

Embodied Energy in Buildings



*A talk by Elspeth Clements for the Highgate Society Sustainable Living Group
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WHAT IS EMBODIED ENERGY IN BUILDINGS?

It is the energy of the demolition of the existing structure and the construction of its replacement. It is split into:

- Initial embodied energy - energy consumed to construct a building.
- Recurring embodied energy – energy expended to maintain or repair building

WHAT DOES EMBODIED ENERGY INCLUDE? (It is relatively 'invisible')

- Extraction and processing of raw materials,
- Manufacturing of construction materials,
- Transportation
- Distribution,
- Assembly
- Construction
- Ongoing repair and maintenance

WHY IS THIS A PROBLEM FOR CONSTRUCTION?

- 11% of CO₂ of global emissions are the result of embodied energy in construction
- Global building stock expected to double by 2050
- Initial embodied energy will be responsible for 50% of construction footprint
- By 2050, global building stock is expected to double in size.
- Upfront carbon released will be responsible for half of the entire carbon footprint of new construction
- Therefore, the built environment sector has a vital role to play in responding to the climate emergency, and addressing upfront carbon is a critical and urgent focus.

CURRENT POLICIES TO FIX IT

- Short answer – not a lot – **an overlooked policy**

CURRENT POLICIES ON EMBODIED ENERGY

UK Government

- Nothing to monitor or regulate embodied energy currently

London Plan

- Whole life cycle carbon policy (WLC) policy exists and include embodied energy but only for referred building

Haringey

- " preferable that buildings are adapted with viable interventions in order to improve their energy performance "

Camden

- Embodied energy not included in Carbon Descent dataset

Highgate Neighbourhood Plan

- Anything on embodied energy removed as it did not align with local plans

HIGH PROFILE CASES

Demolition and rebuild of the existing 1929 M&S on Oxford Street



Cllr. Geoff Barraclough, voting against the scheme, told fellow committee members:

“There will be 39,500 tonnes of carbon in the building of this new construction..... which would require 2.4 million trees to offset. You can’t get 2.4 million trees on top of the new building. Just to put that 39,500 tonnes of carbon in context, last week the council announced that we are going to spend £17 million to retrofit all of our building to save 1,700 tonnes of carbon every year. And so this is 23 years of what we have just saved as a council, going into one building.’

- Demolition and rebuild of the existing 1929 building **approved** by Westminster City Council in November 2021
- Referred to GLA who are content the “carbon footprint had been considered”.
- Currently with Department for Levelling Up, Housing and Communities which has blocked the demolition until ministers can scrutinise the plans.

Norman Fosters 'Tulip' viewing platform



A new 305m high public cultural and tourist attraction designed by Lord Foster and planned to be built next to The Gherkin,

