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:	House Andre Tournon Sur Rhone
Street:	
Postcode/City:	Tournon sur
Province/Country:	France / FR-France
Building type:	Single Family House
Climate data set:	ud---03-Tournon avec masque LAMP Temp 1960-1990
Climate zone:	4: Warm-temperate — Altitude of location: 168 m
Home owner / Client:	
Street:	
Postcode/City:	
Province/Country:	
Architecture:	
Street:	
Postcode/City:	
Province/Country:	
Mechanical system:	
Street:	
Postcode/City:	
Province/Country:	
Energy consultancy:	Heliasol
Street:	15 allées des Magnolais
Postcode/City:	69390 Vourles
Province/Country:	FR-France
Certification:	La Maison Passive
Street:	110 rue Réaumur
Postcode/City:	75002 Paris
Province/Country:	FR-France

Year of construction:	2016	Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]:	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,4	IHG cooling case [W/m²]:	2,4
No. of occupants:	2,9	Specific capacity [Wh/K per m² TFA]:	180	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	155,0				
Space heating	Heating demand	kWh/(m²a)	222	≤	-	-	-
	Heating load	W/m²	84	≤	-	-	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	0	≤	10		yes
	Frequency excessively high humidity (> 12 g/kg)	%	0	≤	20		yes
Airtightness	Pressurization test result n_{50}	1/h	5,0	≤	1,0		no
Minimum thermal protection	fulfilled?	yes/no			yes		no
	Smallest temperature factor $f_{Rsi=0.25\ m^2K/W}$	-	-	≥	0,65		-
	highest U-value	W/(m²K)	2,69	≤	1,10		no
	highest U-value	W/(m²K)	0,25	≤	1,15		yes
	highest U-value	W/(m²K)	3,85	≤	1,25		no
	highest U-value	W/(m²K)	-	≤	0,85		-
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	555	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	453	≤	414	429	no
	Generation of renewable energy	kWh/(m²a)	0	≥	-	11	

EnerPHit (refurbishment): Component characteristics

Building envelope to exterior air[1] (U-value)	W/(m²K)	0,25	≤	0,3	yes
Building envelope to ground[1] (U-value)	W/(m²K)	1,36	≤	0,22	no
Wall w/int. insulation in contact w/exterior air (U-value)	W/(m²K)	0,45	≤	0,5	yes
Wall w/interior insulation in contact w/ground (U-value)	W/(m²K)	0,45	≤	0,42	no
Flat roof (SRI)	-	-	≥	-	-
Inclined and vertical external surface (SRI)	-	9	≥	-	-
Windows/Entrance doors ($U_{W/D,installed}$)	W/(m²K)	2,58	≤	1,08	no
Windows ($U_{W,installed}$)	W/(m²K)	-	≤	1,13	-
Windows ($U_{W,installed}$)	W/(m²K)	-	≤	1,23	-
Glazing (g-value)	-	0,77	≥	0,96	no
Glazing/sun protection (max. solar load)	kWh/(m²a)	73	≤	-	-
Ventilation (effective heat recovery efficiency)	%	0	≥	75	no
Ventilation (humidity recovery efficiency)	%	0	≥	-	-

[1] Without windows, doors and external walls with interior insulation

[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? no

Task: | First name: | Surname: | Signature:

Issued on: | City:

PHPP Check

EnerPHit with PHPP Version 9.:

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overh

▼ 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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

		Active						
	Select the active variant here >>>>>>>	1-Existing	Existing	Basement	Roof+MVHR	Walls+Windows	DHW Storage tank + PV 8 kWp	National Regulation
Results	**Units**	1	1	2	3	4	5	6
Heating demand	kWh/(m²a)	**222,4**	222,4	132,9	95,6	25,0	25,0	162,6
Heating load	W/m²	**83,6**	83,6	60,5	44,4	15,6	15,6	68,4
Cooling & dehum. demand	kWh/(m²a)							
Cooling load	W/m²							
Frequency of overheating (> 25 °C)	%	**0,0**	0,0	0,1	0,1	0,0	0,0	0,0
PER demand	kWh/(m²a)	**453,0**	453,0	282,2	212,5	82,5	79,4	338,9
EnerPHit Classic?	yes / no	**no**	no	no	no	no	yes	no
Final energy		-	-	-	-	-	-	-
User determined results		-	-	-	-	-	-	-
PE demand [kWh/(m².a)]		**555,4**	555,4	363,1	279,4	128,4	122,0	426,9
Renewable Energy Production [kWh/(m²ground.a)]	**kWh/(m²ground.a)**	**0,0**	0,0	0,0	0,0	0,0	35,2	0,0
DU PT	**W/(m².K)**	**0,03**	0,03	0,04	0,04	0,03	0,03	0,03
			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	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	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	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	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	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
			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	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	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	0,0	0,0	0,0
			0,0	0,0	0,0	0,0	0,0	0,0

Input variables		**Units**	**Value**	**1**	**2**	**3**	**4**	**5**	**6**
	Building assembly layers	U-Value							
a	**Exterior Insulation Wall**	W/(mK)	0,032	0,032	0,032	0,032	0,032	0,032	0,032
		mm	0	0	0	0	250	250	0
b	**Ext Insulation Ceiling Attic**	W/(mK)	0,032	0,032	0,032	0,032	0,032	0,032	0,032
		mm	0	0	0	250	250	250	220
c	**Ext Insulation Insulated Slab**	W/(mK)	0,025	0,025	0,025	0,025	0,025	0,025	0,025
		mm	0	0	100	100	100	100	0
d	**Ext Insulation Pitched Roof**	W/(mK)	0,032	0,032	0,032	0,032	0,032	0,032	0,032
		mm	0	0	0	250	250	250	0
e	**Ext Insulation Uninsulated Slab**	W/(mK)	0,025	0,025	0,025	0,025	0,025	0,025	0,025
		mm	0	0	150	150	150	150	40
f	**Ext Insul Staircase Walls / Walls to Basement**	W/(mK)	0,032	0,032	0,032	0,032	0,032	0,032	0,025
		mm	0	0	200	200	200	200	40
g	**Interior insulation Staircase slab**	W/(mK)	0,022	0,022	0,022	0,022	0,022	0,022	0,022
		mm	0	0	180	180	180	180	0
h		W/(mK)	0						
		mm	0						
i		W/(mK)	0						
		mm	0						
j		W/(mK)	0						
		mm	0						
k		W/(mK)	0						
		mm	0						
l		W/(mK)	0						
		mm	0						
m		W/(mK)	0						
		mm	0						
n		W/(mK)	0						
		mm	0						
o		W/(mK)	0						
		mm	0						
p		W/(mK)	0						
		mm	0						
q		W/(mK)	0						
		mm	0						
r		W/(mK)	0						
		mm	0						
s		W/(mK)	0						
		mm	0						
t		W/(mK)	0						
		mm	0						
u		W/(mK)	0						
		mm	0						
v		W/(mK)	0						
		mm	0						
w		W/(mK)	0						
		mm	0						
x		W/(mK)	0						
		mm	0						
y		W/(mK)	0						
		mm	0						
z		W/(mK)	0						
		mm	0						
	Radiation balance	Areas							
	Thermal bridges	Areas							
	Windows and shading	Windows	Shading						
	Ventilation	Ventilation							

	Ventilation type	select	1-Balanced PH ventilation with HR	1-Balanced PH ventilation with HR	1-Balanced PH ventilation with HR	1-Balanced PH ventilation with HR	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	5,00	5	4	2,5	1	1	5
	Design air flow rate (maximum)	m³/h	173	173	173	173	173	173	173
	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	2-Outside of thermal envelope	2-Outside of thermal envelope

	Ventilation unit selection	select	01ud-Existing MVHR, not functioning	01ud-Existing MVHR, not functioning	01ud-Existing MVHR, not functioning	02ud-Novus 300 - Paul	02ud-Novus 300 - Paul	02ud-Novus 300 - Paul	01ud-Existing MVHR, not functioning
Summer ventilation		SummVent							
Heat generator		PER							
Compressor cooling units		Cooling units							
User determined parameters									

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

Comparison between two variants

EnerPHit with PHPP Version 9.3

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

▼ Surface temperature
▼ Annuity
▼ Energy, CO_2, Costs
▼ Boundary conditions

Selection of comparison configuration

Description	1-	
Component type		
Building component		

Calculation of the selected configuration

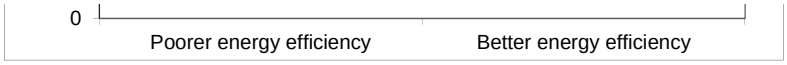
	Poorer energy efficiency		Better energy efficiency		Difference / Savings / Profit		
Design according to variant							
Minimum inside surface temperature							°C

	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

Boundary conditions					
Interest rate + inflation		**Price of final energy [€/kWh]**		**Utilisation period [a]**	
Nominal interest rate	3,0%	Electricity	0,15	Assembly layers	50
Inflation	1,0%	Gas / Oil	0,09	Vent. system	30
Period under consideration [a]	30	Wood	0,07	Thermal bridges	50
		District heating	0,10	Entire building	50
		Other	0,09	Windows	40


0
Poorer energy efficiency
Better energy efficiency

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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Selection of climate data

Country:	ud-User Data
Region:	All
	1-Alphabetic sorting
Climate data set:	ud---03-Tournon avec masque LAMP Temp 1960-1990
Climate zone:	4: Warm-temperate

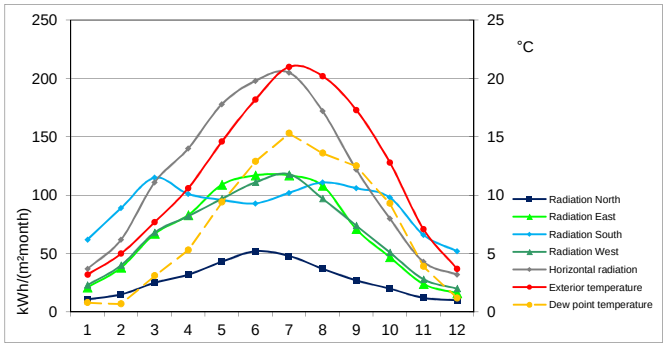
Altitude

Weather station:	168,0	m
Building location:	168	m

Result overview

Annual heating demand	222,4	kWh/(m²a)
Heating load	83,6	W/m²
Frequency of overheating	0,0	%
Sensible cooling	0,0	kWh/(m²a)
Latent cooling	0,1	kWh/(m²a)
Cooling load	-	W/m²
PER demand	453,0	kWh/(m²a)

	Data for heating Annual method	Data from monthly balance Heating	Cooling	
Heating / cooling period	188	334	62	d/a
Heating / cooling degree hours	63	75	-7	kKh/a
Radiation North	102	284	85	kWh/(m²a)
Radiation East	239	701	225	kWh/(m²a)
Radiation South	480	989	213	kWh/(m²a)
Radiation West	251	691	215	kWh/(m²a)
Horizontal radiation	408	1175	377	kWh/(m²a)



	Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load Weather 1	Heating load Weather 2	Cooling load Weather 1	Cooling load Weather 2	PER factors	
	Days	31	28	31	30	31	30	31	31	30	31	30	31						
	ud---03-Tournon avec masque LAMP Temp 196	Latitude °	45,1	Longitude °	4,8	Altitude [m]	168	Daily temperature swing Summer [K]			10,4			Radiation: [W/m²]		Radiation: [W/m²]			
° C	Exterior temperature	3,2	5,0	7,7	10,6	14,6	18,2	21,0	20,2	17,3	12,8	7,1	3,7	-3,5	0,6	25,0	25,0	1,25	Household electricity
kWh/(m²month)	Radiation North	11	15	25	32	43	52	48	37	27	20	12	10	14	9	51	51	1,25	Domestic hot water
kWh/(m²month)	Radiation East	21	38	67	83	109	117	117	108	71	47	24	16	29	9	152	152	1,75	Heating
kWh/(m²month)	Radiation South	62	89	115	101	96	93	102	111	106	98	66	52	99	10	160	160	1,20	Cooling
kWh/(m²month)	Radiation West	23	40	68	82	97	111	118	97	74	51	28	20	31	9	144	144	1,40	Dehumidification
kWh/(m²month)	Horizontal radiation	37	62	111	140	178	198	205	172	122	80	43	32	51	20	245	245		
° C	Dew point temperature	0,8	0,7	3,1	5,3	9,4	12,9	15,3	13,6	12,5	9,3	3,9	1,2			18,3	18,3		
° C	Sky temperature	-6,1	-6,7	-3,9	-1,6	3,3	6,1	9,6	8,1	7,1	3,7	-2,6	-5,4			16,1	18,3		
° C	Ground temperature	8,2	7,7	8,7	10,8	13,6	16,2	18,1	18,6	17,6	15,5	12,7	10,1	7,7	7,7	18,8	18,8		
	Comment:	Meteonorm 6.1																	

U-value of building assemblies

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 %

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.	Building assembly description	Interior insulation?
01ud		

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:

U-value supplement: W/(m²K)
U-value: W/(m²K)

Assembly no.	Building assembly description	Interior insulation?
02ud	**Dalle basse de l'escalier**	

Heat transmission resistance [m²K/W]

Orientation of building element: **3-Floor**
Adjacent to: **2-Ground**
interior R_{si}: 0,17
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]
Chape sèche - Etape 1	**0,350**					**20**
TMS SI - Etape 1	**0,022**					**0**
Beton	**2,000**					**200**

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: **22,0** cm

U-value supplement: W/(m²K)
U-value: **3,057** W/(m²K)

Assembly no.	Building assembly description	Interior insulation?
03ud	**Mur RDC sur cage d'escalier cave**	**yes**

Heat transmission resistance [m²K/W]

Orientation of building element: **0,13**
Adjacent to: **0,13**
interior R_{si}: 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]
Enduit ciment int	**0,800**					**10**
Agglo béton	**1,000**					**200**
Isolation extérieure	**0,032**					**0**

Percentage of sec. 1: 100%
Percentage of sec. 2:
Percentage of sec. 3:
Total: **21,0** cm

U-value supplement W/(m²K) **U-value:** **2,116** W/(m²K)

Assembly no.		Interior insulation?
04ud	**Mur Ext**	**no**

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]
Enduit ciment ext	**1,000**					**2**
Agglo béton	**1,000**					**200**
XPS Styrodur	**0,036**					**60**
Brique platriere	**0,600**					**40**
Enduit platre int	**0,800**					**2**
Isolation Exterieure	**0,032**					**0**

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			**30,4** cm

U-value supplement _____ W/(m²K) **U-value: 0,455** W/(m²K)

Assembly no.		Interior insulation?
05ud		

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]

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			cm

U-value supplement _____ W/(m²K) **U-value: 3,846** W/(m²K)

Assembly no.		Interior insulation?
06ud		

Heat transmission resistance [m²K/W]

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

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	Percentage of sec. 2	Percentage of sec. 3	Total
100%			cm

U-value supplement _____ W/(m²K) **U-value: 2,941** W/(m²K)

Assembly no. | Interior insulation?

07ud | **Dalle RDC isolée sur cave** | **no**

Heat transmission resistance [m²K/W]

Orientation of building element: 0,17 — interior R_{si}: 0,17

Adjacent to: 0,17 — exterior R_{se}: 0,17

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Carrelage	**1,500**					**10**
Chape	**1,500**					**120**
XPS Styrodur	**0,036**					**60**
Plancher béton hourdis	**2,000**					**200**
Isolation en sous face	**0,025**					**0**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **39,0** cm

U-value supplement: W/(m²K) | **U-value: 0,456** W/(m²K)

Assembly no. | Interior insulation?

08ud | **Dalle RDC non isolée sur cave** | **no**

Heat transmission resistance [m²K/W]

Orientation of building element: 0,17 — interior R_{si}: 0,17

Adjacent to: 0,17 — exterior R_{se}: 0,17

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Carrelage	**1,500**					**10**
Chape	**1,500**					**50**
Plancher béton hourdis	**2,000**					**200**
Isolation sous face	**0,025**					**0**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **26,0** cm

U-value supplement: W/(m²K) | **U-value: 2,083** W/(m²K)

Assembly no. | Interior insulation?

