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How to calculate and mitigate construction emissions of a large-scale industrial facility

Increasing knowledge about and reducing emissions from new construction is crucial to reaching the 1.5-degree target and halting global warming. By providing key insights on how to calculate and mitigate construction emissions, the thesis hopes to do just that.

Carbon emissions associated with a building consist of two different types of emissions. The first part is the emissions from operating the facility, such as emissions from the energy used to heat a building. The other part is the type of emissions that arise from the actual construction. For a long time, there has been an emphasis on increasing the efficiency of buildings. That focus has helped reduce carbon emissions when a building is inhabited and used. However, while the emissions from operating the facilities have decreased, the share of emissions from construction has increased.

As a Master's Thesis at the department of Energy Sciences at the Faculty of Engineering at Lund University, the authors set out to investigate how to calculate the emissions associated with the construction of a large-scale industrial facility. The construction emissions include all emissions generated from raw material extraction until a building has been erected. The results showed that around 90% of all emissions occur in the so-called product stage. The product stage includes extraction, transport, and manufacturing of construction materials. The remaining 10% of emissions occur due to transporting materials from the manufacturer to the construction site, from the energy used on the construction site and all waste of materials generated.

This project took place before the first sod, and consequently, many uncertainties emerged. However, the calculations are still of great importance because they allow for identifying significant sources of emissions early in the project. In fact, the earlier measurements are begun, the higher the potential to reduce emissions of new constructions is. One notable finding is how important it is to put pressure on suppliers and contractors, as different materials such as steel can have an enormous impact on construction emissions. Other key findings are the positive effects of optimising and minimising material use and implementing an efficient waste management plan. By striving to reduce, reuse, and recycle, there is a big potential to decrease construction emissions.

In January 2022, the National Board of Housing, Building and Planning (Sv. Boverket) introduced a new law on so-called "Climate Declarations". The law requires all new construction of buildings to calculate the exact same emissions as the thesis has measured. However, industrial facilities such as the one studied in this project are not required to perform the calculations. Searching the internet for similar studies on comparable buildings and facilities also proved quite fruitless. With that in mind, there is hope for the Master's Thesis to put H2 Green Steel in a unique and leading role to serve as a lighthouse for other companies looking to perform similar work.

All in all, there is a hope that the findings of this thesis can help spread knowledge about the importance of learning about, measuring, managing, and positively influencing emissions from new construction. By spreading information about this prevalent and imminent problem, there is hope to halt global warming.