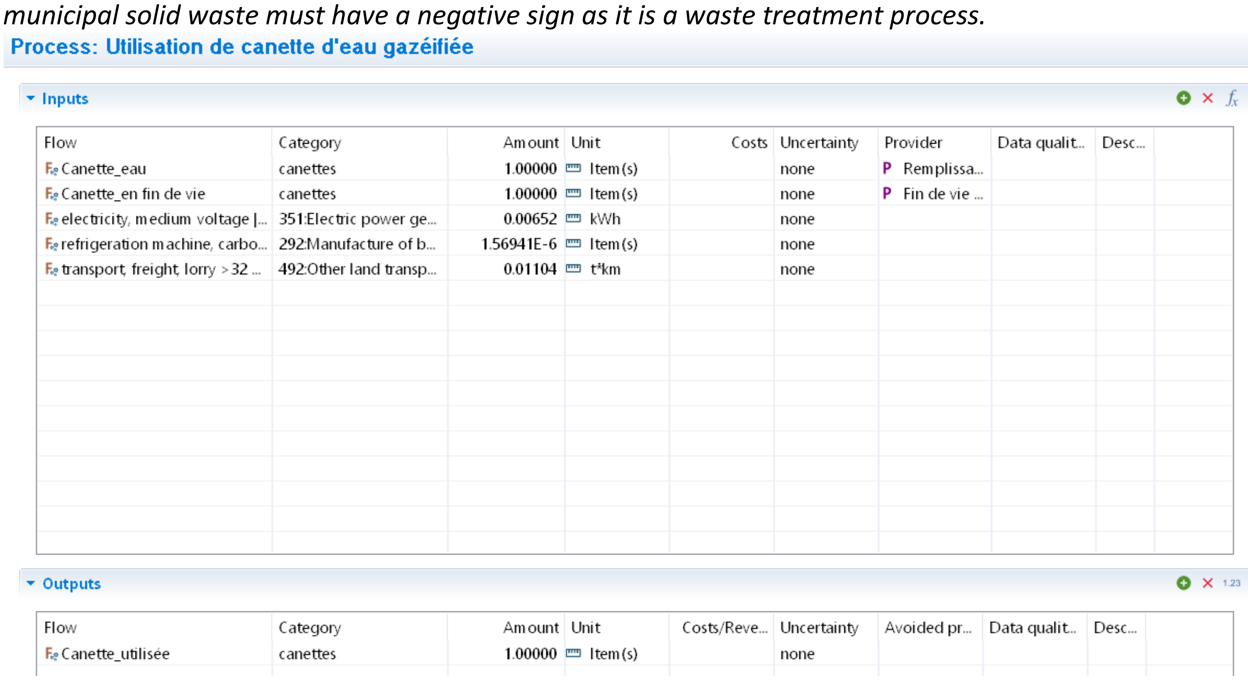
- *Find aluminium with a lower carbon footprint*
- *Minimise the quantity of aluminium used*
- *Change the material type for delivering the carbonated water*
- *Change the location of production to have access to electricity with a lower carbon footprint*

5. Inventory modelling in OpenLCA

For more details, please consult the document ***Step-by-step construction of an openLCA model to calculate the carbon footprint of cans of carbonated water*** *for solutions to questions 5.1 et 5.2.*

5.1. Model the 4 gate-to-gate unit processes.

You will need to create four processes (see screen capture below). Please note that the quantity of the input municipal solid waste must have a negative sign as it is a waste treatment process.