09ud | **Mur non isolé sur cave** | **no**

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]
Agglo Béton	**1,000**					**200**
Enduit platre int	**0,800**					**10**
Isolation sur cave	**0,032**					**0**

Percentage of sec. 1: 100% | Percentage of sec. 2 | Percentage of sec. 3 | Total: **21,0** cm

U-value supplement: W/(m²K) | **U-value: 2,116** W/(m²K)

Assembly no. 10ud — **Mur intérieur isolé sur combles non chauffes** — Interior insulation? **no**

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]
Enduit platre int	**0,800**					**15**
Agglo béton	**1,000**					**200**
XPS Styrodur	**0,036**					**90**
Enduit platre int	**0,800**					**10**
Isolation sur combles	**0,032**					**0**

Percentage of sec. 1: 100% — Percentage of sec. 2 — Percentage of sec. 3 — Total: **31,5** cm

U-value supplement: W/(m²K) — **U-value: 0,334** W/(m²K)

Assembly no. 11ud — **Mur intérieur non isolé sur combles non chauffés** — Interior insulation?

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]
Enduit platre int	**0,800**					**15**
Agglo béton	**1,000**					**200**
Enduit platre int	**0,800**					**10**
Isolation sur combles	**0,032**					**0**

Percentage of sec. 1: 100% — Percentage of sec. 2 — Percentage of sec. 3 — Total: **22,5** cm

U-value supplement: W/(m²K) — **U-value: 2,036** W/(m²K)

Assembly no. 12ud — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element — interior R_{si}

Adjacent to — 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. | Interior insulation?

13ud | **Porte escalier sur cave**

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]

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

U-value supplement: W/(m²K) | **U-value:** 3,846 W/(m²K)

Assembly no. | Interior insulation?

14ud | **Plancher haut sur combles non chauffés**

Heat transmission resistance [m²K/W]

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

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]
Interior Wood panels	0,130					15
XPS Styrodur	0,036	Rafters	0,130			45
Mineral wool	0,040					60
Mineral wool	0,040			Joists	0,130	60
Exterior Insulation	0,032					0

Percentage of sec. 1: 70% | Percentage of sec. 2: 20,0% | Percentage of sec. 3: 10,0% | Total: 18,0 cm

U-value supplement: W/(m²K) | **U-value:** 0,251 W/(m²K)

Assembly no. | Interior insulation?

15ud | **Toiture pente**

Heat transmission resistance [m²K/W]

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

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]
Interior Wood panels	0,130					15
Mineral wool	0,040	Roof Rafters	0,130			200
Exterior Insulation	0,032					0

Percentage of sec. 1: 85% | Percentage of sec. 2: 15,0% | Percentage of sec. 3 | Total: 21,5 cm

U-value supplement: W/(m²K) | **U-value:** 0,248 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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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]
								11 Months	2 Months
	Treated floor area	1	**155,00**	m²	*Treated floor area according to PHPP manual*				
A	**North windows**	2	**9,32**	m²	Results come from the 'Windows' worksheet.	**North windows**	**2,659**	**508**	**84**
A	**East windows**	3	**4,32**	m²	Window areas are subtracted from individual opaque areas.	**East windows**	**2,680**	**731**	**153**
A	**South windows**	4	**5,94**	m²	which is displayed in the 'Windows' worksheet.	**South windows**	**2,682**	**1580**	**256**
A	**West windows**	5	**5,90**	m²		**West windows**	**2,681**	**924**	**181**
A	**Horizontal windows**	6	**0,00**	m²		**Horizontal windows**			
A	**Exterior door**	7	**1,94**	m²	*Please subtract area of door from respective building assembly*	**Exterior door**	**2,500**		
A	**External wall - Ambient**	8	**218,25**	m²	*Temperature zone "A" is ambient air*	**External wall - Ambient**	**0,455**	**1239**	**403**
B	**External wall - Ground**	9	**13,35**	m²	*Temperature zone "B" is the ground*	**External wall - Ground**	**0,455**		
A	**Roof/Ceiling - Ambient**	10	**56,30**	m²		**Roof/Ceiling - Ambient**	**0,248**	**322**	**127**
B	**Floor slab / Basement ceiling**	11	**213,63**	m²		**Floor slab / Basement ceiling**	**1,359**		
		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	**Unheated attic**	14	**115,75**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):* **100%**	**Unheated attic**	**0,367**		
						Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**228,10**	m	*Units in m*	**Thermal bridges Ambient**	**0,125**		
P	**Perimeter thermal bridges**	16	**64,75**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*	**Perimeter thermal bridges**	**-0,217**		
B	**Thermal bridges FS/BC**	17	**60,78**	m	*Units in m*	**Thermal bridges FS/BC**	**-0,018**		
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			**644,69**	**m²**		**Average therm. envelope**	**0,835**		

Go to building components list

Area input

Sort: AS LIST

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		+	**213,63**	-		)		=	213,6									
	Treated floor area	**1**	Treated floor area	**1**	x (		x		+	**155,00**	-		)		=	155,0									
	Exterior door	**7**	Exterior door	**1**	x (	**0,90**	x	**2,15**	+		-		) -		=	1,9	Exterior door	**2,50**							
1	**Porte escalier sur cave**	**11**	Floor slab / Basement ceiling	**1**	x (	**1,00**	x	**2,15**	+		-		) -	**0,0**	=	2,2	**13ud-Porte escalier sur cave**	**3,846**							
2	**Dalle non isolée**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**43,30**	-		) -	**0,0**	=	43,3	**08ud-Dalle RDC non isolée sur cave**	**2,083**							
3	**Dalle isolée**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**100,25**	-		) -	**0,0**	=	100,3	**07ud-Dalle RDC isolée sur cave**	**0,456**							
4	**Dalle basse de l'escalier**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**16,29**	-		) -	**0,0**	=	16,3	**02ud-Dalle basse de l'escalier**	**3,057**							
5	**Murs de la cage d'escalier sur cave**	**11**	Floor slab / Basement ceiling	**1**	x (	**1,60**	x	**2,25**	+	**18,70**	-	**2,15**	) -	**0,0**	=	20,2	**03ud-Mur RDC sur cage d'escalier cave**	**2,116**							
6	**Mur Nord**	**8**	External wall - Ambient	**1**	x (		x		+	**75,80**	-	**1,94**	) -	**9,3**	=	64,5	**04ud-Mur Ext**	**0,455**	**0**	**90**	**North**	**0,70**	**0,90**	**0,90**
7	**Mur Sud enterré**	**9**	External wall - Ground	**1**	x (	**14,70**	x	**0,50**	+		-		) -	**0,0**	=	7,4	**04ud-Mur Ext**	**0,455**							
8	**Mur Sud non enterré**	**8**	External wall - Ambient	**1**	x (		x		+	**48,60**	-	**7,35**	) -	**5,9**	=	35,3	**04ud-Mur Ext**	**0,455**	**180**	**90**	**South**	**0,70**	**0,90**	**0,90**
9	**Mur Est enterré**	**9**	External wall - Ground	**1**	x (	**4,00**	x	**1,50**	+		-		) -	**0,0**	=	6,0	**04ud-Mur Ext**	**0,455**							
10	**Mur Est non enterré**	**8**	External wall - Ambient	**1**	x (		x		+	**52,15**	-	**6,00**	) -	**4,3**	=	41,8	**04ud-Mur Ext**	**0,455**	**90**	**90**	**East**	**0,70**	**0,90**	**0,90**
11	**Mur Ouest**	**8**	External wall - Ambient	**1**	x (		x		+	**67,05**	-		) -	**5,9**	=	61,2	**04ud-Mur Ext**	**0,455**	**270**	**90**	**West**	**0,70**	**0,90**	**0,90**
12	**Murs intérieurs sur cave**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**20,00**	-		) -	**0,0**	=	20,0	**09ud-Mur non isolé sur cave**	**2,116**							
13	**Murs pignon chambre sud sur combles non chauffés**	**14**	Unheated attic	**1**	x (		x		+	**5,00**	-		) -	**0,0**	=	5,0	**10ud-Mur intérieur isolé sur combles non chauffes**	**0,334**							
14	**Murs pignon mezzanine sur combles non chauffés**	**14**	Unheated attic	**1**	x (		x		+	**7,30**	-		) -	**0,0**	=	7,3	**11ud-Mur intérieur non isolé sur combles non chauffés**	**2,036**							
15	**Plancher haut sur combes non chauffés**	**14**	Unheated attic	**1**	x (		x		+	**103,45**	-		) -	**0,0**	=	103,5	**14ud-Ceiling to unheated attic**	**0,251**							
16	**Toiture pente Nord**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**30,00**	-		) -	**0,0**	=	30,0	**15ud-Pitched roof**	**0,248**	**0**	**24**	**Hor**	**1,00**	**0,80**	**0,90**
17	**Toiture pente Sud**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**19,60**	-		) -	**0,0**	=	19,6	**15ud-Pitched roof**	**0,248**	**180**	**31**	**South**	**1,00**	**0,80**	**0,90**
18					x (		x		+		-		) -	**0,0**	=									
19	**Dalle non isolée - Dim supp pour isolation**	**11**	Floor slab / Basement ceiling	**1**	x (	**14,75**	x	**0,25**	+		-	**3,69**	) -	**0,0**	=	0,0	**08ud-Dalle RDC non isolée sur cave**	**2,083**	**0**	**90**	**North**			
20	**Dalle isolée - Dim supp pour isolation**	**11**	Floor slab / Basement ceiling	**1**	x (	**37,50**	x	**0,25**	+		-		) -	**0,0**	=	9,4	**07ud-Dalle RDC isolée sur cave**	**0,456**	**0**	**90**	**North**			
21	**Dalle basse escalier - Dim supp pour isolation**	**11**	Floor slab / Basement ceiling	**1**	x (	**18,40**	x	**0,15**	+		-		) -	**0,0**	=	2,8	**02ud-Dalle basse de l'escalier**	**3,057**						
22	**Murs cage escalier - Dim supp pour isolation**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**0,09**	-		) -	**0,0**	=	0,1	**03ud-Mur RDC sur cage d'escalier cave**	**2,116**	**0**	**90**	**North**			
23	**Ext Wall - Extra Size for Insulation**	**8**	External wall - Ambient	**1**	x (	**34,18**	x	**0,20**	+	**8,58**	-		) -	**0,0**	=	15,4	**04ud-Mur Ext**	**0,455**	**0**	**90**	**North**	**0,70**	**0,90**	**0,90**
24	**Unins Wall Basement - Extra Size for Insulation**	**11**	Floor slab / Basement ceiling	**1**	x (	**14,75**	x	**0,15**	+		-	**2,95**	) -	**0,0**	=	-0,7	**09ud-Mur non isolé sur cave**	**2,116**	**0**	**90**	**North**			

Areas determination

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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]
									11 Months	2 Months
	Treated floor area	1	**155,00**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**9,32**	m²	Results come from the 'Windows' worksheet.		**North windows**	**2,659**	**508**	**84**
A	**East windows**	3	**4,32**	m²	Window areas are subtracted from individual opaque areas.		**East windows**	**2,680**	**731**	**153**
A	**South windows**	4	**5,94**	m²	which is displayed in the 'Windows' worksheet.		**South windows**	**2,682**	**1580**	**256**
A	**West windows**	5	**5,90**	m²			**West windows**	**2,681**	**924**	**181**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**			
A	**Exterior door**	7	**1,94**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**2,500**		
A	**External wall - Ambient**	8	**218,25**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,455**	**1239**	**403**
B	**External wall - Ground**	9	**13,35**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0,455**		
A	**Roof/Ceiling - Ambient**	10	**56,30**	m²			**Roof/Ceiling - Ambient**	**0,248**	**322**	**127**
B	**Floor slab / Basement ceiling**	11	**213,63**	m²			**Floor slab / Basement ceiling**	**1,359**		
		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	**Unheated attic**	14	**115,75**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**100%**	**Unheated attic**	**0,367**		
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**228,10**	m	*Units in m*		**Thermal bridges Ambient**	**0,125**		
P	**Perimeter thermal bridges**	16	**64,75**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**-0,217**		
B	**Thermal bridges FS/BC**	17	**60,78**	m	*Units in m*		**Thermal bridges FS/BC**	**-0,018**		
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			**644,69**	**m²**			**Average therm. envelope**	**0,835**		

Go to building components list

25	**Int Wall Attic - Extra Size for Insulation**	**8**	External wall - Ambient	**1**	x (		x		+		-		) -	**0,0**	=	0,0	**10ud-Mur intérieur isolé sur combles non chauffes**	**0,334**	**0**	**90**	**North**	**0,50**	**0,90**	**0,90**
26	**Int Wall Attic Not Insulated - Extra Size for Insulation**	**8**	External wall - Ambient	**1**	x (		x		+		-		) -	**0,0**	=	0,0	**11ud-Mur intérieur non isolé sur combles non chauffés**	**2,036**	**0**	**90**	**North**	**0,50**	**0,90**	**0,90**
27	**Ceiling to attic - Extra Size for Insulation**	**10**	Roof/Ceiling - Ambient	**1**	x (	**34,18**	x	**0,25**	+		-	**6,84**	) -	**0,0**	=	1,7	**14ud-Ceiling to unheated attic**	**0,251**	**0**	**90**	**North**	**0,50**	**0,90**	**0,90**
28	**Pitched Roof - Extra Size for Insulation**	**10**	Roof/Ceiling - Ambient	**1**	x (	**19,98**	x	**0,25**	+		-		) -	**0,0**	=	5,0	**15ud-Pitched roof**	**0,248**	**0**	**90**	**North**	**1,00**	**0,90**	**0,90**
29					x (		x		+		-		) -	**0,0**	=									
30					x (		x		+		-		) -	**0,0**	=									
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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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	**155,00**	m²	*Treated floor area according to PHPP manual*				11 Months
A	**North windows**	2	**9,32**	m²	Results come from the 'Windows' worksheet.		**North windows**	**2,659**	**508**
A	**East windows**	3	**4,32**	m²	Window areas are subtracted from individual opaque areas.		**East windows**	**2,680**	**731**
A	**South windows**	4	**5,94**	m²	which is displayed in the 'Windows' worksheet.		**South windows**	**2,682**	**1580**
A	**West windows**	5	**5,90**	m²			**West windows**	**2,681**	**924**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**		
A	**Exterior door**	7	**1,94**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**2,500**	
A	**External wall - Ambient**	8	**218,25**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,455**	**1239**
B	**External wall - Ground**	9	**13,35**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0,455**	
A	**Roof/Ceiling - Ambient**	10	**56,30**	m²			**Roof/Ceiling - Ambient**	**0,248**	**322**
B	**Floor slab / Basement ceiling**	11	**213,63**	m²			**Floor slab / Basement ceiling**	**1,359**	
		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	**Unheated attic**	14	**115,75**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**100%**	**Unheated attic**	**0,367**	
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**228,10**	m	*Units in m*		**Thermal bridges Ambient**	**0,125**	
P	**Perimeter thermal bridges**	16	**64,75**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**-0,217**	
B	**Thermal bridges FS/BC**	17	**60,78**	m	*Units in m*		**Thermal bridges FS/BC**	**-0,018**	
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			**644,69**	**m²**			**Average therm. envelope**	**0,835**	

