

Shifting to Biobased Building Materials in Animal Housing

Agricultural buildings are an integral part of our day-to-day life feeding society and contributing to economy, yet their climate impact is rarely studied. This thesis shows that how we can reduce embodied carbon by up to 95%.

Agricultural buildings quietly support everyday life. They house the chickens that lay our eggs and the cows that produce our milk. These buildings are exempt from Sweden's climate declaration requirement because of their essential economic role. Imagine the number of buildings that are exempted, can we really achieve our climate goal by setting such facilities aside?

Life cycle assessment (LCA) has been widely applied to residential and office buildings; however little attention has been given to animal housing. So, this degree project aims to contribute knowledge to the carbon impact that is overlooked in these facilities.

The study is conducted on a poultry building for egg-laying chickens situated in Borby Sweden. A comparative LCA is carried out for two construction types over the building's life cycle; namely conventional construction and biobased construction. The conventional construction utilizes steel, concrete and other non-biobased building materials whereas the biobased construction substitutes these materials with biobased alternatives. In addition, the biobased construction also integrates design strategies to withstand the challenging indoor environment found in animal housing such as harsh chemical environment and high-pressure water wash that is characteristic to animal housing.

The assessment focuses on the embodied carbon, using Global Warming Potential (GWP) as the main indicator. The results indicate that material choice has a decisive impact. In the product stage A1-A3; the biobased construction achieves a reduction of 367 kg CO₂-eq/m² Gross Internal Floor Area (GIFA) i.e. 95 % decrease in GWP-total. In addition, biogenic carbon storage in timber results in a carbon sequestration potential of -176 kg CO₂-eq/m² GIFA i.e. 86 % higher.

At the same time, the study reveals important trade-offs. In the biobased construction, the installation stage A5 becomes the single largest contributor to climate impact, mainly due to material waste during construction. These highlights the need for improved installation methods and better material efficiency.

By providing quantified evidence from a real animal housing facility, this thesis shows that agricultural buildings deserve greater research attention. Hence such studies can be an eye opener for policy makers in to investigating this area more thoroughly.