Process: Utilisation de canette d'eau gazéifiée

Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty	Provider	Data qualit...	Desc...
Canette_eau	canettes	1.00000	Item(s)		none	P Remplissa...		
Canette_en fin de vie	canettes	1.00000	Item(s)		none	P Fin de vie ...		
electricity, medium voltage |...	351:Electric power ge...	0.00652	kWh		none			
refrigeration machine, carbo...	292:Manufacture of b...	1.56941E-6	Item(s)		none			
transport, freight, lorry >32 ...	492:Other land transp...	0.01104	t*km		none			

Outputs

Flow	Category	Amount	Unit	Costs/Reve...	Uncertainty	Avoided pr...	Data qualit...	Desc...
Canette_utilisée	canettes	1.00000	Item(s)		none			

Process: Remplissage de canette d'eau gazéifiée

Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty	Provider	Data qualit...	Desc...
Canette_alum	canettes	1.00000	Item(s)		none	P Producti...		
carbon dioxide, liquid | mar...	201:Manufacture of b...	0.20000	g		none			
electricity, medium voltage |...	351:Electric power ge...	9.00000	Wh		none			
tap water | market for tap w...	360:Water collection, ...	0.35500	kg		none			

Outputs

Flow	Category	Amount	Unit	Costs/Reve...	Uncertainty	Avoided pr...	Data qualit...	Desc...
Canette_eau	canettes	1.00000	Item(s)		none			

Process: Production de canette d'aluminium

Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty	Provider	Data qualit...	Desc...
aluminium, primary, ingot | ...	242:Manufacture of b...	13.00000	g		none	P aluminiu...		
electricity, medium voltage |...	351:Electric power ge...	30.00000	Wh		none			
natural gas, high pressure | ...	352:Manufacture of g...	0.00300	m3		none			

Outputs

Flow	Category	Amount	Unit	Costs/Reve...	Uncertainty	Avoided pr...	Data qualit...	Desc...
Canette_alum	canettes	1.00000	Item(s)		none			
Carbon dioxide, fossil	Emission to air/unspe...	0.00570	kg		none			

Process: Fin de vie de canette d'eau gazéifiée (100% enfouissement)

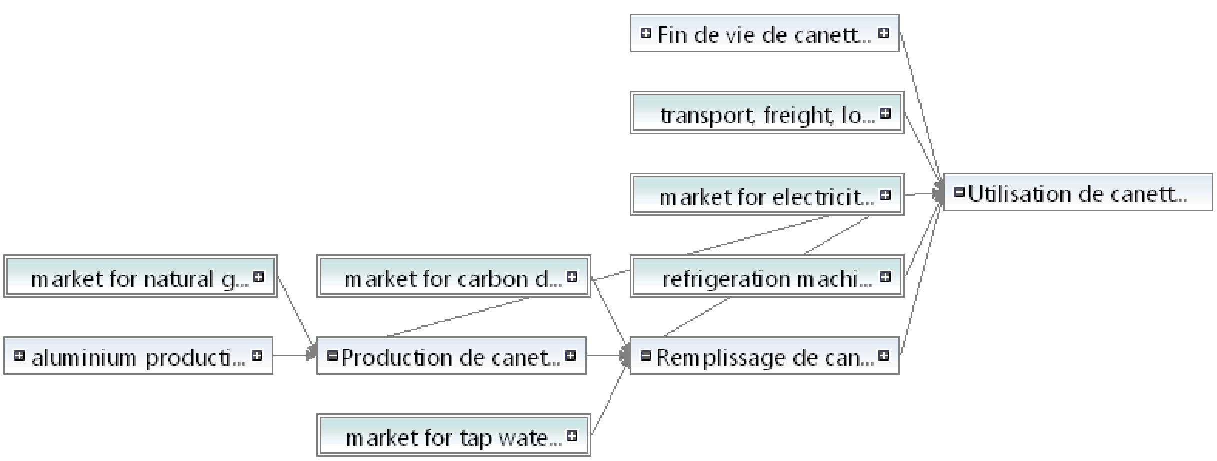
Inputs

Flow	Category	Amount	Unit	Costs	Uncertainty	Provider	Data qualit...	Desc...
municipal solid waste | treat...	382:Waste treatment ...	-13.00000	g		none			
transport, freight, lorry > 32 ...	492:Other land transp...	0.00039	t*km		none			