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	**Insulated Slab / Exterior Wall**	**16**	Perimeter thermal bridges	**1**	x (	**37,50**	-		) =	37,50	**0,000**		or		**0,000**	
2	**Insulated Slab / Interior Wall to Basement**	**16**	Perimeter thermal bridges	**1**	x (	**12,50**	-		) =	12,50	**-1,300**		or		**-1,300**	
3	**Staircase Slab / Staircase Wall**	**17**	Thermal bridges FS/BC	**1**	x (	**17,80**	-		) =	17,80	**-0,800**		or		**-0,800**	
4	**Uninsulated Slab / Exterior Wall**	**16**	Perimeter thermal bridges	**1**	x (	**14,75**	-		) =	14,75	**0,150**		or		**0,150**	
5	**Interior Wall to Basement / Uninsulated Slab**	**17**	Thermal bridges FS/BC	**1**	x (	**14,75**	-		) =	14,75	**0,860**		or		**0,860**	
6	**Insulated Slab / Staircase Walls**	**17**	Thermal bridges FS/BC	**1**	x (	**13,20**	-		) =	13,20	**0,180**		or		**0,180**	
7	**Staircase Walls / Insulated Slab (North)**	**17**	Thermal bridges FS/BC	**1**	x (	**2,26**	-		) =	2,26	**0,180**		or		**0,180**	
8	**Intermediate Floor / Exterior Wall**	**15**	Thermal bridges Ambient	**1**	x (	**52,20**	-		) =	52,20	**0,200**		or		**0,200**	
9	**Ceiling Attic / Exterior Wall**	**15**	Thermal bridges Ambient	**1**	x (	**34,18**	-		) =	34,18	**0,000**		or		**0,000**	
10	**Ceiling Attic / Interior Walls**	**15**	Thermal bridges Ambient	**1**	x (	**27,35**	-		) =	27,35	**0,200**		or		**0,200**	
11	**Pitched Roof / Exterior Facade Wall**	**15**	Thermal bridges Ambient	**1**	x (	**8,15**	-		) =	8,15	**-0,020**		or		**-0,020**	
12	**Pitched Roof / Exterior Gable Wall**	**15**	Thermal bridges Ambient	**1**	x (	**11,83**	-		) =	11,83	**0,100**		or		**0,100**	
13	**(Faite) Pitched Roof / Exterior Facade Wall**	**15**	Thermal bridges Ambient	**1**	x (	**1,40**	-		) =	1,40	**0,030**		or		**0,030**	
14	**(Faite) North Pitched Roof / South Pitched Roof**	**15**	Thermal bridges Ambient	**1**	x (	**4,23**	-		) =	4,23	**0,030**		or		**0,030**	
15	**Pitched Roof / Interior Gable Wall to Attic**	**15**	Thermal bridges Ambient	**1**	x (	**8,55**	-		) =	8,55	**0,100**		or		**0,100**	
16	**Exterior Walls - Outwards Angles**	**15**	Thermal bridges Ambient	**1**	x (	**35,88**	-		) =	35,88	**0,000**		or		**0,000**	
17	**Exterior Walls to Basement - Outwards Angles**	**17**	Thermal bridges FS/BC	**1**	x (	**3,18**	-		) =	3,18	**0,000**		or		**0,000**	
18	**Exterior Walls - Inwards Angles**	**15**	Thermal bridges Ambient	**1**	x (	**17,83**	-		) =	17,83	**0,050**		or		**0,050**	
19	**Exterior Walls to Basement - Inwards Angles**	**17**	Thermal bridges FS/BC	**1**	x (	**1,59**	-		) =	1,59	**0,050**		or		**0,050**	
20	**Staircase Walls to Basement - Outwards Angles**	**17**	Thermal bridges FS/BC	**1**	x (	**8,00**	-		) =	8,00	**-0,300**		or		**-0,300**	
21	**Interior Wall to Attic - Inwards Angles**	**15**	Thermal bridges Ambient	**1**	x (	**2,50**	-		) =	2,50	**0,050**		or		**0,050**	
22	**Interior Wall to Atic - Wall Penetration**	**15**	Thermal bridges Ambient	**1**	x (	**24,00**	-		) =	24,00	**0,400**		or		**0,400**	
23					x (		-		) =				or			
24					x (		-		) =				or			
25					x (		-		) =				or			
26					x (		-		) =				or			

Areas determination

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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	**155,00**	m²	*Treated floor area according to PHPP manual*				11 Months
A	**North windows**	2	**9,32**	m²			**North windows**	**2,659**	**508**
A	**East windows**	3	**4,32**	m²	Results come from the 'Windows' worksheet.		**East windows**	**2,680**	**731**
A	**South windows**	4	**5,94**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**2,682**	**1580**
A	**West windows**	5	**5,90**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**2,681**	**924**
A	**Horizontal windows**	6	**0,00**	m²			**Horizontal windows**		
A	**Exterior door**	7	**1,94**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**	**2,500**	
A	**External wall - Ambient**	8	**218,25**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0,455**	**1239**
B	**External wall - Ground**	9	**13,35**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0,455**	
A	**Roof/Ceiling - Ambient**	10	**56,30**	m²			**Roof/Ceiling - Ambient**	**0,248**	**322**
B	**Floor slab / Basement ceiling**	11	**213,63**	m²			**Floor slab / Basement ceiling**	**1,359**	
		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	**Unheated attic**	14	**115,75**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**100%**	**Unheated attic**	**0,367**	
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**228,10**	m	*Units in m*		**Thermal bridges Ambient**	**0,125**	
P	**Perimeter thermal bridges**	16	**64,75**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**-0,217**	
B	**Thermal bridges FS/BC**	17	**60,78**	m	*Units in m*		**Thermal bridges FS/BC**	**-0,018**	
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			**644,69**	**m²**			**Average therm. envelope**	**0,835**	

Go to building components list

27					x (		-		) =							or				
28					x (		-		) =							or				
29					x (		-		) =							or				
30					x (		-		) =							or				
31					x (		-		) =							or				
32					x (		-		) =							or				
33					x (		-		) =							or				
34					x (		-		) =							or				
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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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	$T_{g,ave}$	12,8	°C
Amplitude of $T_{g,ave}$	$T_{g,\wedge}$	8,9	°C
Phase shifting of $T_{e,m}$	τ	1,2	Months
Length of the heating period	n	6,2	Months
Heating degree hours - exterior	G_t	63,0	kKh/a

Building data				Building data			
Area of ground floor slab / basement ceilin	A	226,8	m²	U-value floor slab/basement ceiling	U_f	0,137	W/(m²K)
Perimeter length	P	52,2	m	TBs floor slab / basement ceiling	Ψ_B*l	-12,14	W/K
Charact. dimension of floor slab	B'	8,69	m	U-value floor slab / basement ceiling i	U_f'	0,083	W/(m²K)
				Equivalent thickness floor	d_t	23,98	m

Floor slab type (select only one)

	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)
x	**Unheated basement**						
	Height aboveground wall	h	0,69 m	U-Value wall above ground	U_W	2,062	W/(m²K)
	Basement wall height below ground level	z	2,92 m	U-Value wall below ground	U_{WB}	2,062	W/(m²K)
	Air change unheated basement	n	0,20 h^{-1}	U-Value basement floor slab	U_{fB}	3,704	W/(m²K)
	Air flow basement	V	404 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	2,988 W/K
Phase shift	β		Months	Harmonic fraction	$\Psi_{P,harm}$*l	2,988 W/K

Groundwater correction						
Depth of the groundwater table	z_w	3,0	m	Groundwater correction factor	G_w	1,11055888 -
Groundwater flow rate	q_w	0,05	m/d			

Interim results

Phase shift	β	0,69	Months	Steady-state heat flow	Φ_{stat}	150,1 W
Steady-state transmittance	L_S	20,80	W/K	Periodic heat flow	Φ_{harm}	68,9 W
Exterior periodic transmittance	L_{pe}	13,43	W/K	Heat losses during heating period	Q_{tot}	989 kWh
Transmittance building	L_0	21,91	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	8,2	7,7	8,7	10,8	13,6	16,2	18,1	18,6	17,6	15,5	12,7	10,1	13,1
Summer	8,5	8,0	8,9	11,1	13,8	16,5	18,3	18,8	17,9	15,8	13,0	10,3	13,4

Design ground temperature for 'Heating load' worksheet 7,7 **For 'Cooling load' worksheet** 18,8

Reduction factor for 'Annual heating' worksheet 0,72

Total result (all building parts)

Phase shift	β	0,69	Months	Steady-state heat flow	Φ_{stat}	150,1 W
Steady-state transmittance	L_S	20,80	W/K	Periodic heat flow	Φ_{harm}	68,9 W
Exterior periodic transmittance	L_{pe}	13,43	W/K	Heat losses during heating period	Q_{tot}	989 kWh
Transmittance building	L_0	21,91	W/K	Charact. dimension of floor slab	B'	8,69 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	**8,2**	**7,7**	**8,7**	**10,8**	**13,6**	**16,2**	**18,1**	**18,6**	**17,6**	**15,5**	**12,7**	**10,1**	**13,1**
Summer	**8,5**	**8,0**	**8,9**	**11,1**	**13,8**	**16,5**	**18,3**	**18,8**	**17,9**	**15,8**	**13,0**	**10,3**	**13,4**

Design ground temperature for 'Heating load' worksheet **7,7** **For 'Cooling load' worksheet** **18,8**

Reduction factor for 'Annual heating' worksheet **0,72**

Passive House Components

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overhea

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: 0,3 W/(m²K) | 0,22 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					
02ud	**Dalle basse de l'escalier**	**Dalle basse de l'escalier**	**0,220**	**3,057**	**0**
03ud	**Mur RDC sur cage d'escalier cave**	**Mur RDC sur cage d'escalier cave**	**0,210**	**2,116**	**1**
04ud	**Mur Ext**	**Mur Ext**	**0,304**	**0,455**	**1**
05ud				**3,846**	**0**
06ud				**2,941**	**0**
07ud	**Dalle RDC isolée sur cave**	**Dalle RDC isolée sur cave**	**0,390**	**0,456**	**1**
08ud	**Dalle RDC non isolée sur cave**	**Dalle RDC non isolée sur cave**	**0,260**	**2,083**	**1**
09ud	**Mur non isolé sur cave**	**Mur non isolé sur cave**	**0,210**	**2,116**	**1**
10ud	**Mur intérieur isolé sur combles non chauffes**	**Mur intérieur isolé sur combles non chauffes**	**0,315**	**0,334**	**1**

Glazing

Glazing

	Recommended glazing type to start planning: Triple thermally insulated glazing (Please consider the comfort criterion!)		
ID	**Description**	**g-Value**	U_g-Value
			W/(m²K)
01ud	**Existing Glazing**	**0,77**	**2,70**
02ud	**New glazing Triple**	**0,60**	**0,65**
03ud	**Double Vitrage Basse Emissivité**	**0,64**	**2,00**
04ud			
05ud			
06ud			
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 Frame Timber 1 Casement**	**1,60**	**1,60**	**1,60**	**1,60**	**0,140**	**0,140**	**0,140**	**0,140**	**0,040**	**0,040**	**0,040**	**0,040**	**0,100**	**0,100**	**0,100**	**0,100**	
02ud	**Existing Frame Timber 2 Casements**	**1,60**	**1,60**	**1,60**	**1,60**	**0,140**	**0,080**	**0,140**	**0,140**	**0,040**	**0,040**	**0,040**	**0,040**	**0,100**	**0,100**	**0,100**	**0,100**	
03ud	**New Frame Smartwin 1 Casement**	**0,70**	**0,70**	**0,91**	**0,70**	**0,086**	**0,086**	**0,086**	**0,086**	**0,026**	**0,026**	**0,025**	**0,026**	**0,000**	**0,000**	**0,020**	**0,020**	
04ud	**New Frame Smartwin 2 Casements**	**0,70**	**0,70**	**0,91**	**0,70**	**0,086**	**0,060**	**0,086**	**0,086**	**0,026**	**0,026**	**0,025**	**0,026**	**0,000**	**0,000**	**0,020**	**0,020**	
05ud																		
06ud																		
07ud																		
08ud																		
09ud																		
10ud																		

Ventilation units with heat recovery

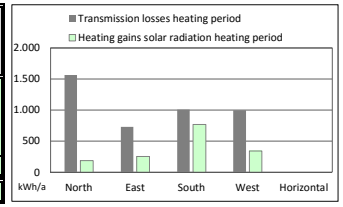
Ventilation units with heat recovery

	Recommended specifications to start planning: Frost protection: Yes; Humidity recovery: Yes	75 %		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	**Existing MVHR, not functioning**	**0%**	**0%**	**0,45**	**100**	**200**							
02ud	**Novus 300 - Paul**	**93%**	**0%**	**0,24**	**121**	**231**		**100**	**incl.**	**yes**	**/**	**65**	**46**
03ud													
04ud													
05ud													
06ud													
07ud													
08ud													
09ud													
10ud													

Windows

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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	102	0,56	0,95	0,85	0,55	0,77	0,25	9,32	2,66	5,14	102	North	1561	182
East	239	0,69	0,95	0,85	0,56	0,77	0,31	4,32	2,68	2,44	239	East	730	250
South	480	0,73	0,95	0,85	0,59	0,77	0,35	5,94	2,68	3,51	480	South	1003	767
West	251	0,63	0,95	0,85	0,58	0,77	0,29	5,90	2,68	3,42	251	West	995	336
Horizontal	408	1,00	0,95	0,85	0,00	0,00	0,00	0,00	0,00	0,00	408	Horizontal	0	0
Total or average value for all windows.						0,77	0,29	25,48	2,67	14,51			4290	1536



Heating degree hours [kKh/a] 63,0

Go to glazing list
Go to window frames list

					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)	%
	South																					
1	Wd - Lo	180	90	South	1,100	1,350	8-South Wall - Not Buried	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,5	0,88	2,68	59%
3	Wd - Hi	180	90	South	1,100	1,350	8-South Wall - Not Buried	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	4,5	2,63	2,68	59%
	West																					
2	Wd - Lo	270	90	West	1,100	1,350	11-West Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	3,0	1,75	2,68	59%
1	Wd - Hi	270	90	West	0,800	1,800	11-West Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,4	0,79	2,68	55%
1	Wd - Lo	270	90	West	1,100	1,350	11-West Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,5	0,88	2,68	59%
	North																					
1	WdDo - Lo E	0	90	North	0,800	2,150	6-North Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,7	0,97	2,68	57%
1	WdDo - Lo W	0	90	North	0,800	2,150	6-North Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,7	0,97	2,68	57%
2	WdDo2V - Lo	0	90	North	0,600	2,150	6-North Wall	01ud-Existing Glazing	02ud-Existing Frame Timber 2 Casements	0,77	2,70	1,60	0,040	0	1	1	1	0,100	2,6	1,42	2,61	55%
1	Wd - Lo	0	90	North	1,000	1,250	6-North Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,3	0,70	2,68	56%
1	Wd - Hi	0	90	North	1,000	1,250	6-North Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,3	0,70	2,68	56%
1	Wd - Hi	0	90	North	0,800	1,000	6-North Wall	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	0,8	0,37	2,69	47%
	East																					
1	Wd - Lo	90	90	East	1,000	1,250	10-East Wall - Not Buried	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,3	0,70	2,68	56%
1	Wd - Hi	90	90	East	1,000	1,250	10-East Wall - Not Buried	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,3	0,70	2,68	56%
1	WdDo - Lo	90	90	East	0,800	2,280	10-East Wall - Not Buried	01ud-Existing Glazing	01ud-Existing Frame Timber 1 Casement	0,77	2,70	1,60	0,040	1	1	1	1	0,100	1,8	1,04	2,68	57%

Heating degree hours [kKh/a] **63,0**

					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)	%

Calculation of shading coefficients

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Latitude: 45,06 °

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	5,14	56%	29%	21%	16
East	2,44	69%	42%	30%	63
South	3,51	73%	52%	52%	73
West	3,42	63%	37%	27%	53
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_{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 [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
	South											0,15														
1	**Wd - Lo**	180	90	South	0,82	1,07	0,9			0,20	0,050	0,15	0,05	92%	94%				90%	96%	79%		87%	92%	76%	76%
3	**Wd - Hi**	180	90	South	0,82	1,07	2,6			0,20	0,050	0,67	0,25	92%	94%				90%	86%	71%		87%	54%	44%	44%
	West																									
2	**Wd - Lo**	270	90	West	0,82	1,07	1,8			0,20	0,050	0,78	0,30	92%	94%	29%			84%	77%	59%		94%	77%	34%	24%
1	**Wd - Hi**	270	90	West	0,52	1,52	0,8			0,20	0,050	0,65	0,50	92%	94%	29%			77%	86%	61%		91%	90%	39%	28%
1	**Wd - Lo**	270	90	West	0,82	1,07	0,9			0,20	0,050	0,15	0,05	92%	94%	29%			84%	93%	71%		94%	97%	43%	31%
	North																									
1	**WdDo - Lo E**	0	90	North	0,52	1,87	1,0			0,20	0,050	2,67	0,65	92%	94%	29%			83%	65%	50%		84%	64%	25%	18%
1	**WdDo - Lo W**	0	90	North	0,52	1,87	1,0			0,20	0,050	3,00	0,30	92%	94%	29%			83%	56%	43%		84%	55%	22%	16%
2	**WdDo2V - Lo**	0	90	North	0,38	1,87	1,4			0,20	0,350	1,50	0,80	92%	94%	29%			90%	79%	65%		90%	82%	35%	25%
1	**Wd - Lo**	0	90	North	0,72	0,97	0,7			0,20	0,050	0,15	0,05	92%	94%	29%			87%	92%	74%		87%	97%	40%	28%
1	**Wd - Hi**	0	90	North	0,72	0,97	0,7			0,20	0,050	2,02	0,25	92%	94%	29%			87%	53%	42%		87%	53%	22%	15%
1	**Wd - Hi**	0	90	North	0,52	0,72	0,4			0,20	0,050	0,67	0,50	92%	94%	29%			83%	81%	62%		84%	84%	33%	24%
	East																									
1	**Wd - Lo**	90	90	East	0,72	0,97	0,7			0,20	0,050	0,15	0,05	92%	94%	29%			82%	92%	70%		93%	97%	42%	30%
1	**Wd - Hi**	90	90	East	0,72	0,97	0,7			0,20	0,050	0,15	0,05	92%	94%	29%			82%	92%	70%		93%	97%	42%	30%
1	**WdDo - Lo**	90	90	East	0,52	2,00	1,0			0,20	0,050	0,15	0,05	92%	94%	29%			77%	96%	68%		91%	99%	42%	30%

