



CIRAIG™

Interuniversity Research Centre for the
Life Cycle of Products, Processes and Services



Lab 5 – Sensitivity analysis

Carbon footprint of a carbonated water can



POLYTECHNIQUE
MONTREAL

WORLD-CLASS
ENGINEERING



Context

The interpretation of the carbonated water can system has started during lab 4 after the impact assessment.

During this lab we will deepen the interpretation with sensitivity analysis.



Question 1

Sensitivity analysis (scenario) – Show with a graph how the result would change according those changes in the system:

- a) Use different impact methods (*ReCiPe Endpoint (H)* and *Ecological scarcity*) and discuss to what extent the results and conclusions of the study are sensitive to the choice of impact assessment method

Step 1) Recalculate the endpoint results with ReCiPe Lab 2

Step 2) Copy results in Excel

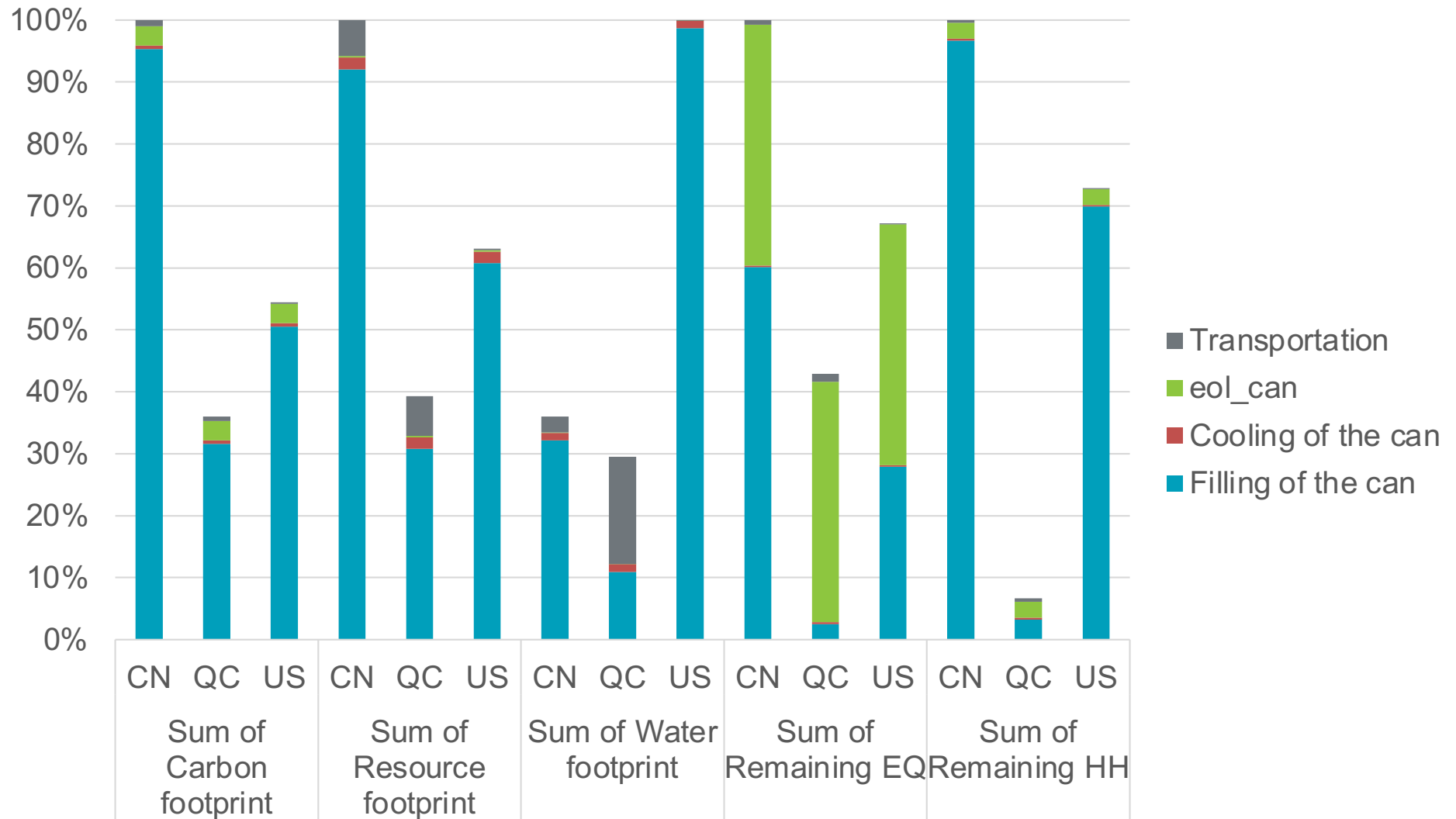
Step 3) Recalculate the endpoint results with Ecological scarcity for the two system from Lab 2

Step 4) Copy results in Excel

Step 5) Plot a comparative graph between the methods

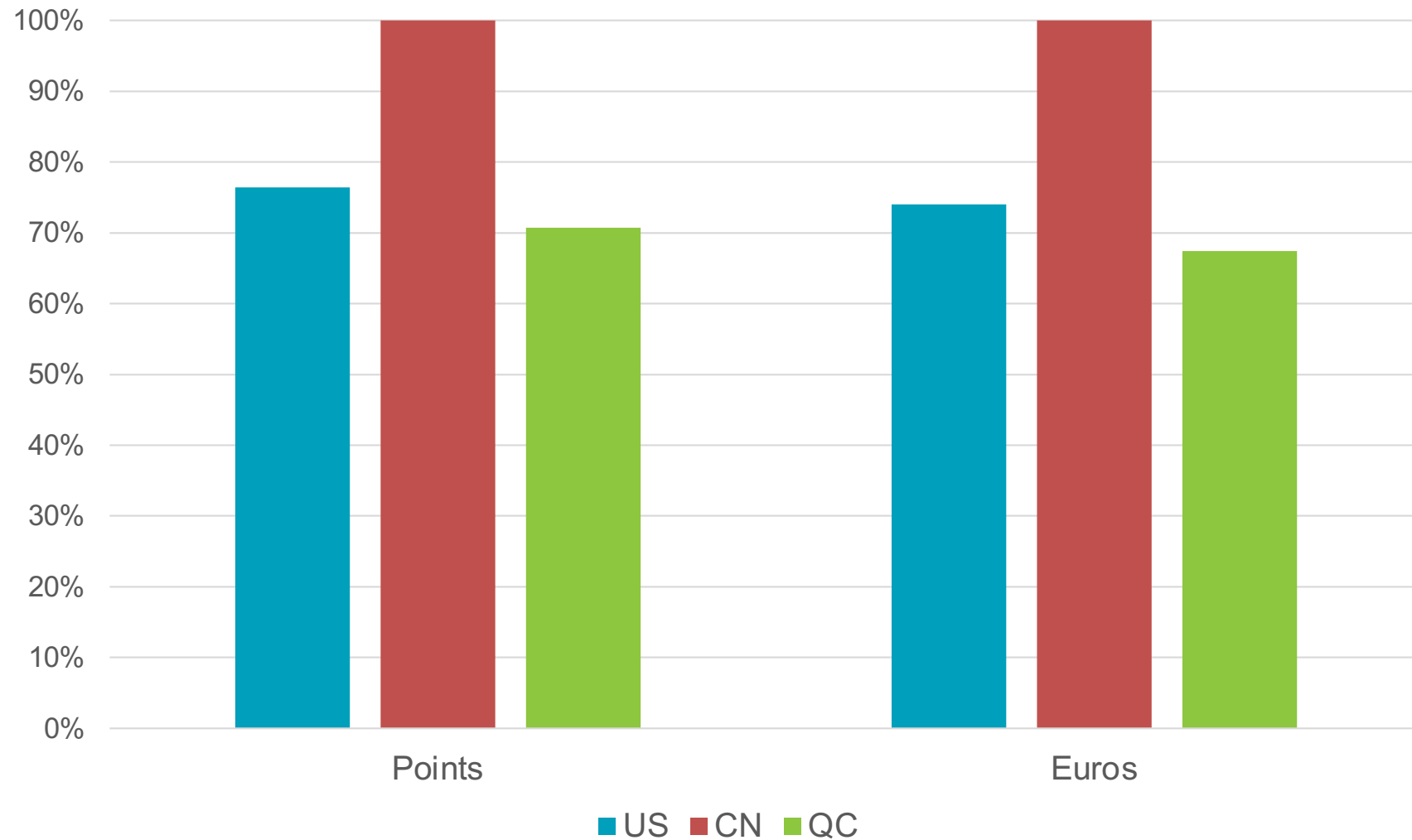
Question 1 a)

