DISASSEMBLY AND RECYCLING OF AIRCRAFT CABIN COMPONENTS

Authors: Azzahra Sophie Larasati, Thinal Amunugama, Dilbara Abdushukurova, Minaz Javaherinik, Philip Hilke, Janice Burmeister
Project Advisors: Victor Vichniakov and Evelyn Mank

INTRODUCTION

With an increasing number of aircraft reaching retirement age and the growing use of composite materials in cabin interiors, components such as overhead stowage compartments (Fig. 1) and sidewall panels (Fig. 2) of the Airbus A320 require sustainable end-of-life management. Typically, large proportion of these components is composed of glass fiber reinforced prepreg (GFRP), phenolic resin, and Nomex® honeycomb (meta-aramid paper with phenolic coating). This study compares three end-of-life options: **Landfilling**, **Recycle**, and **Reuse** using Life Cycle Assesment (LCA) framework for these cabin components.

Fig.1 Overhead Stowage Compartment (OHSC) [1]

Fig.2 Sidewall Panel (SWP) [2]

PROS AND CONS

LANDFILL [5]

Pros: None.
Cons: High resource loss, & significant energy waste.

RECYCLE [6]

Pros: Zero waste.
Cons: Relatively high environmental impacts.

REUSE [7]

Pros: Significant avoided burden.
Cons: Market limitations persist.

LIFE CYCLE ASSESSMENT

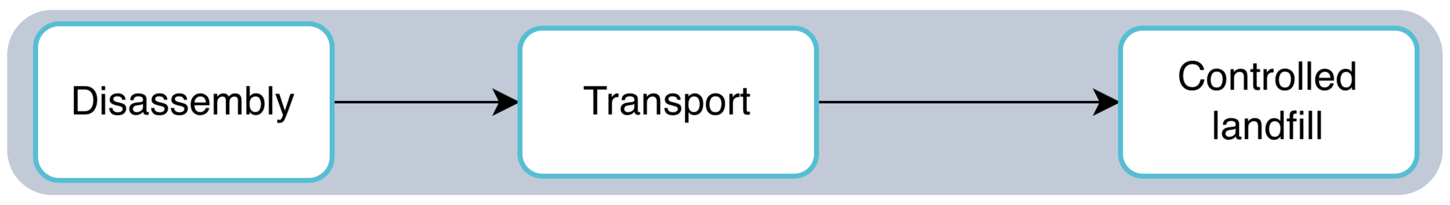

Fig.3 Baseline end-of-life scenario (controlled landfill).