Ventilation data

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Treated floor area A_{TFA}	m²	155		*('Areas' worksheet)*
Room height h	m	2,50	2,50	
Volume of ventilated space (A_{TFA}*h) : V_V	m³	388		*(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			0,07	0,18				
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	5,00	5,00	439	m³	3,40	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	0,396	0,990

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)*	**133**	**0,34**	**0,00**	**0,0%**	**0,0%**	**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
34%	34%	39%	44%	57%	70%	-	73%	68%	56%	41%	35%

Standard data input for balanced ventilation

Dimensioning of ventilation system with only one ventilation unit

Occupancy	m²/P	53				
Number of occupants	P	2,9				
Supply air per person	m³/(P*h)	30				
Supply air requirement	m³/h	88				
Extract air rooms		Kitchen	Bathroom	Bathroom (shower only)	WC	
Quantity		1	1		2	
Extract air requirement per room	m³/h	60	40	20	20	
Total extract air requirement	m³/h	140				

Design air flow rate (maximum) m³/h **173** Recommended: 151 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	173	0,45
Standard	**24,0**	**0,77**	133	0,34
Basic		**0,54**	93	0,24
Minimum		**0,40**	69	0,18
	Average value	0,77	Average air flow rate (m³/h) **133**	Average air change rate (1/h) **0,34**

Selection of ventilation unit with heat recovery

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

	Go to ventilation units list Sort: BY ID	Heat recovery efficiency Unit η_{WRG}	Energy recovery η_{ERV}	Specific efficiency [Wh/m³]	Application [m³/h]	Frost power input
Ventilation unit selection	**01ud-Existing MVHR, not functioning**	0,00	0,00	0,45	100 - 200	N/A

Conductivity supply air duct	Y	W/(mK)	0,215	Implementation of frost protection	**2-Elec.**
Length of supply air duct		m	1	Limit temperature [°C]	0
Conductivity extract air duct	Y	W/(mK)	0,215	Useful energy [kWh/a]	66
Length of extract air duct		m	1		
Temperature of mechanical services room		°C	7,1	Room temperature (°C)	20
(Enter only if the central unit is outside of the thermal envelope)				Avg. ambient temp. heat. period (°C)	7,1
				Avg. ground temp (°C)	12,8

Effective heat recovery efficiency $\eta_{HR,eff}$ **0,0%**

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	**160**	mm
Insulation thic	**100**	mm
Reflective coating?	**x**	Yes
		No
Thermal conductivity	**0,032**	W/(mK)
Nominal air flow rate	133	m³/h
Δϑ	13	K
Exterior duct diameter	0,160	m
Exterior diameter	0,360	m
α–Interior	9,05	W/(m²K)
α-Surface	2,17	W/(m²K)
Ψ–value	**0,215**	**W/(mK)**
Surface temperature difference	1,130	K

Secondary calculation
Ψ-value extract or exhaust air duct

Nominal width:	**160**	mm
Insulation thickness	**100**	mm
Reflective coating?	**x**	yes
		no
Thermal conductivity	**0,032**	W/(mK)
Nominal air flow rate	133	m³/h
Δϑ	13	K
Exterior duct diameter	0,160	m
Exterior diameter	0,360	m
α–Interior	9,05	W/(m²K)
α-Surface	2,17	W/(m²K)
Ψ–value	**0,215**	**W/(mK)**
Surface temperature difference	1,130	K

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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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	155	*('Areas' worksheet)*
Room height h	m	2,50	*(Worksheet 'Annual heating')*
Room air volume for ventilation (A_{TFA}*h) = V_V	m³	388	*(Worksheet 'Annual heating')*
Number of occupants	P	2,9	*('Ventilation' worksheet)*
Room temperature	°C	20	*(Worksheet 'Annual heating')*
Average external temp. heating period	°C	7,1	*('Ventilation' worksheet)*
Average ground temp.	°C	12,8	*('Ground' worksheet)*
Length of the heating period	d/a	188	*('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											24	7	0	77%	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%								
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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

Ventilation unit no.	Quantity [-]	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
			Change sorting type																				
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
																					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: **11,0** (only enter when at least one unit is installed outside of the thermal envelope)

Quantity	Round duct ins. diameter mm	Rectangular duct Width mm	Height mm	Insulation thickness mm	Thermal conductivity W/(m K)	Reflective insulation duct (x)	Duct transmittance 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										
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Specific energy for heating (annual method)

EnerPHit with PHPP Version 9.3

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Interior temperature: 20,0 °C
Building type: Single Family House
Treated floor area A_{TFA}: 155,0 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	218,2	*	0,455	*	1,00	*	63,0	=	6255	40,35
External wall - Ground	B	13,4	*	0,455	*	0,72	*	63,0	=	274	1,77
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	*	63,0	=	879	5,67
Floor slab / Basement ceiling	B	213,6	*	1,359	*	0,72	*	63,0	=	13104	84,54
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
Unheated attic	X	115,8	*	0,367	*	1,00	*	63,0	=	2676	17,26
Windows	A	25,5	*	2,673	*	1,00	*	63,0	=	4290	27,68
Exterior door	A	1,9	*	2,500	*	1,00	*	63,0	=	305	1,97
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	*	63,0	=	1800	11,61
Perimeter TB (length/m)	P	64,8	*	-0,217	*	0,72	*	63,0	=	-634	-4,09
Ground TB (length/m)	B	60,8	*	-0,018	*	0,72	*	63,0	=	-49	-0,32
Total of all building envelope areas		644,7									kWh/(m²a)
Transmission heat losses Q_T									Total	28899	186,4

		A_{TFA} m²		Clear room height m		m³		
Ventilation system:	Effective air volume, V_V	155,0	*	2,50	=	387,5		
Effective heat recovery efficiency	η_{eff} 0%							
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	0,343	* (1 -	0,00	) +	0,396	=	0,739			
	V_V m³	n_V 1/h		c_{Air} Wh/(m³K)		G_t kKh/a		kWh/a		kWh/(m²a)
Ventilation heat losses Q_V	387,5	* 0,739	*	0,33	*	63,0	=	5956		38,4

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend Saving	=	kWh/a	kWh/(m²a)
Total heat losses Q_L	(28899	+	5956	)	1,0	=	34855	**224,9**

Orientation of the area	Reduction factor See 'Windows' sheet		g-Value (perp. radiation)		Area m²		Radiation HP kWh/(m²a)		kWh/a	kWh/(m²a)
North	0,25	*	0,77	*	9,32	*	102	=	182	
East	0,31	*	0,77	*	4,32	*	239	=	250	
South	0,35	*	0,77	*	5,94	*	480	=	767	
West	0,29	*	0,77	*	5,90	*	251	=	336	
Horizontal	0,00	*	0,00	*	0,00	*	408	=	0	
Available solar heat gains Q_S								Total	1536	9,9

	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	*	188	*	2,42	*	155,0	=	1695	10,9

		kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I =	3231	20,8
Ratio of free heat to losses	Q_F / Q_V =	0,09	
Utilisation factor heat gains h_G	$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6)$ =	100%	
Heat gains Q_G	η_G * Q_F =	3231	**20,8**

		kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G =	31625	**204**

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

Specific energy for heating (monthly method)

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 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:	Single Family House	
Treated floor area A_{TFA}:	155,0	m²
Spec. Capacity:	180	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	218,2	*	0,455	*	1,00	*	75	=	7439	48,00
External wall - Ground	B	13,4	*	0,455	*	1,00	*	58	=	354	2,28
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	*	75	=	1046	6,75
Floor slab / Basement ceiling	B	213,6	*	1,359	*	1,00	*	58	=	16927	109,20
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
Unheated attic	X	115,8	*	0,367	*	1,00	*	75	=	3183	20,53
Windows	A	25,5	*	2,673	*	1,00	*	75	=	5102	32,92
Exterior door	A	1,9	*	2,500	*	1,00	*	75	=	362	2,34
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	*	75	=	2140	13,81
Perimeter TB (length/m)	P	64,8	*	-0,217	*	1,00	*	58	=	-818	-5,28
Ground TB (length/m)	B	60,8	*	-0,018	*	1,00	*	58	=	-64	-0,41

Transmission heat losses Q_T — Total 35672 kWh/a — 230,1 kWh/(m²a)

	A_{TFA} m²		Clear room height m		Effective air volume V_V m³
	155	*	2,50	=	388

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR}		$n_{V,Res}$ 1/h		$n_{V,equi,fraction}$ 1/h
Effective air change rate Ambient nV,e	0,343	*(1-	0%	)*(1-	0,00	)+	0,396	=	0,739
Effective air change rate Ground nV,g	0,343	*	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	388	*	0,739	*	0,33	*	75	=	7084	45,7
Ventilation losses ground $Q_{V,e}$	388	*	0,000	*	0,33	*	58	=	0	0,0

Ventilation heat losses Q_V — Total 7084 kWh/a — 45,7 kWh/(m²a)

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend saving		kWh/a	kWh/(m²a)
Total heat losses Q_L	(35672	+	7084	) *	1,0	=	42756	**275,8**

Orientation of the area	Reduction factor see 'Windows' worksheet		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0,25	*	0,77	*	9,3	*	284	=	508
East	0,31	*	0,77	*	4,3	*	701	=	731
South	0,35	*	0,77	*	5,9	*	989	=	1580
West	0,29	*	0,77	*	5,9	*	691	=	924
Horizontal	0,00	*	0,00	*	0,0	*	1175	=	0
Sum opaque areas									2454

Available solar heat gains Q_S — Total 6197 kWh/a — 40,0 kWh/(m²a)

	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	*	334	*	2,4	*	155,0	=	3010	19,4

			kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I	=	9207	59,4
Ratio free heat to losses	Q_F / Q_L	=	0,22	
Utilisation factor heat gains h_G		=	90%	
Heat gains Q_G	η_G * Q_F	=	8279	**53,4**

			kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G	=	34477	**222**

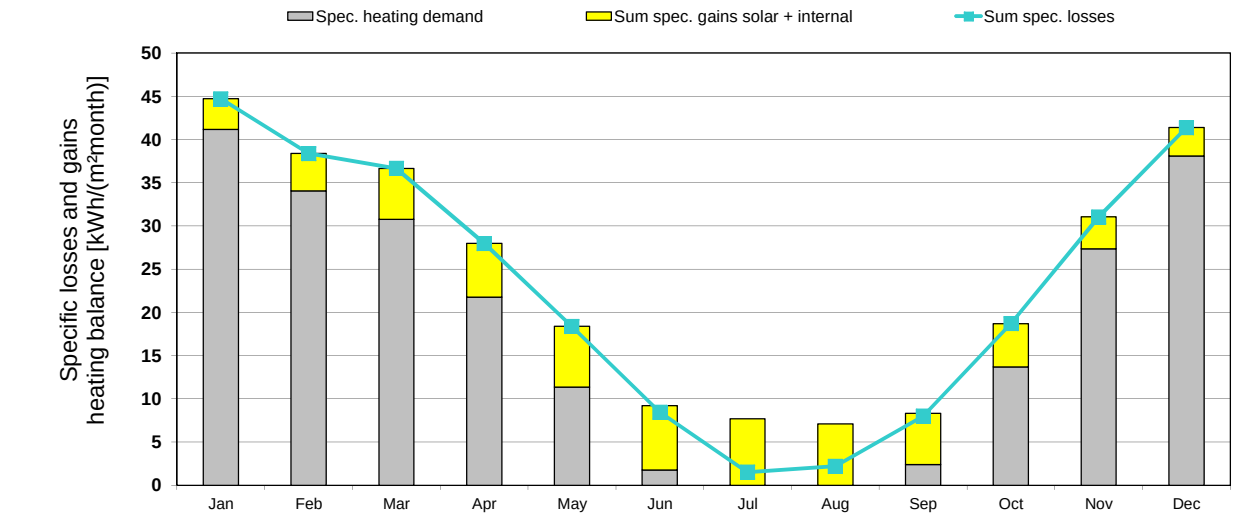
Limiting value	kWh/(m²a)	**Requirement met?**	(Yes/No)
	-		-

Specific energy for heating (monthly method)

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Interior temperature: 20 °C
Building type: Single Family House
Treated floor area A_{TFA}: 155 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - External	12,7	10,3	9,4	7,0	4,3	1,6	-0,5	0,1	2,2	5,6	9,5	12,3	74	kKh
Heating degree hours - Ground	8,8	8,3	8,4	6,6	4,8	2,7	1,4	1,1	1,7	3,3	5,2	7,4	60	kKh
Losses - Exterior	4466	3626	3308	2472	1502	550	-170	45	762	1955	3338	4333	26188	kWh
Losses - Ground	2463	2322	2374	1863	1344	762	404	296	477	942	1474	2080	16802	kWh
Sum spec. losses	44,7	38,4	36,7	28,0	18,4	8,5	1,5	2,2	8,0	18,7	31,0	41,4	277,4	kWh/m²
Solar gains - North	20	27	45	57	77	93	86	66	48	36	21	18	593	kWh
Solar gains - East	22	40	70	87	114	122	122	113	74	49	25	17	853	kWh
Solar gains - South	99	142	184	161	153	149	163	177	169	157	105	83	1743	kWh
Solar gains - West	31	53	91	110	130	148	158	130	99	68	37	27	1082	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	98	154	244	280	337	373	382	334	254	188	110	83	2836	kWh
Internal heat gains	279	252	279	270	279	270	279	279	270	279	270	279	3289	kWh
Sum spec. gains solar + internal	3,5	4,3	5,9	6,2	7,0	7,5	7,7	7,1	5,9	5,0	3,7	3,3	67,1	kWh/m²
Utilisation factor	100%	100%	100%	100%	100%	90%	20%	31%	95%	100%	100%	100%	82%	
Annual heating demand	6381	5280	4770	3371	1760	273	0	0	373	2121	4242	5906	34477	kWh
Spec. heating demand	**41,2**	**34,1**	**30,8**	**21,7**	**11,4**	**1,8**	**0,0**	**0,0**	**2,4**	**13,7**	**27,4**	**38,1**	**222,4**	kWh/m²



Annual heating demand: Comparison

Monthly method	*('Heating')*	34477	kWh/a	222,4	**kWh/(m²a)** reference to treated floor area according to PHPP
Annual method	*('Annual heating')*	31625	kWh/a	204,0	**kWh/(m²a)** reference to treated floor area according to PHPP

Heating load

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Interior temperature: 20 °C
Building type: Single Family House
Treated floor area A_{TFA}: 155,0 m²

	Design temperature		Radiation:	North	East	South	West	Horizontal	
Weather 1:	-3,5	°C		14	29	99	31	51	W/m²
Weather 2:	0,6	°C		9	9	10	9	20	W/m²
Ground design temp.	7,7	°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	218,2	*	0,455	*	1,00	*	23,5	or	19,4	=	2334	or	1926
External wall - Ground	B	13,4	*	0,455	*	1,00	*	12,3	or	12,3	=	75	or	75
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	*	23,5	or	19,4	=	328	or	271
Floor slab / Basement ceiling	B	213,6	*	1,359	*	1,00	*	12,3	or	12,3	=	3567	or	3567
	A		*		*	1,00	*	23,5	or	19,4	=		or	
	A		*		*	1,00	*	23,5	or	19,4	=		or	
Unheated attic	X	115,8	*	0,367	*	1,00	*	23,5	or	19,4	=	998	or	824
Windows	A	25,5	*	2,673	*	1,00	*	23,5	or	19,4	=	1600	or	1321
Exterior door	A	1,9	*	2,500	*	1,00	*	23,5	or	19,4	=	114	or	94
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	*	23,5	or	19,4	=	671	or	554
Perimeter TB (length/m)	P	64,8	*	-0,217	*	1,00	*	12,3	or	12,3	=	-172	or	-172
Ground TB (length/m)	B	60,8	*	-0,018	*	1,00	*	12,3	or	12,3	=	-13	or	-13
Building element towards neighbour	I		*		*	1,00	*	3,0	or	3,0	=		or	

Transmission heat load P_T

Total = 9502 or 8447

Ventilation system:

Effective air volume, V_V: A_{TFA} 155,0 m² * Clear room height 2,50 m = 388 m³

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

Energetically effective air changes n_V: $n_{V,Res}$ (Heating Load) 0,990 1/h + $n_{V,system}$ 0,343 1/h *(1- Φ_{HP} 0,00 or 0,00) = 1,334 1/h or 1,334 1/h

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
387,5	*	1,334	or	1,334	*	0,33	*	23,5	or	19,4	=	4008	or	3308

Total heating load P_L

	PL 1 W		PL 2 W
$P_T + P_V$ =	13509	or	11755

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	9,3	*	0,8	*	0,25	*	14	or	9	=	25	or	16
East	4,3	*	0,8	*	0,31	*	29	or	9	=	30	or	9
South	5,9	*	0,8	*	0,35	*	99	or	10	=	158	or	16
West	5,9	*	0,8	*	0,29	*	31	or	9	=	41	or	12
Horizontal	0,0	*	0,0	*	0,40	*	51	or	20	=	0	or	0

Solar heating power P_S

Total = 255 or 53

Internal heating load P_I

Spec. power W/m² 1,9 * A_{TFA} 155 m² = P_I 1 298 W or P_I 2 298 W

Heating power (gains) P_G

	P_G 1 W		P_G 2 W
$P_T + P_I$ =	553	or	351

$P_L - P_G$ = 12956 or 11404

Heating load P_H = **12956 W**

Area specific space heating load P_H / A_{TFA} = **83,6 W/m²**

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

Supply air temperature without heating $\vartheta_{Supply,Min}$: °C -3,5 °C 0,6

For comparison: heating load transportable by the supply Air $P_{Supply\ Air,Max}$ = 2437 W specific: 15,7 W/m²

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

Summer ventilation

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building volume:	388	m³	Building type:	Single Family House	
Max. indoor absolute humidity:	12	g/kg	Heat recovery η_{HRV}:	0%	
Internal humidity sources:	105,2694887	g/(P*h)	Energy recovery η_{ER}:	0%	
			Subsoil heat exchanger η^*_{SHX}:	0%	

Results passive cooling				Results active cooling		
Frequency of overheating:	0,0%	at the overheating limit ϑ_{max} = 25 °C		Useful cooling demand:	0,0	kWh/(m²a)
max. humidity:	13,6	g/kg		Dehumidification demand:	0,1	kWh/(m²a)
Frequency of exceeded humidity:	0,3%			Frequency of exceeded humidity:	2,6%	

Summer basic ventilation to ensure adequate air quality

Air change rate via vent. system with supply air:	0,34	1/h	HRV/ERV in summer (check only one field)	
			None	x
			Automatic bypass, controlled by temperature difference	
			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:		1/h		

Effective air change rate

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HP}		$n_{V,equi,fraction}$ 1/h
Exterior $n_{V,e}$	0,343	*(1-	0%	)*(1-	0,00	) =	0,343
without HR	0,343	*(1-	0%	)		=	0,343
Ground $n_{L,g}$	0,343	*	0%	*(1-	0,00	) =	0,000
without HR	0,343	*	0%			=	0,000

Ventilation conductance

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)			
exterior $H_{V,e}$	388	*	0,343	*	0,33	=	43,9	W/K
without HR	388	*	0,343	*	0,33	=	43,9	W/K
ground $H_{V,g}$	388	*	0,000	*	0,33	=	0,0	W/K
without HR	388	*	0,000	*	0,33	=	0,0	W/K
Infiltration, window, extract air system	388	*	0,396	*	0,33	=	50,6	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	1,00	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]	**Day GF**	**1st floor**					
		3	**12**					
Climate boundary conditions								
	Temperature diff interior - exterior	**4**	**4**					K
	Wind velocity	**1**	**1**					m/s
Window group 1								
	Quantity	**4**	**6**					
	Clear width	**0,84**	**0,84**					m
	Clear height	**1,92**	**1,92**					m
	Tilting window (check if appropriate)	**x**	**x**					
	Opening width (for tilting windows)	**0,055**	**0,055**					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		**0,05**	**0,31**	**0,00**	**0,00**	**0,00**	**0,00**	**0,36** **1/h**

Secondary calculation: Additional night ventilation for cooling

Air change value during additional window night ventilation

Description								
	Reduction factor	**Night**						
		100%						
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	**1**						
	Clear width	**0,84**						m
	Clear height	**1,92**						m
	Tilting window (check if appropriate)	**x**						
	Opening width (for tilting windows)	**0,055**						m
Window group 2 (cross ventilation)								
	Quantity	**2**						
	Clear width	**0,84**						m
	Clear height	**1,92**						m
	Tilting window (check if appropriate)	**x**						
	Opening width (for tilting windows)	**0,055**						m
	Difference in height to window 1	**0,00**						m
							Total	
Result: Night ventilation values		**0,15**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,15** **1/h**

Summer: Passive cooling

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type:	Single Family House		Treated floor area A_{TFA}:	155,0	m²
Upper temperature limit:	25	°C	Building volume:	388	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	2,0	g/(m²h)
Spec. capacity:	180	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	218,2	*	0,455	*	1,00	=	99,3
External wall - Ground	B	13,4	*	0,455	*	1,00	=	6,1
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	=	14,0
Floor slab / Basement ceiling	B	213,6	*	1,359	*	1,00	=	290,3
	A		*		*	1,00	=	
	A		*		*	1,00	=	
Unheated attic	X	115,8	*	0,367	*	1,00	=	42,5
Windows	A	25,5	*	2,673	*	1,00	=	68,1
Exterior door	A	1,9	*	2,500	*	1,00	=	4,8
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	=	28,6
Perimeter TB (length/m)	P	64,8	*	-0,217	*	1,00	=	-14,0
Ground TB (length/m)	B	60,8	*	-0,018	*	1,00	=	-1,1

Exterior thermal transmittance, $H_{T,e}$	257,3	W/K
Ground thermal transmittance, $H_{T,g}$	281,2	W/K

Summer ventilation

from 'SummVent' worksheet

Ventilation unit conductance			Ventilation parameter			Summer ventilation regulation	
exterior $H_{V,e}$	43,9	W/K	Temperature amplitude summer	10,4	K		HRV/ERV
without HR	43,9	W/K	Minimum acceptable indoor temperature	22,0	°C	None	x
ground $H_{V,g}$	0,0	W/K	Heat capacity air	0,33	Wh/(m³K)	Controlled by temperature	
without HR	0,0	W/K	Supply air changes	0,34	1/h	Controlled by enthalpy	
Ventilation conductance, others			Outdoor air changes	0,40	1/h	Always	
exterior	50,6	W/K	Window night ventilation air change rate, manual @ 1K	1,00	1/h		Additional ventilation
			Air change rate due to mech. automatically controlled vent.	0,00	1/h	Controlled by temperature	
			Specific power consumption for	0,00	Wh/m³	Controlled by humidity	x
			η_{HR}	0%			
			η_{ERV}	0%			
			η^*_{SHX}	0%			

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	*	0,21	*	0,95	*	0,77	*	9,3	*	55%	=	0,7
East	0,9	*	0,30	*	0,95	*	0,77	*	4,3	*	56%	=	0,5
South	0,9	*	0,52	*	0,95	*	0,77	*	5,9	*	59%	=	1,2
West	0,9	*	0,27	*	0,95	*	0,77	*	5,9	*	58%	=	0,6
Horizontal	0,9	*	1,00	*	0,95	*	0,00	*	0,0	*	0%	=	0,0
Sum opaque areas													3,8

Solar aperture	Total	6,8	m²	0,04 m²/m²

	Specif. power q_I W/m²		A_{TFA} m²		W	W/m²
Internal heat gains Q_I	2,4	*	155	=	376	2,4

Frequency of overheating $h_{\vartheta \geq Jmax}$ 0,0%

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

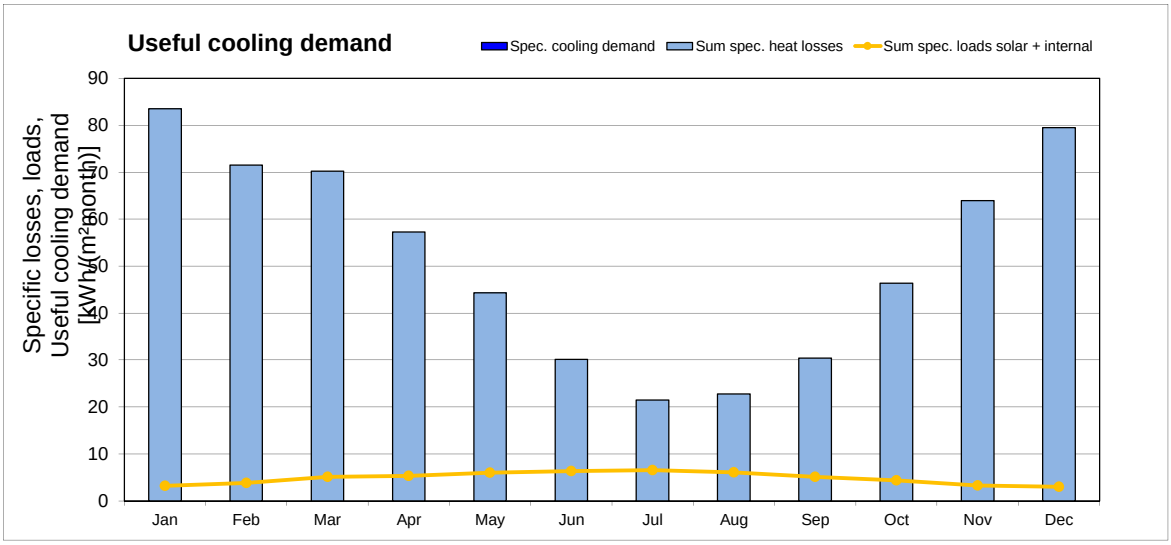
Transmission kWh/d		Ventilation kWh/d		Solar load kWh/d		1/k		Spec. capacity Wh/(m²K)		A_{TFA}: m²			
(32,1	+	17,2	+	20,8	) *	1000	/ (	180	*	155	) =	**2,5**	K

Cooling: energy value for useful cooling energy

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Interior Temperature: 25 °C
Building type: Single Family House
Treated Floor Area A_{TFA}: 155 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	16,5	13,8	13,2	10,7	8,1	5,3	3,3	4,0	5,9	9,4	13,2	16,1	119	kKh
Heating degree hours - Ground	12,5	11,6	12,2	10,2	8,5	6,3	5,2	4,8	5,3	7,1	8,8	11,1	104	kKh
Losses - Exterior	5545	4618	4434	3592	2700	1745	1095	1302	1949	3134	4422	5418	39953	kWh
Losses - Ground	3685	3431	3591	3019	2510	1863	1522	1409	1564	2087	2610	3282	30574	kWh
Losses summer ventilation	3712	3041	2863	2266	1663	1066	708	815	1197	1962	2877	3616	25784	kWh
Sum spec. heat losses	83,5	71,5	70,2	57,3	44,3	30,2	21,5	22,7	30,4	46,3	63,9	79,5	621,4	kWh/m²
Solar load North	11	15	25	32	43	51	47	37	27	20	12	10	328	kWh
Solar load East	14	26	46	56	74	80	80	74	48	32	16	11	557	kWh
Solar load South	74	107	138	121	115	112	122	133	127	118	79	62	1309	kWh
Solar load West	19	34	57	69	82	93	99	82	62	43	24	17	681	kWh
Solar load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Opaque	98	154	244	280	337	373	382	334	254	188	110	83	2836	kWh
Internal heat gains	279	252	279	270	279	270	279	279	270	279	270	279	3289	kWh
Sum spec. loads solar + internal	3,2	3,8	5,1	5,3	6,0	6,3	6,5	6,1	5,1	4,4	3,3	3,0	58,1	kWh/m²
Utilisation factor losses	4%	5%	7%	9%	14%	21%	30%	27%	17%	9%	5%	4%	9%	
Useful cooling energy demand	0	0	0	0	0	0	2	0	0	0	0	0	2	kWh
Spec. cooling 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
Specif. dehumidification demand	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,1**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,1**	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	12%	100%	100%	100%	100%	100%	14%	



Cooling: energy value for useful cooling energy

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²

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

Building type:	Single Family House		Treated floor area A_{TFA}:	155,0	m²
Interior temperature summer:	25	°C	Building volume:	388	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	2,0	g/(m²h)
Spec. capacity:	180	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	218,2	*	0,455	*	1,00	*	7	=	726	4,68
External wall - Ground	B	13,4	*	0,455	*	1,00	*	10	=	60	0,39
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	*	7	=	102	0,66
Floor slab / Basement ceiling	B	213,6	*	1,359	*	1,00	*	10	=	2882	18,59
	A		*		*	1,00	*		=		
	A		*		*	1,00	*		=		
Unheated attic	X	115,8	*	0,367	*	1,00	*	7	=	311	2,00
Windows	A	25,5	*	2,673	*	1,00	*	7	=	498	3,21
Exterior door	A	1,9	*	2,500	*	1,00	*	7	=	35	0,23
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	*	7	=	209	1,35
Perimeter TB (length/m)	P	64,8	*	-0,217	*	1,00	*	7	=	-103	-0,66
Ground TB (length/m)	B	60,8	*	-0,018	*	1,00	*	10	=	-11	-0,07
											kWh/(m²a)
Transmission losses Q_T (negative: heat loads)									Total	4710	30,4

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior $H_{V,e}$	43,9	W/K
without HR	43,9	W/K
ground $H_{V,g}$	0,0	W/K
without HR	0,0	W/K

Ventilation conductance, others

exterior	50,6	W/K

Ventilation parameter

Temperature amplitude summer	10,4	K
Minimum acceptable indoor temperature	22,0	°C
Heat capacity air	0,33	Wh/(m³K)
Supply air changes	0,34	1/h
Outdoor air changes	0,40	1/h
Window night vent. air change rate, manual @ 1K	1,00	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}	0%	
η_{ERV}	0%	
η^*_{SHX}	0%	

Summer ventilation regulation

	HRV/ERV in summer
None	x
Controlled by temp.	
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 $n_{V,e}$	0,343	*(1-	0%	)*(1-	0,00	)+	0,396	=	0,739
Effective air change rate Ground $n_{V,g}$	0,343	*	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	388	*	0,739	*	0,33	*	7	=	619	4,0
Ventilation losses ground $Q_{V,e}$	388	*	0,000	*	0,33	*	0	=	0	0,0
Heat losses summer ventilation	388	*	1,020	*	0,33	*	12	=	1523	9,8
Ventilation heat losses Q_V								Total	2142	13,8

	Q_T kWh/a		Q_V kWh/a		kWh/a	kWh/(m²a)
Total heat losses Q_L	4710	+	2142	=	6852	**44,2**

Orientation of the area	Reduction factor		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0,14	*	0,77	*	9,3	*	85	=	84
East	0,20	*	0,77	*	4,3	*	225	=	153
South	0,26	*	0,77	*	5,9	*	213	=	256
West	0,19	*	0,77	*	5,9	*	215	=	181
Horizontal	0,40	*	0,00	*	0,0	*	377	=	0
Sum opaque areas									716
									kWh/(m²a)
Available solar heat gains Q_S								Total	1390	9,0

	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	*	62	*	2,4	*	155,0	=	559	3,6
									kWh/a	kWh/(m²a)
Sum heat loads Q_F							Q_S + Q_I	=	1949	**12,6**

Ratio of losses to free heat gains	Q_L / Q_F	=	3,52
Utilisation factor heat losses η_G		=	28%
		kWh/a	kWh/(m²a)
Useful heat losses $Q_{V,n}$	η_G * Q_L	=	1947 **12,6**
		kWh/a	kWh/(m²a)
Useful cooling demand Q_K	Q_F - $Q_{V,n}$	=	2 **0**

	kWh/(m²a)	(Yes/No)
Recommended maximum value	15	**Requirement met?** **Yes**

Compressor - cooling units

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type:	Single Family House		Treated floor area A_{TFA}:	155,0	m²
Interior temperature summer:	25,0	°C	Mechanical cooling:		
Nominal humidity:	12,0	g/kg	Air change rate via ventilation system with supply air:	0,3	
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	2,0	

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	0,0		0,1					14%
Cooling contribution by:								
Supply air cooling	(	+		) /	2,0	=		
Recirculation cooling	(	+		) /	0,0	=		
Dehumidification				/		=		0%
Remaining for panel cooling				/	0,0	=		100%
Cooling distribution				/		=		100%
Total	(0,0	+	0,0	) /		=	0,0	0%

