PHPP

BRIEF INSTRUCTIONS

Place your mouse here to see the PHPP help.

If no help appears when the mouse passes over cell B4, you can activate it by going into the Menu Bar Tools/Options/View, and under "Comments", select "Comment Indicator Only".

Passive House verification: meaning of field formats

Example	Field Format	Meaning
78,8	Arial, blue, bold with yellow background	Input field: Please enter the required value here
01ud Triple-low-e Kr08	Arial Narrow, blue, with yellow background	Data entry field with drop down list
80	Arial, blue, bold with grey background	Link (through Variants-macro). Attention: do not overwrite!
6619	Arial, black, standard on white background	Calculation field; please do not change
78,8	Arial, violet, bold with white background	Field with reference to another worksheet
126,0	Arial, black, large & bold on green background	Important result

Passive House planning: worksheet directory

Worksheet name (to show/hide worksheets please use the separate 'Profile settings' tool)	Function	Brief description	Required for the certification?
Verification	Building data; summary of results	Building description, selection of the calculation method, summary of results	yes
Overview	Overview of the specific data of the project entered	In-depth project description, overview of all results and input variables, specific details on building envelope, building services systems as well as general information.	no
Cross check	Data entry assistance	Information in case PHPP does not calculate, overview of errors, plausibility checks	yes
Variants	Calculation of variants	Input parameters and results for variant calculation. Predefined fields for frequent entries, as well as user-defined area.	no
Comparison	Comparison between two variants	Comparison between two variants from the perspective of energy demand and economic viability. Input of comparison configurations.	No
Climate	Climate region selection or definition of user data	Climate data for: 'Annual heating', 'Windows', 'Heating load', 'Heating', 'Summer', 'Cooling', 'Cooling units', 'Cooling load' worksheets	yes
U-Values	Calculation of standard building assembly U-Values	Heat transmission coefficient calculations in accordance with DIN EN ISO 6946.	yes
Areas	Areas summary	Building assembly areas, thermal bridges, treated floor area. Use exterior dimension references!	yes
Ground	Calculation of reduction factors below ground	More precise calculation of heat losses through the ground	if applicable
Components	Building component database	Database of certified, Passive House suitable components and entry of user-defined components	yes
Windows	UW-Value determination	Input of geometry, orientation, frame lengths, frame widths, U_g and U-values of the frame, and the thermal bridge heat loss coefficients of the connections; from these inputs, determine U_w and total radiation.	yes
Shading	Determination of shading coefficients	Input of shading parameters, e.g. balcony, neighbouring building, window reveal and calculating the shading factors	yes
Ventilation	Air flow rates, Exhaust/Supply air balancing, Pressurization test results	Sizing the ventilation system from extract and supply air requirements, infiltration air change rate and actual efficiency of heat recovery, input of pressurization test results	yes
Addl vent	Design and planning of ventilation systems with diverse ventilation units	Extension of the 'Ventilation' worksheet for dimensioning air flows, for special building uses and systems with various ventilation units	if used
Annual heating	Annual space heating demand / Annual method	Calculation of the annual space heating demand according to the energy balance method following EN 13790: Transmission + Ventilation - h (Solar gains + Internal gains)	no
Heating	Space heating demand calculation Monthly method according to EN 13790	Calculation procedure for the monthly method following EN 13790. Make appropriate selection in the 'Verification' worksheet, if calculations should be performed following this procedure	yes
Heating Load	Building heating load calculation	Calculation of the nominal heating load using a balance procedure for the design day: max transmission + max ventilation - η (minimum solar gains + internal heat gains)	yes
SummVent	Determination of summer ventilation	Ventilation in cooling case and estimation of air flow rates for natural ventilation during the summer period	yes
Summer	Assessment of summer climate	Calculation of the frequency of overheating as a measure of summer comfort	yes
Cooling	Monthly method for cooling demand	Annual useful cooling demand calculation	if present
Cooling units	Latent cooling energy	Calculation of the energy demand for dehumidification and choice of cooling method	if present
Cooling load	Building cooling load calculation	Calculation of the daily average cooling load of the building	no
DHW+Distribution	Distribution losses; DHW requirement and losses	Heat loss calculation of the distribution systems (heating; DHW); calculation of the useful heat requirement of DHW and storage losses	yes
SolarDHW	Solar DHW heating	Solar contribution calculation for DHW and space heating contribution	if solar panels are used
PV	Electricity generation by photovoltaic	Electricity generation calculation of PV system	no
Electricity	Electricity demand for dwellings	Calculation of the electricity demand of Passive Houses with residential use	yes
Use non-res	Patterns of non-residential utilisation	Input or selection of utilisation patterns for planning of electricity demand and internal heat gains	no
Electricity non-res	Electricity demand for non-residential use	Calculation of the electricity demand for lighting, electric devices and kitchens for non-residential buildings	no
Aux Electricity	Auxiliary electricity demand	Calculation of auxiliary electricity and corresponding primary energy demand	yes
IHG	Internal heat gains in dwellings	Calculation of the internal heat gains based on the Electricity and Aux Electricity sheets.	no
IHG non-res	Internal heat gains for non-residential use	Calculation of the internal heat gains for non-residential buildings based on the 'Electricity non-res' worksheet and the occupancy	no
PER	Specific primary energy and CO_2 demands	Selection of heat generators, calculation of the primary energy and CO_2 specific demands from the present results	yes
Compact	Performance ratio of heat generator Compact heat pump unit	Calculation of the performance ratio of combined heat generation for heating and DHW by means of an electric heat pump compact unit exclusively, considering the specific project boundary conditions.	if present
HP	Performance ratio of heat generation of the heat pump	Calculation of the performance ratio for heat generation for one to two electric-run heat pumps, considering the specific project boundary conditions.	if present
HP Ground	Ground probe or ground collector in combination with a heat pump	Heat source calculation for a ground probe or horizontal subsoil heat exchanger for ground-coupled heat pumps, considering the specific project boundary conditions.	if present
Boiler	Performance ratio of heat generator Boiler	For the calculation of the performance ratio of heat generation with standard boilers (NT and calorific boilers) for the project given boundary conditions.	if present
District Heating	District heat transfer station	Calculation of the final and primary energy demands (heat)	if present
Data	Database	Table of primary energy factors following [GEMIS] and database of EnEV (German energy efficiency regulation).	No

EnerPHit Verification

Building:	Stacken ("Stjärnhus") - existing		
Street:	Teleskopgatan 2, Bergsjön		
Postcode/City:	41518	Göteborg	
Province/Country:	Västra Götaland	SE-Sweden	
Building type:	Block of flats		
Climate data set:	SE0003a-Göteborg		
Climate zone:	2: Cold	Altitude of location:	97 m

Home owner / Client:	Kollektivhuset Stacken		
Street:	Teleskopgatan 2		
Postcode/City:	41518	Göteborg	
Province/Country:	Västra Götaland	SE-Sweden	

Architecture:	Helhetshus Arkitektstudio AB		
Street:	Järntorgsgatan 12-14		
Postcode/City:	41301	Göteborg	
Province/Country:	Västra Götaland	SE-Sweden	

Mechanical system:	Energigruppen Stacken		
Street:	Teleskopgatan 2, Bergsjön		
Postcode/City:	41518	Göteborg	
Province/Country:	Västra Götaland	SE-Sweden	

Energy consultancy:	Energigruppen Stacken		
Street:	Teleskopgatan 2, Bergsjön		
Postcode/City:	41518	Göteborg	
Province/Country:	Västra Götaland	SE-Sweden	

Certification:	Passivhusbyrån Ingo Theoboldt		
Street:	Vasared 301		
Postcode/City:	52394		
Province/Country:	Västra Götaland	SE-Sweden	

Year of construction:	1969	Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
No. of dwelling units:	40	Internal heat gains (IHG) heating case [W/m²]:	2,7	IHG cooling case [W/m²]:	4,2
No. of occupants:	83,5	Specific capacity [Wh/K per m² TFA]:	204	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	3320,2				
Space heating	Heating demand kWh/(m²a)	13	≤	30	-	yes
	Heating load W/m²	11	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	1	≤	10		yes
	Frequency excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0,6	≤	1,0		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	103	≤	120		yes
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	67	≤	-	-	-
	Generation of renewable energy kWh/(m²a)	243	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

EnerPHit Classic? yes

Task:	First name:	Surname:	Signature:

Issued on:	City:

PHPP Check

EnerPHit with PHPP Version 9.:

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

▼ Overview input errors

Congratulations! There are no error messages in your PHPP.

Verification	-
Climate	-
U-Values	-
Areas	-
Ground	-
Components	-
Windows	-
Shading	-
Ventilation	-
Addl vent	-
SummVent	-
Cooling units	-
DHW+Distribution	-
SolarDHW	-
PV	-
Electricity	-
Use non-res	-
Electricity non-res	-
Aux Electricity	-
IHG	-
IHG non-res	-
PER	-
Compact	-
HP	-
HP Ground	-
Boiler	-
District heating	-

▼ **Are results missing from 'Verification' worksheet? Possible causes can be found next**

▼ **The following information is based on the energy balance calculation entered**

▼ **Plausibility check**

Variant calculation

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

		Active						
	Select the active variant here >>>>>>>	4-Facade-ins.	Pre-roofins. & MVHR	2015	New Windows	Facade-ins.		
Results	Units	4	1	2	3	4	5	6
Heating demand	kWh/(m²a)	12,6	130,0	58,9	42,2	12,6		
Heating load	W/m²	10,9	52,6	30,9	21,6	10,9		
Cooling & dehum. demand	kWh/(m²a)							
Cooling load	W/m²							
Frequency of overheating (> 25 °C)	%	1,4	0,0	0,0	0,5	1,4		
PER demand	kWh/(m²a)	66,6	195,8	121,1	99,9	66,6		
EnerPHit Classic?	yes / no	yes	no	no	no	yes		
Final energy		-	-	-	-	-	-	-
User determined results		-	-	-	-	-	-	-

Input variables	Units	Value	1	2	3	4	5	6
Building assembly layers	U-Value							
a Rockwool_Redair_Facade	W/(mK)	0,035				0,035		
	mm	250				250		
b w/o additional roof insulation	W/(mK)	0	-0,04					
	mm	0	500					
c	W/(mK)	0						
	mm	0						
d	W/(mK)	0						
	mm	0						
e	W/(mK)	0						
	mm	0						
f	W/(mK)	0						
	mm	0						
Radiation balance	Areas							
a								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
b								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
c								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
d								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
e								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
f								
Coefficient of absorption exterior	-	0,00						
Coefficient of emission exterior	-	0,00						
Thermal bridges	Areas							
1 Balcony floor connection	W/(mK) or W/K	0	2,1	2,1	2,1	0		
2	W/(mK) or W/K	0						
3	W/(mK) or W/K	0						
4	W/(mK) or W/K	0						
5	W/(mK) or W/K	0						
6	W/(mK) or W/K	0						
7	W/(mK) or W/K	0						
8	W/(mK) or W/K	0						
9	W/(mK) or W/K	0						
10	W/(mK) or W/K	0						
Windows and shading	Windows	Shading						
a **High g glazing**	Glazing list	Frame list						
Active variant: g-Value:0,53 U-Value: 0,53 W/(m²K)	Glazing	04ud-3glas SmartWin			04ud-3glas SmartWin	04ud-3glas SmartWin		
U-Value [W/(m²K]: left: 0,7 right: 0,7 bottom: 0,91 top: 0,7 Width [m]: left: 0,086 right: 0,086 bottom: 0,086 top: 0,086	Frame	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal			03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal		
Reveal depth (o_{Reveal})	m	0,270			0,27	0,27		
Distance from glazing edge to reveal (d_{Reveal})	m	0,020			0,02	0,02		
Overhang depth (o_{over})	m	0,270			0,27	0,27		
Distance from upper glazing edge to overhang (d_{over})	m	0,020			0,02	0,02		
Reduction factor for temporary sun protection (z)	%	100%			100%	100%		
b **Low g glazing**	Glazing list	Frame list						
Active variant: g-Value:0,35 U-Value: 0,47 W/(m²K)	Glazing	06ud-low-g 3glas SmartWin			06ud-low-g 3glas SmartWin	06ud-low-g 3glas SmartWin		
U-Value [W/(m²K]: left: 0,7 right: 0,7 bottom: 0,91 top: 0,7 Width [m]: left: 0,086 right: 0,086 bottom: 0,086 top: 0,086	Frame	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal			03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal		
Window reveal depth	m	0,270			0,27	0,27		
Distance from glazing edge to reveal	m	0,020			0,02	0,02		
Overhang depth	m	0,270			0,27	0,27		
Distance from upper glazing edge to overhang	m	0,020			0,02	0,02		
Reduction factor for temporary sun protection	%	100%			100%	100%		
c	Glazing list	Frame list						
	Glazing							
	Frame							
Window reveal depth	m							
Distance from glazing edge to reveal	m							
Overhang depth	m							
Distance from upper glazing edge to overhang	m							
Reduction factor for temporary sun protection	%							
Ventilation	Ventilation							
Ventilation type	select	1-Balanced PH ventilation with HR	3-Only window ventilation	1-Balanced PH ventilation with HR	1-Balanced PH ventilation with HR	1-Balanced PH ventilation with HR		
Air change rate at pressurisation test (n_{50})	1/h	0,60	2	2	0,6	0,6		
Design air flow rate (maximum)	m³/h	3200	4100	6154	3200	3200		

Installation site ventilation unit	Inside / Outside	2-Outside of thermal envelope	2-Outside of thermal envelope	2-Outside of thermal envelope	2-Outside of thermal envelope	2-Outside of thermal envelope	
Ventilation unit selection	select	01ud-Swegon Gold	98ud-Extract air system	01ud-Swegon Gold	01ud-Swegon Gold	01ud-Swegon Gold	
Summer ventilation	SummVent						
Heat generator	PER						
Primary heat generator	Select						
	Heating fraction	0%					
	DHW fraction	0%					
Secondary heat generator (optional)	Select						
Further input for heat generator (selection unit)	HP						
Heat pump	HP heating	None					
	HP DHW	0					
	Compact						
Passive House compact unit with exhaust air heat pump	Unit selection						
	Boiler						
Boiler (gas, oil and wood)	Boiler selection	None					
	Fuel	None					
	District heating						
District heating	Selection of heat source	None					
Other heat generators (heating)	Description						
	Contribution	0%					
	PER-factor						
	PE factor						
	CO_2 factor						
Other heat generators (DHW)	Description						
	Contribution	0%					
	PER-factor						
	PE factor						
	CO_2 factor						
External RE-generation plant	Description	Monocrystalline photovoltaic electric solar energy panels				Monocrystalline photovoltaic electric solar energy panels	
	kWh/a	124000				124000	
Compressor cooling units	Cooling units						
User determined parameters							

Information: New feature for experienced PHPP users (feedback welcome)!

EnerPHit with PHPP Version 9.3

Comparison between two variants

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Selection of comparison configuration

Description	1-	
Component type		
Building component		

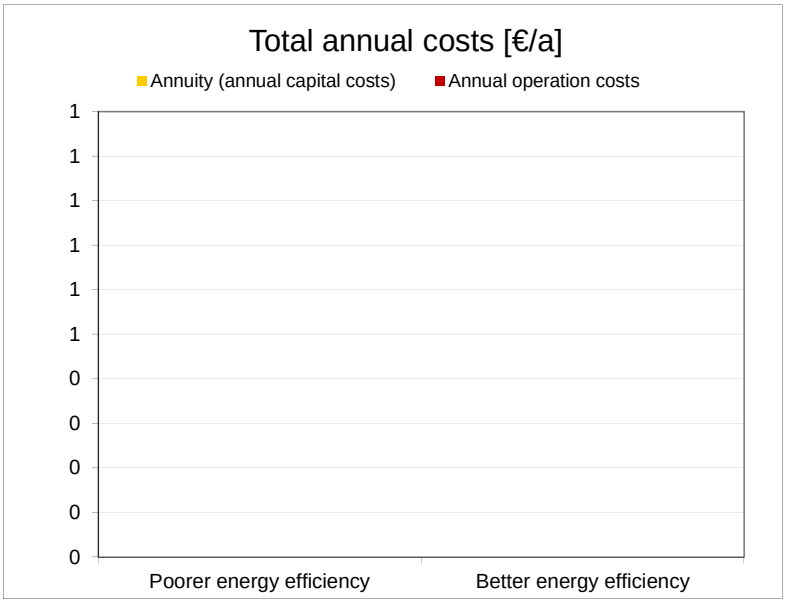
Calculation of the selected configuration

	Poorer energy efficiency		Better energy efficiency		Difference / Savings / Profit		
Design according to variant							
Minimum inside surface temperature							°C

	Investment costs						
	Per m² of building element	Complete building element	Per m² of building element	Complete building element	Per m² of building element	Complete building element	
Area of building element	1		1		1		m²
Investment costs minus financial support							€
Annuity (annual capital costs)							€/a

	Operation (heating + cooling + mechanical ventilation)						
	Per m² of TFA	Entire building	Per m² of TFA	Entire building	Per m² of building element	Complete building element	
Area	1		1		1		m²
Heating demand							kWh/a
Cooling + dehumidification demand							kWh/a
CO_2 emissions							kg/a
Primary energy renewable (PER)							kWh/a
Annual operation costs							€/a

	Cost-effectiveness						
Maximal economically viable additional investment costs							€
Average cost for saved kWh of final energy					-		Cent/kWh
Total annual costs							€/a



▼ Surface temperature

▼ Annuity

▼ Energy, CO_2, Costs

▼ Boundary conditions

Input of comparison configurations	1	2	3	4	5
Description					
Component type					
Building component					
Variant "Poorer energy efficiency"					
Investment costs [€]					
Annual maintenance costs [€/a]					
Variant "Better energy efficiency"					
Investment costs [€]					
Annual maintenance costs [€/a]					
Financial support (present value) [€]					

Results (manual transfer)

Description					

Climate data

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Selection of climate data

Country:	SE-Sweden
Region:	All
	1-Alphabetic sorting
Climate data set:	SE0003a-Göteborg
Climate zone:	2: Cold

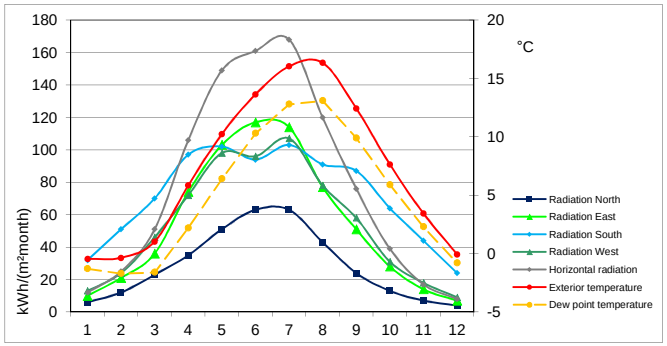
Altitude

Weather station:	20,0	m
Building location:	97	m

Result overview

Annual heating demand	12,6	kWh/(m²a)
Heating load	10,9	W/m²
Frequency of overheating	1,4	%
Sensible cooling	0,7	kWh/(m²a)
Latent cooling	0,0	kWh/(m²a)
Cooling load	-	W/m²
PER demand	66,6	kWh/(m²a)

	Data for heating	Data from monthly balance		
	Annual method	Heating	Cooling	
Heating / cooling period	233	212	123	d/a
Heating / cooling degree hours	95	90	-33	kKh/a
Radiation North	130	100	225	kWh/(m²a)
Radiation East	251	198	391	kWh/(m²a)
Radiation South	443	359	400	kWh/(m²a)
Radiation West	271	223	358	kWh/(m²a)
Horizontal radiation	346	258	598	kWh/(m²a)



	Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load		Cooling load		PER	
	Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Weather 1	Weather 2	factors	
	SE0003a-Göteborg	Latitude °	57,8	Longitude °	11,9	Altitude [m]	20	Daily temperature swing Summer [K]			8,2			Radiation: [W/m²]		Radiation: [W/m²]			
° C	Exterior temperature	-0,5	-0,4	1,0	5,8	10,2	13,6	16,0	16,3	12,4	7,6	3,4	-0,1	-12,2	-9,5	23,0	23,0	1,25	Household electricity
kWh/(m²month)	Radiation North	6	12	23	35	51	63	63	43	24	13	7	4	5	5	64	64	1,25	Domestic hot water
kWh/(m²month)	Radiation East	10	21	36	74	103	117	114	77	51	28	14	7	10	5	155	155	1,55	Heating
kWh/(m²month)	Radiation South	32	51	70	97	102	94	103	91	87	64	44	24	30	5	187	187	1,00	Cooling
kWh/(m²month)	Radiation West	13	24	46	72	98	96	107	78	58	31	18	9	10	5	151	151	1,00	Dehumidification
kWh/(m²month)	Horizontal radiation	12	25	51	106	149	161	168	120	76	39	17	8	15	5	217	217		
° C	Dew point temperature	-1,3	-1,7	-1,6	2,2	6,4	10,3	12,8	13,1	9,9	5,9	2,3	-0,8			16,1	16,1		
° C	Sky temperature	-10,2	-10,5	-9,3	-5,5	-0,9	3,3	6,3	7,6	3,8	-0,5	-5,7	-9,5			13,3	16,1		
° C	Ground temperature	15,7	15,5	15,6	15,9	19,9	20,4	20,8	21,0	17,4	17,1	16,6	16,1	15,5	15,5	21,0	21,0		
	Comment:																		

U-value of building assemblies

EnerPHit with PHPP Version 9.3

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Secondary calculation: Equivalent thermal conductivity of still air spaces -> (on the right)
Wedge-shaped assembly layer -> (on the right)
Unheated / uncooled attic -> (on the right)

Assembly no. 01ud | Building assembly description: **External Wall** | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 0,13 | interior R_{si}: 0,13
Adjacent to: 0,04 | exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Insulation	0,040					110
Concrete	2,100					190
Ext. Insulation	0,037					0
Plaster	0,800					0
Rockwool	0,035					250

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: 55,0 cm

U-value supplement: W/(m²K) | **U-value: 0,098** W/(m²K)

Assembly no. 02ud | Building assembly description: **Roof** | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 0,1 | interior R_{si}: 0,10
Adjacent to: 0,1 | exterior R_{se}: 0,10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Insulation	0,040					500
Concrete	2,300					220
	0,000					0

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: 72,0 cm

U-value supplement: W/(m²K) | **U-value: 0,078** W/(m²K)

Assembly no. 03ud | Building assembly description: **Floor slab** | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 0,17 | interior R_{si}: 0,17
Adjacent to: 0 | exterior R_{se}: 0,00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Flooring	1,200					40
Betong reinf.	2,300					120
makadam	0,700					290
betong arbetsplatta	1,150					50

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: 50,0 cm

U-value supplement W/(m²K)

U-value: **1,402** W/(m²K)

Assembly no. | Interior insulation?

04ud | **Hissvägg**

Heat transmission resistance [m²K/W]

Orientation of building element: 0,13 — interior R_{si}: 0,13

Adjacent to: 0,13 — exterior R_{se}: 0,13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
lättblock	**0,700**					**150**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **15,0** cm

U-value supplement: W/(m²K)

U-value: 2,108 W/(m²K)

Assembly no. | Interior insulation?

05ud | **Hisstak**

Heat transmission resistance [m²K/W]

Orientation of building element: 0,1 — interior R_{si}: 0,10

Adjacent to: 0,1 — exterior R_{se}: 0,10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
lättblock	**0,700**					**150**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **15,0** cm

U-value supplement: W/(m²K)

U-value: 2,414 W/(m²K)

Assembly no. | Interior insulation?

