COREWOOD
- KERNEN TIL ET GODT BYGGERI

Exterior wall
created on 24.4.2023

CLT. 180 mm Enertherm ALU og skalmur.

Thermal protection

U = 0,11 W/(m²K)

EnEV Bestand*: U<0,24 W/(m²K)

excellent insufficient

Moisture proofing

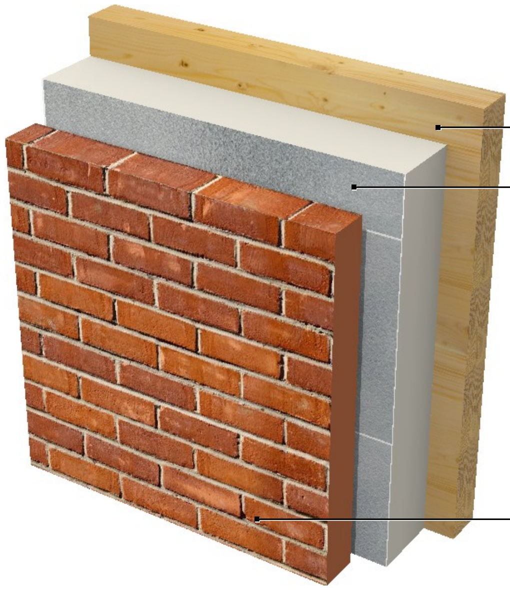
Drying reserve: 0 g/m²a
(leads to devaluation)
No condensate

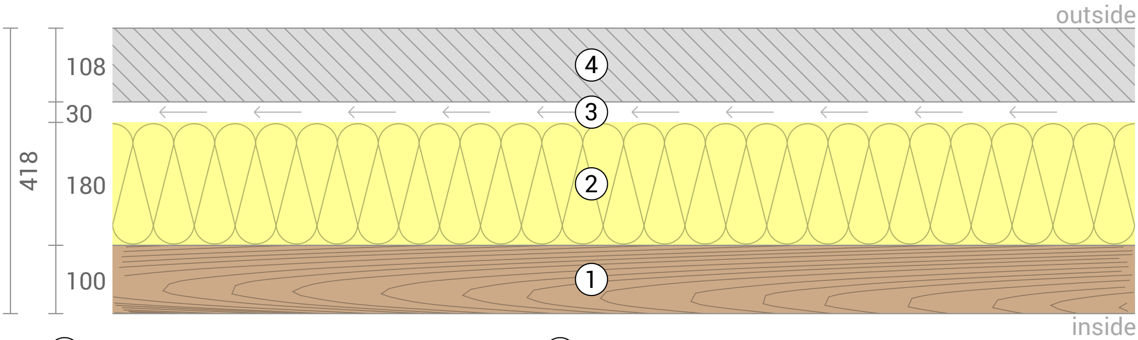
excellent insufficient

Heat protection

Temperature amplitude damping: 63
phase shift: 11,7 h
Thermal capacity inside: 79 kJ/m²K

excellent insufficient





1. Cross Laminated Timber (100 mm)
2. EU IKO enertherm ALU (180 mm)
3. Rear ventilated level (30 mm)
4. solid brick 1800 kg/m3, DIN 105 (108 mm)

Inside air :	20,0°C / 50%			Thickness:	41,8 cm
Outside air:	-5,0°C / 80%	sd-value:	18004,0 m	Weight:	250 kg/m²
Surface temperature.:	19,3°C / -4,9°C	Drying reserve:	0 g/m²a	Heat capacity:	88 kJ/m²K

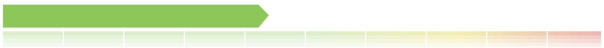
☑ EnEV Bestand ☑ BEG Einzelmaßn. ☑ GEG 2020 Bestand ☑ GEG 2020 Neubau

*Comparison of the U-value with den Höchstwerten aus EnEV 2014 Anlage 3 Tabelle 1 (EnEV Bestand); den techn. Mindestanforderungen für BEG Einzelmaßnahmen; den Höchstwerten aus GEG 2020 Anlage 7 (GEG 2020 Bestand); 80% des U-Werts der Referenzausführung aus GEG 2020 Anlage 1 (GEG20 Neubau)

CLT. 180 mm Enertherm ALU og skalmur., U=0,11 W/(m²K)

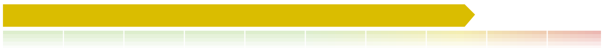
LCA

Heat loss: 8 kWh/m² per heating season



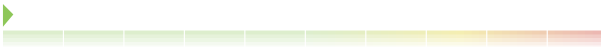
Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

