Life Cycle Assessment American Center, Rangoon, Myanmar

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YOST GRUBE HALL ARCHITECTURE

Introduction

This LCA looks at the cradle to grave operations of a building, quantifying the environmental impacts of the materials, production process, transportation, operating use, deconstruction, and disposal. There are several environmental categories that can be identified for evaluating global impacts including global warming, ozone depletion, eutrophication, acidification, smog formation, particulates, and fossil fuels. According to the International Organization for Standardization, there are four phases for performing LCA of a building: goal and scope definition, life cycle inventory (LCI), impact assessment and analysis of results. The goal and scope defines the intent of the LCA (cradle to gate, cradle to grave) and the limitations. The LCI is a data collection process that quantifies the materials being used and their energy inputs and outputs. The impact assessment looks at the LCI damage it may have on the environment.

Methods

This LCA was conducted in Tally, in accordance with LEED and the life cycle assessments they reward points for. All of the data set comes from Tally. Materials were selected by YGH and input to Tally within Revit. The base LCA study was conducted on the American Center base Revit model provided by YGH. The building is two stories and 2400 m2. It has an information center, library, offices and conference room. The building is designed to teach children in Myanmar about the United States. The LCA data collected from this data was compared to the same building using a mixture of metal stud and concrete with wall assembly types constructed of only wood and only concrete. The environmental impact categories calculated in the life cycle assessment of the American Center were global warming potential and primary energy demand. The research focused on these two LCA categories in particular and focused further on the wall assemblies and how they impacted both primary energy demand and global warming potential. Global warming potential is the measurement of gas emissions that are causing an increased greenhouse effect. Primary energy demand is a measurement of the total energy drawn from the earth. It is energy demand from non-renewable resources and renewable resources.

Results

Tally breaks all of the materials into percentages of the total buildings GWP and PED, therefore the data will be in the form of overall percentages and how they differed from wall assembly to wall assembly. The base numbers were calculated, with the GWP for building 1 being 501.2 kgCO2eq/m2 and the PED output at 5,778 MJ/m2. An all wood framed wall construction method would drop the buildings GWP to 388.8 kgCO2eq/m2 and the PED output to 4,197 MJ/m2. In comparison, an all concrete wall structure would cause the building to have a GWP of 444.8 kgCO2eq/m2 and a PED of 4,448 MJ/m2.

