LIFE CYCLE ASSESSMENT THROUGH BIM-BASED ADVANCED CALCULATION VIRTUAL ENVIRONMENT WORKFLOWS

Tassiane Feijo Brazzalle

Supervisor
Lavinia Chiara Tagliabue(1), Giovanni Dotelli(2)

(1) University of Turin, Computer Science Department, Corso Svizzera 185, 10149 Torino, Italy
(2) Politecnico Di Milano, Milan, 20129, Italy

Abstract

The global construction sector face the need of adapting to climate change and at the same time to shift the industry towards decarbonisation, decreasing the energy use in buildings in order to comply to international regulations. Every country that undersigned the Paris Agreement is expected to stablish decreasing goals for energy consumption and carbon emission according to their economic reality.

Construction materials aiming energy saving, electricity consumption and carbon emission are deeply connected because one can be accounted for the increase of the previous two. Constructions materials are held to be the higher title of carbon emission source since the efforts for shifting to renewables is already a reality. That conclusion throws light over solutions we can already implement in order to avoid emissions from construction materials before it assumes the title of higher impact sector. Also construction materials are everywhere, in existing buildings, not only in construction sites. They are the existing buildings everywhere, most of them out of use, full of potential but energy inefficient. By restoring existing buildings we allow the maintenance of memory, reuse structures, safekeep their construction mass by repurpousing it. To restore means to avoid demolition of potential useful assets, waste generation and its soil filling, and all the carbon emission related to construction products production.

This research seeks to exposes the potential of Building Information Modelling implementation for refurbishment of existing buildings focused on the energy saving efforts and strategies, centered in material selection elected its performance aiming the lowest energy consumption by the building and by considerable decrease of carbon emission rates, calculated by Life Cycle Assessment.

A workflow is a process starting with the development of a BIM of an existing building simulating its conditions and calculating what would be the current energy consumption. The model undergoes an energy performance simulation to understand which areas are most strategic to go under renovation. The results of the simulation will be imputed in a cloud based LCA calculation tool to calculate its embodied carbon emissions. The BIM is developed in Phases, going through the same process once included insulation materials on the envelope components. The materials are chosen from Environmental Product Declaration database. The generated data are, again, imputed in the third party software to assess the reduction or avoidance of emissions related to the maintenance of the embodied carbon emissions and the impact of the materials needed to fulfil the energy and carbon goals described before. Parameters are created in order to compare their performances.

Dissertation:
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Presentation video:
https://youtu.be/pvM0-UKIT_E

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