Primary energy (non renewable): 267 kWh/m²



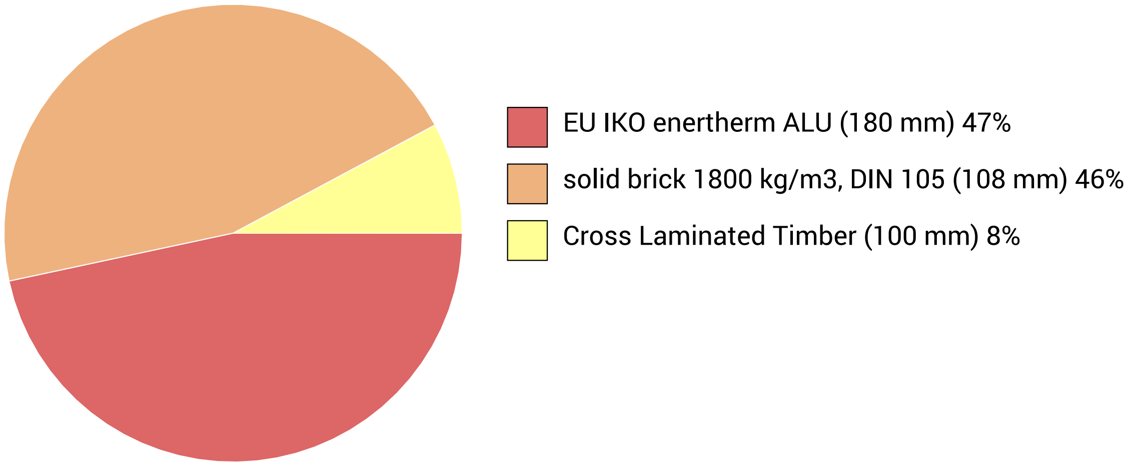
Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

Green house gas potential: -7,9 kg CO_2 Äqv./m²

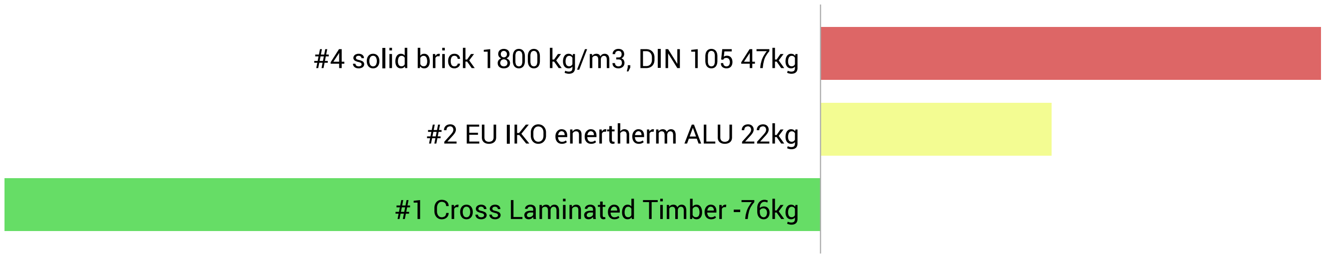


For the production of the building materials used, more greenhouse gases were withdrawn from the atmosphere than emitted.

Composition of non-renewable primary energy of production:



Composition of the greenhouse potential of production:



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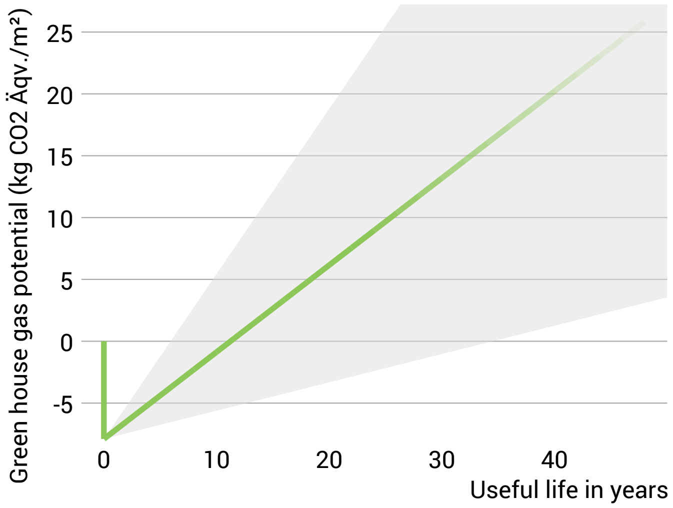
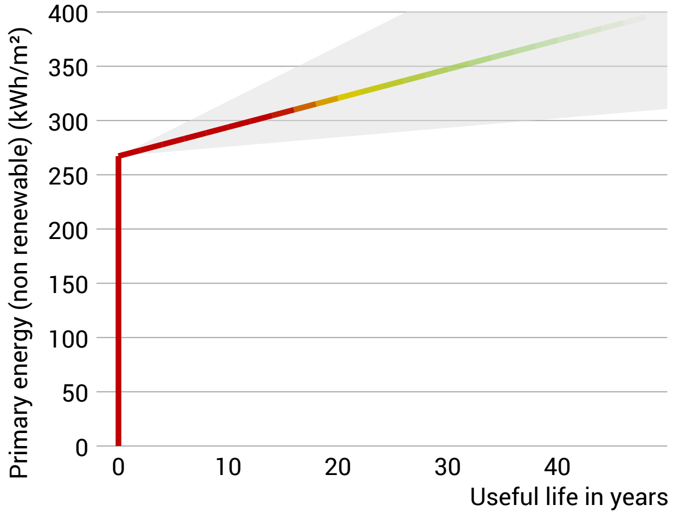
Global warming potential and primary energy for construction and use





