Energy Study of My Workshop Using Tally and Energy Plus in Revit

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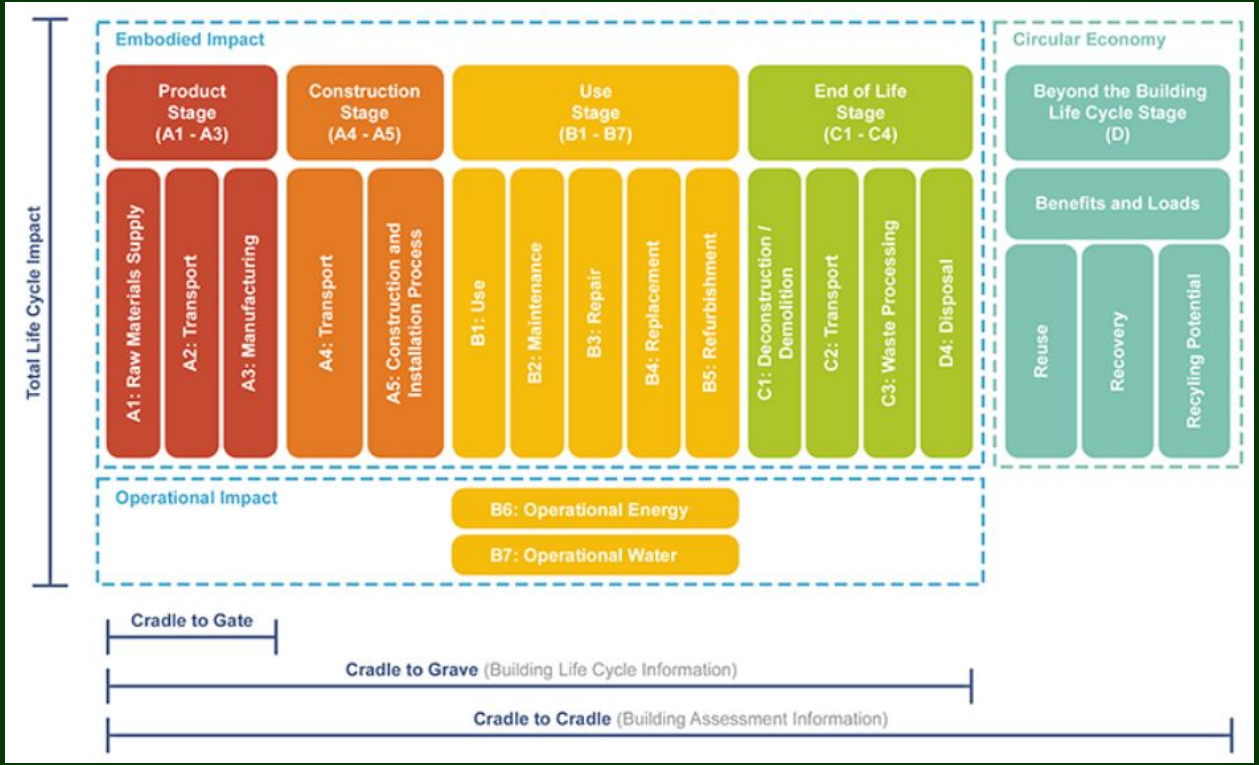
Life Cycle Analysis



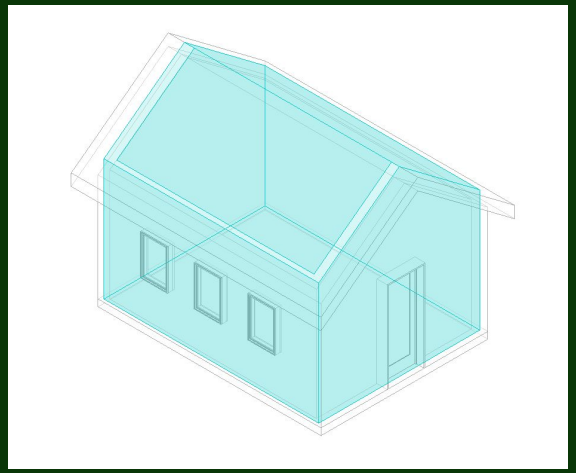
The building sector is the largest contributor to global warming potential, accounting for 48% of the energy consumption worldwide.