06ud | **Yttervägg entrévåning**

Heat transmission resistance [m²K/W]

Orientation of building element: 0,13 — interior R_{si}: 0,13

Adjacent to: 0,04 — exterior R_{se}: 0,04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Puts	**1,000**					**10**
isolering	**0,040**					**50**
Arm. Betong	**2,300**					**250**
Rockwool	**0,035**					**250**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **56,0** cm

U-value supplement: W/(m²K)

U-value: 0,115 W/(m²K)

Assembly no. 07ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 08ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 09ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 10ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 11ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 12ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 13ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 14ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 15ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 16ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 17ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 18ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 19ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}:

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Assembly no. 20ud

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

Adjacent to

interior R_{si}:

exterior R_{se}:

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]

Percentage of sec. 1: 100%

Percentage of sec. 2

Percentage of sec. 3

Total cm

U-value supplement W/(m²K)

U-value: W/(m²K)

Areas determination

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment	Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]	Radiation-load cooling period [kWh/a]
								7 Months	4 Months
	Treated floor area	1	**3320,20**	m²	*Treated floor area according to PHPP manual*				
A	**North windows**	2	**116,45**	m²	Results come from the 'Windows' worksheet.	**North windows**	**0,706**	**2663**	**6317**
A	**East windows**	3	**157,96**	m²	Window areas are subtracted from individual opaque areas.	**East windows**	**0,684**	**5314**	**11099**
A	**South windows**	4	**118,94**	m²	which is displayed in the 'Windows' worksheet.	**South windows**	**0,696**	**7261**	**9538**
A	**West windows**	5	**211,79**	m²		**West windows**	**0,757**	**9490**	**18583**
A	**Horizontal windows**	6	**0,00**	m²		**Horizontal windows**			
A	**Exterior door**	7	**2,00**	m²	*Please subtract area of door from respective building assembly*	**Exterior door**	**5,000**		
A	**External wall - Ambient**	8	**2204,00**	m²	*Temperature zone "A" is ambient air*	**External wall - Ambient**	**0,123**	**-260**	**578**
B	**External wall - Ground**	9	**0,00**	m²	*Temperature zone "B" is the ground*	**External wall - Ground**			
A	**Roof/Ceiling - Ambient**	10	**484,00**	m²		**Roof/Ceiling - Ambient**	**0,107**	**-91**	**106**
B	**Floor slab / Basement ceiling**	11	**484,00**	m²		**Floor slab / Basement ceiling**	**1,402**		
		12	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*				
		13	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"* Factor for X				
X		14	**0,00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):* **75%**				
						Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**208,00**	m	*Units in m*	**Thermal bridges Ambient**	**0,000**		
P	**Perimeter thermal bridges**	16	**0,00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*	**Perimeter thermal bridges**			
B	**Thermal bridges FS/BC**	17	**0,00**	m	*Units in m*	**Thermal bridges FS/BC**			
I	**Building element towards neighbour**	18	**0,00**	m²	*No heat losses, only considered for the heating load calculation*	**Building element towards neighbour**			
Total thermal envelope			**3779,14**	**m²**		**Average therm. envelope**	**0,382**		

Go to building components list

Area input

Sort: BY ID

Area no.	Building assembly description	To group No.	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User determined [m²]	-	User subtraction [m²]	-	Subtraction window areas [m²]	) =	Area [m²]	Selection building assembly / Building system	U-Value [W/(m²K)]	Deviation from North	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity
	Projected building footprint	**0**	Projected building footprint	**1**	x (		x		+	**511,00**	-		)		=	511,0									
	Treated floor area	**1**	Treated floor area	**1**	x (		x		+	**3186,20**	-		)		=	3186,2									
	Exterior door	**7**	Exterior door	**1**	x (	**1,00**	x	**2,00**	+		-		) -		=	2,0	Exterior door	**5,00**							
1	**Fasad 1a**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**23,44**	+		-		) -	**93,2**	=	138,8	**01ud External Wall**	**0,098**	**298**	**90**	**West**	**0,70**	**0,40**	**0,90**
2	**Fasad 1b**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**23,44**	+		-		) -	**46,3**	=	139,5	**01ud External Wall**	**0,098**	**278**	**90**	**West**	**0,70**	**0,40**	**0,90**
3	**Fasad 2a**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**23,44**	+		-		) -	**73,9**	=	158,2	**01ud External Wall**	**0,098**	**10**	**90**	**North**	**0,70**	**0,40**	**0,90**
4	**Fasad 2b**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**23,44**	+		-		) -	**42,6**	=	143,2	**01ud External Wall**	**0,098**	**350**	**90**	**North**	**0,70**	**0,40**	**0,90**
5	**Fasad 3a**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**23,44**	+		-		) -	**72,2**	=	159,8	**01ud External Wall**	**0,098**	**82**	**90**	**East**	**0,70**	**0,40**	**0,90**
6	**Fasad 3b**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**23,44**	+		-		) -	**42,6**	=	143,2	**01ud External Wall**	**0,098**	**62**	**90**	**East**	**0,70**	**0,40**	**0,90**
7	**Fasad 4a**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**23,44**	+		-		) -	**71,5**	=	160,5	**01ud External Wall**	**0,098**	**154**	**90**	**South**	**0,70**	**0,40**	**0,90**
8	**Fasad 4b**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**23,44**	+		-		) -	**43,2**	=	142,6	**01ud External Wall**	**0,098**	**134**	**90**	**East**	**0,70**	**0,40**	**0,90**
9	**Fasad 5a**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**23,44**	+		-		) -	**72,2**	=	159,8	**01ud External Wall**	**0,098**	**226**	**90**	**West**	**0,70**	**0,40**	**0,90**
10	**Fasad 5b**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**23,44**	+		-		) -	**47,4**	=	138,4	**01ud External Wall**	**0,098**	**206**	**90**	**South**	**0,70**	**0,40**	**0,90**
11	**Balkongsidväggar**	**8**	External wall - Ambient	**10**	x (	**1,82**	x	**25,94**	+		-		) -	**0,0**	=	472,1	**01ud External Wall**	**0,098**	**0**	**90**	**North**	**0,70**	**0,40**	**0,90**
12	**Golvplatta**	**11**	Floor slab / Basement ceiling	**1**	x (	**1,00**	x	**484,00**	+		-		) -	**0,0**	=	484,0	**03ud Floor slab**	**1,402**	**0**	**0**	**Hor**			
13	**Tak**	**10**	Roof/Ceiling - Ambient	**1**	x (	**1,00**	x	**484,00**	+		-	**6,00**	) -	**0,0**	=	478,0	**02ud Roof**	**0,078**	**0**	**0**	**Hor**	**0,40**	**0,40**	**0,90**
14					x (		x		+		-		) -	**0,0**	=									
15	**Balkonggolv**	**1**	Treated floor area	**1**	x (	**40,00**	x	**3,35**	+		-		) -	**0,0**	=	134,0								
16					x (		x		+		-		) -	**0,0**	=									
17	**Hissvägg**	**8**	External wall - Ambient	**1**	x (	**2,50**	x	**10,00**	+		-		) -	**0,0**	=	25,0	**04ud Hissvägg**	**2,108**	**0**	**90**	**North**	**0,70**	**0,40**	**0,90**
18	**Hisstack**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**6,00**	-		) -	**0,0**	=	6,0	**05ud Hisstak**	**2,414**	**0**	**90**	**North**	**0,70**	**0,40**	**0,90**
19					x (		x		+		-		) -	**0,0**	=									
20	**Fasad 1a bv**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**2,50**	+		-		) -	**0,0**	=	24,8	**06ud Yttervägg entrévåning**	**0,115**	**10**	**90**	**North**	**0,70**	**0,40**	**0,90**
21	**Fasad 1b bv**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**2,50**	+		-		) -	**0,0**	=	19,8	**06ud Yttervägg entrévåning**	**0,115**	**350**	**90**	**North**	**0,70**	**0,40**	**0,90**
22	**Fasad 2a bv**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**2,50**	+		-		) -	**0,0**	=	24,8	**06ud Yttervägg entrévåning**	**0,115**	**82**	**90**	**East**	**0,70**	**0,40**	**0,90**
23	**Fasad 2b bv**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**2,50**	+		-		) -	**0,0**	=	19,8	**06ud Yttervägg entrévåning**	**0,115**	**62**	**90**	**East**	**0,70**	**0,40**	**0,90**
24	**Fasad 3a bv**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**2,50**	+		-		) -	**0,0**	=	24,8	**06ud Yttervägg entrévåning**	**0,115**	**154**	**90**	**South**	**0,70**	**0,40**	**0,90**
25	**Fasad 3b bv**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**2,50**	+		-		) -	**0,0**	=	19,8	**06ud Yttervägg entrévåning**	**0,115**	**134**	**90**	**East**	**0,70**	**0,40**	**0,90**
26	**Fasad 4a bv**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**2,50**	+		-		) -	**0,0**	=	24,8	**06ud Yttervägg entrévåning**	**0,115**	**226**	**90**	**West**	**0,70**	**0,40**	**0,90**
27	**Fasad 4b bv**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**2,50**	+		-		) -	**0,0**	=	19,8	**06ud Yttervägg entrévåning**	**0,115**	**206**	**90**	**South**	**0,70**	**0,40**	**0,90**
28	**Fasad 5a bv**	**8**	External wall - Ambient	**1**	x (	**9,90**	x	**2,50**	+		-		) -	**0,0**	=	24,8	**06ud Yttervägg entrévåning**	**0,115**	**298**	**90**	**West**	**0,70**	**0,40**	**0,90**
29	**Fasad 5b bv**	**8**	External wall - Ambient	**1**	x (	**7,93**	x	**2,50**	+		-		) -	**0,0**	=	19,8	**06ud Yttervägg entrévåning**	**0,115**	**278**	**90**	**West**	**0,70**	**0,40**	**0,90**
30					x (		x		+		-		) -	**0,0**	=									

Areas determination

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]	Radiation-load cooling period [kWh/a]
									7 Months	4 Months
	Treated floor area	1	**3320,20**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**116,45**	m²			**North windows**	**0,706**	**2663**	**6317**
A	**East windows**	3	**157,96**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0,684**	**5314**	**11099**
A	**South windows**	4	**118,94**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0,696**	**7261**	**9538**
A	**West windows**	5	**211,79**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0,757**	**9490**	**18583**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**			
A	**Exterior door**	7	**2,00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**5,000**		
A	**External wall - Ambient**	8	**2204,00**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,123**	**-260**	**578**
B	**External wall - Ground**	9	**0,00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**			
A	**Roof/Ceiling - Ambient**	10	**484,00**	m²			**Roof/Ceiling - Ambient**	**0,107**	**-91**	**106**
B	**Floor slab / Basement ceiling**	11	**484,00**	m²			**Floor slab / Basement ceiling**	**1,402**		
		12	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*					
		13	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X				
X		14	**0,00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	75%				
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**208,00**	m	*Units in m*		**Thermal bridges Ambient**	**0,000**		
P	**Perimeter thermal bridges**	16	**0,00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**			
B	**Thermal bridges FS/BC**	17	**0,00**	m	*Units in m*		**Thermal bridges FS/BC**			
I	**Building element towards neighbour**	18	**0,00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**			
Total thermal envelope			**3779,14**	**m²**			**Average therm. envelope**	**0,382**		

Go to building components list

31					x (		x		+		-		) -	0,0	=									
32					x (		x		+		-		) -	0,0	=									
33					x (		x		+		-		) -	0,0	=									
34					x (		x		+		-		) -	0,0	=									
35					x (		x		+		-		) -	0,0	=									
36					x (		x		+		-		) -	0,0	=									
37					x (		x		+		-		) -	0,0	=									
38					x (		x		+		-		) -	0,0	=									
39					x (		x		+		-		) -	0,0	=									
40					x (		x		+		-		) -	0,0	=									
41					x (		x		+		-		) -	0,0	=									
42					x (		x		+		-		) -	0,0	=									
43					x (		x		+		-		) -	0,0	=									
44					x (		x		+		-		) -	0,0	=									
45					x (		x		+		-		) -	0,0	=									
46					x (		x		+		-		) -	0,0	=									
47					x (		x		+		-		) -	0,0	=									
48					x (		x		+		-		) -	0,0	=									
49					x (		x		+		-		) -	0,0	=									
50					x (		x		+		-		) -	0,0	=									
Aend																								

Areas determination

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]
	Treated floor area	1	**3320,20**	m²	*Treated floor area according to PHPP manual*				7 Months
A	**North windows**	2	**116,45**	m²			**North windows**	**0,706**	**2663**
A	**East windows**	3	**157,96**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0,684**	**5314**
A	**South windows**	4	**118,94**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0,696**	**7261**
A	**West windows**	5	**211,79**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0,757**	**9490**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**		
A	**Exterior door**	7	**2,00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**5,000**	
A	**External wall - Ambient**	8	**2204,00**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,123**	**-260**
B	**External wall - Ground**	9	**0,00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**		
A	**Roof/Ceiling - Ambient**	10	**484,00**	m²			**Roof/Ceiling - Ambient**	**0,107**	**-91**
B	**Floor slab / Basement ceiling**	11	**484,00**	m²			**Floor slab / Basement ceiling**	**1,402**	
		12	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*				
		13	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X			
X		14	**0,00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**75%**			
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**208,00**	m	*Units in m*		**Thermal bridges Ambient**	**0,000**	
P	**Perimeter thermal bridges**	16	**0,00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**		
B	**Thermal bridges FS/BC**	17	**0,00**	m	*Units in m*		**Thermal bridges FS/BC**		
I	**Building element towards neighbour**	18	**0,00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**		
Total thermal envelope			**3779,14**	**m²**			**Average therm. envelope**	**0,382**	

Go to building components list

Thermal bridge inputs

No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [m]	-	Subtraction length [m]	)=	Length ℓ [m]	User determined Ψ-Wert [W/(mK)]	User determined $f_{Rsi=0,25}$ (optional)	or	Selection building system	Ψ-Value [W/(mK)]	f_{Rsi}-Requirement met?
1	**Balcony floor connection**	**15**	Thermal bridges Ambient	**40**	x (	**5,20**	-		) =	208,00	**0,000**		or		**0,000**	
2					x (		-		) =				or			
3					x (		-		) =				or			
4					x (		-		) =				or			
5					x (		-		) =				or			
6					x (		-		) =				or			
7					x (		-		) =				or			
8					x (		-		) =				or			
9					x (		-		) =				or			
10					x (		-		) =				or			
11					x (		-		) =				or			
12					x (		-		) =				or			
13					x (		-		) =				or			
14					x (		-		) =				or			
15					x (		-		) =				or			
16					x (		-		) =				or			
17					x (		-		) =				or			
18					x (		-		) =				or			
19					x (		-		) =				or			
20					x (		-		) =				or			
21					x (		-		) =				or			
22					x (		-		) =				or			
23					x (		-		) =				or			
24					x (		-		) =				or			
25					x (		-		) =				or			
26					x (		-		) =				or			
27					x (		-		) =				or			
28					x (		-		) =				or			
29					x (		-		) =				or			
30					x (		-		) =				or			
31					x (		-		) =				or			
32					x (		-		) =				or			
33					x (		-		) =				or			
34					x (		-		) =				or			

Areas determination

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a]
	Treated floor area	1	**3320,20**	m²	*Treated floor area according to PHPP manual*				7 Months
A	**North windows**	2	**116,45**	m²			**North windows**	**0,706**	**2663**
A	**East windows**	3	**157,96**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0,684**	**5314**
A	**South windows**	4	**118,94**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0,696**	**7261**
A	**West windows**	5	**211,79**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0,757**	**9490**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**		
A	**Exterior door**	7	**2,00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**5,000**	
A	**External wall - Ambient**	8	**2204,00**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,123**	**-260**
B	**External wall - Ground**	9	**0,00**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**		
A	**Roof/Ceiling - Ambient**	10	**484,00**	m²			**Roof/Ceiling - Ambient**	**0,107**	**-91**
B	**Floor slab / Basement ceiling**	11	**484,00**	m²			**Floor slab / Basement ceiling**	**1,402**	
		12	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*				
		13	**0,00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X			
X		14	**0,00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**75%**			
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**208,00**	m	*Units in m*		**Thermal bridges Ambient**	**0,000**	
P	**Perimeter thermal bridges**	16	**0,00**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**		
B	**Thermal bridges FS/BC**	17	**0,00**	m	*Units in m*		**Thermal bridges FS/BC**		
I	**Building element towards neighbour**	18	**0,00**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**		
Total thermal envelope			**3779,14**	**m²**			**Average therm. envelope**	**0,382**	

Go to building components list

35					x (		-		) =							or				
36					x (		-		) =							or				
37					x (		-		) =							or				
38					x (		-		) =							or				
39					x (		-		) =							or				
40					x (		-		) =							or				
41					x (		-		) =							or				
42					x (		-		) =							or				
43					x (		-		) =							or				
44					x (		-		) =							or				
45					x (		-		) =							or				
46					x (		-		) =							or				
47					x (		-		) =							or				
48					x (		-		) =							or				
49					x (		-		) =							or				
50					x (		-		) =							or				

TBend

Heat losses through the ground

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building section 1

Ground characteristics				
Thermal conductivity	λ	2,0	W/(mK)	
Heat capacity	ρc	2,0	MJ/(m³K)	
Periodic penetration depth	δ	3,17	m	

Climate data			
Avg indoor temp. winter	T_i	20,0	°C
Avg indoor temp. summer	T_i	25,0	°C
Avg ground surface temperature	$T_{g,ave}$	8,1	°C
Amplitude of $T_{g,ave}$	$T_{g,\wedge}$	8,4	°C
Phase shifting of $T_{e,m}$	τ	1,3	Months
Length of the heating period	n	7,7	Months
Heating degree hours - exterior	G_t	95,1	kKh/a

Building data							
Area of ground floor slab / basement ceilin	A	484,0	m²	U-value floor slab/basement ceiling	U_f	1,402	W/(m²K)
Perimeter length	P	90,2	m	TBs floor slab / basement ceiling	Ψ_B*l	0,00	W/K
Charact. dimension of floor slab	B'	10,74	m	U-value floor slab / basement ceiling i	U_f'	1,402	W/(m²K)
				Equivalent thickness floor	d_t	1,43	m

Floor slab type (select only one)

x	**Slab on grade**						
	Perimeter insulation width/depth	D	m	Orientation of perimeter insulation	horizontal		
	Perimeter insulation thickness	d_n	m	(check only one field)	vertical	x	
	Conductivity perimeter insulation	λ_n	W/(mK)				
	Heated basement or floor slab completely / partially below ground level						
	Basement wall height below ground level	z	m	U-Value wall below ground	U_{wB}		W/(m²K)
	Unheated basement						
	Height aboveground wall	h	m	U-Value wall above ground	U_W		W/(m²K)
	Basement wall height below ground level	z	m	U-Value wall below ground	U_{WB}		W/(m²K)
	Air change unheated basement	n	0,20 h^{-1}	U-Value basement floor slab	U_{fB}		W/(m²K)
	Air flow basement	V	m³				
	Suspended floor above a ventilated crawl space (at max. 0.5 m below ground)						
	U-Value crawl space	U_{Crawl}	W/(m²K)	Area of ventilation openings	εP		m²
	Height of crawl space wall	h	m	Wind velocity at 10 m height	v	4,0	m/s
	U-Value crawl space wall	U_W	W/(m²K)	Wind shield factor	f_W	0,05	-

Additional thermal bridge heat losses at perimeter						
				Steady-state fraction	$\Psi_{P,stat}$*l	0,000	W/K
Phase shift	β		Months	Harmonic fraction	$\Psi_{P,harm}$*l	0,000	W/K

Groundwater correction							
Depth of the groundwater table	z_w	3,0	m	Groundwater correction factor	G_w	1,13885624	-
Groundwater flow rate	q_w	0,05	m/d				

Interim results

Phase shift	β	1,01	Months	Steady-state heat flow	Φ_{stat}	2382,1	W
Steady-state transmittance	L_S	200,96	W/K	Periodic heat flow	Φ_{harm}	255,9	W
Exterior periodic transmittance	L_{pe}	78,03	W/K	Heat losses during heating period	Q_{tot}	14757	kWh
Transmittance building	L_0	678,56	W/K				

Monthly average temperatures in the ground for monthly method (building assembly 1)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	15,7	15,5	15,6	15,9	16,4	16,8	17,2	17,4	17,4	17,1	16,6	16,1	16,5
Summer	19,3	19,1	19,1	19,4	19,9	20,4	20,8	21,0	20,9	20,6	20,1	19,7	20,0

Design ground temperature for 'Heating load' worksheet 15,5 **For 'Cooling load' worksheet** 21,0

Reduction factor for 'Annual heating' worksheet 0,23

Total result (all building parts)

Phase shift	β	1,01	Months	Steady-state heat flow	Φ_{stat}	2382,1	W
Steady-state transmittance	L_S	200,96	W/K	Periodic heat flow	Φ_{harm}	255,9	W
Exterior periodic transmittance	L_{pe}	78,03	W/K	Heat losses during heating period	Q_{tot}	14757	kWh
Transmittance building	L_0	678,56	W/K	Charact. dimension of floor slab	B'	10,74	m

Monthly Average temperatures in the ground for monthly method (all building assemblies)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	**15,7**	**15,5**	**15,6**	**15,9**	**16,4**	**16,8**	**17,2**	**17,4**	**17,4**	**17,1**	**16,6**	**16,1**	**16,5**
Summer	**19,3**	**19,1**	**19,1**	**19,4**	**19,9**	**20,4**	**20,8**	**21,0**	**20,9**	**20,6**	**20,1**	**19,7**	**20,0**

Design ground temperature for 'Heating load' worksheet **15,5** **For 'Cooling load' worksheet** **21,0**

Reduction factor for 'Annual heating' worksheet **0,23**

Passive House Components

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Go to: 'AREAS' | www.passivehouse.com/component-database
Thermal bridges (Psi-values) | Ventilation units
Glazing | Compact units
Window frame | Heat recovery DHW

Building assemblies (U-Values)

Recommended starting values for optimisation: U-values for walls and roofs | Floor slabs: 0,12 W/(m²K) | 0,4 W/(m²K)

		1			
ID	**Building system**	**Building assembly**	**Total thickness**	**U-Value**	**Interior insulation**
	Summary of the constructions calculated in 'U values' worksheet		m	W/(m²K)	-
01ud	**External Wall**	**External Wall**	**0,550**	**0,098**	**0**
02ud	**Roof**	**Roof**	**0,720**	**0,078**	**0**
03ud	**Floor slab**	**Floor slab**	**0,500**	**1,402**	**0**
04ud	**Hissvägg**	**Hissvägg**	**0,150**	**2,108**	**0**
05ud	**Hisstak**	**Hisstak**	**0,150**	**2,414**	**0**
06ud	**Yttervägg entrévåning**	**Yttervägg entrévåning**	**0,560**	**0,115**	**0**
07ud					
08ud					
09ud					
10ud					

Glazing

Glazing

	Recommended glazing type to start planning: Triple or quadruple thermally insulated glazing (Please consider the comfort criterion!)		
ID	**Description**	**g-Value**	U_g-Value
			W/(m²K)
01ud	**1+Double glazing 4/12mm air/4**	**0,60**	**1,00**
02ud	**Door Panel**	**0,00**	**3,00**
03ud	**3glas SW**	**0,53**	**0,53**
04ud	**3glas SmartWin**	**0,53**	**0,53**
05ud	**Door Panel**	**0,00**	**3,00**
06ud	**low-g 3glas SmartWin**	**0,35**	**0,47**
07ud			
08ud			
09ud			
10ud			

Window frame

Window frame

		U_f-Value				Frame width				Glazing edge thermal bridge				Installation thermal bridge				Curtain wall facades:
ID	Description	left	right	bottom	above	left	right	bottom	above	$\Psi_{Glazing\ edge}$ left	$\Psi_{Glazing\ edge}$ right	$\Psi_{Glazing\ edge}$ bottom	$\Psi_{Glazing\ edge}$ top	$\Psi_{installation}$ left	$\Psi_{installation}$ right	$\Psi_{installation}$ bottom	$\Psi_{installation}$ top	χ_{GC} -value Glass carrier
		W/(m²K)	W/(m²K)	W/(m²K)	W/(m²K)	m	m	m	m	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/K
01ud	**EXISTING: timber 68 mm**	**1,60**	**1,60**	**1,60**	**1,60**	**0,140**	**0,140**	**0,140**	**0,140**	**0,050**	**0,050**	**0,050**	**0,050**	**0,070**	**0,070**	**0,070**	**0,070**	
02ud	**Existing Door Frame**	**1,60**	**1,60**	**1,60**	**1,60**	**0,200**	**0,200**	**0,200**	**0,200**	**0,070**	**0,070**	**0,070**	**0,070**	**0,070**	**0,070**	**0,100**	**0,070**	
03ud	**pro Passivhausfenster - SmartWin - with Super Spacer TriSeal**	**0,70**	**0,70**	**0,91**	**0,70**	**0,086**	**0,086**	**0,086**	**0,086**	**0,026**	**0,026**	**0,025**	**0,026**	**0,020**	**0,020**	**0,020**	**0,020**	
04ud																		
05ud																		
06ud																		
07ud																		
08ud																		
09ud																		
10ud																		

Ventilation units with heat recovery

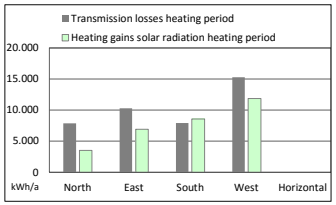
Ventilation units with heat recovery

	Recommended specifications to start planning: Frost protection: Yes, directly electric; Humidity recovery: Yes	80 %		0,45	Additional Device Data								
ID	Description	Effective heat recovery efficiency	Energy recovery value η_{ER}	Electric efficiency	Application range		External pressure per section	Fittings Dp_{intern}	Frost protection necessary	Noise protection			Additional info
	User defined area	%	%	Wh/m³	m³/h	m³/h	Pa	Pa		35 dB(A)	Supply air dB(A)	Extract air dB(A)	
01ud	**Swegon Gold**	**80%**		**0,45**									
02ud													
03ud													
04ud													
05ud													
06ud													
07ud													
08ud													
09ud													
10ud													

Windows

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Window area orientation	Global radiation (main orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation		Transmission losses heating period	Heating gains solar radiation heating period
Standard values →	kWh/(m²a)	0,75	0,95	0,85				m²	W/(m²K)	m²	kWh/(m²a)		kWh/a	kWh/a
North	130	0,85	0,95	0,85	0,71	0,47	0,49	116,45	0,71	82,98	131	North	7822	3485
East	251	0,85	0,95	0,85	0,71	0,35	0,48	157,96	0,68	111,56	257	East	10267	6869
South	443	0,71	0,95	0,85	0,71	0,42	0,40	118,94	0,70	84,49	421	South	7867	8512
West	271	0,77	0,95	0,85	0,71	0,46	0,44	211,79	0,76	150,89	277	West	15242	11816
Horizontal	346	1,00	0,95	0,85	0,00	0,00	0,00	0,00	0,00	0,00	346	Horizontal	0	0
Total or average value for all windows.						0,42	0,45	605,14	0,72	429,91			41198	30683