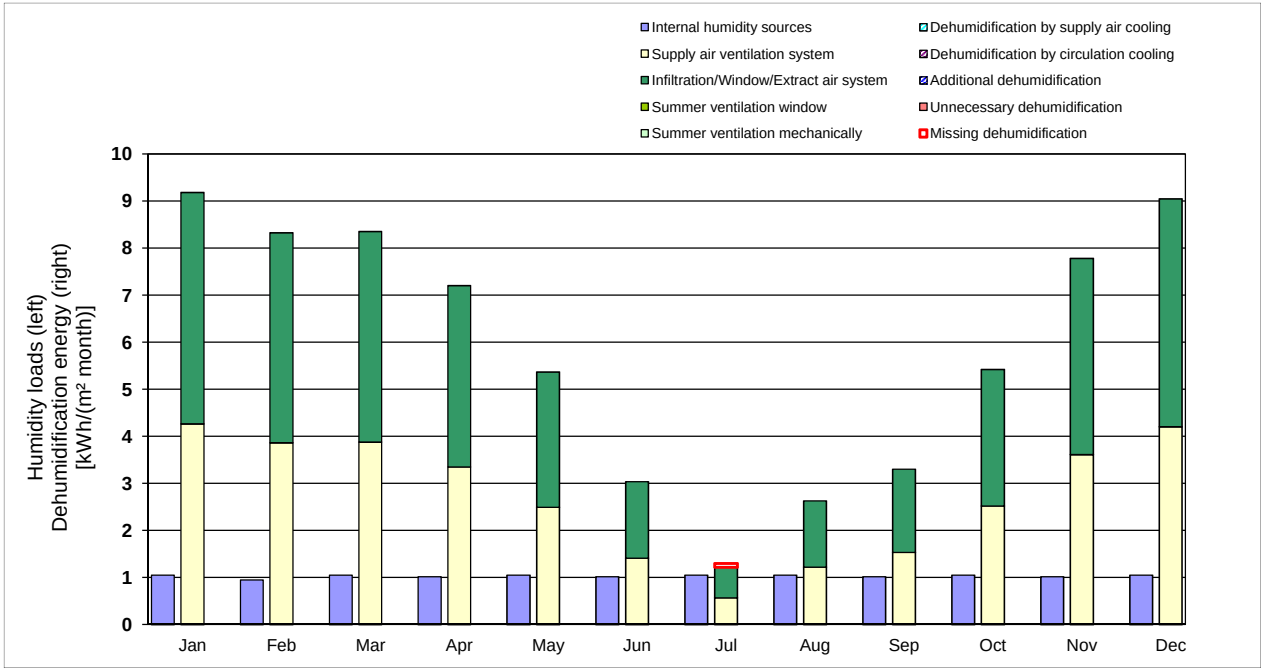
			(Yes/No)
Unsatisfied demand		**Cooling demand covered?**	

Compressor - cooling units

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a

Humidity loads and humidity removal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Internal humidity sources	1,1	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,0	1,1	12	kWh/m²
Infiltration/Window/Extract air system	-4,9	-4,5	-4,5	-3,9	-2,9	-1,6	-0,7	-1,4	-1,8	-2,9	-4,2	-4,8	-38	kWh/m²
Supply air ventilation system	-4,3	-3,9	-3,9	-3,3	-2,5	-1,4	-0,6	-1,2	-1,5	-2,5	-3,6	-4,2	-33	kWh/m²
Summer ventilation window	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
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	0,1	0,0	0,0	0,0	0,0	0,0	0	kWh/m²



Cooling load

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type: **Single Family House**

Treated floor area A_{TFA}: **155,0** m² | Building volume: **388** m³ | Interior temperature: **25** °C

Spec. capacity: **180** Wh/(m²K) | Nominal humidity: **12,0** g/kg | Internal humidity sources: **2,0** g/kg

Temperature:	Outdoor air	Dew point	Sky
Weather 1:	25,0 °C	18,3 °C	16,1 °C
Weather 2:	25,0 °C	18,3 °C	18,3 °C
Ground design temp.	18,8 °C	SHX	12,8 °C

Radiation:	North	East	South	West	Horizontal	
Weather 1:	51	152	160	144	245	W/m²
Weather 2:	51	152	160	144	245	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	218,2	*	0,455	*	1,00	*	0,0	or	0,0	=	0	or	0
External wall - Ground	B	13,4	*	0,455	*	1,00	*	-6,2	or	-6,2	=	-37	or	-37
Roof/Ceiling - Ambient	A	56,3	*	0,248	*	1,00	*	0,0	or	0,0	=	0	or	0
Floor slab / Basement ceiling	B	213,6	*	1,359	*	1,00	*	-6,2	or	-6,2	=	-1789	or	-1789
	A		*		*	1,00	*	0,0	or	0,0	=		or	
	A		*		*	1,00	*	0,0	or	0,0	=		or	
Unheated attic	X	115,8	*	0,367	*	1,00	*	0,0	or	0,0	=	0	or	0
Windows	A	25,5	*	2,673	*	1,00	*	0,0	or	0,0	=	0	or	0
Exterior door	A	1,9	*	2,500	*	1,00	*	0,0	or	0,0	=	0	or	0
Exterior TB (length/m)	A	228,1	*	0,125	*	1,00	*	0,0	or	0,0	=	0	or	0
Perimeter TB (length/m)	P	64,8	*	-0,217	*	1,00	*	-6,2	or	-6,2	=	86	or	86
Ground TB (length/m)	B	60,8	*	-0,018	*	1,00	*	-6,2	or	-6,2	=	7	or	7
Building element towards neighbour	I		*		*	1,00	*	3,0	or	3,0	=		or	
Radiation correction outdoor air				$L_{ambient}$ W/K		-11,4	*	0,0	or	0,0	=	0	or	0
Radiation correction sky				L_{Sky} W/K		10,8	*	-8,9	or	-6,7	=	-96	or	-73
Transmission heat load P_T										Total	=	**-1829**	or	**-1805**

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 $P_{V,e}$	388	*	0,739	or	0,739	*	0,33	*	0,0	or	0,0	=	0	or	0
Ground $P_{L,e}$	388	*	0,000	or	0,000	*	0,33	*	-12,2	or	-12,2	=	0	or	0
Summer ventilation $P_{L,S}$	388	*	0,000	or	0,000	*	0,33	*	0,0	or	0,0	=	0	or	0
Ventilation heat load P_V												Total	**0**	or	**0**

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	9,3	*	0,8	*	0,10	*	51	or	51	=	36	or	36
East	4,3	*	0,8	*	0,15	*	152	or	152	=	74	or	74
South	5,9	*	0,8	*	0,26	*	160	or	160	=	192	or	192
West	5,9	*	0,8	*	0,13	*	144	or	144	=	87	or	87
Horizontal	0,0	*	0,0	*	0,40	*	245	or	245	=	0	or	0
Sum opaque areas											479	or	479
Solar load P_S										Total	**867**	or	**867**

Internal heating load P_I	Spec. power W/m²		A_{TFA} m²		P_I 1 W		P_I 2 W
	2,4	*	155	=	**376**	or	**376**

$P_T + P_V + P_S + P_I$ = **-586** or **-563**

Cooling load P_C = **0** W

Area specific cooling load P_C / A_{TFA} = **0,0** W/m²

Please enter the minimum supply air temperature. **3** °C

Supply air temperature without cooling $\vartheta_{Supply,Min}$ = 25,0 °C / 25,0 °C

For comparison: cooling load, transportable through the supply air $P_{Supply;Max}$ = **966** W / **966** W

specific: 6,2 W/m² / 6,2 W/m²

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

Daily internal temperature stroke

(Transmission -1805,4 W + Ventilation 0,0 W + Solar load 867,3 W) * Time 24 h/d / (Spec. capacity 180 Wh/(m²K) * A_{TFA} 155 m²) = **-0,8** K

Dehumidific. load

from 'Cooling' worksheet

Absolute humidity exterior air	13,2	or	13,2	g/kg	Absolute humid. supply air	13,2	or	13,2	g/kg
Outdoor air mass flow	181	or	181	kg/h	Supply air mass flow	157	or	157	kg/h
Summer vent. air mass flow	0	or	0	kg/h	**Humid. load, supply air**	187	or	187	g/h
Humidity load, outdoor air	215	or	215	g/h	**Humidity load, internal**	310	or	310	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	*	712	or	712	=	**504**	or	**504**

Dehumidification load P_T = **504** W

Area specific dehumidification load P_T / A_{TFA} = **3,2** 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	0,0	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	0,1	0,0	0,0	0,0	0,0	0,0	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	12%	100%	100%	100%	100%	100%	

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

Heat distribution and domestic hot water (DHW) system

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Interior temperature:	20	°C	Interior temperature summer:	25	°C
Building type:	Single Family House				
Treated floor area A_{TFA}:	155	m²			
Occupancy:	2,9	Pers			
Number of dwelling units:	1				
Annual heating demand $q_{Heating}$	34477	kWh/a	Annual useful cooling dem. q_{Cool}	2	kWh/a
Length of heating period:	188	d	Length cooling period:	62	d
Average heating load P_{ave}:	7,6	kW	Average cooling load $P_{Average}$:	0,0	kW
Marginal usability of additional heat gains:	100%		Marginal utility of additional heat losses:	0%	

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												
Nominal width of pipe		mm												
Insulation thickness		mm												
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient per m of insulated pipe		W/(mK)												
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												
Total heating loss coefficient per m of pipe	Ψ	W/(mK)												
Temp. of the room through which the pipes pass	ϑ_x	°C	20	20	20	20	20							
Design forward flow temperature	ϑ_V	°C	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0		
Design system heating load	$P_{heating}$	kW												
Forward flow temperature control ('x' if applicable)			x	x	x	x	x	x	x	x	x	x		
Design return flow temperature	ϑ_R	°C												
Annual heat emission per m of plumbing	q^*_{HL}	kWh/(m·a)												
Possible utilisation factor of released heat	η_G	-												
Annual heat losses of heating distribution	Q_{HL}	kWh/a											kWh/a: **0**	kWh/(m²a): **0,0**
Annual heat losses of heating storage		kWh/a											**0**	**0,0**
Annual heat losses of heating		kWh/a											**0**	**0,0**
Performance ratio of heat distribution	$ea_{,HL}$	-											**100%**	

DHW useful heat

DHW demand for showers, per person and day (with 60°C)		litre/person/d	16,0
DHW demand others, per person and day (with 60°C)		litre/person/d	9,0
Performance of shower drain-water heat recovery		-	0%
Effective DHW demand	V_{DHW}	litre/person/d	25
Average cold water temperature of the supply	ϑ_{TW}	°C	12,8
DHW demand for washing machines and dishwashers non-elect		kWh/a	0
Effective useful heat DHW	Q_{DHW}	kWh/a	1472

kWh/a	kWh/(m²a)
1472	9,5

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

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	**11,8**	11,8	11,8	11,8	11,8		
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												
Nominal width of pipe		mm												
Insulation thickness		mm												
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient per m of insulated pipe		W/(mK)												
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												
Total heating loss coefficient per m of pipe	Ψ	W/(mK)												
Daily circulation period of operation.	td_{Circ}	h/d												
Design return flow temperature	ϑ_R	°C												
Circulation period of operation per year	t_{Circ}	h/a												
Annual heat released per m of pipe	q^*_Z	kWh/m/a												
Annual heat loss from circulation lines	QZ	kWh/a											kWh/a: **0**	kWh/(m²a): **0,0**
DHW individual pipes														
Exterior pipe diameter	d_{U_Pipe}	m	**0,016**											
Accumulated length per single pipes	L_U	m	**30,00**											
Amount of tapping points in building	$n_{tapping\ point}$	-	**5,00**											
Average pipe length per tapping point	$L_{U,\ average}$	m	6,0											
Tap openings per person per day		-	**3**											
Utilisation days per year		d	**365**											
Heat loss per tap opening	$q_{Individual}$	kWh/tap opening	0,0419											
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	**135**										kWh/a: **135**	kWh/(m²a): **0,9**
Total heat losses of DHW distribution	Q_{WL}												kWh/a: **135**	kWh/(m²a): **0,9**
Performance ratio of DHW distribution pipes	$ea_{,HL}$	-											**109%**	

Storage heat losses

		Storage 1	Storage 2	Buffer storage tank (only heating)	Compact unit		
Selection of storage tank		2-DHW only	0-No storage tank	0-No storage tank	0-No		
Storage necessary for HP							
Solar DHW connection							
Heat loss rate	W/K	5,0	3,0				
Storage volume	litre	300			---		
Standby fraction	-	30%					
Location of storage tank, inside or outside of thermal envelope		2-Outside	1-Inside	2-Outside			
Temperature of mechanical room	°C	11,8					
Typical storage tank temperature	°C	60,0					
Manual entry of storage temperature	°C						
Average standby heat losses storage tank	W	72					
Additional heat losses storage tank, solar operation	W			---	---		
Possibly utilisation factor of heat losses		---	---		---		
Annual heat losses DHW storage tank	kWh/a	633		---		kWh/a: **633**	kWh/(m²a): **4,1**
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}	**768**	**5,0**
Performance ratio DHW-distribution + storage	$e_{a,WL}$	**152%**	
Total heating demand of DHW system		kWh/a	kWh/(m²a)
Including storage tank	Q_{gDHW}	**2240**	**14,5**

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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type:	Single Family House	
Treated floor area A_{TFA}:	155,0	m²
Projected building footprint $A_{Projected}$:	213,6	m²
Latitude *('Climate' worksheet)*	45,1	°
DHW demand *('DHW+Distribution')*	2240	kWh/a
Heating demand ('Heating' and 'DHW+Distribution' worksheets)	34477	kWh/a
Occupancy	2,9	Persons

Location: Selection in 'Areas' worksheet			**Collector**		
Size of selected area		m²	Heating support (please check, if applicable)		
Free area (less solar thermal and electrical systems)		m²	DHW priority (check if appropriate)		x
Deviation from North	180	°			
Angle of inclination from the horizontal	30	°			
Alternative input: Deviation from North	180	°			
Alternative input: Angle of inclination from the horizontal	30	°			

Solar collector area		0,00	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}		

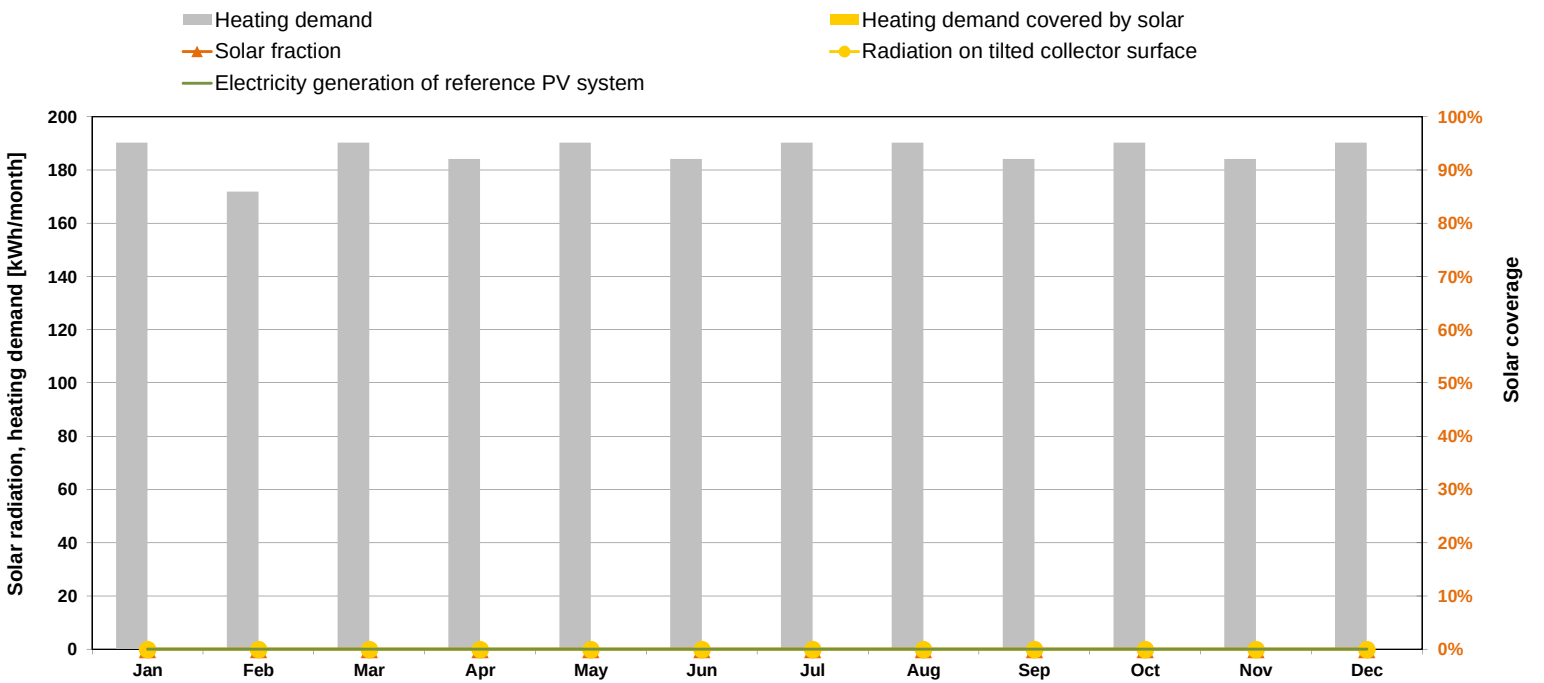
Results

	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$_{el}$	**$PER_{sol.therm}$** kWh$_{el}$ / kWh$_{th}$*kWh$_{prime}$/kWh$_{el}$
	1,25	
	1,75	

			kgCO$_2$eq/ $m^2_{Projected}$*a	kgCO$_2$eq/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	190	172	190	184	190	184	190	190	184	190	184	190	2240	kWh/month
Space heating demand	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heating demand	190	172	190	184	190	184	190	190	184	190	184	190	2240	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	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month

