

## Pudsede facader, U-værdi, 300 mm træfiber

### Thermal protection

**U = 0,11** W/(m²K)

EnEV Bestand\*: U<0,24 W/(m²K)



excellent

### Moisture proofing

Drying reserve: 5993 g/m²a  
No condensate



excellent

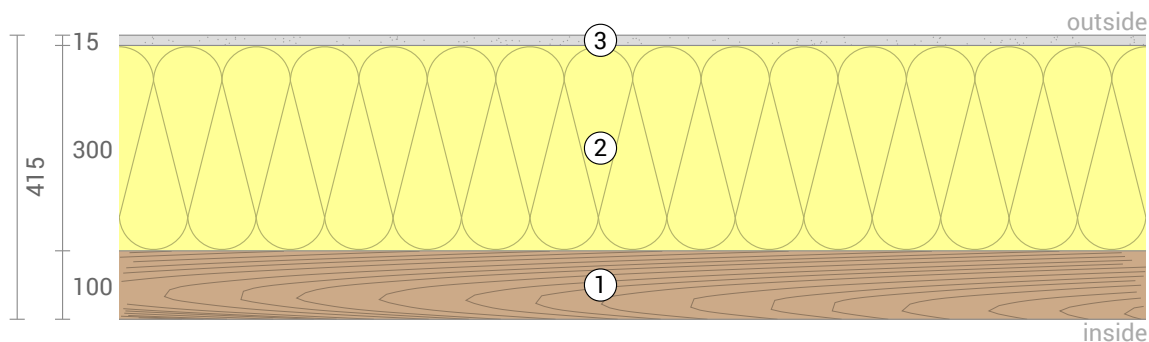
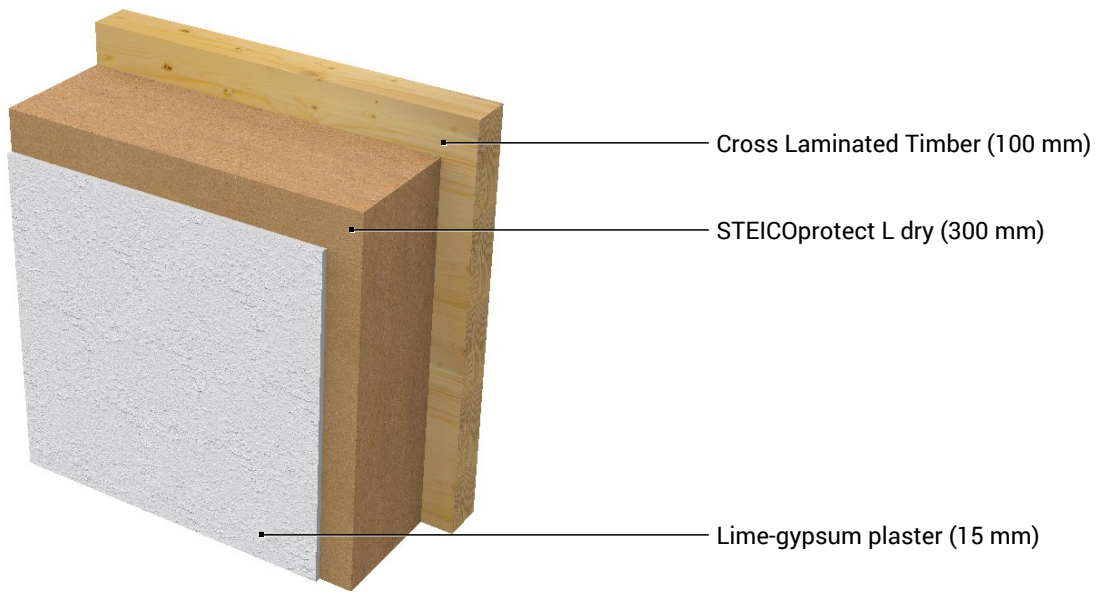
### Heat protection

