COREWOOD
- KERNEN TIL ET GODT BYGGERI

Ydervæg med 300 mm træfiber og træfacade.

Exterior wall
created on 24.4.2023

Thermal protection

U = 0,10 W/(m²K)

EnEV Bestand*: U<0,24 W/(m²K)

excellent insufficient

Moisture proofing

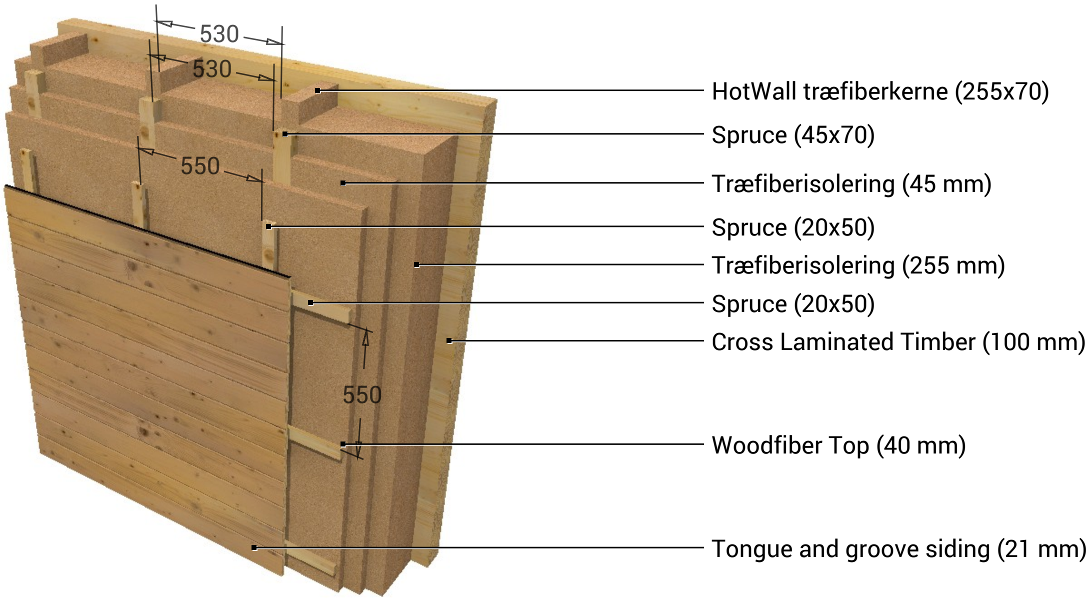
Drying reserve: 5036 g/m²a
No condensate

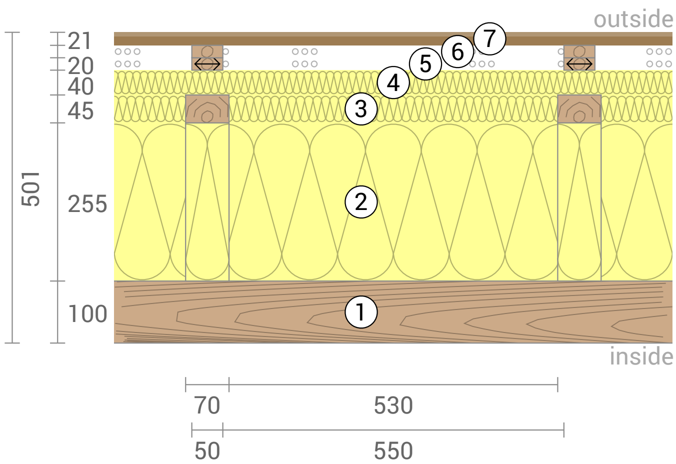
excellent insufficient

Heat protection

Temperature amplitude damping: >100
phase shift: non relevant
Thermal capacity inside: 95 kJ/m²K

excellent insufficient





1. Cross Laminated Timber (100 mm)
2. Træfiberisolering (255 mm)
3. Træfiberisolering (45 mm)
4. Woodfiber Top (40 mm)
5. Rear ventilated level (20 mm)
6. Rear ventilated level (20 mm)
7. Tongue and groove siding (21 mm)

<-> Layers marked by arrows are perpendicular to the main axis.

