Council of the European Union – Brussels, 15th September 2023

Supporting the co-decision process of the PPWR:

Environmental analysis of Reuse scenarios

Joint Research Centre (JRC)

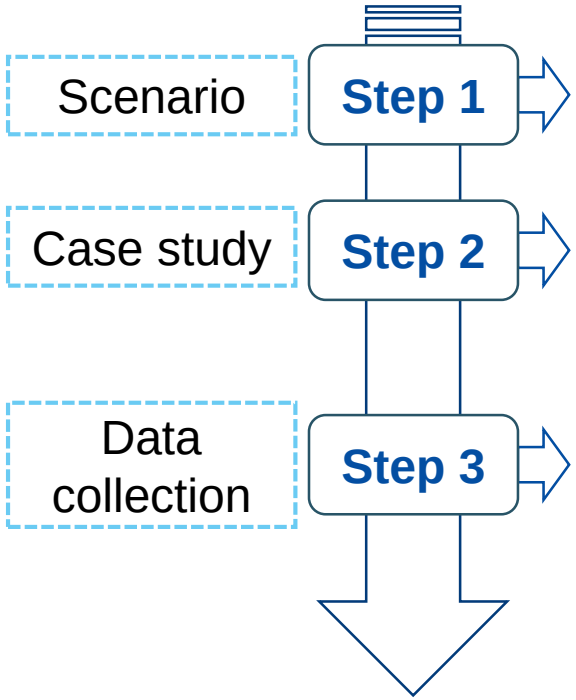
Sustainable Resource Directorate – Unit D.3

European Commission

Joint Research Centre – European Commission

- As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support the EU policies with independent evidence throughout the whole policy cycle.
- **The JRC** has been performing a study assessing the environmental performance of Single Use packaging products versus Multiple Use packaging products as in the focus of reuse targets of the Packaging and Packaging Waste Regulation (PPWR) proposal.

Method: Case study setting & data collection



Selecting a target of the PPWR to be analysed (Scenario)

- *e.g. -> PPWR Art.26.2 – "Cold or hot beverages […]": 20% (by 2030)*

Identifying a **representative case study** for the assessed Scenario

- Multiple-use product case compared to single-use option
  - *e.g. -> Comparing plastic (PP*) **MU** cup **vs** Paper-based **SU** cup*

Gathering relevant data for the case study

- Collecting data from literature and references
- Some data collected/verified on site (*e.g., visit at the JRC canteen*)
- Relevant parameters identified for each case-study:

- *Number of reuses*
- *Transport distances*
- *Number of transported items*
- *Washing (energy, detergent and water consumption, rinsing, re-washing)*
- *Energy mix*
- *End-of-Life waste management*
- *Recycled content*

**PP: polypropylene*

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Focus of the task and objective of the study

Focus ⇨ **Reuse targets** of the PPWR for **packaging** for the **food and beverages** sector

- *Cold or hot beverages packaging*
- *Take-away prepared food packaging*
- *Alcoholic beverages in the form of beer, carbonated beverages, etc.*
- *Alcoholic beverages in the form of wine*
- *HORECA sector full switch to reusable packaging (dine-in)*

Objectives ⇨ Assessing the **environmental performance** of Single Use (**SU**) vs Multiple Use (**MU**) products targeted by the PPWR

Ongoing Study
(started: May 2023)

Preliminary results

- *Life Cycle Assessment based approach **(LCA)***
- *Based on the **Product Environmental Footprint** (PEF)*
- ***Parametrized model** from raw materials to end-of-life*

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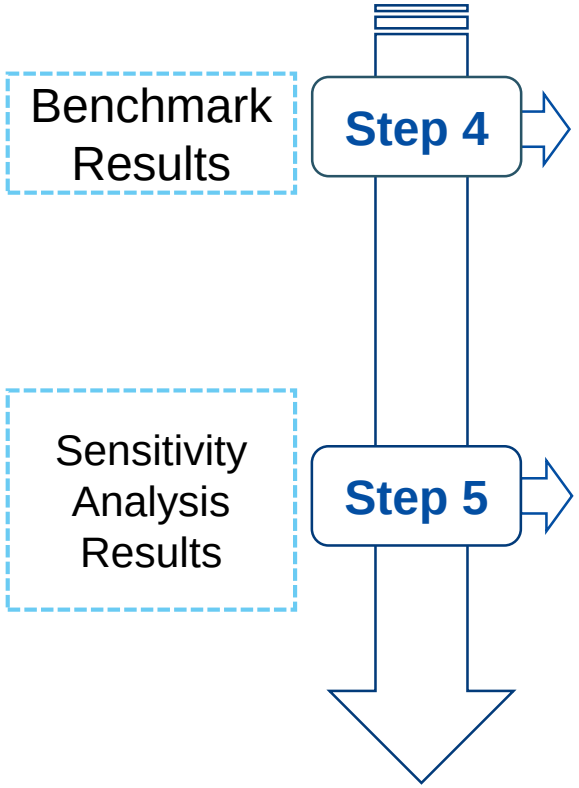
Method: Assessment of the environmental impacts



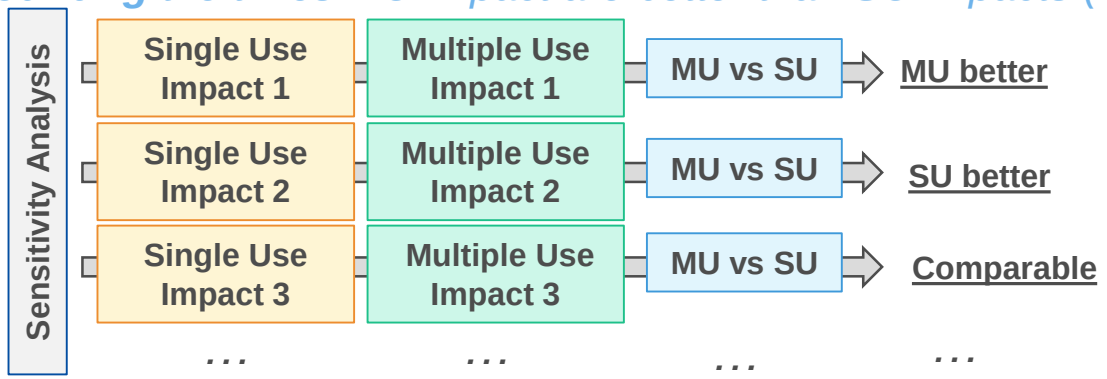
Environmental impacts: **Benchmark values**

- Calculated considering average values of the parameters (step 3) as for the representative case-studies (Step 2)
  - *Question -> are the life cycle impacts of the PP multiple use cup **lower/higher** than those of the Paper-based single use cup?*

Environmental impacts: **Sensitivity Analysis (varying parameters)**

- Identify the **variation ranges** of the parameters in each case-study
- Thousands random extractions of a parameter value in the range with equal probability (*Monte Carlo simulations*)
- Re-Running case-study assessment (as Step 4)

***Counting** the times MU impact are better than SU impacts (i.e., MU impacts are lower)?*



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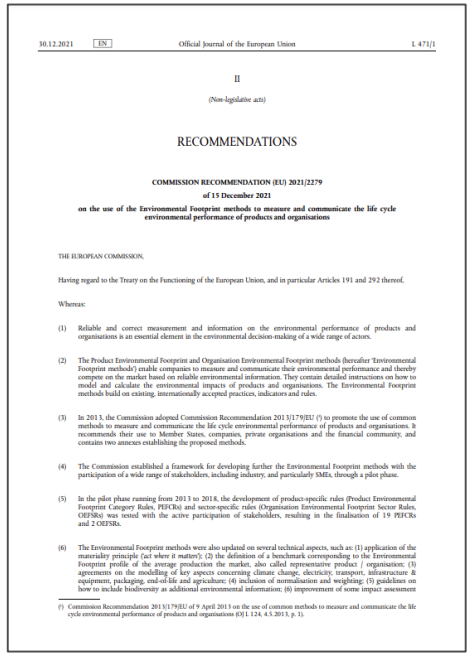
LCA based on the Product Environmental Footprint

Approach ⇨ **Develop LCA according to the EU *Product Environmental Footprint* method**



30.12.2021 EN Official Journal of the European Union L 471/1

II

(Non-legislative acts)

RECOMMENDATIONS

COMMISSION RECOMMENDATION (EU) 2021/2279
of 15 December 2021
on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Articles 191 and 292 thereof,

Whereas:

(1) Reliable and correct measurement and information on the environmental performance of products and organisations is an essential element in the environmental decision-making of a wide range of actors.

(2) The Product Environmental Footprint and Organisation Environmental Footprint methods (hereafter 'Environmental Footprint methods') enable companies to measure and communicate their environmental performance and thereby compete on the market based on reliable environmental information. They contain detailed instructions on how to model and calculate the environmental impacts of products and organisations. The Environmental Footprint methods build on existing, internationally accepted practices, indicators and rules.

(3) In 2013, the Commission adopted Commission Recommendation 2013/179/EU (1) to promote the use of common methods to measure and communicate the life cycle environmental performance of products and organisations. It recommends their use to Member States, companies, private organisations and the financial community, and contains two annexes establishing the proposed methods.

(4) The Commission established a framework for developing further the Environmental Footprint methods with the participation of a wide range of stakeholders, including industry, and particularly SMEs, through a pilot phase.

(5) In the pilot phase running from 2013 to 2018, the development of product-specific rules (Product Environmental Footprint Category Rules, PEFCRs) and sector-specific rules (Organisation Environmental Footprint Sector Rules, OEFSRs) was tested with the active participation of stakeholders, resulting in the finalisation of 19 PEFCRs and 2 OEFSRs.

(6) The Environmental Footprint methods were also updated on several technical aspects, such as: (1) application of the materiality principle ('act where it matters'); (2) the definition of a benchmark corresponding to the Environmental Footprint profile of the average production the market, also called representative product / organisation; (3) agreements on the modelling of key aspects concerning climate change, electricity, transport, infrastructure & equipment, packaging, end-of-life and agriculture; (4) inclusion of normalisation and weighting; (5) guidelines on how to include biodiversity as additional environmental information; (6) improvement of some impact assessment

(1) Commission Recommendation 2013/179/EU of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (OJ L 124, 4.5.2013, p. 1).