Temperature amplitude damping: >100  
phase shift: non relevant  
Thermal capacity inside: 110 kJ/m²K



excellent

insufficient



① Cross Laminated Timber (100 mm)

② STEICOprotect L dry (300 mm)

③ Lime-gypsum plaster (15 mm)

Inside air : 20,0°C / 50%  
Outside air: -5,0°C / 80%  
Surface temperature.: 19,6°C / -4,9°C

sd-value: 5,0 m  
Drying reserve: 5993 g/m²a

Thickness: 41,5 cm  
Weight: 104 kg/m²  
Heat capacity: 172 kJ/m²K

EnEV Bestand  BEG Einzelmaßn.  GEG 2020 Bestand  GEG 2020 Neubau

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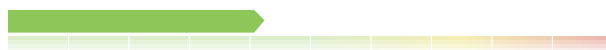
## LCA

Heat loss: 9 kWh/m² per heating season



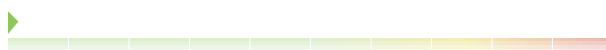
Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

Primary energy (non renewable): 142 kWh/m²



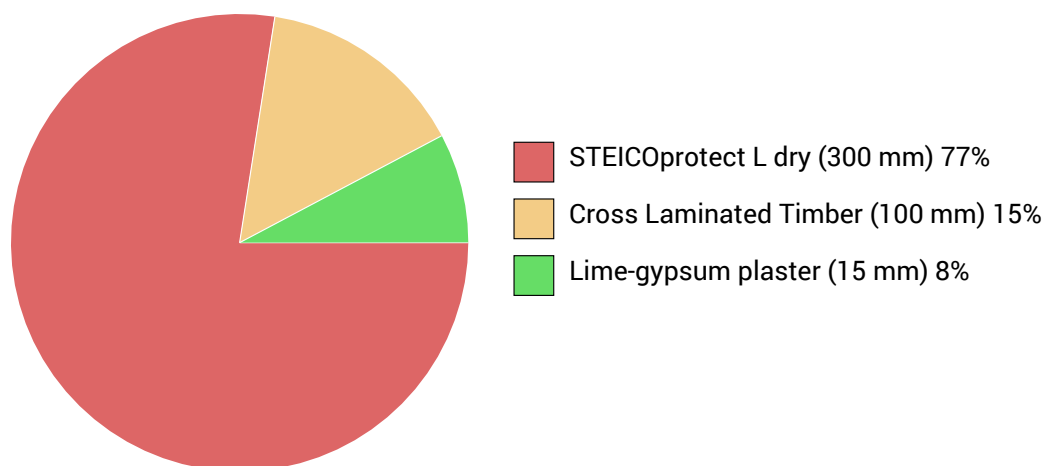
Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

Green house gas potential: -103 kg CO2 Äqv./m²

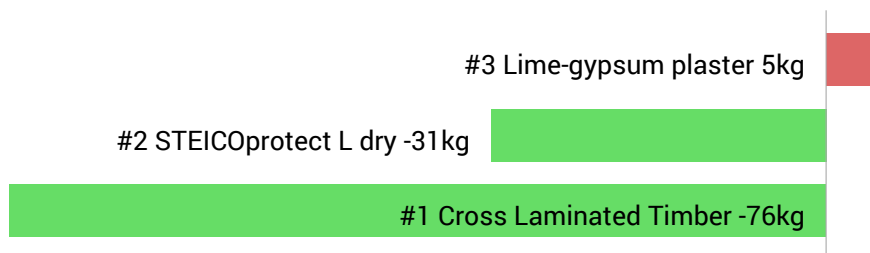


For the production of the building materials used, more greenhouse gases were withdrawn from the atmosphere than emitted.

