

Brief instructions



Place your mouse pointer here to see the PHPP assistance.

If no help appears when the mouse passes over cell to the left, activate it in the Excel Options by selecting "Comment indicator only".

Explanation of cell formats:

Example	Cell format	Meaning
78.8	light yellow	Input field: Please enter the required value here
01ud Triple-low-e Kr08	light yellow, drop-down list	Input field with drop-down list (click on cell to display options field)
80	grey, protected	Link (through Variants-macro). Attention: do not overwrite!
6619	white, protected	Calculation field; please do not change
126.0	green, protected	Important result

Overview of worksheets:

Worksheet name (to show/hide worksheets please use the separate 'Profile settings' tool)	Function	Brief description	Required for certification?
Verification	Building data; summary of results	Building description, summary of results, verification of compliance with criteria	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
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
PHeco	Cost efficiency calculation	Life cycle costs of different variants can be compared.	no
Moni	Comparison of PHPP calculation and measured values	The PHPP calculation is adapted to the real boundary conditions of the year under consideration and compared with the measured consumption.	no
Climate	Climate region selection or definition of user-defined data	Climate data for the worksheets: Annual heating, Windows, Heating Load, Heating, Summer, Cooling, Cooling units, Cooling Load and location specific PER factors	yes
U-values	Calculation of standard building assembly U-values	Calculation of heat transfer coefficients according to DIN EN ISO 6946, secondary calculations and calculations for special cases	yes
Areas	Areas summary	Building component areas, thermal bridges, Treated Floor Area. Pay attention to the external dimension reference! Additional calculation for internal downpipes	yes
Ground	Calculation of the temperature reduction factors against the ground	More precise calculation of heat losses through the ground	optional
Components	Building component database	Database of certified, Passive House suitable components and entry of user-defined components	yes
Windows	Determination of the U-value for windows and doors	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 reduction factors	Input of shading parameters, e.g. balcony, neighbouring building, window reveal and calculating the shading reduction factors	yes
Ventilation	Air quantities and supply air/extract air balance for the heating period, input of the airtightness test result	Sizing the ventilation system from extract and supply air requirements, infiltration air change rate and actual efficiency of heat recovery, input of pressurisation test results	yes
Addl vent	Design and planning of ventilation systems with diverse ventilation units	Extension of the 'Ventilation' worksheet for dimensioning airflows, for special building uses and systems with various ventilation units	if applicable
Addl vent. 2	Design and planning of ventilation systems with diverse ventilation units	The copy of the Addl. vent. worksheet is used if the 'Addl vent.' worksheet is not sufficient.	if applicable
Annual heating	Annual heating demand / annual method (only informative)	Calculation of the annual heating demand according to the heating period method based on EN 13790: Transmission + ventilation - h (solar offer + internal sources)	no
Heating	Heating demand calculation by the monthly method according to ISO 52016	Calculation procedure for the monthly method based on DIN EN ISO 52016	yes
Heating load	Building heating load calculation	Calculation of the nominal heating load according to heat balance for the design period: Transmission + ventilation - (solar offer + internal sources)	yes
SummVent	Determination of summer ventilation	Summer ventilation and estimation of airflow rates for summer window ventilation	yes
Summer	Assessment of summer climate	Calculation of the frequency of overheating as a measure of summer comfort	In case of no active cooling
Cooling	Monthly method for cooling demand	Annual useful cooling demand calculation	In case of active cooling
Cooling units	Latent cooling energy	Calculation of the energy demand for dehumidification and choice of cooling method	
Cooling load	Building cooling load calculation	Calculation of the daily average cooling load of the building	

DHW+Distribution	Distribution losses; DHW requirement and losses	Calculation of the heat losses of the distribution lines (heating, DHW, cooling); calculation of the useful heat demand for DHW and storage losses	yes
SolarDHW	Solar DHW generation	Solar contribution calculation for DHW and supplementary space heating contribution	if present
PV	Photovoltaic power generation	Electricity generation calculation of PV system	if present
Electricity	Electricity demand for dwellings	Calculation of the electricity demand of Passive Houses with residential use	For residential buildings
Use non-res	Utilisation profiles non-residential	Input or selection of utilisation profiles for planning of electricity demand and internal heat gains	For non-residential buildings
Electricity non-res	Electricity demand for non-residential use	Calculation of the electricity demand for lighting, equipment and kitchens of non-residential buildings, as well as the total electricity demand incl. heating, cooling/dehumidification and DHW	For non-residential buildings
Aux Electricity	Auxiliary electricity demand	Calculation of auxiliary electricity and corresponding primary energy demand	yes
IHG	Internal heat gains residential buildings	Calculation of the internal heat gains based on the 'Electricity' and 'Aux Electricity' worksheets.	For residential buildings in case of no standard IHG
IHG non-res	Internal heat gains non-residential buildings	Calculation of the internal heat gains for non-residential buildings based on the 'Electricity non-res' worksheet and the occupancy	For non-residential buildings in case of no standard IHG
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 HP-compact 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 (PE) factors	no

PHI Low Energy Building-Verification

10.4a EN

PHPP



Photo or drawing		Building: Block C Cranwood House	
		Street: 102-106 Woodside Avenue, Muswell Hill	
		Postcode/City: N10 3JA London	
		Province/Country: Greater London GB-United Kingdom/ Britain	
		Building type: 3-Double house	
		Climate data set: GB0027a-Northolt, Altitude corrected	
		Climate zone: 4: Warm-temperate Altitude of location: 91.35 m	
		Home owner / Client: London Borough of Haringey Council	
		Street: River Park House, 225 High Rd	
		Postcode/City: N22 8HQ London	
Province/Country: Greater London GB-United Kingdom/ Britain			
Mechanical engineer: NLY			
Street: The Coach House, Furze Hill, Ivy Barnes Lane			
Postcode/City: CM4 0EW Margaretting			
Province/Country: Ingatestone GB-United Kingdom/ Britain			
Certification: Mead Consulting			
Street: 3 Harvey Road			
Postcode/City: N8 9PD London			
Province/Country: Greater London GB-United Kingdom/ Britain			
Architecture: Delta Architects			
Street: 1 Batemans Row			
Postcode/City: EC2A 3HH London			
Province/Country: Greater London GB-United Kingdom/ Britain			
Energy consultancy: PRP			
Street: 10 Lindsey Street			
Postcode/City: EC1A 9HP London			
Province/Country: Greater London GB-United Kingdom/ Britain			
Year of construction: 2024			
No. of dwelling units: 2			
No. of occupants: 5.5			
Interior temperature winter [°C]: 20.0			
Internal heat gains (IHG) winter [W/m²]: 2.5			
Specific heat capacity [Wh/K per m² TFA]: 60			
Interior temp. summer [°C]: 25.0			
IHG summer [W/m²]: 2.5			
Mechanical cooling:			

Specific building characteristics with reference to the treated floor area					4 error message(s) in 'Check' worksheet'	
Criteria	Alternative criteria	Fullfilled? ²				
			Criteria	Alternative criteria	Fullfilled? ²	
Space heating	Treated floor area m²	254.5				
	Heating demand kWh/(m²a)	18	≤	30	-	Yes
	Heating load W/m²	13	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤			
	Frequency of overheating (> 25 °C) %	9	≤	10		Yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		Yes
Airtightness	Pressurisation test result n ₅₀ 1/h	0.6	≤	1.0		Yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	41	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	34	≤	75	75	Yes
	Renew. energy generation (in rel. to projected building footprint area) kWh/(m²a)	0	≥	-	-	

I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.				PHI Low Energy Building? ☐	
Task: 1-Design		First name: Eve		Surname: Russell	
Certificate-ID		Issued on:		City:	

▼ Overview of input errors

There are still 4 error message(s) in your PHPP.

Verification	-
Moni	-
Climate	-
U-values	-
Areas	-
Ground	-
Components	-
Windows	-
Shading	-
Ventilation	3 Error(s)
Addl vent	-
Addl vent 2	-
SummVent	-
Cooling units	-
DHW+Distribution	1 Error(s)
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 are listed below

Heating demand / heating load is not calculated because:

-
-
-
-
-
-
-
-

Cooling demand / cooling load is not calculated because:

-
-
-
-
-
-
-
-

PE / PER specific value is not calculated because:

-
-
-

▼ The following notes are based on the energy balance

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-
-
-
-
-
-

▼ Plausibility check

		Comment:	
<u>Verification</u>	-		
	-		
	-		
	-		
<u>Climate</u>	-		
<u>U-values</u>	-		
	A very small thermal conductivity [W/(mK)] was set:0.018		
<u>Areas</u>	Info: compactness of the building: 2.8 m² envelope area per m² of treated floor area		
	-		
	-		
	Has the area of the door in the external wall been deducted?		
	-		
	-		
	-		
	-		
	The areas facing north and south differ greatly from each other (27 m²) (Query will only work if all orientations have been entered; doors are not taken into account)		
	-		
	-		
	-		
	Average reduction factor for shading of building elements: 100 % -> Very little shading		
	-		
<u>Ground</u>	-		
	More exact results can be achieved if you fill in the 'Ground' worksheet.		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
<u>Components</u>	-		
	-		
	-		

	-		
	-		
	-		
	Is a transom-mullion construction used? Have the corresponding glass carrier values been entered in the 'Components' worksheet and the quantity in the 'Window' worksheet?		
	Are there roller shutters, external venetian blinds, etc.? Has their installation been entered? In which worksheet?		
	-		
	-		
	-		
	-		
	-		
<u>Windows</u>	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
<u>Shading</u>	North, : are there any shading elements on the horizon for this/these orientation(s)? Trees, houses, mountains that are further away almost always have an influence as well.		
	-		
	Info: reduction factor for shading in winter: minimum: 75% , maximum: 98% , average: 81%		
	Info: Reduction factor shading summer: Average:81%		
	Shading from the horizon and wind protection coefficient ('Ventilation' worksheet) do not match.		
<u>Ventilation</u>	-		
	-		
	-		
	-		
	-		
	Has the net air volume for the pressurisation test been calculated correctly? Please check.		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
<u>Addl vent</u>	-		
	-		
	-		
	-		

	-		
	-		
	-		
	-		
	-		
<u>Heating</u>	-		
	-		
	-		
	-		
<u>Heating load</u>	The maximum permissible supply air temperature which has been entered is relatively low.		
	-		
	-		
<u>SummVent</u>	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
<u>Summer</u>	Info: Solar aperture per m² building envelope area:0.04		
<u>Cooling units</u>	-		
<u>Cooling load</u>	-		
<u>DHW+Distribution</u>	-		
	-		
	-		
	There are no distribution losses through DHW pipes. Is this correct?		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	-		
	Is there no storage tank?		
	-		
<u>PV</u>	-		
	-		
	-		
<u>Electricity</u>	-		
	-		
<u>Electricity non-res</u>	-		
	-		
	-		
	-		
<u>Aux Electricity</u>	-		
<u>IHG</u>	-		
<u>IHG non-res</u>	-		

Compact

-

Climate data

PHI Low Energy Building with PHPP Version 10.4a EN

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)



Selection of climate data

Country: GB-United Kingdom/ Britain

Region: Zone 02 - Thames Valley

1-Sort alphabetically

Climate data set: GB0027a-Northolt

Climate zone: 4: Warm-temperate

Altitude

Weather station: 40 m

Building location: 91 m

Temperature increase Summer: °C

Result overview

Annual heating demand 17.7 kWh/(m²a)

Heating load 12.8 W/m²

Frequency of overheating 9.2 %

Sensible cooling 3.2 kWh/(m²a)

Latent cooling 0.1 kWh/(m²a)

Cooling load 9.0 W/m²

PER demand 33.6 kWh/(m²a)

Data for heating Annual method

Data from monthly balance Heating Cooling

Heating / cooling period 201 273 275 d/a

Heating / cooling degree hours 64 78 -86 kWh/a

Radiation North 99 176 292 kWh/(m²a)

Radiation East 214 393 618 kWh/(m²a)

Radiation South 401 629 749 kWh/(m²a)

Radiation West 220 386 589 kWh/(m²a)

Horizontal radiation 315 577 937 kWh/(m²a)

