Case Study: Assessing Scope 3 Emissions from Materials Logistics in Aviation Leasing

Abstract

This case study quantifies Scope 3, Category 4 emissions generated from transporting aircraft materials and components during lease transition activities. Using DEFRA emission factors and real-world flight and road distance data, it assesses emissions related to shipments from global vendors to MRO facilities and onward to lessees. The analysis found that material logistics generated measurable CO2e emissions for each transport leg, reinforcing the need for strategic logistics planning. Based on total emissions, the study also calculates the number of trees required to offset this impact, offering aviation lessors a tangible benchmark for sustainability initiatives.

Introduction

In aviation leasing, much of the environmental focus is placed on aircraft operations and fuel burn. However, material movements related to lease transitions-such as the delivery of serviceable components, rotables, and structural items-constitute a notable but often overlooked part of a lessor's emissions footprint. These activities fall under Scope 3, Category 4 (Upstream Transportation and Distribution) according to the Greenhouse Gas (GHG) Protocol. This study analyzes emissions associated with shipping materials from vendor locations to MROs and ultimately to airline customers, providing lessors with insights to improve environmental performance during asset transitions.

Scope and Objectives

The primary objectives of this study were:
1. To calculate the CO2e emissions associated with the transportation of aircraft materials from vendor to MRO and onward.
2. To distinguish the emissions by mode of transport-air and road.
3. To contextualize the emissions in terms of environmental offset potential (i.e. number of trees required).
4. To provide an actionable framework for reducing hidden emissions in technical event logistics.

Methodology

Data Collection:
- Vendor shipments were traced based on location and destination points provided in technical records.
- Main airports in the origin and destination regions were assumed for flight distance calculations.
- Road distances between airport and MRO/final recipient were measured using Google Maps.

Emissions Calculation:
- Flight distances were calculated using AirMilesCalculator.com.
- DEFRA 2023 emissions factors were applied:
  - By flight category (domestic, short-haul, long-haul)
  - By road transport (assumed via articulated lorry)
- Emissions were split between air and road transport, then aggregated to determine total kg CO2e per shipment.

Carbon Offset Equivalency:
- Based on EcoLab estimates, each tree absorbs approximately 25 kg CO2e per year.
- Total emissions were divided by 25 to estimate the number of trees needed to offset each shipment.

Key Findings

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1. Total Emissions:
- Material movements generated measurable emissions on a per-shipment basis, ranging from <1 kg CO2e to over 60 kg CO2e depending on the weight, origin, and transport mode. Example: A 69.6 kg part shipped from Frankfurt to Rome generated 66.6 kg CO2e.

2. Air vs. Road Contributions:
- Air transport accounted for the majority of emissions, especially on longer routes or where flight categories carried higher emission factors.
- Road transport added marginally to emissions but was still relevant for final-mile delivery.

3. Offset Perspective:
- Across all shipments, individual parts required an average of 1-3 trees to offset transport emissions.
- This provides a relatable benchmark for emissions dialogue with investors, regulators, and airline customers.

Discussion

This analysis reveals that even routine materials logistics during lease transitions have a measurable carbon impact. While emissions per shipment may seem small in isolation, the cumulative effect across a portfolio of aircraft-each requiring multiple components-can be substantial.

For aviation lessors, addressing these emissions presents a valuable opportunity to lead on sustainability. Implementing procurement guidelines that favor low-carbon logistics partners, consolidating shipments, or switching to carbon-neutral carriers are just a few potential actions.

Moreover, this case study provides a transparent, auditable methodology that aligns with CSRD and GHG reporting frameworks, ensuring lessors can confidently report Scope 3 Category 4 emissions with precision.

Conclusion

Aviation lessors often focus on emissions from aircraft operations, but the emissions from moving spare parts during lease transitions are an important part of the full lifecycle impact. This case study demonstrates that with accessible tools-like DEFRA emissions factors, flight calculators, and Google Maps-lessors can gain visibility over these emissions and begin to manage them.

By adopting data-driven logistics decisions and offset strategies, lessors can improve environmental performance, demonstrate regulatory compliance, and support airline customers in meeting their own sustainability targets. Oak Tree ESG stands ready to support lessors in calculating, reporting, and mitigating these emissions through targeted Scope 3 services.