- *Full Life cycle accounting*
- *Following **EC Recommendation 2279/2021***
- *Use of the Environmental Footprint database (EF3.1)*
- *Results referring to **16 different impact categories*** →
- *Results of different impacts in **Aggregated Score***
- ***End of life modelling** considering relevant parameters, including: recycled content, recyclability, quality of recycled materials, etc. (Circular Footprint Formula)*

1. ***Climate Change***
2. ***Water Use impacts (Deprived Water)***

Other impacts (acronyms)

3. *Ozone Depletion (ODP)*
4. *Human Toxicity, cancer (Htox_c)*
5. *Human Toxicity, non-cancer (Htox_nc)*
6. *Particulate Matter (PM)*
7. *Ionising Radiation (IR)*
8. *Photochemical Ozone Formation (POF)*
9. *Acidification (AC)*
10. *Eutrophication terrestrial (TEU)*
11. *Eutrophication freshwater (FEU)*
12. *Eutrophication marine (MEU)*
13. *Ecotoxicity freshwater (ECOTOX)*
14. *Land Use (LU)*
15. *Resource Use, minerals and metals (MRU)*
16. *Resource Use, fossils (FRU)*

Robust method in line with advancements of the scientific community

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Scenarios under exam

Scenario 1 ⇨
- **The target:** *PPWR Art.26.2 – "Cold or hot beverages […]": 20% (by 2030)*
- **Presented case Study**: *"Single use paper cup (with LDPE lining and PS lid)" VS "Multiple use PP cup"*

Scenario 2 ⇨
- **The target**: *PPWR Art.26.3 – "Take-away ready-prepared food […]": 10% (by 2030)*
- **Presented case Study**: *"Single use cardboard tray with LDPE lining" VS "Multiple use PP clamshell tray"*

Scenario 3 ⇨
- **The target**: *PPWR Art.26.5 – "Alcoholic beverages in the form of wine […]": 5% (by 2030)*
- **Presented case Study**: *"Single use wine glass bottle" VS "Multiple use wine glass bottle (thicker)"*

Scenario Restaurant ⇨
- **The target**: *PPWR Art.22 (Annex V.3) – Single Use ban in Restaurants 100% (by 2030)*
- **Presented case Study**: *"Single use hamburger meal" (Paper trays for hamburger & fries + paper cup) VS "Multiple use hamburger meal" (PP plate for hamburger & fries + PP cup)*

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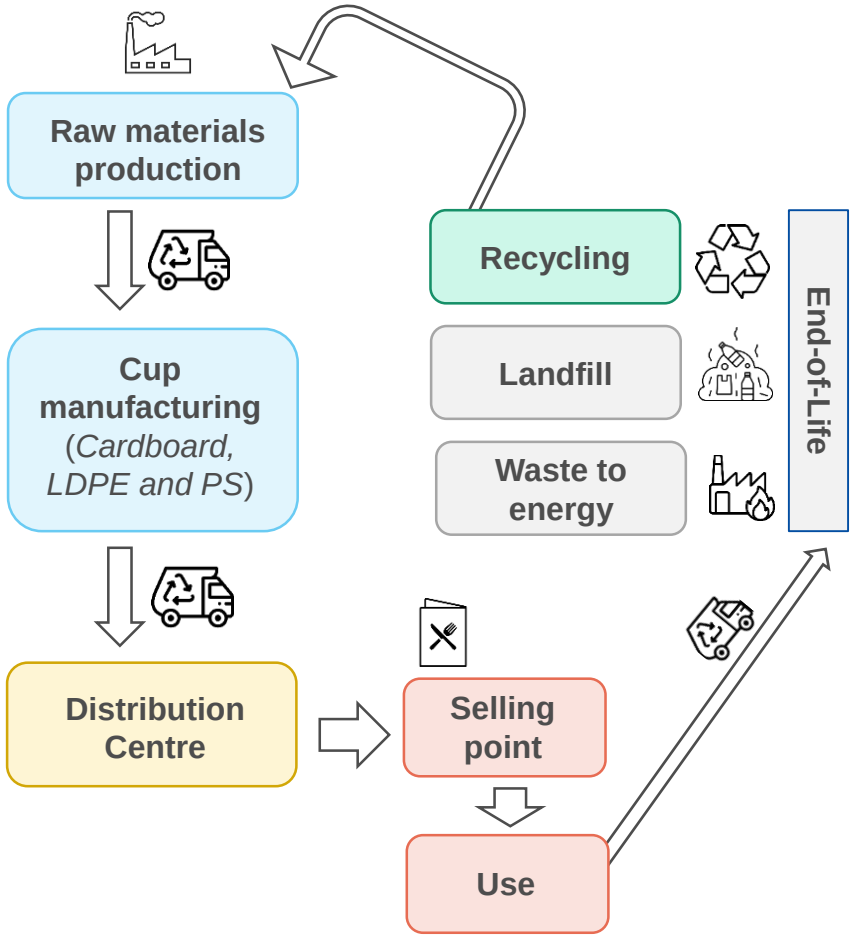
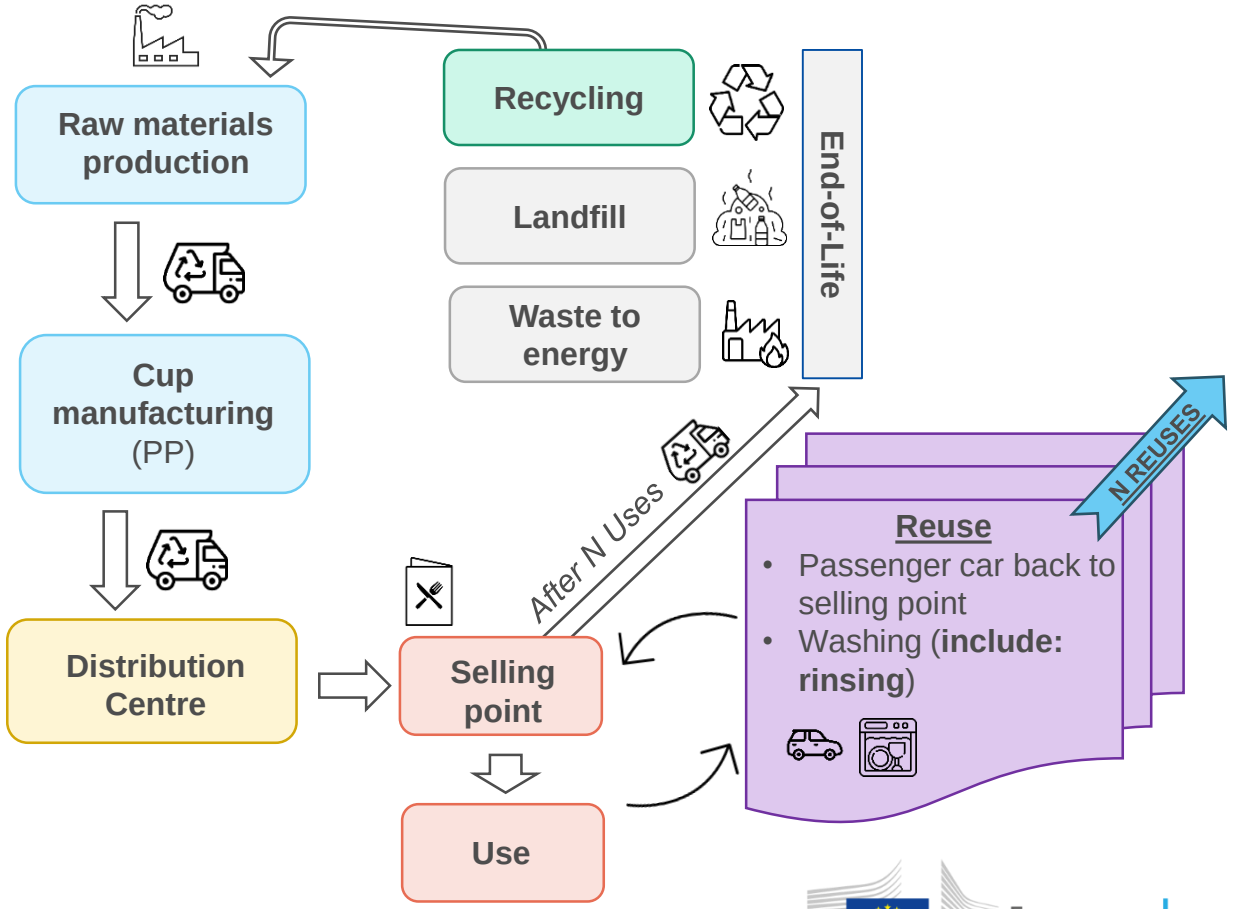
Scenario 1 (hot / cold beverages) - System boundaries

