



ESA CLEAN SPACE DAYS 2026

01.07.2026, ESTEC, The Netherlands

#CSD2026

Clean Space LCA Project Repository

EUROPEAN SPACE AGENCY

Repository status and data structure

26 mission
implementations

39 iterations over all
implemented missions



Mass



Orbit



LCA
Iteration



Project
phase



System
Integrator



CS- and ESA
Project PoC



LCA
practitioner



Date of
final report



Issue of
HB and TN



DQR method
applicable



LCA DB-
version



Report quality
evaluation

Example: LCA dataset

 Mass GSE: ~18,000 kg PFM satellite: ~1,200 kg FM2 satellite: ~1,200 kg	 Orbit SSO	 Project phase B; C/D; E1	 CS- and ESA Project PoC XX	 Date of final report 01/05/2025	 LCA DB-version SimaPro 9.4 Ecoinvent V3 (version 3.8) database ESA LCI database (2015 version) LCIA method: EF 3.0	 Report quality evaluation All glob. Indicators: DQR < 3 Limitation
 LCA Iteration 2nd	 System Integrator XX	 LCA practitioner XX	 DQR method applicable ESA-OPS-SC-TN-2023-002			

Repository status and data structure



Mission
description



Most impactful
indicators



Hotspots of
models



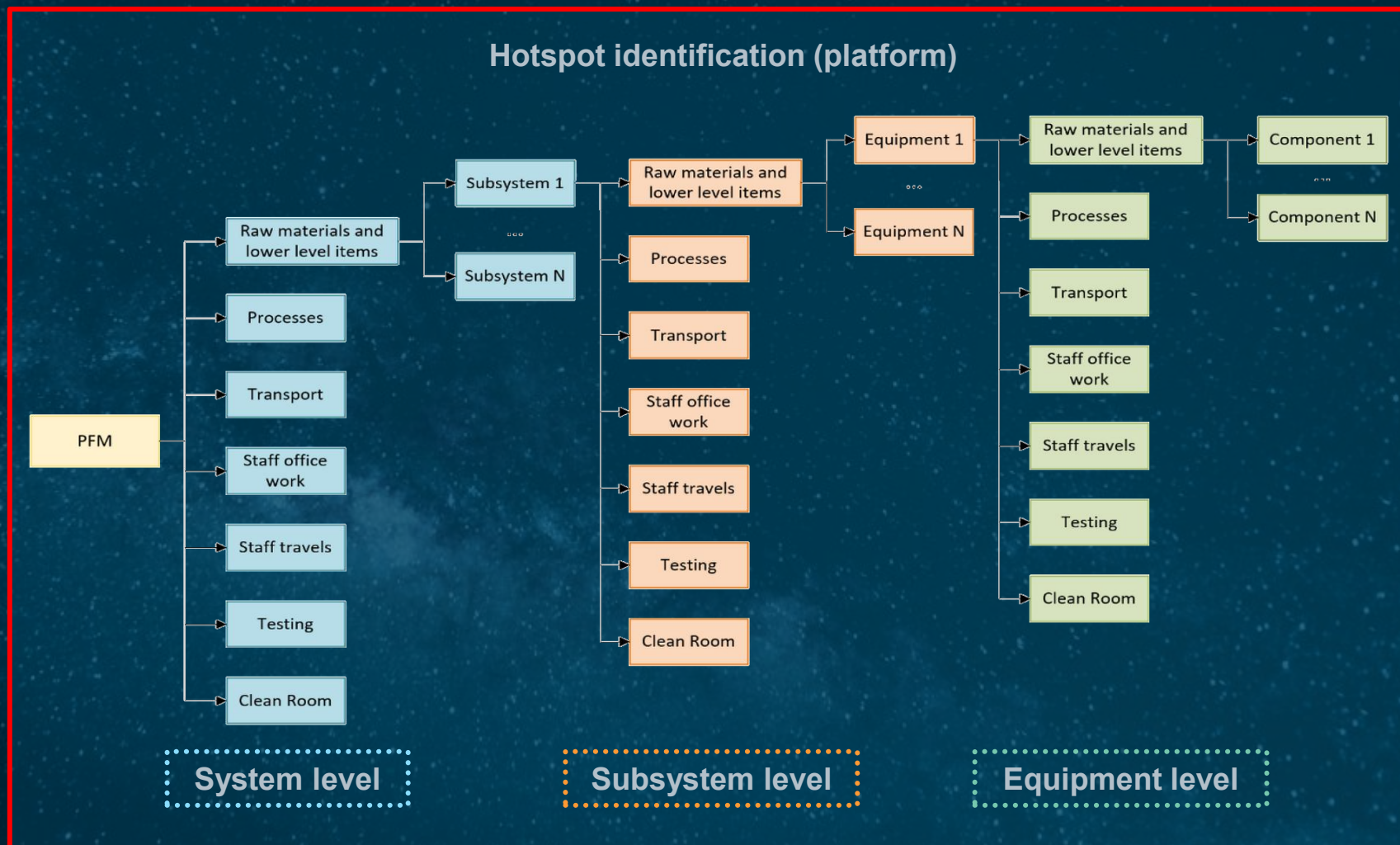
Key equipment
hotspots



Main problems
raised



Limitations of
the study



Example: LCA dataset



Mission description

Space-segment:

- PFM
- FM2
- EFM + QM
- FM2 Cleanroom storage GSE

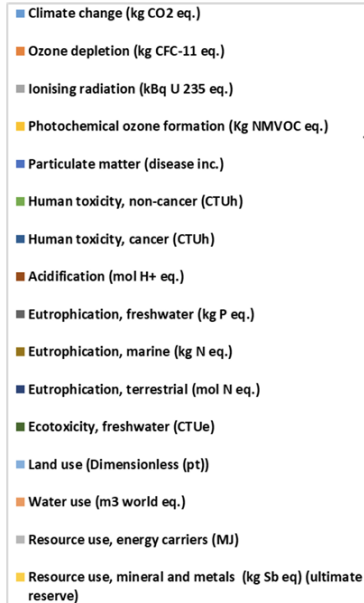
Scope:

- Development
- Manufacturing and AIT
- Launch preparation



Most impactful indicators

1. Climate change
2. Resource use - energy carriers
3. Resource use - mineral and metals
4. Ecotoxicity, freshwater



Limitations of the study