GB0027a-Northolt

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load		Cooling load		PER factors	
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Weather 1	Weather 2		
GB0027a-Northolt, Altitude corrected	Latitude °	51.55	Longitude °	-0.42	Altitude [m]	91	ΔT Summer [K]				9.4	T Comfort criterion [°C]	-4.8	Radiation: [W/m²]		Radiation: [W/m²]		
° C	Exterior temperature	4.8	5.1	7.3	9.7	12.9	15.9	18.1	17.8	15.0	11.5	7.6	5.2	-1.5	1.5	26.0	20.7	1.30
kWh/(m²month)	Radiation North	7	12	23	33	44	53	48	39	24	17	9	6	8	5	95	50	1.30
kWh/(m²month)	Radiation East	17	26	47	72	93	102	96	84	66	39	19	14	12	5	220	180	1.65
kWh/(m²month)	Radiation South	50	58	79	89	90	85	88	93	92	77	55	41	28	15	185	255	1.00
kWh/(m²month)	Radiation West	18	27	49	71	83	88	94	80	58	42	24	14	14	10	220	180	1.15
kWh/(m²month)	Horizontal radiation	22	36	73	111	144	154	152	130	90	55	28	18	20	15	320	260	
° C	Dew point temperature	2.3	1.7	2.6	4.2	7.4	10.0	11.7	12.1	10.3	8.4	5.3	3.2			19.7	17.0	
° C	Sky temperature	-5.4	-5.9	-4.8	-2.9	0.9	4.1	6.5	6.7	4.4	1.8	-1.8	-4.4			17.9	14.5	
	Comment	Temp = 1991-2020 Met Office; Other derived from Meteonorm v8																
° C	Ground temperature (project-specific)	11.1	10.0	9.0	8.7	10.6	13.7	14.8	15.9	16.3	12.7	12.5	12.0	12.0		14.8	14.8	
	Relative humidity	84%	79%	72%	69%	69%	68%	66%	69%	74%	81%	85%	87%					

Occupant electricity (ε

Domestic hot water

Heating

Cooling

Dehumidification

U-values of building assemblies

PHI Low Energy Building with PHPP Version 10.4a EN

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Show special cases and secondary calculations on the right ->

Description of building assembly						Assembly no.	
FLOOR GF01 Ground Floor						01ud	
Orientation of building assembly (or R _{si})		3-Floor		Interior insulation?			
Adjacent to (or R _{se})		2-Ground		U-value supplement [W/(m²K)]			
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Floor Finish							
Screed	1.150					75	
Insulation	0.018					175	
Slab	2.300					225	
Percentage of sec. 1:	100%	Percentage of sec. 2:		Percentage of sec. 3:			
Heat transmission resistance coefficients						Total thickness [cm]: 47.5	
Interior R _{si} :		0.17	m²K/W				
Exterior R _{se} :		0.00	m²K/W		U-value [W/(m²K)]: 0.099		

Description of building assembly						Assembly no.	
WALL TYPE E2						02ud	
Orientation of building assembly (or R _{si})		2-Wall		Interior insulation?			
Adjacent to (or R _{se})		1-Outdoor air		U-value supplement [W/(m²K)]		0.030	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
Brickwork	0.800					103	
Nyrock Rainscreen 032 Slab	0.032					300	
Insulation							
Dense Blockwork	0.510					140	
Gyproc Soundbloc	0.250					15	
Gyproc Fireline Duplex with VCL	0.250					15	
Percentage of sec. 1:	100%	Percentage of sec. 2:		Percentage of sec. 3:			
Heat transmission resistance coefficients						Total thickness [cm]: 57.3	
Interior R _{si} :		0.13	m²K/W				
Exterior R _{se} :		0.04	m²K/W		U-value [W/(m²K)]: 0.129		

Description of building assembly						Assembly no.	
WALL TYPE E3						03ud	
Orientation of building assembly (or R _{si})		2-Wall		Interior insulation?			
Adjacent to (or R _{se})		1-Outdoor air		U-value supplement [W/(m²K)]		0.030	
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]	
White Render						23	
Dense Blockwork						100	
Mineral Fibre Insulation	0.035					280	
Dense Blockwork						140	
Gyproc Soundbloc						30	

Percentage of sec. 1:		100%	Percentage of sec. 2:			Percentage of sec. 3:			
Heat transmission resistance coefficients									
Interior R _{si} :		0.13			Total thickness [cm]:				57.3
Exterior R _{se} :		0.04			U-value [W/(m²K)]:				0.152

Description of building assembly

Assembly no.

FLOOR TYPE 1

04ud

Orientation of building assembly (or R_{si})

3-Floor

Adjacent to (or R_{se})

2-Ground

Interior insulation?

U-value supplement [W/(m²K)]

0.030

Area section 1

λ [W/(mK)]

Area section 2 (optional)

λ [W/(mK)]

Area section 3 (optional)

λ [W/(mK)]

Thickness [mm]

Floor Finish

15

Screed

1.150

50

PIR Rigid Insulation

0.022

185

RC Slab

0.830

250

Cellcore Void Former

0.350

150

Concrete Blinding

0.350

50

Percentage of sec. 1:

100%

Percentage of sec. 2:

Percentage of sec. 3:

Heat transmission resistance coefficients

Total thickness [cm]:

70.0

Interior R_{si}:

0.17

m²K/W

U-value [W/(m²K)]:

0.135

Exterior R_{se}:

0.00

m²K/W

Description of building assembly

Assembly no.

FLAT ROOF R3

05ud

Orientation of building assembly (or R_{si})

1-Roof

Adjacent to (or R_{se})

1-Outdoor air

Interior insulation?

U-value supplement [W/(m²K)]

0.030

Area section 1

λ [W/(mK)]

Area section 2 (optional)

λ [W/(mK)]

Area section 3 (optional)

λ [W/(mK)]

Thickness [mm]

VCL Gypsum Fireline board

0.160

15

Air Cavity

0.330

Metal webbed timber joist

0.022

Rockwool insulation

0.040

Metal webbed timber joist

0.022

225

Air Cavity

0.330

Furring timbers

0.039

50

WBP plywood

0.150

18

Hardrock multifix DD insulation board

0.039

300

Roof finish

25

Percentage of sec. 1:

100%

Percentage of sec. 2:

Percentage of sec. 3:

Heat transmission resistance coefficients

Total thickness [cm]:

63.3

Interior R_{si}:

0.10

m²K/W

U-value [W/(m²K)]:

0.102

Exterior R_{se}:

0.04

m²K/W

Description of building assembly

Assembly no.

06ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement [W/(m²K)]

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:

Heat transmission resistance coefficients

Total thickness [cm]:

Interior R_{si} :		m^2K/W	
Exterior R_{se} :		m^2K/W	
			U-value $[W/(m^2K)]$:

Description of building assembly						Assembly no.	
						07ud	

Orientation of building assembly (or R _{si})				Interior insulation?			
Adjacent to (or R _{se})				U-value supplement [W/(m²K)]			

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:	

Heat transmission resistance coefficients

Interior R_{si}:

m²K/W

Exterior R_{se}:

m²K/W

Total thickness [cm]:

U-value [W/(m²K)]:

Description of building assembly						Assembly no.	
						08ud	

Orientation of building assembly (or R _{si})				Interior insulation?			
Adjacent to (or R _{se})				U-value supplement [W/(m²K)]			

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:	

Heat transmission resistance coefficients

Interior R_{si}:

m²K/W

Exterior R_{se}:

m²K/W

Total thickness [cm]:

U-value [W/(m²K)]:

Description of building assembly						Assembly no.	
						09ud	

Orientation of building assembly (or R _{si})				Interior insulation?			
Adjacent to (or R _{se})				U-value supplement [W/(m²K)]			

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:	

Heat transmission resistance coefficients

Total thickness [cm]:

Interior R_{si} :		m^2K/W	
Exterior R_{se} :		m^2K/W	
			U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

10ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

11ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

12ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

--	--	--

Description of building assembly

Assembly no.

13ud

Orientation of building assembly (or R_{si})

Interior insulation?

Adjacent to (or R_{se})

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

m^2K/W

Exterior R_{se} :

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

14ud

Orientation of building assembly (or R_{si})

Interior insulation?

Adjacent to (or R_{se})

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

m^2K/W

Adjacent to (or R_{se})

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

15ud

Orientation of building assembly (or R_{si})

Interior insulation?

Adjacent to (or R_{sa})

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

m^2K/W

Exterior R_{se} :

m^2K/W

Total thickness [cm]:

U-value $[W/(m^2K)]$:

--	--	--

Description of building assembly

Assembly no.

16ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness $[cm]$:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

17ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness $[cm]$:

U-value $[W/(m^2K)]$:

Description of building assembly

Assembly no.

18ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement $[W/(m^2K)]$

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:		

Heat transmission resistance coefficients

Interior R_{si} :

Exterior R_{se} :

m^2K/W

m^2K/W

Total thickness $[cm]$:

U-value $[W/(m^2K)]$:

--	--	--

Description of building assembly

Assembly no.

19ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement [W/(m²K)]

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:

Heat transmission resistance coefficients

Interior R_{si}:

Exterior R_{se}:

m²K/W

m²K/W

Total thickness [cm]:

U-value [W/(m²K)]:

Description of building assembly

Assembly no.

20ud

Orientation of building assembly (or R_{si})

Adjacent to (or R_{se})

Interior insulation?

U-value supplement [W/(m²K)]

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:

Heat transmission resistance coefficients

Interior R_{si}:

Exterior R_{se}:

m²K/W

m²K/W

Total thickness [cm]:

U-value [W/(m²K)]:

Summary				Average U-value [W/(m²K)]	Radiation gains		Radiation load
Temp. - zone	Thermal envelope Areas [m²]	Area group	Group no.		Heating period [kWh/a]	Cooling period [kWh/a]	
	254.50	Treated floor area	1		9 months	9 months	
A	14.38	North windows	2	1.054	429	1001	
A	0.00	East windows	3				
A	29.94	South windows	4	0.905	4053	4434	
A	0.00	West windows	5				
A	0.00	Horizontal windows	6				
A	11.20	Exterior door	7	1.000			
A	370.87	External wall - ambient	8	0.134	74	272	
B	0.00	External wall ground/basement	9				
A	143.78	Roof / ceiling - ambient	10	0.102	-21	104	
B	143.78	Floor slab / basement ceiling	11	0.099			
	0.00		12				
	0.00		13				
	0.00		14				
Thermal bridges, length [m]				Ψ [W/(mK)]			
A	0.00	Thermal bridges ambient	15				
P	0.00	Perimeter thermal bridges	16				
B	0.00	Thermal bridges FS/BC	17				
Building element towards neighbour, [m²]				[W/(m²K)]			
I	0.00	Building element towards neighbour	18				
Total thermal envelope [m²]				[W/(m²K)]			
	713.96	Average U-value of thermal envelope:		0.185			

User-defined temperature reduction factors				
Zo- ne	Heating- demand	Heating load	Cooling demand	Passive cooling
X				
Y				
Z				
Auxiliary calculation for the determination of temperature reduction factors				
Temperature of the adjacent zone [°C]:				