Scenario 1
Single Use paper cup



Scenario 1
Multiple Use PP cup



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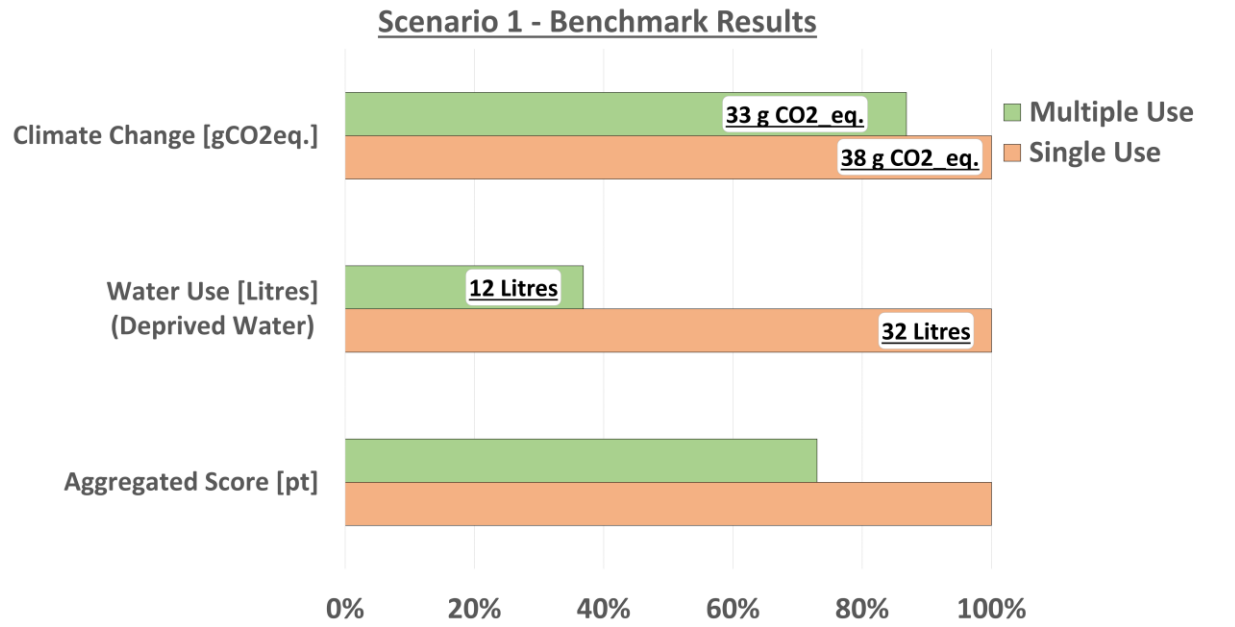
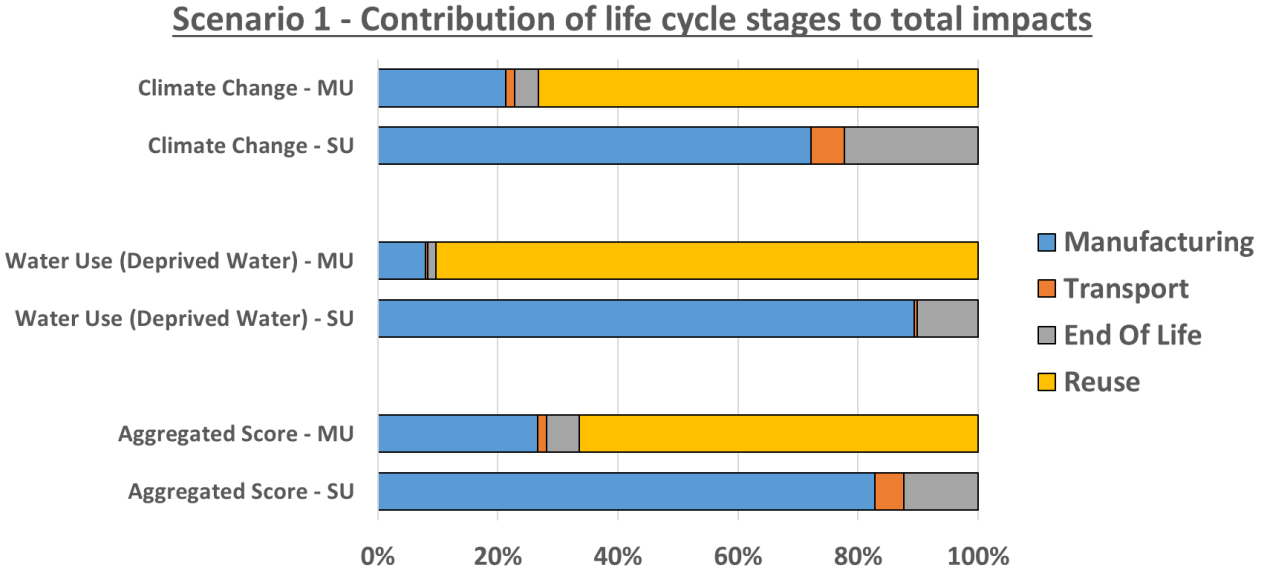
Scenario 1 - Environmental performances

PRELIMINARY RESULTS





Paper cup (SU) vs PP cup (MU)

- **Climate Change and Water Use impacts are lower** in **MU** case (due to high impacts of paper production).
- **Aggregated Score performance** is better for **MU**.
- **MU** impacts are driven by the **Reuse step** (washing and transport) whilst **SU** impacts are mainly related to the **Manufacturing step**.
- Assumptions on **consumers' behaviour and washing practices** play a crucial role.
- **Reuse impacts** are mostly influenced by transport with passenger car, electricity and heat for rinsing.

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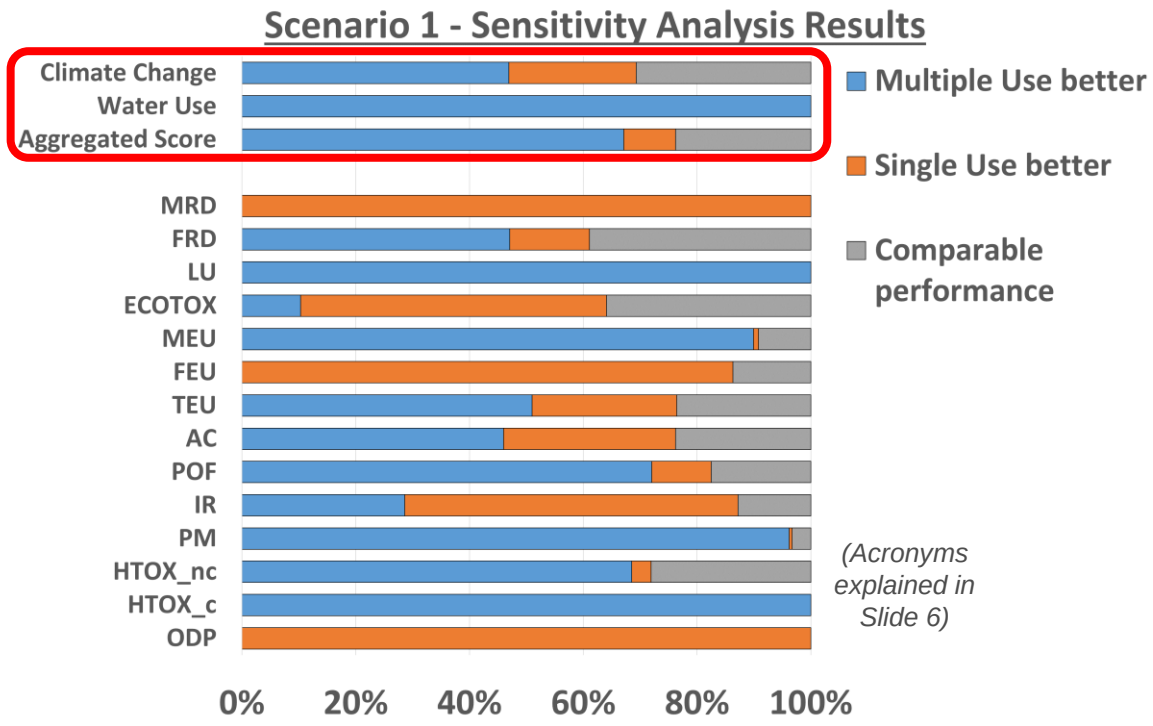
PRELIMINARY RESULTS

Scenario 1 - Environmental performance

Sensitivity Analysis of scenario 1:

Scenario 1

(**recycling** of paper-based cups range: **5%-30%**)



(Acronyms explained in Slide 6)

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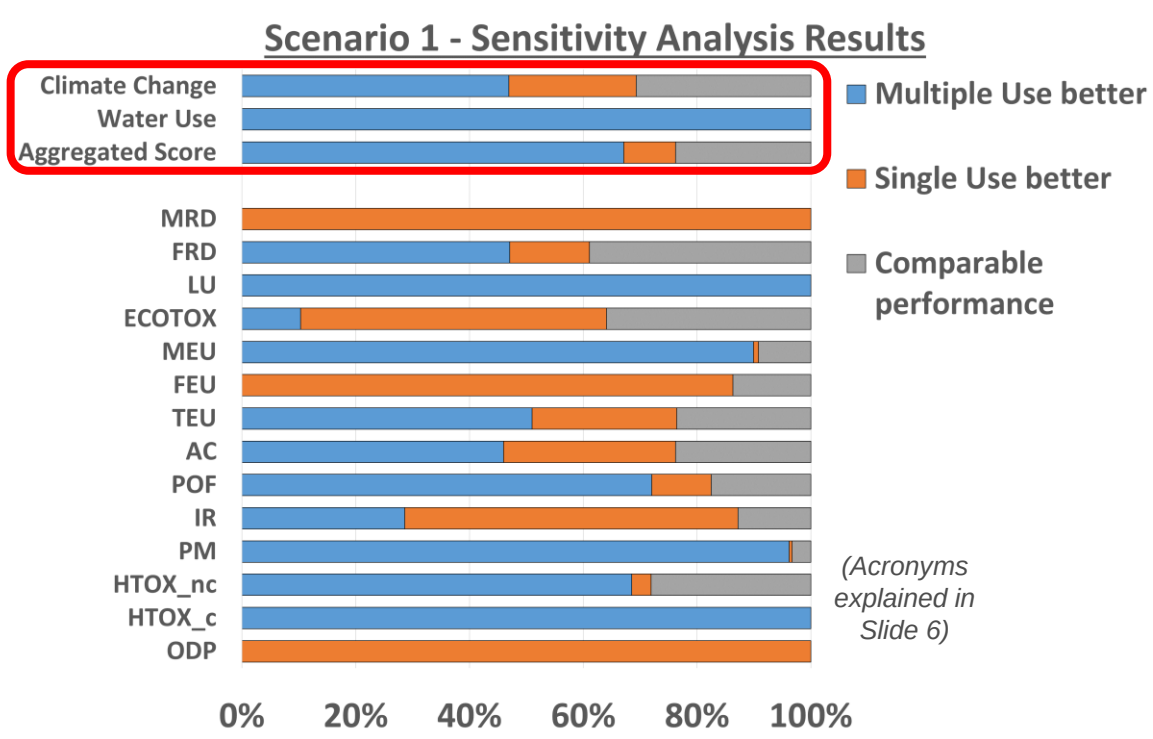
PRELIMINARY RESULTS

Scenario 1 - Environmental performance

Sensitivity Analysis of scenario 1:

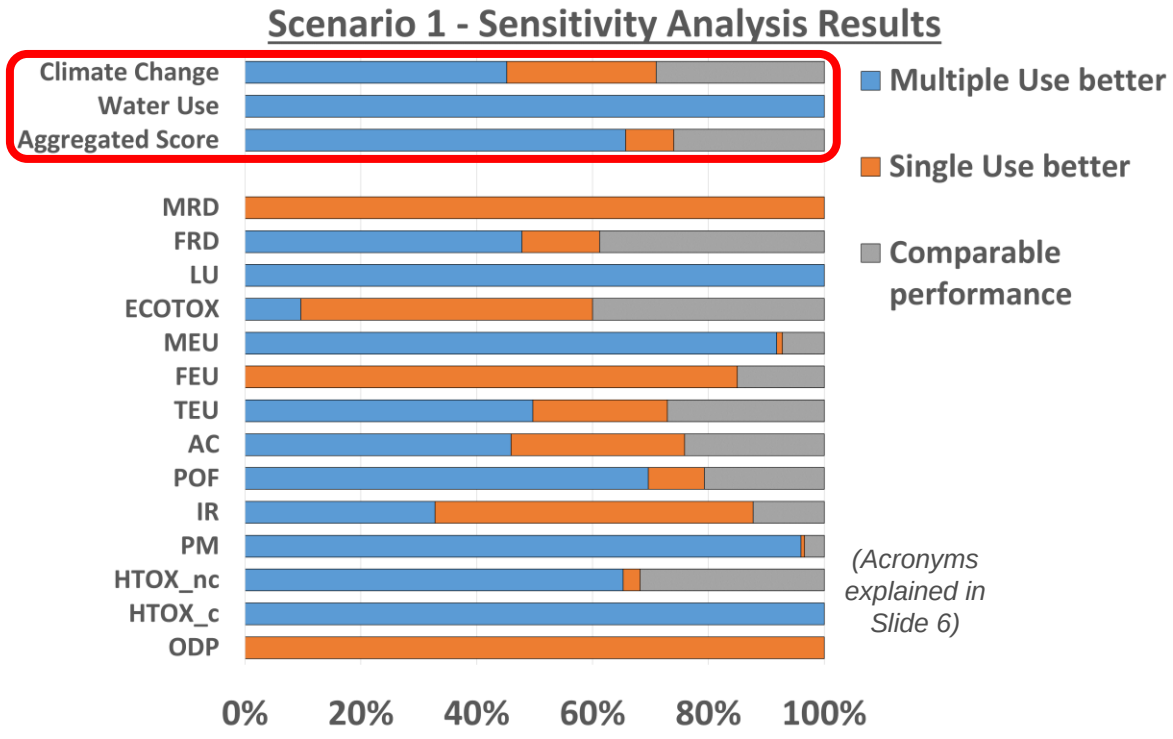
Scenario 1

(**recycling** of paper-based cups range: **5%-30%**)