Composition of non-renewable primary energy of production:

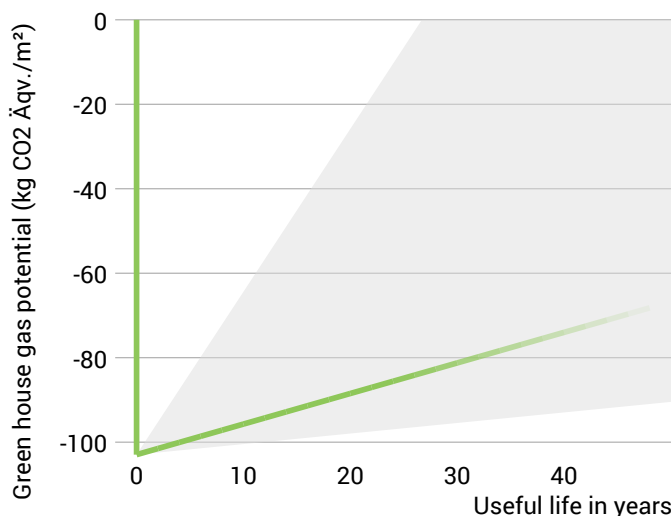


Composition of the greenhouse potential of production:



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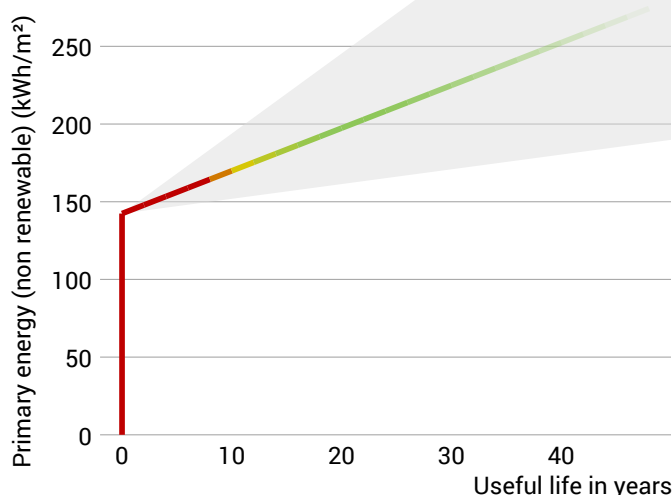
## Global warming potential and primary energy for construction and use



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/m<sup>2</sup> 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 CO<sub>2</sub> eqv/m<sup>2</sup> per kWh of heat was used. Heat source: Heat pump (air-water).