Go to glazing list
Go to window frames list

Heating degree hours [kKh/a]: 95,1

Qua n- tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Window rough openings: Width	Window rough openings: Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	g-Value: Perpen- dicular radiation	U-Value: Glazing	U-Value: Frames (avg.)	Ψ Glazing edge (Avg.)	Installation situation: left	right	bottom	top	Ψ Installation (Avg.)	Results: Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
2	F1a GF	298	90	West	1,000	2,100	1-Fasad 1a	02ud Door Panel	02ud Existing Door Frame	0,00	3,00	1,60	0,070	1	0	1	1	0,077	4,2	2,04	2,58	49%
1	F1b GF	278	90	West	1,000	2,100	2-Fasad 1b	02ud Door Panel	02ud Existing Door Frame	0,00	3,00	1,60	0,070	1	1	1	1	0,075	2,1	1,02	2,65	49%
2	F1b GF	278	90	West	1,100	0,750	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,77	0,026	1	1	1	1	0,020	1,7	1,07	0,80	65%
2	F2a GF	10	90	North	1,100	0,750	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,77	0,026	1	1	1	1	0,020	1,7	1,07	0,80	65%
1	F4a GF	154	90	South	0,700	0,800	7-Fasad 4a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,76	0,026	1	1	1	1	0,020	0,6	0,33	0,84	59%
2	F5b GF	206	90	South	0,600	2,200	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,72	0,026	1	0	1	1	0,020	2,6	1,74	0,74	66%
1	F5b GF FD	206	90	South	1,000	2,200	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	0	1	1	0,020	2,2	1,68	0,66	76%
2	F1a v1 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v1 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v1 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v1 SW	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 SW	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v2 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v2 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v2 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v2 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	0,700	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,5	1,02	0,68	69%
1	F4b v1 tw	134	90	East	1,300	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,76	0,026	1	1	1	1	0,020	1,3	0,93	0,70	72%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v3 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v3 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v3 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v3 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v4 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v4 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v4 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v4 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%

Heating degree hours [kKh/a] 95,1

Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Window rough openings: Width	Window rough openings: Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	g-Value: Perpen-dicular radiation	U-Value: Glazing	U-Value: Frames (avg.)	Ψ Glazing edge: $\Psi_{Glazing\ edge}$ (Avg.)	Installation situation: left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Results: Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v5 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v5 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
11	F1a v5 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	18,5	13,32	0,71	72%
1	F1a v5 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v6 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v6 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v6 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v6 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v7 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v7 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v7 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v7 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%

Heating degree hours [kKh/a] 95,1

					Window rough openings		Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows					Results			
Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Width	Height	Selection from 'Areas' worksheet	Selection from 'Components' worksheet	Selection from 'Components' worksheet	Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F1a v8 ww	298	90	West	1,200	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1a v8 ws	298	90	West	0,450	1,400	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F1a v8 bd	298	90	West	0,800	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F1a v8 sw	298	90	West	1,300	2,100	1-Fasad 1a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F1b v1 tw	278	90	West	0,700	1,000	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F1b v1 ww	278	90	West	1,200	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F1b v1 ws	278	90	West	0,450	1,400	2-Fasad 1b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
2	F2a v1 ww	10	90	North	1,200	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F2a v1 ws	10	90	North	0,450	1,400	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%
1	F2a v1 bd	10	90	North	0,800	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,71	72%
1	F2a v1 sw	10	90	North	1,300	2,100	3-Fasad 2a	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,67	80%
1	F2b v1 tw	350	90	North	0,700	1,000	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F2b v1 ww	350	90	North	1,200	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F2b v1 ws	350	90	North	0,450	1,400	4-Fasad 2b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F3a v1 ww	82	90	East	1,200	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3a v1 ws	82	90	East	0,450	1,400	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F3a v1 bd	82	90	East	0,800	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F3a v1 sw	82	90	East	1,300	2,100	5-Fasad 3a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F3b v1 tw	62	90	East	0,700	1,000	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F3b v1 ww	62	90	East	1,200	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F3b v1 ws	62	90	East	0,450	1,400	6-Fasad 3b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F4a v1 ww	154	90	South	1,200	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4a v1 ws	154	90	South	0,450	1,400	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F4a v1 bd	154	90	South	0,800	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F4a v1 sw	154	90	South	1,300	2,100	7-Fasad 4a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F4b v1 tw	134	90	East	0,700	1,000	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,77	62%
2	F4b v1 ww	134	90	East	1,200	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F4b v1 ws	134	90	East	0,450	1,400	8-Fasad 4b	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
2	F5a v1 ww	226	90	West	1,200	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,65	75%
2	F5a v1 ws	226	90	West	0,450	1,400	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,79	54%
1	F5a v1 bd	226	90	West	0,800	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,73	0,026	1	0	1	1	0,020	1,7	1,21	0,67	72%
1	F5a v1 sw	226	90	West	1,300	2,100	9-Fasad 5a	06ud-low-g 3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,35	0,47	0,74	0,026	0	1	1	1	0,020	2,7	2,17	0,62	80%
1	F5b v1 tw	206	90	South	0,700	1,000	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	1	1	1	0,020	0,7	0,44	0,81	62%
2	F5b v1 ww	206	90	South	1,200	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,75	0,026	1	0	1	1	0,020	3,4	2,52	0,70	75%
2	F5b v1 ws	206	90	South	0,450	1,400	10-Fasad 5b	04ud-3glas SmartWin	03ud-pro Passivhausfenster - SmartWin - with Super Spacer TriSeal	0,53	0,53	0,73	0,026	0	1	1	1	0,020	1,3	0,68	0,82	54%

Heating degree hours [kKh/a] **95,1**

Quantity	Description	Deviation from north	Angle of inclination from the horizontal	Orientation	Window rough openings: Width	Window rough openings: Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	g-Value: Perpendicular radiation	U-Value: Glazing	U-Value: Frames (avg.)	Ψ Glazing edge: $\Psi_{Glazing\ edge}$ (Avg.)	Installation situation: left	Installation situation: right	Installation situation: bottom	Installation situation: top	Installation situation: $\Psi_{Installation}$ (Avg.)	Results: Window Area	Results: Glazing area	Results: U_w installed	Results: Glazed fraction per window
		°	°		m	m		Sort: AS LIST	Sort: AS LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%

Calculation of shading coefficients

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Latitude: 57,783 °

Orientation	Glazing area [m²]	Reduction factor winter r_v	Reduction factor cooling $r_{v,1}$	Reduction factor cooling load $r_{v,2}$	Solar load [kWh/(m²$_{glazing}$a)]
North	82,98	85%	85%	85%	76
East	111,56	85%	85%	85%	99
South	85,18	71%	79%	79%	113
West	150,89	77%	88%	88%	126
Horizontal	0,00	100%	100%	100%	0

								Horizon		Lateral reveal		Reveal / Overhang					Reduction factors for shading in winter				Reduction factors for shading in summer				
Quan-tity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / transparent	Horizon	Reveal	Overhang	Total for heating case	Horizon	Reveal	Overhang	Total for cooling case	Total for cooling load
		[Degree]	[Degree]		w_G [m]	h_G [m]	A_G [m²]	h_{hor} [m]	d_{hor} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	z [%]		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
2	F1a GF	298	90	West	0,60	1,70	2,0	15,50	95,00					75%	75%			85%			64%	89%			66%	66%
1	F1b GF	278	90	West	0,60	1,70	1,0	15,50	95,00					75%	75%			85%			64%	89%			67%	67%
2	F1b GF	278	90	West	0,93	0,58	1,1	15,50	95,00					75%	75%			85%			64%	89%			67%	67%
2	F2a GF	10	90	North	0,93	0,58	1,1							75%	75%						75%				75%	75%
1	F4a GF	154	90	South	0,53	0,63	0,3							75%	75%						75%				75%	75%
2	F5b GF	206	90	South	0,43	2,03	1,7	25,00	32,00					75%	75%			29%			22%	68%			51%	51%
1	F5b GF FD	206	90	South	0,83	2,03	1,7	25,00	32,00					75%	75%			29%			22%	68%			51%	51%
2	F1a v1 ww	298	90	West	1,03	1,23	2,5	12,50	95,00									88%			88%	91%			91%	91%
2	F1a v1 ws	298	90	West	0,28	1,23	0,7	12,50	95,00									88%			88%	91%			91%	91%
1	F1a v1 bd	298	90	West	0,63	1,93	1,2	12,50	95,00									88%			88%	91%			91%	91%
1	F1a v1 SW	298	90	West	1,13	1,93	2,2	12,50	95,00									88%			88%	91%			91%	91%
1	F1b v1 tw	278	90	West	0,53	0,83	0,4	12,50	95,00									88%			88%	91%			91%	91%
2	F1b v1 ww	278	90	West	1,03	1,23	2,5	12,50	95,00									88%			88%	91%			91%	91%
2	F1b v1 ws	278	90	West	0,28	1,23	0,7	12,50	95,00									88%			88%	91%			91%	91%
2	F2a v1 ww	10	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F2a v1 ws	10	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F2a v1 bd	10	90	North	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F2a v1 SW	10	90	North	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	F2b v1 tw	350	90	North	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	F2b v1 ww	350	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F2b v1 ws	350	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F3a v1 ww	82	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F3a v1 ws	82	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F3a v1 bd	82	90	East	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F3a v1 sw	82	90	East	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	F3b v1 tw	62	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	F3b v1 ww	62	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F3b v1 ws	62	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F4a v1 ww	154	90	South	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F4a v1 ws	154	90	South	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F4a v1 bd	154	90	South	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F4a v1 sw	154	90	South	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	F4b v1 tw	134	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	F4b v1 ww	134	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F4b v1 ws	134	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F5a v1 ww	226	90	West	1,03	1,23	2,5	22,20	32,00					75%	75%			42%			31%	67%			51%	51%
2	F5a v1 ws	226	90	West	0,28	1,23	0,7	22,20	32,00					75%	75%			42%			31%	67%			51%	51%
1	F5a v1 bd	226	90	West	0,63	1,93	1,2	22,20	32,00					75%	75%			42%			31%	67%			51%	51%
1	F5a v1 sw	226	90	West	1,13	1,93	2,2	22,20	32,00					75%	75%			42%			31%	67%			51%	51%
1	F5b v1 tw	206	90	South	0,53	0,83	0,4	22,20	32,00					75%	75%			35%			26%	71%			53%	53%
2	F5b v1 ww	206	90	South	1,03	1,23	2,5	22,20	32,00					75%	75%			35%			26%	71%			53%	53%
2	F5b v1 ws	206	90	South	0,28	1,23	0,7	22,20	32,00					75%	75%			35%			26%	71%			53%	53%
2	F1a v2 ww	298	90	West	1,03	1,23	2,5	9,73	95,00									90%			90%	93%			93%	93%
2	F1a v2 ws	298	90	West	0,28	1,23	0,7	9,73	95,00									90%			90%	93%			93%	93%
1	F1a v2 bd	298	90	West	0,63	1,93	1,2	9,73	95,00									90%			90%	93%			93%	93%
1	F1a v2 sw	298	90	West	1,13	1,93	2,2	9,73	95,00									90%			90%	93%			93%	93%
1	F1b v1 tw	278	90	West	0,53	0,83	0,4	9,73	95,00									90%			90%	93%			93%	93%
2	F1b v1 ww	278	90	West	1,03	1,23	2,5	9,73	95,00									90%			90%	93%			93%	93%
2	F1b v1 ws	278	90	West	0,28	1,23	0,7	9,73	95,00									90%			90%	93%			93%	93%
2	F2a v1 ww	10	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F2a v1 ws	10	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F2a v1 bd	10	90	North	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F2a v1 sw	10	90	North	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	F2b v1 tw	350	90	North	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	F2b v1 ww	350	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F2b v1 ws	350	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F3a v1 ww	82	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F3a v1 ws	82	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F3a v1 bd	82	90	East	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F3a v1 sw	82	90	East	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	F3b v1 tw	62	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	F3b v1 ww	62	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F3b v1 ws	62	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F4a v1 ww	154	90	South	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F4a v1 ws	154	90	South	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	F4a v1 bd	154	90	South	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	F4a v1 sw	154	90	South	0,53	1,93	1,0							75%	75%						75%				75%	75%
1	F4b v1 tw	134	90	East	1,13	0,83	0,9							75%	75%						75%				75%	75%
2	F4b v1 ww	134	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	F4b v1 ws	134	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	F5a v1 ww	226	90	West	1,03	1,23	2,5	19,43	32,00					75%	75%			47%			36%	71%			53%	53%
2	F5a v1 ws	226	90	West	0,28	1,23	0,7	19,43	32,00					75%	75%			47%			36%	71%			53%	53%
1	F5a v1 bd	226	90	West	0,63	1,93	1,2	19,43	32,00					75%	75%			47%			36%	71%			53%	53%
1	F5a v1 sw	226	90	West	1,13	1,93	2,2	19,43	32,00					75%	75%			47%			36%	71%			53%	53%
1	F5b v1 tw	206	90	South	0,53	0,83	0,4	19,43	32,00					75%	75%			42%			31%	74%			56%	56%

Quan-tity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / transparent	Horizon	Reveal	Overhang	**Total for heating case**	Horizon	Reveal	Overhang	**Total for cooling case**	**Total for cooling load**
		[Degree]	[Degree]		w_O [m]	h_O [m]	A_O [m²]	h_{Hori} [m]	d_{Hori} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	**z [%]**		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
2	**F5b v1 ww**	206	90	South	1,03	1,23	2,5	**19,43**	**32,00**					75%	75%			42%			31%	74%			56%	56%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7	**19,43**	**32,00**					75%	75%			42%			31%	74%			56%	56%
2	**F1a v3 ww**	298	90	West	1,03	1,23	2,5	**6,96**	**95,00**									93%			93%	95%			95%	95%
2	**F1a v3 ws**	298	90	West	0,28	1,23	0,7	**6,96**	**95,00**									93%			93%	95%			95%	95%
1	**F1a v3 bd**	298	90	West	0,63	1,93	1,2	**6,96**	**95,00**									93%			93%	95%			95%	95%
1	**F1a v3 sw**	298	90	West	1,13	1,93	2,2	**6,96**	**95,00**									93%			93%	95%			95%	95%
1	**F1b v1 tw**	278	90	West	0,53	0,83	0,4	**6,96**	**95,00**									93%			93%	95%			95%	95%
2	**F1b v1 ww**	278	90	West	1,03	1,23	2,5	**6,96**	**95,00**									93%			93%	95%			95%	95%
2	**F1b v1 ws**	278	90	West	0,28	1,23	0,7	**6,96**	**95,00**									93%			93%	95%			95%	95%
2	**F2a v1 ww**	10	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F2a v1 ws**	10	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F2a v1 bd**	10	90	North	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F2a v1 sw**	10	90	North	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F2b v1 tw**	350	90	North	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F2b v1 ww**	350	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F2b v1 ws**	350	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F3a v1 ww**	82	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F3a v1 ws**	82	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F3a v1 bd**	82	90	East	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F3a v1 sw**	82	90	East	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F3b v1 tw**	62	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F3b v1 ww**	62	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F3b v1 ws**	62	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F4a v1 ww**	154	90	South	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F4a v1 ws**	154	90	South	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F4a v1 bd**	154	90	South	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F4a v1 sw**	154	90	South	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F4b v1 tw**	134	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F4b v1 ww**	134	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F4b v1 ws**	134	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F5a v1 ww**	226	90	West	1,03	1,23	2,5	**16,66**	**32,00**					75%	75%			54%			41%	74%			55%	55%
2	**F5a v1 ws**	226	90	West	0,28	1,23	0,7	**16,66**	**32,00**					75%	75%			54%			41%	74%			55%	55%
1	**F5a v1 bd**	226	90	West	0,63	1,93	1,2	**16,66**	**32,00**					75%	75%			54%			41%	74%			55%	55%
1	**F5a v1 sw**	226	90	West	1,13	1,93	2,2	**16,66**	**32,00**					75%	75%			54%			41%	74%			55%	55%
1	**F5b v1 tw**	206	90	South	0,53	0,83	0,4	**16,66**	**32,00**					75%	75%			50%			37%	77%			58%	58%
2	**F5b v1 ww**	206	90	South	1,03	1,23	2,5	**16,66**	**32,00**					75%	75%			50%			37%	77%			58%	58%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7	**16,66**	**32,00**					75%	75%			50%			37%	77%			58%	58%
2	**F1a v4 ww**	298	90	West	1,03	1,23	2,5	**4,19**	**95,00**									96%			96%	97%			97%	97%
2	**F1a v4 ws**	298	90	West	0,28	1,23	0,7	**4,19**	**95,00**									96%			96%	97%			97%	97%
1	**F1a v4 bd**	298	90	West	0,63	1,93	1,2	**4,19**	**95,00**									96%			96%	97%			97%	97%
1	**F1a v4 sw**	298	90	West	1,13	1,93	2,2	**4,19**	**95,00**									96%			96%	97%			97%	97%
1	**F1b v1 tw**	278	90	West	0,53	0,83	0,4	**4,19**	**95,00**									96%			96%	97%			97%	97%
2	**F1b v1 ww**	278	90	West	1,03	1,23	2,5	**4,19**	**95,00**									96%			96%	97%			97%	97%
2	**F1b v1 ws**	278	90	West	0,28	1,23	0,7	**4,19**	**95,00**									96%			96%	97%			97%	97%
2	**F2a v1 ww**	10	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F2a v1 ws**	10	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F2a v1 bd**	10	90	North	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F2a v1 sw**	10	90	North	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F2b v1 tw**	350	90	North	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F2b v1 ww**	350	90	North	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F2b v1 ws**	350	90	North	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F3a v1 ww**	82	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F3a v1 ws**	82	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F3a v1 bd**	82	90	East	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F3a v1 sw**	82	90	East	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F3b v1 tw**	62	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F3b v1 ww**	62	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F3b v1 ws**	62	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F4a v1 ww**	154	90	South	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F4a v1 ws**	154	90	South	0,28	1,23	0,7							75%	75%						75%				75%	75%
1	**F4a v1 bd**	154	90	South	0,63	1,93	1,2							75%	75%						75%				75%	75%
1	**F4a v1 sw**	154	90	South	1,13	1,93	2,2							75%	75%						75%				75%	75%
1	**F4b v1 tw**	134	90	East	0,53	0,83	0,4							75%	75%						75%				75%	75%
2	**F4b v1 ww**	134	90	East	1,03	1,23	2,5							75%	75%						75%				75%	75%
2	**F4b v1 ws**	134	90	East	0,28	1,23	0,7							75%	75%						75%				75%	75%
2	**F5a v1 ww**	226	90	West	1,03	1,23	2,5	**13,89**	**32,00**					75%	75%			62%			46%	78%			58%	58%
2	**F5a v1 ws**	226	90	West	0,28	1,23	0,7	**13,89**	**32,00**					75%	75%			62%			46%	78%			58%	58%
1	**F5a v1 bd**	226	90	West	0,63	1,93	1,2	**13,89**	**32,00**					75%	75%			62%			46%	78%			58%	58%
1	**F5a v1 sw**	226	90	West	1,13	1,93	2,2	**13,89**	**32,00**					75%	75%			62%			46%	78%			58%	58%
1	**F5b v1 tw**	206	90	South	0,53	0,83	0,4	**13,89**	**32,00**					75%	75%			59%			45%	81%			60%	60%
2	**F5b v1 ww**	206	90	South	1,03	1,23	2,5	**13,89**	**32,00**					75%	75%			59%			45%	81%			60%	60%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7	**13,89**	**32,00**					75%	75%			59%			45%	81%			60%	60%
2	**F1a v5 ww**	298	90	West	1,03	1,23	2,5	**2,77**	**95,00**									97%			97%	98%			98%	98%
2	**F1a v5 ws**	298	90	West	0,28	1,23	0,7	**2,77**	**95,00**									97%			97%	98%			98%	98%
11	**F1a v5 bd**	298	90	West	0,63	1,93	13,3	**2,77**	**95,00**									97%			97%	98%			98%	98%
1	**F1a v5 sw**	298	90	West	1,13	1,93	2,2	**2,77**	**95,00**									97%			97%	98%			98%	98%
1	**F1b v1 tw**	278	90	West	0,53	0,83	0,4	**2,77**	**95,00**									97%			97%	98%			98%	98%
2	**F1b v1 ww**	278	90	West	1,03	1,23	2,5	**2,77**	**95,00**									97%			97%	98%			98%	98%
2	**F1b v1 ws**	278	90	West	0,28	1,23	0,7	**2,77**	**95,00**									97%			97%	98%			98%	98%
2	**F2a v1 ww**	10	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F2a v1 ws**	10	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	**F2a v1 bd**	10	90	North	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	**F2a v1 sw**	10	90	North	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	**F2b v1 tw**	350	90	North	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	**F2b v1 ww**	350	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F2b v1 ws**	350	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	**F3a v1 ww**	82	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%

Quan-tity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / transparent	Horizon	Reveal	Overhang	**Total for heating case**	Horizon	Reveal	Overhang	**Total for cooling case**	**Total for cooling load**
		[Degree]	[Degree]		w_O [m]	h_O [m]	A_O [m²]	h_{Hori} [m]	d_{Hori} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	**z [%]**		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
2	F3a v1 ws	82	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F3a v1 bd	82	90	East	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F3a v1 sw	82	90	East	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F3b v1 tw	62	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F3b v1 ww	62	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F3b v1 ws	62	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F4a v1 ww	154	90	South	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4a v1 ws	154	90	South	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F4a v1 bd	154	90	South	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F4a v1 sw	154	90	South	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F4b v1 tw	134	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F4b v1 ww	134	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4b v1 ws	134	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F5a v1 ww	226	90	West	1,03	1,23	2,5	11,12	32,00									70%			70%	82%			82%	82%
2	F5a v1 ws	226	90	West	0,28	1,23	0,7	11,12	32,00									70%			70%	82%			82%	82%
1	F5a v1 bd	226	90	West	0,63	1,93	1,2	11,12	32,00									70%			70%	82%			82%	82%
1	F5a v1 sw	226	90	West	1,13	1,93	2,2	11,12	32,00									70%			70%	82%			82%	82%
1	F5b v1 tw	206	90	South	0,53	0,83	0,4	11,12	32,00									70%			70%	84%			84%	84%
2	F5b v1 ww	206	90	South	1,03	1,23	2,5	11,12	32,00									70%			70%	84%			84%	84%
2	F5b v1 ws	206	90	South	0,28	1,23	0,7	11,12	32,00									70%			70%	84%			84%	84%
2	F1a v6 ww	298	90	West	1,03	1,23	2,5														75%				100%	100%
2	F1a v6 ws	298	90	West	0,28	1,23	0,7														75%				100%	100%
1	F1a v6 bd	298	90	West	0,63	1,93	1,2														75%				100%	100%
1	F1a v6 sw	298	90	West	1,13	1,93	2,2														75%				100%	100%
1	F1b v1 tw	278	90	West	0,53	0,83	0,4														75%				100%	100%
2	F1b v1 ww	278	90	West	1,03	1,23	2,5														75%				100%	100%
2	F1b v1 ws	278	90	West	0,28	1,23	0,7														75%				100%	100%
2	F2a v1 ww	10	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F2a v1 ws	10	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F2a v1 bd	10	90	North	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F2a v1 sw	10	90	North	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F2b v1 tw	350	90	North	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F2b v1 ww	350	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F2b v1 ws	350	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F3a v1 ww	82	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F3a v1 ws	82	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F3a v1 bd	82	90	East	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F3a v1 sw	82	90	East	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F3b v1 tw	62	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F3b v1 ww	62	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F3b v1 ws	62	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F4a v1 ww	154	90	South	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4a v1 ws	154	90	South	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F4a v1 bd	154	90	South	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F4a v1 sw	154	90	South	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F4b v1 tw	134	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F4b v1 ww	134	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4b v1 ws	134	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F5a v1 ww	226	90	West	1,03	1,23	2,5	8,35	32,00									79%			79%	86%			86%	86%
2	F5a v1 ws	226	90	West	0,28	1,23	0,7	8,35	32,00									79%			79%	86%			86%	86%
1	F5a v1 bd	226	90	West	0,63	1,93	1,2	8,35	32,00									79%			79%	86%			86%	86%
1	F5a v1 sw	226	90	West	1,13	1,93	2,2	8,35	32,00									79%			79%	86%			86%	86%
1	F5b v1 tw	206	90	South	0,53	0,83	0,4	8,35	32,00									80%			80%	88%			88%	88%
2	F5b v1 ww	206	90	South	1,03	1,23	2,5	8,35	32,00									80%			80%	88%			88%	88%
2	F5b v1 ws	206	90	South	0,28	1,23	0,7	8,35	32,00									80%			80%	88%			88%	88%
2	F1a v7 ww	298	90	West	1,03	1,23	2,5														75%				100%	100%
2	F1a v7 ws	298	90	West	0,28	1,23	0,7														75%				100%	100%
1	F1a v7 bd	298	90	West	0,63	1,93	1,2														75%				100%	100%
1	F1a v7 sw	298	90	West	1,13	1,93	2,2														75%				100%	100%
1	F1b v1 tw	278	90	West	0,53	0,83	0,4														75%				100%	100%
2	F1b v1 ww	278	90	West	1,03	1,23	2,5														75%				100%	100%
2	F1b v1 ws	278	90	West	0,28	1,23	0,7														75%				100%	100%
2	F2a v1 ww	10	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F2a v1 ws	10	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F2a v1 bd	10	90	North	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F2a v1 sw	10	90	North	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F2b v1 tw	350	90	North	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F2b v1 ww	350	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F2b v1 ws	350	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F3a v1 ww	82	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F3a v1 ws	82	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F3a v1 bd	82	90	East	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F3a v1 sw	82	90	East	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F3b v1 tw	62	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F3b v1 ww	62	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F3b v1 ws	62	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F4a v1 ww	154	90	South	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4a v1 ws	154	90	South	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	F4a v1 bd	154	90	South	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	F4a v1 sw	154	90	South	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	F4b v1 tw	134	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	F4b v1 ww	134	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	F4b v1 ws	134	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	F5a v1 ww	226	90	West	1,03	1,23	2,5	5,58	32,00									87%			87%	90%			90%	90%
2	F5a v1 ws	226	90	West	0,28	1,23	0,7	5,58	32,00									87%			87%	90%			90%	90%
1	F5a v1 bd	226	90	West	0,63	1,93	1,2	5,58	32,00									87%			87%	90%			90%	90%
1	F5a v1 sw	226	90	West	1,13	1,93	2,2	5,58	32,00									87%			87%	90%			90%	90%
1	F5b v1 tw	206	90	South	0,53	0,83	0,4	5,58	32,00									89%			89%	92%			92%	92%