Modeling Challenges

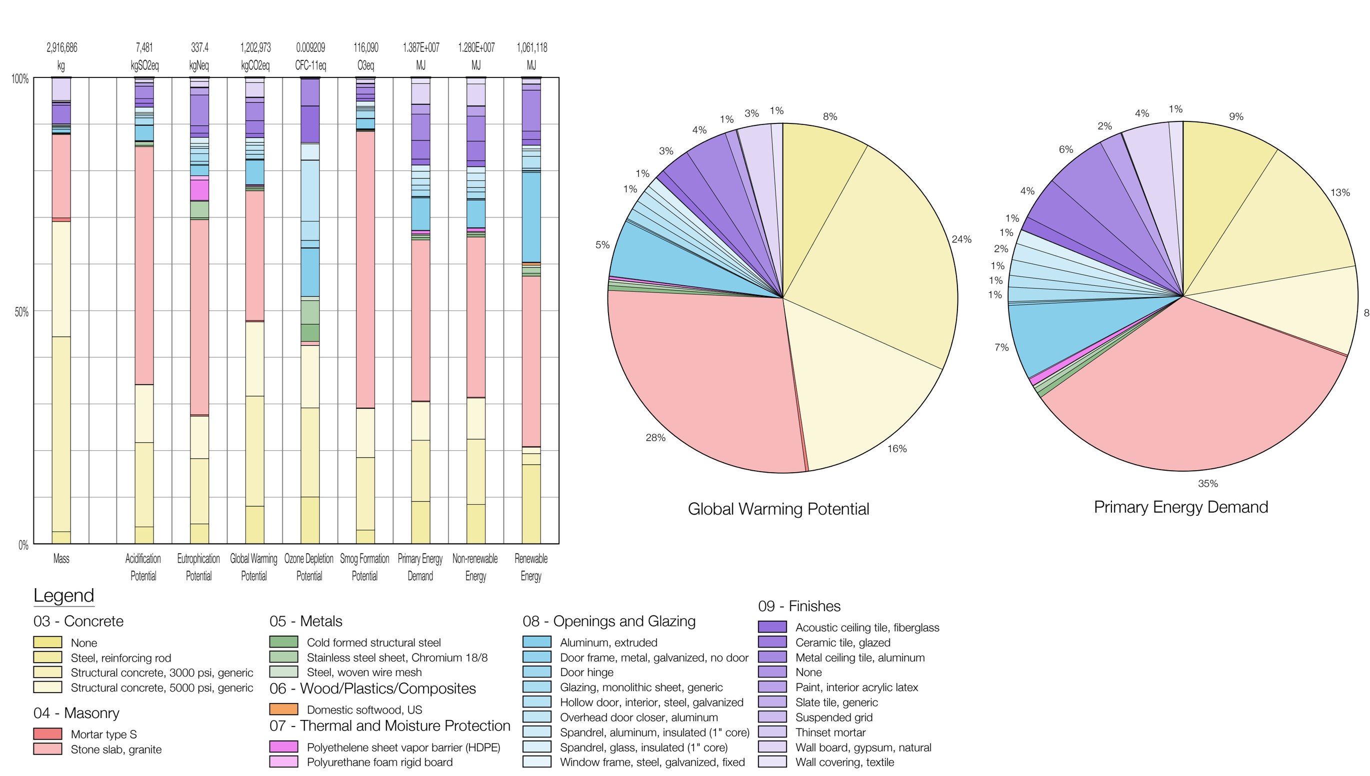
There were limitations to the data calculated and LCA has been a retroactive tool in most cases. The information found can act as general guidelines on what materials have a greater impact on the environment around them, but are in need of greater specificity. Tally produces the necessary baseline information to make informed decisions on material selection and their affects on the earth, but is limited in the amount of detail. The materials selected for each wall, floor, ceiling and other systems were generalized. The building is currently in the design development stage and did not have the material detail necessary for pinpointing exact materials within specific wall types that are leading to higher GWP and PED.