Outputs

Flow	Category	Amount	Unit	Costs/Reve...	Uncertainty	Avoided pr...	Data qualit...	Desc...
Canette_en fin de vie	canettes	1.00000	Item(s)		none			

5.2. Generate the cans of carbonated water product system and calculate the carbon footprint.



6. Bonus question

6.1. Build a technology matrix, an environmental matrix and a final demand vector for this product system.

The technological matrix contains the economic flows of the product system in the rows and all the unit processes in the columns. To build it identify all of the unit processes in the columns and indicate in each line each economic flow associated with it. Assure that the matrix is square! I advise you to also include the units of your economic flows as the units used must be consistent from one row to the next. You must also fill in the matrix column by column to indicate the quantities of economic flows consumed and produced for each process. A positive value indicates a flux that is produced by the process (process reference flow). A negative value indicates a flow that is consumed the process (inputs). Be sure to be consistent with the quantities in each column and double check your units! An aggregated process will only be represented by a reference flow value and by zeros everywhere else.

The environmental matrix contains the product system elementary flows in rows and the all unit processes in columns. To build it identify all of the unit processes in the columns and indicate in each line each elementary flow associated with it. To simplify things, you can build this matrix directly below the technology matrix. I advise you to also include the units of your elementary flows as the units used must be consistent from one row to the next. Also, you must fill in the matrix column by column to the indicate the quantities of elementary flows consumed et produced for each process. A positive value indicates a flux that is produced by the process (emissions). A negative value indicates a flow that is consumed the process (extraction from the environment). The quantities indicated must be consistent with the quantity of reference economic flows in the technology matrix. Be sure to be consistent with the quantities in each column and double check your units!

The final demand vector indicates the quantities of economic flows required for producing the functional unit.

Bonus – Technology matrix

Economic flow

Processes

	Drinking 1 carbonated water can	Filling	Cooling	End of life can	Can production	Electricity production	NG production	Aluminium production	Water production	Pressurized CO2 prod	Fridge production	Landfilling	Transport
Used can [Unit]	1												
Carbonated can [unit]	-1	1											
Refrigerated can [unit]	-1		1										
End of life can [unit]	-1			1									
Empty aluminium can [unit]		-1			1								
Electricity [kWh]		-9	-0,00652		-3,00E-02	1							
Natural gas [Nm3]					-0,003		1						
Aluminium [kg]					-1,30E-02			1					
Tap water [m3]		-0,355							1				
Pressurized CO2 [kg]		-0,2								1			
Fridge [unité]			-1,57E-06								1		
Landfilling [kg]				-1,30E-02								1	
Transport [tkm]	-1,10E-02			-3,90E-04									1

Environmental matrix

Elementary flow

Processes

	Drinking 1 carbonated water can	Filling	Cooling	End of life can	Can production	Electricity production	NG production	Aluminium production	Water production	Pressurized CO2 prod	Fridge production	Landfilling	Transport
CO2 [kg]	0	0	0	0	5,70E-03	2,22E-01	1,57E-01	1,06E+01	9,80E-01	5,18E-01	1,92E+02	9,30E-02	1,32E-01
CH4 [kg]	0	0	0	0	0,00E+00	7,10E-04	9,80E-03	1,72E-02	2,29E-03	1,15E-02	9,43E-01	2,91E-02	1,83E-02

Final demand vector

Economic flow

	Drinking 1 carbonated water can
Used can [Unit]	1
Carbonated can [unit]	0
Refrigerated can [unit]	0
End of life can [unit]	0
Empty aluminium can [unit]	0
Electricity [kWh]	0
Natural gas [Nm3]	0
Aluminium [kg]	0
Tap water [m3]	0
Pressurized CO2 [kg]	0
Fridge [unité]	0
Landfilling [kg]	0
Transport [tkm]	0