Inside air :	20,0°C / 50%			Thickness:	50,1 cm
Outside air:	-5,0°C / 80%	sd-value:	4,7 m	Weight:	89 kg/m²
Surface temperature.:	19,3°C / -4,9°C	Drying reserve:	5036 g/m²a	Heat capacity:	141 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)

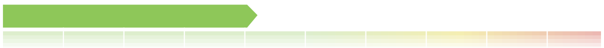
COREWOOD

- KERNEN TIL ET GODT BYGGERI

Ydervæg med 300 mm træfiber og træfacade., U=0,10 W/(m²K)

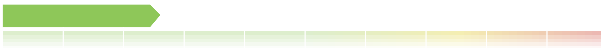
LCA

Heat loss: 8 kWh/m² per heating season



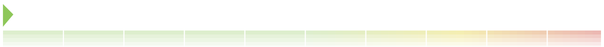
Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

Primary energy (non renewable): 85 kWh/m²



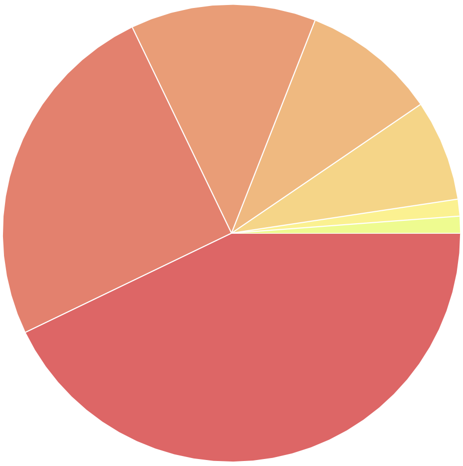
Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

Green house gas potential: -121 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:

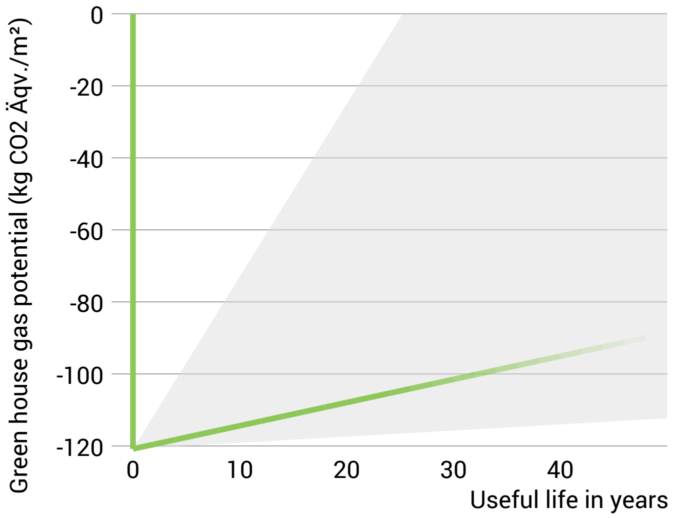


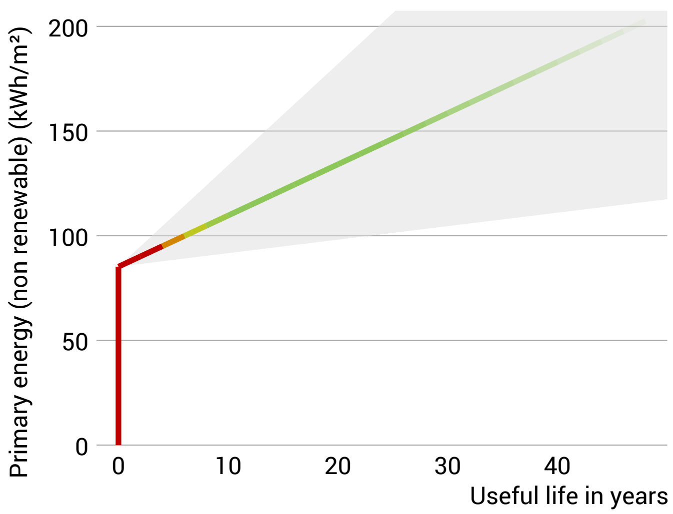
- Woodfiber Top (40 mm) 43%
- Cross Laminated Timber (100 mm) 25%
- HotWall træfiberkerne (255x70) 13%
- Træfiberisolering (255 mm) 10%
- Tongue and groove siding (21 mm) 7%
- Træfiberisolering (45 mm) 1%
- Spruce (45x70) 1%

Composition of the greenhouse potential of production:

Ydervæg med 300 mm træfiber og træfacade., U=0,10 W/(m²K)

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).

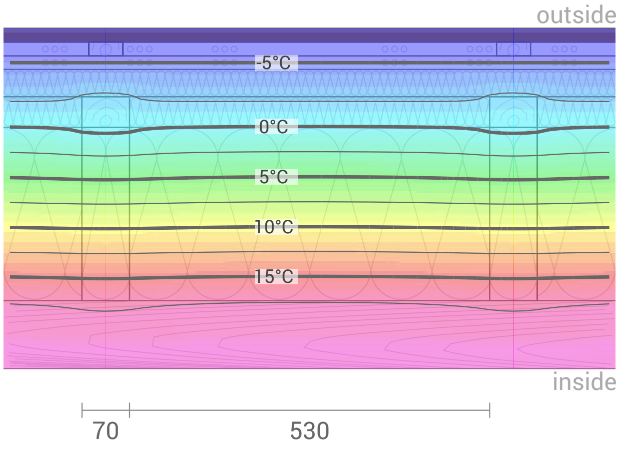
Hints

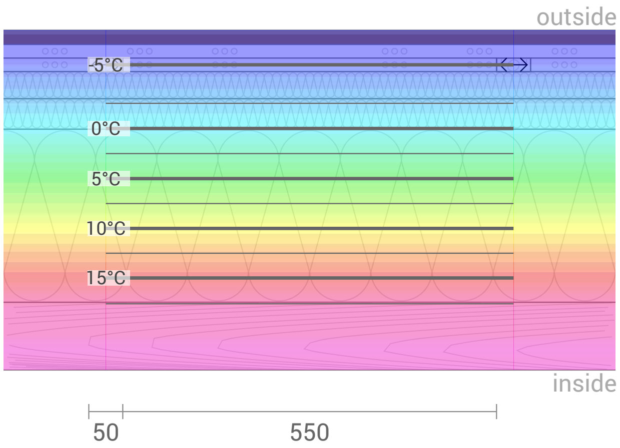
Calculated for the location DIN V 18599, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: DIN V 18599-10:2007-02

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.

Ydervæg med 300 mm træfiber og træfacade., U=0,10 W/(m²K)

Temperature profile





Top left: Temperature profile in the blue section (see right illustration). Bottom left: Temperature profile in the green section.

Layers (from inside to outside)

#		Material	λ	R	Temperatur [°C]		Weight
			[W/mK]	[m²K/W]	min	max	[kg/m²]
		Thermal contact resistance*		0,130	19,3	20,0	
1	10 cm	Cross Laminated Timber	0,130	0,769	17,1	19,4	50,0
2	25,5 cm	Træfiberisolering	0,036	7,083	-0,5	17,5	11,3
	25,5 cm	HotWall træfiberkerne (12%)	0,050	5,100	-0,7	17,2	3,3
3	4,5 cm	Træfiberisolering	0,036	1,250	-3,0	0,1	2,0
	4,5 cm	Spruce (12%)	0,130	0,346	-2,1	-0,5	2,4
4	4 cm	Woodfiber Top	0,050	0,800	-4,9	-2,1	10,8
		Thermal contact resistance*		0,130	-5,0	-4,9	
5	2 cm	Rear ventilated level (outside air)			-5,0	-5,0	0,0
6	2 cm	Rear ventilated level (outside air)			-5,0	-5,0	0,0
7	2,1 cm	Tongue and groove siding			-5,0	-5,0	7,4
	50,1 cm	Whole component		9,638			88,5