Results from Lab 4 using IMPACT World+



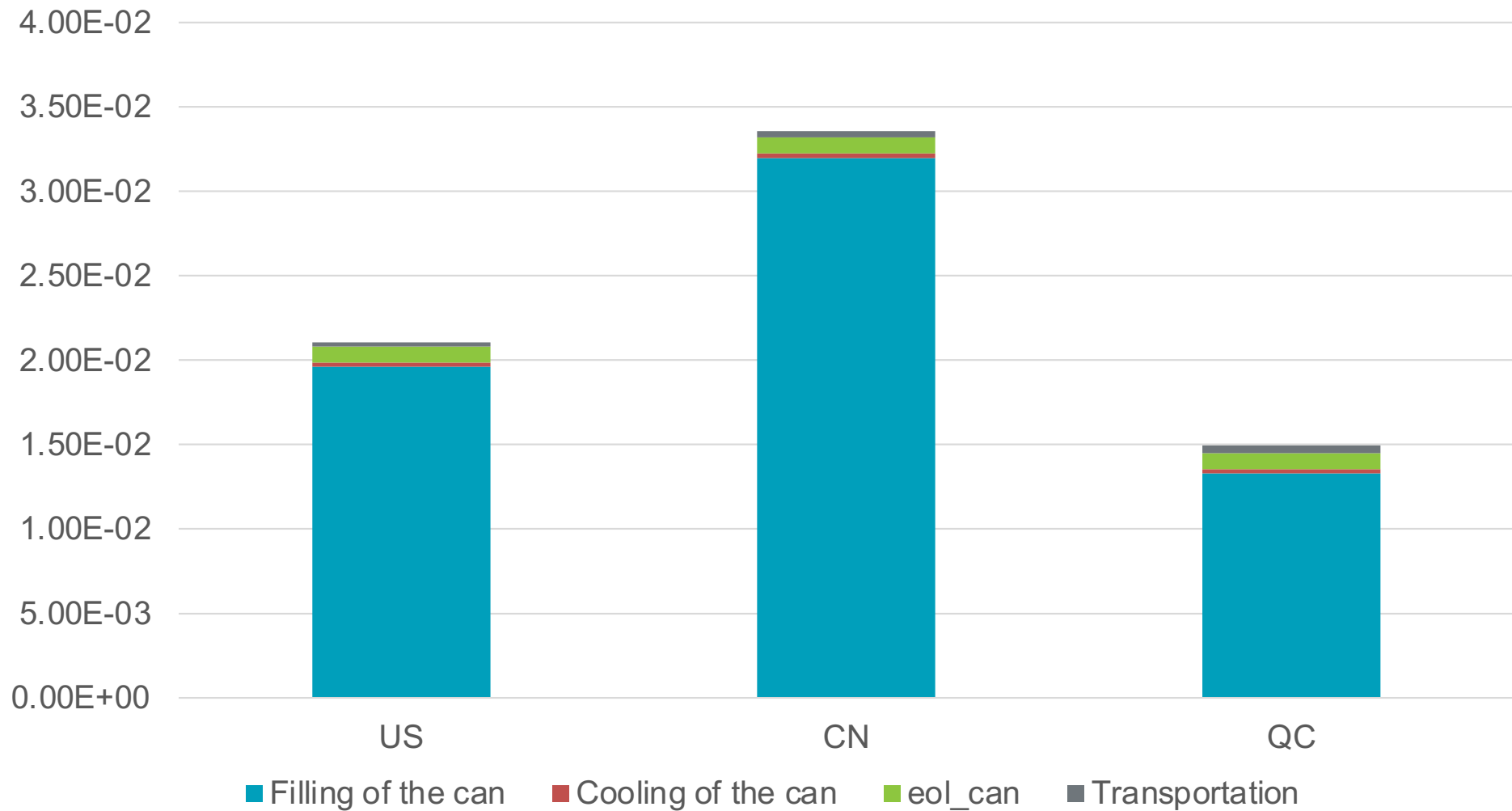
Question 1 a)

Results from Lab 4 using IMPACT World+ with external normalization



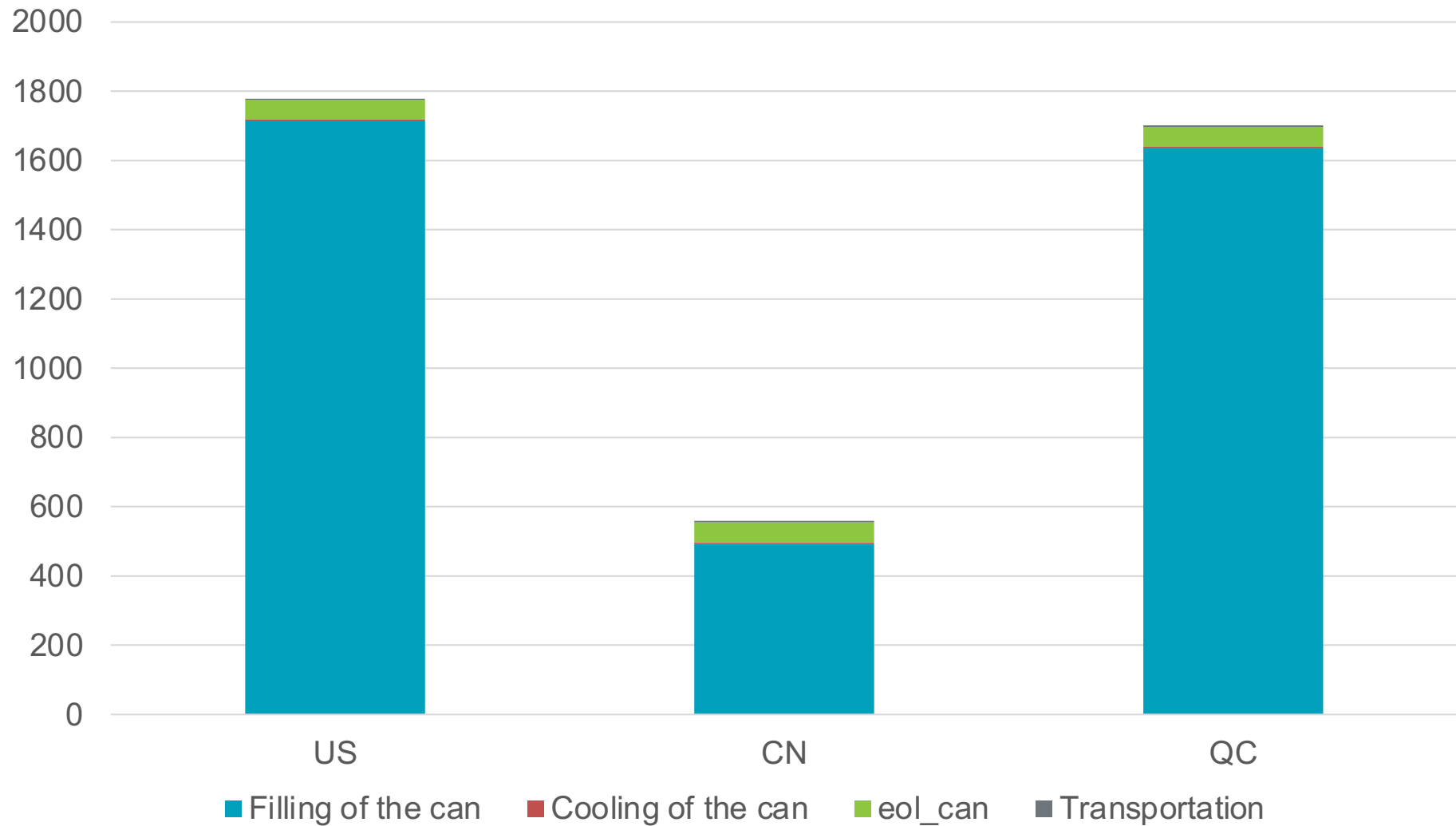
Question 1 a)