Scenario 1bis

(recycling of paper-based cups range increased:15%- 45%)



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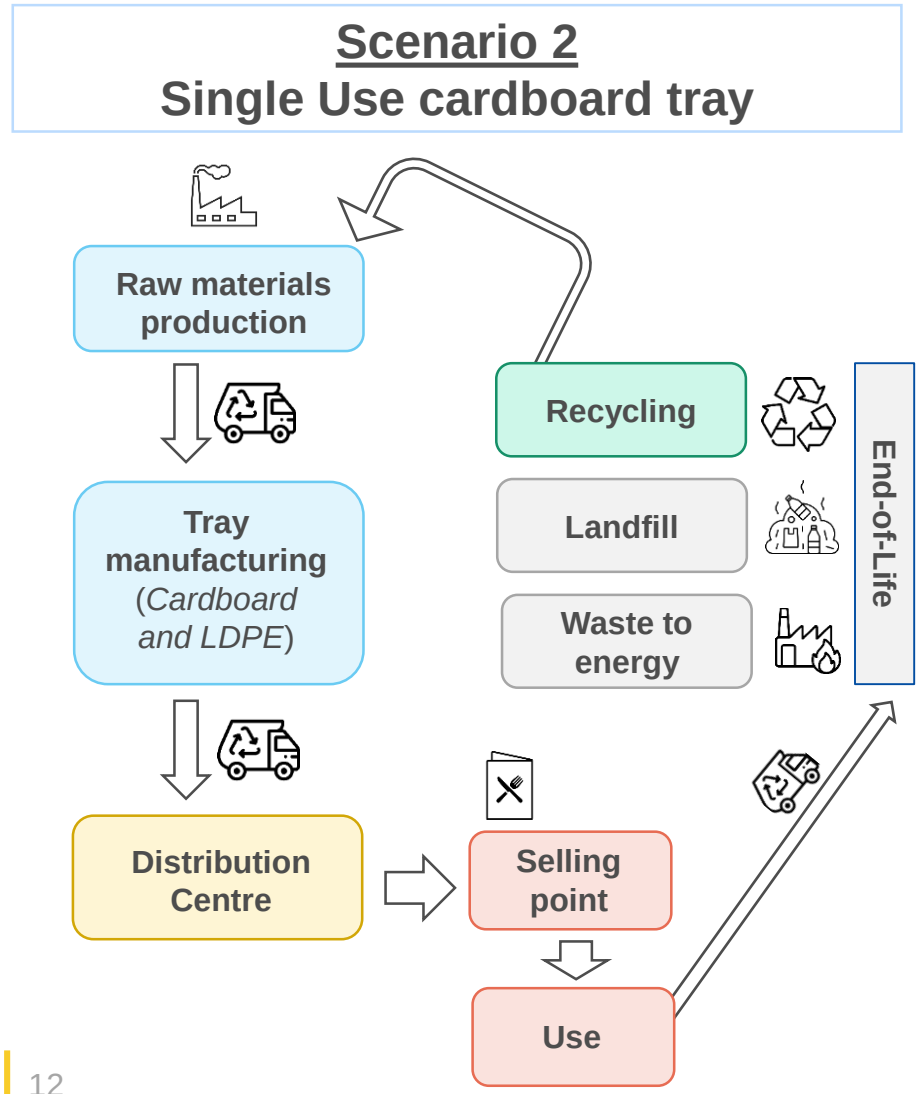
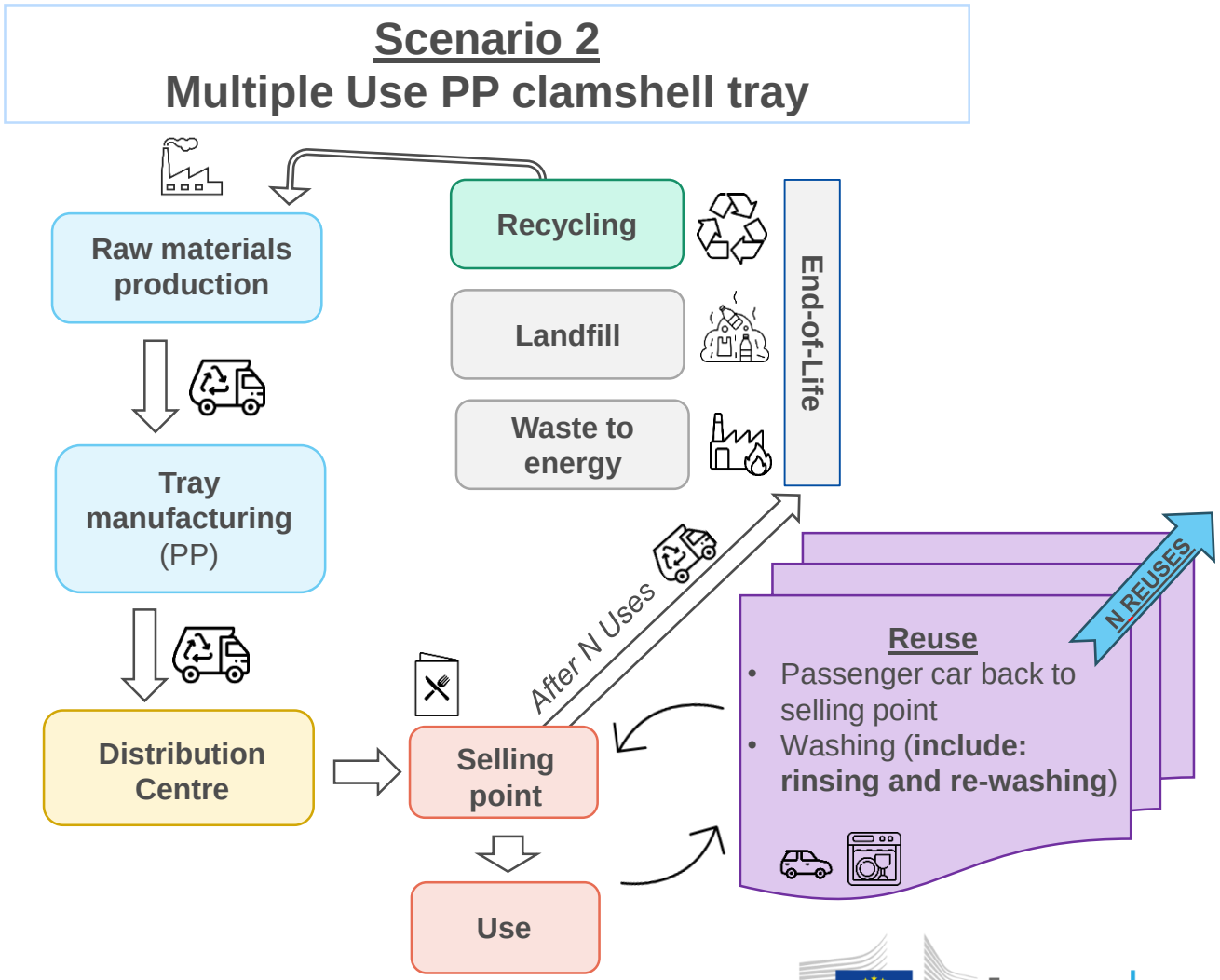
Scenario 2 (take away food) - System boundaries