If I make informed design choices, I can improve that situation.

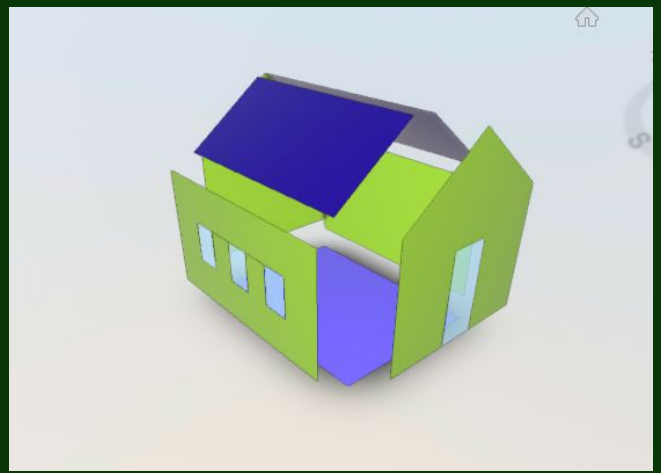
Image credit browningday.com

Images of Models

My 192 ft^2 Workshop Model in Revit



My Building Envelope



My Energy Model

Analysis of Embodied Energy (EE)

Looking at the PDF Report I created by inputting material properties in Tally, I identified an estimate of the environmental impact potential of the Embodied Energy of my structure. Values are below. This is for a building life of 80 years.

Life Cycle Stage	Global Warming Potential (kg CO_2eq)
Product Stage [A1-A3]	713.7 kg CO2eq
Construction Stage [A4]	91.40 kg CO2eq
End of Life Stage [C2-C4]	2,030 kg CO2eq
Use Stage [B2-B5]	2,735 kg CO2eq
Module D [D]	428.0 kg CO2eq
TOTAL FOR THESE STAGES (EE)	6001.7 kg CO2eq

Analysis of Operational Energy (OE)

Looking at the Autodesk Insight Report I created using Energy Plus, I identified an estimate of the environmental impact potential of the Operational Energy consumed by my structure over its life. Values are below. This is for a building life of 20 years.

Life Cycle Stage	Global Warming Potential (kg CO_2eq)
Operational Energy [B6]	30,744.96 kgCO_2e
TOTAL FOR THIS STAGE (OE)	30,744.96 kgCO_2e

Life Cycle Global Warming Potential (GWP)

Combining these, I can estimate the environmental impact of my structure over a 20 year life cycle.

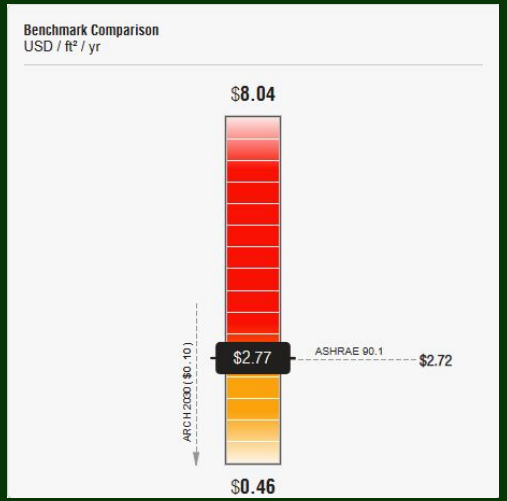
Life Cycle Stage	Global Warming Potential (kg CO_2eq)
Product Stage [A1-A3]	178.42 kg CO2eq
Construction Stage [A4]	22.85 kg CO2eq
End of Life Stage [C2-C4]	507.50 kg CO2eq
Use Stage [B2-B5]	683.75 kg CO2eq
Use Stage [B6]	30,744.96 kg CO2eq
Module D [D]	107.00 kg CO2eq
TOTAL FOR THESE STAGES (EE+OE)	32244.48 kg CO2eq