Results using ReCiPe method



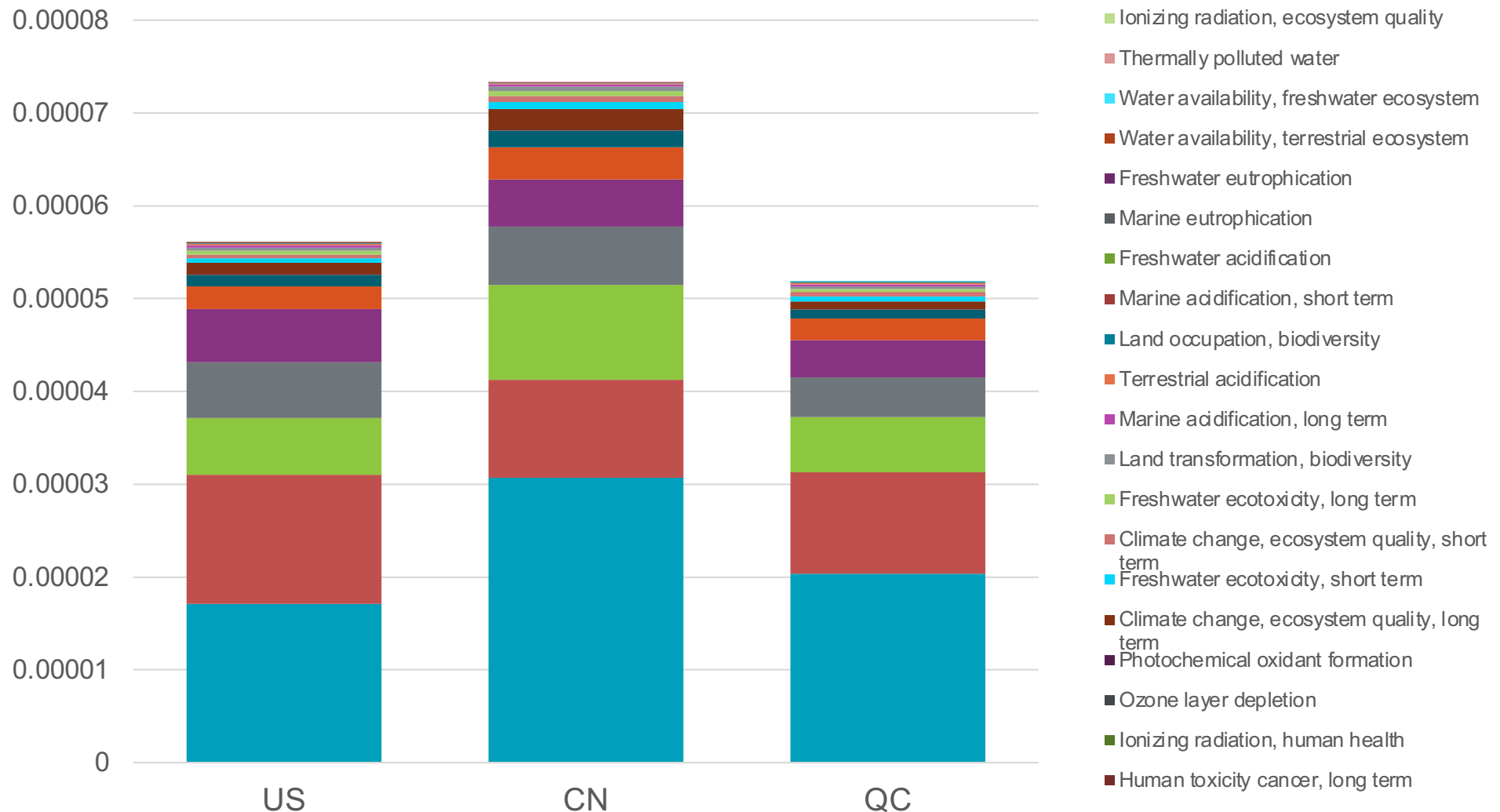
Question 1 a)

Results using Ecological scarcity method



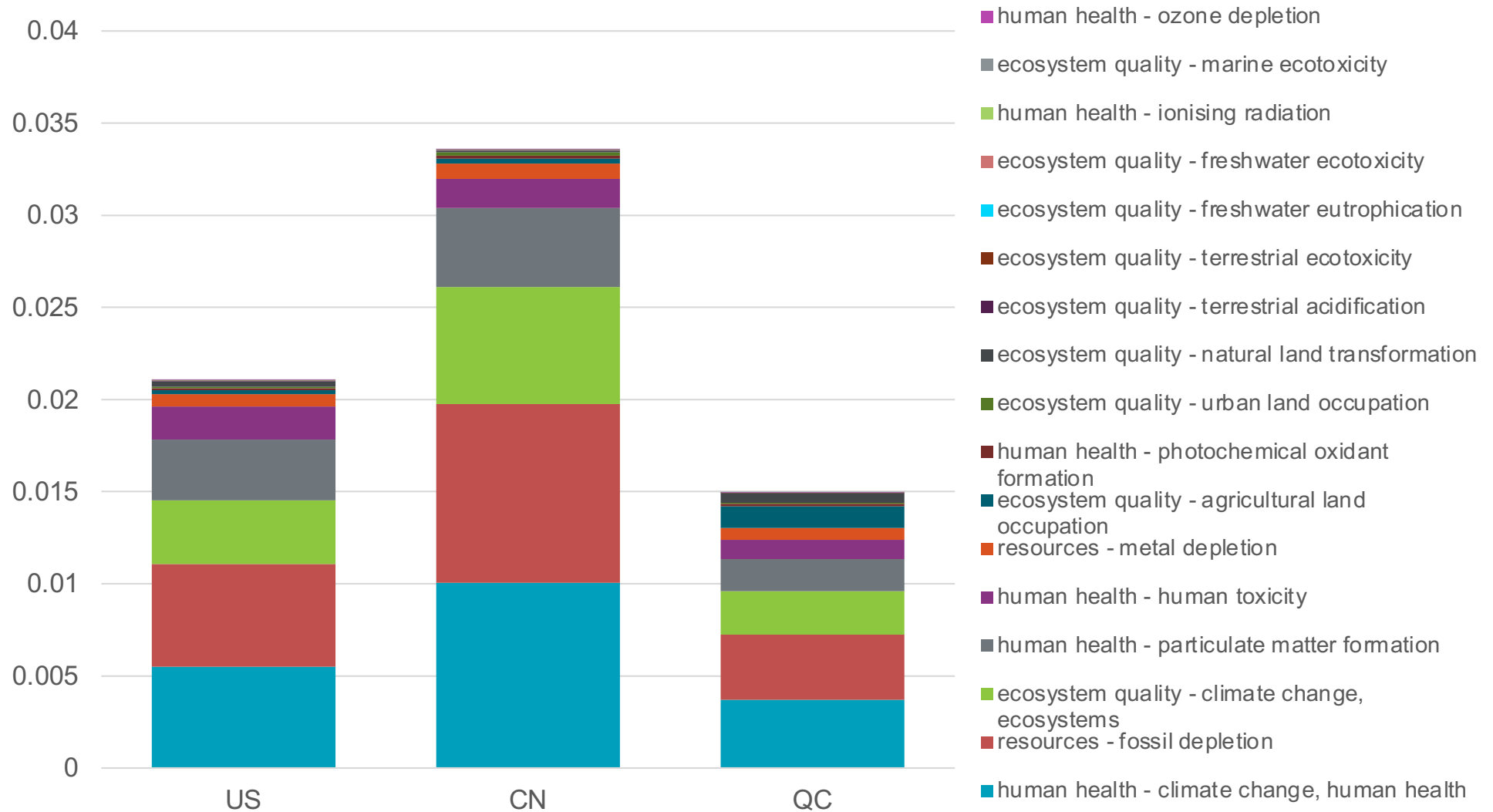
Question 1 a)