Go to building components list

Area input															Building assembly selection		Radiation balance input							
Area no.	Building assembly description	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User-defined calculation [m²]	-	User-defined 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	Orien- tation	Reduction factor shading	Exterior absorptivity	Exterior emissivity	
	Projected building footprint	0-Projected building footprint:	1	x (		x		+	143.78	-		)	=	143.8	2-Sort by ID									
	Treated floor area	1-Treated floor area	1	x (		x		+	254.50	-		)	=	254.5										
	Exterior door	7-Exterior door	2	x (		x		+	5.60	-		)	=	11.2	Exterior door	1.00			Radiation balance window frames:					
1	C North Elevation Brick (Matt)	8-External wall - ambient	1	x (		x		+	70.40	-		)	=	59.3	02ud-WALL TYPE E2	0.129	352	90	North	1.00	0.50	0.90		
2	C North Elevation Concrete	8-External wall - ambient	1	x (		x		+	20.20	-		)	=	16.9	03ud-WALL TYPE E3	0.152	352	90	North	1.00	0.50	0.90		
3	C North Elevation Floor Slab	8-External wall - ambient	1	x (		x		+	6.90	-		)	=	6.9	03ud-WALL TYPE E3	0.152	352	90	North	1.00	0.50	0.90		
4	C-E 01 North Inset Elevation	8-External wall - ambient	1	x (		x		+	7.00	-		)	=	7.0	02ud-WALL TYPE E2	0.129	352	90	North	1.00	0.50	0.90		
5	C-W 01 North Inset Elevation	8-External wall - ambient	1	x (		x		+	7.00	-		)	=	7.0	02ud-WALL TYPE E2	0.129	352	90	North	1.00	0.50	0.90		
6				x (		x		+		-		)	=											
7	C East Elevation Brick (Matt)	8-External wall - ambient	1	x (		x		+	90.60	-		)	=	90.6	02ud-WALL TYPE E2	0.129	82	90	East	1.00	0.50	0.90		
8	C East Elevation Concrete	8-External wall - ambient	1	x (		x		+	6.90	-		)	=	6.9	03ud-WALL TYPE E3	0.152	82	90	East	1.00	0.50	0.90		
9	C East Elevation Floor Slab	8-External wall - ambient	1	x (		x		+	5.40	-		)	=	5.4	03ud-WALL TYPE E3	0.152	82	90	East	1.00	0.50	0.90		
10				x (		x		+		-		)	=											
11	C South Elevation Brick (Matt)	8-External wall - ambient	1	x (		x		+	50.50	-		)	=	27.7	02ud-WALL TYPE E2	0.129	172	90	South	1.00	0.50	0.90		
12	C South Elevation Concrete	8-External wall - ambient	1	x (		x		+	41.10	-		)	=	34.0	03ud-WALL TYPE E3	0.152	172	90	South	1.00	0.50	0.90		
13	C South Elevation Floor Slab	8-External wall - ambient	1	x (		x		+	6.30	-		)	=	6.3	03ud-WALL TYPE E3	0.152	172	90	South	1.00	0.50	0.90		
14				x (		x		+		-		)	=											
15	C West Elevation Brick (Matt)	8-External wall - ambient	1	x (		x		+	97.50	-		)	=	97.5	02ud-WALL TYPE E2	0.129	270	90	West	1.00	0.50	0.90		
16	C West Elevation Floor Slab	8-External wall - ambient	1	x (		x		+	5.40	-		)	=	5.4	03ud-WALL TYPE E3	0.152	270	90	West	1.00	0.50	0.90		
17				x (		x		+		-		)	=											
18	C Floor Slab	11-Floor slab / basement ceiling	1	x (		x		+	143.78	-		)	=	143.8	01ud-FLOOR GF01 Ground Floor	0.099	0	180	Hor	1.00	0.50	0.90		
19	C Roof	10-Roof / ceiling - ambient	1	x (		x		+	143.78	-		)	=	143.8	05ud-Flat Roof R3	0.102	0	0	Hor	1.00	0.50	0.90		
20				x (		x		+		-		)	=											
21				x (		x		+		-		)	=											
22				x (		x		+		-		)	=											
23				x (		x		+		-		)	=											
24				x (		x		+		-		)	=											
25				x (		x		+		-		)	=											
26				x (		x		+		-		)	=											
27				x (		x		+		-		)	=											
28				x (		x		+		-		)	=											
29				x (		x		+		-		)	=											
30				x (		x		+		-		)	=											
31				x (		x		+		-		)	=											
32				x (		x		+		-		)	=											
33				x (		x		+		-		)	=											
34				x (		x		+		-		)	=											
35				x (		x		+		-		)	=											
36				x (		x		+		-		)	=											
37				x (		x		+		-		)	=											
38				x (		x		+		-		)	=											
39				x (		x		+		-		)	=											
40				x (		x		+		-		)	=											
41				x (		x		+		-		)	=											
42				x (		x		+		-		)	=											
43				x (		x		+		-		)	=											
44				x (		x		+		-		)	=											
45				x (		x		+		-		)	=											
46				x (		x		+		-		)	=											
47				x (		x		+		-		)	=											
48				x (		x		+		-		)	=											
49				x (		x		+		-		)	=											
50				x (		x		+		-		)	=											

Aend

Auxiliary calculation for interior drain pipes that are ventilated through the roof								
	Nominal width:	λ	Insulation thickness	Reflective coating?	Ψ -value	Length	$\Psi \cdot l$	
Climate	mm	W/(mK)	mm		W/(mK)	m	W/K	
Room temperature °C	20.0							
Ground temperature °C	11.9							
Ambient temperature heating period °C	7.5							
Limitation of airflow rate in the pipe system:					Total	m 0.00	W/K 0.000	
Nominal width mm								
Number of parallel pipes					Reduction factor sewer temperature		0.649	
Capacitance rate W/K	0.0				Reduction factor warming of air		1.000	
					Spec. loss with respect to ambient air [W/K]		0.000	
								This result is automatically transferred to the energy balance

Heat losses through the ground

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building section 1

Ground characteristics				Climate data			
Thermal conductivity	λ	2.0	W/(mK)	Avg. indoor temp. winter	θ_i	20.0	°C
Heat capacity	ρc	2.0	MJ/(m³K)	Avg. indoor temp. summer	θ_i	25.0	°C
Periodic penetration depth	δ	3.17	m	Avg. ground surface temperature	$\theta_{e,m}$	11.9	°C
				Amplitude of $\theta_{e,m}$	$\theta_{e,\wedge}$	6.7	°C
				Phase shift of θ_e	τ	1.2	Months
				Length of the heating period	n	6.6	Months
				Heating degree hours - exterior	G_t	64.4	kKh/a

Building data							
Area floor slab / basement ceiling	A	143.8	m²	U-value floor slab / basement ceiling	U_f	0.099	W/(m²K)
Perimeter length	P	47.9	m	TBs floor slab / basement ceiling	$\Psi_B * \ell$	0.00	W/K
Charact. dimension of floor slab	B'	6.00	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)				
Area of interior wall towards heated	A_{wl}		m²	U-value of interior wall towards heated	U_{wl}		W/(m²K)
Heated basement or floor slab completely / partially below ground level							
Area basement wall below ground	A_{wb}		m²	U-value wall below ground	U_{wB}		W/(m²K)
Unheated basement							
Area basement wall above ground	A_W		m²	U-value wall above ground	U_W		W/(m²K)
Area basement wall below ground	A_{wb}		m²	U-value wall below ground	U_{wB}		W/(m²K)
Area of interior wall towards heated	A_{wl}		m²	U-value of interior wall towards heated	U_{wl}		W/(m²K)
Air change unheated basement	n	0.20	h⁻¹	U-value basement floor slab	U_{fB}		W/(m²K)
Air volume basement	V		m³				
Suspended floor above a ventilated crawl space (at max. 0.5 m below ground)							
U-value crawl space	U_{Crawl}		W/(m²K)	Area of ventilation openings	εP		m²
Height of crawl space wall	h		m	Wind velocity at 10 m height	v	4.0	m/s
U-value crawl space wall	U_W		W/(m²K)	Wind shield factor	f_W	0.05	-
Area of interior wall towards heated	A_{wl}		m²	U-value of interior wall towards heated	U_{wl}		W/(m²K)

Perimeter thermal bridges				Perimeter TBs steady-state fraction	$\Psi_{P,stat} * \ell$	0.000	W/K
Phase shifting (optional)	β		Months	Perimeter TBs harmonic fraction	$\Psi_{P,harm} * \ell$	0.000	W/K

Groundwater correction							
Depth of the groundwater table	z_w	3.0	m	Groundwater correction factor	G_w		-
Groundwater flow rate	q_w	0.05	m/d				

Interim results							
Steady-state conductance	H_S		W/K	Conductance building	H_0		W/K
Exterior periodic conductance	H_{pe}		W/K	Internal harmonic conductance	H_{pi}		W/K
External phase shift	β		Months	Internal phase shift	α		Months

Total result - Standard values

Steady-state conductance	H_S		W/K	Conductance building	H_0		W/K
Exterior periodic conductance	H_{pe}		W/K	Internal harmonic conductance	H_{pi}		W/K
External phase shift	β		Months	Internal phase shift	α		Months
Steady-state heat flow	Φ_{stat}	136.7	W	Heat losses during heating period	Q_{tot}	644	kWh
External periodic heat flow	$\Phi_{harm,e}$	16.6	W	Charact. dimension of floor slab	B'	6.00	m
Internal harmonic conductance	$\Phi_{harm,i}$	20.0	W				

Heat flow into the ground for monthly method (all building parts)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
heat flow	127	143	157	166	167	160	146	131	116	108	107	114	137

Design ground temperature for 'Heating load' worksheet

12.0

For 'Cooling load' worksheet

14.8

Passive House Components

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

[◀ Contents](#) [Link to 'Areas' worksheet](#)

Building assemblies (U-values)

Typical for climate zone 'Warm-temperate': U-value for walls and roofs 0.3 W/(m²K)

		1			
ID	Building system	Building assembly	Total thickness	U-value	Interior insulation
	Summary of building assemblies calculated in 'U values' worksheet		m	W/(m²K)	-
01ud	FLOOR GF01 Ground Floor	FLOOR GF01 Ground Floor	0.475	0.099	0
02ud	WALL TYPE E2	WALL TYPE E2	0.573	0.129	0
03ud	WALL TYPE E3	WALL TYPE E3	0.573	0.152	0
04ud	FLOOR TYPE 1	FLOOR TYPE 1	0.700	0.135	0
05ud	FLAT ROOF R3	FLAT ROOF R3	0.633	0.102	0
06ud					
07ud					
08ud					
09ud					
10ud					
11ud					
12ud					
13ud					

Glazing and door panels			
Typical for 'Warm-temperate' climate zone: Triple low-e glazing			
ID	Description	g-value	U _p -value
			W/(m²K)
01ud	Generic NorDan Palliser Road	0.45	0.52
02ud			
03ud			
04ud			
05ud			
06ud			
07ud			
08ud			
09ud			
10ud			
11ud			
12ud			
13ud			

[illegible]

Ventilation units														Ventilation units					
Typical for climate zone 'Warm-temperate': Frost protection: Yes, Energy recovery: No				75 %				0.45											
ID	Description	Heating period		Cooling period		Specific electric power	Additional device data												
		Heat recovery efficiency	Humidity recovery efficiency η_{ERV}	HR efficiency, cooling	Humidity recovery efficiency η_{ERV}		Air flow range		External pressure	Fittings $D_{p,ext}$	Frost protection necessary	Noise protection			Additional info				
		%	%	%	%	Wh/m³	m³/h	m³/h	Pa	Pa		35 dB(A)	Supply air dB(A)	Extract air dB(A)					
01ud	Generic MVHR	86%	0%			0.44	75	120	100	incl.	yes	/	62	49					
02ud																			
03ud																			
04ud																			
05ud																			
06ud																			
07ud																			
08ud																			
09ud																			
10ud																			
11ud																			
12ud																			
13ud																			

Drain water heat recovery (shower)				
ID	Description	Nominal efficiency	Effective dead time	Nominal airflow rate
		-	s	l/min
01ud				
02ud				
03ud				
04ud				
05ud				
06ud				
07ud				
08ud				
09ud				
10ud				
11ud				
12ud				
13ud				

Heat pumps, e.g. according to EN 14825 / EN 14511																																					
with heating and/or cooling function and, if applicable, DHW generation																																					
Heating / DHW																																					
ID		Description	Use for heating/DHW	Heat source	Heat sink	Test point 1				Test point 2				Test point 3				Test point 4				Test point 5				Test point 6				Test point 7				Test point 8			
						Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP	Temp. source	Temp. sink	Htg. capacity	COP
			select			°C	°C	kW		°C	°C	kW		°C	°C	kW		°C	°C	kW		°C	°C	kW		°C	°C	kW		°C	°C	kW		°C	°C	kW	
01ud																																					
02ud																																					
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09ud																																					
10ud																																					
11ud																																					
12ud																																					
13ud																																					

[illegible]

Combined ventilation and split units (air source heat pump), PHI test method															Heating																							
ID		Description		Ventilation													Heating																					
																	Heating test point 1										Heating test point 2					Heating						
		Ventilation function	Heating period		Cooling period		Specific electric efficiency	Range of use from to		External pressure per section	Frost protection necessary	Noise protection			Heating function	Temperature		Normal operation				Silent mode				Temperature		Normal operation				Silent mode				Tempe		
		Heat recovery efficiency	Humidity recovery rate η_{ERV}	HR efficiency, cooling	Humidity recovery rate η_{ERV}	Sour- ce										Sink	Heating capacity max / on-off limit		COP max / on-off limit		Heating capacity max / on-off limit		COP max / on-off limit		Sour- ce	Sink	Heating capacity max / on-off limit		COP max / on-off limit		Heating capacity max / on-off limit		COP max / on-off limit		Sour- ce			
		Mark with an 'x'		%	%	%	%	Wh/m³	m³/h	m³/h	Pa		35 dB(A)	Supply air dB(A)	Extract air dB(A)	Mark with an 'x'	°C	°C	kW	kW			kW	kW			°C	°C	kW	kW			kW	kW			°C	
01ud																																						
02ud																																						
03ud																																						
04ud																																						
05ud																																						
06ud																																						
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10ud																																						
11ud																																						
12ud																																						
13ud																																						

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

PHPP, Windows

51.6

Orientation	Glazing area [m²]	Reduction factor winter $r_{S,S}$	Reduction factor cooling $r_{S,1}$	Reduction factor cooling load $r_{S,2}$	Solar load [kWh/(m² _{Glazing} a)]
North	8.92	75%	100%	100%	112
East	0.00	100%	100%	100%	0
South	21.11	84%	73%	65%	210
West	0.00	100%	100%	100%	0
Horizontal	0.00	100%	100%	100%	0

[illegible]

