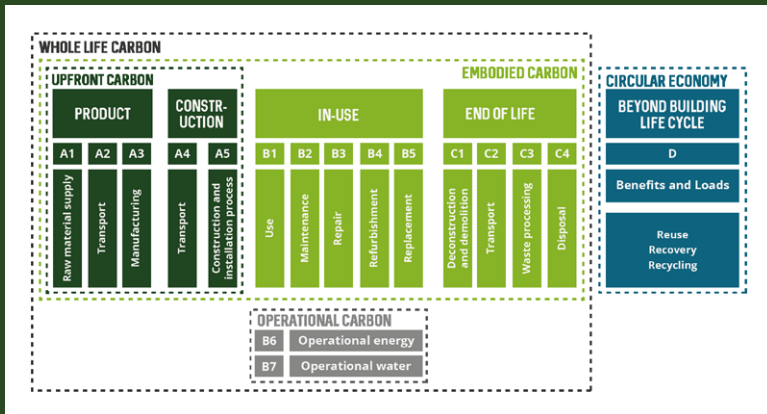




WE FOCUS ON UPFRONT CARBON AS THEY ARE MOST LIKELY THE MAJORITY OF EMBODIED CARBON IMPACTS ASSOCIATED WITH A PROJECT.

INCLUDED ARE PRODUCT STAGES A1-A3, PLUS TRANSPORT A4 TO WALES AND MATERIAL WASTE FROM CONSTRUCTION INSTALLATION A5W.

EXCLUDED ARE EMISSIONS DUE TO ENERGY USAGE ON SITE DURING CONSTRUCTION
INSTALLATION A5a.

ROOFS

Estimation of upfront embodied carbon impacts.

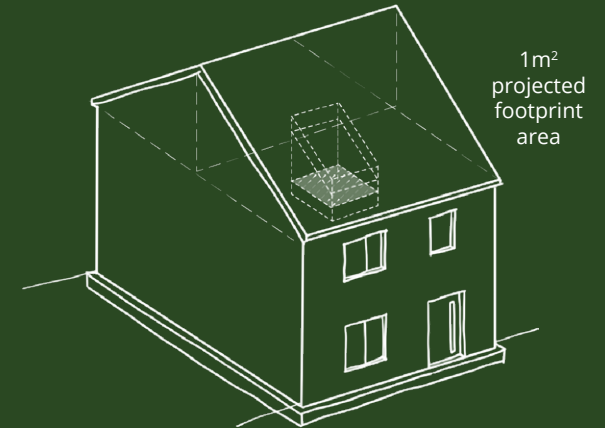
Calculated per m² of horizontal projection area (or footprint area to be covered with a roof including external walls) to a common U-value of 0.11W/m²K.

Includes timber trusses or rafters, insulation, internal lining, membranes and roof finish.

Excludes fascias, sole plates, rainwater goods.

Medium to large format concrete tiles have been assumed for all options. An allowance has been made for fixings.

The roof pitch has been assumed at 30°, with a structural span of 8m for trusses.



*Based on a notional detached
2-storey 3B house of 80m²*



ALL FIGURES ARE SENSITIVE TO ASSUMPTIONS AND EXCLUSIONS,
WHICH IS WHY IT IS IMPORTANT TO CRITICALLY REVIEW EVERY FIGURE
AND UNDERSTAND ITS PARAMETERS AND SYSTEM BOUNDARIES!

A KEY INFORMATION IS THE FUNCTIONAL UNIT AS THE BASIS FOR COMPARISONS – HERE WE HAVE TAKEN 1 SQUARE METER OF PROJECTED FOOTPRINT AREA IN ORDER TO DIRECTLY COMPARE THE IMPACT OF THE DIFFERENT ROOF CONSTRUCTIONS AND BUILD-UPS AGAINST EACH OTHER.

