Using LCA for sustainable design

Athena
Sustainable Materials
Institute

Introduction to LCA

What is LCA?

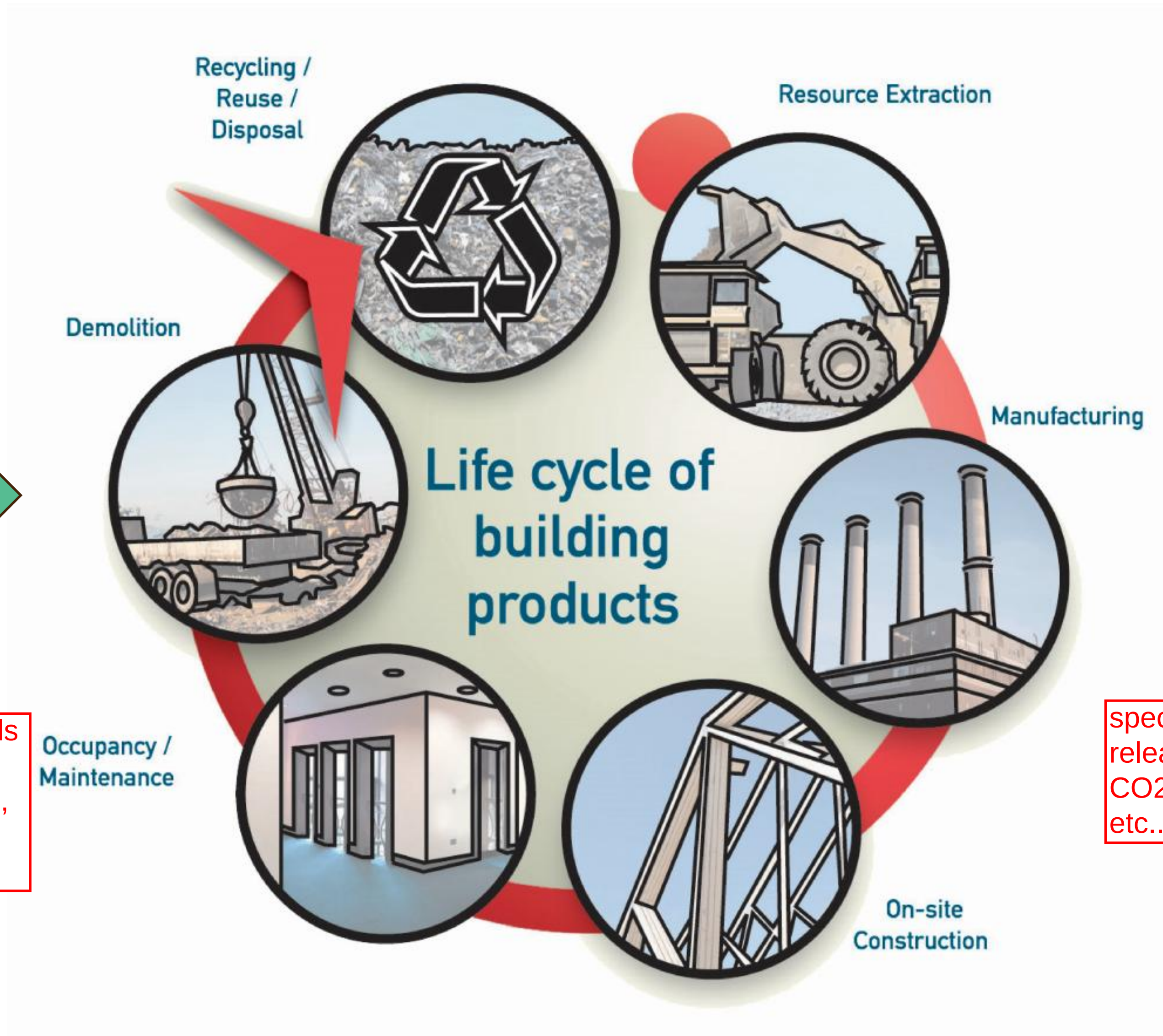
Life cycle assessment inventories all the flows between a product and nature, and then estimates the environmental impact of those flows.