Treated floor area A_{TFA}	255	m²	
Room height h	2.50	m	Used 2.50 m
Reference volume for the ventilation system ($A_{TFA} \cdot h$) = V_V	636	m³	

Selection of ventilation input

Type of ventilation	1-Balanced PH ventilation with HR	
'Ventilation' worksheet	x	Standard project design for residential buildings
'Addl vent' worksheet		Multiple ventilation units, non-res

Infiltration air change rate

			For annual demand:	For heating load:	
Wind protection coefficient, e	2-Moderate protection	0.07	0.18		
Wind protection coefficient, f		15	15		
Net air volume for pressurisation test	V_{n50}	1294	m³		
Air change rate from pressurisation test	n_{50}	0.60	1/h		
Air permeability	q_{50}	1.09	m³/(hm²)		
Excess extract air		0.00	0.00	1/h	
Infiltration air change rate	$n_{V,Rest}$	0.085	0.214	1/h	

Results

Average airflow rate	Average air change rate heating period	Excess air (extract air system)	Effective heat recovery efficiency	Humidity recovery efficiency	Heat recovery efficiency, cooling	Humidity recovery efficiency	Specific electric efficiency	SHX Heat recovery efficiency
m³/h	1/h	1/h	[-]	[-]	[-]	[-]	Wh/m³	[-]
191	0.30	0.00	75.0%	N/A	65.0%	N/A	0.45	0.0%

Transfer

Efficiency SHX

0%

η_{*SHX}

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
44%	43%	44%	48%	57%	-	-	-	66%	60%	51%	46%

Ventilation data

PHI Low Energy Building with PHPP Version 10.4a EN

PHPP

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Dimensioning of a ventilation system with only one ventilation unit

Occupant density	m²/P	46					
Number of occupants	P	5.5					
Supply air per person	m³/(P*h)	30					
Supply air demand	m³/h	164					
Extract air rooms			Bathroom				
Quantity			Kitchen	Bathroom	(shower only)	WC	
Extract air demand per room	m³/h	60	40	20	20		
Total extract air demand	m³/h	140					

Design airflow rate (maximum)

m³/h248

Recommended:

248

m³/h

Calculation of the average air change rate

Type of operation	Daily operation hours h/d	Factors referenced to maximum	Airflow rate m³/h	Air change rate 1/h
Maximum		1.00	248	0.39
Standard	24.0	0.77	191	0.30
Basic ventilation		0.54	134	0.21
Minimum		0.40	99	0.16
Average value		0.77	Average airflow rate (m³/h) 191	Average air change rate (1/h) 0.30

Selection of ventilation unit with heat recovery

Location of ventilation unit

1-Inside thermal envelope

	T _{room} > T _{outdoor}		T _{room} < T _{outdoor}				
	Heat recovery efficiency Unit η _{HR}	Energy recovery efficiency	Cool recovery rate Unit η _{HR}	Energy recovery efficiency	Specific power input [Wh/m³]	Airflow range [m³/h]	Frost protection necessary
Selection of ventilation unit	97ud-Default	0.75	N/A	0.65	N/A	0.45	N/A

Go to ventilation units list

1-Sort as list

Conductivity of outdoor air duct	Ψ	W/(mK)	0.000	HR efficiency, cooling	Implementation of frost protection	Limit temperature [°C]	Useful energy [kWh/a]	2-Electr.
Length of outdoor air duct		m	1					
Conductivity of exhaust air duct	Ψ	W/(mK)	0.000					
Length of exhaust air duct		m	1					
Temperature of mechanical room (enter only if the unit is outside of the thermal envelope)		°C			Room temperature (°C)		20	
					Avg. ambient temp. heating period (°C)		7.5	
					Avg. ground temp (°C)		11.9	

Effective heat recovery efficiency

η_{HR,eff}

75.0%

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:		mm
Insulation thickness:		mm
Reflective coating?		
Thermal conductivity		W/(mK)
Nominal airflow rate	191	m³/h
Δθ	12	K
Exterior duct diameter	0.000	m
Exterior diameter	0.000	m
α-Interior		W/(m²K)
α-Surface		W/(m²K)
Ψ-value		W/(mK)
Surface temperature difference		K

Secondary calculation

Ψ-value extract or exhaust air duct

Nominal width:		mm
Insulation thickness:		mm
Reflective coating?		
Thermal conductivity		W/(mK)
Nominal airflow rate	191	m³/h
Δθ	12	K
Exterior duct diameter	0.000	m
Exterior diameter	0.000	m
α-Interior		W/(m²K)
α-Surface		W/(m²K)
Ψ-value		W/(mK)
Surface temperature difference		K

Planning ventilation systems with multiple ventilation units

Ventilation unit / Effective heat recovery efficiency			
x	Standard project design ('Ventilation' worksheet)		
	Multiple ventilation units, non-res (this worksheet)		
Treated floor area A_{TFA}	255	m ²	('Areas' worksheet)
Room height h	2.50	m	('Ventilation' worksheet)
Reference volume for the ventilation system ($A_{TFA} \cdot h$) = V_V	636	m ³	('Annual heating' worksheet)
Number of occupants	5.5	P	('Verification' worksheet)
Interior temperature	20	°C	('Annual heating' worksheet)
Average ambient temp. heating period	7.5	°C	('Ventilation' worksheet)
Average ground temperature	11.9	°C	('Ground' worksheet)
Length of the heating period	201	d/a	('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		Annual average values		
		V _{SUP} m³/h	V _{ETA} m³/h	V _{SUP} m³/h	V _{ETA} m³/h	ACH 1/h
1	Unit 1	152	152	117	117	---
2						---
3						---
4						---
5						---
6						---
7						---
8						---
9						---
10						---

T _{room} > T _{outdoor}		T _{room} < T _{outdoor}		Specific electric efficiency	SHX heat recovery efficiency
Effective heat recovery efficiency	Humidity recovery efficiency	HR efficiency, cooling	Humidity recovery efficiency		
	0%		N/A	0.44	0%

Overall results vent. system					
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Recommendations for dimensioning air quantities

Use building materials/furnishings with low odour and low VOCs
It is strongly recommended to use building materials that cause very low or no VOCs/odours instead of increasing the outdoor air volume in order to clear the air.
This holds true regardless of 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 units themselves.

Assessment of airflow rates according to the number of persons
Also in non-residential buildings, the number of persons is fundamentally important for assessing the airflow rates. For good indoor air quality, airflow rates between 20 to 30 m3/(h*P) are sufficient.
Greater airflow rates can lead to indoor air that is too dry in winter. The airflow rates are defined by the classification according to the EN 13779 norm. The classification must be agreed with the client in advance.
IDA 3 is adequate for office buildings. IDA 4 has proven to be satisfactory for school buildings, as flushing ventilation is carried out during breaks anyway. For typical outdoor air CO₂ concentrations of around 400-500 ppm, it is possible to comply even with 1500 ppm. Exceeding this figure temporarily is permissible.

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

Flushing phase for intermittent operation
In case the ventilation is used intermittently (turned off at night), then the air in the room should be flushed in the morning during approx. 1 or 2 hours before the building is occupied, 'and in order to eliminate emissions released during the night. The flushing phase increases the operating period of the ventilation system (utilisation time + flushing phase). Please consider this during the design stage.

Dimensioning of air quantities

When dimensioning the air quantities, please consider the design recommendations given above.
The operation period of the ventilation system can be determined on the basis of the daily utilisation hours including the flushing phase.
Periods with a lower air demand (operation modes) can be taken into account by means of reduction factors.

Room no.	Quantity q	Room name	Allocation to ventilation unit (No.)	Area A m²	Clear height h m	Room vol. A x h m³	Volume flow per room			ACH per room n 1/h	Utilisation period h/d	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											V _{SUP} m³/h	V _{ETA} m³/h	V _{TRANS} m³/h	ACH 1/h
1	1	Dwelling unit	1	255	2.70	687	152	152		0.22	24	7		77%	100%					117	117		0.17
2														100%	100%								
3														100%	100%								
4														100%	100%								
5														100%	100%								
6														100%	100%								
7														100%	100%								
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30														100%	100%								
Additional rows: please select full rows above, and copy and insert them multiple times.																				117	117	---	0.17

Selection of the ventilation unit

Up to 10 different ventilation units can be considered. Identical units can be considered by changing the quantity. The data from ventilation units certified by the Passive House Institute can be found in the 'Components' worksheet together with the entry of user-defined data. If compact units are used, then standard project planning in the worksheet "Ventilation" should be used.

[Go to list of ventilation units](#)

Ventilation unit no.	Quantity	Description of ventilation units	Selection of ventilation unit	Design air flow rate per unit m³/h	Application range air flow rate from to m³/h m³/h		Specific electric efficiency Wh/m³	Pressure loss calculation			Application range		Interior location (x)	Exterior location (x)	T _{room} > T _{outdoor}		T _{room} < T _{outdoor}		Frost protection necessary	Subsoil HX		Frost protection (electr. / hydr.)			
								ODA-SUP Δp _{Duct} Pa	ETA-EHA Δp _{Duct} Pa	Additional Δp _{Intern} Pa	per line Δp _{External} Pa	Subtraction Δp _{Intern} Pa			Heat recovery efficiency Unit [-]	Humidity recovery efficiency Effective [-]	HR efficiency, cooling [-]	Humidity recovery efficiency [-]		Heat recovery efficiency	Effective HR	Execution	Limit temperature °C	Useful energy kWh/a	
1	1	Unit 1	01ud-Generic MVHR	152	75	120	0.44	100	100		100	-		x	0.86		0%	N/A	N/A	yes		0%	2-Electr.	-3	7
2																								0	
3																								0	
4																								0	
5																								0	
6																								0	
7																								0	
8																								0	
9																								0	
10																								0	
Total (direct electric)																								7	
Total (hydraulic via heat generator)																								0	

[Sorting options](#)

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 are considered through the effective heat recovery in the section above.

One section of a duct entered here may also be used for multiple ventilation units.

If a ventilation unit is considered more than once in a given row (quantity >1 for identical units) in the section "Selection of the ventilation unit", the ducts corresponding to this unit should be entered once (duct sections for one ventilation unit).

Temperature of installation room

22.0

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

Quantity	Round duct diameter mm	Rectangular duct width mm	Height mm	Insulation thickness mm	Thermal conductivity W/(m K)	Reflective aluminum coating? (x)	Conductance duct W/(m K)	Length of supply air duct m	Outdoor or supply air duct (1)	Exhaust or extract air duct (1)	Duct type	Design air flow rate	Assignment to ventilation unit (enter 1 for the corresponding ventilation unit)									
													vent. unit 1	vent. unit 2	vent. unit 3	vent. unit 4	vent. unit 5	vent. unit 6	vent. unit 7	vent. unit 8	vent. unit 9	vent. unit 10
												0										
												0										
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Additional rows: please select full rows above, and compy and insert them multiple times.

Interior temperature:20.0°C

Building type:3-Double house

Treated floor area A_{TFA}:254.5m²

Transmission heat losses Q_T

Building assembly	Temperature zone	Area m²		U-value W/(m²K)		Temperature reduction factor		G _t kKh/a	=	kWh/a	Per m² of TFA
External wall - ambient	A	370.9	*	0.134	*	1.00	*	64.4	=	3211	12.62
External wall ground/basement	B		*		*	0.70	*		=		
Roof / ceiling - ambient	A	143.8	*	0.102	*	1.00	*	64.4	=	948	3.72
Floor slab / basement ceiling	B	143.8	*	0.099	*	0.70	*	64.4	=	644	2.53
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
Windows	A	44.3	*	0.953	*	1.00	*	64.4	=	2721	10.69
Exterior door	A	11.2	*	1.000	*	1.00	*	64.4	=	721	2.83
Thermal bridges ambient (length/m)	A		*		*	1.00	*		=		0.00
Perimeter thermal bridges (length/m)	P		*		*	0.70	*		=		0.00
Thermal bridges ground (length/m)	B		*		*	0.70	*		=		0.00
											kWh/(m²a)
Sum of all areas of the building envelope		714.0								8245	32.4

Total transmission heat losses Q_T = 8245 kWh/a

Ventilation heat losses Q_V

Reference volume for the ventilation system, V_V (A_{TFA}*h)

Ventilation system:

Effective heat recovery efficiency of the heat exchanger

Heat recovery efficiency of SHX

Energetically effective air changes n_V

Total ventilation heat losses Q_V = 2169 kWh/a

8245 kWh/a + 2169 kWh/a = 10415 kWh/a

40.9 kWh/(m²a)

Available solar heat gains Q_S

Orientation of the area	Reduction factor See 'Windows' worksheet		g-value (perp. radiation)		Area m²	Global radiation heating period kWh/(m²a)	=	kWh/a	
North	0.38	*	0.45	*	14.38	100	=	243	
East	0.00	*	0.00	*	0.00	214	=	0	
South	0.48	*	0.45	*	29.94	398	=	2565	
West	0.00	*	0.00	*	0.00	220	=	0	
Horizontal	0.00	*	0.00	*	0.00	315	=	0	
									kWh/(m²a)
								2807	11.0

Total available solar heat gains Q_S = 2807 kWh/a

Internal heat gains Q_I

	Length heating period d/a		Spec. power q _I W/m²		A _{TFA} m²	=	kWh/a	kWh/(m²a)
	0.024	*	201	*	254.5	=	3066	12.0

Utilisation factor heat gains η_G				
	Free heat Q_F	$Q_S + Q_L =$	kWh/a 5874	kWh/(m²a) 23.1
	Ratio of free heat to losses	$Q_F / Q_L =$	0.56	
	Utilisation factor heat gains η_G	$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6) =$	97%	
Total heat gains Q_G			$\eta_G * Q_F =$	kWh/a 5723 kWh/(m²a) 22.5

Annual heating demand Q_H				
			$Q_L - Q_G =$	kWh/a 4692 kWh/(m²a) 18.4
	Limit value	kWh/(m²a) 30	Requirement met?	Yes

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Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

PHPP

The sum of the heating periods calculated through the monthly method is presented on this worksheet.

