

Project task
Wintersemester 2024

Title	Innovative Headlamp Design: Advanced Materials and Manufacturing Techniques
Company	ZKW Group GmbH
Responsible	Dr. Baran Sarac
Description	<p>New sustainable headlamp design concepts require minimized environmental impact, enhanced energy efficiency, advanced materials, and alignment with evolving automotive industry standards for greener and more responsible manufacturing practices.</p> <p>In the course, students are expected to focus on two key tasks.</p> <p><u>Task A – Calculation of Product Carbon Footprint (PCF) analysis:</u></p> <p>This calculation will determine the processes, materials, and lifecycle stages that will be included in the assessment to ensure a comprehensive evaluation of the product's environmental impact.</p> <p>Every group will do an LCA study of a headlamp (base task). The next step is to explore solutions for the current status quo of life cycle stages, focusing on substituting materials, optimizing the use phase, and improving end-of-life processes such as disassembly. For a general overview, each group will try to find solutions for different life cycle stages using a relevant software. Data basis such as runtime (normative background) in the various lighting functions and current electrical consumption in these functions is provided by ZKW to ensure a standardized calculation basis. The students will calculate LCA depending on different impact categories via LCA software and assess which categories would have the highest potential for improvement and compare their interactions in between.</p> <p><u>Life-Cycle stages to focus on:</u></p> <ul style="list-style-type: none">- Raw-Materials- Manufacturing processes- Use-Phase- End-Of-Life

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Find relevant Impact categories:

Climate change (mandatory category)

Choose 3 categories from: (Stratospheric) Ozone depletion, Human toxicity, Respiratory inorganics, Ionizing radiation, (Ground-level) Photochemical ozone formation, Acidification (land and water), Eutrophication (land and water), Ecotoxicity, Land use, Resource depletion (minerals, fossil and renewable energy resources, water).

Task B – Sustainable Design & Material & Manufacturing Optimization:

What kind of influence of the life cycle stages? Understand the relative effect on an individual component (maybe another material/recycled material). Find a solution for one of the life cycles stages:

- Raw-Materials (which materials are used now? which can fit to the technical aspects we need? Any possibilities of changing them with post-industrial/consumer recycled – biogenic materials?)
- Manufacturing processes (efficiency in manuf. steps/ are there any other manuf. processes which can work more efficient?)
- Use-Phase (how much light is necessary & how much is produced? How to improve efficiency of the headlamp)
- End-Of-Life (disassembly, recycling, repairability, reusability)

Each group will complete a different set of tasks. After learning the theoretical part at Hochschule Magdeburg, each group of students will present the ZKW team about their project plant and how their knowledge can turn into practical use. Students will also learn in detail about the selected materials and design by examining the individual components of the selected headlamp sent to them. They will also gain practical knowledge during their excursion to ZKW about the processing steps of real components and headlamp product assembly.

Supervisor	Prof.in Dr.-Ing. Gilian Gerke Prof. Dr.-Ing. Benedikt Lamontain
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