- **Completeness**
→ Limited data availability (reliance on generic proxies)
- **Sensitivity**
→ Less accurate Impact Assessment



Hotspots of models

Models included: PFM, FM2, EFM, QM and GSE

Major hotspot:

PFM:

1. Office work
2. GSE manufacturing
3. Travels

FM2:

1. Model manufacturing
2. Cleanroom
3. Office work

Cross-mission hotspot comparison

Objective

Identification of recurring hotspots across missions to enable comparability and prioritisation

Approach

Comparison of hotspots based on:

- Hotspot level (system, subsystem, equipment)
- Source (e.g. materials, energy, processes)
- Impact coverage across indicators
- Associated missions

Outcome

Supports transferability of mitigation measures and prioritisation of high-impact solutions

LCA Equipment List

Objective

Identify shared equipment references across missions to support comparability and reuse

Approach

Comparison of equipment based on:

- Associated missions
- Average Data Quality Rating (DQR)
- Supplier (traceability)
- Mass (scalability)

Outcome

Supports reuse of existing LCA knowledge and more time- and cost-efficient modelling decisions

Key takeaways

- Enables consistent and comparable extraction of data and environmental assessment across missions
- Identifies and prioritises recurring environmental hotspots
- Supports efficient reuse of LCA knowledge at equipment and mission level
- Reduces effort for Ecodesign analysis in early project phases and EIP implementation
- Continuously improving repository, strengthened with each implemented mission



→ THE EUROPEAN SPACE AGENCY

THANK YOU!