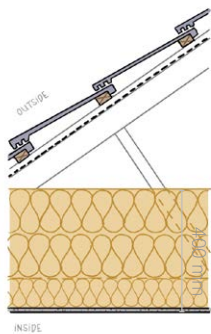
EMBODIED CARBON IMPACTS

ROOFS

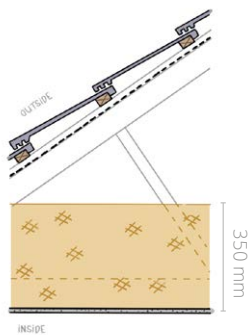
EMBODIED CARBON: EXAMPLE OF ROOF BUILD UPS

A1-A4 plus A5w site wastage (excludes A5a)
0.11W/m²K

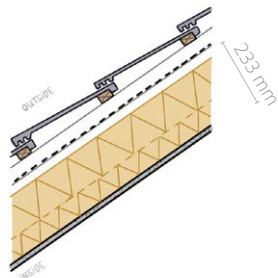
Pitched Trussed Cold Roof
Mineral Wool



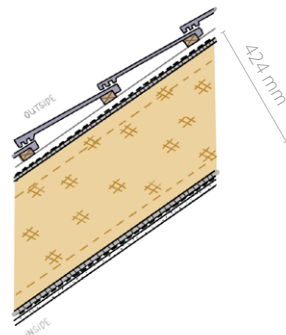
Pitched Trussed Cold Roof
Cellulose



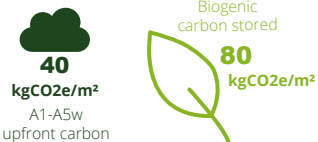
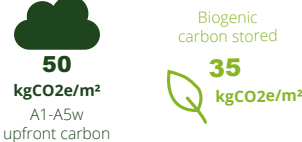
Pitched Warm Roof
PIR between Rafters



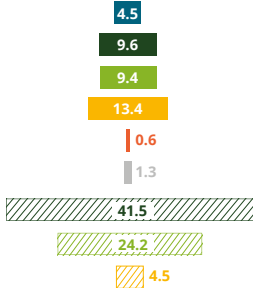
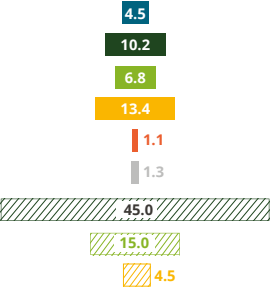
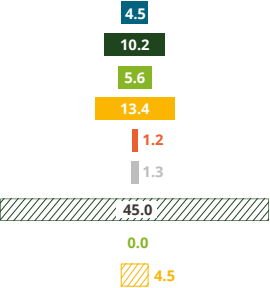
Pitched Warm Roof
Cellulose between I-Beams



Estimated
Upfront Carbon
Impacts
per m² of
projected
footprint area



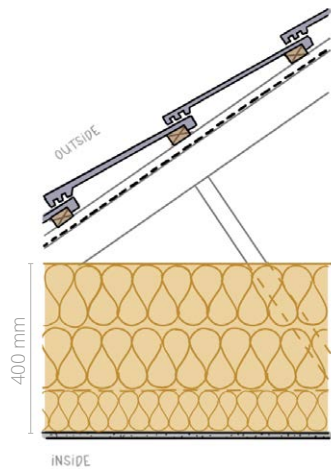
- Internal lining
- Roof structure
- Insulation
- Cladding
- Membranes
- Fixtures etc
- Roof structure biogenic stored
- Insulation biogenic stored
- Cladding biogenic stored (roofing battens)



EMBODIED CARBON: EXAMPLE OF ROOF BUILD UPS

A1-A4 plus A5w site wastage (excludes A5a)
0.11W/m²K

Pitched Trussed Cold Roof - Mineral Wool at Loft Level



Medium to large format interlocking concrete roof tiles
25mm roofing battens
25mm counter battens
Roofing membrane
Trussed rafter (assumed 8m span) @ 600mm ctrs
400mm mineral wool batts (11kg/m³) above and between joists
Vapour control layer
15mm plasterboard
3mm plaster skim



LOW DENSITY MINERAL WOOL IS ACTUALLY VERY GOOD IN TERMS OF UPFRONT EMBODIED CARBON! THIS IS NOT THE CASE FOR HIGHER DENSITY RAINSCREEN SLABS.