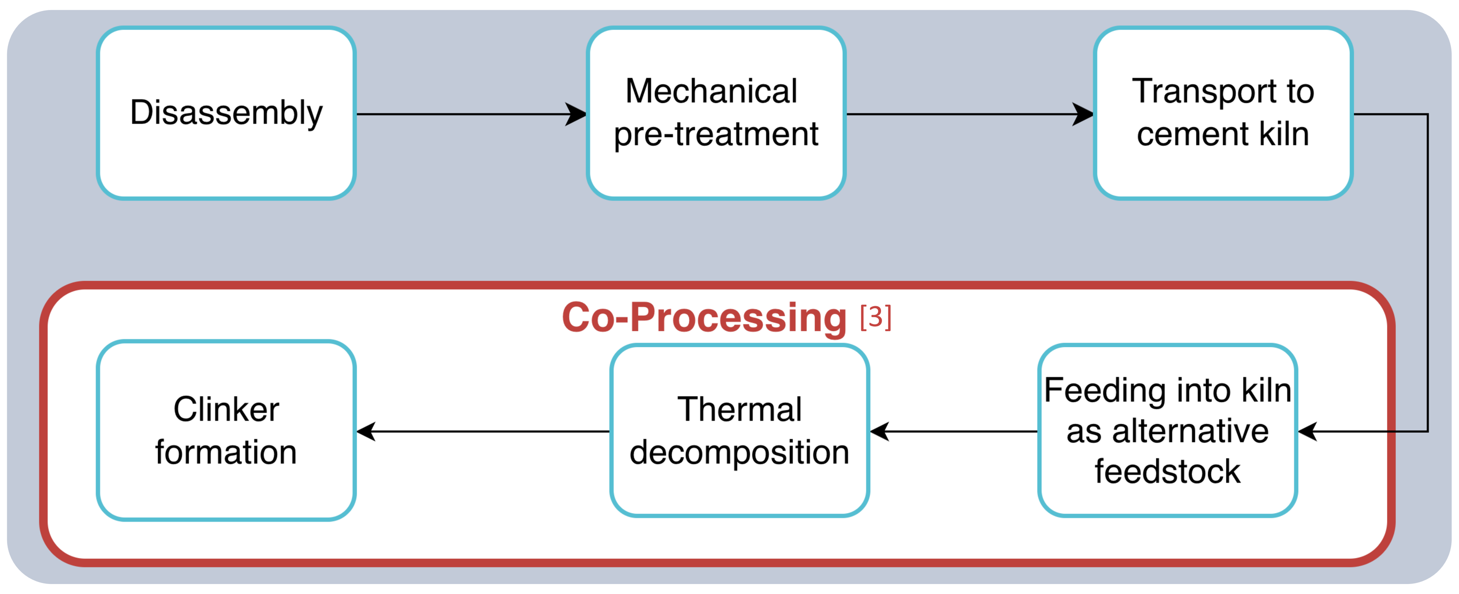

Fig.4 Recycle end-of-life scenario: mechanical recycling and co-processing in a cement kiln.

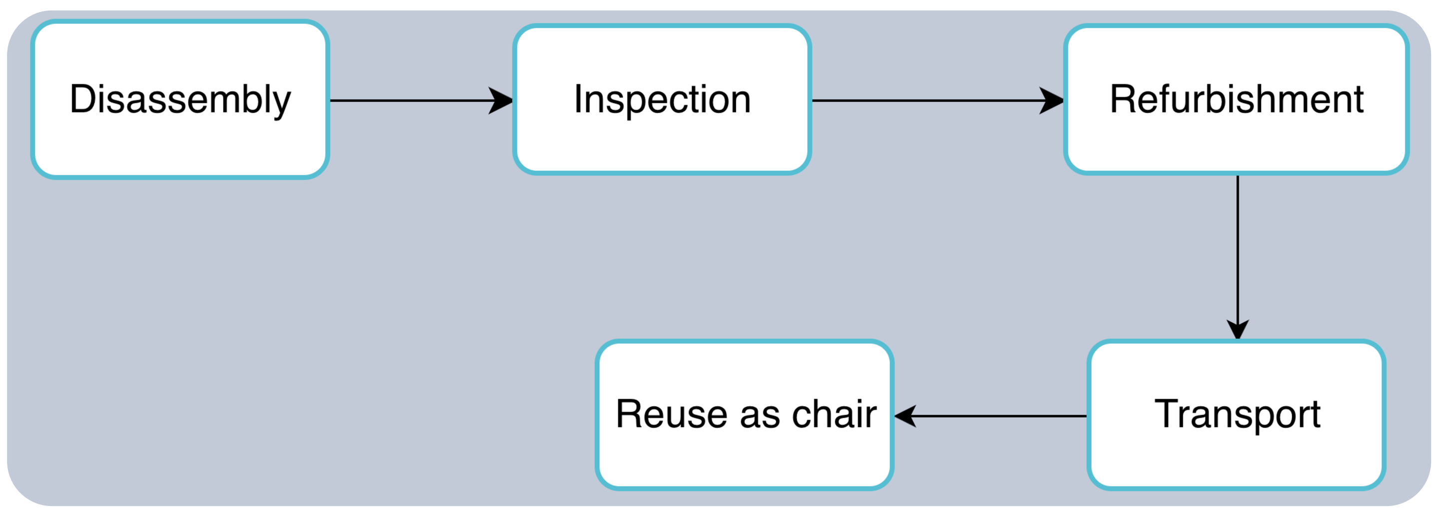

Fig.5 Reuse scenario: second-life application of aircraft cabin components.

Life Cycle Assessment (LCA) evaluates the environmental impacts of a product across its entire life cycle, from raw material extraction and manufacturing to use and end-of-life treatment. It quantifies impacts such as greenhouse gas emissions (kg CO_2-eq), energy consumption, and resource use, enabling a systematic comparison of different management or disposal options. [4]
In this project, LCA is applied to assess alternative end-of-life pathways for aircraft cabin components. The environmental performance of different scenarios, including **landfill** disposal (Fig. 3), **recycling** with co-processing in a cement kiln (Fig. 4), and **reuse** in second-life applications (Fig. 5), is compared to identify the more sustainable management options.

SUSTAINABILITY SCORE

When comparing the LCA results, indicators should be differentiated!
The **direct LCA impact** (Fig. 6) reflects current and past environmental effects during the life cycle. In contrast, the **overall sustainability score** (Fig. 7) also includes long-term impacts, indirect effects, and broader sustainability aspects. Considering both indicators together provides a more comprehensive understanding of environmental performance, highlighting not only short-term impacts but also potential long-term sustainability implications.