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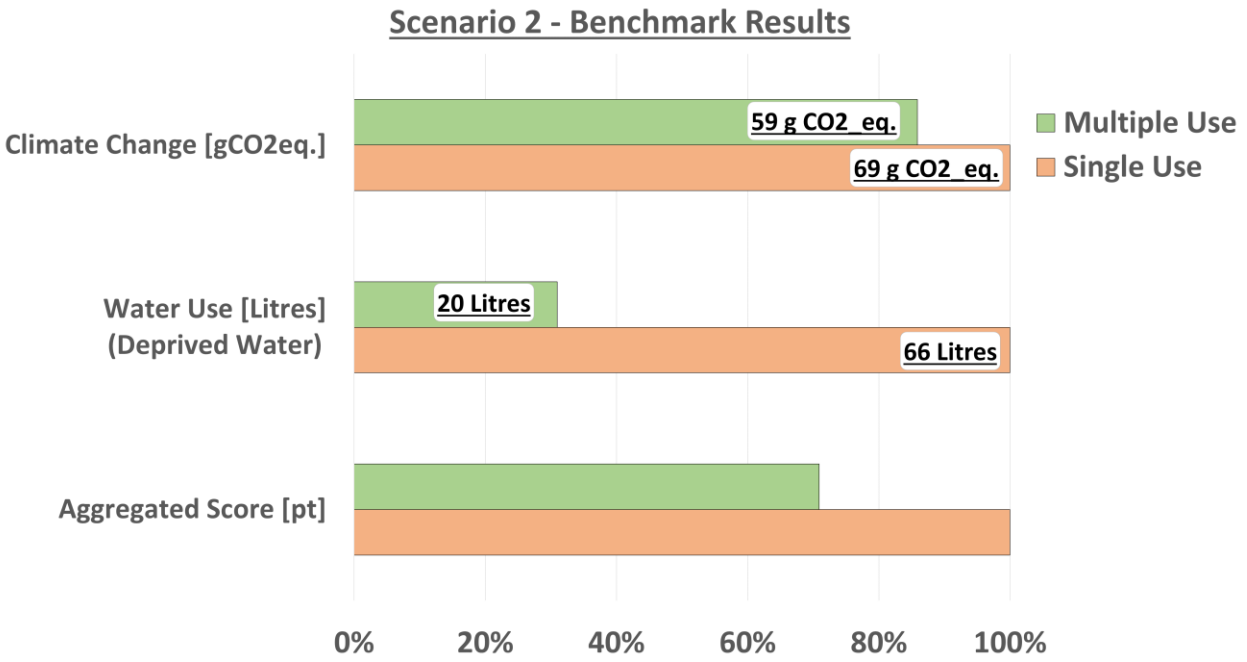
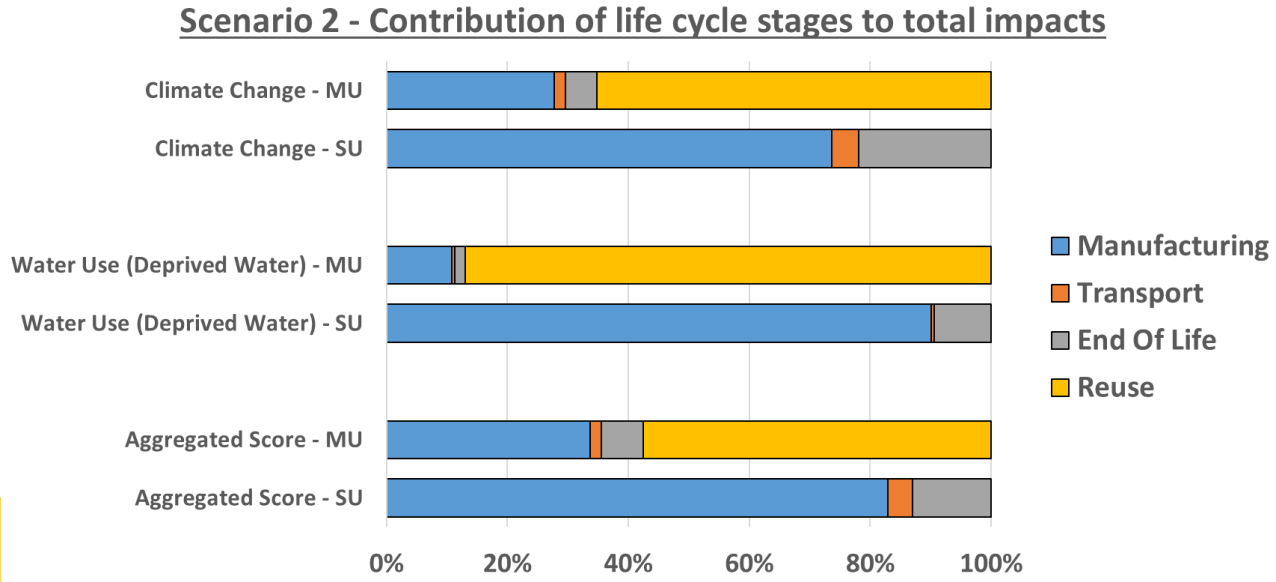
Scenario 2 - Environmental performances

PRELIMINARY RESULTS





Cardboard tray (SU) vs PP tray (MU)

- **Climate Change and Water Use impacts are lower** in the multiple use case due to high impacts of paper production.
- **Aggregated Score performance** is better for MU.
- MU impacts are related to the **Reuse step** (washing and transport) whilst SU impacts are mainly related to the **Manufacturing step.**
- **Reuse impacts** are mostly influenced by transport with passenger car and electricity.
- Assumptions on **consumers' behaviour and washing practices** play a crucial role, having ***major influence on results, higher compared to the Scenario 1***.

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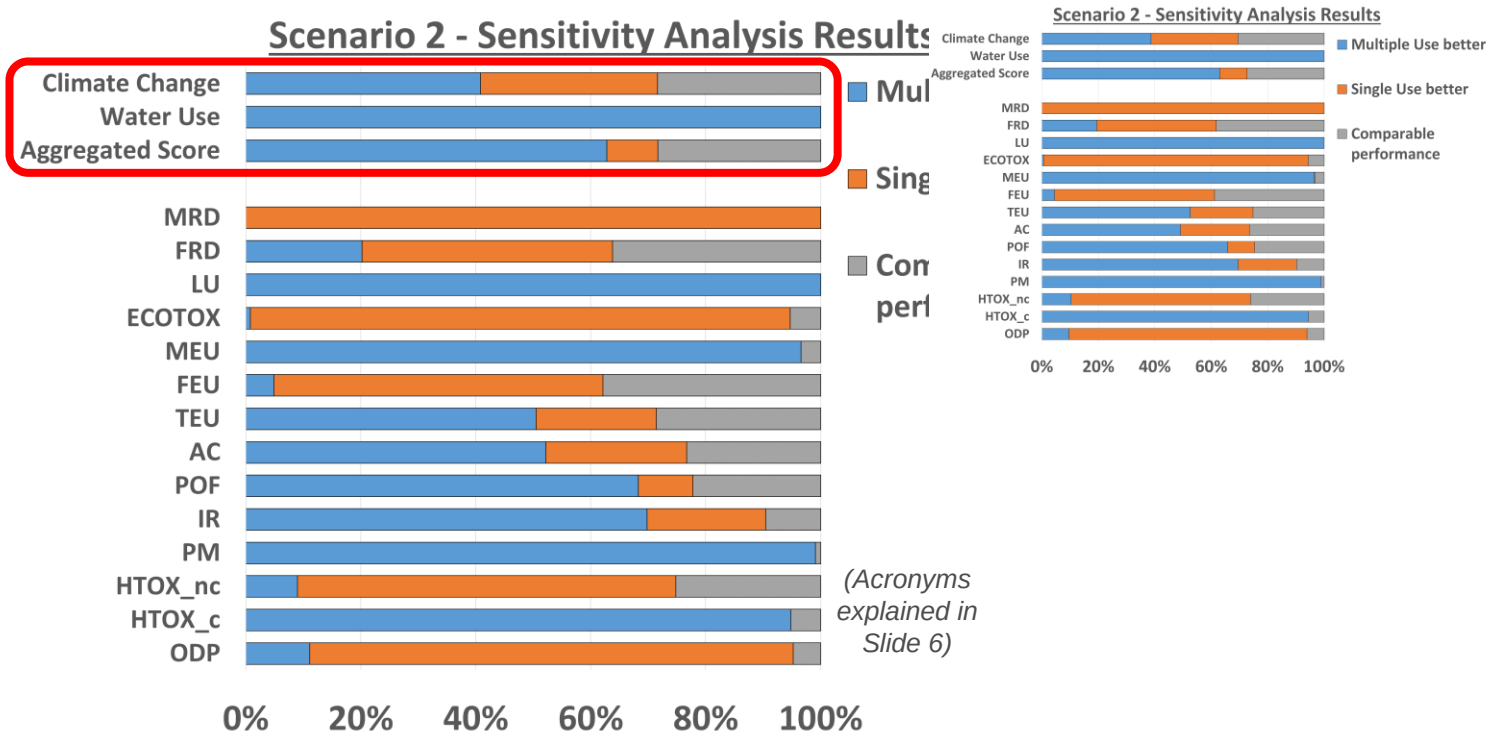
Scenario 2 - Environmental performance

PRELIMINARY RESULTS

Scenario 2
MU return includes passenger car

Part of impacts for returning back are allocated to the **MU**, even if the trip is done also for other purposes – e.g., buying new food



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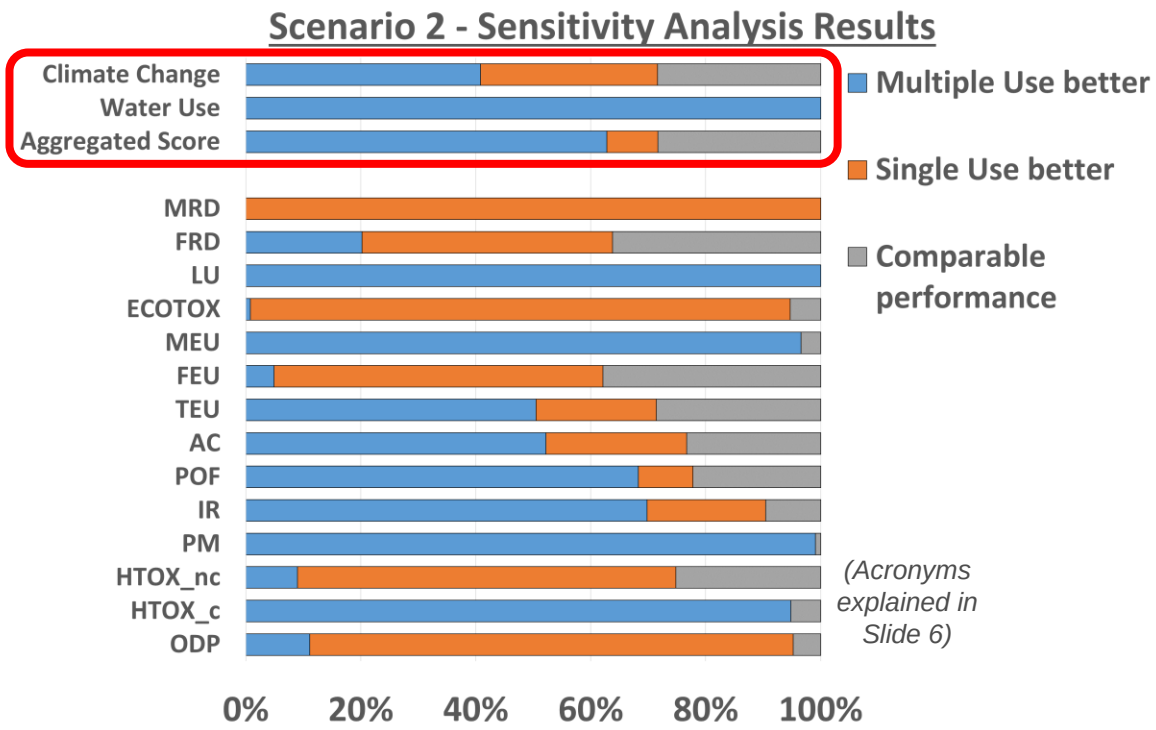
Scenario 2 - Environmental performance