Interior temperature:	20	°C
Building type:	3-Double house	
Treated floor area A_{TFA} :	254.5	m ²
Spec. Capacity:	60	Wh/(m ² K)

Temperature

Building assembly		Temperature zone	Area m ²		U-value W/(m ² K)		reduction factor		G _t kKh/a	=	kWh/a		Per m ² of TFA
External wall - ambient		A	370.9	*	0.134	*	1.00	*	78	=	3868		15.20
External wall ground/basement		B		*		*	1.00	*		=			
Roof / ceiling - ambient		A	143.8	*	0.102	*	1.00	*	78	=	1142		4.49
Floor slab / basement ceiling		B	143.8	*	0.099	*	1.00	*	61	=	876		3.44
		A		*		*	1.00	*		=			
		A		*		*	1.00	*		=			
		A		*		*	1.00	*		=			
Windows		A	44.3	*	0.953	*	1.00	*	78	=	3278		12.88
Exterior door		A	11.2	*	1.000	*	1.00	*	78	=	869		3.41
Thermal bridges ambient (length/m)		A		*		*	1.00	*		=			0.00
Perimeter thermal bridges (length/m)		P		*		*	1.00	*		=			0.00
Thermal bridges ground (length/m)		B		*		*	1.00	*		=			0.00
Sum of all areas of the building envelope			714.0										
Total transmission heat losses Q _T										=	10034	kWh/(m ² a)	39.4

 m^2

Reference volume for the ventilation system, V_V ($A_{TFA} \cdot h$)

255	*	2.50	=	636
-----	---	------	---	-----

	$n_{V,system}$ 1/h	η^{*SHX}	η_{HR}	$n_{V,Res}$ 1/h	$n_{V,equi,fraction}$ 1/h	
Effective air change rate Ambient $n_{V,e}$	0.300	*(1- 0%)	*(1- 0.75)	+ 0.085	= 0.160	
Effective air change rate Ground $n_{V,g}$	0.300	* 0%	*(1- 0.75)		= 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	636	* 0.160	* 0.33	* 78	= 2614	10.3
Ventilation losses ground $Q_{V,e}$	636	* 0.000	* 0.33	* 53	= 0	0.0
	Total ventilation heat losses Q_V				2614	10.3

(

(10034	+	2614	) *	1.0	=	12647	49.7
Q _T		Q _V		Reduction factor		kWh/a	kWh/(m²a)
kWh/a		kWh/a		night/weekend			
				lowering			

Area	Global radiation
1	1000
2	1000
3	1000
4	1000
5	1000
6	1000
7	1000
8	1000
9	1000
10	1000
11	1000
12	1000
13	1000
14	1000
15	1000
16	1000
17	1000
18	1000
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88	1000
89	1000
90	1000
91	1000
92	1000
93	1000
94	1000
95	1000
96	1000
97	1000
98	1000
99	1000
100	1000

Orientation of the area	Reduction factor see 'Windows' worksheet		g-value (perp. radiation)		Area m ²		Global radiation kWh/(m ² a)		kWh/a
North	0.38	*	0.45	*	14.4	*	176	=	429
East	0.00	*	0.00	*	0.0	*	393	=	0
South	0.48	*	0.45	*	29.9	*	629	=	4053
West	0.00	*	0.00	*	0.0	*	386	=	0
Horizontal	0.00	*	0.00	*	0.0	*	577	=	0
Sum opaque areas									692
Total available solar heat gains Q_s									5174
									20.3

kh/d		Length Heat. Period d/a		Spec. Power q_i W/m ²		A_{TFA} m ²		kWh/a		kWh/(m ² a)
0.024	*	273	*	2.5	*	254.5	=	4157		16.3

		kWh/a	kWh/(m ² a)
Free heat Q _F	Q _S + Q _I =	9331	36.7
Ratio free heat to losses	Q _F / Q _L =	0.74	
Utilisation factor heat gains h _G	=	87%	

ne

$$\eta_G * Q_F = \boxed{8154} \quad \boxed{32.0}$$

kWh/a kWh/(m²a)

Q₁

$Q_L - Q_G =$	4493	17.7
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 $\text{kWh}/(\text{m}^2 \cdot \text{a})$

Requirement met?

Yes

Specific energy for heating (monthly method)

PHI Low Energy Building with PHPP Version 10.4a EN



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Interior temperature:

20

°C

Building type:

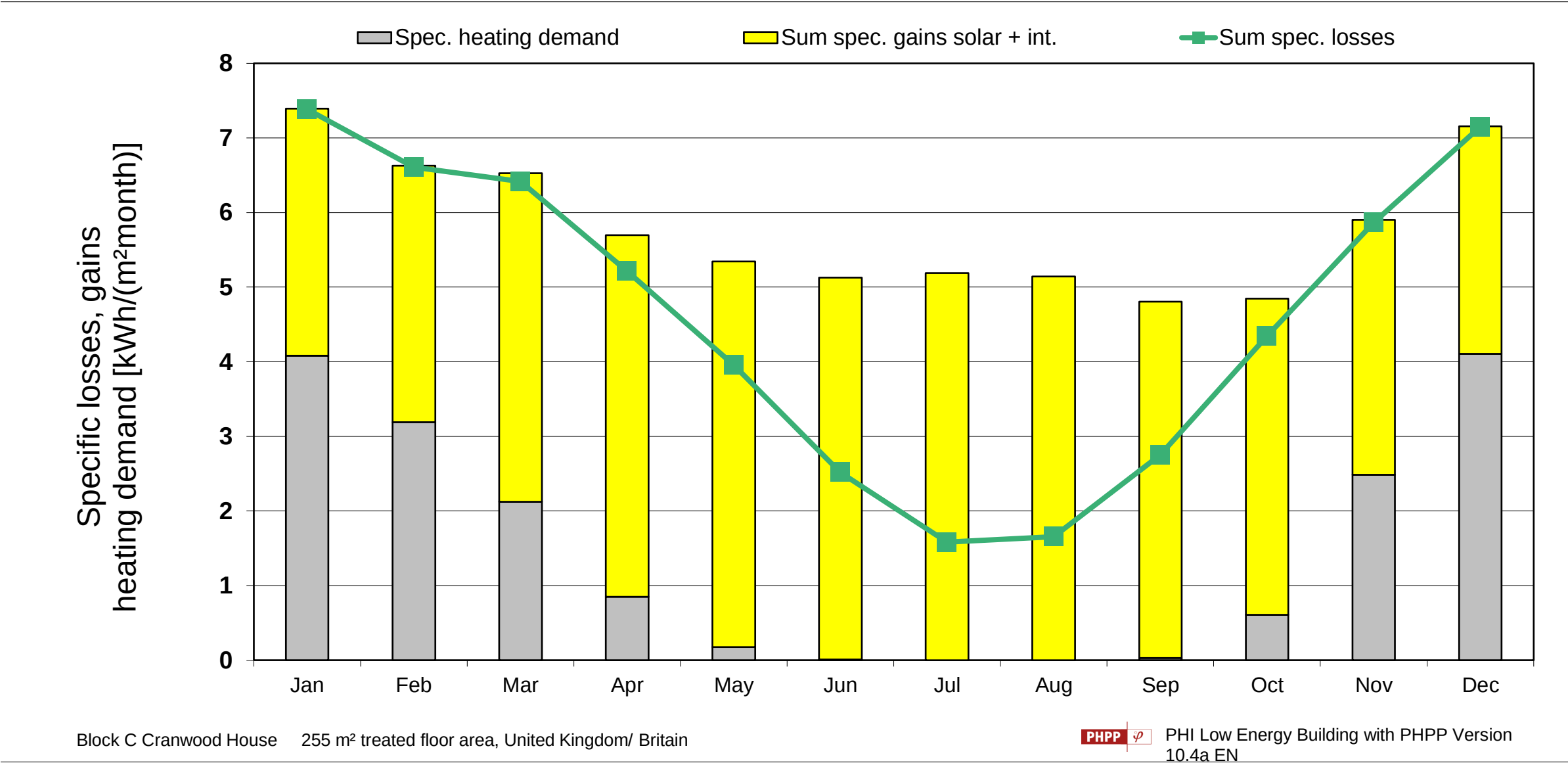
3-Double house

Treated floor area A_{TFA}:

255

m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - exterior	11.8	10.5	10.0	8.0	5.8	3.5	1.9	2.1	4.1	6.8	9.3	11.4	85	kKh
Heating degree hours - ground	6.6	6.7	8.2	8.3	8.7	8.0	7.6	6.8	5.9	5.6	5.4	5.9	84	kKh
Losses - exterior	1785	1586	1516	1208	883	526	294	324	616	1026	1416	1735	12915	kWh
Losses - ground	95	96	117	119	124	115	109	97	84	80	77	85	1197	kWh
Sum spec. losses	7.4	6.6	6.4	5.2	4.0	2.5	1.6	1.7	2.8	4.3	5.9	7.2	55.5	kWh/m²
Solar gains - North	17	29	57	81	107	128	118	95	58	42	23	15	771	kWh
Solar gains - East	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - South	319	371	506	573	585	556	570	601	595	492	350	262	5779	kWh
Solar gains - West	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - Opaque	34	49	87	123	151	162	160	141	106	72	41	28	1155	kWh
Internal heat gains	472	426	472	457	472	457	472	472	457	472	457	472	5558	kWh
Sum spec. gains solar + int.	3.3	3.4	4.4	4.9	5.2	5.1	5.2	5.1	4.8	4.2	3.4	3.1	52.1	kWh/m²
Utilisation factor	100%	99%	97%	90%	73%	49%	31%	32%	57%	88%	99%	100%	73%	
Annual heating demand	1039	811	540	216	44	3	0	0	7	155	632	1045	4493	kWh
Spec. heating demand	4.1	3.2	2.1	0.8	0.2	0.0	0.0	0.0	0.0	0.6	2.5	4.1	17.7	kWh/m²



Annual heating demand: Comparison

Monthly method	(<i>'Heating'</i>)	4493 kWh/a	17.7 kWh/(m²a) reference to treated floor area according to PHPP
Annual method	(<i>'Annual heating'</i>)	4692 kWh/a	18.4 kWh/(m²a) reference to treated floor area according to PHPP

Heating load

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Interior temperature:

20

°C

Building type:

3-Double house

Treated floor area A_{TFA}:

254.5

m²

Design temperature

Radiation:

North

East

South

West

Horizontal

Weather 1:

-1.5

°C

Weather 2:

1.5

°C

Ground design temp.

