

POPULAR SCIENCE SUMMARY

A critical aspect of sustainable building design involves maximizing natural light utilization while minimizing environmental impact. This research responds to this imperative by developing an evaluation methodology, based on the Life Cycle Assessment (LCA) approach, tailored specifically to daylighting systems, such as windows, skylights, or shading devices.

The study was split into two phases. First, it started with a comprehensive review of current LCA methodologies, understanding their applicability to the daylight systems. Five different frameworks with varying scopes, but all applicable in a European context, were thoroughly studied and compared to understand their differences. Additionally, a research was conducted on the key aspects of the daylight systems affecting the environmental impact over their lifespan.

A methodology was developed, including aspects from these frameworks, considering the structure established in the ISO 14040/14044 standards. The focus was put on a holistic approach, considering three aspects: daylight quality, energy performance, and overall environmental footprint.

The framework was then applied to a case study to evaluate its applicability, examining the use of an innovative daylighting solution in two different spatial contexts: a single office and an open-plan office, represented by the PASSYS and BESTEST test cells, respectively. A workflow was developed in Rhino and Grasshopper to obtain the results and they were later analysed.

This application proved the potential of the methodology to offer a comprehensive understanding of a system's environmental impact, emphasizing the importance of context-based evaluations for daylight systems. Moreover, the establishment of a baseline emerged as a crucial step, enabling accurate and meaningful comparisons between different systems.