PRELIMINARY RESULTS

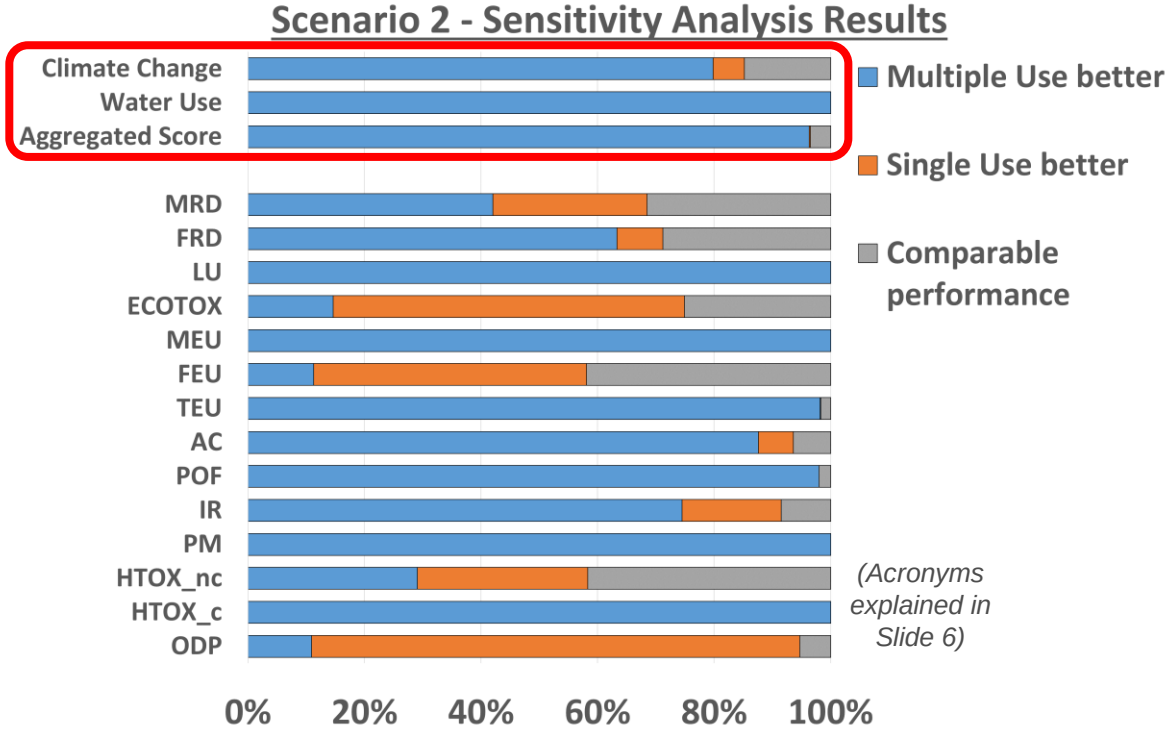
Scenario 2
MU return includes passenger car

Part of the impacts for returning empty tray back are allocated to the **MU**, even if the trip is done also for other purposes – e.g., buying new food



Scenario 2 bis
MU return without impacts from car

The impacts for returning empty tray back are not allocated to the MU



Crucial role of the assumptions on consumers' behaviour on the MU take back.

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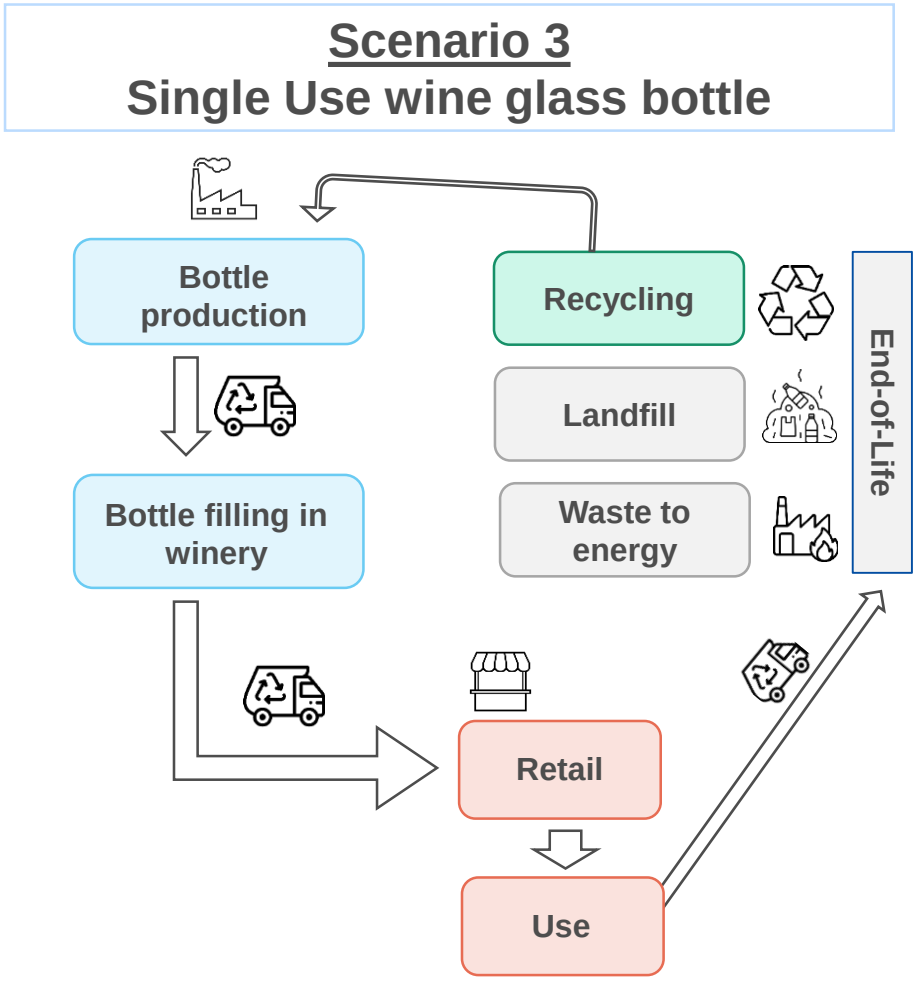
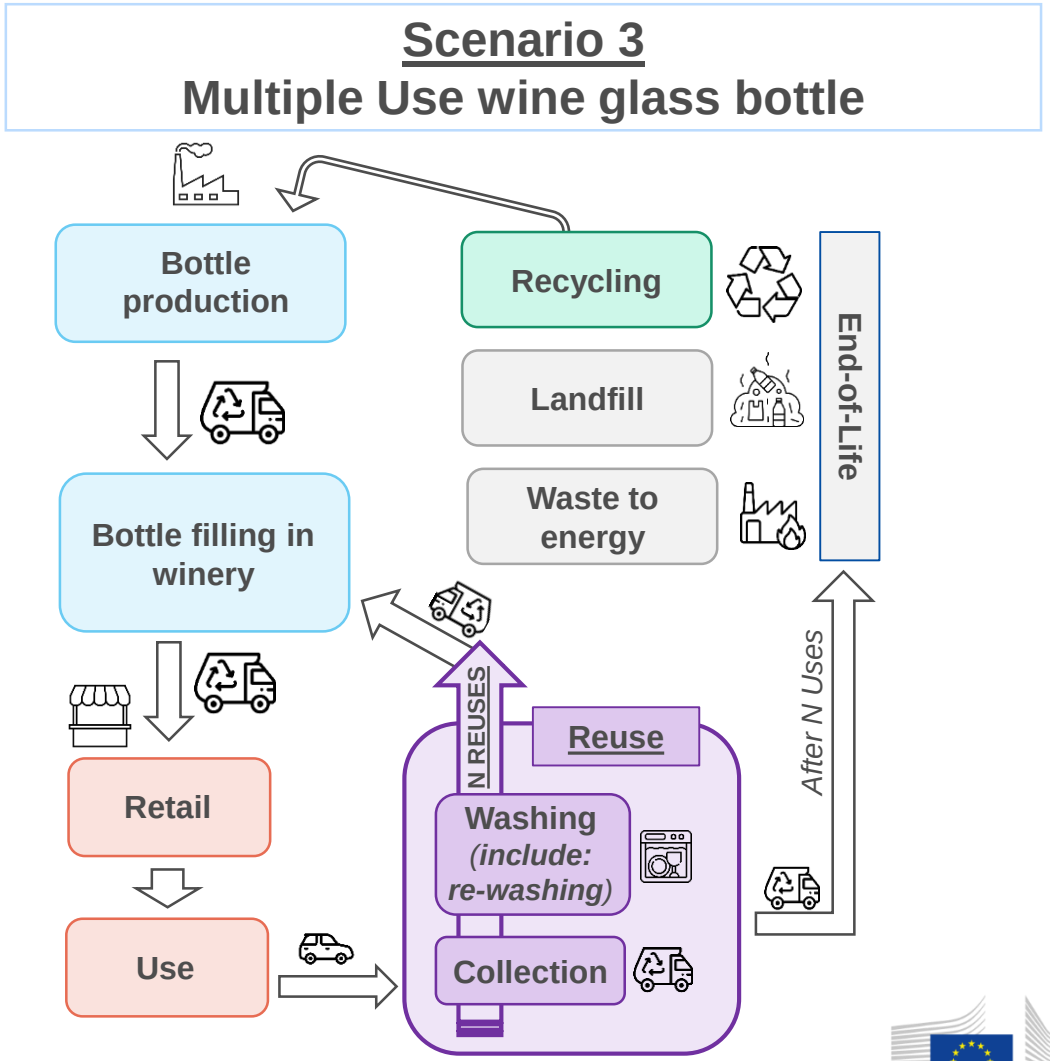
Scenario 3 (Wine bottle) - System boundaries