Quan-tity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / transparent	Horizon	Reveal	Overhang	**Total for heating case**	Horizon	Reveal	Overhang	**Total for cooling case**	**Total for cooling load**
		[Degree]	[Degree]		w_G [m]	h_G [m]	A_G [m²]	h_{Hori} [m]	d_{Hori} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	**z [%]**		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
2	**F5b v1 ww**	206	90	South	1,03	1,23	2,5	5,58	32,00									89%			89%	92%			92%	92%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7	5,58	32,00									89%			89%	92%			92%	92%
2	**F1a v8 ww**	298	90	West	1,03	1,23	2,5														75%				100%	100%
2	**F1a v8 ws**	298	90	West	0,28	1,23	0,7														75%				100%	100%
1	**F1a v8 bd**	298	90	West	0,63	1,93	1,2														75%				100%	100%
1	**F1a v8 sw**	298	90	West	1,13	1,93	2,2														75%				100%	100%
1	**F1b v1 tw**	278	90	West	0,53	0,83	0,4														75%				100%	100%
2	**F1b v1 ww**	278	90	West	1,03	1,23	2,5														75%				100%	100%
2	**F1b v1 ws**	278	90	West	0,28	1,23	0,7														75%				100%	100%
2	**F2a v1 ww**	10	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F2a v1 ws**	10	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	**F2a v1 bd**	10	90	North	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	**F2a v1 sw**	10	90	North	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	**F2b v1 tw**	350	90	North	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	**F2b v1 ww**	350	90	North	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F2b v1 ws**	350	90	North	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	**F3a v1 ww**	82	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F3a v1 ws**	82	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	**F3a v1 bd**	82	90	East	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	**F3a v1 sw**	82	90	East	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	**F3b v1 tw**	62	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	**F3b v1 ww**	62	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F3b v1 ws**	62	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	**F4a v1 ww**	154	90	South	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F4a v1 ws**	154	90	South	0,28	1,23	0,7							95%	95%						95%				95%	95%
1	**F4a v1 bd**	154	90	South	0,63	1,93	1,2							95%	95%						95%				95%	95%
1	**F4a v1 sw**	154	90	South	1,13	1,93	2,2							95%	95%						95%				95%	95%
1	**F4b v1 tw**	134	90	East	0,53	0,83	0,4							95%	95%						95%				95%	95%
2	**F4b v1 ww**	134	90	East	1,03	1,23	2,5							95%	95%						95%				95%	95%
2	**F4b v1 ws**	134	90	East	0,28	1,23	0,7							95%	95%						95%				95%	95%
2	**F5a v1 ww**	226	90	West	1,03	1,23	2,5	2,81	32,00									94%			94%	95%			95%	95%
2	**F5a v1 ws**	226	90	West	0,28	1,23	0,7	2,81	32,00									94%			94%	95%			95%	95%
1	**F5a v1 bd**	226	90	West	0,63	1,93	1,2	2,81	32,00									94%			94%	95%			95%	95%
1	**F5a v1 sw**	226	90	West	1,13	1,93	2,2	2,81	32,00									94%			94%	95%			95%	95%
1	**F5b v1 tw**	206	90	South	0,53	0,83	0,4	2,81	32,00									96%			96%	96%			96%	96%
2	**F5b v1 ww**	206	90	South	1,03	1,23	2,5	2,81	32,00									96%			96%	96%			96%	96%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7	2,81	32,00									96%			96%	96%			96%	96%
2	**F5b v1 ws**	206	90	South	0,28	1,23	0,7														75%				100%	100%

Ventilation data

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Treated floor area A_{TFA}	m²	3320		*('Areas' worksheet)*
Room height h	m	2,50	2,50	
Volume of ventilated space (A_{TFA}*h) : V_V	m³	8301		*(Worksheet 'Annual heating')*

Ventilation type

Please select: **1-Balanced PH ventilation with HR**

Infiltration air change rate

Wind protection coefficients e and f		
Coefficient e for wind protection class	Several side exposed	One side exposed
No protection	0,10	0,03
Moderate protection	0,07	0,02
High protection	0,04	0,01
Coefficient f	15	20

			For annual demand:	For heating load:				
Wind protection coefficient, e			0,08	0,20				
Wind protection coefficient, f			15	15	Net air volume for press. test	V_{n50}	Air permeability	q_{50}
Air change rate at press. test	n_{50}	1/h	0,60	0,60	9080	m³	1,44	m³/(hm²)

			For annual demand:	For heating load:
Excess extract air		1/h	0,00	0,00
Infiltration air change rate	$n_{V,Rest}$	1/h	0,053	0,131

Selection of ventilation input - Results

PHPP offers two methods for dimensioning air quantities and choosing the ventilation unit. With "Standard data input for balanced ventilation", supply or extract air quantities for residential buildings and parameters for ventilation systems with a maximum of 1 ventilation unit can be planned. Projects with up to 10 different ventilation units and air quantities determined according to rooms or zones can be entered in the 'Addl vent' worksheet. Please select your design method here:

	Ventilation unit / Heat recovery efficiency design		Average air flow rate m³/h	Average air change rate 1/h	Extract air excess (extract air system) 1/h	Effective heat recovery efficiency unit [-]	Energy recovery [-]	Specific power input Wh/m³	Heat recovery efficiency SHX [-]
x	Standard design	*('Ventilation' worksheet, see below)*	2462	0,30	0,00	78,2%	N/A	0,45	0,0%
	Multiple ventilation units, non-res	*('Addl vent' worksheet)*							

Cooling degree	Efficiency SHX η^*_{SHX}
	0%

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37%	36%	36%	44%	-	-	-	-	-	53%	44%	38%

Standard data input for balanced ventilation

Dimensioning of ventilation system with only one ventilation unit

Occupancy	m²/P	40				
Number of occupants	P	83,5				
Supply air per person	m³/(P*h)	30				
Supply air requirement	m³/h	2504		Bathroom		
Extract air rooms		Kitchen	Bathroom	(shower only)	WC	Design
Quantity						1
Extract air requirement per room	m³/h	60	40	20	20	8000
Total extract air requirement	m³/h	8000				

Design air flow rate should cover at least the extract air demand according to DIN 1946!

Design air flow rate (maximum) m³/h 3200 Recommended: 8000 m³/h

Average air change rate calculation

Type of operation	Daily operation times h/d	Factors referenced to maximum	Air flow rate m³/h	Air change rate 1/h
maximum		1,00	3200	0,39
Standard	**24,0**	**0,77**	2462	0,30
Grundlüftung		**0,54**	1723	0,21
Minimum		**0,40**	1280	0,15
	Average value	0,77	Average air flow rate (m³/h) **2462**	Average air change rate (1/h) **0,30**

Selection of ventilation unit with heat recovery

Location of ventilation unit: **2-Outside of thermal envelope**

	Go to ventilation units list Sortierung: WIE LISTE	Heat recovery efficiency Unit η_{WRG}	Energy recovery η_{ERV}	Specific efficiency [Wh/m³]	Application [m³/h]	Frost power input
Ventilation unit selection	**01ud-Swegon Gold**	0,80	N/A	0,45	N/A	N/A

Conductivity supply air duct	Y	W/(mK)	1,922	Implementation of frost protection	2-Elec.
Length of supply air duct		m	5	Limit temperature [°C]	-15
Conductivity extract air duct	Y	W/(mK)	1,922	Useful energy [kWh/a]	0
Length of extract air duct		m	5	Room temperature (°C)	20
Temperature of mechanical services room		°C	3,7	Avg. ambient temp. heat. period (°C)	3,2
(Enter only if the central unit is outside of the thermal envelope)				Avg. ground temp (°C)	8,1

Effective heat recovery efficiency $\eta_{HR,eff}$ **78,2%**

Effective heat recovery efficiency subsoil heat exchanger

SHX efficiency η^*_{SHX}

Heat recovery efficiency SHX η_{SHX} 0%

Secondary calculation
Ψ-value supply or outdoor air duct

Nominal width	1000	mm
Insulation thic	50	mm
Reflective coating?		Yes
	x	No
Thermal conductivity	0,040	W/(mK)
Nominal air flow rate	2462	m³/h
Δϑ	16	K
Exterior duct diameter	1,000	m
Exterior diameter	1,100	m
α–Interior	3,45	W/(m²K)
α-Surface	5,94	W/(m²K)
Ψ–value	**1,922**	**W/(mK)**
Surface temperature difference	1,525	K

Secondary calculation
Ψ-value extract or exhaust air duct

Nominal width:	1000	mm
Insulation thickness	50	mm
Reflective coating?		yes
	x	no
Thermal conductivity	0,040	W/(mK)
Nominal air flow rate	2462	m³/h
Δϑ	16	K
Exterior duct diameter	1,000	m
Exterior diameter	1,100	m
α–Interior	3,45	W/(m²K)
α-Surface	5,94	W/(m²K)
Ψ–value	**1,922**	**W/(mK)**
Surface temperature difference	1,525	K

Extended input for balanced ventilation (at the moment this worksheet is inactive. Calculation takes place in the 'Ventilation' worksheet.)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Planning ventilation systems with multiple ventilation units

Ventilation unit / Heat recovery efficiency design			
In Ventilation sheet (standard design)		x	*('Ventilation' worksheet)*
In 'Addl vent worksheet (this worksheet)		0,0	*(Addl vent)*
Treated floor area A_{TFA}	m²	3320	*('Areas' worksheet)*
Room height h	m	2,50	*(Worksheet 'Annual heating')*
Room air volume for ventilation (A_{TFA}*h) = V_V	m³	8301	*(Worksheet 'Annual heating')*
Number of occupants	P	83,5	*('Ventilation' worksheet)*
Room temperature	°C	20	*(Worksheet 'Annual heating')*
Average external temp. heating period	°C	3,2	*('Ventilation' worksheet)*
Average ground temp.	°C	8,1	*('Ground' worksheet)*
Length of the heating period	d/a	233	*('Heating' worksheet)*
Ventilation type		1-Balanced PH ventilation with HR	*('Ventilation' worksheet)*

Results of ventilation design and unit selection:

Venti-lation unit no.	Description of the unit	Design V_{SUP} m³/h	Design V_{ETA} m³/h	Annual average value V_{SUP} m³/h	Annual average value V_{ETA} m³/h	Air ch.rt. 1/h	Effective heat recovery efficiency	Energy recovery efficiency	Spec. input power	Heat recov. efficiency SHX
1						---				
2						---				
3						---				
4						---				
5						---				
6						---				
7						---				
8						---				
9						---				
10						---				
Result for overall vent. syst.										

Recommendations for dimensioning air quantities

Use of low odour and low VOCs building materials/furnishings:
It is strongly recommended to use building materials that cause no or very low VOCs/odours instead of increasing the outdoor air volume in order to clear the air.
This holds true independently from the chosen approach to determine air quality; emissions of all sources in the room should be considered, e.g. furniture, carpets and ventilation or air-conditioning unit.

Assessment of volume flow rates according to the number of persons
Also in non-residential buildings, the number of persons is fundamentally important for assessing the volume air flow rates. For good indoor air quality volumes between 20 to 30 m³/h/person are sufficient.
Higher outdoor air amounts may lead to excessively dry indoor air in winter. The air flow rates are specified by classification according to EN 13779. The classification must be agreed with the client in advance.
IDA 3 is adequate for office buildings. IDA 4 has proven satisfactory for school buildings as flushing ventilation is carried out during breaks anyway. For typical outdoor air CO_2 concentrations of around 400-500 ppm, it is possible to comply even with 1500 ppm. Exceeding this figure temporarily is permissible.

Outdoor air flow rates per person:
- Recommended for residential buildings: around 30 m³/(h person)
- Recommended for offices and similar uses: around 30 m³/(h person) (AMEV: 28 m³/(h person); EN 13779 / IDA 3: at least 24 m³/(h person))
- Recommended for schools and day care centres: 15 to 20 m³/(h person) (Source: Guidelines for energy-efficient educational buildings, Passive House Institute, 2010)
- Recommendation for sport halls: 60 m³/(h person) (DIN 18032-1)

Flushing phase for intermittent ventilation operation
In case the ventilation is to be used intermittently (turned off at night), then it should be flushed in the morning, approx. 1 to 2 hours before building is occupied. This should be done in order to refresh air from emissions such as VOCs. Flushing the building causes that the ventilation system works for a longer period (utilisation time + flushing phase). Please consider this at design stage.

Dimensioning of air quantities

When dimensioning the air quantities, please consider the design recommendations given above.
The operation period of the ventilation can be determined on the basis of daily utilisation hours, including flushing phase if applicable. In addition, time periods with reduced ventilation requirements (operation modes) can be taken into account by means of reduction factors.

Room no.	Amount a	Room name	Allocation to ventilation unit (No.)	Area A m²	Clear height h m	Room vol. A x h m³	Volume flow per room V_{SUP} m³/h	V_{ETA} m³/h	V_{TRANS} m³/h	Air chng. rt. per room n 1/h	Utilisation times h/d h	d/week d	Duration of holidays d	Reduction factor 1	Operation red. 1	Reduction factor 2	Operation red. 2	Reduction factor 3	Operation red. 3	Annual average value: V_{SUP} m³/h	V_{ETA} m³/h	V_{TRANS} m³/h	Change rate 1/h
1													0	100%	100%								
2													0	100%	100%								
3													0	100%	100%								
4													0	100%	100%								
5													0	100%	100%								
6													0	100%	100%								
7													0	100%	100%								
8													0	100%	100%								
9													0	100%	100%								
10													0	100%	100%								
11													0	100%	100%								
12													0	100%	100%								
13													0	100%	100%								
14													0	100%	100%								
15													0	100%	100%								
16													0	100%	100%								
17													0	100%	100%								
18													0	100%	100%								
19													0	100%	100%								
20													0	100%	100%								
21													0	100%	100%								
22													0	100%	100%								
23													0	100%	100%								
24													0	100%	100%								
25													0	100%	100%								
26													0	100%	100%								
27													0	100%	100%								
28													0	100%	100%								
29													0	100%	100%								
30													0	100%	100%								
		Additional lines: Please mark complete lines above, copy and paste multiple times																				---	

Ventilation unit selection

Up to 10 different ventilation units are considered. By changing the amount, identical units can be considered. The data from PHI certified ventilation units as well as the entry data lines for user data for other ventilation units can also be found in the worksheet 'Components'. When choosing to use a compact unit the standard design in the 'Ventilation' worksheet has to be used.

Go to ventilation units list

Venti-lation unit no.	Quan-tity [-]	Description of ventilation units	Selection of type of ventilation unit	Design vol. flow per unit m³/h	Application range for volume flow rate from m³/h	to m³/h	Electrical efficiency Pa	Pressure loss calculation ODA-SUP Δp_{Duct} Pa	ETA-EHA Δp_{Duct} Pa	Additional Δp_{Intern} Pa	Application range per line $\Delta p_{External}$ Pa	Subtraction Δp_{Intern} degree	Interior location (x)	Exterior location (x)	Heat recovery efficiency Unit [-]	Effective [-]	Energy recovery efficiency [-]	Frost protection necessary	Subsoil HX Efficiency of heat recovery	Effective efficiency of heat recovery	Frost protection (electr. / hydr.) Tipe perature	Limit temperature °C	Useful V_{SUP} kWh/a
1																					**2-Elec.**		0
2																					**2-Elec.**		0
3																					**2-Elec.**		0
4																					**2-Elec.**		0
5																					**2-Elec.**		0
6																					**2-Elec.**		0
7																					**2-Elec.**		0
8																					**2-Elec.**		0
9																					**2-Elec.**		0
10																					**2-Elec.**		0

Change sorting type

Total (directly electric) 0

Total (hydraulic and heat generator) 0

Data entries for duct sections between the ventilation unit and the thermal envelope

The duct sections between the ventilation unit and the thermal envelope should be as short as possible and should be well insulated, whether the ventilation unit is located indoors or outdoors. The dimensions of these duct sections can be entered here. The heat losses of the overlying duct sections will be considered for the effective heat recovery efficiency.
One section of a duct entered here may also be used for multiple ventilation units.
If in the section "Ventilation unit - selection" (above) a ventilation unit is selected as multiple units (amount larger than 1 for identical units), then the corresponding duct sections may simply be entered (duct sections for one ventilation unit).

Temperature of installation location (only enter when at least one unit is installed outside of the thermal envelope)

Quan-tity	Round duct ins. diameter mm	Rectangular duct Width mm	Height mm	Insulation thickness mm	Thermal conducti-vity W/(m K)	Reflective insulation duct (x)	Duct transmit-tance W/(m K)	Length of supply air duct m	Outdoor or supply air duct (1)	Exhaust or extract air duct (1)	Duct type	Design volume rate	Assignment to ventilation unit (enter 1 for the corresponding ventilation unit) Vent. unit 1	Vent. unit 2	Vent. unit 3	Vent. unit 4	Vent. unit 5	Vent. unit 6	Vent. unit 7	Vent. unit 8	Vent. unit 9	Vent. unit 10
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										
												0										

Additional lines: Please mark complete lines above, copy and paste multiple times

Specific energy for heating (annual method)

EnerPHit with PHPP Version 9.3

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Interior temperature: 20,0 °C
Building type: Block of flats
Treated floor area A_{TFA}: 3320,2 m²

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Temp. factor f_t		G_t kKh/a		kWh/a	Per m² of treated floor area
External wall - Ambient	A	2204,0	*	0,123	*	1,00	*	95,1	=	25774	7,76
External wall - Ground	B		*		*	0,23	*		=		
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	*	95,1	=	4930	1,48
Floor slab / Basement ceiling	B	484,0	*	1,402	*	0,23	*	95,1	=	14757	4,44
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
	X		*		*	0,75	*		=		
Windows	A	605,1	*	0,716	*	1,00	*	95,1	=	41198	12,41
Exterior door	A	2,0	*	5,000	*	1,00	*	95,1	=	951	0,29
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	*	95,1	=	0	0,00
Perimeter TB (length/m)	P		*		*	0,23	*		=		0,00
Ground TB (length/m)	B		*		*	0,23	*		=		0,00
Total of all building envelope areas		3779,1								kWh/a	kWh/(m²a)
Transmission heat losses Q_T									Total	87610	26,4

Ventilation system:

		A_{TFA} m²		Clear room height m		m³
Effective air volume, V_V		3320,2	*	2,50	=	8300,5
Effective heat recovery efficiency	η_{eff} 78%					
Efficiency of subsoil heat exchanger						
Heat recovery efficiency of SHX	η_{SHX} 0%					

	$n_{V,system}$ 1/h		η_{HR}		$n_{V,Res}$ 1/h		1/h
Energetically effective air changes nV	0,297	* (1 -	0,78	) +	0,053	=	0,117

	V_V m³		n_V 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a	kWh/(m²a)
Ventilation heat losses Q_V	8300,5	*	0,117	*	0,33	*	95,1	=	30527	9,2

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend Saving		kWh/a	kWh/(m²a)
Total heat losses Q_L	(87610	+	30527	)	1,0	=	118137	**35,6**

Orientation of the area	Reduction factor See 'Windows' sheet		g-Value (perp. radiation)		Area m²		Radiation HP kWh/(m²a)		kWh/a
North	0,49	*	0,47	*	116,45	*	131	=	3485
East	0,48	*	0,35	*	157,96	*	257	=	6869
South	0,40	*	0,42	*	118,94	*	421	=	8512
West	0,44	*	0,46	*	211,79	*	277	=	11816
Horizontal	0,00	*	0,00	*	0,00	*	346	=	0
Available solar heat gains Q_S								Total	30683

kWh/(m²a): 9,2

	kh/d		Length heating period d/a		Spec. power q_l W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0,024	*	233	*	2,70	*	3320,2	=	50192	15,1

		kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I =	80876	24,4
Ratio of free heat to losses	Q_F / Q_V =	0,68	
Utilisation factor heat gains h_G	$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6)$ =	95%	
Heat gains Q_G	η_G * Q_F =	76600	**23,1**

		kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G =	41537	**13**

	kWh/(m²a)	(Yes/No)
Limiting value	30	**Requirement met?** **Yes**

Specific energy for heating (monthly method)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

The sum of the heating periods calculated through the monthly method will be presented on this side.

Interior temperature:	20	°C
Building type:	Block of flats	
Treated floor area A_{TFA}:	3320,2	m²
Spec. Capacity:	204	Wh/(m²K)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Month. red. fac.		G_t kKh/a		kWh/a	Per m² of treated floor area
External wall - Ambient	A	2204,0	*	0,123	*	1,00	*	90	=	24477	7,37
External wall - Ground	B		*		*	1,00	*		=		
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	*	90	=	4681	1,41
Floor slab / Basement ceiling	B	484,0	*	1,402	*	1,00	*	20	=	13495	4,06
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
	X		*		*	0,75	*		=		
Windows	A	605,1	*	0,716	*	1,00	*	90	=	39124	11,78
Exterior door	A	2,0	*	5,000	*	1,00	*	90	=	903	0,27
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	*	90	=	0	0,00
Perimeter TB (length/m)	P		*		*	1,00	*		=		0,00
Ground TB (length/m)	B		*		*	1,00	*		=		0,00

		kWh/(m²a)
Transmission heat losses Q_T	Total 82680	24,9

Effective air volume V_V: A_{TFA} 3320 m² * Clear room height 2,50 m = 8301 m³

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR}		$n_{V,Res}$ 1/h		$n_{V,equi,fraction}$ 1/h
Effective air change rate Ambient nV,e	0,297	*(1-	0%	)*(1-	0,78	)+	0,053	=	0,117
Effective air change rate Ground nV,g	0,297	*	0%	*(1-	0,78	)		=	0,000

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)		G_t kKh/a	=	kWh/a	kWh/(m²a)
Ventilation losses ambient Q_V	8301	*	0,117	*	0,33	*	90	=	28990	8,7
Ventilation losses ground $Q_{V,e}$	8301	*	0,000	*	0,33	*	60	=	0	0,0
Ventilation heat losses Q_V								Total	28990	8,7

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend saving	=	kWh/a	kWh/(m²a)
Total heat losses Q_L	(82680	+	28990	) *	1,0	=	111670	**33,6**

Orientation of the area	Reduction factor see 'Windows' worksheet		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)	=	kWh/a
North	0,49	*	0,47	*	116,5	*	100	=	2663
East	0,48	*	0,35	*	158,0	*	198	=	5314
South	0,40	*	0,42	*	118,9	*	359	=	7261
West	0,44	*	0,46	*	211,8	*	223	=	9490
Horizontal	0,00	*	0,00	*	0,0	*	258	=	0
Sum opaque areas									787

		kWh/(m²a)
Available solar heat gains Q_S	Total 25515	7,7

	kh/d		Length Heat. Period d/a		Spec. Power q_I W/m²		A_{TFA} m²	=	kWh/a	kWh/(m²a)
Internal heat gains Q_I	0,024	*	212	*	2,7	*	3320,2	=	45652	13,7

		kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I =	71167	21,4
Ratio free heat to losses	Q_F / Q_L =	0,64	
Utilisation factor heat gains h_G	=	98%	
Heat gains Q_G	η_G * Q_F =	69822	**21,0**

		kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G =	41848	**13**

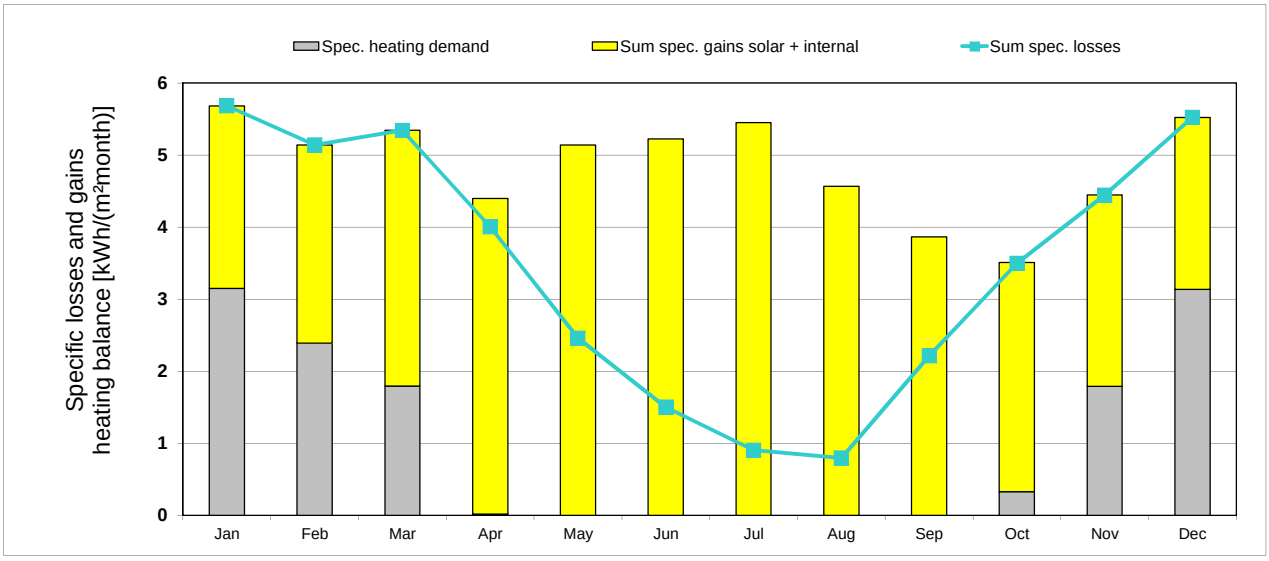
	kWh/(m²a)		(Yes/No)
Limiting value	30	**Requirement met?**	**Yes**