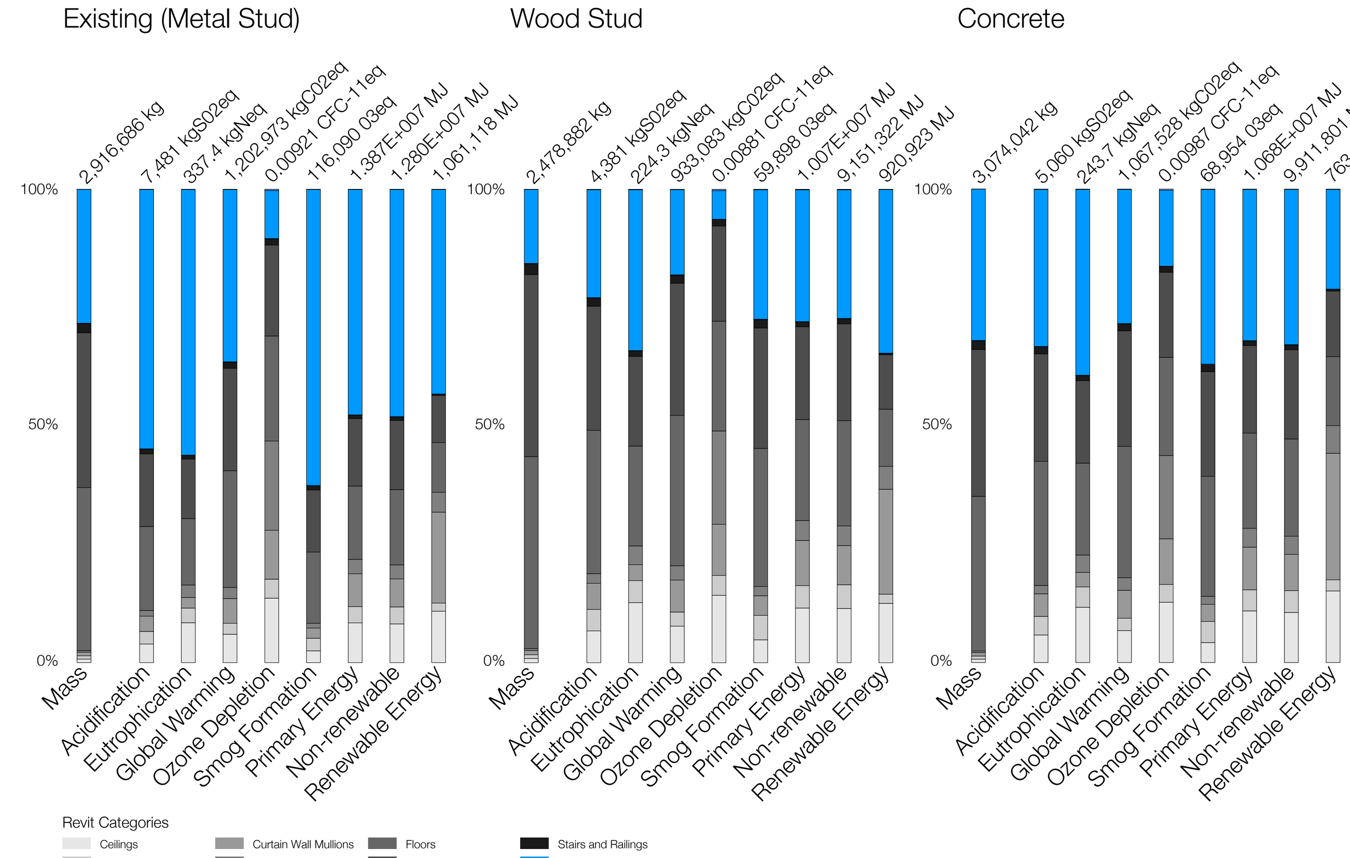
> A major step in reducing the impact of buildings from cradle to grave is to run life cycle assessments early in the design phase to help inform material selection.

Conclusions

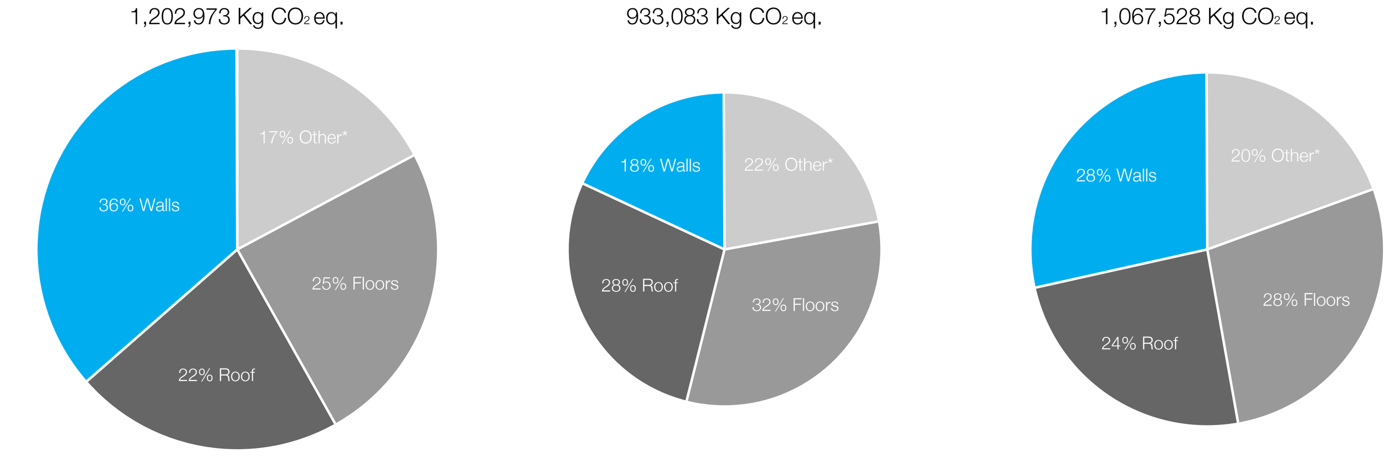
As architects we need to design buildings with greater knowledge of the global warming potential, primary energy demand, as well as other environmental impact categories that were not calculated such as acidification potential and nonrenewable energy. A major step in reducing the impact of buildings from cradle to grave is to run life cycle assessments early in the design phase to help inform material selection. Source materials locally to limit the travel impact, reduce the amount of materials that require extensive amounts of energy to produce such as steel, or insure that the materials have a high-recycled content.