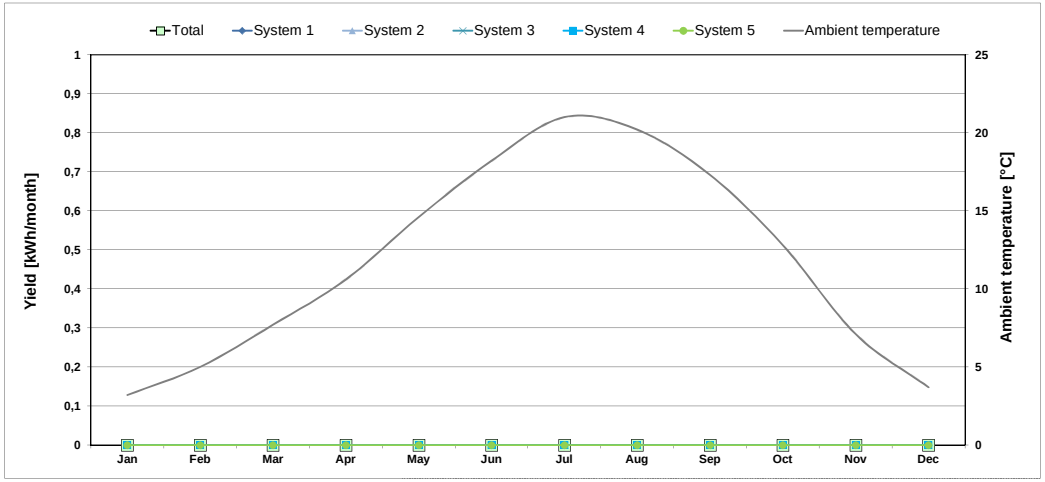
Photovoltaic systems

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Climate data set: ud---03-Tournon avec masque LAMP Temp 1960-1990
Building type: Single Family House
Projected building footprint: 213,6 m²

		System 1	System 2	System 3	System 4	System 5	Reference PV syst.	
Name of system								
Location: Selection in 'Areas' worksheet		17-Toiture pente Sud						
Size of selected area		19,6						m²
Deviation from North		180					180	°
Angle of inclination from horizontal		32					30	°
Alternative input: Deviation from North		180						°
Alternative input: Angle of inclination from the horizontal		32						°
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_{MPP0}	8,55					7,71	A
Nominal voltage	U_{MPP0}	32,00					30,50	V
Nominal power	P_n	274	0	0	0	0	235	Wp
Temperature coefficient short-circuit current	α	0,080					0,040	%/K
Temperature coefficient open-circuit voltage	β	-0,361					-0,340	%/K
Module dimensions: Height		1,641					1,658	m
Module dimensions: Width		0,989					0,994	m
							1,6	Module area [m²]
Further specifications								
Number of modules	n_M	0					0,0	
Height of module array								m
Height of horizon	h_{Hori}							m
Horizontal distance	a_{Hori}							m
Additional reduction factor shading	r_{other}	77%						
Efficiency of the inverter	η_{HRV}	95%					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		19,6						m²
Allocation to building element		0%						
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		0,00	0,00	0,00	0,00	0,00	0,0	#DIV/0!	kWh$_{prim}$/kWh$_f$



Information from the module data sheet

5-Poly-Si

Nominal current	I_{MPP0}	8,6	A
Nominal voltage	U_{MPP0}	32,0	V
Nominal power	P_n	273,6	Wp
Temperature coefficient short-circuit current	α	0,1	%/K
Temperature coefficient open-circuit voltage	β	-0,4	%/K

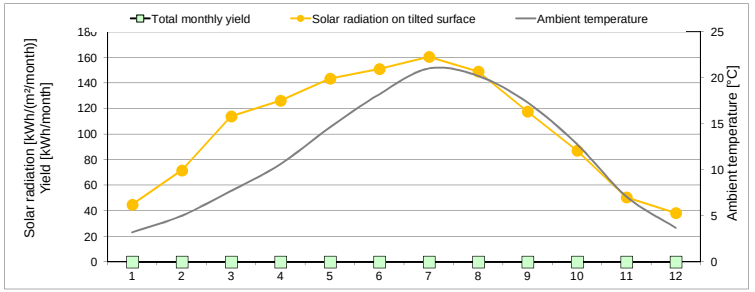
Further specifications

Latitude		45,1	°
Number of modules	n_M	0,0	
Deviation from North		180,0	°
Angle of inclination from horizontal		32,0	°
Height of module array		1,0	m
Height of horizon	h_{Horiz}	0,0	m
Horizontal distance	a_{Horiz}	1000,0	m
Additional reduction factor shading	r_{other}	0,77	
Efficiency of the inverter	η_{HRV}	0,95	
Annual losses due to shading			kWh

Annual yield of inverter

	Electricity	PER-factor	1-PE-factors (non-renewable) PHI Certification
		1,0	0,00
kWh/a		#WERT!	#WERT!
kWh/m²$_{Projected}$*a	#WERT!	#WERT!	#WERT!

1-CO2 factors GEMIS (Germany)	Specific PE value (non-renewable)	Specific value of CO_2-equivalent emissions [g/kWh]	
0,063			
#WERT!			kgCO_2eq/a (absolute)
#WERT!			CO_2eq/m²Projected*a (projected building footprint)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Year	
Solar radiation on tilted surface	45	71	114	126	143	151	160	149	118	87	51	38	kWh/(m²month)	1252,7	kWh/(m²a)
Ambient temperature	3	5	8	11	15	18	21	20	17	13	7	4	°C	11,8	°C
Total monthly yield	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month	0,0	kWh/a
Losses through shading situation	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month	0,0	kWh/a

Electricity demand for residential buildings

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Households	1
Persons	2,9
Living area (m²)	155
Heating demand [kWh/(m²a)]	222,4

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:	1,70	2,0
Energy carrier for DHW:	1,25	2,6

Solar fraction of DHW Laundry&Dish	
Marginal performance ratio DHW	100%
Marginal performance ratio Heating	109%

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)	* 2,9	P	=	211	*	100%		=	**211**								
2-Cold water connection														*		0%			* (1+	0,30	) *	1,00	*(1-		) =	
Clothes washing	1	1	1,10	kWh/Use		* 1,00	*	57	/(P*a)	* 2,9	P	=	185	*	100%		=	**185**								
2-Cold water connection														*		0%			* (1+	0,05	) *	1,00	*(1-		) =	
Clothes drying with:	1	1	3,50	kWh/Use	Residual dampness	0,88	*	57	/(P*a)	* 2,9	P	=	0		0%		=	**0**								
1-Clothes line					0,60							=	0			0%						1,00	*			**0**
Energy consumed by evaporation	1	1	3,13	kWh/Use		* 0,60	*	57	/(P*a)	* 2,9	P	=	315	*		100%			* (1+	0,00	) *	1,09	*(1-	0,33	) =	**229**
Refrigerating	1	1	0,78	kWh/d		* 1,00	*	365	d/a	* 1	HH	=	285	*	100%		=	**285**								
Freezing	1	0	0,88	kWh/d		* 0,90	*	365	d/a	* 1	HH	=	289	*	100%		=	**289**								
or combination	0	1	1,00	kWh/d		* 1,00	*	365	d/a	* 1	HH	=	0	*	100%		=	**0**								
Cooking with:	1	1	0,25	kWh/Use		* 1,00	*	500	/(P*a)	* 2,9	P	=	368	*	100%		=	**368**								
1-Electricity					Average lamp efficiency [lm/W]									*		0%										**0**
Lighting	1	1	21	W	35	* 1,00	*	2,90	kh/(P*a	* 2,9	P	=	178	*	100%		=	**178**								
Consumer electronics	1	1	80	W		* 1,00	*	0,55	kh/(P*a	* 2,9	P	=	130	*	100%		=	**130**								
Small appliances, etc.	1	1	50	kWh		* 1,00	*	1,00	/(P*a)	* 2,9	P	=	147	*	100%		=	**147**								
Total aux. electricity													722					722								
Other:																										
				kWh/a									0					**0**								
				kWh/a									0					**0**								
				kWh/a									0					**0**								
Total													2829	kWh				**2513**	kWh			**0**	kWh			**229**
Specific demand																		**16,2**	kWh/(m²a)			**0,0**	kWh/(m²a)			**1,5**
Recommended maximum value																		18								

DHW Non-Electric - Wash&Dish

Non-Renewable Non-Electric DHW Wash&Dish

Use non-residential buildings

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Latitude [°]: 45

	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).

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Treated floor area A_{TFA}:	155,0	m²
Auxiliary electricity demand:	721,9	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	0,56	0,95	0,85	0,55
East	0,69			0,56
South	0,73			0,59
West	0,63			0,58

				Facade with windows				Geometry: input of a typical room														
Lighting / non-residential	Net ground area	Room category	Power of nominal lighting	Deviation from North	Orientation	Light transmission glazing	Window existing?	Room depth	Room width	Room height	Lintel height	Window width	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))
Room / Zone	m²		Lux	Degrees		-	[x]	m	m	m	m	m		W/m²	W/m²		[x]			h/a	h/a	h/a	kWh/a	kWh/(m²a)
			15																		9			
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
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						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
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						69%							None		0,0			Manual	Without motion detector					
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						69%							None		0,0			Manual	Without motion detector					
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						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			Manual	Without motion detector					
						69%							None		0,0			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	22-	1	1	*	6	*	80	* (	1925	* (1-	0,3	)		=	647	=	646,8
PC in energy saving mode		1			6	*	2,0	*	1925	*	0,3			=	7	=	6,9
Monitor 1	22-	1	1	*	6	*	28	* (	1925	* (1-	0,3	)		=	226	=	226,4
Monitor in energy saving mode		1			6	*	2,0	*	1925	*	0,3			=	7	=	6,9
PC 2		1	0	*	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	*	0	*	28	* (	0	* (1-	0	)		=	0	=	0,0
Monitor in energy saving mode		1			0	*	2,0	*	0	*	0			=	0	=	0,0
Copier	22-	1	1	*	1	*	400	* (	2750			-	2475	) =	110	=	110,0
Copier in energy saving mode		1			1	*	30	*	2475					=	74	=	74,3
Printer	22-	1	1	*	2	*	300	* (	2750			-	2475	) =	165	=	165,0
Printer in energy saving mode		1			2	*	2	*	2475					=	10	=	9,9
Server	22-	1	1	*	1	*	100	* (	2750					=	275	=	275,0
Server in energy saving mode		1			1	*	2,0	* (	8760			-	2750	) =	12	=	12,0
Telephone system		1	1	*	1	*	94	*	8760					=	823	=	823,4
Hand Dryer (WC)		1	1	*	6	*	2000	*	20					=	240	=	240,0
				*		*		*						=	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	1	*	0	*	4	*	0,25	=	0	*		0%				=	0,0
Gas									kWh / Cover			*	0%					=	0
Dishwashing		1	1	*	0	*	4	*	0,10	=	0	*		55%				=	0,0
DHW connection									kWh/d			*	0%		* (1+	0,30	) * 1,20 *(1-	0,00	) = 0
Refrigerating		1	1		365				0,38	=	140	*		100%				=	140,0
Coffee machine		1	1		200				0,25		50	*		100%				=	50,0
											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											722								721,9

Hot water non-electric dishwashing

Total	3509	kWh	**0**	**0,0**	**3509**	kWh/a kW
Specific demand			**0,0**	**0,0**	**23**	kWh/(m²a) kW

Aux Electricity

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Treated floor area	155	m²
Heating period	188	d
Air volume	388	m³
Dwelling units	1	HH

Heat recovery efficiency ventilation unit	0,00	
Operation vent. system Winter	4,51	kh/a
Operation vent. system Summer	4,25	kh/a
Air change rate	0,34	h⁻¹

Annual space heating demand	222	kWh/(m²a)
Boiler rated power	3	kW
DHW system heating demand	2240	kWh/a
Design forward flow temperature	40	°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 *	0,34	h⁻¹ *	4,5	kh/a *	388	m³ =	270		considered in heat recovery efficiency					
Defroster HX	1	1	Data entries in 'Ventilation' worksheet or in 'Addl vent'								66	*	1,0	/	4,51	=	15	
Summer ventilation	1	0,00	0,45	Wh/m³ *	0,34	h⁻¹ *	4,2	kh/a *	388	m³ =	254	*	1,0	/	4,25	=		0
																	Internal heat sources ' Additional summer ventilation'	0,0
Additional vent. summer	0		0,00	Wh/m³ *	0,00	h⁻¹ *	4,2	kh/a *	388	m³ =	0	*	1,0	/	4,25	=		
Heating system				Controlled / non controlled														
Enter the rated power of the pump				W														
Circulator pump heating			110	W *	1,0	*	4,5	kh/a *	1	=	0	*	1,0	/	4,51	=	0	
Boiler electricity consumption at 30% load				W														
Aux. energy - Heat. boiler	0	0	25	W *	1,00	*	0,00	kh/a *	1	=	0	*	1,0	/	4,51	=	0	
Aux. energy - Wood fired/Pellet boiler	1	1	Data entries in 'Boiler' worksheet. Aux. energy demand including possible drinking water production.								132	*	1,0	/	4,51	=	29	
DHW system																		
Enter average power consumption of pump				W														
Circulation pump DHW	0		29	W *	1,00	*	4,8	kh/a *	1	=	0	*	1,0	/	8,76	=	0	0
Enter the rated power of the pump				W														
Storage load pump DHW			56	W *	1,00	*	0,0	kh/a *	1	=	0	*	1,0	/	8,76	=	0	0
Boiler electricity consumption at 100% load				W														
DHW boiler aux. energy	0	1	76	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		40	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	*	1	=	0	*	1,0	/	4,25	=		0
Aux. electricity dehum.				kWh/a *	1,00	*	1,0	*	1	=	0	*	1,0	/	4,25	=		0
Misc. aux. electricity																		
Misc. aux. electricity				kWh/a *	1,00	*	1,0	*	1	=	0	*	1,0	/	8,76	=	0	0
Total											722						44	0
Specific demand	kWh/(m²a) (treated floor area)										4,7							

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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Utilisation: 10-Dwelling