This is called **life cycle** assessment because it looks at every stage (phase) of the product's life, for a comprehensive cradle-to-grave environmental footprint.

Inputs and outputs are measured in each life phase – this results in an environmental **inventory**.

Resources in

specific raw materials consumed:
water, iron, sand, oil, limestone, energy, etc...



Emissions out

specific molecules released:
CO_2, CFCs, NO_x, etc...

Next is **impact assessment**, where the inventory is projected to potential for environmental damage to air, land and water due to, for example, construction of a building.

Potential to create smog

Potential to deplete the ozone layer

Potential to increase climate change

Potential to create acid rain

Potential to cause water eutrophication

The Value of LCA

- Provides **real data** to inform green choices (replacing guesswork).
- Is the basis for **transparent disclosure** of environmental performance.
- Addresses **embodied** impacts (which are too often ignored).
- Identifies **hot spots** so we know where to look for improvements.

Are the typical characteristics we look for in green products real environmental performance measures or are they **proxy measures** where we assume there is a related green benefit?

55% recycled content!

Local product!

(Sounds good, but what's the environmental benefit?)

This kind of measured environmental **performance data** is much more useful.

Environmental Facts

One square meter of carpet

Life cycle impact from cradle to one year of usage

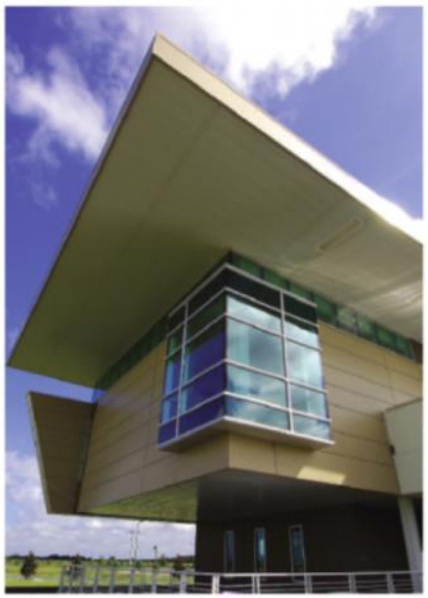
Energy Consumption	
Total nonrenewable primary energy	209.12 MJ
Total renewable primary energy	4.02 MJ
Total primary energy	213.14 MJ
Resource Consumption	
Nonrenewable resources	15.40 kg
Water	0.5338 m^3
Waste Produced	
Non-hazardous waste	15.52 kg
Hazardous waste	0.0706 kg
Impact Measures	
Acidification potential	2.06 mol H+ Equiv.
Eutrophication potential	0.0044 kg N-Equiv.
Global warming potential	10.61 kg CO_2-Equiv.
Ozone depletion potential	9.34E-07 kg CFC 11-Equiv.
Smog potential	0.50 kg NOx-Equiv.

Manufacturers are starting to publish LCA-based information in **Environmental Product Declarations.**

ENVIRONMENTAL PRODUCT DECLARATION

INSULATED METAL PANELS

KINGSPAN INSULATED PANELS NORTH AMERICA
INSULATED WALL & ROOF PANEL SYSTEMS



Kingspan Insulated Panels

Kingspan Insulated Panels North America, announces the first of its kind UL certified ISO compliant Environmental Product Declaration (EPD). The EPD describes environmental manufacturing footprints from cradle to grave based on an ISO compliant Life Cycle Assessment (LCA).

Kingspan's LCA calculates the environmental footprint at each stage of the supply chain, manufacturing processes, product use and end of life. All the significant environmental impacts associated with the product, including the impact on water, air, land and climate change are reported based on ISO LCA standards.

Kingspan Insulated Panels North America is part of Kingspan Group plc, the world's largest manufacturer of insulated metal panels, and as such is committed to reducing the impact of its business operations, products and services on the environment.

Follow our sustainability journey at: **www.pathtonetzero.com**

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

ENVIRONMENTAL PRODUCT DECLARATION

Kingspan.