12.0

°C

8

12

28

14

20

W/m²

5

5

15

10

15

Transmission heat load P _T		Area	U-value	Temperature	Temp Diff 1	Temp Diff 2	PT 1	PT 2
Building assembly	Temperature zone	m²	W/(m²K)	reduction factor	K	K	W	W
External wall - ambient	A	370.9	* 0.134	* 1.00	* 21.5	or 18.5	= 1072	or 923
External wall ground/basement	B		*	* 1.00	* 8.0	or 8.0	=	or
Roof / ceiling - ambient	A	143.8	* 0.102	* 1.00	* 21.5	or 18.5	= 316	or 272
Floor slab / basement ceiling	B	143.8	* 0.099	* 1.00	* 8.0	or 8.0	= 114	or 114
	A		*	* 1.00	* 21.5	or 18.5	=	or
	A		*	* 1.00	* 21.5	or 18.5	=	or
	A		*	* 1.00	* 21.5	or 18.5	=	or
Windows	A	44.3	* 0.953	* 1.00	* 21.5	or 18.5	= 909	or 782
Exterior door	A	11.2	* 1.000	* 1.00	* 21.5	or 18.5	= 241	or 207
Thermal bridges ambient (length/m)	A		*	* 1.00	* 21.5	or 18.5	=	or
Perimeter thermal bridges (length/m)	P		*	* 1.00	* 8.0	or 8.0	=	or
Thermal bridges ground (length/m)	B		*	* 1.00	* 8.0	or 8.0	=	or
Building element towards neighbour	I		*	* 1.00	* 3.0	or 3.0	=	or
Total							= 2652	or 2298

Reference volume for the ventilation system, V_V (A_{TFA}*h)

254.5m² * 2.50m = 636.3m³

Ventilation system:

Heat recovery efficiency of the heat exchanger

η_{HR}75%

Efficiency of SHX

0%

Heat recovery efficiency SHX

0%

or

0%

Energetically effective air changes n_V

0.2141/h + 0.3001/h *(1- 0.75 or 0.75) = 0.2891/h or 0.2891/h

V_Vm³

636.3

n_V1/h

0.289

or

n_V1/h

0.289

* C_{Air}Wh/(m³K)

0.33

* TempDiff 1K

21.5

or

TempDiff 2K

18.5

= P_V 1W

1303

or

P_V 2W

1121

Total heat load P_L

P_T + P_V

= 3955 or 3419

PL 1W

PL 2W

Solar heat power P _S		Area	g-value	Reduction factor	Radiation 1	Radiation 2	P _T 1	P _T 2
Orientation of the area		m²	(perp. radiation)	(see 'Windows' worksheet)	W/m²	W/m²	W	W
North		14.4	* 0.5	* 0.38	* 8	or 5	= 20	or 13
East		0.0	* 0.0	* 0.40	* 12	or 5	= 0	or 0
South		29.9	* 0.5	* 0.48	* 28	or 15	= 178	or 94
West		0.0	* 0.0	* 0.40	* 14	or 10	= 0	or 0
Horizontal		0.0	* 0.0	* 0.40	* 20	or 15	= 0	or 0
Total solar heat power P _S							= 198	or 107

Internal heat load P_I

Spec. powerW/m²

2.0

* A_{TFA}m²

255

= P_I 1W

507

or

P_I 2W

507

Total heat power (gains) P_G

P_S + P_I

= 705 or 614

PG 1W

PG 2W

Heating load P_H

P_L - P_G

= 3250 or 2805

Heating load P_H

= 3250W

Area specific space heating load P_H / A_{TFA}

= 12.8W/m²

For comparison: heat load via supply air

Input max. supply air temperature

52

°CMax. supply air temperature θ_{Supply,Max}

14.6

Supply air temperature without heating θ_{Supply,Min}

15.4

Heating load that can be transported by the supply air P_{Supply,Max}

= 2354W

P_{Supply,Max} / A_{TFA}

= 9.3W/m²

Heating via supply air?

No

Summer ventilation



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building volume:	636	m³	Building type:	3-Double house
Max. absolute indoor humidity:	12	g/kg	Heat recovery efficiency:	75%
Internal humidity sources:	100	g/(P*h)	Humidity recovery efficiency η_{EER} :	0%
			Subsoil heat exchanger efficiency η^*_{SHX} :	0%

Basic ventilation to ensure adequate air quality (summer)

Air change via vent. system with supply air:	0.30	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
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Window ventilation air change rate:	0.00	1/h
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Effective air change rate

	$n_{V,\text{system}}$ 1/h		η^*_{SHX}		η_{HR}		$n_{V,\text{equi,fraction}}$ 1/h
Exterior $n_{V,e}$	0.300	*(1-	0%	)*(1-	0.75	) =	0.075
without HR	0.300	*(1-	0%	)		=	0.300
Ground $n_{L,g}$	0.300	*	0%	*(1-	0.75	) =	0.000
without HR	0.300	*	0%			=	0.000

Ventilation conductance

	V_V m³		$n_{V,\text{equi,fraction}}$ 1/h		C_{Air} Wh/(m³K)		
exterior $H_{V,e}$	636	*	0.075	*	0.33	=	15.7 W/K
without HR	636	*	0.300	*	0.33	=	63.0 W/K
ground $H_{V,g}$	636	*	0.000	*	0.33	=	0.0 W/K
without HR	636	*	0.000	*	0.33	=	0.0 W/K
Infiltration, window, extract air system	636	*	0.085	*	0.33	=	17.9 W/K

Additional night ventilation for cooling (summer)

Additional ventilation regulation				
Minimum acceptable indoor temp.	22.0	°C		
Type of additional ventilation				
Window night ventilation, manual	Night ventilation rate	0.03	1/h	
Mechanical, automatically controlled ventilation	Corresponding air change rate		1/h	Controlled by (please check)
	Specific electric efficiency		Wh/m³	Temperature diff.
	released as heat into the building			Humidity diff.
	Temperature increase	0.0	K	x

Results passive cooling			Results active cooling	
Overheating limit ϑ_{max} :	25	°C	Useful cooling demand:	kWh/(m²a)
Frequency of overheating:	9.2%		Dehumidification demand:	kWh/(m²a)
Max. humidity:	16.0	g/kg	Frequency of excessively high humidity:	
Frequency of excessively high humidity:	0.3%			

Secondary calculation: basic ventilation through windows

Estimation of the window air exchange to ensure adequate air quality in summer

Description						
Open duration [h/d]						
Climate boundary conditions						
Temperature diff interior - exterior						K
Wind velocity						m/s
Window group 1						
Quantity						
Clear width						m
Clear height						m
Tilting window (check if appropriate)						
Opening width (for tilting windows)						m
Window group 2 (cross ventilation)						
Quantity						
Clear width						m
Clear height						m
Tilting window (check if appropriate)						
Opening width (for tilting windows)						m
Difference in height to window 1						m
						Total
Result: Air change rate	0.00	0.00	0.00	0.00	0.00	0.00 1/h

Secondary calculation: Additional night ventilation through windows

Parameters for additional night ventilation through windows for cooling in summer

Description	Night					
Reduction factor	30%					
Climate boundary conditions						
Temperature diff interior - exterior	1	1	1	1	1	K
Wind velocity	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 rates	0.03	0.00	0.00	0.00	0.00	0.03 1/h

Summer: Passive cooling

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:	3-Double house	
Overheating limit:	25	°C
Max. indoor absolute humidity:	12	g/kg
Spec. capacity:	60	Wh/(m²K)

Treated floor area A _{TFA} :	254.5	m²
Building volume:	636	m³
Internal humidity sources:	2.2	g/(m²h)

Conductance

Building assembly		Temperature zone	Area m²		U-value W/(m²K)		Temperature reduction factor		H _{Summer} heat conductance
External wall - ambient		A	370.9	*	0.134	*	1.00	=	49.9
External wall ground/basement		B		*		*	1.00	=	
Roof / ceiling - ambient		A	143.8	*	0.102	*	1.00	=	14.7
Floor slab / basement ceiling		B	143.8	*	0.099	*	1.00	=	14.3
		A		*		*	1.00	=	
		A		*		*	1.00	=	
		A		*		*	1.00	=	
Windows		A	44.3	*	0.953	*	1.00	=	42.2
Exterior door		A	11.2	*	1.000	*	1.00	=	11.2
Thermal bridges ambient (length/m)		A		*		*	1.00	=	
Perimeter thermal bridges (length/m)		P		*		*	1.00	=	
Thermal bridges ground (length/m)		B		*		*	1.00	=	
Exterior thermal conductance H _{T,e}									= 118.0 W/K
Ground thermal conductance, H _{T,g}									= 14.3 W/K

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, unit		
exterior H _{V,e}	15.7	W/K
without HR	63.0	W/K
ground H _{V,g}	0.0	W/K
without HR	0.0	W/K
Ventilation conductance, others		
exterior	17.9	W/K
Ventilation system		
η _{HR}	75%	
η _{ERV}	0%	
η*SHX	0%	

Ventilation parameters	
Daily temperature fluctuation in summer	
Minimum acceptable indoor temperature	
Heat capacity air	
Supply air change rate	
Outdoor air change rate	
Window night ventilation air change rate, manual @ 1K	
Air change rate due to mech. automatically controlled vent.	
Specific electricity consumption for this	
Temperature increase	

9.4	K
22.0	°C
0.33	Wh/(m³K)
0.30	1/h
0.09	1/h
0.03	1/h
0.00	1/h
0.00	Wh/m³
0.0	K

Summer ventilation control	
	HRV/ERV
None	x
Temperature controlled	
Enthalpy controlled	
Always	
Additional ventilation	
Temperature controlled	
Enthalpy controlled	x

Solar aperture

Orientation of the area	Angle factor Summer		Shading factor Summer		Dirt		g-value (perp. radiation)		Area m²		Glazing fraction		Aperture m²
North	0.9	*	1.00	*	0.95	*	0.45	*	14.4	*	62%	=	3.4
East	0.9	*	1.00	*	0.95	*	0.00	*	0.0	*	0%	=	0.0
South	0.9	*	0.65	*	0.95	*	0.45	*	29.9	*	70%	=	5.3
West	0.9	*	1.00	*	0.95	*	0.00	*	0.0	*	0%	=	0.0
Horizontal	0.9	*	1.00	*	0.95	*	0.00	*	0.0	*	0%	=	0.0
Sum opaque areas													1.7
Solar aperture													= 10.4

Internal heat gains Q_I

Specif. power q _I W/m²		A _{TFA} m²		W
2.5	*	255	=	634

Frequency of overheating h_{ḡ ≥ ḡ_{max}}

9.2%

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

Recommendation: maximum 5%. If the frequency of overheating (25 °C) exceeds 10%, additional measures to protect against summer heat are mandatory.

Overheating degree hours

1233

Kh

Daily indoor temperature fluctuation

1.9

K

Stress test for summer comfort

Influence of use

Basic summer ventilation via windows	1/h	0.00	0.00	0.00	0.00	0.00	
Additional night ventilation via windows	1/h	0.03	0.03	0.00	0.03	0.03	
Use of temporary shading	-	90%	70%	90%	0%	90%	
Internal heat gains	W/m²	2.5	3.1	2.5	2.5	5.0	

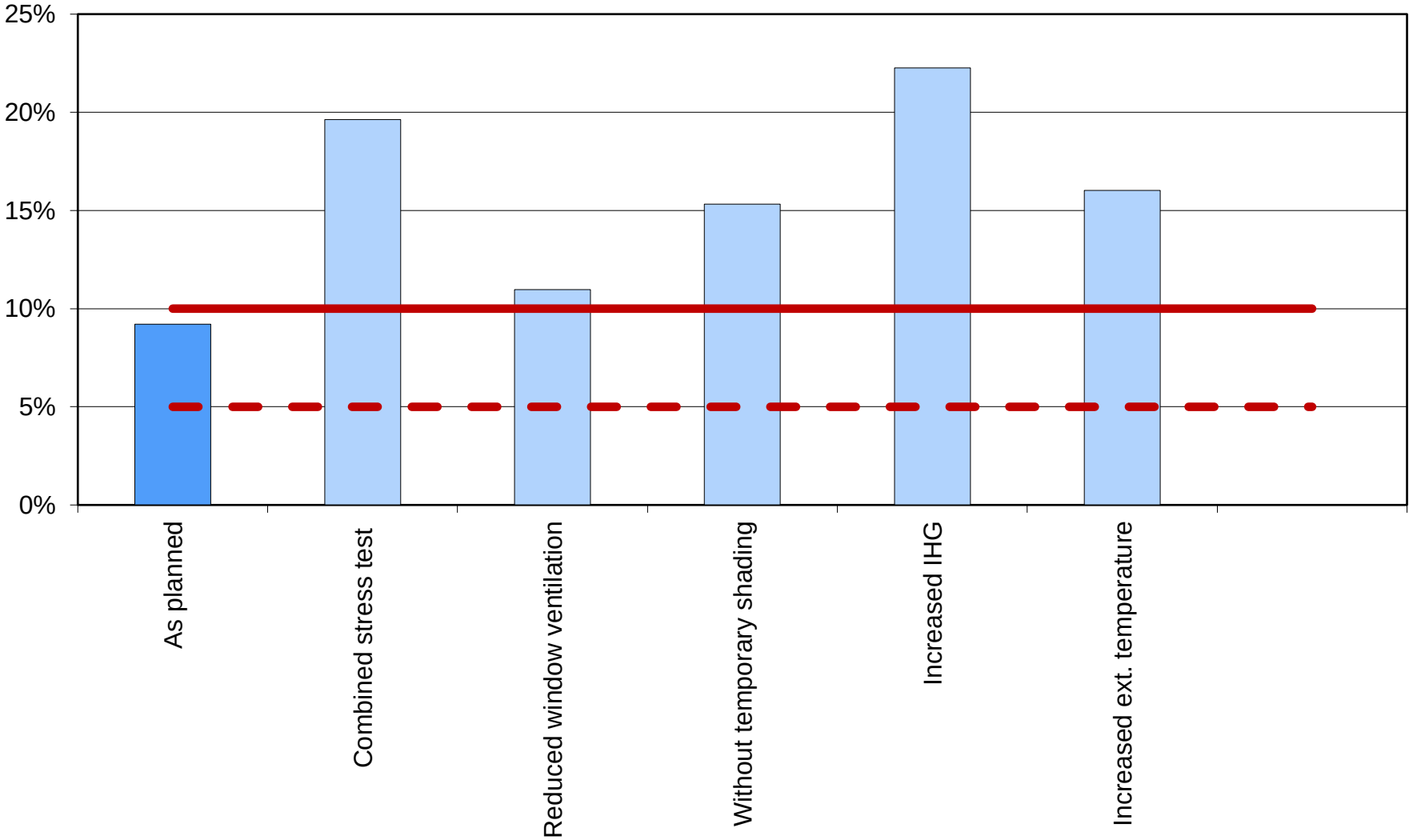
Summer climate

Summer temperature increase	K	0.0	1.5	0.0	0.0	0.0	2.0	
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Results

Frequency of overheating		9%	20%	11%	15%	22%	16%	-
Overheating degree hours	Kh	1233	4221	1607	2927	5052	3223	-
Daily indoor temperature fluctuation	K	1.9	2.0	1.8	2.2	2.3	1.8	-

Frequency of overheating



Cooling: specific energy demand for useful cooling

PHI Low Energy Building with PHPP Version 10.4a EN



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

The sum of the cooling periods calculated through the monthly method is presented on this worksheet.