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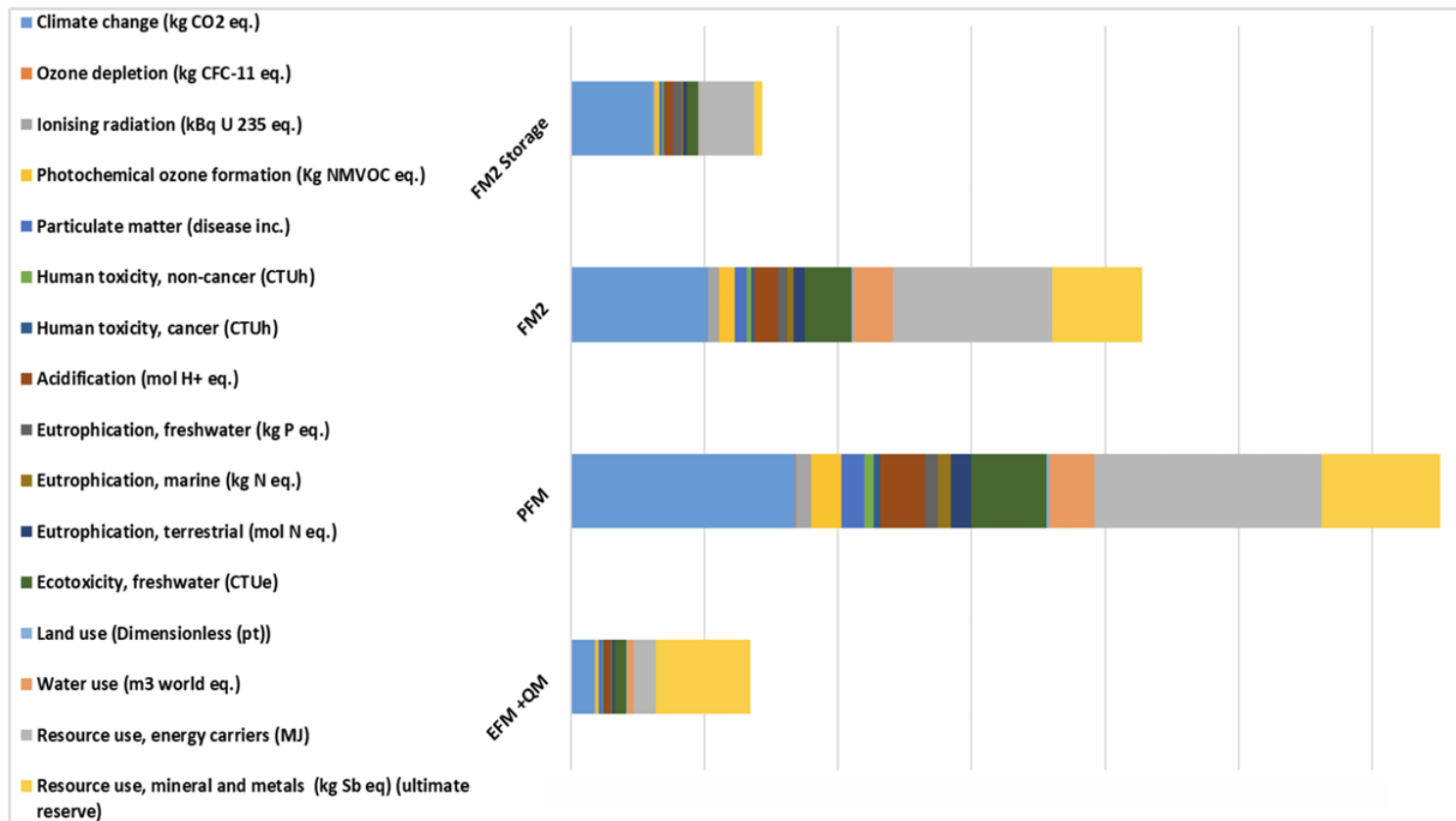
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Appendix: Structure

1. Solutions that are believed to be ready for usage (e.g. TRL $\geq$ 7)
2. Known Hotspots (and source) :
 - a. Hotspot name (e.g. RW)
 - b. Level of the hotspot (system, subsystem, equipment) (e.g. equipment)
 - c. Source (if known) (e.g. aluminum from flywheel)
 - d. Impact on climate change (y/n) (yes)
 - e. Indicator (s)
 - i. Specific (one indicator different from Co2) / Generic (most of the indicators) [e.g. Generic]
 - ii. Name of the indicator / Percentage (>50, >80, all) [>50% of indicators have more than 10% of impact]
 - f. Limitations (e.g. only secondary data / literature review, not good quality, further investigation needed)
 - g. Associated missions (TBD)
 - h. Preliminary identified solutions (e.g. titanium from the flywheel instead of aluminum)
 - i. Potential reduction of the solution at the level of the hotspot (e.g. 20% in all indicators)
3. Known Gaps
 - a. Environmental impacts on the atmosphere
 - b. Electronic components
4. Other with associated missions
 - a. Ex. Data collection from suppliers not standardized / associated missions (list): LSTM, Forum
5. Generic datasets available
6. Certified datasets available / under development

Appendix: LSTM example

LSTM LCA results: Single score



PEF single score – ESA adpatation []

Reference:
ESA CSID 2024
[CRISTAL & LSTM Life Cycle Assessment](#)