Energy Optimization

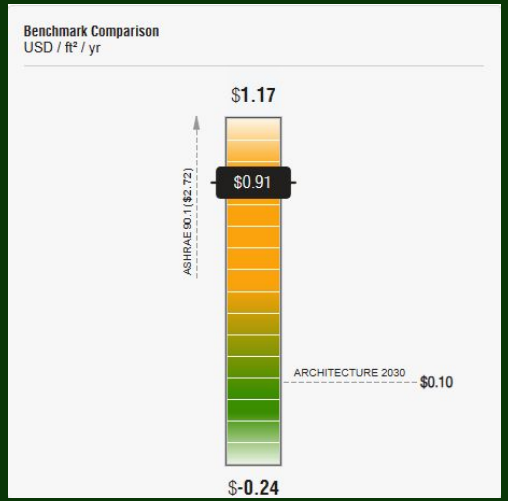
Energy Plus allows me to examine and manipulate several different factors to optimize the Operational Energy used by my structure each year. I can compare before and after values and the effects in terms of dollars per square foot per year.

Before optimization, my workshop requires $2.77/sf/year which is this number x 192 $531.84 since my building is 192sf.

Over 20 years, this amount is $10,637



BEFORE Optimization



AFTER Optimization

After optimization, my workshop requires $0.91/sf/year which is this number x 192 $174.72 since my building is 192sf.

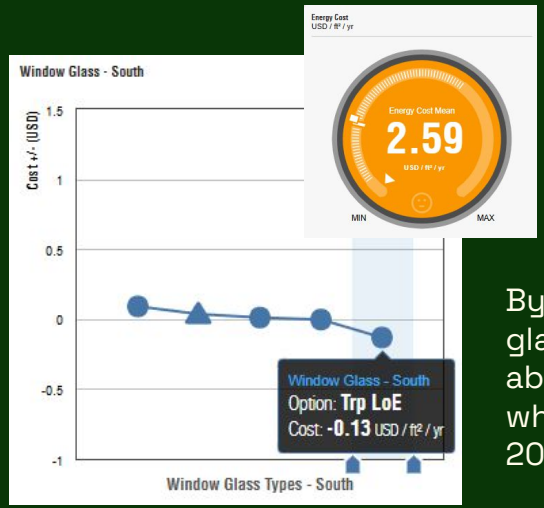
Over 20 years, this amount is $3,494.

Optimization Factors

I can optimize factors like adding shades over windows, changing Window-Wall-Ratio, glass type in windows, wall construction, roof construction, infiltration, lighting, occupancy, plug loads, HVAC systems, operating schedule, and adding solar panels (PV).

Before optimization, my workshop energy used a composite of several different types of window systems.

BEFORE Optimization



AFTER Optimization

By switching to a LoE glazing system, I am able to save $0.13/sf/yr which is $499.20 over 20 years.

Optimization Factors

Here are the Optimization Factors I integrated and their associated savings.

Factor	Reduction ($)
Rotate Building [180º]	0.09
WWR-N/S/E/W	0.11
Shades	already optimized
Wall Construction	0.80
Roof Construction	0.09
Infiltration	0.01

Factor	Reduction ($)
Lighting Efficiency	0.25
Occupancy Controls	0.08
Plug Load Efficiency	0.26
HVAC	0.67
Operating Schedule	0.05
Solar Panels [90%]	0.16

If I revised my design to incorporate all these factors, I could save up to $2.57/sf/yr or $9,869 over 20 years.

Thank
You