Building type:	3-Double house	
Interior temperature summer:	25	°C
Max. indoor absolute humidity:	12	g/kg
Spec. capacity:	60	Wh/(m²K)

Treated floor area A _{TFA} :	254.5	m²
Building volume:	636	m³
Internal humidity sources:	2.2	g/(m²h)

Transmission losses Q_T (negative: heat loads)

Transmission losses Q _T (negative: heat loads)				Temperature									
Building assembly	Temperature zone	Area m ²		U-value W/(m ² K)		reduction factor		G _t kKh/a		kWh/a		Per m ² of TFA	
External wall - ambient	A	370.9	*	0.134	*	1.00	*	86	=	4273		16.79	
External wall ground/basement	B		*		*	1.00	*		=				
Roof / ceiling - ambient	A	143.8	*	0.102	*	1.00	*	86	=	1261		4.96	
Floor slab / basement ceiling	B	143.8	*	0.099	*	1.00	*	64	=	922		3.62	
	A		*		*	1.00	*		=				
	A		*		*	1.00	*		=				
	A		*		*	1.00	*		=				
Windows	A	44.3	*	0.953	*	1.00	*	86	=	3621		14.23	
Exterior door	A	11.2	*	1.000	*	1.00	*	86	=	960		3.77	
Thermal bridges ambient (length/m)	A		*		*	1.00	*		=			0.00	
Perimeter thermal bridges (length/m)	P		*		*	1.00	*		=			0.00	
Thermal bridges ground (length/m)	B		*		*	1.00	*		=			0.00	
Sum of all areas of the building envelope		714.0										kWh/(m ² a)	
Total transmission heat losses Q _T										=	11038	43.4	

Ventilation heat losses Q_V

Information from the 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior H _{V,e}	15.7	W/K
without HR	63.0	W/K
ground H _{V,g}	0.0	W/K
without HR	0.0	W/K

Ventilation conductance, others

exterior	17.9	W/K
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Ventilation system

η _{HR}	75%
η _{ERV}	0%
η* _{SHX}	0%

Ventilation parameter s

Daily temperature fluctuation in summer	9.4	K
Minimum acceptable indoor temperature	22.0	°C
Heat capacity air	0.33	Wh/(m³K)
Supply air change rate	0.30	1/h
Outdoor air change rate	0.09	1/h
Window night vent. air change rate, manual @ 1K	0.03	1/h
Air change rate due to mech., autom. controlled vent.	0.00	1/h
Specific electricity consumption for this	0.00	Wh/m³
Temperature increase	0.0	K

Summer ventilation control

HRV/ERV in summer	
None	x
Temperature controlled	
Enthalpy controlled	
Always	
Additional ventilation	
Temperature controlled	
Humidity controlled	x

Hygienic change rate:	η _{V,system} 1/h	η* _{SHX}	η _{HR} (considers bypass)	η _{V,Rest} 1/h	η _{V,equi,fraction} 1/h
Effective air change rate ambient n _{V,e}	0.300	*(1- 0%)	*(1- 0.00)	+ 0.085	= 0.385
Effective air change rate ground n _{V,g}	0.300	* 0%	*(1- 0.00)		= 0.000

	V _V m³	η _{V,equi,fraction} 1/h	c _{Air} Wh/(m³K)	G _t kKh/a	kWh/a	kWh/(m²a)
Ventilation losses ambient Q _V	636	* 0.385	* 0.33	* 80	= 6478	25.5
Ventilation losses ground Q _{V,e}	636	* 0.000	* 0.33	* 0	= 0	0.0
Heat losses summer ventilation	636	* 0.052	* 0.33	* 104	= 1136	4.5
Total ventilation heat losses Q _V =					7615	29.9

Total heat losses Q_L

11038	+	7615	=	18652	73.3
Q _T		Q _V		kWh/a	kWh/(m²a)
kWh/a		kWh/a			

Available solar heat gains Q_S

Orientation of the area	Reduction factor		g-value (perp. radiation)		Area m²		Global radiation kWh/(m²a)	=	kWh/a	kWh/(m²a)	
North	0.53	*	0.45	*	14.4	*	292	=	1001	3.9	
East	0.40	*	0.00	*	0.0	*	618	=	0	0.0	
South	0.44	*	0.45	*	29.9	*	749	=	4434	17.4	
West	0.40	*	0.00	*	0.0	*	589	=	0	0.0	
Horizontal	0.40	*	0.00	*	0.0	*	937	=	0	0.0	
Sum opaque areas								=	1044	4.1	
Total										6479	25.5

Internal heat gains Q_I

kh/d	Length cooling period d/a	*	Spec. power q _I W/m²	*	A _{TFA} m²	=	kWh/a	kWh/(m²a)
0.024	275	*	2.5	*	254.5	=	4187	16.5

Sum heat loads Q_F

Q _S + Q _I =	10666	41.9
	kWh/a	kWh/(m²a)

Utilisation factor heat losses η_L

Ratio of losses to free heat gains

Utilisation factor heat losses η_L

Useful heat losses $Q_{L,n}$

$Q_L / Q_F =$

1.75

$=$

53%

$\eta_L * Q_L =$

9848

kWh/a

kWh/(m²a)

$Q_F - Q_{L,n} =$

818

kWh/a

kWh/(m²a)

Useful cooling demand Q_K

Recommendation

15

kWh/(m²a)

Target value reached?

Yes

Dehumidification demand Q_{Dr}

Recommendation

0

kWh/(m²a)

$Q_{Tr} =$

21

0.1

Target value reached?

Yes

Cooling: specific energy demand for useful cooling

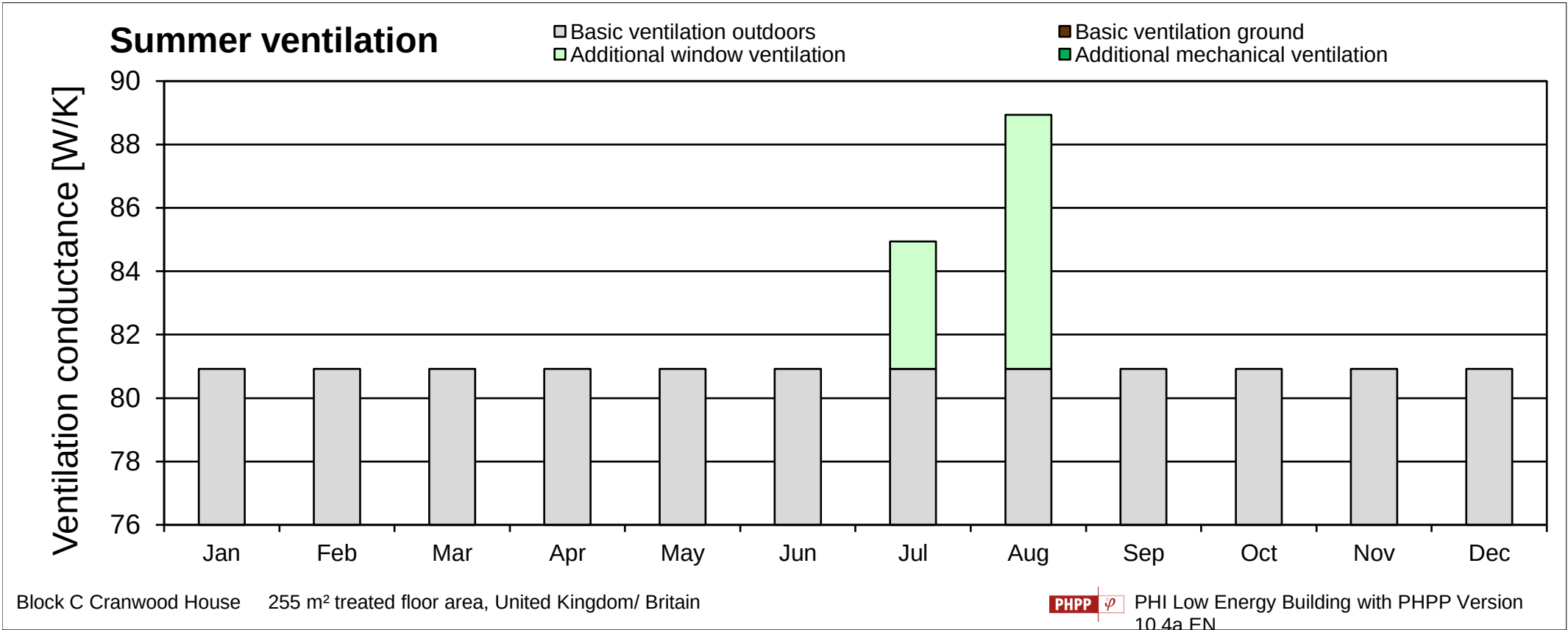
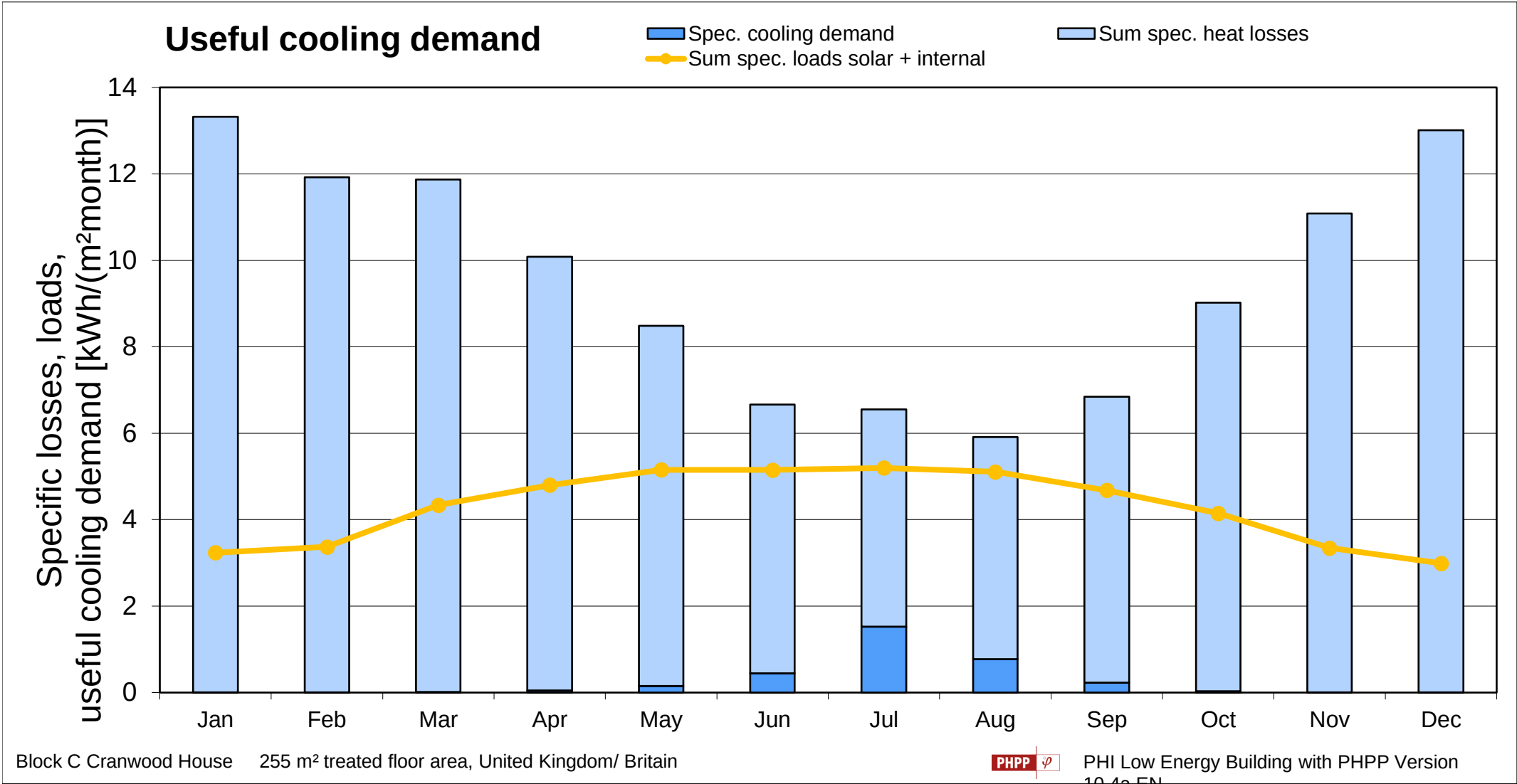
Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:3-Double house