Results per CSI Division, itemized by Material





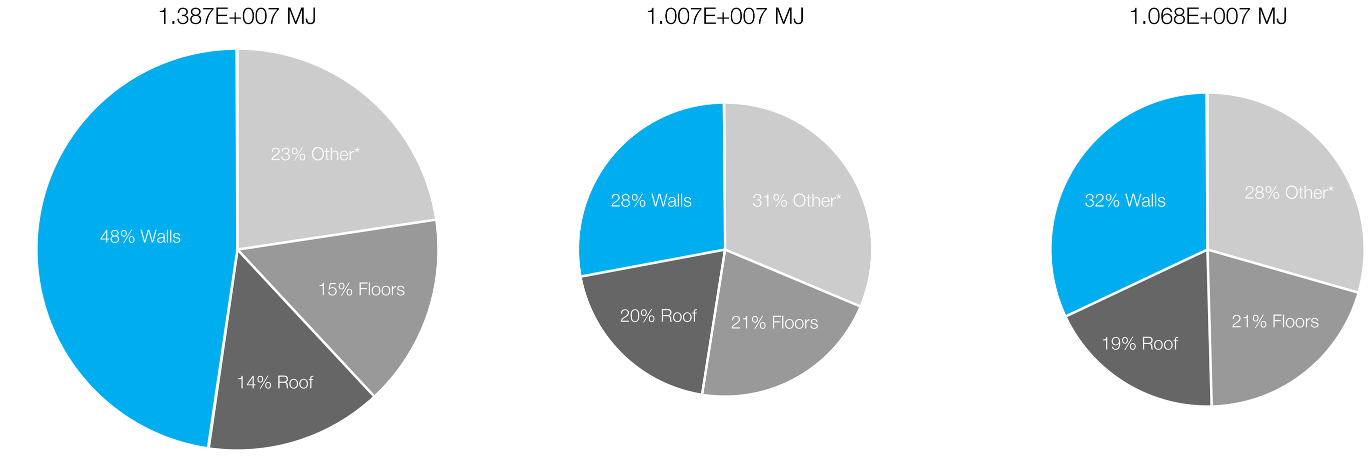
Global Warming Potential
Results Per Revit Category