Kingspan Insulated Panels North America
Insulated Metal Roof and Wall Panel Systems

According to ISO 14025

Life Cycle Assessment results and analysis

A life cycle assessment, complying with ISO 14040 / 14044, describing the declared product and based on plausible, transparent and credible data, is presented. Model assumptions with a relevant influence on the declared results are clearly stated below. The aggregated values of the life cycle inventory analysis and the categories of the life cycle impact assessment below are clearly scaled to the functional or declared unit.

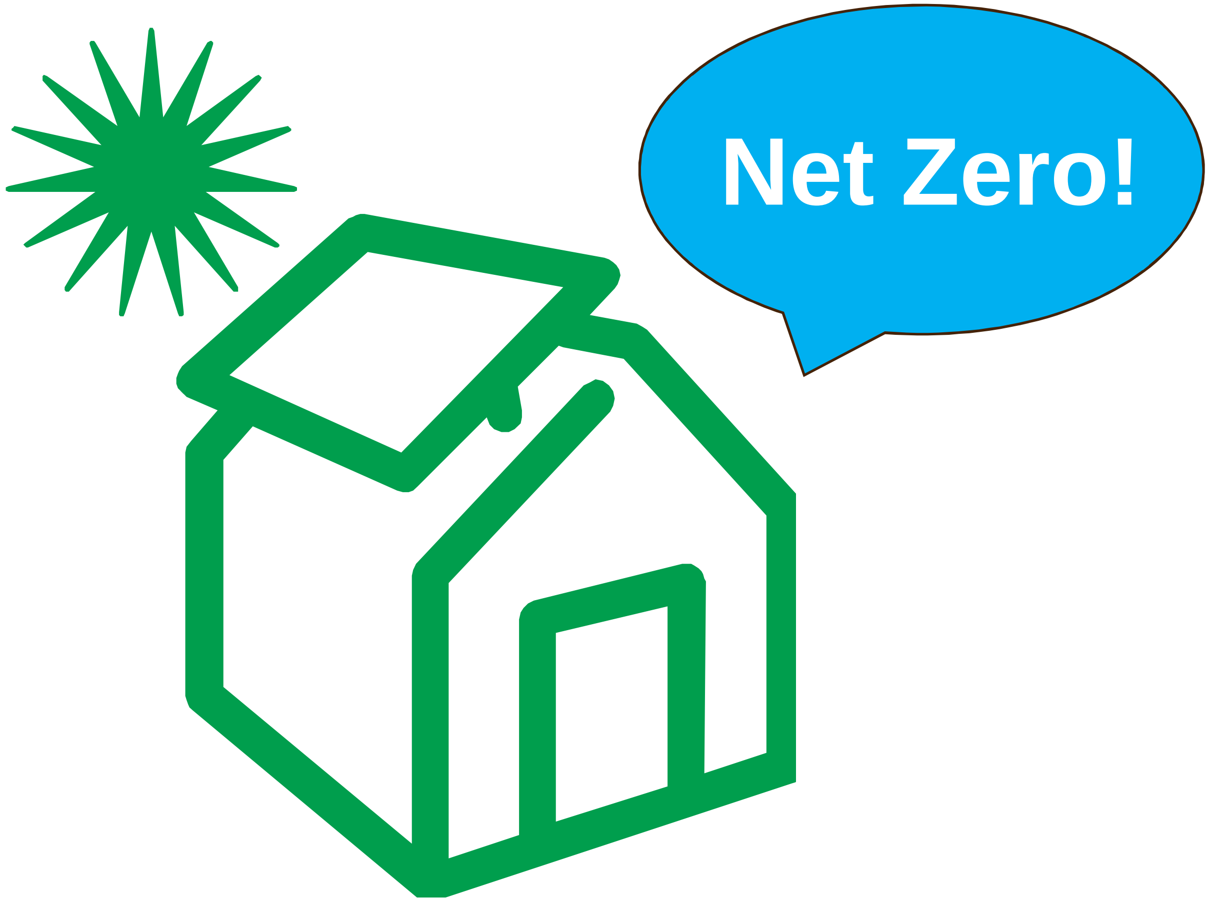
Material and energy resources

Primary energy consumption

	100 square feet	Unit / 100ft²	Total Life Cycle	1. Raw Mater-ials	2. Tran-sport	3. Mfg Emiss & Scrap credits	4. Purc-hased Energy	5. Insta-llation & Maint-enance	6. End of Life
CPL	Primary Energy from Non-renewable Resources	MJ	1.45E +04	1.38E +04	1.29E +02	-4.59E +02	8.37E +02	1.18E +02	8.36E +01
CPL	Primary Energy from Renewable Resources	MJ	5.14E +02	2.94E +02	1.87E -01	2.68E +01	1.87E +02	2.45E +00	4.21E +00
CPL	Energies from Secondary Fuels	MJ	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00
Lami-nated	Primary Energy from Non-renewable Resources	MJ	1.63E +04	1.33E +04	1.26E +02	-8.94E +01	2.83E +03	4.35E +01	7.65E +01
Lami-nated	Primary Energy from Renewable Resources	MJ	3.21E +02	2.84E +02	1.82E -01	5.46E +00	2.56E +01	1.13E +00	4.17E +00
Lami-nated	Energies from Secondary Fuels	MJ	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00	0.00E +00