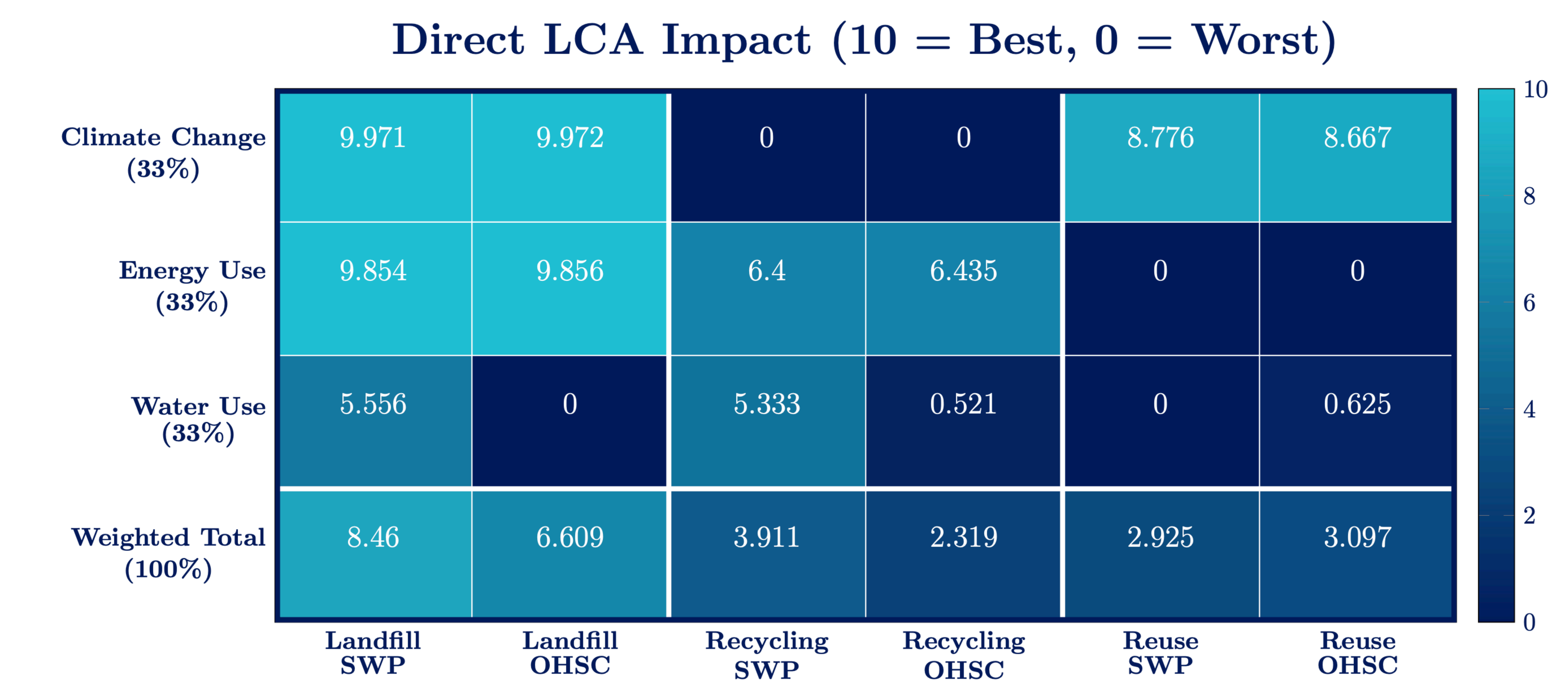

Fig. 6 Heat Map Showing Direct LCA Impacts Across Scenarios

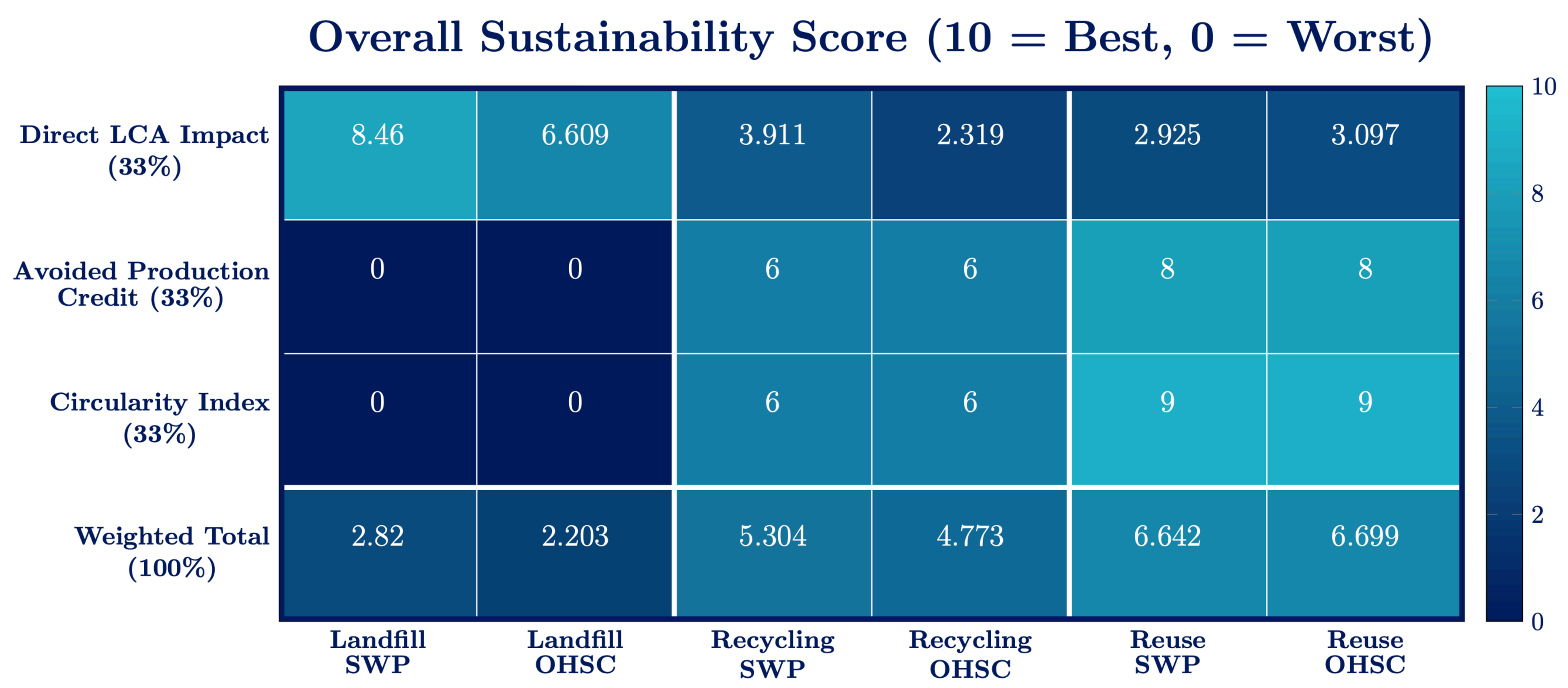

Fig. 7 Heat Map Showing Overall Sustainability Score Across Scenarios

DECISION TREE

The following decision tree illustrates the selection of end-of-life options based on the condition of the selected aircraft cabin parts within the scope of this study.