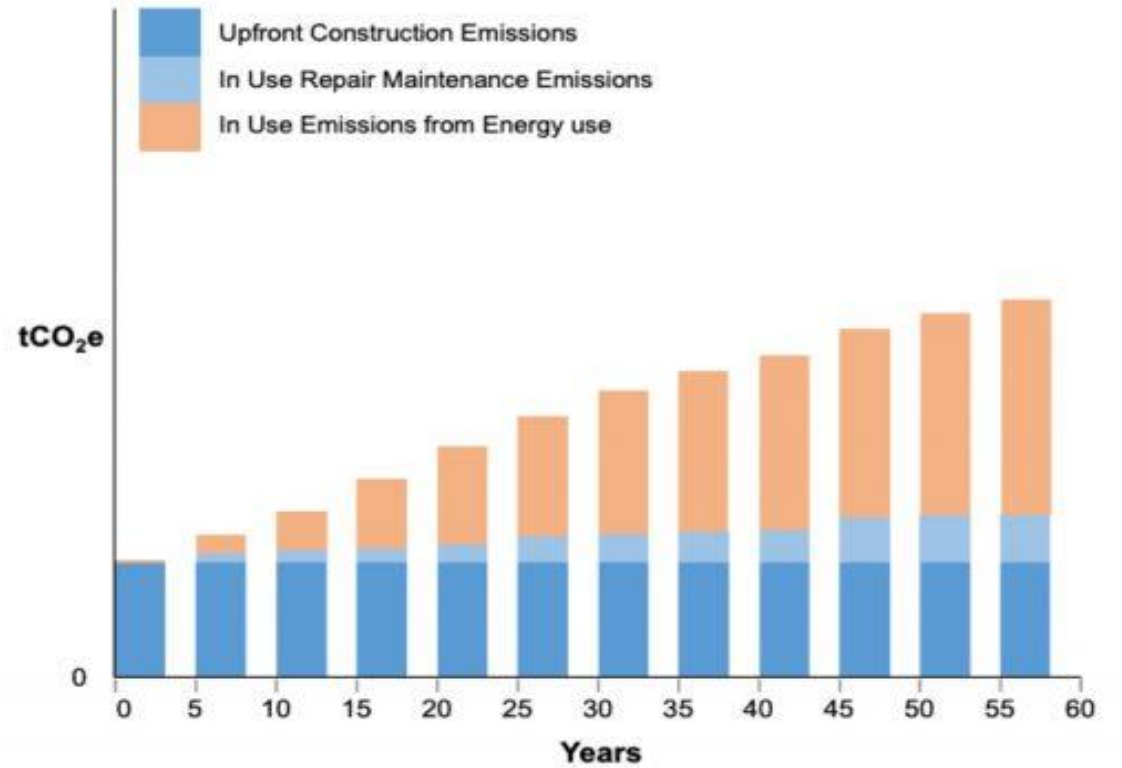
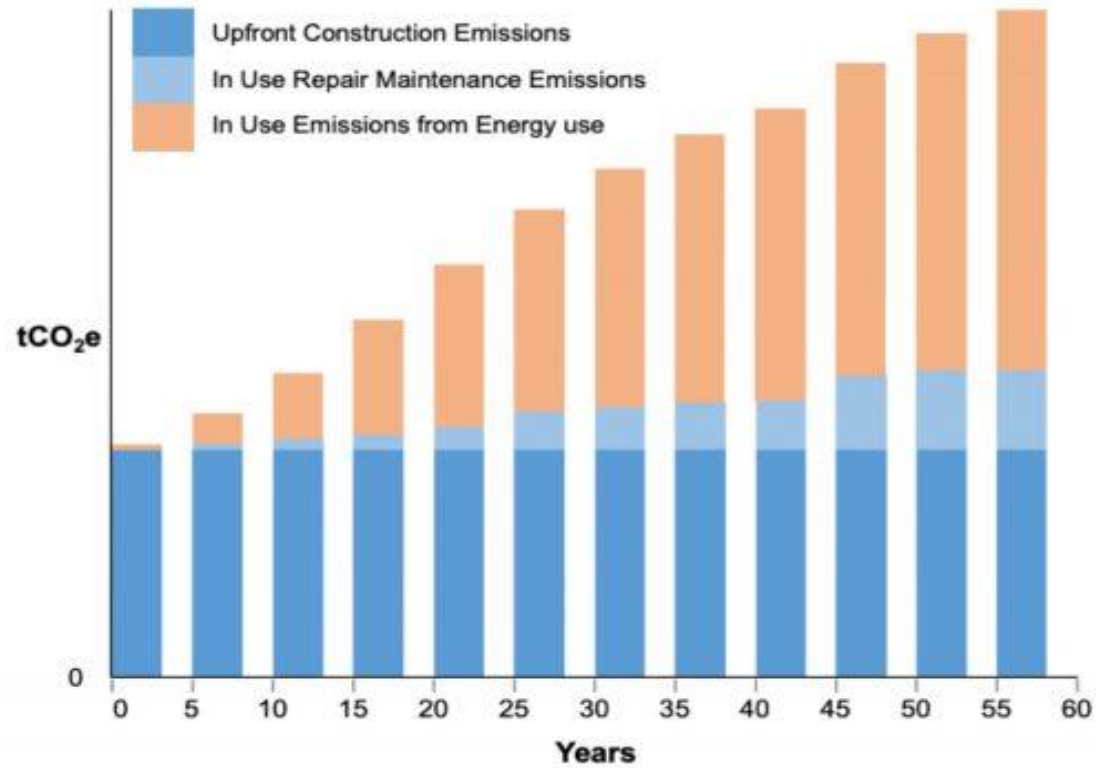
- Approved by City of London Planners Nov 2018
- GLA refused planning permission for the tower
- Developer appealed to DLUHC
- Unexpectedly rejected by DLUHC citing its “highly unsustainable concept of using vast quantities of reinforced concrete ...only to enjoy a view”.

Hybrid – part retained, part new



- Private developer, Ashby Capital remodelled an outdated office building into a brand-new one resulting in significant energy and emission savings compared with building from scratch.
- 100% of total excavation waste has been diverted from landfill,
- 99% of total construction and demolition waste has been diverted from landfill,
- 100% of electricity comes from a renewable source,
- Re-purposing the building's existing frame has saved thousands of tonnes in CO2 emissions.