IMPACT World+ with external normalization (points) by impact category



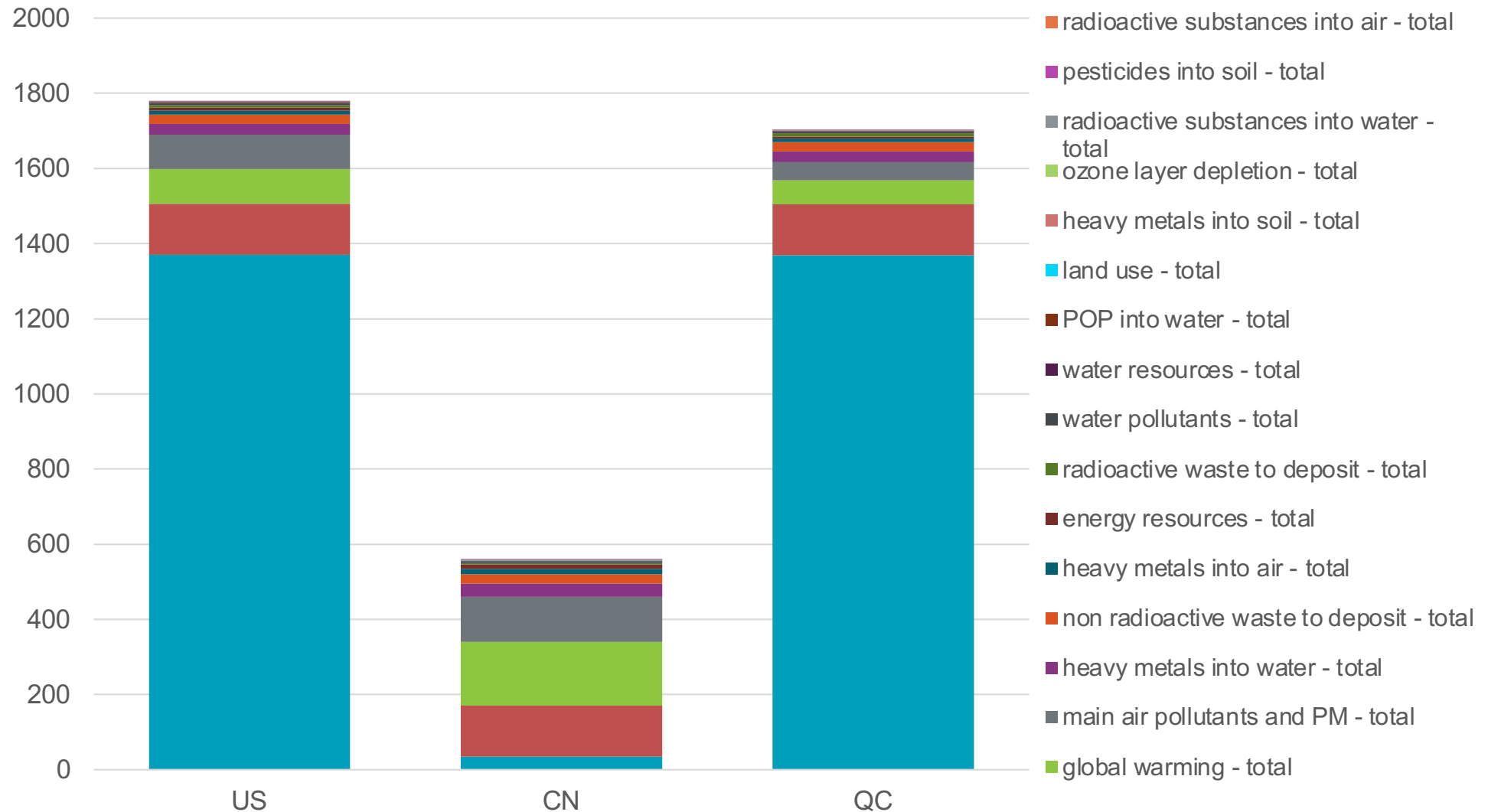
Question 1 a)

ReCiPe by impact category



Question 1 a)

Ecological scarcity by impact category



Question 1

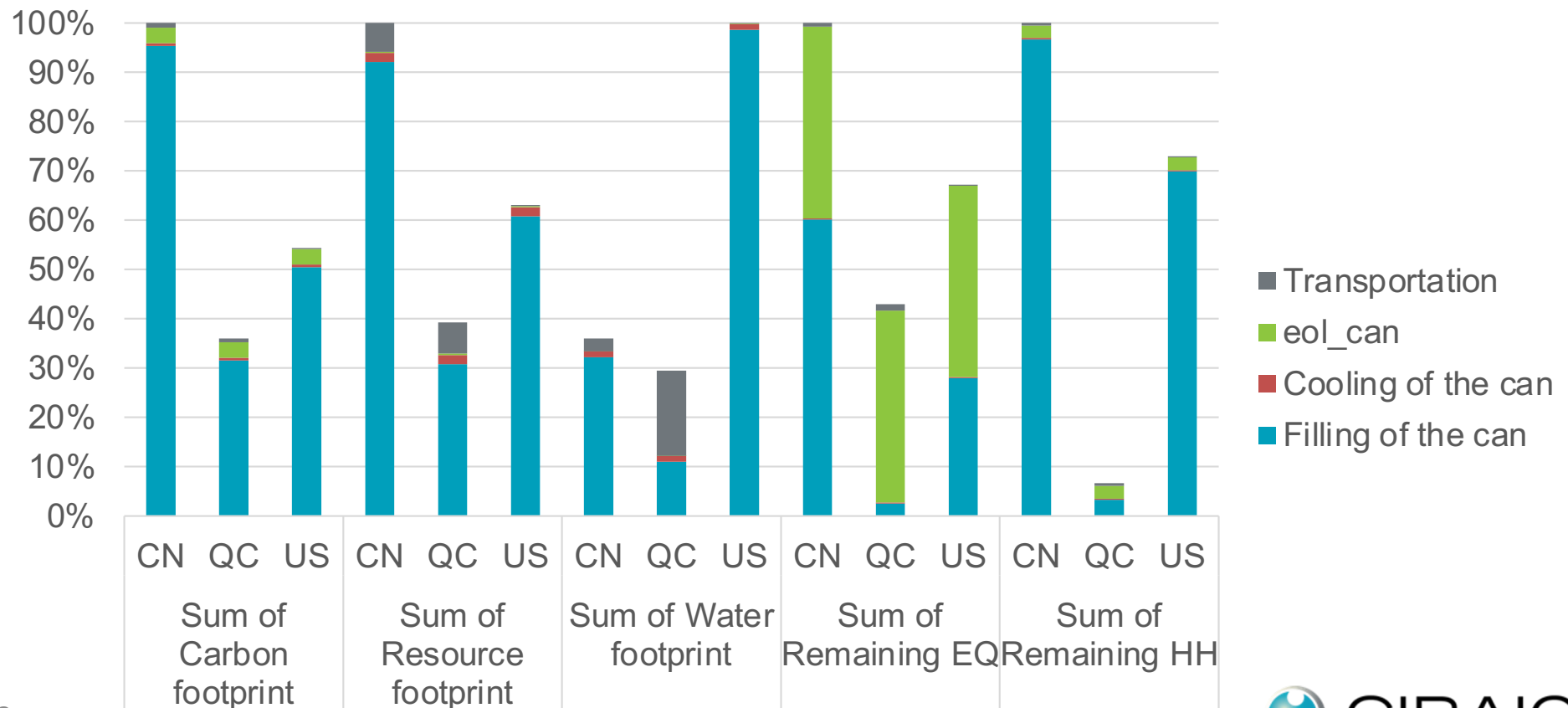
Sensitivity analysis (scenario)

