

Quantifying Value Chain Emissions: A Case Study at GKN Aerospace

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Primary Topic: A Systems Approach to Overcoming Supply Chain & Logistics Challenges

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Abstract: Growing concerns over environmental degradation and global warming have compelled companies worldwide to take an active role in mitigating climate change. To develop effective climate change mitigation strategies, organizations must first assess their value chain emissions. The Greenhouse Gas (GHG) Protocol, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), provides a standardized framework for quantifying such emissions. It categorizes them into three scopes: direct emissions (Scope 1), indirect energy-related emissions (Scope 2), and other indirect value chain emissions (Scope 3). Scope 3 emissions often account for more than 75% of a company's total footprint and in manufacturing sectors such as aerospace, they can exceed 90%, highlighting the need to prioritize Scope 3 in target setting and mitigation actions.

This study focuses on quantifying Scope 3 Category 1 emissions, or *Purchased Goods and Services* (PG&S), within the aerospace sector using GKN Aerospace as a case study. These emissions arise from procured raw materials, components, and outsourced processes, many of which are energy-intensive. Two estimation methods were compared across 2022–2023 procurement data: mass-based and spend-based approaches. The results show that the spend-based approach tends to overestimate emissions by approximately a factor of three compared with the mass-based method. For 2023, mass-based accounting estimated Category 1 emissions at 0.012 MT CO₂eq for the focal site, with titanium and nickel alloys dominating the footprint, while process-level analysis identified forging as the principal emitter.

To explore mitigation potential, scenario analyses were developed drawing on prior life cycle assessment (LCA) evidence comparing conventional manufacturing with additive manufacturing (AM). Based on realistic adoption projections, expert input, and internal roadmaps, the study estimates that approximately 22% of relevant production could transition to AM by 2035 at GKN Aerospace, resulting in an ~18% reduction in site-level PG&S emissions relative to a non-AM scenario. This quantification of value chain emissions provides a data-driven decarbonization pathway for the aerospace sector centered on materials, processes, and the deployment of AM technologies.