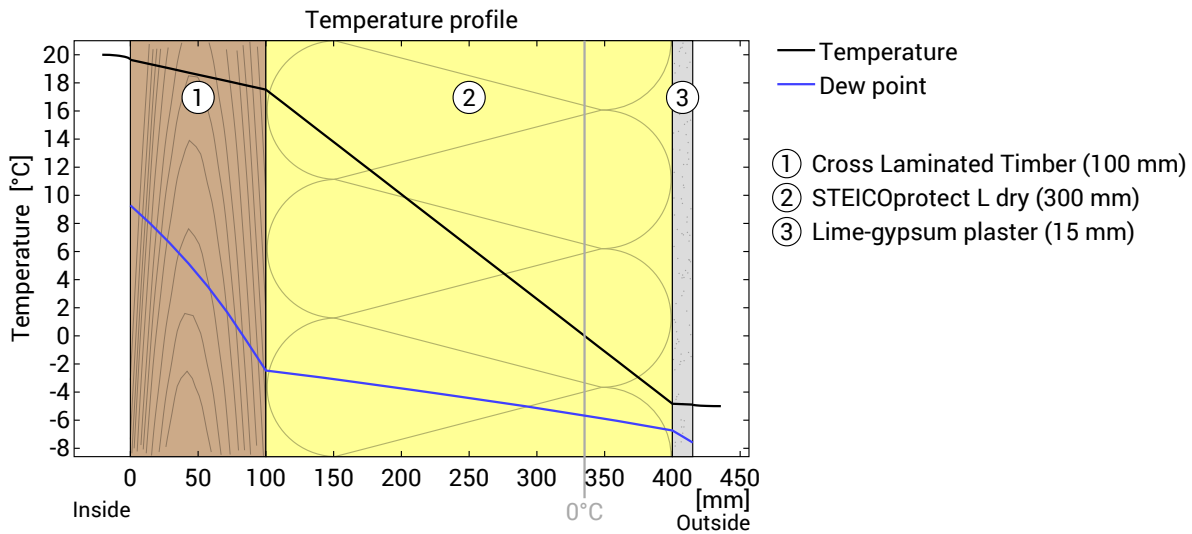
### Hints

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	$\lambda$ [W/mK]	R [m <sup>2</sup> K/W]	Temperatur [°C]		Weight [kg/m <sup>2</sup> ]
				min	max	
	Thermal contact resistance*		0,130	19,6	20,0	
1	10 cm Cross Laminated Timber	0,130	0,769	17,5	19,6	50,0
2	30 cm STEICOprotect L dry	0,037	8,108	-4,8	17,5	33,0
3	1,5 cm Lime-gypsum plaster	0,700	0,021	-4,9	-4,8	21,0
	Thermal contact resistance*		0,040	-5,0	-4,9	
	41,5 cm Whole component		9,069			104,0

\*Assuming free circulating air at the inside surface.

Surface temperature inside (min / average / max): 19,6°C 19,6°C 19,6°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.

Interior heat transfer resistance Rsi (user input deviating from DIN 4108-3):0.13 m²K/W

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

Drying reserve according to DIN 4108-3:2018: 5993 g/(m²a)

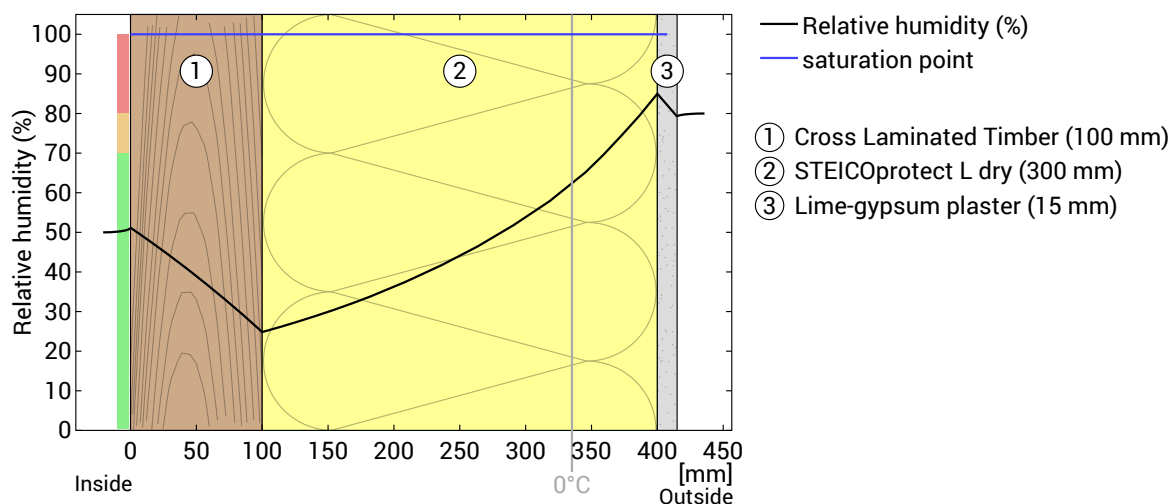
At least required by DIN 68800-2: 100 g/(m²a)

#	Material	sd-value [m]	Condensate [kg/m²] [Gew.-%]	Weight [kg/m²]
1	10 cm Cross Laminated Timber	4,00	-	50,0
2	30 cm STEICOprotect L dry	0,90	-	33,0
3	1,5 cm Lime-gypsum plaster	0,15	-	21,0
	41,5 cm Whole component	5,05	0	104,0

## Humidity

The temperature of the inside surface is 19,6 °C leading to a relative humidity on the surface of 51%.Mould formation is not expected under these conditions.

The following figure shows the relative humidity inside the component.