b) Identify which are the scenario analysis you've already performed throughout the different labs and discuss how sensitive such choices are on the results and conclusion of the study

Question 1

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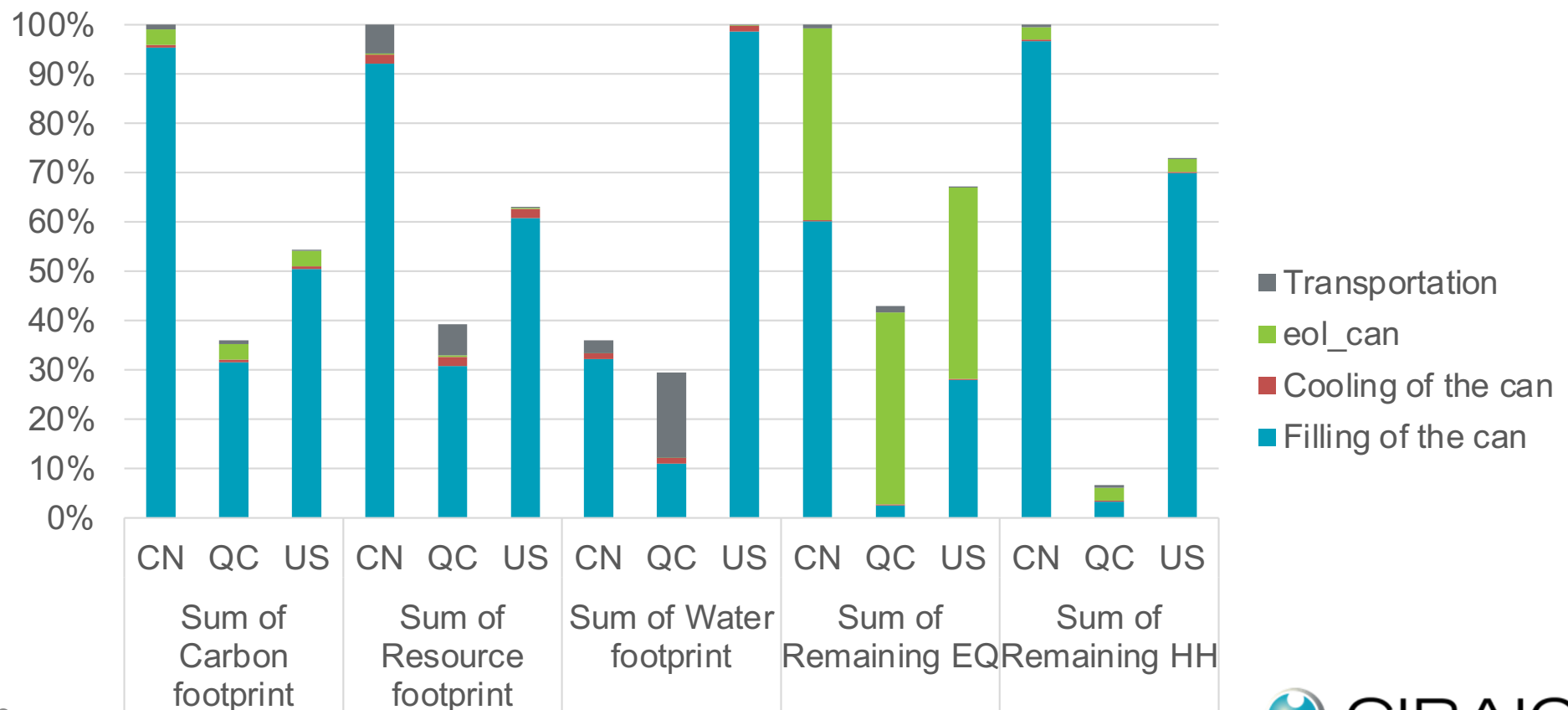
- *modification of the electricity grid mix for the production of aluminum (LAB2)*



Question 1

b) Identify which are the scenario analysis you've already performed throughout the different labs and discuss how sensitive such choices are on the results and conclusion of the study

- *modification of the transport distances (LAB2)*



Question 1

b) Identify which are the scenario analysis you've already performed throughout the different labs and discuss how sensitive such choices are on the results and conclusion of the study

- *Two modeling scenarios to solve the multifunctionality of EoL processes of the aluminium can (LAB3)*

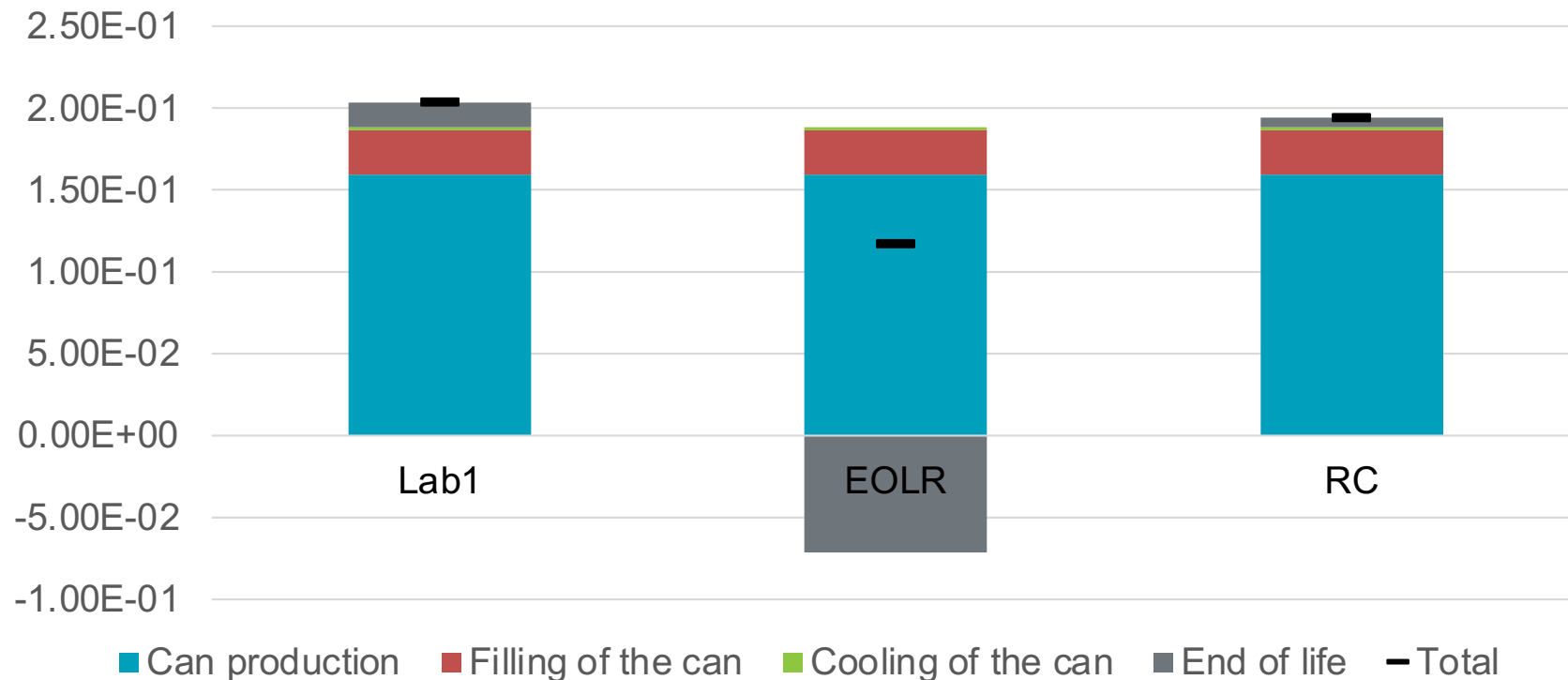
End of life recycling approach: 0.117 kg CO₂-eq/FU