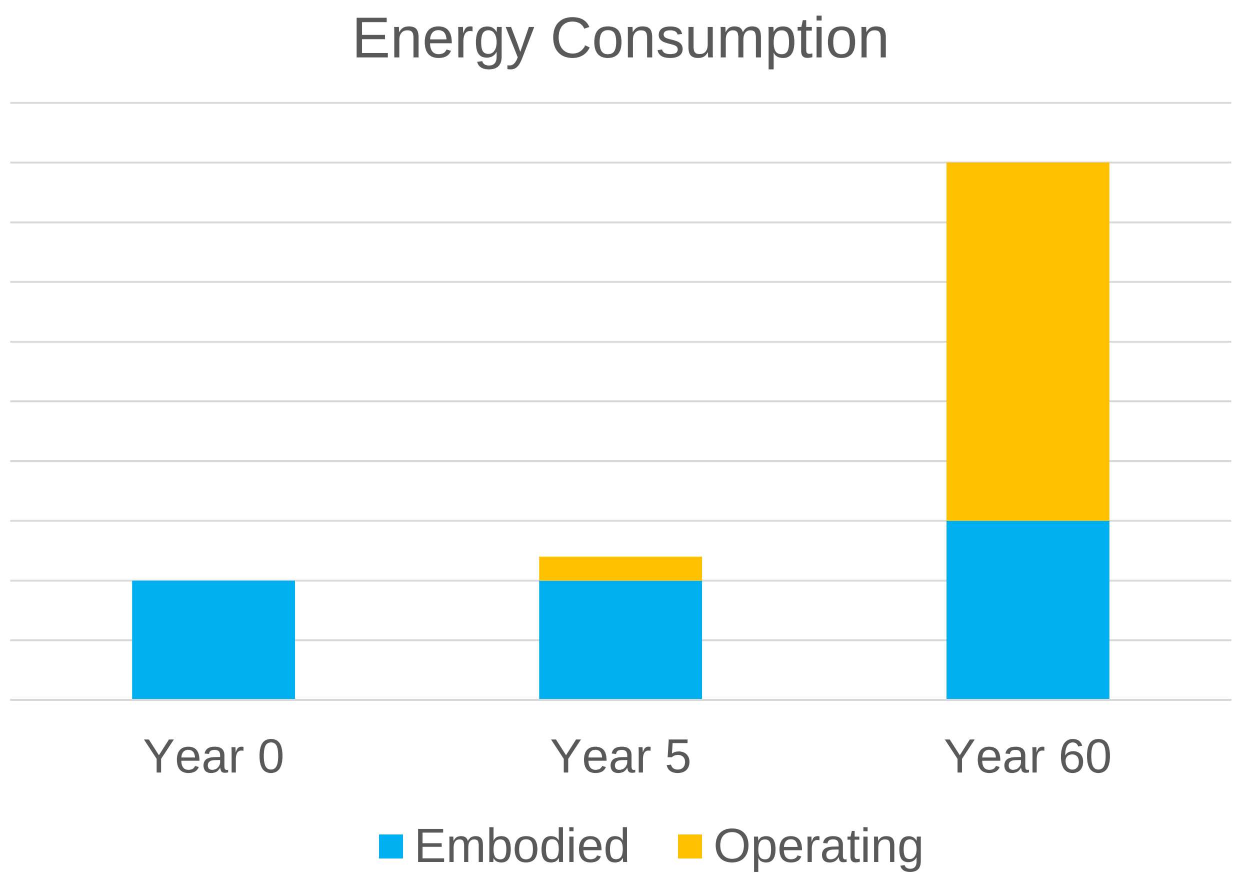
EPDs are required under M1b

LCA addresses more than just operating energy performance – it includes **embodied** environmental impacts.



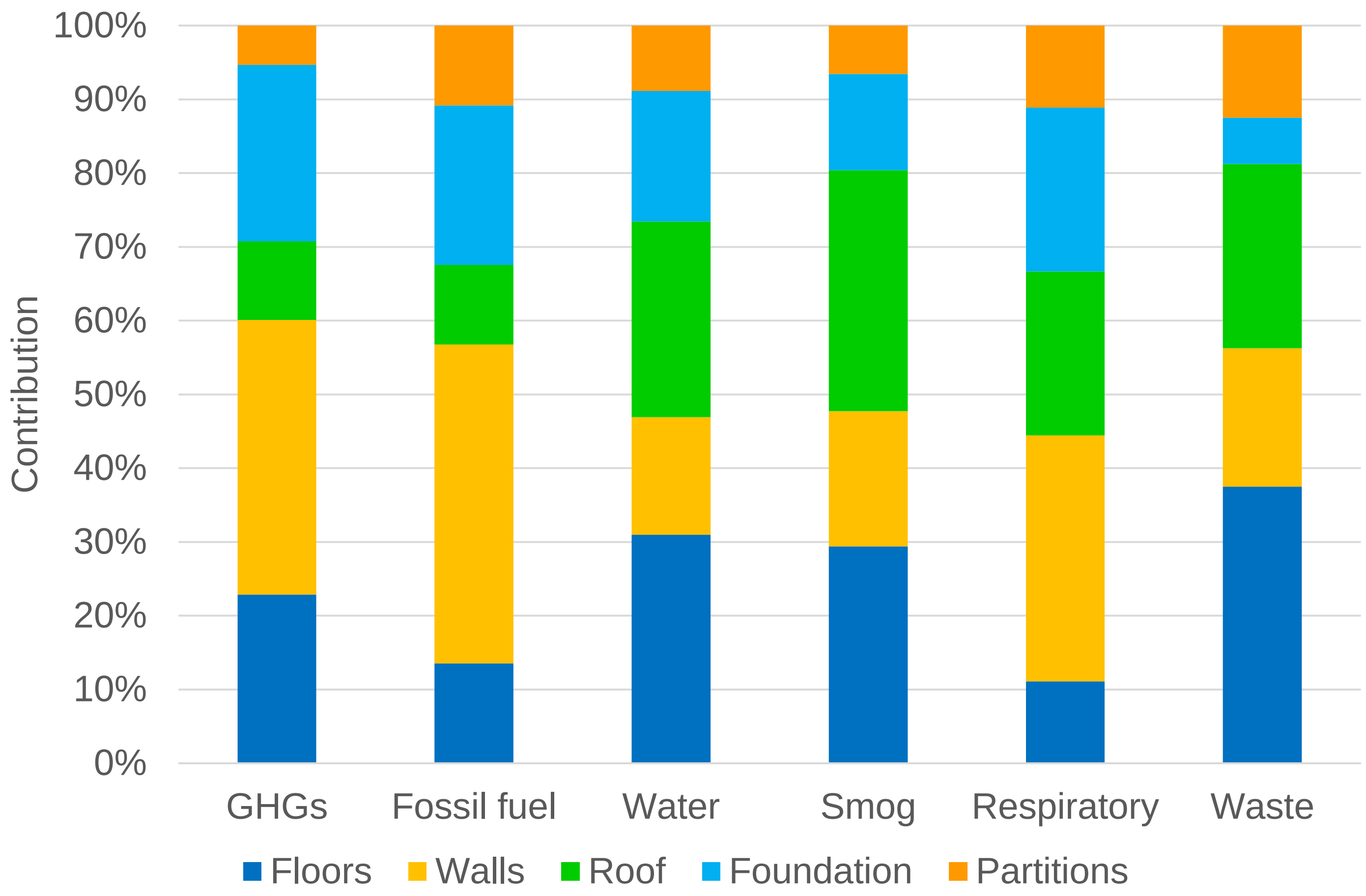
(If we don’t count everything it took to make the building…..)