The **left figure** shows the global warming potential of the production of the component in the vertical part of the curve. Greenhouse gas emissions (through heating) arising during use of the building are indicated by the upward curve.

The **figure at the bottom left** shows the non-renewable primary energy expenditure for the production of the component in the vertical part of the curve. The primary energy required during use of the building (through heating) is represented by the upward curve.

The longer the component is used unchanged, the more environmentally friendly it is, because the production costs contribute less to the total emissions (indicated by the color of the curve).

Due to unknown solar and internal gains, the heating demand can only be estimated. Accordingly, primary energy consumption and global warming potential during the use phase are only vaguely known. For the estimation it was assumed that solar and internal profits contribute with 4 kWh/a/m² component area. The light gray area indicates the area in which the curve is located with great certainty. For heat generation, a primary energy input of 0,60 kWh per kWh of heat and a global warming potential of 0,16 kg CO2 eqv/m² per kWh of heat was used. Heat source: Heat pump (air-water).

Hints

Calculated for the location DIN V 18599, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: DIN V 18599-10:2007-02

The climate and energy data on which this calculation is based can, in some cases, show considerable fluctuations and, in individual cases, deviate considerably from the actual value.

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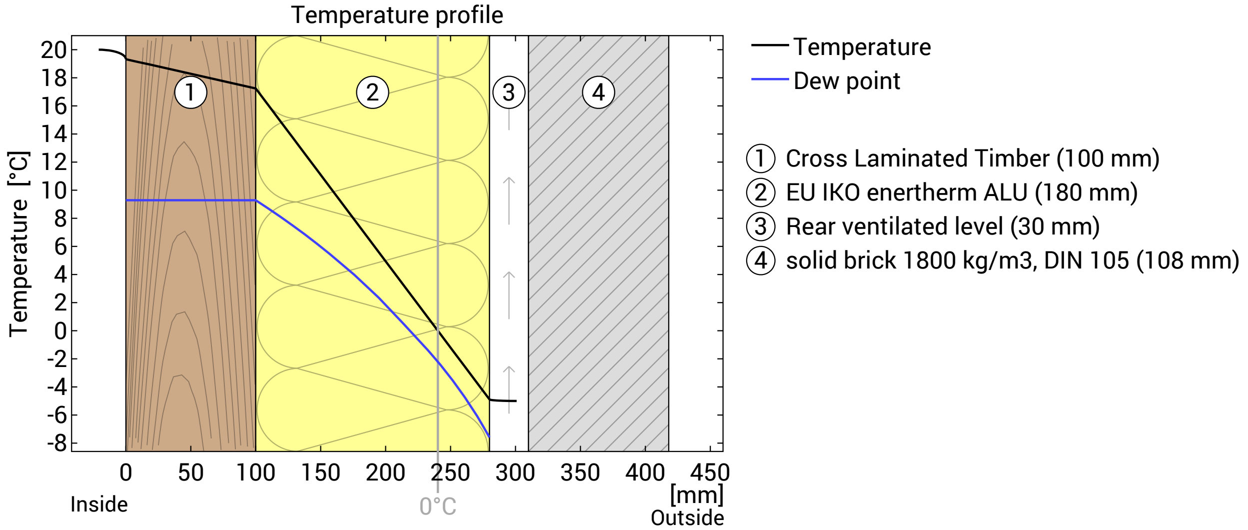
Temperature profile



Temperature and dew-point temperature in the component. The dew-point indicates the temperature, at which water vapour condensates. As long as the temperature of the component is everywhere above the dew-point temperature, no condensation occurs. If the curves have contact, condensation occurs at the corresponding position.