Specific energy for heating (monthly method)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Interior temperature: 20 °C
Building type: Block of flats
Treated floor area A_{TFA}: 3320 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - External	15,4	13,8	14,3	10,4	7,5	4,8	3,1	2,9	5,6	9,3	12,1	15,1	114	kKh
Heating degree hours - Ground	3,2	3,0	3,3	3,0	0,1	-0,3	-0,6	-0,7	1,9	2,2	2,4	2,9	20	kKh
Losses - Exterior	16712	15029	15513	11281	8100	5167	3390	3128	6073	10141	13115	16384	124033	kWh
Losses - Ground	2155	2037	2225	2007	66	-179	-387	-487	1277	1470	1647	1953	13784	kWh
Sum spec. losses	5,7	5,1	5,3	4,0	2,5	1,5	0,9	0,8	2,2	3,5	4,4	5,5	41,5	kWh/m²
Solar gains - North	156	317	609	948	1386	1715	1707	1158	644	346	183	104	9273	kWh
Solar gains - East	310	612	1005	1939	2623	2954	2897	2006	1378	799	428	221	17172	kWh
Solar gains - South	588	954	1336	1928	2109	2000	2156	1831	1684	1204	811	440	17042	kWh
Solar gains - West	634	1121	1997	3001	3921	3839	4269	3205	2468	1421	868	449	27193	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	51	94	161	260	346	379	391	284	198	117	68	36	2385	kWh
Internal heat gains	6675	6029	6675	6460	6675	6460	6675	6675	6460	6675	6460	6675	78598	kWh
Sum spec. gains solar + internal	2,5	2,7	3,5	4,4	5,1	5,2	5,5	4,6	3,9	3,2	2,7	2,4	45,7	kWh/m²
Utilisation factor	100%	100%	100%	91%	48%	29%	17%	17%	57%	100%	100%	100%	63%	
Annual heating demand	10452	7939	5956	57	0	0	0	0	0	1089	5944	10412	41848	kWh
Spec. heating demand	**3,1**	**2,4**	**1,8**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,3**	**1,8**	**3,1**	**12,6**	kWh/m²



Annual heating demand: Comparison

Monthly method	*('Heating')*	41848	kWh/a	12,6	**kWh/(m²a)** reference to treated floor area according to PHPP
Annual method	*('Annual heating')*	41537	kWh/a	12,5	**kWh/(m²a)** reference to treated floor area according to PHPP

Heating load

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Interior temperature: 20 °C
Building type: Block of flats
Treated floor area A_{TFA}: 3320,2 m²

	Design temperature		Radiation:	North	East	South	West	Horizontal	
Weather 1:	-12,2	°C		5	10	30	10	15	W/m²
Weather 2:	-9,5	°C		5	5	5	5	5	W/m²
Ground design temp.	15,5	°C							

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Factor always 1 (except "X")		TempDiff 1 K		TempDiff 2 K		PT 1 W		PT 2 W
External wall - Ambient	A	2204,0	*	0,123	*	1,00	*	32,2	or	29,5	=	8717	or	7985
External wall - Ground	B		*		*	1,00	*	4,5	or	4,5	=		or	
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	*	32,2	or	29,5	=	1667	or	1527
Floor slab / Basement ceiling	B	484,0	*	1,402	*	1,00	*	4,5	or	4,5	=	3031	or	3031
	A		*		*	1,00	*	32,2	or	29,5	=		or	
	A		*		*	1,00	*	32,2	or	29,5	=		or	
	X		*		*	0,75	*	32,2	or	29,5	=		or	
Windows	A	605,1	*	0,716	*	1,00	*	32,2	or	29,5	=	13934	or	12764
Exterior door	A	2,0	*	5,000	*	1,00	*	32,2	or	29,5	=	322	or	295
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	*	32,2	or	29,5	=	0	or	0
Perimeter TB (length/m)	P		*		*	1,00	*	4,5	or	4,5	=		or	
Ground TB (length/m)	B		*		*	1,00	*	4,5	or	4,5	=		or	
Building element towards neighbour	I		*		*	1,00	*	3,0	or	3,0	=		or	

Transmission heat load P_T

Total = 27671 or 25602

Ventilation system:

Effective air volume, V_V: A_{TFA} 3320,2 m² * Clear room height 2,50 m = 8301 m³

Heat recovery efficiency of the heat exchanger η_{HR} 78%
Heat recovery efficiency SHX 0% Heat recovery efficiency SHX $\eta_{SHX\ 1}$ 0% or $\eta_{SHX\ 2}$ 0%

		$n_{V,Res}$ (Heating Load) 1/h		$n_{V,system}$ 1/h		Φ_{HP}		Φ_{HP}		1/h		1/h
Energetically effective air changes	n_V	0,131	+	0,297	*(1-	0,78	or	0,78	) =	0,196	or	0,196

Ventilation heat load P_V

V_V m³		n_V 1/h		n_V 1/h		c_{Air} Wh/(m³K)		TempDiff 1 K		TempDiff 2 K		P_V 1 W		P_V 2 W
8300,5	*	0,196	or	0,196	*	0,33	*	32,2	or	29,5	=	17263	or	15814

Total heating load P_L

		PL 1 W		PL 2 W
$P_T + P_V$	=	44934	or	41416

Orientation of the area	Area m²		g-Value (perp. radiation)		Reduction factor (see 'Windows' worksheet)		Radiation 1 W/m²		Radiation 2 W/m²		P_T 1 W		P_T 2 W
North	116,5	*	0,5	*	0,49	*	5	or	5	=	132	or	133
East	158,0	*	0,4	*	0,48	*	11	or	5	=	306	or	134
South	118,9	*	0,4	*	0,40	*	27	or	5	=	552	or	101
West	211,8	*	0,5	*	0,44	*	12	or	5	=	516	or	213
Horizontal	0,0	*	0,0	*	0,40	*	15	or	5	=	0	or	0

Solar heating power P_S

Total = 1505 or 581

Internal heating load P_I

Spec. power W/m² 2,2 * A_{TFA} 3320 m² = P_I 1 7312 W or P_I 2 7312 W

Heating power (gains) P_G

		P_G 1 W		P_G 2 W
$P_T + P_I$	=	8817	or	7893

$P_L - P_G$	=	36116	or	33523
Heating load P_H	=	36116		W
Area specific space heating load P_H / A_{TFA}	=	10,9		W/m²

Input max. supply air temperature 52 °C
Max. supply air temperature $\vartheta_{Supply,Max}$ 52 °C

Supply air temperature without heating $\vartheta_{Supply,Min}$ 13,0 °C or 13,6 °C

For comparison: heating load transportable by the supply Air $P_{Supply\ Air,Max}$ = 31693 W specific: 9,5 W/m²

Supply air heating: Sufficient? (Yes/No) No

Summer ventilation

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building volume:	8301	m³	Building type:	Block of flats	
Max. indoor absolute humidity:	12	g/kg	Heat recovery η_{HRV}:	78%	
Internal humidity sources:	78,74673704	g/(P*h)	Energy recovery η_{ER}:	0%	
			Subsoil heat exchanger η^*_{SHX}:	0%	

Results passive cooling				Results active cooling		
Frequency of overheating:	1,4%	at the overheating limit ϑ_{max} = 25 °C	Useful cooling demand:	0,7	kWh/(m²a)
max. humidity:	12,0	g/kg	Dehumidification demand:	0,0	kWh/(m²a)
Frequency of exceeded humidity:	0,1%		Frequency of exceeded humidity:	0,2%	

Summer basic ventilation to ensure adequate air quality

Air change rate via vent. system with supply air:	0,50	1/h	HRV/ERV in summer (check only one field)	
			None	
			Automatic bypass, controlled by temperature difference	x
			Automatic bypass, controlled by enthalpy difference	
			Always	
Air change rate via extract air system:		1/h		
			Specific power consumption (for extract air system)	0,20 Wh/m³
Window ventilation air change rate:	0,10	1/h		

Effective air change rate

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HP}		$n_{V,equi,fraction}$ 1/h
Exterior $n_{V,e}$	0,500	*(1-	0%	)*(1-	0,78	) =	0,109
without HR	0,500	*(1-	0%	)		=	0,500
Ground $n_{L,g}$	0,500	*	0%	*(1-	0,78	) =	0,000
without HR	0,500	*	0%			=	0,000

Ventilation conductance

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)			
exterior $H_{V,e}$	8301	*	0,109	*	0,33	=	298,8	W/K
without HR	8301	*	0,500	*	0,33	=	1369,6	W/K
ground $H_{V,g}$	8301	*	0,000	*	0,33	=	0,0	W/K
without HR	8301	*	0,000	*	0,33	=	0,0	W/K
Infiltration, window, extract air system	8301	*	0,153	*	0,33	=	417,7	W/K

Additional summer ventilation for cooling

Additional ventilation regulation

Minimum acceptable indoor temp. 22,0 °C

Type of additional ventilation

Window night ventilation, manual	Night ventilation value	0,20	1/h	
Mechanical, automatically Controlled ventilation	Corresponding air change rate during operation, in addition to basic air change		1/h	Controlled by (please check)
	Specific power consumption		Wh/m³	Temperature diff.
				Humidity diff. x

Secondary calculation: Hygienic air change rate through window ventilation

Estimation for window air change rate to ensure sufficient air quality

Description								
	Open duration [h/d]							
Climate boundary conditions								
	Temperature diff interior - exterior							K
	Wind velocity							m/s
Window group 1								
	Quantity							
	Clear width							m
	Clear height							m
	Tilting window (check if appropriate)							
	Opening width (for tilting windows)							m
Window group 2 (cross ventilation)								
	Quantity							
	Clear width							m
	Clear height							m
	Tilting window (check if appropriate)							
	Opening width (for tilting windows)							m
	Difference in height to window 1							m
							Total	
Result: Air change rate		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**1/h**

Secondary calculation: Additional night ventilation for cooling

Air change value during additional window night ventilation

Description								
	Reduction factor							
Climate boundary conditions								
	Temperature diff interior - exterior	1	1	1	1	1	1	K
	Wind velocity	0	0	0	0	0	0	m/s
Window group 1								
	Quantity							
	Clear width							m
	Clear height							m
	Tilting window (check if appropriate)							
	Opening width (for tilting windows)							m
Window group 2 (cross ventilation)								
	Quantity							
	Clear width							m
	Clear height							m
	Tilting window (check if appropriate)							
	Opening width (for tilting windows)							m
	Difference in height to window 1							m
							Total	
Result: Night ventilation values		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**1/h**

Summer: Passive cooling

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type:	Block of flats		Treated floor area A_{TFA}:	3320,2	m²
Upper temperature limit:	25	°C	Building volume:	8301	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	2,0	g/(m²h)
Spec. capacity:	204	Wh/(m²K)			

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Red. factor $f_{T,Summer}$		H_{Summer} heat conductance
External wall - Ambient	A	2204,0	*	0,123	*	1,00	=	271,0
External wall - Ground	B		*		*	1,00	=	
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	=	51,8
Floor slab / Basement ceiling	B	484,0	*	1,402	*	1,00	=	678,6
	A		*		*	1,00	=	
	A		*		*	1,00	=	
	X		*		*	0,75	=	
Windows	A	605,1	*	0,716	*	1,00	=	433,2
Exterior door	A	2,0	*	5,000	*	1,00	=	10,0
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	=	0,0
Perimeter TB (length/m)	P		*		*	1,00	=	
Ground TB (length/m)	B		*		*	1,00	=	

Exterior thermal transmittance, $H_{T,e}$ 766,1 W/K

Ground thermal transmittance, $H_{T,g}$ 678,6 W/K

Summer ventilation

from 'SummVent' worksheet

Ventilation unit conductance

exterior $H_{V,e}$	298,8	W/K
without HR	1369,6	W/K
ground $H_{V,g}$	0,0	W/K
without HR	0,0	W/K

Ventilation conductance, others

exterior	417,7	W/K

Ventilation parameter

Temperature amplitude summer	8,2	K
Minimum acceptable indoor temperature	22,0	°C
Heat capacity air	0,33	Wh/(m³K)
Supply air changes	0,50	1/h
Outdoor air changes	0,15	1/h
Window night ventilation air change rate, manual @ 1K	0,20	1/h
Air change rate due to mech. automatically controlled vent.	0,00	1/h
Specific power consumption for	0,00	Wh/m³
η_{HR}	78%	
η_{ERV}	0%	
η^*_{SHX}	0%	

Summer ventilation regulation

	HRV/ERV
None	
Controlled by temperature	x
Controlled by enthalpy	
Always	
	Additional ventilation
Controlled by temperature	
Controlled by humidity	x

Orientation of the area	Angle factor Summer		Shading factor Summer		Shading dirt		g-Value (perp. radiation)		Area m²		Portion of glazing	=	**Aperture** m²
North	0,9	*	0,85	*	0,95	*	0,47	*	116,5	*	71%	=	28,1
East	0,9	*	0,85	*	0,95	*	0,35	*	158,0	*	71%	=	28,4
South	0,9	*	0,79	*	0,95	*	0,42	*	118,9	*	71%	=	23,8
West	0,9	*	0,88	*	0,95	*	0,46	*	211,8	*	71%	=	52,0
Horizontal	0,9	*	1,00	*	0,95	*	0,00	*	0,0	*	0%	=	0,0
Sum opaque areas													4,4

Solar aperture Total 136,6 m²/m² 0,04

Internal heat gains Q_I

Specif. power q_I W/m²		A_{TFA} m²	=	W	W/m²
4,2	*	3320	=	13789	4,2

Frequency of overheating $h_{\vartheta \geq Jmax}$ 1,4%

At the overheating limit ϑ_{max} = 25 °C

If the "frequency over 25°C" exceeds 10%, additional measures to protect against the heat during the summer are necessary.

Daily internal temperature stroke

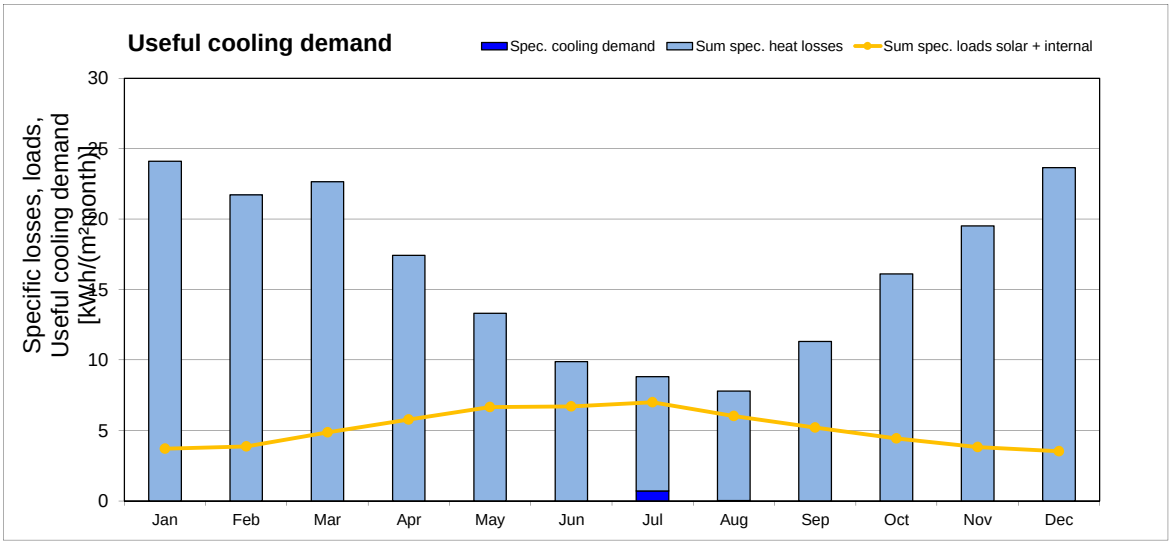
Transmission kWh/d		Ventilation kWh/d		Solar load kWh/d		1/k		Spec. capacity Wh/(m²K)		A_{TFA}: m²			
(75,4	+	236,5	+	444,7	) *	1000	/ (	204	*	3320	) =	1,1	K

Cooling: energy value for useful cooling energy

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Interior Temperature: 25 °C
Building type: Block of flats
Treated Floor Area A_{TFA}: 3320 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	19,1	17,2	18,0	14,0	11,2	8,4	6,9	6,7	9,2	13,1	15,7	18,8	159	kKh
Heating degree hours - Ground	6,9	6,4	7,0	6,6	3,8	3,3	3,1	3,0	5,5	5,9	6,0	6,6	64	kKh
Losses - Exterior	48527	43666	45691	35418	28242	21070	17204	16615	23242	33119	39785	47762	400340	kWh
Losses - Ground	4680	4317	4749	4450	2590	2264	2137	2037	3720	3995	4090	4477	43505	kWh
Losses summer ventilation	26836	24114	24791	17984	13392	9438	7563	7128	10642	16398	20924	26286	205495	kWh
Sum spec. heat losses	24,1	21,7	22,7	17,4	13,3	9,9	8,1	7,8	11,3	16,1	19,5	23,7	195,6	kWh/m²
Solar load North	166	336	644	1004	1468	1816	1807	1227	682	366	194	110	9819	kWh
Solar load East	328	648	1064	2053	2778	3129	3068	2125	1459	846	454	234	18185	kWh
Solar load South	693	1123	1574	2271	2485	2356	2540	2157	1984	1419	956	518	20076	kWh
Solar load West	773	1368	2435	3661	4783	4683	5208	3909	3010	1733	1059	547	33170	kWh
Solar load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Opaque	51	94	161	260	346	379	391	284	198	117	68	36	2385	kWh
Internal heat gains	10259	9266	10259	9928	10259	9928	10259	10259	9928	10259	9928	10259	120795	kWh
Sum spec. loads solar + internal	3,7	3,9	4,9	5,8	6,7	6,7	7,0	6,0	5,2	4,4	3,8	3,5	61,6	kWh/m²
Utilisation factor losses	15%	18%	21%	33%	50%	68%	78%	77%	46%	28%	20%	15%	31%	
Useful cooling energy demand	0	0	0	0	0	13	2366	69	0	0	0	0	2448	kWh
Spec. cooling demand	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,7**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,7**	kWh/m²
Specif. dehumidification demand	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%	100%	99%	



Cooling: energy value for useful cooling energy

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

The sum of the cooling periods calculated through the monthly method will be presented on this side.

Building type:	Block of flats		Treated floor area A_{TFA}:	3320,2	m²
Interior temperature summer:	25	°C	Building volume:	8301	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	2,0	g/(m²h)
Spec. capacity:	204	Wh/(m²K)			

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Mon. red. fac.		G_t kKh/a		kWh/a	per m² treated floor area
External wall - Ambient	A	2204,0	*	0,123	*	1,00	*	33	=	9001	2,71
External wall - Ground	B		*		*	1,00	*		=		
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	*	33	=	1722	0,52
Floor slab / Basement ceiling	B	484,0	*	1,402	*	1,00	*	13	=	9028	2,72
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
	X		*		*	0,75	*		=		
Windows	A	605,1	*	0,716	*	1,00	*	33	=	14388	4,33
Exterior door	A	2,0	*	5,000	*	1,00	*	33	=	332	0,10
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	*	33	=	0	0,00
Perimeter TB (length/m)	P		*		*	1,00	*		=		0,00
Ground TB (length/m)	B		*		*	1,00	*		=		0,00
										kWh/(m²a)	
Transmission losses Q_T (negative: heat loads)									Total	34470	10,4

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior $H_{V,e}$	298,8	W/K
without HR	1369,6	W/K
ground $H_{V,g}$	0,0	W/K
without HR	0,0	W/K

Ventilation conductance, others

exterior	417,7	W/K

Ventilation parameter

Temperature amplitude summer	8,2	K
Minimum acceptable indoor temperature	22,0	°C
Heat capacity air	0,33	Wh/(m³K)
Supply air changes	0,50	1/h
Outdoor air changes	0,15	1/h
Window night vent. air change rate, manual @ 1K	0,20	1/h
Air changes rate due to mech., autom. controlled vent.	0,00	1/h
Specific power consumption for	0,00	Wh/m³
η_{HR}	78%	
η_{ERV}	0%	
η^*_{SHX}	0%	

Summer ventilation regulation

	HRV/ERV in summer
None	
Controlled by temp.	x
Controlled by enthalpy	
Always	
	Additional ventilation
Controlled by temp.	
Controlled by humidity	x

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR} (considers bypass)		$n_{V,Rest}$ 1/h		$n_{V,equi,fraction}$ 1/h
Hygienic air change									
Effective air change rate Ambient $n_{V,e}$	0,500	*(1-	0%	)*(1-	0,00	)+	0,153	=	0,653
Effective air change rate Ground $n_{V,g}$	0,500	*	0%	*(1-	0,00	)		=	0,000

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a	kWh/(m²a)
Ventilation losses ambient Q_V	8301	*	0,653	*	0,33	*	32	=	57687	17,4
Ventilation losses ground $Q_{V,e}$	8301	*	0,000	*	0,33	*	0	=	0	0,0
Heat losses summer ventilation	8301	*	0,336	*	0,33	*	41	=	37520	11,3
Ventilation heat losses Q_V								Total	95208	28,7

	Q_T kWh/a		Q_V kWh/a		kWh/a	kWh/(m²a)
Total heat losses Q_L	34470	+	95208	=	129678	**39,1**

Orientation of the area	Reduction factor		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0,52	*	0,47	*	116,5	*	225	=	6317
East	0,51	*	0,35	*	158,0	*	391	=	11099
South	0,48	*	0,42	*	118,9	*	400	=	9538
West	0,54	*	0,46	*	211,8	*	358	=	18583
Horizontal	0,40	*	0,00	*	0,0	*	598	=	0
Sum opaque areas									1400
									kWh/(m²a)
Available solar heat gains Q_S								Total	46938	14,1

	kh/d		Length heat. period d/a		Spec. power q_I W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0,024	*	123	*	4,2	*	3320,2	=	40706	12,3

			kWh/a	kWh/(m²a)
Sum heat loads Q_F	Q_S + Q_I	=	87644	**26,4**

				kWh/(m²a)
Ratio of losses to free heat gains	Q_L / Q_F	=	1,48	
Utilisation factor heat losses η_G		=	66%	
Useful heat losses $Q_{V,n}$	η_G * Q_L	=	85195	**25,7**
Useful cooling demand Q_K	Q_F - $Q_{V,n}$	=	2448	**1**

	kWh/(m²*a)		(Yes/No)
Recommended maximum value	15	**Requirement met?**	**Yes**

Compressor - cooling units

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type:	Block of flats		Treated floor area A_{TFA}:	3320,2	m²
Interior temperature summer:	25,0	°C	Mechanical cooling:		
Nominal humidity:	12,0	g/kg	Air change rate via ventilation system with supply air:	0,5	
Internal humidity sources:	2,0	g/(m²h)			

Supply air cooling
check as appropriate

On/Off mode (check as appropriate)		
Max. cooling capacity (sensible + latent)		kW
Temperature reduction dry	0,0	K
Seasonal energy efficiency ratio		

Recirculation cooling
check as appropriate

On/Off mode (check as appropriate)		
Max. cooling capacity (sensible + latent)		kW
Volume flow rate at nominal power		m³/h
Temperature reduction dry		K
Variable air volume (check if appropriate)		
Seasonal energy efficiency ratio		

Additional dehumidification
check as appropriate

Waste heat to room (please check if applicable)	
Seasonal energy efficiency ratio	

Panel cooling
check as appropriate

Seasonal energy efficiency ratio	

	Sensible kWh/(m²a)		Latent kWh/(m²a)		COP		Electricity demand (kWh/a) kWh/(m²a)	Sensible fraction
Useful cooling total	0,7		0,0					99%
Cooling contribution by:								
Supply air cooling	(	+		) /	0,0	=		
Recirculation cooling	(	+		) /	0,0	=		
Dehumidification				/		=		0%
Remaining for panel cooling				/	0,0	=		100%
Cooling distribution				/		=		100%
Total	(0,0	+	0,0	) /		=	0,0	0%