Recycled content approach: 0.194 kg CO₂-eq/FU

Question 1

b) Identify which are the scenario analysis you've already performed throughout the different labs and discuss how sensitive such choices are on the results and conclusion of the study

- *Two modeling scenarios to solve the multifunctionality of EoL processes of the aluminium can (LAB3)*



Question 1

b) Identify which are the scenario analysis you've already performed throughout the different labs and discuss how sensitive such choices are on the results and conclusion of the study

- Variation of the recycling rate (from 0% of the reference case to 75% and variation of the use of recycled content (LAB3)

Reference case (recycling rate = 0%):

0.203 kg CO₂-eq/FU

LAB3 (recycling rate = 75%, recycled content approach):

0.194 kg CO₂-eq/FU

LAB3 (recycling rate = 75% + primary aluminium = 60%):

0.137 kg CO₂-eq/FU

Question 2 - Sensitivity analysis (tornado graph)

Order in an ascending way the sensitivity of those different parameters according the carbon footprint indicator from IW+ footprint version (use lab 1 system):

- Aluminium mass of the can
- End of life transport distance
- Amount of electricity for the can production
- Amount of natural gas in can production

Question 2 - Sensitivity analysis (tornado graph)

Order in an ascending way the sensitivity of those different parameters according the carbon footprint indicator from IW+ footprint version (use lab 1 system):

Step 1) Create parameters (*dist_eol*, *elec_can_prod*, *ng_can_prod*, *mass_can*) and change input values to newly created parameters

Step 2) Create the product system

Step 3) Go to parameters tab and add parameters

Step 4) Change the value of 1 parameter (+1%)

Step 5) Calculate result with IW+ footprint version and copy impact results to excel

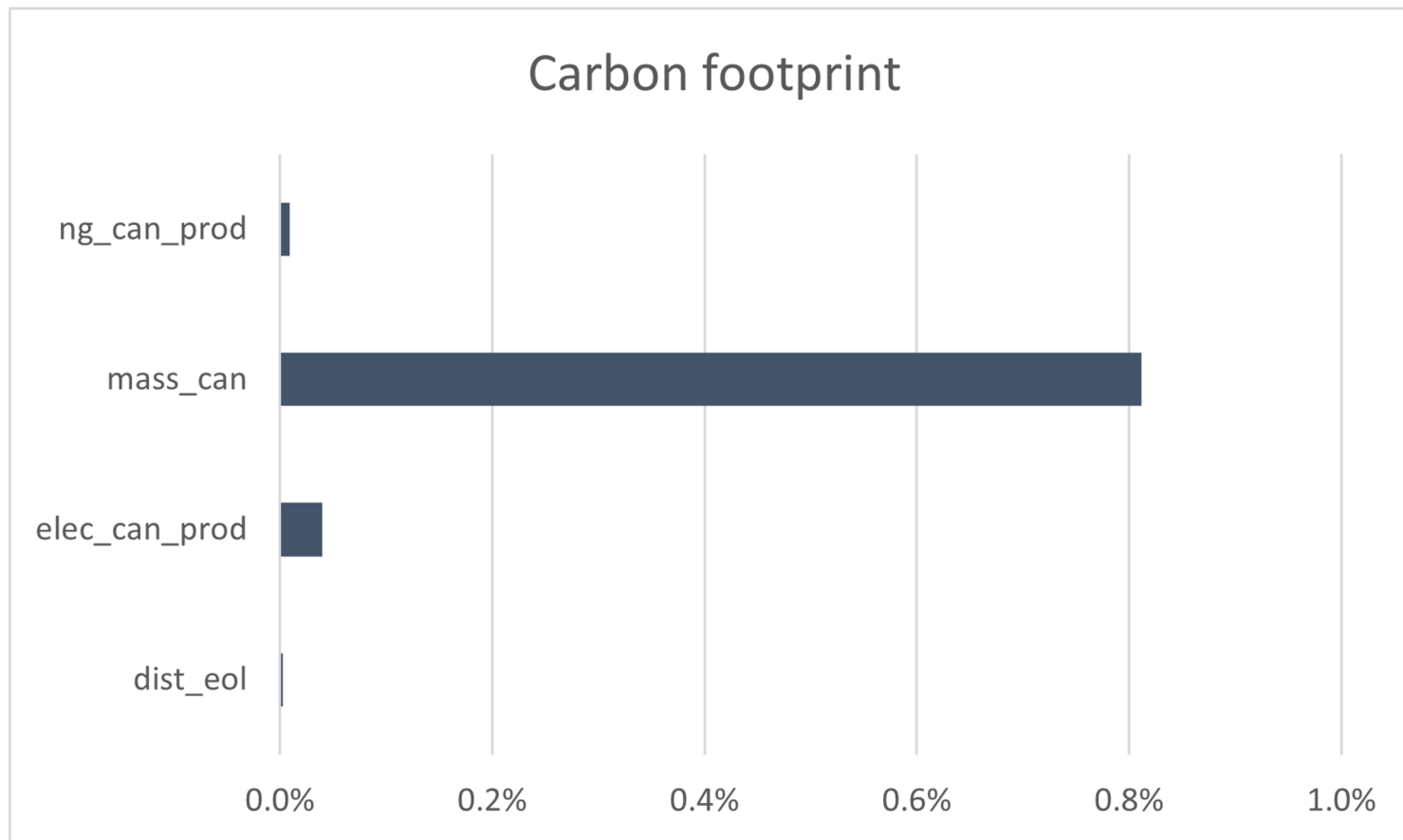
Step 6) Redo Step 4 and 5 for all parameters