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,130	19,3	20,0	
1	10 cm	Cross Laminated Timber	0,130	0,769	17,2	19,3	50,0
2	18 cm	EU IKO enertherm ALU	0,022	8,182	-4,9	17,2	5,8
		Thermal contact resistance*		0,130	-5,0	-4,9	
3	3 cm	Rear ventilated level (outside air)			-5,0	-5,0	0,0
4	10,8 cm	solid brick 1800 kg/m3, DIN 105			-5,0	-5,0	194,4
	41,8 cm	Whole component		9,211			250,2

*Thermal contact resistances according to DIN 6946 for the U-value calculation. Rsi=0,25 and Rse=0,04 according to DIN 4108-3 were used for moisture proofing and temperature profile.

Surface temperature inside (min / average / max):	19,3°C	19,3°C	19,3°C
Surface temperature outside (min / average / max):	-4,9°C	-4,9°C	-4,9°C

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Moisture proofing

For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 20°C und 50% Humidity; outside: -5°C und 80% Humidity. This climate complies with DIN 4108-3.

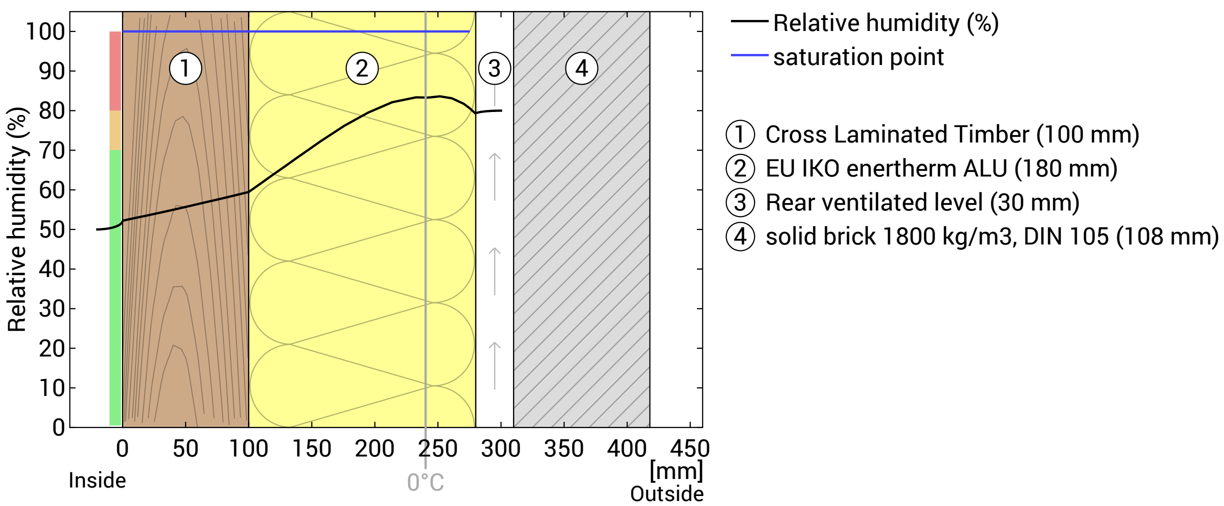
This component is free of condensate under the given climate conditions.

Drying reserve according to DIN 4108-3:2018: 0 g/(m²a)
At least required by DIN 68800-2: 100 g/(m²a)
The moisture protection of this component is therefore rated poorly.

#		Material	sd-value [m]	Condensate [kg/m²]	Condensate [Gew.-%]	Weight [kg/m²]
1	10 cm	Cross Laminated Timber	4,00	-	-	50,0
2	18 cm	EU IKO enertherm ALU	18000	-		5,8
	41,8 cm	Whole component	18.004,00	0		250,2

Humidity

The temperature of the inside surface is 19,3 °C leading to a relative humidity on the surface of 52%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.



Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

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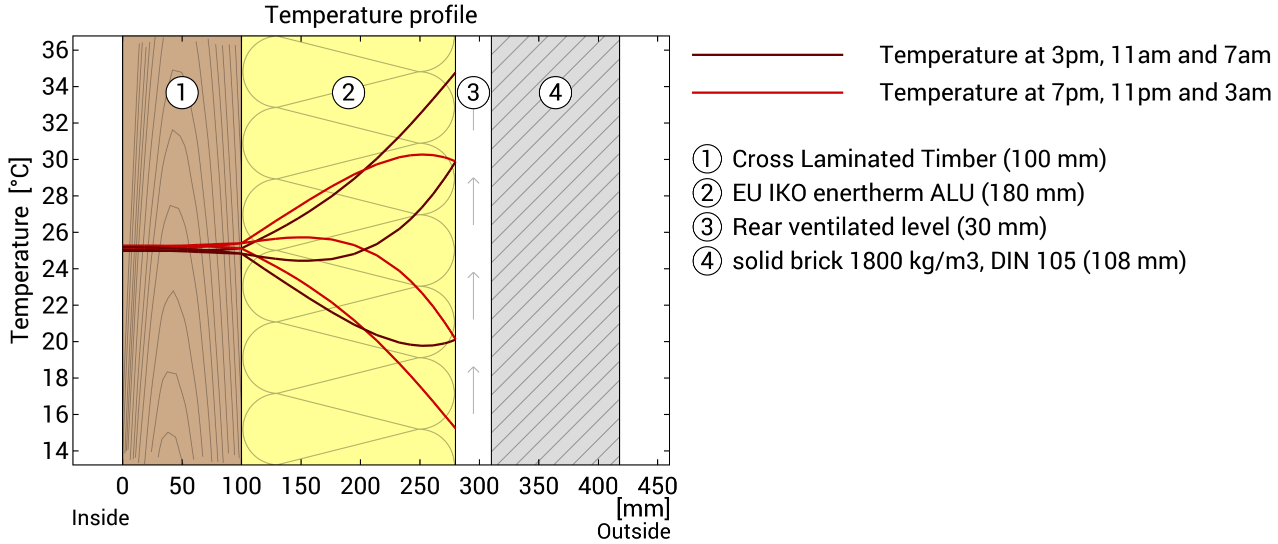
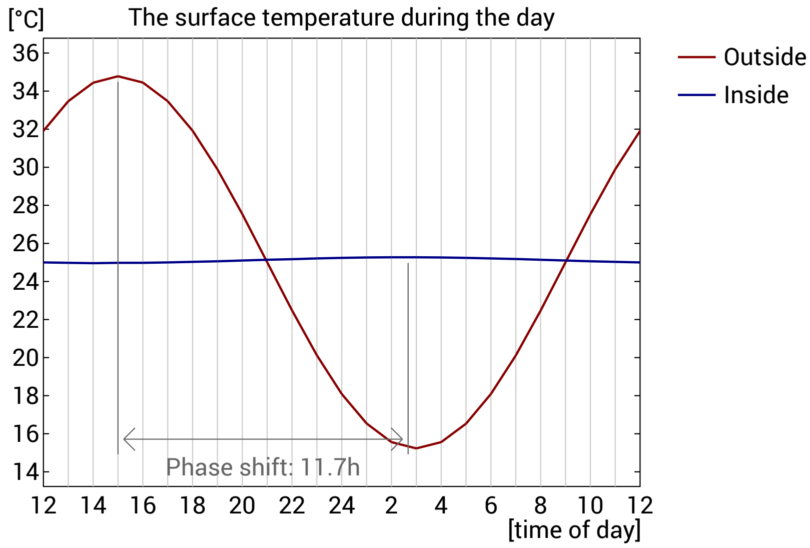
Heat protection

The following results are properties of the tested component alone and do not make any statement about the heat protection of the entire room:





Top: Temperature profile within the component at different times. From top to bottom, brown lines: at 3 pm, 11 am and 7 am and red lines at 7 pm , 11 pm and 3 am.
Bottom: Temperature on the outer (red) and inner (blue) surface in the course of a day. The arrows indicate the location of the temperature maximum values . The maximum of the inner surface temperature should preferably occur during the second half of the night.

Phase shift*	11,7 h	Heat storage capacity (whole component):	88 kJ/m²K
Amplitude attenuation **	62,9	Thermal capacity of inner layers:	79 kJ/m²K
TAV ***	0,016		

* The phase shift is the time in hours after which the temperature peak of the afternoon reaches the component interior.
** The amplitude attenuation describes the attenuation of the temperature wave when passing through the component. A value of 10 means that the temperature on the outside varies 10x stronger than on the inside, e.g. outside 15-35 °C, inside 24-26 °C.
*** The temperature amplitude ratio TAV is the reciprocal of the attenuation: TAV = 1 / amplitude attenuation

Note: The heat protection of a room is influenced by several factors, but essentially by the direct solar radiation through windows and the total amount of heat storage capacity (including floor, interior walls and furniture). A single component usually has only a very small influence on the heat protection of the room.