Embodied impacts are important because we feel them **today**, not 60 years down the road. Taking steps to reduce embodied impacts of construction has an immediate benefit.



Over the life of the building, embodied impacts are less important than operating impacts so we often ignore them. This is a **mistake**.

LCA uncovers the **hot spots** – where in the building the biggest impacts are happening. This tells us where to focus our attention when seeking improvements.



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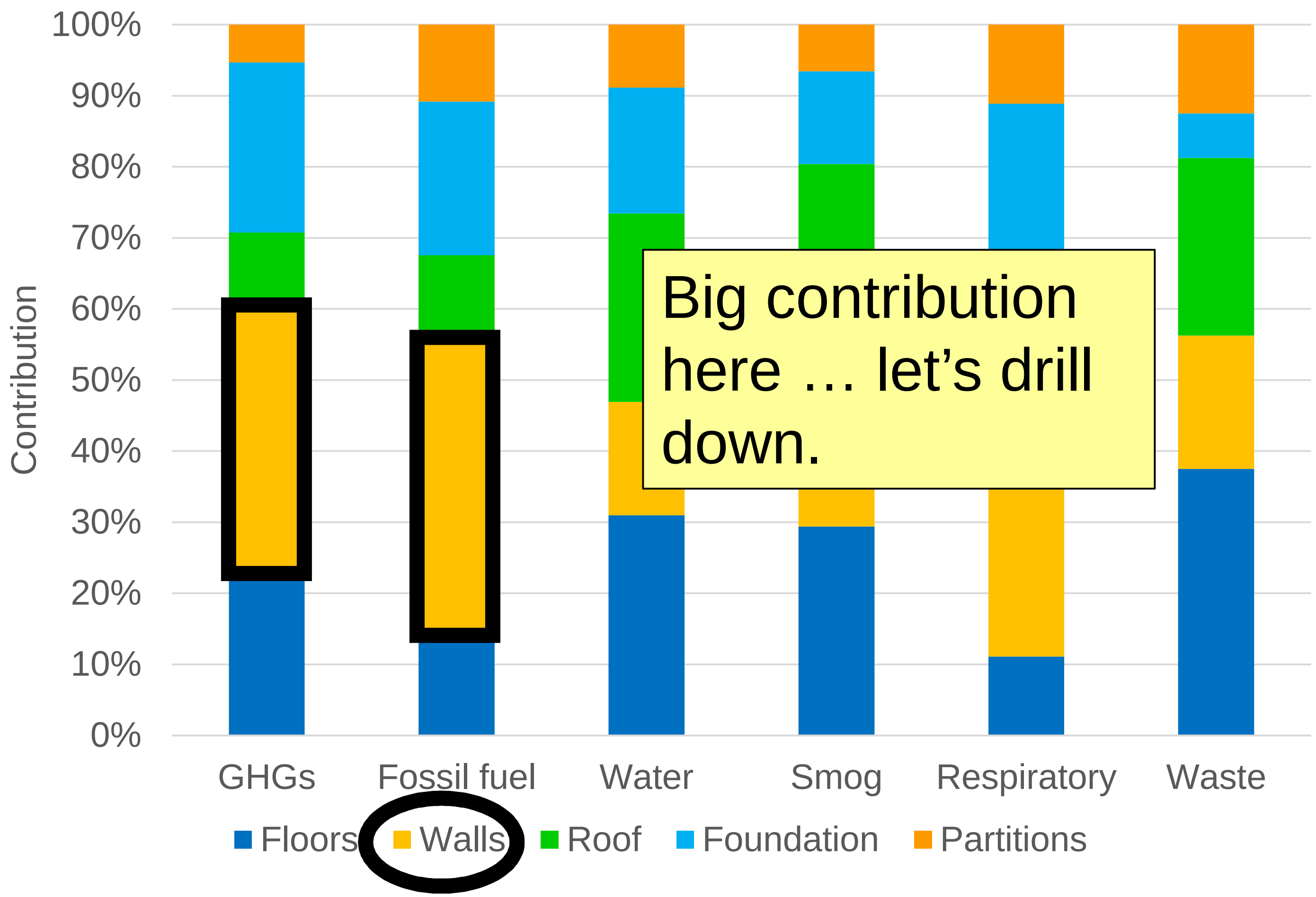
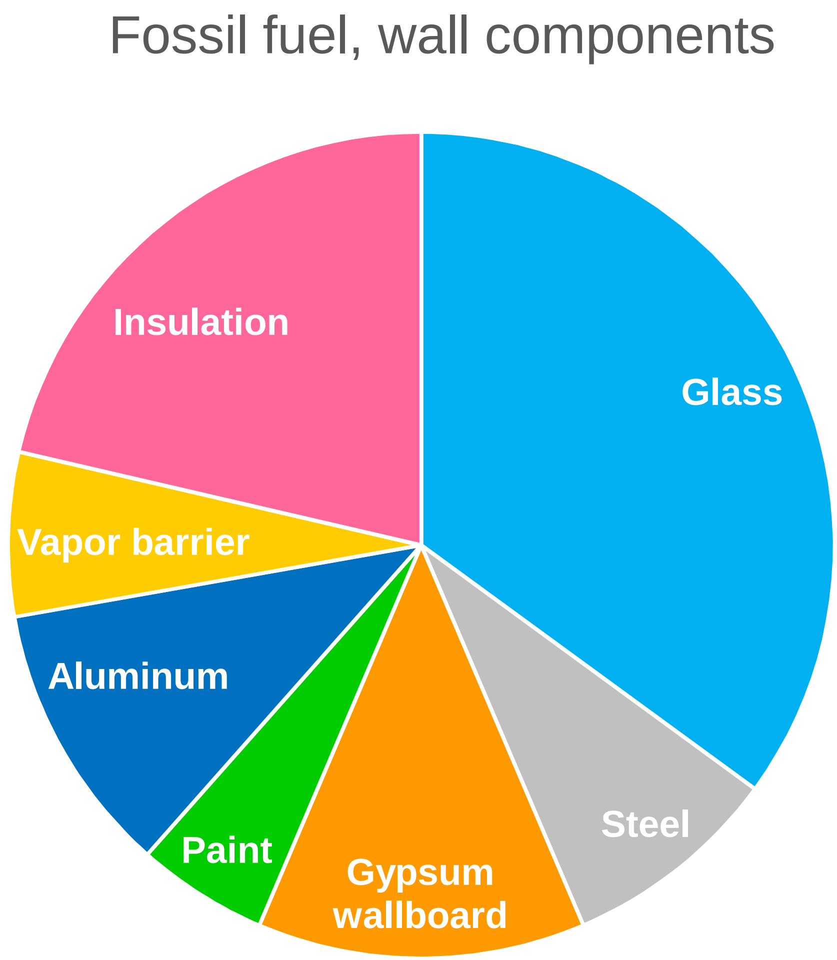


In this example, we'll see a difference if we address the glass – maybe use a different type, or maybe reduce the area.



A few words about LCA **limitations:**

- LCA is just one tool in the sustainability kit.
- It only addresses some of the environmental impacts we may be concerned about.
- We need other tools for different impacts.
- For example:
  - Indoor air quality and human health.
  - Responsible resource extraction (e.g. sustainable harvesting) including all site-specific impacts like biodiversity.
- LCA is an estimating science, not an exact science.
- LCA helps inform direction, it does not delivery absolute answers.