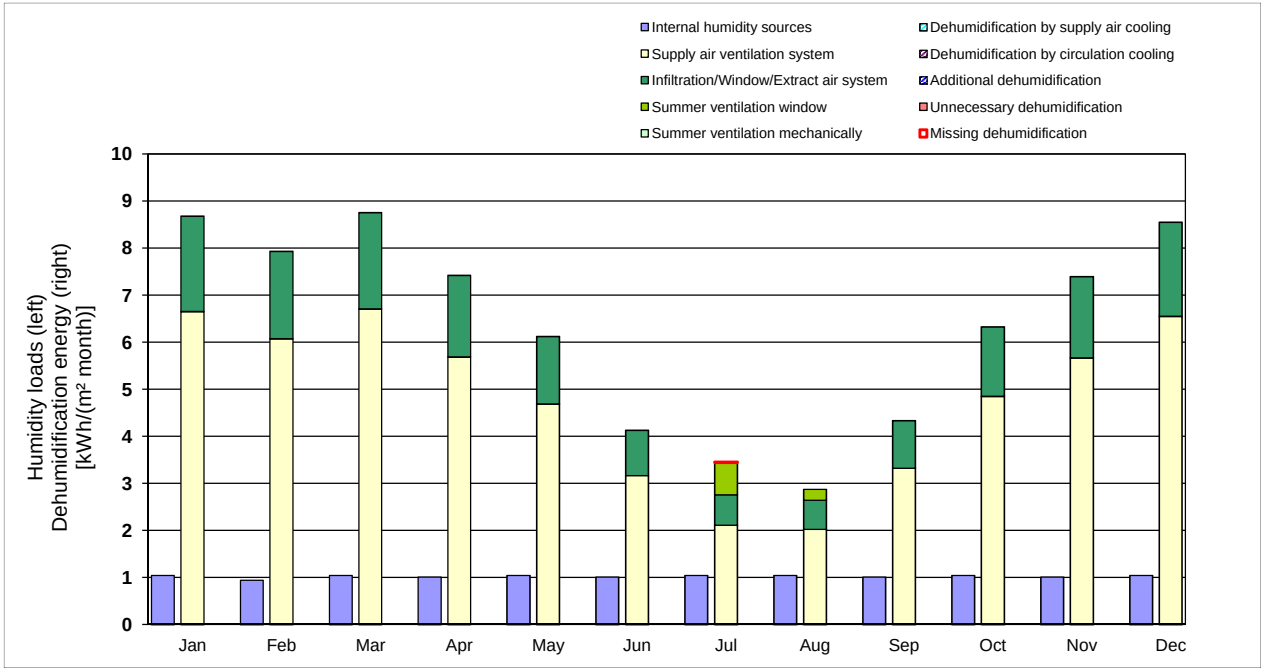
Unsatisfied demand		**Cooling demand covered?**	(Yes/No)

Compressor - cooling units

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Humidity loads and humidity removal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Internal humidity sources	1,0	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	12	kWh/m²
Infiltration/Window/Extract air system	-2,0	-1,9	-2,0	-1,7	-1,4	-1,0	-0,6	-0,6	-1,0	-1,5	-1,7	-2,0	-18	kWh/m²
Supply air ventilation system	-6,7	-6,1	-6,7	-5,7	-4,7	-3,2	-2,1	-2,0	-3,3	-4,8	-5,7	-6,6	-58	kWh/m²
Summer ventilation window	0,0	0,0	0,0	0,0	0,0	0,0	-0,7	-0,2	0,0	0,0	0,0	0,0	-1	kWh/m²
Summer ventilation mechanically	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Total humidity load	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Dehumidification by supply air cooling	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Dehumidification by circulation cooling	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Additional dehumidification	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Total dehumidification	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	
Unnecessary dehumidification	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²
Missing dehumidification	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0	kWh/m²



Cooling load

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type: **Block of flats**

Treated floor area A_{TFA}: **3320,2** m² | Building volume: **8301** m³ | Interior temperature: **25** °C

Spec. capacity: **204** Wh/(m²K) | Nominal humidity: **12,0** g/kg | Internal humidity sources: **2,0** g/kg

Temperature:	Outdoor air	Dew point	Sky
Weather 1:	23,0 °C	16,1 °C	13,3 °C
Weather 2:	23,0 °C	16,1 °C	16,1 °C
Ground design temp.	21,0 °C	SHX	8,1 °C

Radiation:	North	East	South	West	Horizontal	
	64	155	187	151	217	W/m²
	64	155	187	151	217	W/m²

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Factor always 1 (except "X")		TempDiff 1 K		TempDiff 2 K		P_T 1 W		P_T 2 W
External wall - Ambient	A	2204,0	*	0,123	*	1,00	*	-2,0	or	-2,0	=	-532	or	-532
External wall - Ground	B		*		*	1,00	*	-4,0	or	-4,0	=		or	
Roof/Ceiling - Ambient	A	484,0	*	0,107	*	1,00	*	-2,0	or	-2,0	=	-102	or	-102
Floor slab / Basement ceiling	B	484,0	*	1,402	*	1,00	*	-4,0	or	-4,0	=	-2738	or	-2738
	A		*		*	1,00	*	-2,0	or	-2,0	=		or	
	A		*		*	1,00	*	-2,0	or	-2,0	=		or	
	X		*		*	0,75	*	-2,0	or	-2,0	=		or	
Windows	A	605,1	*	0,716	*	1,00	*	-2,0	or	-2,0	=	-850	or	-850
Exterior door	A	2,0	*	5,000	*	1,00	*	-2,0	or	-2,0	=	-20	or	-20
Exterior TB (length/m)	A	208,0	*	0,000	*	1,00	*	-2,0	or	-2,0	=	0	or	0
Perimeter TB (length/m)	P		*		*	1,00	*	-4,0	or	-4,0	=		or	
Ground TB (length/m)	B		*		*	1,00	*	-4,0	or	-4,0	=		or	
Building element towards neighbour	I		*		*	1,00	*	3,0	or	3,0	=		or	
Radiation correction outdoor air				$L_{ambient}$ W/K		-28,2	*	-2,0	or	-2,0	=	55	or	55
Radiation correction sky				L_{Sky} W/K		26,4	*	-11,7	or	-8,9	=	-309	or	-235
Transmission heat load P_T										Total	=	**-4494**	or	**-4420**

Ventilation load	V_V m³		$n_{V,equi,fraction}$ 1/h		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)		TempDiff 1 K		TempDiff 2 K		P_V 1 W		P_V 2 W
Exterior $P_{V,e}$	8301	*	0,653	or	0,653	*	0,33	*	-2,0	or	-2,0	=	-3507	or	-3507
Ground $P_{L,e}$	8301	*	0,000	or	0,000	*	0,33	*	-16,9	or	-16,9	=	0	or	0
Summer ventilation $P_{L,S}$	8301	*	0,203	or	0,203	*	0,33	*	-4,6	or	-4,6	=	-2545	or	-2545
Ventilation heat load P_V												Total	**-6052**	or	**-6052**

Orientation of the area	Area m²		g-Value (perp. radiation)		Reduction factor (see 'Windows' worksheet)		Radiation 1 W/m²		Radiation 2 W/m²		P_T 1 W		P_T 2 W
North	116,5	*	0,5	*	0,52	*	66	or	66	=	1851	or	1851
East	158,0	*	0,4	*	0,51	*	149	or	149	=	4231	or	4231
South	118,9	*	0,4	*	0,48	*	186	or	186	=	4438	or	4438
West	211,8	*	0,5	*	0,54	*	144	or	144	=	7495	or	7495
Horizontal	0,0	*	0,0	*	0,40	*	217	or	217	=	0	or	0
Sum opaque areas											513	or	513
Solar load P_S										Total	**18528**	or	**18528**

Internal heating load P_I	Spec. power W/m²		A_{TFA} m²		P_I 1 W		P_I 2 W
	4,2	*	3320	=	**13789**	or	**13789**

$P_T + P_V + P_S + P_I$	=	**21771**	or	**21845**
Cooling load P_C	=		**21845**	**W**
Area specific cooling load P_C / A_{TFA}	=		**6,6**	**W/m²**

		°C		°C
Please enter the minimum supply air temperature. °C	Supply air temperature without cooling $\vartheta_{Supply,Min}$	**23,0**		**23,0**
		W		W
For comparison: cooling load, transportable through the supply air $P_{Supply;Max}$	=	**31552**		**31552**
		W/m²		W/m²
	specific:	9,5		9,5

Air conditioning over the supply air possible? (yes/no)

Daily internal temperature stroke

Transmission W		Ventilation W		Solar load W		Time h/d		Spec. capacity Wh/(m²K)		A_{TFA} m²		
(-4420,5	+	-6051,6	+	18527,7	) *	24	/ (	204	*	3320	) =	**0,3** K

Dehumidific. load

from 'Cooling' worksheet

Absolute humidity exterior air	11,4	or	11,4	g/kg	Absolute humid. supply air	11,4	or	11,4	g/kg
Outdoor air mass flow	1494	or	1494	kg/h	Supply air mass flow	4897	or	4897	kg/h
Summer vent. air mass flow	2094	or	2094	kg/h	**Humid. load, supply air**	-2734	or	-2734	g/h
Humidity load, outdoor air	-2003	or	-2003	g/h	**Humidity load, internal**	6572	or	6572	g/h

	Enthalpy of vaporisation Wh/kg		g/kg		Humidity load g/h		Humidity load g/h		P_D 1 W		P_D 2 W
	707,639	/	1000	*	1834	or	1834	=	**1298**	or	**1298**
Dehumidification load P_T								=		**1298**	**W**
Area specific dehumidification load P_T / A_{TFA}								=		**0,4**	**W/m²**

Monthly average values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Specific cooling demand	0,0	0,0	0,0	0,0	0,0	0,0	0,7	0,0	0,0	0,0	0,0	0,0	kWh/m²
Specific dehumidification demand	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	99%	100%	100%	100%	100%	100%	

Minimum of sensible cooling load fraction occurred **100%**

Heat distribution and domestic hot water (DHW) system

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Interior temperature:	20	°C	Interior temperature summer:	25	°C
Building type:	Block of flats				
Treated floor area A_{TFA}:	3320	m²			
Occupancy:	83,5	Pers			
Number of dwelling units:	40				
Annual heating demand $q_{Heating}$	41848	kWh/a	Annual useful cooling dem. q_{Cool}	2448	kWh/a
Length of heating period:	233	d	Length cooling period:	123	d
Average heating load P_{ave}:	7,5	kW	Average cooling load $P_{Average}$:	0,8	kW
Marginal usability of additional heat gains:	76%		Marginal utility of additional heat losses:	12%	

Space heat distribution

			Inside thermal envelope					Outside thermal envelope					Total values	
			1	2	3	4	5	1	2	3	4	5	Absolute	Specific
Length of distribution pipes	L_H	m	1800,0											
Nominal width of pipe		mm	32											
Insulation thickness		mm	25											
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)	0,040					50,000	50,000					
Heat loss coefficient per m of insulated pipe		W/(mK)	0,242											
Insulation quality of mountings, pipe suspensions, etc.		-	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None		
Thermal bridge supplement		W/K	272,000											
Total heating loss coefficient per m of pipe	Ψ	W/(mK)	0,393											
Temp. of the room through which the pipes pass	ϑ_x	°C	20	20	20	20	20							
Design forward flow temperature	ϑ_V	°C	55,0	55,0	55,0	55,0	55,0	55,0	55,0	55,0	55,0	55,0		
Design system heating load	$P_{heating}$	kW	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0	110,0		
Forward flow temperature control ('x' if applicable)			x	x	x	x	x	x	x	x	x	x		
Design return flow temperature	ϑ_R	°C	45,0											
Annual heat emission per m of plumbing	q^*_{HL}	kWh/(m·a)	9											
Possible utilisation factor of released heat	η_G	-	76%											
Annual heat losses of heating distribution	Q_{HL}	kWh/a	**3774**										kWh/a: **3774**	kWh/(m²a): **1,1**
Annual heat losses of heating storage		kWh/a											**0**	**0,0**
Annual heat losses of heating		kWh/a											**3774**	**1,1**
Performance ratio of heat distribution	$ea_{,HL}$	-											**109%**	

DHW useful heat

DHW demand for showers, per person and day (with 60°C)		litre/person/d	20,0
DHW demand others, per person and day (with 60°C)		litre/person/d	0,0
Performance of shower drain-water heat recovery		-	0%
Effective DHW demand	V_{DHW}	litre/person/d	20
Average cold water temperature of the supply	ϑ_{TW}	°C	8,1
DHW demand for washing machines and dishwashers non-elect		kWh/a	0
Effective useful heat DHW	Q_{DHW}	kWh/a	36645

kWh/a	kWh/(m²a)
36645	11,0

Auxiliary calculation - DHW demand calculation (for non-res)

Auxiliary calculation - shower drain-water heat recovery

DHW distribution

			Inside thermal envelope					Outside thermal envelope					Total values	
			1	2	3	4	5	1	2	3	4	5	Absolute	Specific
Temp. of room through which the pipes pass	ϑ_X	°C	20,0	20,0	20,0	20,0	20,0							
Design forward flow temperature	ϑ_{dist}	°C	**60,0**	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0	60,0		
DHW circulation pipes														
Length of circulation pipes (forward + return flow)	L_{HS}	m	**300,0**											
Nominal width of pipe		mm	**32**											
Insulation thickness		mm	**25**											
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)	**0,040**					**50,000**	**50,000**					
Heat loss coefficient per m of insulated pipe		W/(mK)	0,242											
Insulation quality of mountings, pipe suspensions, etc.		-	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**		
Thermal bridge supplement		W/K	47,000											
Total heating loss coefficient per m of pipe	Ψ	W/(mK)	**0,399**											
Daily circulation period of operation.	td_{Circ}	h/d	**24,0**											
Design return flow temperature	ϑ_R	°C	55											
Circulation period of operation per year	t_{Circ}	h/a	8760											
Annual heat released per m of pipe	q^*_Z	kWh/m/a	131											
Annual heat loss from circulation lines	QZ	kWh/a	**39308**										kWh/a **39308**	kWh/(m²a) **11,8**
DHW individual pipes														
Exterior pipe diameter	d_{U_Pipe}	m	**0,015**											
Accumulated length per single pipes	L_U	m	**5,00**											
Amount of tapping points in building	$n_{tapping\ point}$	-	**135,00**											
Average pipe length per tapping point	$L_{U,\ average}$	m	0,0											
Tap openings per person per day		-	**3**											
Utilisation days per year		d	**365**											
Heat loss per tap opening	$q_{Individual}$	kWh/tap opening	0,0002											
Amount of tap openings per year and person	n_{Tap}	Tap openings per year	1095											
Annual heat loss of individual pipes	Q_U	kWh/a	**20**										kWh/a **20**	kWh/(m²a) **0,0**
Total heat losses of DHW distribution	Q_{WL}												kWh/a **39328**	kWh/(m²a) **11,8**
Performance ratio of DHW distribution pipes	ea_{+HL}	-											**207%**	

Storage heat losses

		Storage 1	Storage 2	Buffer storage tank (only heating)	Compact unit		
Selection of storage tank		0-No storage tank	0-No storage tank	0-No storage tank	0-No		
Storage necessary for HP							
Solar DHW connection							
Heat loss rate	W/K		3,0				
Storage volume	litre				---		
Standby fraction	-						
Location of storage tank, inside or outside of thermal envelope		2-Outside	1-Inside	2-Outside			
Temperature of mechanical room	°C						
Typical storage tank temperature	°C						
Manual entry of storage temperature	°C						
Average standby heat losses storage tank	W						
Additional heat losses storage tank, solar operation	W			---	---		
Possibly utilisation factor of heat losses		---	---		---		
Annual heat losses DHW storage tank	kWh/a			---		kWh/a	kWh/(m²a)
						0	0,0
Annual heat losses buffer storage tank		---	---		---		

Auxiliary calculation - heat losses through storage tank according to EU efficiency classes

Total energy demand of domestic hot water

		kWh/a	kWh/(m²a)
Heat losses of DHW distribution and storage	Q_{WL}	39328	11,8
Performance ratio DHW-distribution + storage	$e_{a,WL}$	207%	
Total heating demand of DHW system		kWh/a	kWh/(m²a)
Including storage tank	Q_{gDHW}	75973	22,9

Cooling distribution

			Inside thermal envelope					Outside thermal envelope					Total values	
			1	2	3	4	5	1	2	3	4	5	Absolute	Specific
Length of distribution pipes	L_H	m												
Nominal width of pipe		mm												
Insulation thickness		mm												
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient per m pipe	Ψ	W/(mK)												
Temp. of room through which the pipes pass	ϑ_X	°C	25,0	25,0	25,0	25,0	25,0	**25,0**	25,0	25,0	25,0	25,0		
Design forward flow temperature	ϑ_V	°C	**6,0**	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0		
Dimensioning of cooling load of the system	$P_{heating}$	kW												
Forward flow temperature control ('x' if applicable)														
Design return flow temperature	ϑ_R	°C												
Annual heat absorption per m of pipe	q^*_{HL}	kWh/(m·a)												
Possibly utilisation factor of this heat absorption	η_G	-												
Annual heat losses of cooling distribution	Q_{HL}	kWh/a											kWh/a **0**	kWh/(m²a) **0,0**
Performance ratio cold water distribution pipes	$ea_{,HL}$	-											**100%**	

Solar thermal system

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type:	Block of flats	
Treated floor area A_{TFA}:	3320,2	m²
Projected building footprint $A_{Projected}$:	511,0	m²
Latitude *('Climate' worksheet)*	57,8	°
DHW demand *('DHW+Distribution')*	75973	kWh/a
Heating demand ('Heating' and 'DHW+Distribution' worksheets)	45622	kWh/a
Occupancy	83,5	Persons

Location: Selection in 'Areas' worksheet		
Size of selected area		m²
Free area (less solar thermal and electrical systems)		m²
Deviation from North		°
Angle of inclination from the horizontal		°
Alternative input: Deviation from North		°
Alternative input: Angle of inclination from the horizontal		°

Collector		
Heating support (please check, if applicable)		
DHW priority (check if appropriate)	x	

Solar collector area			m²
Specific collector area		0,0	m²/Pers
Height of the collector field			m
Height of horizon	h_{Hori}		m
Horizontal distance	a_{Hori}		m
Additional reduction factor shading	r_{other}		

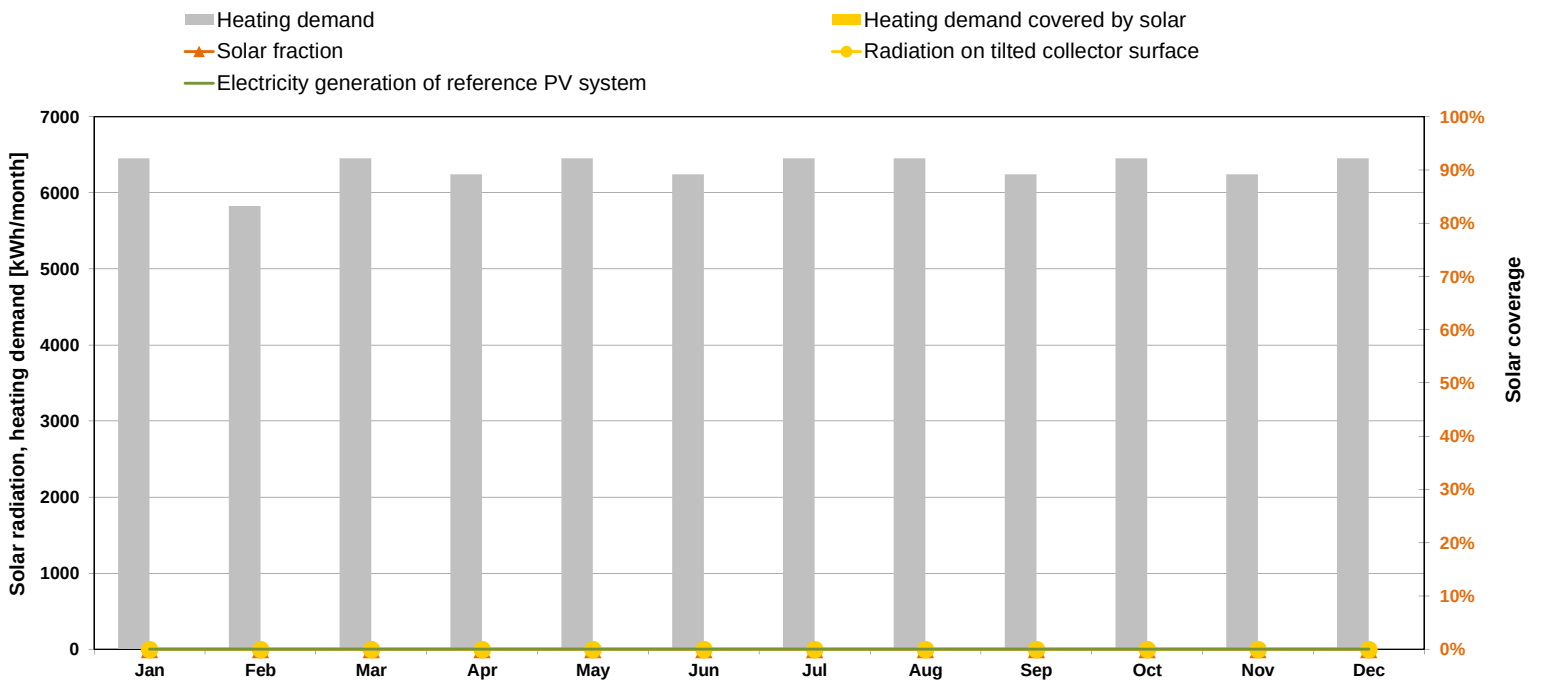
Results

	Projected building footprint area	Absolute
	kWh/($m^2_{Projected}$*a)	kWh/a
Solar contribution total	**0%**	**0,0**	**0**
Solar contribution to DHW	**0%**	**0,0**	**0**
Solar contribution to space heating	**0%**	**0,0**	**0**

Determination of PER factors

Yield reference PV syst. kWh_{el}/a	PER_{el} $kWh_{prim-el}/kWh_{el}$	**$PER_{sol.therm}$** $\frac{kWh_{el}}{kWh_{th}*kWh_{prime}/kWh_{el}}$
	1,25	
	1,55	

		$kgCO_2eq/m^2_{Projected}$*a	$kgCO_2eq/a$
1-CO2 factors GEMIS (Germany)	kgCO2eq/kWhFinal		



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating demand DHW-preparation	6453	5828	6453	6244	6453	6244	6453	6453	6244	6453	6244	6453	75973	kWh/month
Space heating demand	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heating demand	6453	5828	6453	6244	6453	6244	6453	6453	6244	6453	6244	6453	75973	kWh/month
Radiation on tilted collector surface	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Please enter: Solar production for DHW													0	kWh/month
Please enter: Solar production for heating													0	kWh/month
DHW heating demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Space heating demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heating demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Solar fraction	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-
Electricity generation of reference PV system														kWh/month

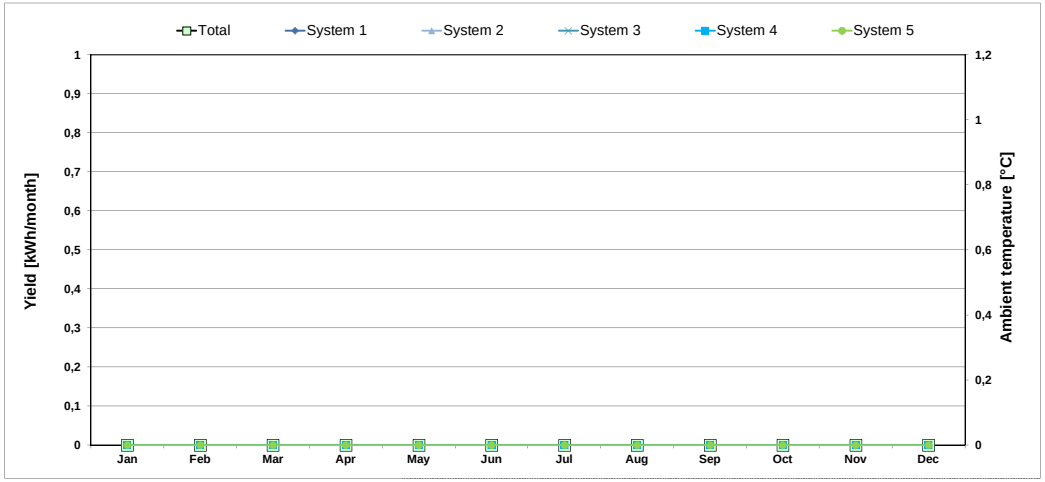
Photovoltaic systems

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Climate data set: SE0003a-Göteborg
Building type: Block of flats
Projected building footprint: 511,0 m²

		System 1	System 2	System 3	System 4	System 5	Reference PV syst.	
Name of system								
Location: Selection in 'Areas' worksheet								
Size of selected area								m²
Deviation from North								°
Angle of inclination from horizontal								°
Alternative input: Deviation from North								°
Alternative input: Angle of inclination from the horizontal								°
Information from the module data sheet								
Technology		5-Poly-Si	5-Poly-Si	5-Poly-Si	5-Poly-Si	5-Poly-Si	4-Mono-Si	
Nominal current	I_{MPPO}						7,71	A
Nominal voltage	U_{MPPO}						30,50	V
Nominal power	P_n	0	0	0	0	0	235	Wp
Temperature coefficient short-circuit current	α						0,040	%/K
Temperature coefficient open-circuit voltage	β						-0,340	%/K
Module dimensions: Height							1,658	m
Module dimensions: Width							0,994	m
							1,6	Module area [m²]
Further specifications								
Number of modules	n_M						0,0	
Height of module array								m
Height of horizon	h_{Hori}							m
Horizontal distance	a_{Hori}							m
Additional reduction factor shading	r_{other}							
Efficiency of the inverter	η_{HRV}						95%	
Results								
Area of module field		0,0	0,0	0,0	0,0	0,0	0,0	m²
Free area on the selected building element								m²
Allocation to building element								
Annual losses due to shading								kWh