Combined upfront embodied carbon per m²

36.2
kgCO₂e/m²

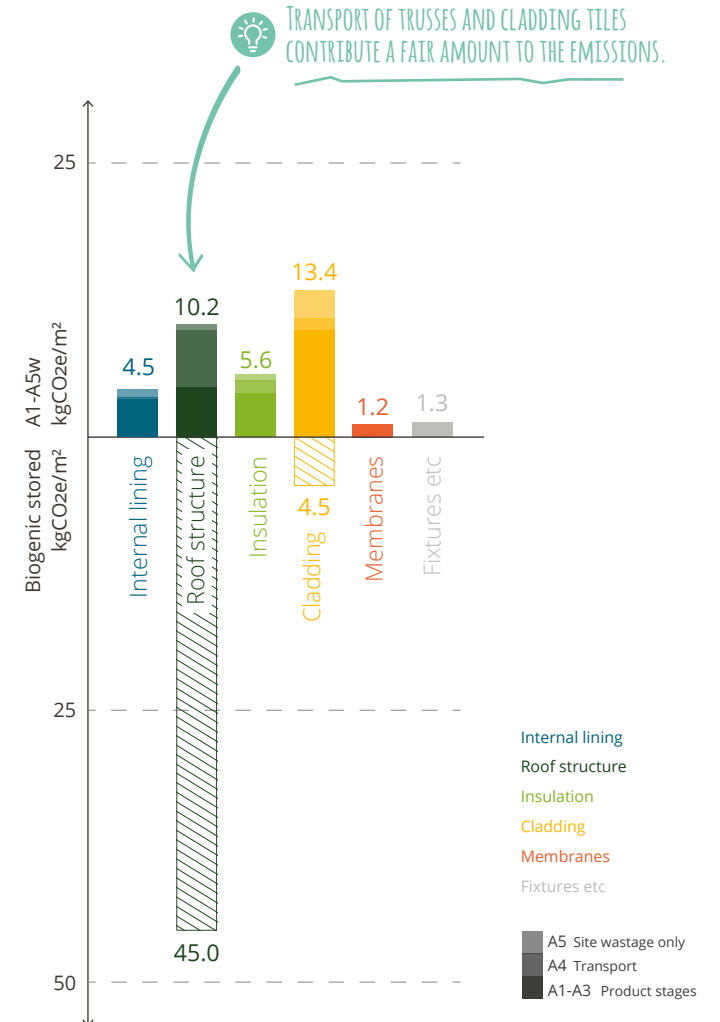
A1-A5w carbon impact

49.5
kgCO₂e/m²

Biogenic carbon stored



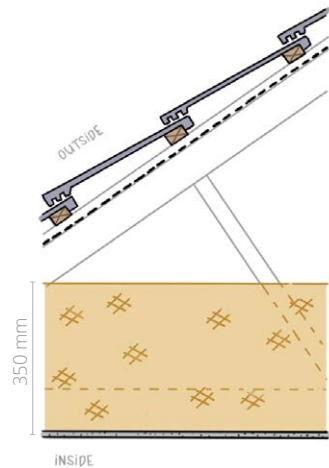
COMMON ROOF STRUCTURES SUCH AS TRUSSES AND BATTENS MADE FROM TIMBER STORE CARBON.



EMBODIED CARBON: EXAMPLE OF ROOF BUILD UPS

A1-A4 plus A5w site wastage (excludes A5a)
0.11W/m²K

Pitched Trussed Cold Roof - Cellulose at Loft Level



- Medium to large format interlocking concrete roof tiles
- 25mm roofing battens
- 25mm counter battens
- Roofing membrane
- Trussed rafters (assumed 8m span) @ 600mm ctrs
- 350mm cellulose insulation above and between joists (40kg/m³)
- Vapour control layer
- 15mm plasterboard
- 3mm plaster skim



LOOSE CELLULOSE AT LOFT LEVEL IS USUALLY INSTALLED AT A LOWER DENSITY THAN INSIDE A FRAME, WHICH REDUCES THE CARBON EMISSIONS (BUT ALSO STORAGE) PER SQUARE METER.