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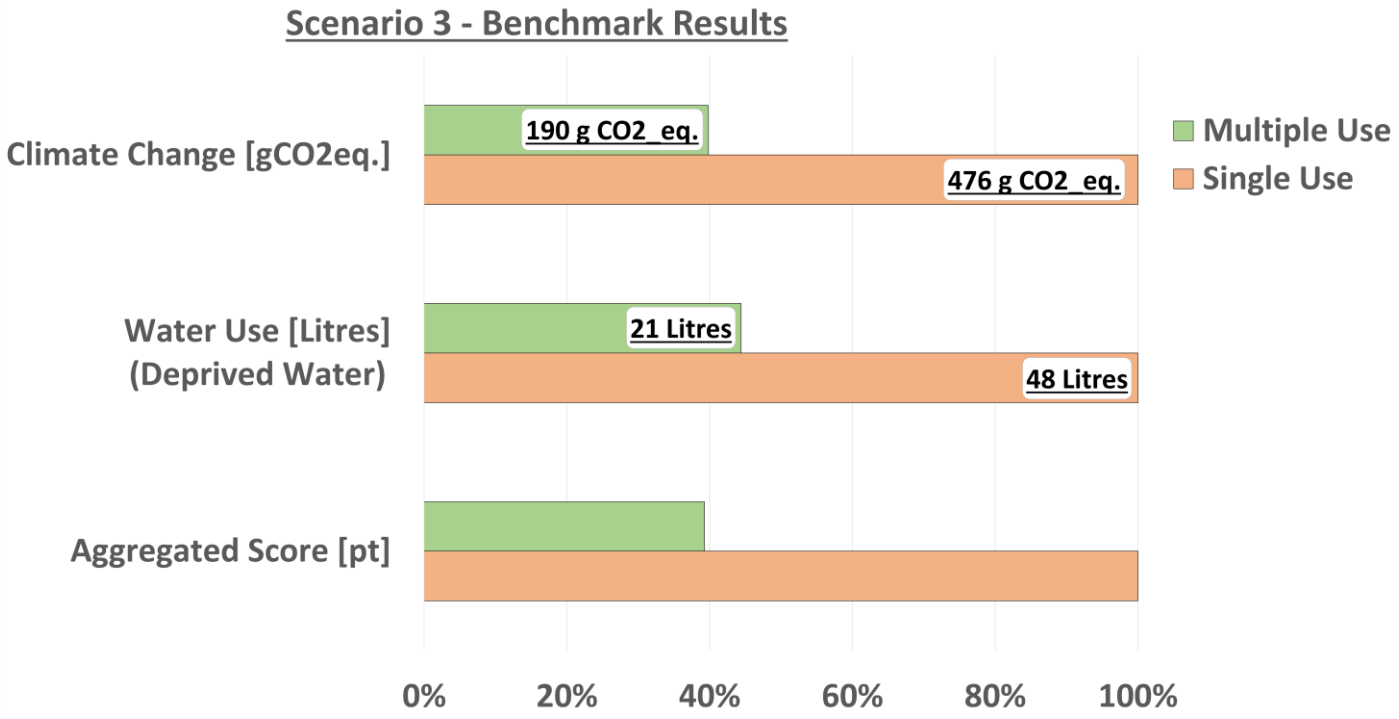
Scenario 3 - Environmental performance

PRELIMINARY RESULTS

Wine bottles (SU) vs Wine bottle (MU – thicker)



- This case study considers **operations for collecting the bottles, cleaning and transporting back to winery**.
- Clear benefits for **MU** bottle (even if considered thicker).
- **Assumption on the Number of reuses** plays a key role in this scenario.
- **Reuse impacts** are mostly influenced by transport with lorry and transport with passenger car.

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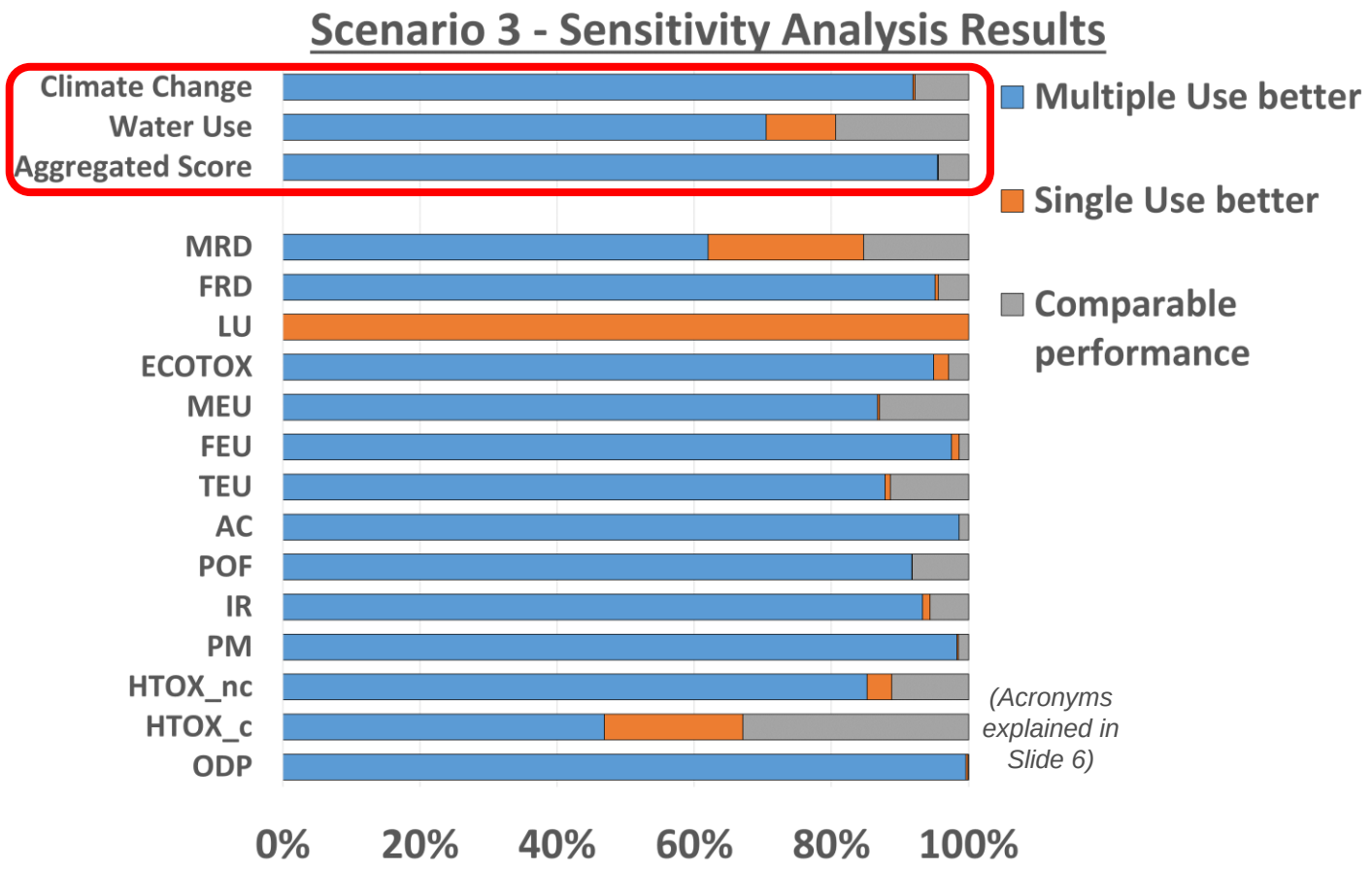
Scenario 3 - Environmental performances

PRELIMINARY RESULTS

Wine bottles (SU) vs Wine bottle (MU – thicker)



- **MU** performs better in almost all impact categories (even assuming long distance for returning the bottle back in the winery).

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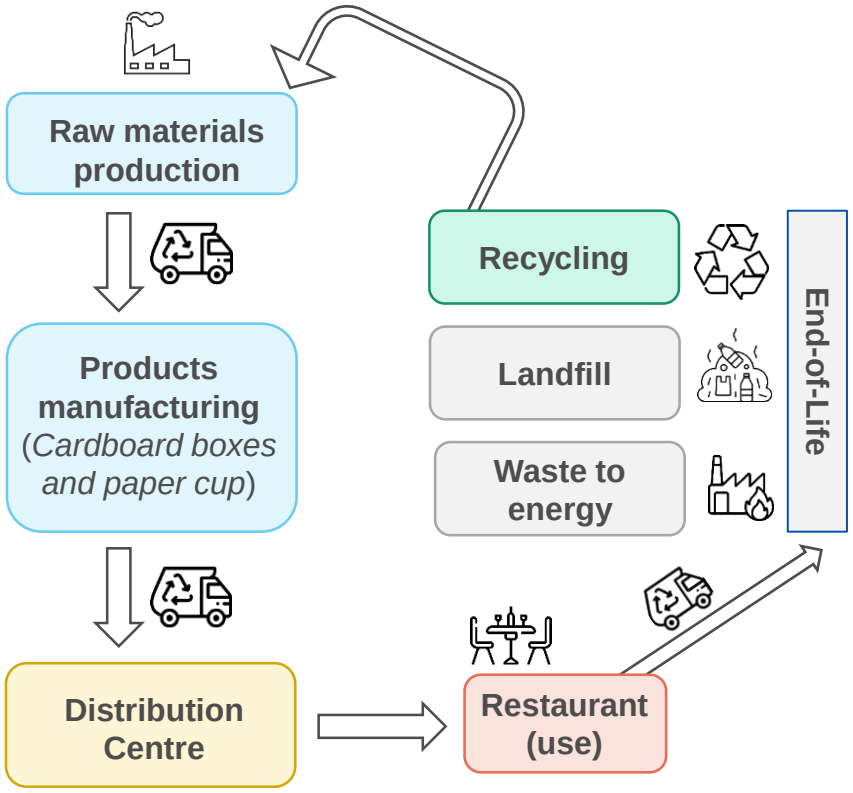
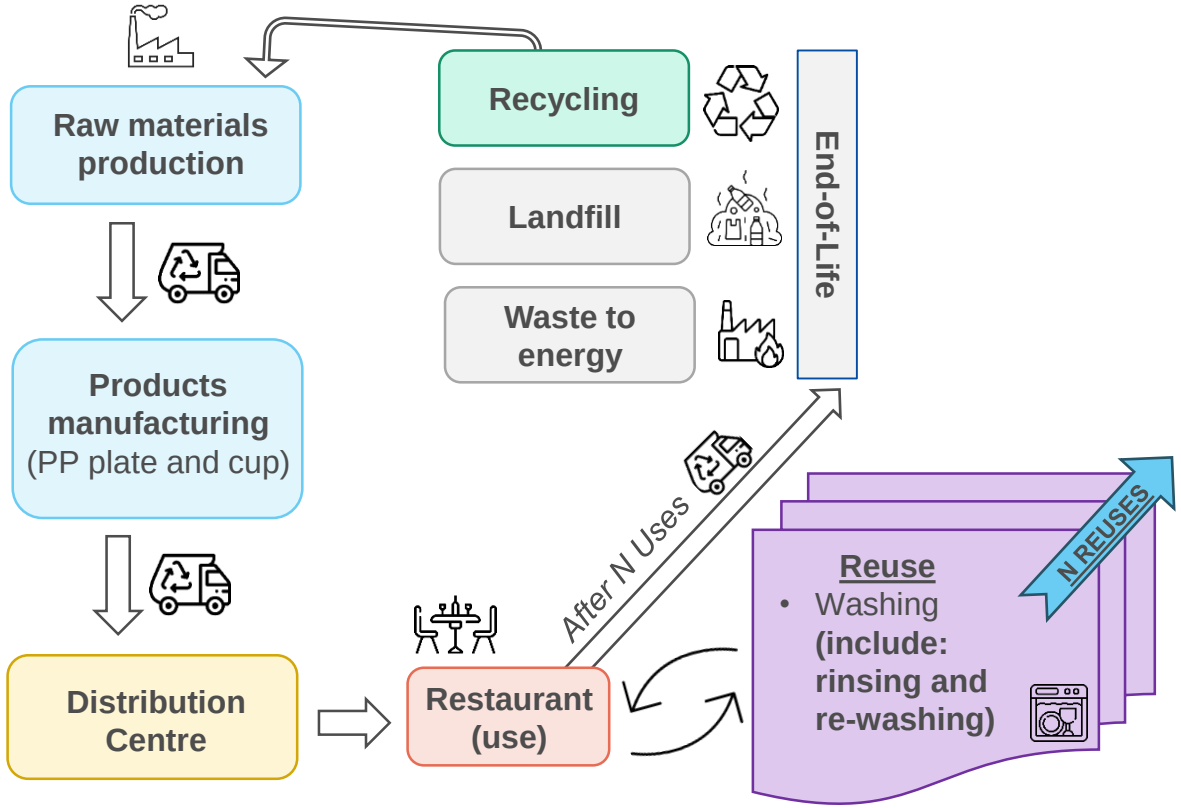
Restaurant Scenario - System boundaries