	Total	
Annual electricity yield of the inverter, absolute	0	kWh/a
Related to projected building footprint area	0	kWh/m²A_{Proje}
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)	0,0	kg/a
PE-factor according to 1-PE-factors (non-renewable) PHI Certification	#DIV/0!	kWh_{prim}/kWh_f



Electricity demand for residential buildings

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Households	40
Persons	83,5
Living area (m²)	3320
Heating demand [kWh/(m²a)]	12,6

PER and PE factors (KWh/kWh)		
Electricity:	1,25	2,6
Non-electric energy carrier for cooking, drying:	1,25	2,6
Energy carrier for heating:	0,80	1,0
Energy carrier for DHW:	0,83	0,7

Solar fraction of DHW Laundry&Dish	
Marginal performance ratio DHW	0%
Marginal performance ratio Heating	0%

Column no.	1	2	3				4		5		6		7		8	8a		9		10		11		12		13
Application	Used ? (1/0)	Within the thermal envelope? (1/0)	Norm demand				Utilisation factor		Frequency		Reference quantity		Useful energy (kWh/a)		Electric fraction	Non-electric fraction		**Electricity demand (kWh/a)**		Additional demand		Marginal performance ratio		Solar fraction		Non-electric demand (kWh/a)
Dishwashing	1	1	1,10	kWh/Use		*	1,00	*	65	/(P*a)	* 83,5	P =	5967	*	100%		=	**5967**								
2-Cold water connection														*		0%			* (1+	0,30	) *	0,00	*(1-		) =	
Clothes washing	1	1	1,10	kWh/Use		*	1,00	*	57	/(P*a)	* 83,5	P =	5233	*	100%		=	**5233**								
2-Cold water connection														*		0%			* (1+	0,05	) *	0,00	*(1-		) =	
Clothes drying with:	1	1	3,50	kWh/Use	Residual dampness	*	0,88	*	57	/(P*a)	* 83,5	P =	14568		100%		=	**14568**								
4-Condensation dryer					0,60							=	0			0%						1,00	*			**0**
Energy consumed by evaporation	0	1	3,13	kWh/Use		*	0,60	*	57	/(P*a)	* 83,5	P =	0	*		100%			* (1+	0,00	) *	0,00	*(1-	0,68	) =	**0**
Refrigerating	1	1	0,78	kWh/d		*	1,00	*	365	d/a	* 40	HH =	11388	*	100%		=	**11388**								
Freezing	1	1	0,88	kWh/d		*	1,00	*	365	d/a	* 40	HH =	12848	*	100%		=	**12848**								
or combination	0	1	1,00	kWh/d		*	1,00	*	365	d/a	* 40	HH =	0	*	100%		=	**0**								
Cooking with:	1	1	0,25	kWh/Use		*	1,00	*	500	/(P*a)	* 83,5	P =	10432	*	100%		=	**10432**								
1-Electricity					Average lamp efficiency [lm/W]									*		0%										**0**
Lighting	1	1	60	W	12	*	1,00	*	2,90	kh/(P*a	* 83,5	P =	14521	*	100%		=	**14521**								
Consumer electronics	1	1	80	W		*	1,00	*	0,55	kh/(P*a	* 83,5	P =	3672	*	100%		=	**3672**								
Small appliances, etc.	1	1	50	kWh		*	1,00	*	1,00	/(P*a)	* 83,5	P =	4173	*	100%		=	**4173**								
Total aux. electricity													14913					14913								
Other:																										
				kWh/a									0					**0**								
				kWh/a									0					**0**								
				kWh/a									0					**0**								
Total													97715	kWh				**97715**	kWh			DHW Non-Electric - Wash&Dish **0**			kWh	**0**
Specific demand																		**29,4**	kWh/(m²a)			Non-Renewable Non-Electric DHW Wash&Dish **0,0**			kWh/(m²a)	**0,0**
Recommended maximum value																		18								

Use non-residential buildings

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Latitude [°]: 58

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	27
	Utilisation pattern			Begin utilisation [h]	End utilisation [h]	Daily utilisation hours [h/d]	Annual utilisation days [d/a]	Annual utilisation hours [h/a]	Annual utilisation hours during daytime [h/a]	Annual utilisation hours during night-time [h/a]	Daily operating hours of heating	Daily operating hours of ventilation	Lighting	Illumination level [lux]	Height of utilisation level (0.8 or 0.0 m)	Height of utilisation level (0.8 or 0.0 m)	Relative absenteeism	Part use factor of building operating period for lighting	Average occupancy [m²/Pers.]
1						0		0	0	0	2	2				0,8			
2						0		0	0	0	2	2				0,8			
3						0		0	0	0	2	2				0,8			
4						0		0	0	0	2	2				0,8			
5						0		0	0	0	2	2				0,8			
6						0		0	0	0	2	2				0,8			
7						0		0	0	0	2	2				0,8			
8						0		0	0	0	2	2				0,8			
9						0		0	0	0	2	2				0,8			
10						0		0	0	0	2	2				0,8			
11						0		0	0	0	2	2				0,8			
12						0		0	0	0	2	2				0,8			
13						0		0	0	0	2	2				0,8			
14						0		0	0	0	2	2				0,8			
15						0		0	0	0	2	2				0,8			
16						0		0	0	0	2	2				0,8			
17						0		0	0	0	2	2				0,8			
18						0		0	0	0	2	2				0,8			
19						0		0	0	0	2	2				0,8			
20						0		0	0	0	2	2				0,8			
21	Single office			7	18	11	250	2750	2543	207	13			500	0,8	0,8	0,30	0,70	10,00
22	Group office			7	18	11	250	2750	2543	207	13			500	0,8	0,8	0,30	0,70	
23	Open-plan office			7	18	11	250	2750	2543	207	13			500	0,8	0,8	0,00	1,00	15,00
24	Meeting			7	18	11	250	2750	2543	207	13			500	0,8	0,8	0,50	1,00	2,00
25	Counter area			7	18	11	250	2750	2543	207	13			200	0,8	0,8	0,00	1,00	
26	Retail			8	20	12	300	3600	2999	601	14			300	0,8	0,8	0,00	1,00	7,00
27	Classroom			8	15	7	200	1400	1398	2	9			300	0,8	0,8	0,25	0,90	2,00
28	University auditorium			8	18	10	150	1500	1409	91	12			500	0,8	0,8	0,25	0,70	0,75
29	Bedroom			0	24	24	365	8760	4407	4353	24			300	0,8	0,8	0,00	0,50	
30	Hotel room			21	8	11	365	4015	755	3260	24			200	0,8	0,8	0,25	0,30	
31	Canteen			8	15	7	250	1750	1748	2	9			200	0,8	0,8	0,00	1,00	
32	Restaurant			10	0	14	300	4200	2404	1796	16			200	0,8	0,8	0,00	1,00	1,50
33	Kitchen non-residential			10	23	13	300	3900	2404	1496	15			500	0,8	0,8	0,00	1,00	
34	Kitchen, Storage, Preparation			7	23	16	300	3900	2404	1496	15			300	0,8	0,8	0,50	1,00	
35	WC, Sanitary			7	18	11	250	2750	2543	207	13			200	0,8	0,8	0,90	1,00	
36	Other habitable rooms			7	18	11	250	2750	2543	207	13			300	0,8	0,8	0,50	1,00	
37	Secondary areas			7	18	11	250	2750	2543	207	13			100	0,8	0,8	0,90	1,00	
38	Circulation area			7	18	11	250	2750	2543	207	13			100	0,0	0,0	0,80	1,00	
39	Storage, Services			7	18	11	250	2750	2543	207	13			100	0,8	0,8	0,98	1,00	
40	Server room			0	24	24	365	8760	4407	4353	24			500	0,8	0,8	0,50	0,50	
41	Workshop			7	16	9	250	2250	2192	58	11			500	0,8	0,8	0,00	1,00	
42	Theatre auditorium			19	23	4	250	1001	55	946	6			200	0,8	0,8	0,00	1,00	
43	Theatre foyer			19	23	4	250	1001	55	946	6			300	0,8	0,8	0,50	1,00	
44	Theatre stage			13	23	10	250	2500	1253	1247	12			1000	0,8	0,8	0,00	0,60	
45	Fair, Congress			13	18	5	150	1350	1260	90	11			300	0,8	0,8	0,50	1,00	
46	Exhibition			10	18	8	250	2001	1850	151	24			200	0,8	0,8	0,00	1,00	
47	Library reading room			8	20	12	300	3600	2999	601	14			500	0,8	0,8	0,00	1,00	
48	Open access library			8	20	12	300	3600	2999	601	14			200	0,8	0,8	0,00	1,00	
49	Library repository			8	20	12	300	3600	2999	601	14			100	0,8	0,8	0,90	1,00	
50	Gymnasium			8	23	15	300	4500	3002	1498	17			300	0,8	0,8	0,30	1,00	
51	Parking garage			7	18	11	250	2750	2543	207	0			75	0,0	0,0	0,95	1,00	
52	Public parking garage			9	0	15	365	5475	3290	2185	0			75	0,0	0,0	0,80	1,00	

Electricity demand for non-residential buildings (at the moment this worksheet is inactive. Calculation takes place in the 'Electricity' worksheet).

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Treated floor area A_{TFA}:	3320,2	m²		
Auxiliary electricity demand:	14913,2	kWh/a		
	PER factors:	**PE factors:**		
Electricity:	1,25	2,6	kWh/kWh	
RE gas / Natural gas:	1,75	1,1	kWh/kWh	
Energy carrier for DHW:		1,1	kWh/kWh	
Solar fraction of DHW	0%			
Marginal performance ratio DHW:				

Window properties (from 'Windows' worksheet):

	Shading	Dirt factor	Non-perpendicular radiation	Glazing fraction
North	0,85	0,95	0,85	0,71
East	0,85			0,71
South	0,71			0,71
West	0,77			0,71

Lighting / non-residential	Net ground area	Room category	Power of nominal lighting	Facade with windows: Deviation from North	Orientation	Light transmission glazing	Window existing?	Geometry: input of a typical room: Room depth	Room width	Room height	Lintel height	Window width
Room / Zone	m²		Lux	Degrees		-	[x]	m	m	m	m	m
			15									
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						
						69%						

Daylight utilisation	User data: Installed lighting power	Installed lighting power (standard)	Lighting control	Motion detector used?	Lighting check		Utilisation hours per year	User determined: Lighting full load hours	**Full load hours of lighting**	**Electricity demand (kWh/a)**	**Spec. electricity demand (kWh/(m²a))**
	W/m²	W/m²		[x]			h/a	h/a	h/a	kWh/a	kWh/(m²a)
							9				
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					
None		0,0	1	0	Manual	Without motion detector					

Office equipment	Room category	Within the thermal envelope [1/0]	Existing [1/0]		Quantity		Power consumption [W]		Utilisation hours per year [h/a]		Relative absenteeism			Duration of utilisation in energy saving mode [h/a]		Useful energy (kWh/a)		Electricity demand [kWh/a]
	2								9	20	18							
PC 1		1	0	*		*	80	* (	0	* (1-	0	)			=	0	=	0,0
PC in energy saving mode		1			0	*	2,0	*	0	*	0				=	0	=	0,0
Monitor 1		1	0	*		*	28	* (	0	* (1-	0	)			=	0	=	0,0
Monitor in energy saving mode		1			0	*	2,0	*	0	*	0				=	0	=	0,0
PC 2		1	0	*		*	80	* (	0	* (1-	0	)			=	0	=	0,0
PC in energy saving mode		1			0	*	2,0	*	0	*	0				=	0	=	0,0
Monitor 2		1	0	*		*	28	* (	0	* (1-	0	)			=	0	=	0,0
Monitor in energy saving mode		1			0	*	2,0	*	0	*	0				=	0	=	0,0
Copier		1	0	*		*	400	* (	0				-	0	) =	0	=	0,0
Copier in energy saving mode		1			0	*	30	*	0						=	0	=	0,0
Printer		1	0	*		*	300	* (	0				-	0	) =	0	=	0,0
Printer in energy saving mode		1			0	*	2	*	0						=	0	=	0,0
Server		1	0	*		*	100	* (	0						=	0	=	0,0
Server in energy saving mode		1			0	*	2,0	* (	8760				-	0	) =	0	=	0,0
Telephone system		1	0	*		*	94	*	8760						=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0
				*		*		*							=	0	=	0,0

Kitchen / Aux. electricity	Room category (predominant utilisation pattern of building)	Within the thermal envelope [1/0]	Existing [1/0]		Utilisation hours per year [h/a]		Number of meals per day of use		Norm consumption		Useful energy [kWh/a]		Non-electric fraction	Electric fraction		Additional demand		Marginal performance ratio		Solar fraction		Non-electric demand (kWh/a)	Electricity demand [kWh/a]
					8				kWh / Meal														
Cooking:		1	0	*	0	*		*	0,25	=	0	*		0%							=		0,0
Electricity									kWh / Cover			*	0%								=	0	
Dishwashing		1	0	*	0	*	0	*	0,10	=	0	*		55%							=		0,0
Cold water connection									kWh/d			*	0%		* (1+	0,30	) *	1,20	*(1-	0,00	) =	0	
Refrigerating		1	0		365					=	0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
											0	*		100%							=		0,0
Total auxiliary electricity											14913												14913,2

	Useful energy		Hot water non-electric dishwashing	Non-electric demand	Electricity demand		
Total	14913	kWh	0	0,0	14913	kWh/a	kW
Specific demand			0,0	0,0	4	kWh/(m²a)	kW

Aux Electricity

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Treated floor area	3320	m²
Heating period	233	d
Air volume	8301	m³
Dwelling units	40	HH

Heat recovery efficiency ventilation unit	0,78	
Operation vent. system Winter	5,59	kh/a
Operation vent. system Summer	3,17	kh/a
Air change rate	0,30	h^{-1}

Annual space heating demand	13	kWh/(m²a)
Boiler rated power	36	kW
DHW system heating demand	75973	kWh/a
Design forward flow temperature	55	°C

Column no.	1	2	3		4		5		6		7		8		9		10	11
Application	Existing [1/0]	Within the thermal envelope [1/0]	Norm demand		Utilisation factor		Period of operation		Reference size		Electricity demand [kWh/a]		Available as interior heat		Utilisation period [h/a]		Internal heat gains winter [W]	Internal heat gains summer [W]
Ventilation system																		
Winter ventilation	1		0,45	Wh/m³	* 0,30	h^{-1} *	5,6	kh/a *	8301	m³ =	**6196**		considered in heat recovery efficiency					
Defroster HX	0	1	Data entries in 'Ventilation' worksheet or in 'Addl vent'								**0**	*	0,2	/	5,59	=	**0**	
Summer ventilation	1	1,00	0,45	Wh/m³	* 0,50	h^{-1} *	3,2	kh/a *	8301	m³ =	**5913**	*	1,0	/	3,17	=		**1868**
																	Internal heat sources ' Additional summer ventilation'	0,0
Additional vent. summer	0		0,00	Wh/m³	* 0,00	h^{-1} *	3,2	kh/a *	8301	m³ =	**0**	*	1,0	/	3,17	=		
Heating system					Controlled / non controlled													
Enter the rated power of the pump				W	0													
Circulator pump heating	1	1	412	W	* 1,0	*	5,6	kh/a *	1	=	**2304**	*	1,0	/	5,59	=	**412**	
Boiler electricity consumption at 30% load				W														
Aux. energy - Heat. boiler	0	0	84	W	* 1,00	*	0,00	kh/a *	1	=	**0**	*	1,0	/	5,59	=	**0**	
Aux. energy - Wood fired/Pellet boiler	0	0	Data entries in 'Boiler' worksheet. Aux. energy demand including possible drinking water production.								**0**	*	1,0	/	5,59	=	**0**	
DHW system																		
Enter average power consumption of pump				W														
Circulation pump DHW	1	1	62	W	* 1,00	*	8,1	kh/a *	1	=	**500**	*	1,0	/	8,76	=	**57**	**57**
Enter the rated power of the pump				W														
Storage load pump DHW			299	W	* 1,00	*	2,1	kh/a *	1	=	**0**	*	1,0	/	8,76	=	**0**	**0**
Boiler electricity consumption at 100% load				W														
DHW boiler aux. energy	0	0	251	W	* 1,00	*	0,0	kh/a *	1	=	**0**	*	1,0	/	8,76	=	**0**	**0**
Enter the rated power of the solar DHW pump				W														
Solar aux. electricity	0		246	W	* 1,00	*	1,8	kh/a *	1	=	**0**	*	1,0	/	8,76	=	**0**	**0**
Aux. electricity cooling and dehumidification																		
Aux. electricity cooling				kWh/a	* 1,00	*	1,0	*	40	=	**0**	*	1,0	/	3,17	=		**0**
Aux. electricity dehum.				kWh/a	* 1,00	*	1,0	*	40	=	**0**	*	1,0	/	3,17	=		**0**
Misc. aux. electricity																		
Misc. aux. electricity				kWh/a	* 1,00	*	1,0	*	40	=	**0**	*	1,0	/	8,76	=	**0**	**0**
Total											**14913**						**469**	**1925**
Specific demand	kWh/(m²a) (treated floor area)										**4,5**							

Internal heat gains for residential buildings (at the moment this worksheet is inactive)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Utilisation: 10-Dwelling

Type of values used: 2-Standard

IHG heating 2,70 W/m²

IHG cooling 4,15 W/m²

No input is necessary

Go to utilisation pattern selection

Persons	83,5	P
Living area	3320	m²

Heating demand	13	kWh/(m²a)
Heating period	233	d/a

Application	Existing [1/0] or occupancy	Within the thermal envelope [1/0]	Norm consumption		Utilisation factor	Frequency		Useful energy [kWh/a]		Included in electricity balance?		Availability		Utilisation period [h/a]		Internal heat gains [W]
Dishwashing	1	1	1,1	kWh/Use	1,00	65	/(P*a)	5967	*			0,30	/	8,76	=	204
Clothes washing	1	1	1,1	kWh/Use	1,00	57	/(P*a)	5233	*			0,30	/	8,76	=	179
Clothes drying with:	1	1	3,5	kWh/Use	0,88	57	/(P*a)	14568	*			0,70	/	8,76	=	1164
4-Condensation dryer		1	0,0					0				0,80				
Energy consumed by evaporation	0	1	-3,1	kWh/Use	0,60	57	/(P*a)	0	* (1-	0	) *	0,00	/	8,76	=	0
Refrigerating	1	1	0,8	kWh/d	1,00	365	d/a	11388	*			1,00	/	8,76	=	1300
Freezing	1	1	0,9	kWh/d	1,00	365	d/a	12848	*			1,00	/	8,76	=	1467
or combination	0	1	1,0	kWh/d	1,00	365	d/a	0	*			1,00	/	8,76	=	0
Cooking	1	1	0,3	kWh/Use	1,00	500	/(P*a)	10432	*			0,50	/	8,76	=	595
Lighting	1	1	60,0	W	1,00	2,9	kh/(P*a)	14521	*			1,00	/	8,76	=	1658
Consumer electronics	1	1	80,0	W	1,00	0,55	kh/(P*a)	3672	*			1,00	/	8,76	=	419
Household appliances/Other	1	1	50,0	kWh	1,00	1,0	/(P*a)	4173	*			1,00	/	8,76	=	476
Auxiliary appliances (cf. aux Electricity sheet)															=	469
Other applications (cf. Electricity sheet)	0	0,0						0	*			0	/	8,76	=	0
Persons	83	1	80,0	W/P	1,00	8,76	kh/a	58486	*			0,55	/	8,76	=	3672
Cold water	83	1	-20,1	W/P	1,00	8,76	kh/a								=	-1673
DHW - circulation	1	1	4487,2	W	1,00	8,76	kh/a	39308	*			1,00	/	8,76	=	4487
DHW - individual pipes	1	1	2,3	W	1,00	8,76	kh/a	20	*			1,00	/	8,76	=	2
DHW storage tank heating case	0	0	0,0	W	1,00	8,76	kh/a	0	*			1,00	/	8,76	=	0
DHW storage tank cooling case	0	0	0,0	W	1,00	8,76	kh/a	0	*			1,00	/	8,76	=	0
Evaporation	83	1	-25,0	W/P	1,00	8,76	kh/a	-18277	*			1,00	/	8,76	=	-2086
Total IHG														W		12334
Specific IHG														W/m²		3,71
Heat available from internal sources										233	d/a			kWh/(m²a)		20,8

Internal heat gains for non residential buildings (at the moment this worksheet is inactive)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Utilisation: 10-Dwelling — IHG 2,70 W/m²

Type of values used: 2-Standard — No input is necessary

Persons: 83,5 P
Treated floor area: 3320,2 m²
Heating period: 233 d/a
Room temperature: 20 °C
Internal heat gains aux. electricity: 469 W

Persons	Selection of user profile	Select	Activity of persons	Planning 0 = according to ground area or usable zone 1 = according to occupancy	Number of occupants		Ground area of useful zone [m²]	Average occupancy [Pers./m²]	Heat emitted per person [W]	Utilisation hours per year [h/a]	Relative presence	Utilisation period [h/a]	Average heat release persons [W]
								27		9	18		
Persons A			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons B			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons C			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons D			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons E			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons F			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Persons G			Invalid input		{	}* or	{	* Not a standard value	} * 0	* 0	* 1,00	/ 8760	= 0
Evaporation (person specific)					0	*			-15	* 0	* 1,00	/ 8760	= 0

Lighting / Equipment / Aux. electricity	Useful energy [kWh/a]	Availability	Utilisation period [h/a]	Average heat release
Lighting	0	* 1	/ 8,76	= 0
Office applications (within therm. envelope)	0	* 1	/ 8,76	= 0
Cooking (within therm. envelope)	0	* 0,5	/ 8,76	= 0
Dishwashing (within therm. envelope)	0	* 0,3	/ 8,76	= 0
Cooling (within therm. envelope)	0	* 1	/ 8,76	= 0
Other (within thermal envelope)	0	* 1	/ 8,76	= 0
Auxiliary appliances (see 'Aux Electricity' worksheet)				= 469

Heat loss due to cold water (calculation from column AJ)	On/Off [1 / 0]	Predominant utilisation pattern of building (Data transferred from 'Electricity non-res' worksheet; input 2	Number of WCs (user data)	Amount of WCs: Utilisation of standard values for schools?	Number of WCs (calculation value)	DT: Cold water temp. - Room temp. [K]	Occupied days per year [d/a] 8	Loss daytime [W]	Loss night-time [W]	Availability	Utilisation period [d/a]	Average power cold water
Cold water due to flushing WC					0	-11,9	0	* (0	+ -16	) * 1	/ 365	= 0

Total IHG	W	469
Specific IHG	W/m²	0,1
Heat available from internal sources	kWh/(m²a)	1

233 d/a

Primary Energy Renewable PER

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

				Building type:	Block of flats
				Treated floor area A_{TFA}:	3320 m²
				Projected building footprint $A_{Projected}$:	511 m²
Selection of heat generation system	**Contribution margin (useful energy)**			Heating demand incl. distribution & hydr. frost protection	14 kWh/(m²a)
Primary heat generator	**Heating**	**DHW**	**Addl. input in following worksheets**	Cooling energy dem. incl. dehumidification	kWh/(m²a)
3-District heating, CGS	100%	100%	District heat	DHW demand including distribution:	23 kWh/(m²a)
Secondary heat generator (optional)					
-	0%	0%	-		

Energy demand	**Final energy**		**PER**			**PE**		**CO_2**	
Reference: Treated floor area	Contribution (final energy)	**Final energy demand**	PER factor	Effective PER factor (including biomass	**PER specific value**	PE factor	PE Value	CO_2 emissions factor (CO_2-eq)	CO_2eq emissions
		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/(m²a)
						1-PE-factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
					66,6		103,4		13,0
Heating				0,80	**13,6**	0,99	**16,8**		**0,4**
Electricity (HP compact unit)			1,55			2,60		0,532	
Electricity (heat pump)			1,55			2,60		0,532	
District heating: 20-Gas CGS 70% PHC	100%	14,4	0,75|1,06|0,85	0,75	10,8	0,70	10,1	-0,070	-1,0
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / RE methanol			2,30			1,10		0,320	
Solar thermal system									
Electricity (direct through DHW storage tank)			1,55			2,60		0,532	
Electricity (direct through heating resistance)			1,55			2,60		0,532	
Aux. electricity (vent.winter, frost protection, circ.pump, boiler, wood / pellets)		2,6	1,55	1,10	2,8	2,60	6,7	0,532	1,4
Cooling and dehumidification			1,00		**1,8**		**4,6**		**0,9**
Electricity cooling (heat pump)			1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer		1,8	1,00		1,8	2,60	4,6	0,532	0,9
Electricity dehumidification (heat pump)			1,00			2,60		0,532	
Auxiliary electricity (dehumidification)			1,00			2,60		0,532	
DHW generation				0,83	**20,0**	0,71	**17,2**		**-1,6**
Electricity (HP compact unit)			1,25			2,60		0,532	
Electricity (heat pump)			1,25			2,60		0,532	
District heating: 20-Gas CGS 70% PHC	100%	24,0	0,75|1,06|0,85	0,83	19,8	0,70	16,8	-0,070	-1,7
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / Methanol			2,30			1,10		0,320	
Solar thermal system									
Electricity (direct)			1,25			2,60		0,532	
Aux. electricity (circ.pump + storage charge, aux.energy DHW + solar DHW)		0,2	1,25	1,25	0,2	2,60	0,4	0,532	0,1
Household electricity		**24,9**		1,25	**31,2**		**64,8**		**13,3**
Electricity (household or non-residential lighting, etc.)		24,9	1,25	1,25	31,2	2,60	64,8	0,532	13,3
Auxiliary electricity (other)			1,25			2,60		0,532	
Gas / RE gas dry/cook		**0,0**	1,75		**0,0**	2,60	**0,0**	0,270	**0,0**