Combined upfront embodied carbon per m²

37.3
kgCO₂e/m²

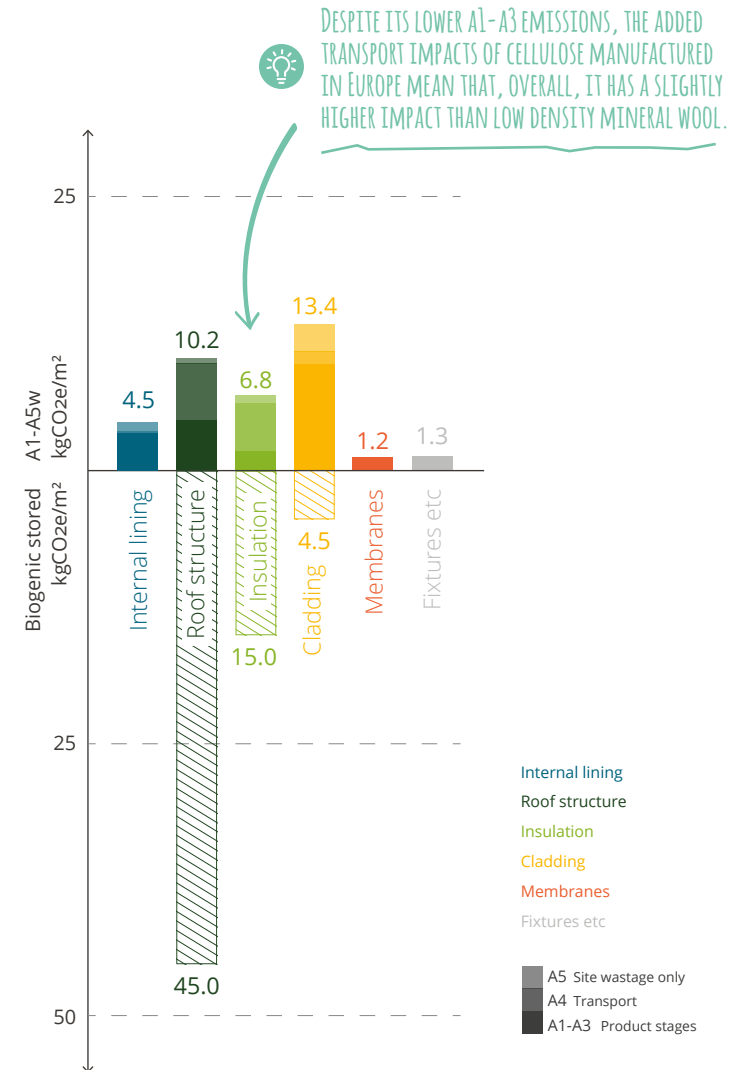
A1-A5w carbon impact

64.5
kgCO₂e/m²

Biogenic carbon stored



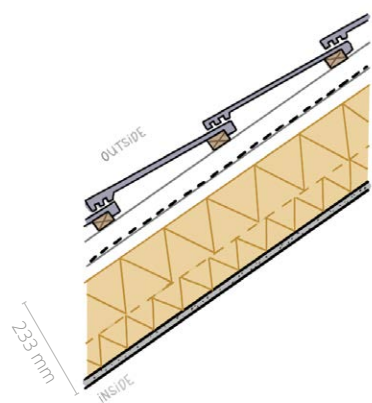
BIO-BASED MATERIALS LIKE CELLULOSE STORE CARBON!



EMBODIED CARBON: EXAMPLE OF ROOF BUILD UPS

A1-A4 plus A5w site wastage (excludes A5a)
0.11W/m²K

Pitched Warm Roof - PIR between Joists



- Medium to large format interlocking concrete roof tiles
- 25mm roofing battens
- 25mm counter battens
- Roofing membrane
- 190mm timber rafters (assumed 4m horizontal span) @ 400mm ctrs
- 140mm PIR between joists
- 62.5mm insulated plasterboard
- 3mm plaster skim



THERE ARE WIDER CONSIDERATIONS WHEN CHOOSING BETWEEN COLD AND WARM ROOFS, INCLUDING USABLE SPACE AND AREA, STRUCTURE, PREFABRICATION, CONTEXT, MEP LOCATION ETC!