Step 6) Calculate baseline scenario

Step 7) on Excel, plot the tornado graph with copied results

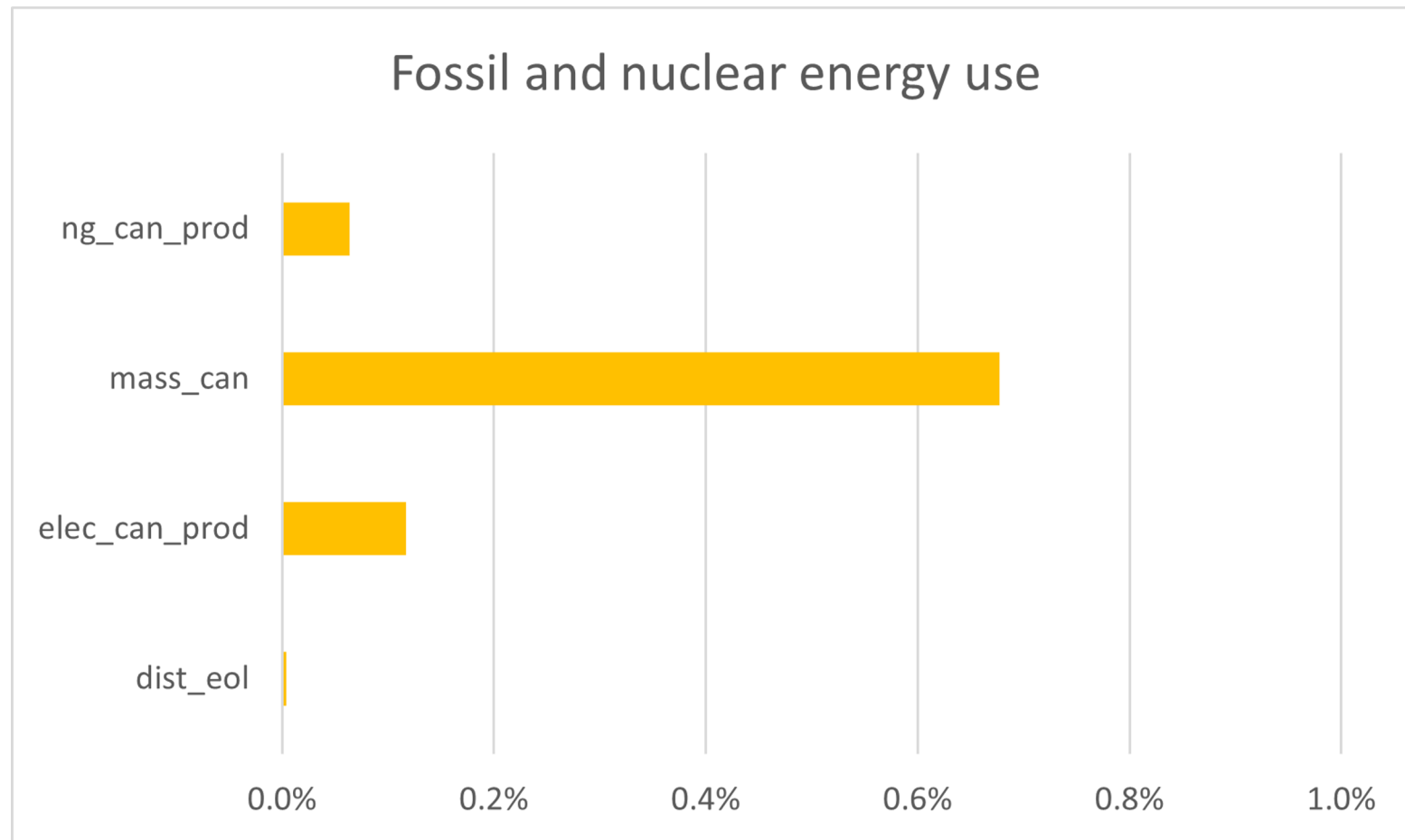
Question 2 - Sensitivity analysis (tornado graph)

Carbon footprint



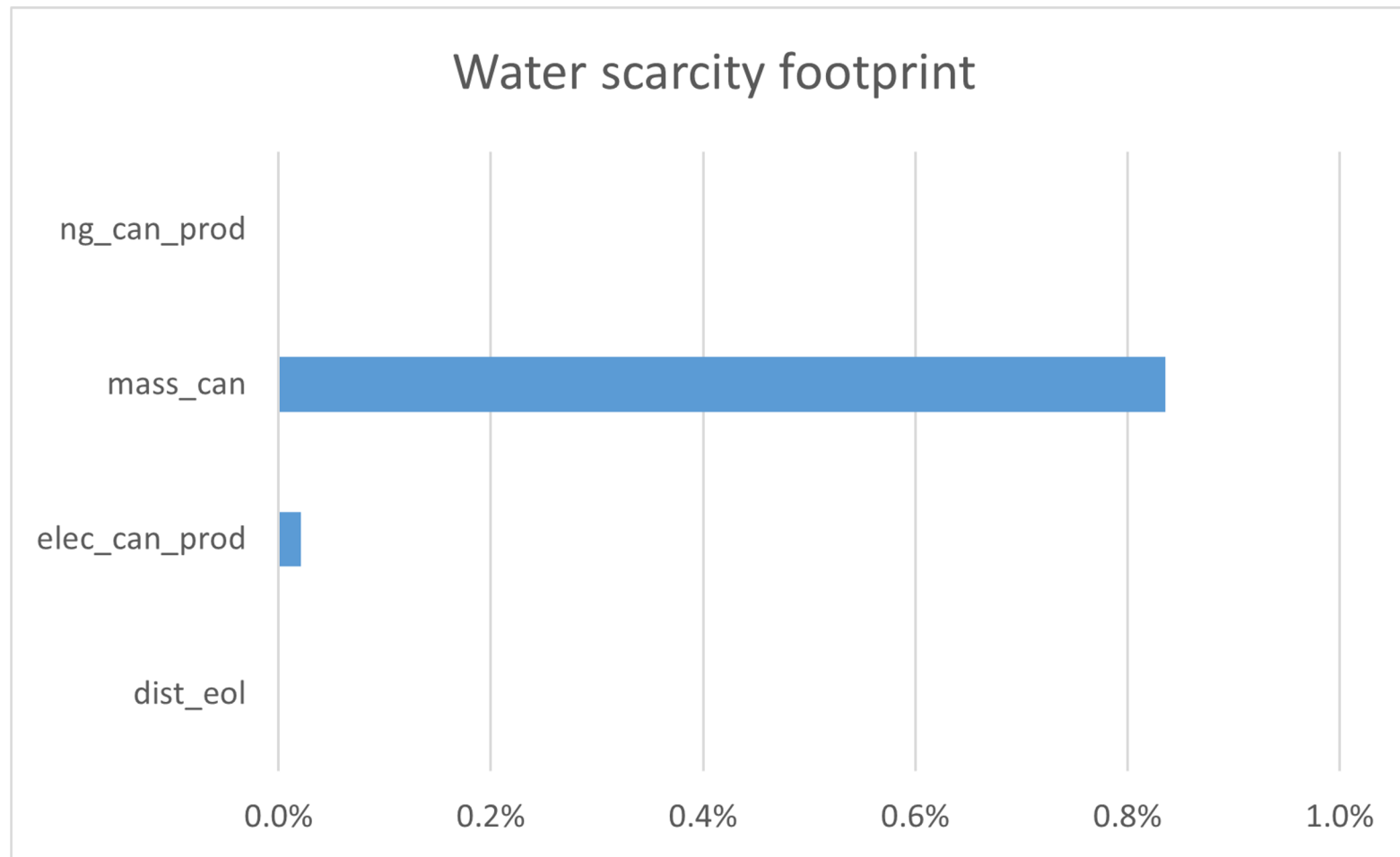
Question 2 - Sensitivity analysis (tornado graph)