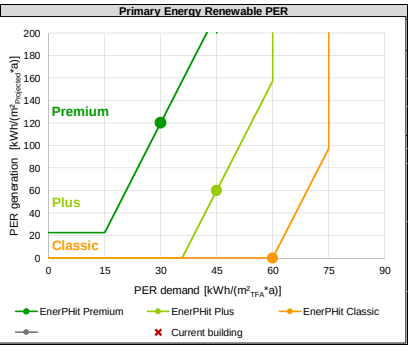
Energy generation	**Final energy**		**PER**		**PE**		**CO_2**	
Reference: Projected building footprint area	Final energy generation	**Final energy generation**	PER factor	**PER specific value**	PE factor	PE Value	Emission factor (CO_2-eq)	CO_2eq emissions
	kWh/a	**kWh/(m²$A_{Projected}$*a)**	kWh/kWh	kWh/(m²$A_{Projected}$a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
				242,7		**0,0**		**31,5**
PV electricity	0	0,0	1,00	0,0	-		-	
Solar thermal system	0	0,0	1,00	0,0	1,2	0,0		
Monocrystalline photovoltaic electric solar energy panels	124000	242,7	1,00	242,7	0,0	0,0	0,130	31,5

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	**120**	**Current building reaches following class for aspect**	**103**	**Requirement met?**	**yes**

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	**Useful energy, performance**				**Airtightness**
	Annual heat. dem. Treated floor area	**Heating load** Treated floor area	**Useful cool. energy** Treated floor area	**Cooling load** Treated floor area	n_{50}
	kWh/(m²a)	W/m²	kWh/(m²a)	W/m²	1/h
Requirement EnerPHit Premium Requirement EnerPHit Plus Requirement EnerPHit Classic	30		-	-	1,00
Requirement					
Current building reaches following class for aspect	13 Premium	11	- Unachieved	-	0,6 Premium

Summary	**Final energy**	**PER specific value**	**PE Value**	**CO2eq emissions**	**CO_2eq substitution balance**
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards such as Effizienzhaus Plus.			1-PE-factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	**225,4**	**221,2**	343,43	43047	43047
Generation	**-124,0**	**-124,0**	0,00	16120	-49848
Demand, cumulative generation (annual balance)	101,39	97,22	343,43	59167	-6801
Demand w/o household electricity	**142,6**	**117,7**	128,15	-1003	-1003
Demand w/o household electricity, cum. generation	18,59	-6,28	128,15	15117	-50851

Primary Energy Renewable PER



Passive House compact unit with exhaust air heat pump

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Calculation based on measured values of the laboratory evaluation for component certification

Building type: **Block of flats**

Treated floor area A_{TFA}: **3320** m²

				Including DHW connection for washing machines & dishwa	
Covered fraction of space heating demand	*('PER' worksheet)*	**0%**			
Space heating demand + distribution losses	Q_H+Q_{HL}: *(DHW+Distribution)*	**45622**	kWh		
Solar contribution for space heating	$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*	**0%**			
Effective annual heating demand	$Q_{H,WI}=Q_H*(1-\eta_{Solar,\ H})$	**0**	kWh		
Covered fraction of DHW demand	*('PER' worksheet)*	**0%**			
Total heating demand of DHW system	Q_{gDHW} *(DHW+Distribution)*	**75973**	kWh	**75973**	kWh
Solar contribution for DHW	$\eta_{Solar,\ DHW}$ *('SolarDHW' worksheet)*	**0%**		**0%**	
Effective DHW demand	$Q_{DHW-WI}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$	**0**	kWh	**0**	kWh

Sort: AS LIST

Compact unit selection: Go to list of compact units

Measured values from laboratory test

Ventilation

Effective heat recovery efficiency	η_{eff} *(Test stand)*		
Electric efficiency	*(Test stand)*		Wh/m³

Heating

		Test point 1	*Test point 2*	*Test point 3*	*Test point 4*	
Outdoor air temperature	T_{amb}					°C
Measured thermal power heat pump Heating	$P_{HP,Heating}$					kW
Measured COP Heating	$COP_{Heating}$					-

Domestic hot water

		Test point 1	*Test point 2*	*Test point 3*	*Test point 4*	
Outdoor air temperature	T_{amb}					°C
Measured thermal power DHW storage heating-up	$P_{DHW,Heating-Up}$					kW
Measured thermal power DHW storage reload	$P_{DHW,Reload}$					kW
Measured COP DHW storage heating-up	$COP_{DHW,Heating-Up}$					-
Measured COP DHW storage reload	$COP_{DHW,Reload}$					-

Standby (inputs required only if different from storage reload)

		Test point 1	*Test point 2*	*Test point 3*	*Test point 4*	
Outdoor air temperature	T_{amb}					°C
Measured thermal power heat pump Standby	$P_{HP,Standby}$					kW
Measured COP Standby	$COP_{Standby}$					-

0%

Specific heat loss storage incl. connections	$U * A_{Storage}$ *(Test stand)*		W/K	
Average storage temperature in standby mode	$T_{DHW,Standby}$ *(Test stand)*		°C	
Heat pump priority	separate heat pumps	DHW priority		Heating priority
	Room temperature (°C)	20		
	Av. ambient temp. Heating P. (°C)	3		
	Av. Ground temp (°C)	8		
Efficiency SHX exhaust air mixing	η^*_{SHX}			
Heat recovery efficiency SHX exhaust air mixing (if applicable)	$\eta_{SHX,add}$ *(Design Value)*	0%		
Volume flow rate of added exhaust air (if applicable)	V_{add} *(Test stand)*		m³/h	
Hydraulic frost protection				

Heat supplied by direct electricity	$Q_{E,dir}$		kWh/a			kWh/a	
Space heat supplied by HP	$Q_{HP,Heating}$		kWh/a			kWh/a	
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	0	kWh/a		0	kWh/a	
Winter standby heat supplied by HP	$Q_{HP,Standby,Winter}$		kWh/a			kWh/a	
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	0	kWh/a		0	kWh/a	
Summer standby heat supplied by HP	$Q_{HP,Standby,Summer}$		kWh/a			kWh/a	
Performance factor of heat generator, DHW & space heating							
Seasonal performance factor	SPF_{H-3}						
			kWh/a	kWh/(m²a)	kWh/a	kWh/(m²a)	
Final energy demand heat generation	Q_{final}						
Annual PE demand (non-renewable primary energy)							
			kg/a	kg/(m²a)	kg/a	kg/(m²a)	
Annual CO_2-equivalent emissions							

Heat pump

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

			Building type:	Block of flats	
			Treated floor area A_{TFA}:	3320	m²
Covered fraction of space heating demand		*('PER' worksheet)*		0%	
Space heating demand + distribution losses		Q_H+Q_{HL}: *(DHW+Distribution)*		45622	kWh/a
Solar fraction for space heat		$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*		0%	
Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$			**0**	kWh/a
Covered fraction of DHW demand		*('PER' worksheet)*		0%	
Total heating demand of DHW system		Q_{gDHW} *(DHW+Distribution)*		75973	kWh/a
Solar fraction for DHW		$\eta_{Solar,\ DHW}$ *('SolarDHW' worksheet)*		0%	
Effective DHW demand	$Q_{DHW,Wi}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$			**0**	kWh/a
Number of heat pumps in the system				1	
Functionality				Heating & DHW	
Heating					
Selection of HP: 2-Standard brine/water heat pump		Heat source:		3-Ground probes	
Selection of distribution system				3-Supply air heating	
Design distribution temperature		θ_{design} *(DHW+Distribution)*		55,00	°C
Nominal power of distribution system		P_{nom}		0,00	kW
Distribution system (to be completed by experienced users only)					
Nominal power of distribution system		P_{nom}			kW
Radiator exponent		n			
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)				0-No	
Specific heat losses storage		U * A $_{Storage}$			W/K
Storage location in thermal envelope				2-Outside	
Room temperature (storage location: outside of thermal envelope)		*(DHW+Distribution)*			°C
Sink temperature of heat pump for heating		θ_{snk}		56,50	°C
Entries in relation to the domestic hot water system					
Selection of HP: 0-None		Heat source:			
DHW temperature		*(DHW+Distribution)*			°C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)				2-Outside	
Specific heat losses storage		U * A $_{Storage}$		0,0	W/K
Room temperature (storage location: outside of thermal envelope)		*(DHW+Distribution)*			°C
Type of backup heater					
Δθ of electric continuous flow water heater					K
Additional options in case of <u>one</u> heat pump for both functions: Heating & DHW					
Same heat pump's sink temperature for Heating and for DHW				1-Yes	
Heat pump priority		*(Manufacturer, tech. data)*			
Control strategy					
Heat pump control strategy					
Heating					
Depth ground water / Ground collector / Ground probe		z			m
Power of pump for ground heat exchanger		P_{pump}			kW

-

Heating

Heat pump: Standard brine/water heat pump

Source: 3-

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1	-5,0	35,0	5,3	3,7
Test point 2	0,0	35,0	6,0	4,3
Test point 3	5,0	35,0	6,7	4,9
Test point 4	-5,0	50,0	5,1	2,6
Test point 5	0,0	50,0	5,9	3,0
Test point 6	5,0	50,0	6,5	3,4
Test point 7				
Test point 8				
Test point 9				
Test point 10				
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0 K

DHW

Heat pump: Standard brine/water heat pump

Source: 3-

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1	-5,0	35,0	5,3	3,7
Test point 2	0,0	35,0	6,0	4,3
Test point 3	5,0	35,0	6,7	4,9
Test point 4	-5,0	50,0	5,1	2,6
Test point 5	0,0	50,0	5,9	3,0
Test point 6	5,0	50,0	6,5	3,4
Test point 7				
Test point 8				
Test point 9				
Test point 10				
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)	$Q_{El,Pump}$		kWh/a
Energy by direct electricity	$Q_{El,dir}$	0	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	0	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	0	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	0	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	0	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	0	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	0	kWh/a
Electrical consumption of HP	Qel_{HP}		kWh/a

		1. HP: Heating or heating & DHW	2. HP: Domestic hot
Seasonal performance factor of heat pump	SPF_{H-1}		
		kWh/a	kWh/(m²a)
Final electrical energy demand heat generation	Q_{final}		
Annual primary energy demand			
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions			

Heat pump ground (ground collectors / ground probes)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type: **Block of flats**

Treated floor area A_{TFA}: **3320** m²

Ground probes

Probe field configuration			A	Individual probe
Length of probe	*('HP' worksheet)*	H	0	m
Probes spacing/distance		B		m
Depth (z=H/2)		z	0	m
Type of probe			A	Double-U
Borehole radius		r_b		m
Inner radius of pipe		r_i		m
Exterior pipe radius		r_a		m
Distance between pipes		B_U		m
Inner radius of pipe casing (only coaxial)		r_{i2}		m
Exterior radius casing pipe (only coaxial)		r_{a2}		m
Thermal conductivity of pipe		λ_R		W/(mK)
Thermal conductivity of back fill		λ_F		W/(mK)
Probe time constant		t_p	0	d
Internal borehole resistance		R_a		Km/W
Borehole resistance		R_b		Km/W

Ground

Soil type	A	Sand, 9% moisture	
Density of the ground	ρ_E	1440	kg/m³
Thermal capacity of ground	cp_E	1507	J/(kgK)
Thermal conductivity of ground	λ_E	1,0	W/(mK)
Soil temperature conductivity	a_E	4,516E-07	m/s²
Ground temperature gradient	Δ_{TG}	**0,022**	K/m

Brine

Brine (characteristics at 2 °C)	A	Ethylene glycol 25%	
Density of the brine	ρ_S	1052	kg/m³
dynamic viscosity of the brine	η_S	0,0052	kg/(ms)
Heat capacity brine	c_{pS}	3950	J/(kgK)
Thermal conductivity of brine	λ_S	0,48	W/(mK)
Brine - mass flow	m_S		kg/s

Operation type

Waste heat from active cooling to ground probe? Please check, if applicable.			
Heat pump operation duration			h/a
Specific heat extraction rate as an annual average	q_{ex}		W/m
	H/R_b		W/K

Ground collectors

Inner radius of pipe	r_i		m
Exterior pipe radius	r_a		m
Thermal conductivity of pipe	λ_r		W/(mK)
Pipe depth	z_{pipe}	0	m
Ground water depth	z_{gw}		m
Pipe spacing	D		m
Base area			m²
Pipe outer surface		#DIV/0!	m²
Pipe length	L	#DIV/0!	m

Brine

Brine (characteristics at 2 °C)	A	Ethylene glycol 25%	
Density of the brine	ρ_S	1052	kg/m³
dynamic viscosity of the brine	η_S	0,0052	kg/(ms)
Heat capacity brine	c_{pS}	3950	J/(kgK)
Thermal conductivity of brine	λ_S	0,48	W/(mK)
Brine - mass flow	m_S		kg/s
Specific heat extraction rate	q_{ex}		W/m²
U * A			W/K

Climate

Period duration		365	d
Average ground surface temp.	T_{m0}	8,1	°C
Surface temperature amplitude	T_1	8,4	°C
Phase shifting surface	t_{02}	39	d

Ground characteristics

		Thermal conductivity [W/(mK)]	Density [kg/m³]	Heat capacity [J/(kg K)]	Heat capacity [MJ/(m³ K)]	Thermal conductivity [10^{-7} m²/s]	Source
A	Sand, 9% moisture	0,980	1440	1507	2,170	4,520	[Neiß 1977]
B	Sand, 13% moisture	1,500	1600	1800	2,880	5,210	[Neiß 1977]
C	Ground, coarse gravel	0,520	2000	1840	3,680	1,410	[VDI 1984]
D	Loam, 36% moisture	2,300	1650	2847	4,700	4,900	[Neiß 1977]
E	Clay	1,280	1500	880	1,320	9,700	[VDI 1984]
F	Clay / Silt	2,200	2550	882	2,250	9,780	[VDI 2000]
G	Slate	2,100	2700	870	2,350	8,940	[VDI 2000]
H	Silt	1,500	1920	2938	5,640	2,660	[ISO 13370]
I	Rock	3,500	2500	2500	6,250	5,600	[ISO 13370]
J							

Result ground probe calculation

Month	Borehole temperature °C
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Properties of the brine

		Temperature [°C]	Density [kg/m³]	Heat capacity [J/(kg K)]	Thermal conductivity [W/(mK)]	Dynamic viscosity [kg/(ms)]
A	Ethylene glycol 25%	2	1052	3950	0,480	0,0052
B	Potassium carbonate	2	1265	2941	0,544	0,0031
C	Potassium formate	2	1226	3190	0,534	0,00237
D	Water	2	997	4190	0,590	0,001307
E						

Boiler (gas, oil and wood)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type:		Block of flats	
Treated floor area A_{TFA}:		3320	m²
Covered fraction of space heating demand	*('PER' worksheet)*	0%	
Space heating demand + distribution losses	Q_H+Q_{HS}: *(DHW+Distribution)*	45622	kWh
Solar contribution for space heating	$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*	0%	
Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$	**0**	kWh
Space heating demand without distribution losses	Q_H *('Verification' worksheet)*	41848	kWh
Covered fraction of DHW demand	*('PER' worksheet)*	0%	
Total heating demand of DHW system	Q_{gDHW} *(DHW+Distribution)*	75973	kWh
Solar contribution for DHW	$\eta_{Solar,\ DHW}$ *('SolarDHW' worksheet)*	0%	
Effective DHW demand	$Q_{DHW,Wi}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$	**0**	kWh

Boiler type		1-None	
Fuel			
PER factors (renewable primary energy)	*('Data' worksheet)*	#NV	kWh_{PER}/kWh_{Final}
PE factor (non-renewable primary energy)	*('Data' worksheet)*	#NV	kWh_{PE}/kWh_{Final}
CO_2 emissions factor (CO_2-equivalent)	*('Data' worksheet)*	#NV	g/kWh
Useful heat provided	Q_{Use}		kWh/a
Max. heating power required for heating the building	P_{BH} *('Heating load' worksheet)*	36,12	kW
Length of the heating period	t_{HP}	5594	h
Length of DHW heating period	t_{DHW}	8760	h

Use characteristic values entered (check if appropriate)?

		Project data		Standard values		Input field	
Design output	P_{nom} *(Rating plate)*	36	kW	36	kW		
Installation of boiler (Outdoor: 0, Indoor: 1)		0		0			
Input values (oil and gas boiler)		Project data		Standard values		Input field	
Boiler efficiency at 30% load	$\eta_{30\%}$ *(Manufacturer)*						
Boiler efficiency at nominal output	$\eta_{100\%}$ *(Manufacturer)*						
Standby heat loss boiler at 70 °C	$q_{B,70}$ *(Manufacturer)*						
Average return flow temperature measured at 30% load	$\vartheta_{30\%}$ *(Manufacturer)*		°C				
Input values (biomass heat generator)		Project data		Standard values		Input field	
Efficiency of heat generator in basic cycle	η_{GZ} *(Manufacturer)*			60%			
Efficiency of heat generator in steady-state operation	η_{SO} *(Manufacturer)*			70%			
Average fraction of heat output released to heating circuit	$z_{HC,m}$ *(Manufacturer)*			0,4			
Temperature difference betw. power-on and power-off	$\Delta\vartheta$ *(Manufacturer)*		K	30	K		
In case of inside installation: area of installation room	$A_{install}$ *(Project)*		m²	0	m²		
Useful heat output per basic cycle	$Q_{N,GZ}$ *(Manufacturer)*		kWh	54,0	kWh		
Average power output of the heat generator	$Q_{N,m}$ *(Manufacturer)*		kW	36,0	kW		
Heat generator with built in conveyor for pellets							
Unit only with regulation (no fan / no starting aid)							
Auxiliary energy demand for a basic cycle	$Q_{HE,GZ}$ *(Manufacturer)*		kWh		kWh		kWh
Power consumption in steady-state operation	$P_{el,SB}$ *(Manufacturer)*		W		W		W

Utilisation factor of heat generator space heating	$\eta_{H,g,K}$ $=f_j*h_{k'}$	0%
Utilisation factor heat generator DHW	$\eta_{DW,g,K}$ $=h_{100\%}/f_{j,DW}$	0%
Utilisation factor heat generator DHW & space heating	$\eta_{g,K}$	0%

		kWh/a	kWh/(m²a)
Final energy demand space heating	$Q_{Final,HE}$ $= Q_{H,wi}* e_{H,g,K}$	0	
Final energy demand DHW	$Q_{Final,TW}$ $= Q_{DHW,wi}* e_{TW,g,K}$	0	
Total final energy demand	Q_{Final} $= Q_{End,HE} + Q_{End,TW}$	0	0,0
Annual PE demand (non-renewable primary energy)			
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions			

District heating and combined heat power (CHP)

Stacken ("Stjärnhus") - existing / Climate: Göteborg / TFA: 3320 m² / Heating: 12,6 kWh/(m²a) / Freq. overheating: 1 % / PER: 66,6 kWh/(m²a)

Building type:		Block of flats	
Treated floor area A_{TFA}:		3320	m²
Covered fraction of space heating demand	*('PER' worksheet)*	100%	
Annual heating demand kWh/a	Q_H *(DHW+Distribution)*	45622	kWh
Solar contribution for space heating	$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*	0%	
Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$	**45622**	kWh
Covered fraction of DHW demand	*('PER' worksheet)*	100%	
DHW demand	Q_{DHW} *(DHW+Distribution)*	75973	kWh
Solar contribution for DHW	$\eta_{Solar,\ DHW}$ *('SolarDHW' worksheet)*	0%	
Effective DHW demand	$Q_{DHW,Wi}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$	**75973**	kWh

	PE factor (non-renewable)	CO_2 emissions factor (CO_2-eq)
	kWh_{PE}/kWh_{Final}	kg/kWh
Definition of heat source for PE factor and CO_2 emissions	0,70	-0,070

20-Gas CGS 70% PHC

Definition of heat source for calculation of PER factor

Heat net

Efficiency district heating net: 80%

PHC complex & boiler for peak loads	Fraction	Efficiency Electricity	Efficiency Heat		PER factors	PER factors
PHC complex	100%	40%	50%	**Within biomass budget**	1,10	0,75
Boiler for peak loads	0%		96%	**Excess of biomass budget**	1,55	1,06
Total	100%			**DHW Summer**	1,25	0,85

Performance ratio of heat transfer station	$h_{a,HX}$	105%
Utilisation factor of heat transfer station	$\eta_{a,SHX}$	0%

		kWh/a	kWh/(m²a)
Final energy demand heat generation	Q_{final} = Q_{Use}* $e_{a,DH}$	0	0,0
Annual PE demand (non-renewable primary energy)		0	0,0
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions		0	0,0

Table of PER and PE factors as well as CO_2-equivalent emission factors of different energy carriers and uses from different sources

			Transfer to 'PER' works	
Energy type	Number	Energy carrier	PER-factor	1-PE-factors (non-renewable) PHI Certification
			$kWh_{prim-el}$/ kWh_{Final}	kWh_{prim}/ kWh_{Final}
	10	None		
Fuel source	20	Heating oil	*2,30*	1,10
	30	Natural gas	*1,75*	1,10
	31	LPG	*1,75*	1,10
	41	Hard coal	*2,30*	1,10
	42	Brown coal	*2,30*	1,20
	32	Biogas	*1,10*	1,10
	21	Pyrolysis oil or bio oil	*1,10*	1,10
	43	Wood	*1,10*	0,20
	44	Wood logs	*1,10*	0,20
	50	Pellets	*1,10*	0,20
	46	Forest woodchips	*1,10*	0,20
	47	Poplar woodchips	*1,10*	0,20
	33	RE-Gas	1,75	
	22	RE-Methanol	2,30	
	48	Biomass	1,10	
Electricity	60	Electricity-mix		2,60
	61	Electricity mix from CHC		2,50
	00	Primary electricity	1,00	
	01	Household electricity	1,25	2,60
	02	Electricity for DHW	1,25	2,60
	03	Electricity for heating	1,55	2,60
	04	Electricity for cooling	1,00	2,60
	05	Electricity for dehumidification	1,00	2,60
	06	Platzhalter_EE-Stromanwendung	-	2,60
	62	Electricity from photovoltaics	*1,00*	0,00
	63	Monocrystalline photovoltaic electric	*1,00*	0,00
	64	Polycrystalline photovoltaic electric s	*1,00*	0,00
	65	Onshore wind power	*1,00*	0,00
	66	Offshore wind power	*1,00*	0,00
	67	Hydroelectric power station > 10MW	*1,00*	0,00
Environmental energy, solar thermal energy	71	Ground heat, geothermal energy	0,00	0,00
	72	Ambient high temperature	0,00	0,00
	73	Ambient low temperature	0,00	0,00
	80	Solar thermal flat plate collector (ger	*1,00*	0,00
	81	Solar thermal evacuated tube collect	*1,00*	0,00
	74	Waste heat	0,00	0,00
User defined energy carrier (for generation, please enter	98	**Eigener Energieträger**		
user defined factords for demand in columns N and O)	99			
	1	1-None		0,00
District heat	10	10-Hard coal CGS 70% PHC		0,80
	11	11-Hard coal CGS 35% PHC		1,10
	12	12-Hard coal CGS 0% PHC		1,50
Gas CGS	20	20-Gas CGS 70% PHC	Calculation	0,70
	21	21-Gas CGS 35% KWK	in	1,10
	22	22-Gas HS 0% PHC	'District	1,50
Heating oil-EL CGS	30	30-Oil CGS 70% PHC	heating'	0,80
	31	31-Oil CGS 35% PHC	worksheet	1,10
	32	32-Oil CGS 0% PHC		1,50
District heating: User determined	40	**40-Eigene Eingabe: 90% KWK**		0,80
District heating combined heat power (CHP)	13	Fossil fuel		0,70
	14	Renewable fuel		0,00
District heating from heating station	15	Fossil fuel		1,30
	16	Renewable fuel		0,10

Heat generator			x) Gas will be used
No.	Type	Fuel ('Comparison' worksheet)	
1	1-None		
10	10-Improved gas condensing boiler	1	x
11	11-Improved oil condensing boiler	2	
12	12-Gas condensing boiler	1	x
13	13-Oil condensing boiler	2	
20	20-Low temperature boiler gas	1	x
21	21-Low temperature boiler oil	2	
30	30-Firewood pieces (direct and indirect heat emission)	3	
31	31-Wood pellets (direct and indirect heat emission)	4	
32	32-Wood pellets (only indirect heat emission)	4	
40	40-Reserve		

Dishwashers and washing machines
1-DHW connection
2-Cold water connection

Clothes drying	Availability electricity	Availability evaporation
1-Clothes line	1	1
2-Drying closet (cold!)	1	1
3-Drying closet (cold!) in extract air	0,9	0,9
4-Condensation dryer	0,7	0
5-Electric exhaust air dryer	1	1
6-Gas exhaust air dryer	1	1

Cooking	Electric fraction	PE factor	CO_2 factor	PER-factor
1-Electricity	100%	2,60	0,53	1,25
2-Natural gas	0%	1,10	0,25	1,75
3-LPG	0%	1,10	0,27	1,75