Combined upfront embodied carbon per m²

50.9
kgCO₂e/m²

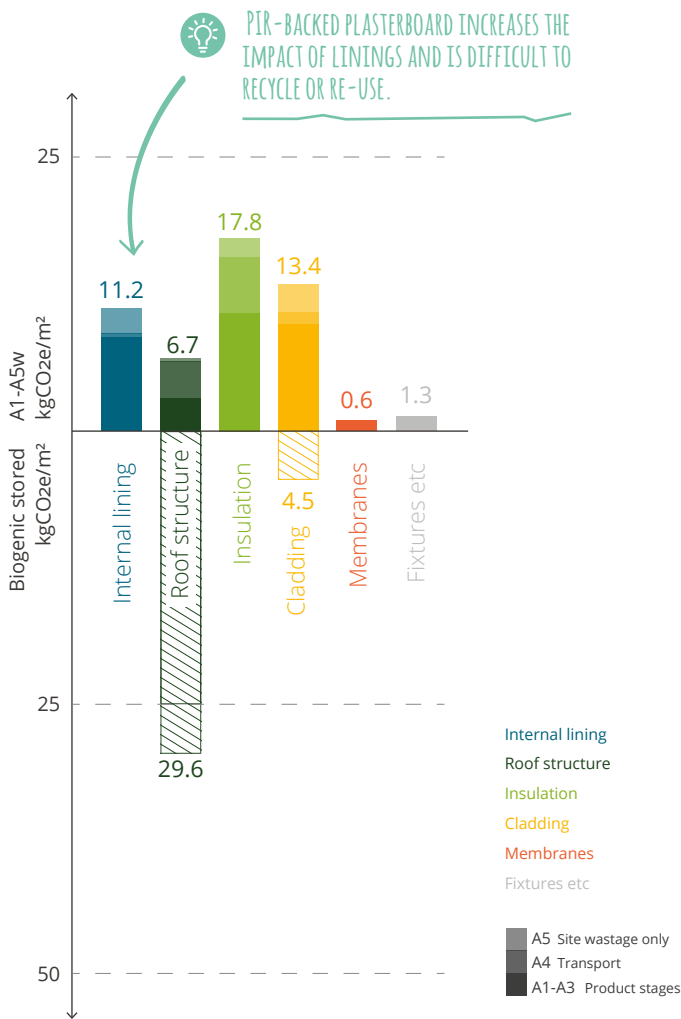
A1-A5w carbon impact

34.1
kgCO₂e/m²

Biogenic carbon stored



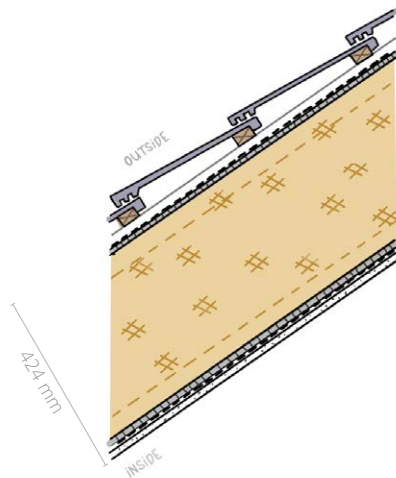
THE SPACING AND SIZE OF ROOF TILES, AS WELL AS THE ROOF PITCH, MAKE A DIFFERENCE!



EMBODIED CARBON: EXAMPLE OF ROOF BUILD UPS

A1-A4 plus A5w site wastage (excludes A5a)
0.11W/m²K

Pitched Warm Roof - Cellulose between I-Beams



Medium to large format interlocking concrete roof tiles
25mm roofing battens
25mm counter battens
Roofing membrane
11mm OSB/3 sheathing board
360mm blown cellulose insulation (50kg/m³) between I-joists
(assumed 4m horizontal span) @ 600mm ctrs
11mm OSB/3 sheathing board
Vapour control layer
12.5mm plasterboard
3mm plaster skim



THIS BUILD UP STORES THE MOST CARBON FROM
TIMBER STRUCTURE AND CELLULOSE INSULATION,
BUT IT ALSO HAS THE THICKEST BUILD-UP.

Combined upfront embodied carbon per m²



42.4
kgCO₂e/m²

A1-A5w carbon impact



80.3
kgCO₂e/m²

Biogenic carbon stored