Restaurant Scenario
Single Use Hamburger meal *



Restaurant Scenario
Multiple Use Hamburger meal **



* Paper trays for hamburger & fries + paper cup
** PP plate for hamburger & fries + PP cup

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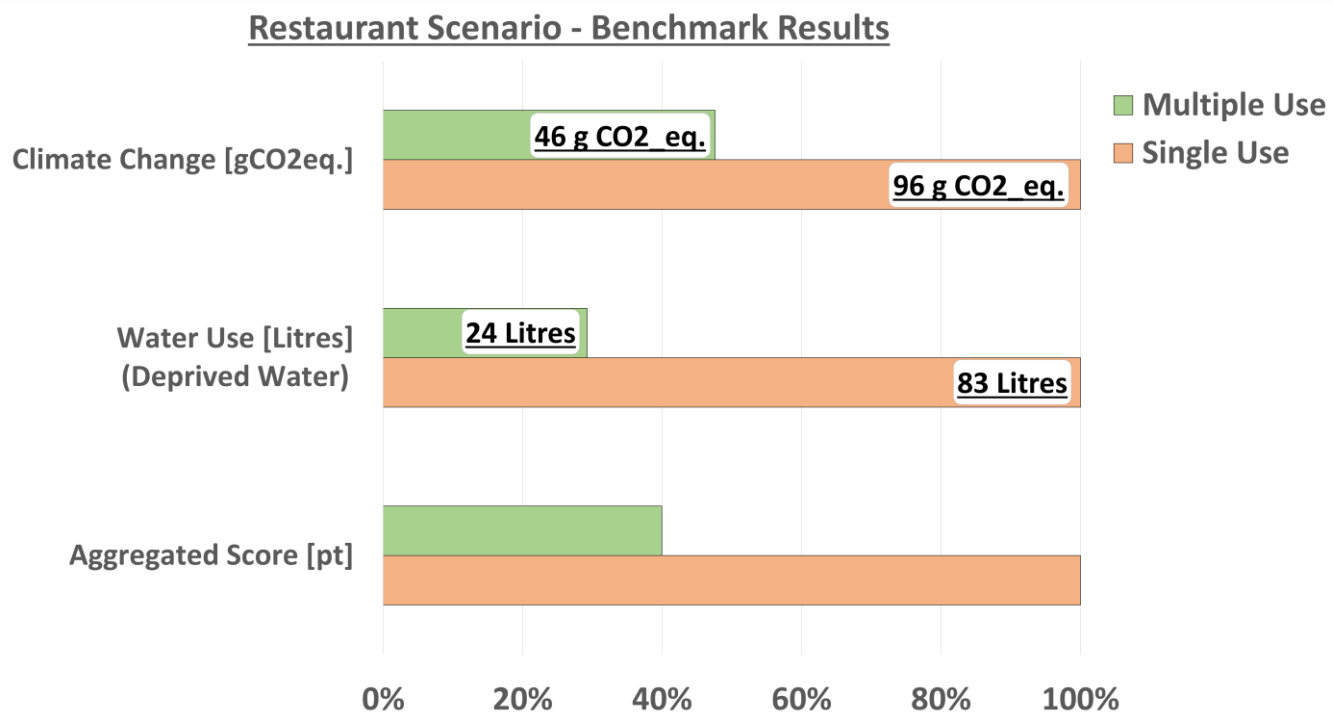
Restaurant Scenario – Env. performance

PRELIMINARY RESULTS

Restaurant Scenario - Hamburger meal



- **The benefits of the MU product** are evident when consumption and washing occurs in the same place (dine-in), since no "take-back" transport occurs.
- Despite the water needs for the washing operations in the reuse, **Water Use impacts are lower in the MU** due to large consumption of water for the paper pulping process.
- **Reuse impacts** are mostly influenced by electricity and heat for washing.

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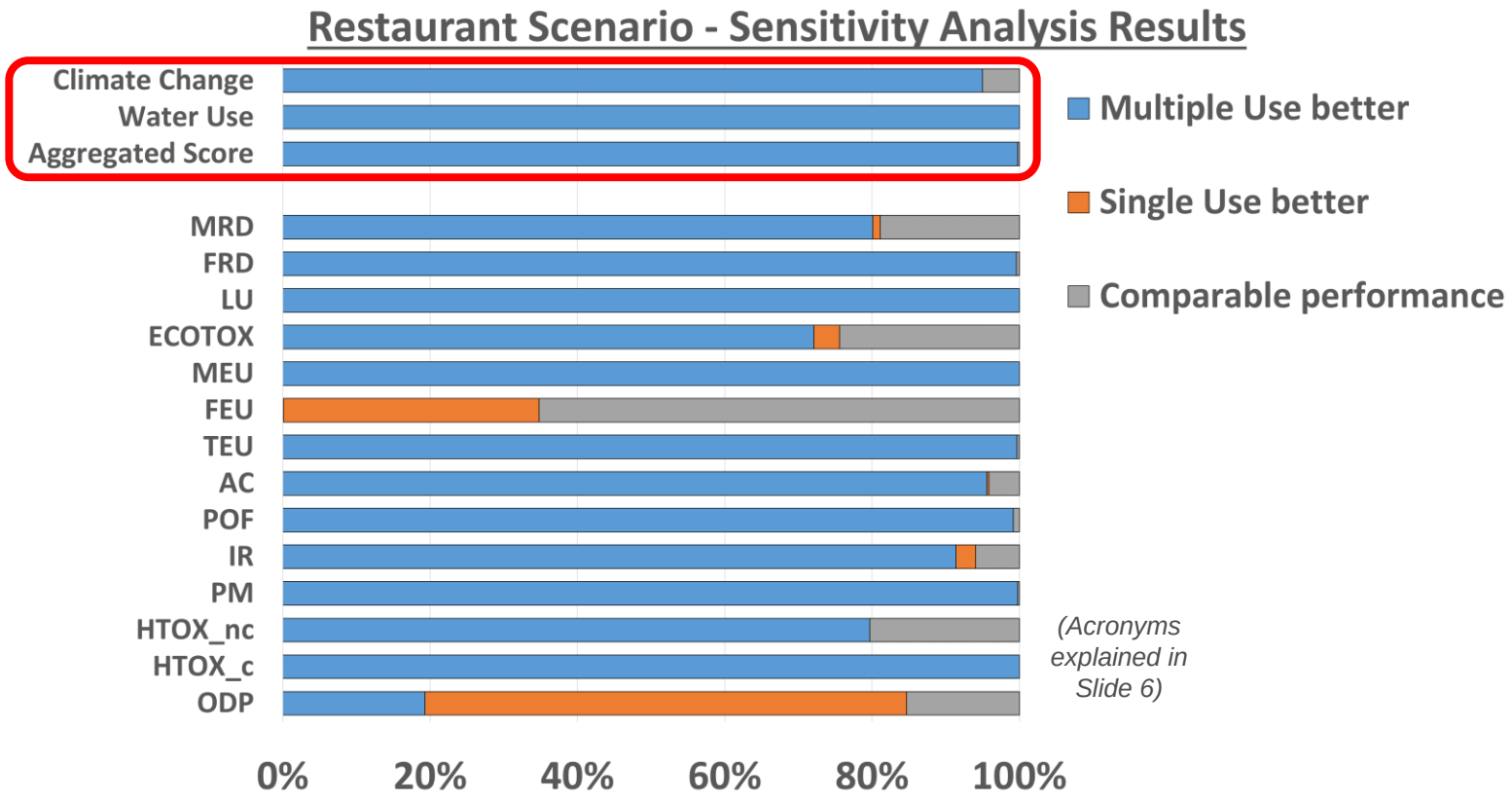
Restaurant Scenario – Env. performances

PRELIMINARY RESULTS

Restaurant Scenario - Hamburger meal



- **Clear benefits** for large majority of impact categories considered.
- **Detergents** and **wastewater treatment** impacts drive the performance in the **Ozone Depletion** and **Freshwater Eutrophication** impact categories, respectively.

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Discussion on the approach

Strengths

- Analysing the **full life cycle of the products is critical** to guarantee robustness of the results.
- **Sensitivity analysis** is crucial to assess the environmental performances for the **variation of the parameter values**.
- Covering more **environmental indicators** (on top of Climate Change and Water Use), ensures a comprehensive overview of the performances and might underline hotspots.
- **Robustness** is ensured by using consistent background datasets and **PEF rules** especially for end-of-life modelling.

Limitations

- **Certain business models are currently not in place:** transparency on assumptions and (primary) data is needed to ensure replicability and flexibility as future changes are to be expected.
- **LCA** results (especially for some of the case-studies) largely depend on underpinning **assumptions.**
- **Key assumptions** for this study (requiring careful assessment / interpretation) included: mass of the items; logistics; washing modelling and washing practices (e.g., rinsing); number of reuses.

Key takeaways

- For case studies where MU benefits were less evident, **it is important to optimize parameters that drive environmental performance to achieve MU to be more beneficial.**
- **Users' behaviour** plays a key role in the environmental performances (i.e., travels by **passenger car** in take-away systems, number of items transported same time).
- The foreseen **number of reuses** and **number of washed items** are among the most relevant parameters driving the results. Primary data on these could be derived from fully implemented reuse schemes.
- **Washing and rinsing** practices can largely affect some MU impacts (e.g., hot / cold water when rinsing). Impacts associated to **electricity** is relevant for certain impact categories.
- We observed a lower relevance of assumptions on **recycled content and recyclability** compared to other parameters in our model.

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Next steps

- **Further work** on the Scenarios and Case Studies is envisioned: targeting and revising assumptions, ranges, further exploring the influence of certain parameters on the results, etc.
- Final draft JRC **Report** to be prepared (expected: November 2023). No further disseminations foreseen before that.
- **Our contact:** ec-eplca@ec.europa.eu

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Thank you for your attention!

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