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

Ydervæg med 300 mm træfiber og træfacade., U=0,10 W/(m²K)

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.

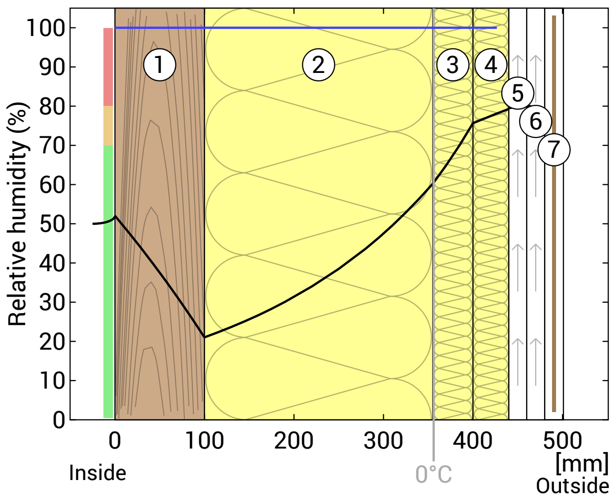
This component is free of condensate under the given climate conditions.

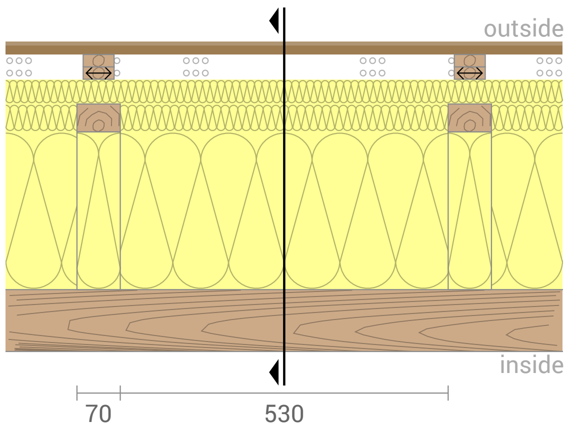
Drying reserve according to DIN 4108-3:2018: 5036 g/(m²a)
At least required by DIN 68800-2: 100 g/(m²a)

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	10 cm	Cross Laminated Timber	4,00	-	-	50,0
2	25,5 cm	Træfiberisolering	0,26	-		11,3
	25,5 cm	HotWall træfiberkerne (12%)	0,77	-		3,3
3	4,5 cm	Træfiberisolering	0,05	-		2,0
	4,5 cm	Spruce (12%)	2,25	-	-	2,4
4	4 cm	Woodfiber Top	0,20	-		10,8
	50,1 cm	Whole component	4,66	0		88,5

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.