NEW BUILD VERSUS RETROFIT



A REBUILD/RETROFIT CASE STUDY

Case study, by Historic Scotland for traditional 2 bedroomed cottage in Dumfries for 100-year life span



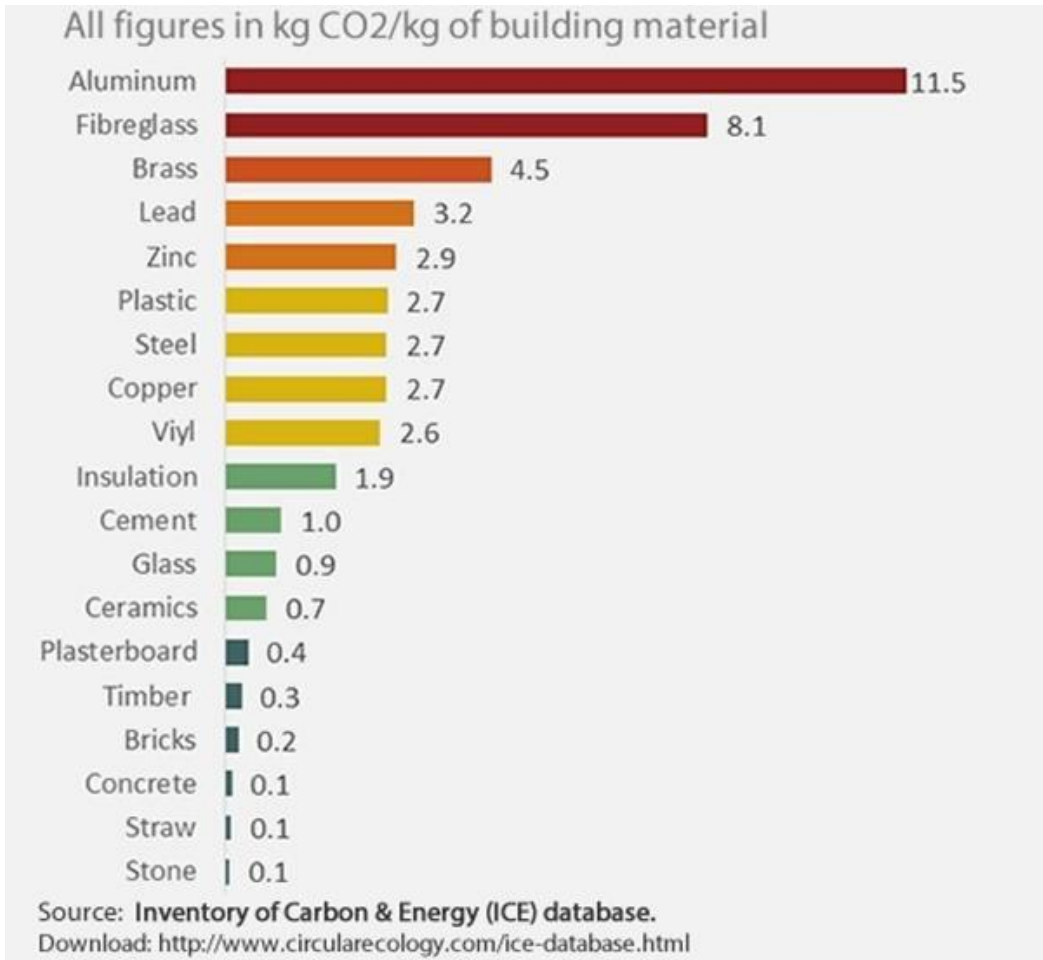
3 options

1. Leave it as it is - worst option – the old house leaking energy like a sieve,
2. Knock it down and rebuild to carbon neutral standards – 80 tonnes of CO₂ produced made up of: -
 - Walls 60%
 - Timber 14%
 - Pipework and drainage 9%
 - Floors 5%
 - Slate roof 5%
 - Photovoltaic panels 3%
 - Other 4%
3. Refurbish to carbon neutral standards carbon investment of 8 tonnes of CO₂ - 10% of new build

Once cost was taken into account, refurbishment became dramatically the most practical and attractive option, too.

THE CHALLENGE FOR ARCHITECTS

Embodied carbon of building materials



- Chart shows the embodied energy of various materials used in buildings.
- However the choice of materials is not straight forward
- Conflicts between embodied energy and other material characteristics
- For example good insulation materials can have other negative characteristics be flammable and toxic
- Whereas brick has an poor insulation characteristics whilst performing well on embodied energy

There is currently insufficient guidance on this, not helped by manufacturers who are keen to push their products.

WHAT NEEDS TO BE DONE?



“Rising emissions in the buildings and construction sector emphasize the urgent need for a triple strategy to aggressively reduce energy demand in the built environment, decarbonize the power sector and implement materials strategies that reduce lifecycle carbon emissions,”.

UN Environment Programme (UNEP)

WHAT WE CAN DO?

- Government needs to address concerns about impact on the economy of any policies which impact on manufacturing
- Reduce the lobby power of the volume house builders who operate on economies of scale
- Look at remodelling industry' preferred method of working is large new build estates on green field sites or massive housing or office developments.
- Train up operatives to overcome skills shortage in dealing with retrofitting old buildings
- Strengthen embodied energy policy from National to Neighbourhood level
- Level up the playing field so that VAT is charged at an equal rate across both new build and refurbishment