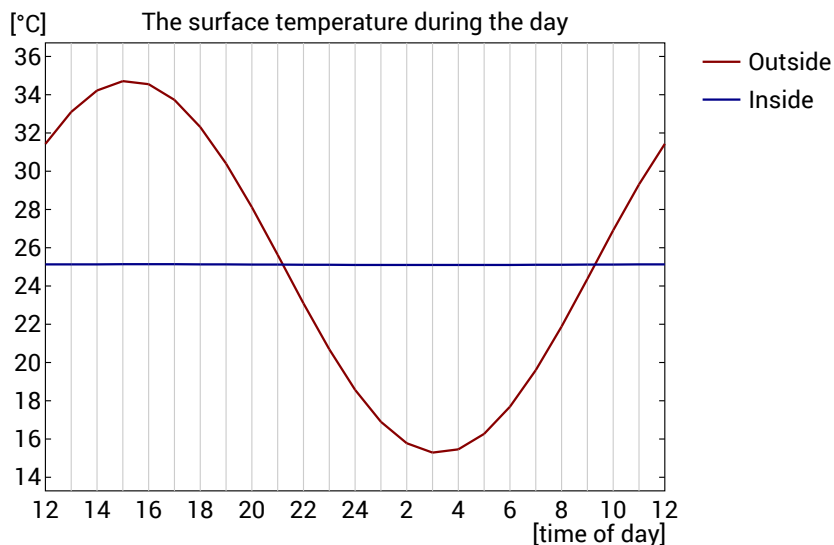
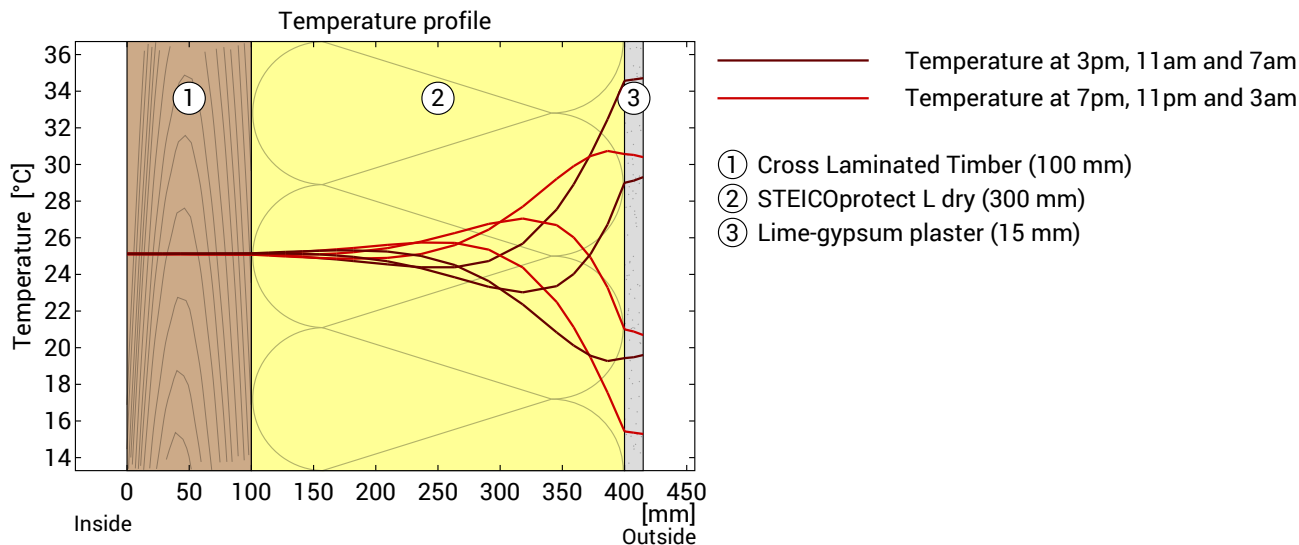


Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

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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*	non relevant	Heat storage capacity (whole component):	172 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	110 kJ/m²K
TAV ***	0,002		

\* 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.