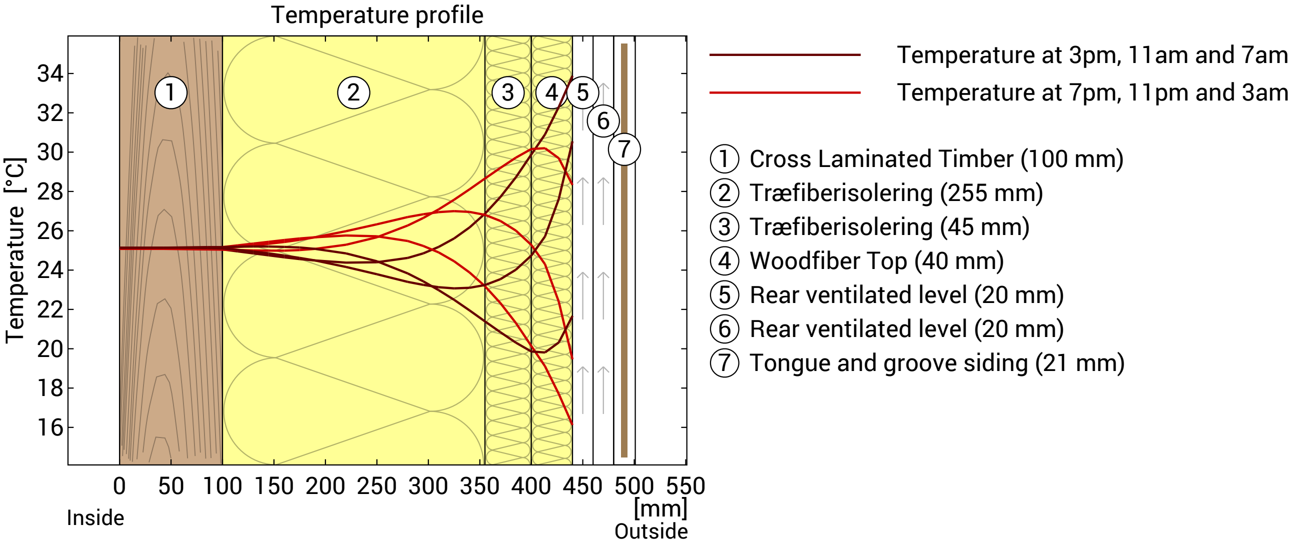
① Cross Laminated Timber (100 mm)
② Træfiberisolering (255 mm)
③ Træfiberisolering (45 mm)
④ Woodfiber Top (40 mm)
⑤ Rear ventilated level (20 mm)
⑥ Rear ventilated level (20 mm)
⑦ Tongue and groove siding (21 mm)

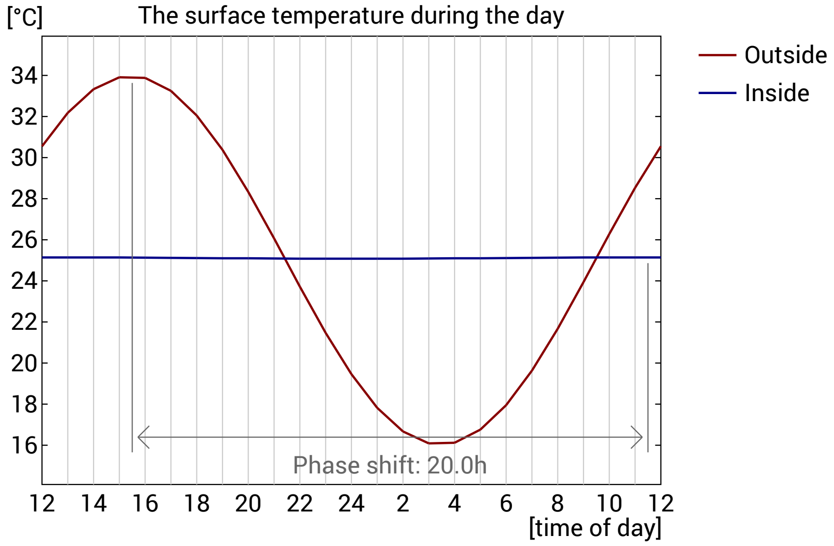
Layers marked with <-> run parallel to the illustrated cutting plane and were not taken into account in the moisture protection calculation.
Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

Ydervæg med 300 mm træfiber og træfacade., U=0,10 W/(m²K)

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):	141 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	95 kJ/m²K
TAV ***	0,004		

* 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.

The calculations presented above have been created for a 1-dimensional cross-section of the component.