Fossil and nuclear energy use



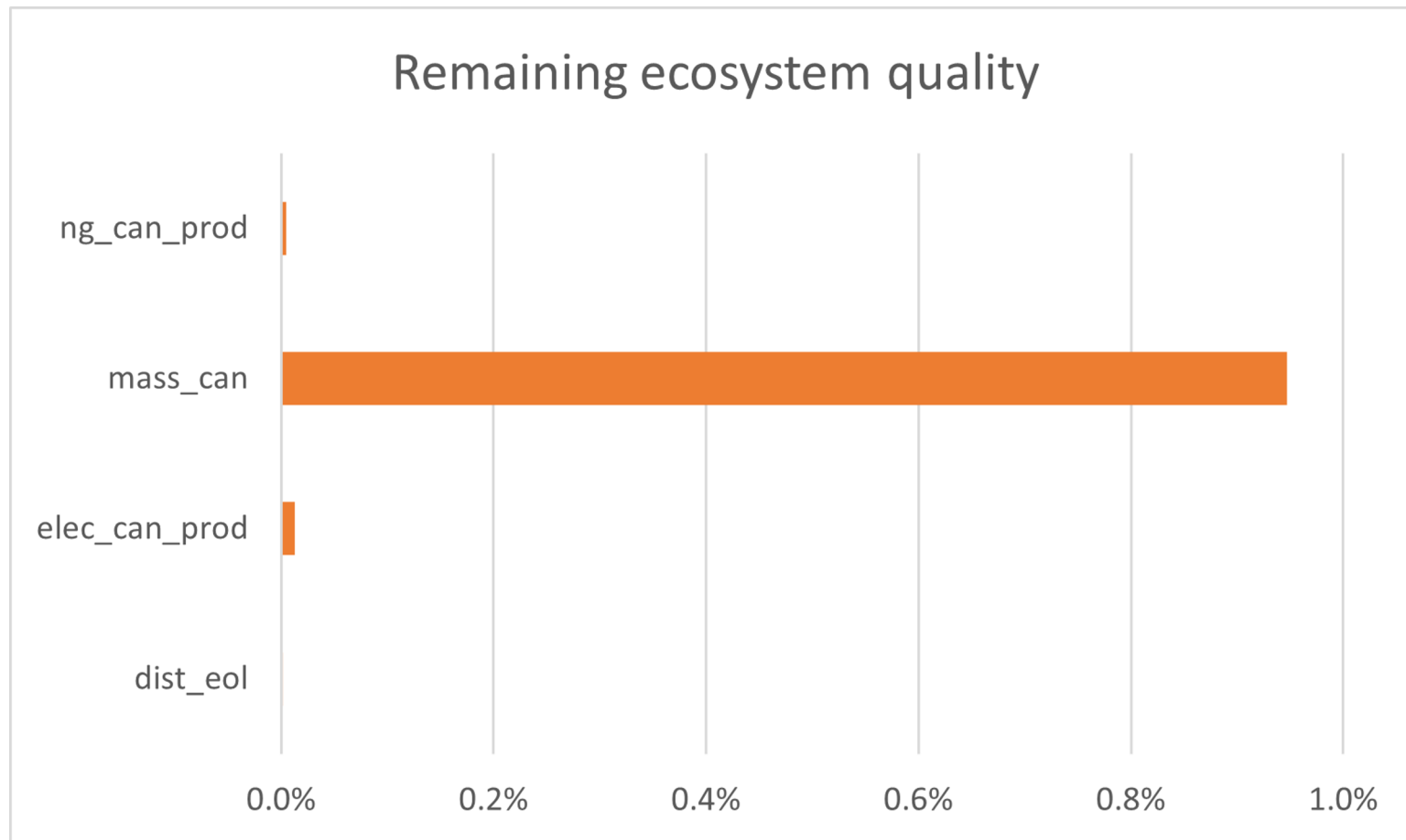
Question 2 - Sensitivity analysis (tornado graph)

Water scarcity footprint



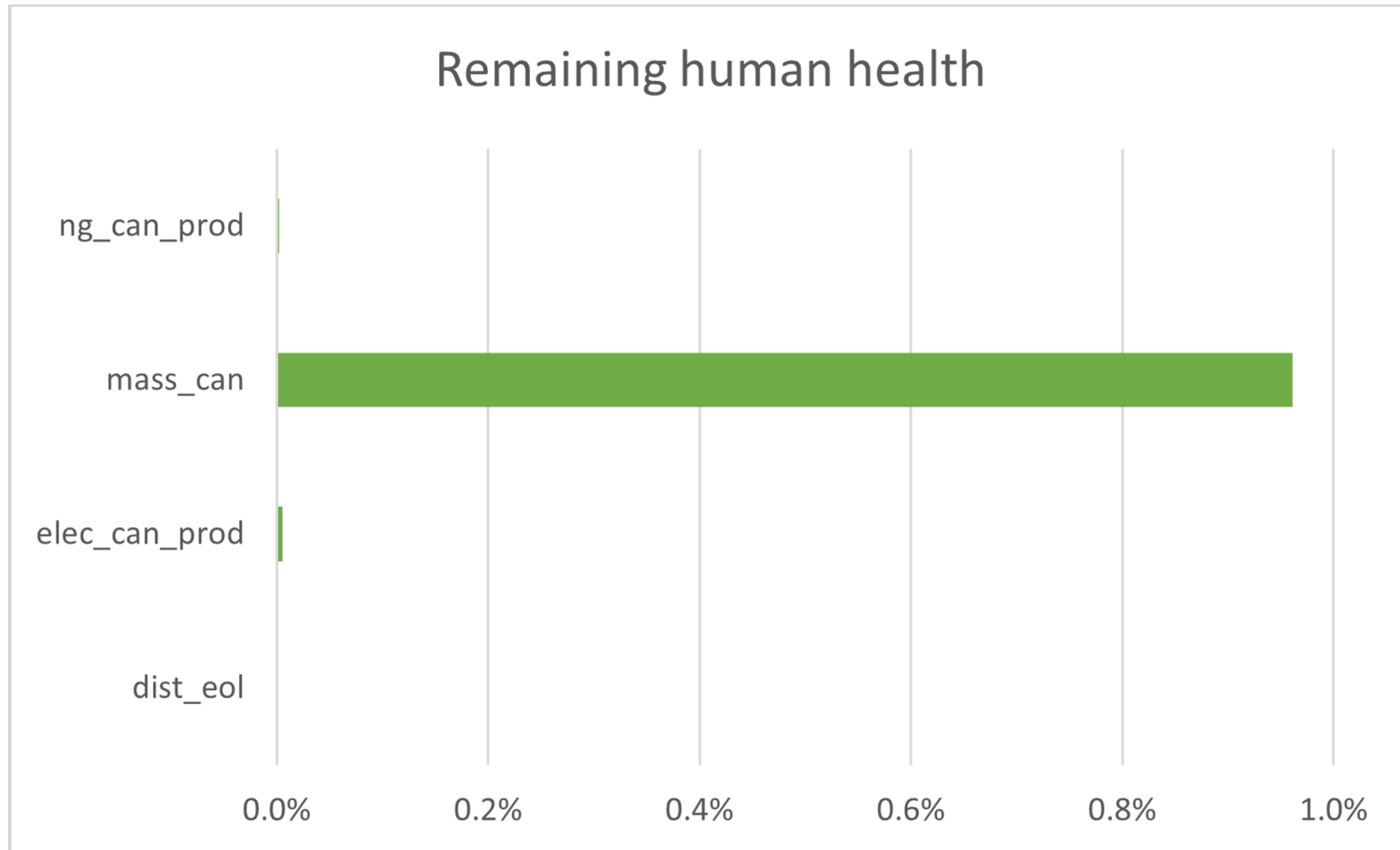
Question 2 - Sensitivity analysis (tornado graph)

Remaining ecosystem quality damage



Question 2 - Sensitivity analysis (tornado graph)

Remaining human health damage



Why, where and which?

LAB 5 – SENSITIVITY ANALYSIS