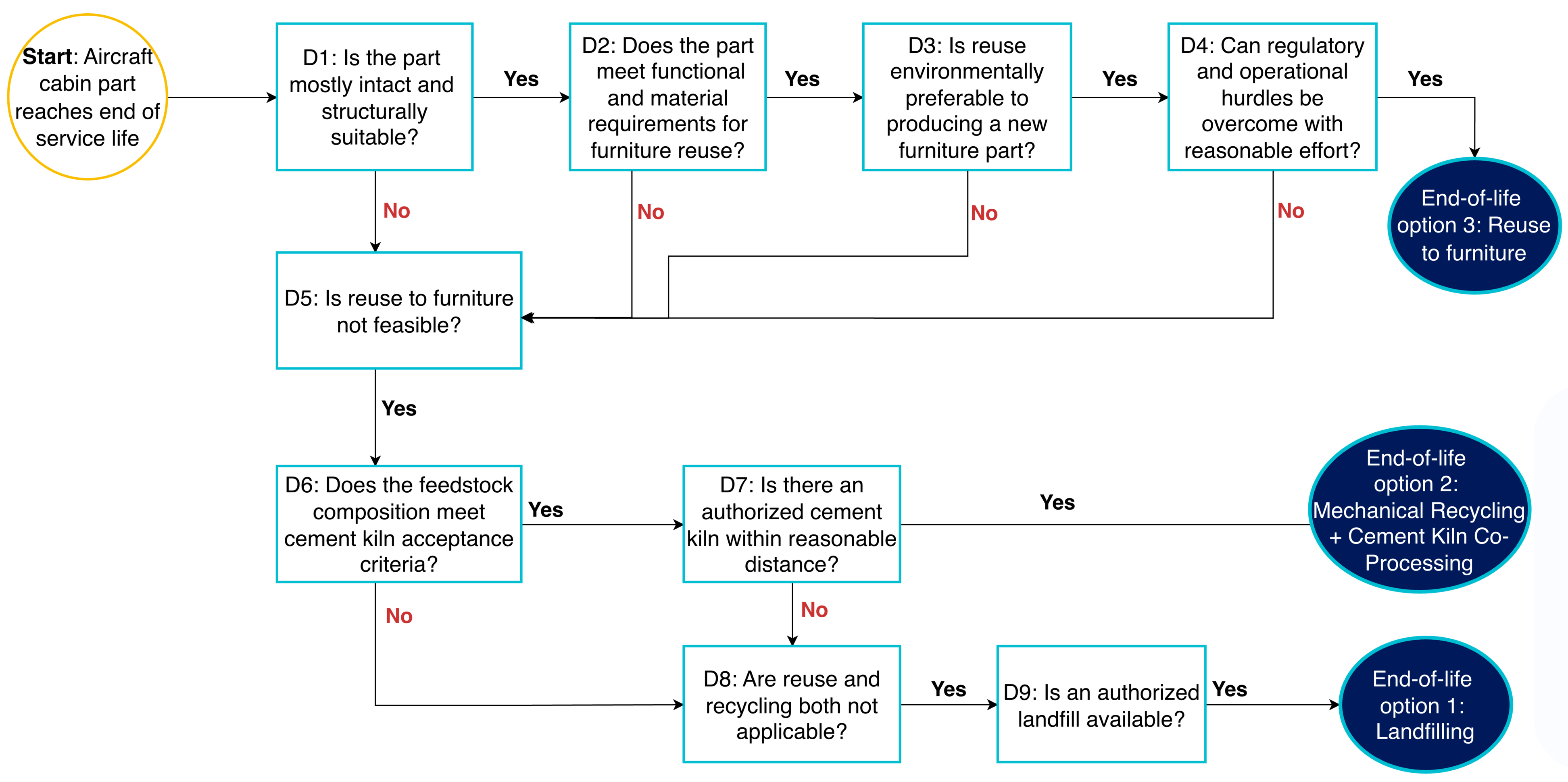

Fig. 8 End-of-life decision tree for selected aircraft cabin parts

CONCLUSION

Given the resource-intensive production, the end-of-life scenario of aircraft cabin parts is significantly relevant. While the optimal scenario is highly dependent on the specific context, this study has approximated the influence of three defined options. The study further provides a guideline to assist in the end-of-life decision process. Further work must be done to evaluate the applicability on larger scale and validate the results with internal Airbus data.

REFERENCES

Team Member	Task Area	Hours
Minaz Javaherinik	Product owner	92
Philip Hilke	Scrum master	93
Thinal Amunugama	Member	98
Azzahra Sophie Larasati	Member	100.5
Janice Burmeister	Member	100
Dilbara Abdushukurova	Member	91

[1] Dreamstime. (n.d.). Airplane bin overhead stock photos. https://www.dreamstime.com/photos-images/airplane-bin-overhead.html
[2] Plane Reclaimers. (n.d.). Airbus interior sidewall panel. https://planereclaimers.aero/product/airbus-interior-sidewall-panel/
[3] Nagle, A. J., Mullally, G., Leahy, P. G., & Dunphy, N. P. (2022). Life cycle assessment of the use of decommissioned wind blades in second life applications. Journal of Environmental Management, 302, 113994. https://doi.org/10.1016/j.jenvman.2021.113994
[4] Bjørn, A., Hauschild, M. Z. Life Cycle Assessment: Theory and Practice. Springer.
[5] Umweltbundesamt. (2016, April 5). Landfill AGICO Cement. (n.d.). Cement cyclone preheater. https://cementplantsupplier.com/cement-manufacturing-equipment/cement-cyclone-preheater/
[6] AGICO Cement. (n.d.). Cement cyclone preheater. https://cementplantsupplier.com/cement-manufacturing-equipment/cement-cyclone-preheater/
[7] Rhodes, M. (2016, April 29). Come on, you know you want a chair made out of a 737 engine. Wired. https://www.wired.com/2016/04/come-know-want-chair-made-737-engine/