RP2007

THE INTEGRATED OPTIMISATION OF LIFE CYCLE ENERGY, GHG AND COST IN BUILDINGS

Research Background

Buildings consume a significant amount of energy over its life cycle. From the energy related to the extraction, manufacture and transportation of raw materials (known as embodied energy) to the energy required to heat and cool a building (known as operational energy), as illustrated in Figure 1 below.

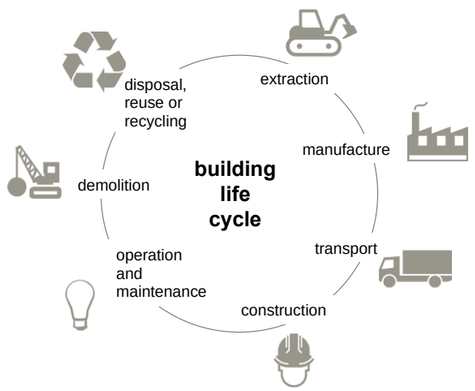

Figure 1: Life cycle stages of a building

Often mitigation measures (such as passive or active as per the energy hierarchy in Figure 2) are implemented to improve a buildings environmental performance.

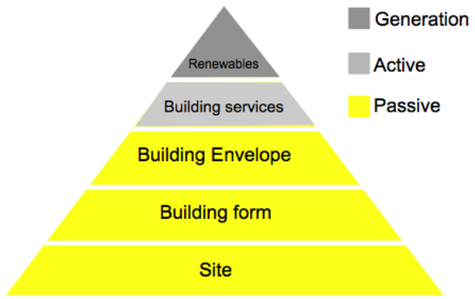

Figure 2: Energy hierarchy

However these measures primarily focus on improving the operational performance of a building, leaving the embodied performance largely ignored. A barrier plaguing the uptake of strategies that decrease both the operational and embodied is the uncertainty towards the financial cost to the developer. Several studies have used Life Cycle analysis (LCA) as a means to assess a buildings energy and GHG performance over the expected lifetime and life cycle cost analysis (LCC) to assess its expected financial performance. However these studies contain several limitations, as illustrated in Figure 3 below, which this research will aim to address.

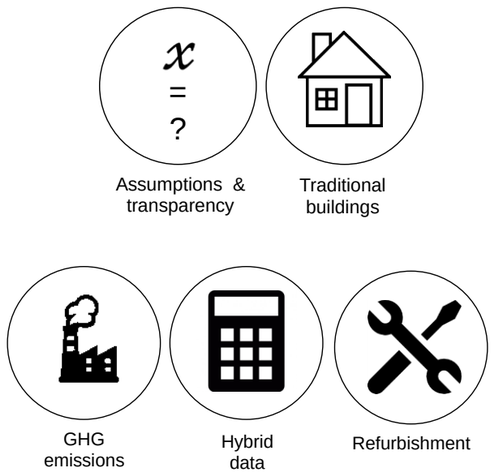

Figure 3: Summary of the limitations of previous LCA and LCC studies

Research Aim

To optimise a buildings life cycle energy and greenhouse gas emissions and determine the life cycle cost of this optimisation.

Research Questions

What methods are available to determine the **life cycle energy** and **GHG** emissions of buildings?

What strategies are currently being employed to **reduce** the energy and GHG emissions of buildings?

How can these strategies be improved so as to **optimise** the energy and GHG emissions of buildings fro a life cycle perspective?

What methods are available to determine the **life cycle cost** of buildings?

What is the life cycle cost of the **optimised** energy and GHG emissions building solution?

Methodology

This research will be completed with a streamlined LCA (focussing on energy and GHG emissions) adopting the input-output based hybrid approach. For the financial performance quantification the Net Present Value technique will be used which helps take into account the time value of money. This research is still in progress and to be completed in 2018.

Anticipated impacts

This research will demonstrate the **net cost and energy and GHG reduction benefit** of a selected building strategy. This research will aid homeowners, project developers and designers to select building strategies that reduce not only the operational but also the embodied energy and GHG emission of a building and identify the net cost of achieving this GHG reduction over its expected life time.

"A means to decrease the life cycle energy and GHG emissions in buildings"

Further information

This research falls under the RP2007 Integrated Carbon Metrics project, a multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the built environment.

http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2007-integrated-carbon-metrics-–-multi-scale-life-cycle

Contact

Monique Fouché

The University of Melbourne
mfouche@student.unimelb.edu.au