Existing (Metal Stud) | Wood Stud | Concrete

*Ceilings, Curtain Panels, Curtain Wall Mullions, Doors, Stairs, Windows

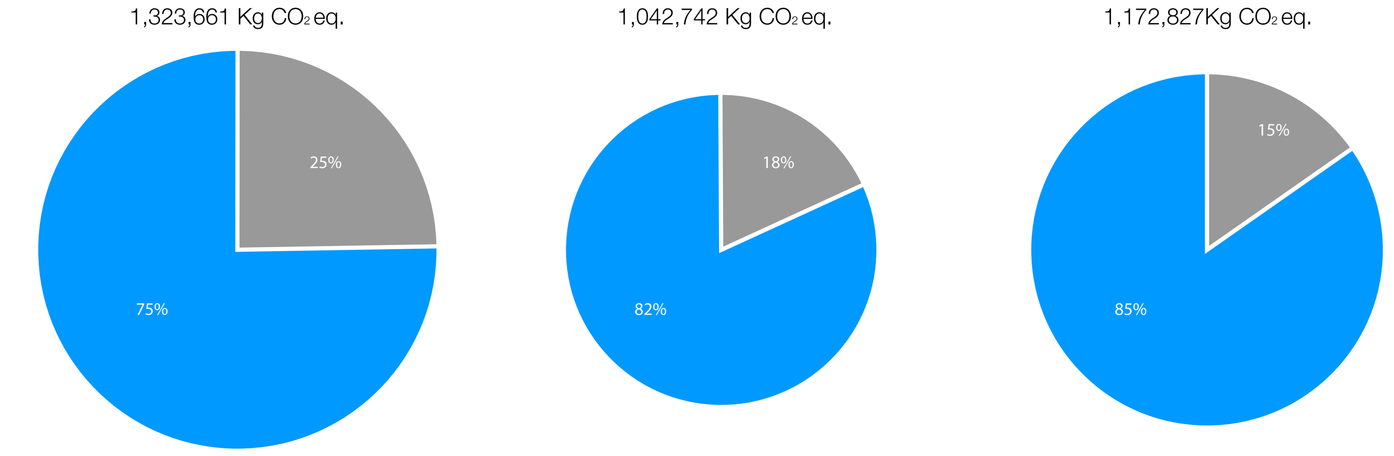
Primary Energy Demand
Results Per Revit Category



Existing (Metal Stud) | Wood Stud | Concrete

*Ceilings, Curtain Panels, Curtain Wall Mullions, Doors, Stairs, Windows

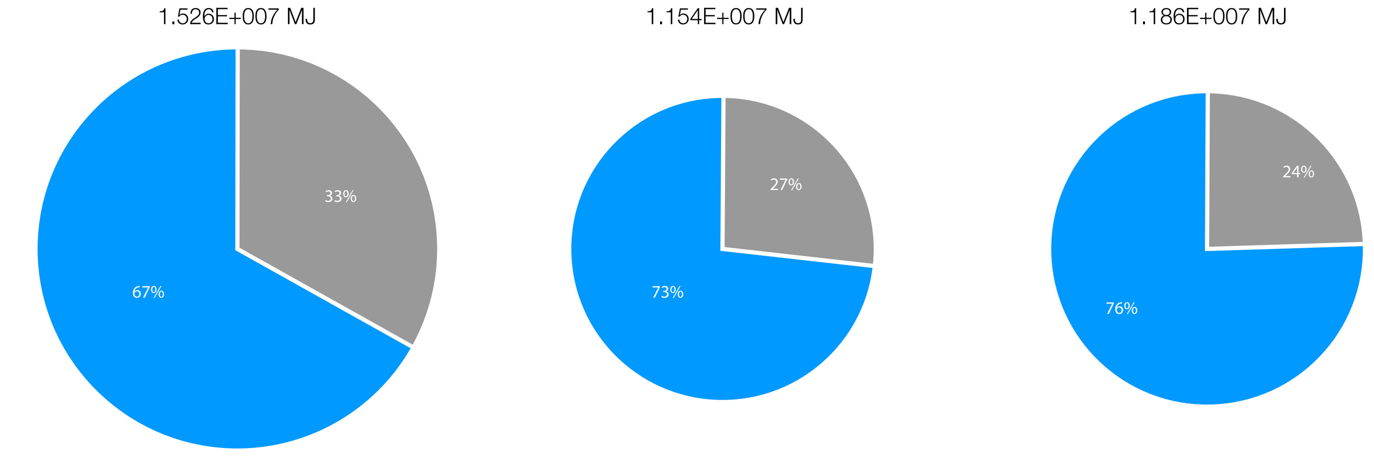
Global Warming Potential
Results per Life Cycle Stage



Existing (Metal Stud) | Wood Stud | Concrete

Legend
Life Cycle Stages
Manufacturing
Maintenance and Replacement

Primary Energy Demand
Results per Life Cycle Stage



Existing (Metal Stud) | Wood Stud | Concrete

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