Type of values used: 2-Standard

IHG heating 2,42 W/m²

IHG cooling 2,42 W/m²

No input is necessary **1,34** W/m²

Go to utilisation pattern selection

Persons	2,9	P	
Living area	155	m²	

Heating demand	222	kWh/(m²a)
Heating period	188	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)	211	*			0,30	/	8,76	=	7
Clothes washing	1	1	1,1	kWh/Use	1,00	57	/(P*a)	185	*			0,30	/	8,76	=	6
Clothes drying with:	1	1	3,5	kWh/Use	0,88	57	/(P*a)	0	*			1,00	/	8,76	=	0
1-Clothes line		1	0,0					0				0,80				
Energy consumed by evaporation	1	1	-3,1	kWh/Use	0,60	57	/(P*a)	-315	* (1-	0	) *	1,00	/	8,76	=	-36
Refrigerating	1	1	0,8	kWh/d	1,00	365	d/a	285	*			1,00	/	8,76	=	33
Freezing	1	0	0,9	kWh/d	0,90	365	d/a	289	*			1,00	/	8,76	=	0
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)	368	*			0,50	/	8,76	=	21
Lighting	1	1	20,8	W	1,00	2,9	kh/(P*a)	178	*			1,00	/	8,76	=	20
Consumer electronics	1	1	80,0	W	1,00	0,55	kh/(P*a)	130	*			1,00	/	8,76	=	15
Household appliances/Other	1	1	50,0	kWh	1,00	1,0	/(P*a)	147	*			1,00	/	8,76	=	17
Auxiliary appliances (cf. aux Electricity sheet)															=	44
Other applications (cf. Electricity sheet)	0	0,0						0	*			0	/	8,76	=	0
Persons	3	1	80,0	W/P	1,00	8,76	kh/a	2064	*			0,55	/	8,76	=	130
Cold water	3	1	-12,2	W/P	1,00	8,76	kh/a								=	-36
DHW - circulation	0	0	0,0	W	1,00	8,76	kh/a	0	*			1,00	/	8,76	=	0
DHW - individual pipes	1	1	15,4	W	1,00	8,76	kh/a	135	*			1,00	/	8,76	=	15
DHW storage tank heating case	1	0	0,0	W	1,00	8,76	kh/a	0	*			1,00	/	8,76	=	0
DHW storage tank cooling case	1	0	0,0	W	1,00	8,76	kh/a	0	*			1,00	/	8,76	=	0
Evaporation	3	1	-25,0	W/P	1,00	8,76	kh/a	-645	*			1,00	/	8,76	=	-74
Total IHG														W		162
Specific IHG														W/m²		1,05
Heat available from internal sources										188	d/a			kWh/(m²a)		4,7

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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Utilisation: 10-Dwelling — IHG 2,42 W/m²

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

Persons: 2,9 P — Treated floor area: 155 m² — Heating period: 188 d/a — Room temperature: 20 °C — Internal heat gains aux. electricity: 44 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	*						*	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)	2597	*	1	/	8,76	=	296
Cooking (within therm. envelope)	0	*	0,5	/	8,76	=	0
Dishwashing (within therm. envelope)	0	*	0,3	/	8,76	=	0
Cooling (within therm. envelope)	140	*	1	/	8,76	=	16
Other (within thermal envelope)	50	*	1	/	8,76	=	6
Auxiliary appliances (see 'Aux Electricity' worksheet)						=	44

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	-7,2	0	* (	0	+	-2	) *	1	/	365	=	0

Total IHG		W	362
Specific IHG		W/m²	2,3
Heat available from internal sources	188 d/a	kWh/(m²a)	11

Primary Energy Renewable PER

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

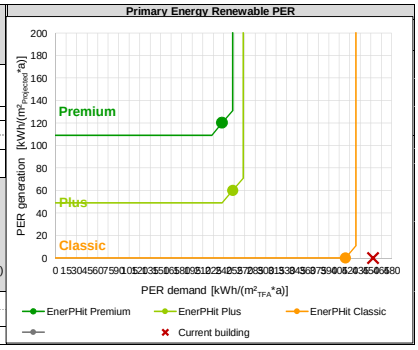
				Building type:	Single Family House
				Treated floor area A_{TFA}:	155 m²
				Projected building footprint $A_{Projected}$:	214 m²
Selection of heat generation system	**Contribution margin (useful energy)**				
Primary heat generator	**Heating**	**DHW**	**Addl. input in following worksheets**	Heating demand incl. distribution & hydr. frost protection	222 kWh/(m²a)
6-Direct electrical (heating resistance / continuous flow water hea	80%	100%	-	Cooling energy dem. incl. dehumidification	kWh/(m²a)
Secondary heat generator (optional)				DHW demand including distribution:	14 kWh/(m²a)
4-Heating boiler	20%	0%	Boiler		

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)	
					453,0		555,4		112,1
Heating				1,70	**418,5**	1,97	**483,5**		**97,4**
Electricity (HP compact unit)			1,75			2,60		0,532	
Electricity (heat pump)			1,75			2,60		0,532	
District heating: 1-None			2,8|4,5|3,3					0,000	
Stückgutfeuerung: 44-Wood logs	20%	64,9	1,10	1,57	101,8	0,20	13,0	0,017	1,1
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)			1,75			2,60		0,532	
Electricity (direct through heating resistance)	80%	177,9	1,75	1,75	311,4	2,60	462,7	0,532	94,7
Aux. electricity (vent.winter, frost protection, circ.pump, boiler, wood / pellets)		3,0	1,75	1,75	5,3	2,60	7,8	0,532	1,6
Cooling and dehumidification			1,20		**2,0**		**4,3**		**0,9**
Electricity cooling (heat pump)			1,20			2,60		0,532	
Auxiliary electricity cooling, ventilation summer		1,6	1,20		2,0	2,60	4,3	0,532	0,9
Electricity dehumidification (heat pump)			1,40			2,60		0,532	
Auxiliary electricity (dehumidification)			1,40			2,60		0,532	
DHW generation				1,25	**18,1**	2,60	**37,6**		**7,7**
Electricity (HP compact unit)			1,25			2,60		0,532	
Electricity (heat pump)			1,25			2,60		0,532	
District heating: 1-None			2,8|4,5|3,3					0,000	
Stückgutfeuerung: 44-Wood logs			1,10			0,20		0,017	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / Methanol			2,30			1,10		0,320	
Solar thermal system									
Electricity (direct)	100%	14,5	1,25	1,25	18,1	2,60	37,6	0,532	7,7
Aux. electricity (circ.pump + storage charge, aux.energy DHW + solar DHW)			1,25			2,60		0,532	
Household electricity		**11,6**		1,25	**14,4**		**30,1**		**6,1**
Electricity (household or non-residential lighting, etc.)		11,6	1,25	1,25	14,4	2,60	30,1	0,532	6,1
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
				0,0		**0,0**		**0,0**
PV electricity	0	0,0	1,00	0,0	-		-	
Solar thermal system	0	0,0	1,00	0,0	1,2	0,0		
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	-	**Current building reaches following class for aspect**	555	**Requirement met?**	-

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	**Useful energy, performance**				**Airtightness**
	Annual heat. dem. Treated floor area kWh/(m²a)	**Heating load** Treated floor area W/m²	**Useful cool. energy** Treated floor area kWh/(m²a)	**Cooling load** Treated floor area W/m²	**n_{50}** 1/h
Requirement EnerPHit Premium Requirement EnerPHit Plus Requirement EnerPHit Classic	-		-	-	1,00
Requirement					
Current building reaches following class for aspect	222	84	-	-	5,0
	Premium		Unachieved		Unachieved



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.	MWh/a	MWh/a	1-PE-factors (non-renewable) PHI Certification MWh/a	1-CO2 factors GEMIS (Germany) kg/a	1-CO2 factors GEMIS (Germany) kg/a
Demand	**42,4**	**70,2**	86,08	17373	17373
Generation	**0,0**	**0,0**	0,00	0	0
Demand, cumulative generation (annual balance)	42,40	70,21	86,08	17373	17373
Demand w/o household electricity	**40,6**	**68,0**	81,43	16420	16420
Demand w/o household electricity, cum. generation	40,61	67,97	81,43	16420	16420

Passive House compact unit with exhaust air heat pump

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

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

Building type: **Single Family House**

Treated floor area A_{TFA}: **155** 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)*	**34477**	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)*	**2240**	kWh	**2240**	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)	7		
	Av. Ground temp (°C)	13		
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				

				Including DHW connection for washing machines & dishwa	
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

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

			Building type:	Single Family House	
			Treated floor area A_{TFA}:	155	m²
Covered fraction of space heating demand		*('PER' worksheet)*		0%	
Space heating demand + distribution losses		Q_H+Q_{HL}: *(DHW+Distribution)*		34477	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)*		1607	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: 0-None		Heat source:			
Selection of distribution system				1-Underfloor heating	
Design distribution temperature		θ_{design} *(DHW+Distribution)*		40,00	°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}			°C
Entries in relation to the domestic hot water system					
Selection of HP: 0-None		Heat source:			
DHW temperature		*(DHW+Distribution)*		60,00	°C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)				2-Outside	
Specific heat losses storage		U * A $_{Storage}$		5,0	W/K
Room temperature (storage location: outside of thermal envelope)		*(DHW+Distribution)*		11,82	°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		50,0	m
Power of pump for ground heat exchanger		P_{pump}		0,05	kW

-

Heating

Heat pump:

Source:

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1				
Test point 2				
Test point 3				
Test point 4				
Test point 5				
Test point 6				
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 $\Delta\theta_{Sink}$ K

DHW

Heat pump:

Source:

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1				
Test point 2				
Test point 3				
Test point 4				
Test point 5				
Test point 6				
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 $\Delta\theta_{Sink}$ K

Electr. energy consumption pump (grnd. water / ground)	$Q_{El,Pump}$	0	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)

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type: **Single Family House**

Treated floor area A_{TFA}: **155** m²

Ground probes

Probe field configuration			**A**	Individual probe
Length of probe	*('HP' worksheet)*	H	**100**	m
Probes spacing/distance		B	**10**	m
Depth (z=H/2)		z	50	m
Type of probe			**A**	Double-U
Borehole radius		r_b	**0,090**	m
Inner radius of pipe		r_i	**0,013**	m
Exterior pipe radius		r_a	**0,016**	m
Distance between pipes		B_U	**0,070**	m
Inner radius of pipe casing (only coaxial)		r_{i2}	**0,050**	m
Exterior radius casing pipe (only coaxial)		r_{a2}	**0,052**	m
Thermal conductivity of pipe		λ_R	**0,42**	W/(mK)
Thermal conductivity of back fill		λ_F	**2,00**	W/(mK)
Probe time constant		t_p	12860	d
Internal borehole resistance		R_a	**0,169**	Km/W
Borehole resistance		R_b	**0,066**	Km/W

Ground

Soil type	**J**	Other soil type	
Density of the ground	ρ_E	2000	kg/m³
Thermal capacity of ground	cp_E	1000	J/(kgK)
Thermal conductivity of ground	λ_E	2,0	W/(mK)
Soil temperature conductivity	a_E	0,000001	m/s²
Ground temperature gradient	Δ_{TG}	**0,022**	K/m

Brine

Brine (characteristics at 2 °C)	**E**	Brine	
Density of the brine	ρ_S	1036	kg/m³
dynamic viscosity of the brine	η_S	0,0052	kg/(ms)
Heat capacity brine	c_{pS}	3815	J/(kgK)
Thermal conductivity of brine	λ_S	0,4405	W/(mK)
Brine - mass flow	m_S	**0,6**	kg/s

Operation type

Waste heat from active cooling to ground probe? Please check, if applicable.		**x**	
Heat pump operation duration			h/a
Specific heat extraction rate as an annual average	q_{ex}		W/m
	H/R_b	**1512**	W/K

Ground collectors

Inner radius of pipe	r_i	**0,013**	m
Exterior pipe radius	r_a	**0,016**	m
Thermal conductivity of pipe	λ_r	**0,420**	W/(mK)
Pipe depth	z_{pipe}	**50**	m
Ground water depth	z_{gw}		m
Pipe spacing	D	**0,4**	m
Base area		**80**	m²
Pipe outer surface		20,1	m²
Pipe length	L	200,0	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	**0,5**	kg/s	
Specific heat extraction rate	q_{ex}		W/m²	
U * A		**2370**	W/K	

Climate

Period duration		365	d
Average ground surface temp.	T_{m0}	**12,8**	°C
Surface temperature amplitude	T_1	**8,9**	°C
Phase shifting surface	t_{02}	**35**	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	**Other soil type**	**2,000**	**2000**	**1000**	**2,000**		

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	**Brine**	**2**	**1036**	**3815**	**0,441**	**0,005**

Result ground probe calculation

Month	Borehole temperature °C
1	**13,9**
2	**13,9**
3	**13,9**
4	**13,9**
5	**13,9**
6	**13,9**
7	**13,9**
8	**13,9**
9	**13,9**
10	**13,9**
11	**13,9**
12	**13,9**

Boiler (gas, oil and wood)

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

		Building type:	Single Family House	
		Treated floor area A_{TFA}:	155	m²
Covered fraction of space heating demand	*('PER' worksheet)*		20%	
Space heating demand + distribution losses	Q_H+Q_{HS}: *(DHW+Distribution)*		34477	kWh
Solar contribution for space heating	$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*		0%	
Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$		**6895**	kWh
Space heating demand without distribution losses	Q_H *('Verification' worksheet)*		34477	kWh
Covered fraction of DHW demand	*('PER' worksheet)*		0%	
Total heating demand of DHW system	Q_{gDHW} *(DHW+Distribution)*		2240	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		30-Firewood pieces (direct and indirect heat emission)	
Fuel		44-Wood logs	
PER factors (renewable primary energy)	*('Data' worksheet)*	1,10	kWh_{PER}/kWh_{Final}
PE factor (non-renewable primary energy)	*('Data' worksheet)*	0,20	kWh_{PE}/kWh_{Final}
CO_2 emissions factor (CO_2-equivalent)	*('Data' worksheet)*	0,017	g/kWh
Useful heat provided	Q_{Use}	6895	kWh/a
Max. heating power required for heating the building	P_{BH} *('Heating load' worksheet)*	12,96	kW
Length of the heating period	t_{HP}	4515	h
Length of DHW heating period	t_{DHW}	8760	h

Use characteristic values entered (check if appropriate)? x

		Project data		Standard values		Input field	
Design output	P_{nom} *(Rating plate)*	3	kW	15	kW	3	
Installation of boiler (Outdoor: 0, Indoor: 1)		1		0		1	
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%		60%			
Efficiency of heat generator in steady-state operation	η_{SO} *(Manufacturer)*	70%		70%			
Average fraction of heat output released to heating circuit	$z_{HC,m}$ *(Manufacturer)*	0,4		0,4			
Temperature difference betw. power-on and power-off	$\Delta\vartheta$ *(Manufacturer)*	30	K	30	K		
In case of inside installation: area of installation room	$A_{install}$ *(Project)*	31	m²	31	m²		
Useful heat output per basic cycle	$Q_{N,GZ}$ *(Manufacturer)*	4,5	kWh	4,5	kWh		
Average power output of the heat generator	$Q_{N,m}$ *(Manufacturer)*	3,0	kW	3,0	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)*	0,11	kWh	0,11	kWh		kWh
Power consumption in steady-state operation	$P_{el,SB}$ *(Manufacturer)*	55	W	55	W		W

Utilisation factor of heat generator space heating	$\eta_{H,g,K}$ $=f_j*h_{k^*}$	69%	
Utilisation factor heat generator DHW	$\eta_{DW,g,K}$ $=h_{100\%}/f_{j,DW}$	0%	
Utilisation factor heat generator DHW & space heating	$\eta_{g,K}$	69%	

		kWh/a	kWh/(m²a)
Final energy demand space heating	$Q_{Final,HE}$ $= Q_{H,wi}* e_{H,g,K}$	10064	
Final energy demand DHW	$Q_{Final,TW}$ $= Q_{DHW,wi}* e_{TW,g,K}$	0	
Total final energy demand	Q_{Final} $= Q_{End,HE} + Q_{End,TW}$	10064	64,9
Annual PE demand (non-renewable primary energy)		2013	13,0
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions		171	1,1

District heating and combined heat power (CHP)

House Andre Tournon Sur Rhone / Climate: Tournon avec masque LAMP Temp 1960-1990 / TFA: 155 m² / Heating: 222,4 kWh/(m²a) / Freq. overheating: 0 % / PER: 453 kWh/(m²a)

Building type:		Single Family House	
Treated floor area A_{TFA}:		155	m²
Covered fraction of space heating demand	*('PER' worksheet)*	0%	
Annual heating demand kWh/a	Q_H *(DHW+Distribution)*	34477	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%	
DHW demand	Q_{DHW} *(DHW+Distribution)*	2240	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

		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	1-None		0,000

Definition of heat source for calculation of PER factor

Heat net — Efficiency district heating net

PHC complex & boiler for peak loads	Fraction	Efficiency Electricity	Efficiency Heat		PER factors	PER factors
PHC complex				**Within biomass budget**	1,10	2,80
Boiler for peak loads	100%			**Excess of biomass budget**	1,75	4,50
Total	100%			**DHW Summer**	1,25	3,30

Performance ratio of heat transfer station $h_{a,HX}$		
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	1,75	2,60
	04	Electricity for cooling	1,20	2,60
	05	Electricity for dehumidification	1,40	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