Interior Temperature:25°C

Treated floor area A_{TFA}:255m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	15.6	13.9	13.9	11.7	9.7	7.2	5.8	6.0	7.8	10.6	13.0	15.3	131	kKh
Heating degree hours - Ground	6.6	6.7	8.2	8.3	8.7	8.0	7.6	6.8	5.9	5.6	5.4	5.9	84	kKh
Losses - Exterior	3059	2728	2702	2274	1873	1382	1101	1142	1502	2064	2554	2996	25376	kWh
Losses - Ground	95	96	117	119	124	115	109	97	84	80	77	85	1197	kWh
Losses summer ventilation	236	209	199	161	124	87	69	69	96	142	189	230	1812	kWh
Sum spec. heat losses	13.3	11.9	11.9	10.0	8.3	6.2	5.0	5.1	6.6	9.0	11.1	13.0	111.5	kWh/m²
Solar load North	24	42	80	115	151	181	167	135	82	60	32	21	1088	kWh
Solar load East	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load South	293	341	465	527	537	510	523	552	546	452	321	241	5308	kWh
Solar load West	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load Opaque	34	49	87	123	151	162	160	141	106	72	41	28	1155	kWh
Internal heat gains	472	426	472	457	472	457	472	472	457	472	457	472	5558	kWh
Sum spec. loads solar + internal	3.2	3.4	4.3	4.8	5.2	5.1	5.2	5.1	4.7	4.1	3.3	3.0	51.5	kWh/m²
Utilisation factor losses	24%	28%	36%	47%	60%	76%	73%	84%	67%	46%	30%	23%	44%	
Useful cooling energy demand	0	1	3	11	38	113	388	197	59	8	1	0	818	kWh
Spec. cooling demand	0.0	0.0	0.0	0.0	0.1	0.4	1.5	0.8	0.2	0.0	0.0	0.0	3.2	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%	95%	100%	100%	100%	100%	100%	97%	



Cooling units



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:3-Double house

Treated floor area A_{TFA}:254.5m²

Interior temperature summer:25.0°C

Mechanical cooling:

Max. indoor absolute humidity:12.0g/kg

Air change rate via ventilation system with supply air:0.31/h

Internal humidity sources:2.2g/(m²h)

Building volume:636m³

Operation time:

hours per day

days a week

Supply air cooling (w/ recirculating air if necessary)

Number of units

Selection list of units

Selection unit

2-Sort by ID

Go to list of combined ventilation/split units

Go to list of HPs according to EN 14825 / EN 14511

Recirculation airflow

Variable?

Total cooling coil

Internal heat recovery

Normal operation

Dehumidification mode

T_e-T_i

K

Cooling capacity kW

maximumon-off limit

EER

maximumon-off limit

Cooling capacity kW

maximumon-off limit

EER

maximumon-off limit

Reduction coefficient C_c

Reheating capacity

Performance ratio of reheating

Dry temperature diff.

K

K

Seasonal energy efficiency ratio

Recirculation cooling

Number of units

Selection list of units

Selection unit

1-Sorting: AS LIST

Go to list of combined ventilation/split units

Go to list of HPs according to EN 14825 / EN 14511

Nominal airflow rate

Variable?

Silent operation

Dehumidification mode

T_a-T_i

K

Cooling capacity kW

maximumon-off limit

EER

maximumon-off limit

Cooling capacity kW

maximumon-off limit

EER

maximumon-off limit

Reduction coefficient C_c

Reheating capacity

Performance ratio of reheating

Dry temperature diff.

K

K

Seasonal energy efficiency ratio

Additional dehumidification

Waste heat to room (check if appropriate)

Seasonal energy efficiency ratio

Panel cooling

Selection unit

1-Sorting: AS LIST

Go to list of HPs according to EN 14825 / EN 14511

Normal operation

No dehumidification

T_a-T_i

K

Cooling capacity kW

maximumon-off limit

EER

maximumon-off limit

Reduction coefficient C_c

Seasonal energy efficiency ratio

Results		Sensible		Latent		SEER	Electricity demand		Sensible fraction	
		kWh/(m²a)		kWh/(m²a)			kWh/(m²a)			
Cooling contribution by:	Supply air cooling	(		+		) /	=			
	Recirculation cooling	(		+		) /	=			
	Dehumidification					/	=		0%	
	Panel cooling					/	=		100%	
	Post heating					/	=		100%	
	Cooling distribution					/	=		100%	
Total cooling contribution		(	0.0	+	0.0	) /	=	0.0	0%	
Useful cooling demand			3.2		0.1				97%	

PHPP, Cooling units

BP10479 PHPP_Block C-Rev 3.xlsx

Unsatisfied demand

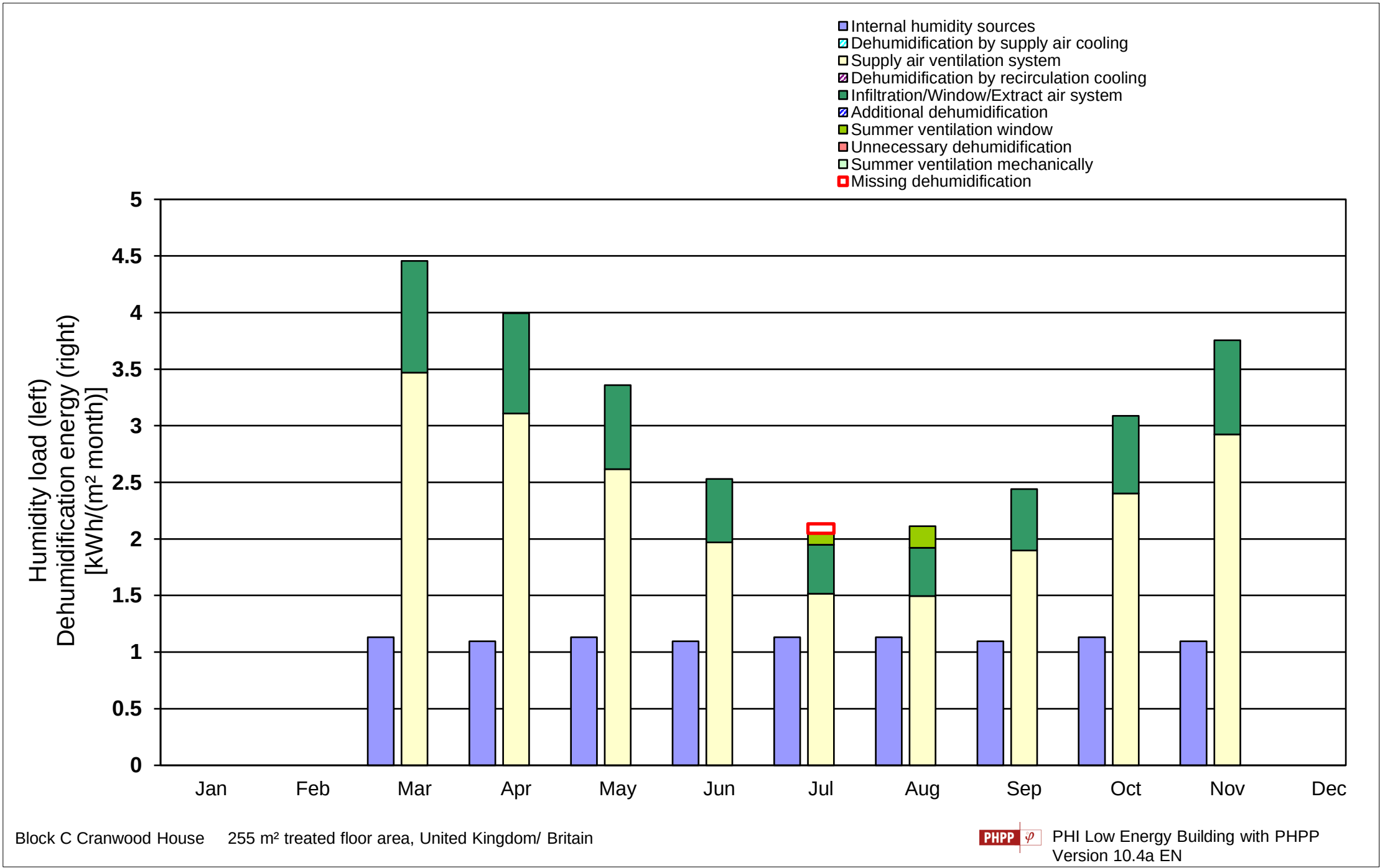
Cooling demand covered?

Cooling units

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Humidity loads and humidity removal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Internal humidity sources	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	13	kWh/m²
Infiltration/Window/Extract air system	-1.0	-0.9	-1.0	-0.9	-0.7	-0.6	-0.4	-0.4	-0.5	-0.7	-0.8	-1.0	-9	kWh/m²
Supply air ventilation system	-3.5	-3.3	-3.5	-3.1	-2.6	-2.0	-1.5	-1.5	-1.9	-2.4	-2.9	-3.4	-32	kWh/m²
Summer ventilation window	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	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 recirculation 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



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:	3-Double house	
Treated floor area A _{TFA} :	254.5	m²
Building volume:	636	m³
Spec. capacity:	60	Wh/(m²K)
Max. indoor absolute humidity:	12.0	g/kg
Internal humidity sources:	2.2	g/(m²h)
Interior temperature summer:	25	°C
SHX	11.9	°C

From 'Climate' worksheet:

Temperature:	Weather 1 °C	Weather 2 °C	Radiation:	Weather 1 W/m²	Weather 2 W/m²
Outdoor air	26.0	20.7	North	95	50
Dew point	19.7	17.0	East	220	180
Sky	17.9	14.5	South	185	255
			West	220	180
			Horizontal	320	260
Ground design temp.		14.8	°C		
Daily temperature swing		9.4	K		

Transmission heat load P _T		Area	U-value	Temperature	Temp Diff 1	Temp Diff 2	P _T 1	P _T 2
Building assembly	Temperature zone	m²	W/(m²K)	reduction factor	K	K	W	W
External wall - ambient	A	370.9	0.134	1.00	1.0	-4.3	49	-215
External wall ground/basement	B			1.00	-10.2	-10.2		
Roof / ceiling - ambient	A	143.8	0.102	1.00	1.0	-4.3	15	-63
Floor slab / basement ceiling	B	143.8	0.099	1.00	-10.2	-10.2	-146	-146
	A			1.00	1.0	-4.3		
	A			1.00	1.0	-4.3		
	A			1.00	1.0	-4.3		
Windows	A	44.3	0.953	1.00	1.0	-4.3	42	-182
Exterior door	A	11.2	1.000	1.00	1.0	-4.3	11	-48
Thermal bridges ambient (length/m)	A			1.00	1.0	-4.3		
Perimeter thermal bridges (length/m)	P			1.00	-10.2	-10.2		
Thermal bridges ground (length/m)	B			1.00	-10.2	-10.2		
Building element towards neighbour	I			1.00	3.0	3.0		
Radiation correction outdoor air			L _{ambient} W/K	-9.2	1.0	-4.3	-9	40
Radiation correction sky			L _{Sky} W/K	9.1	-7.1	-10.5	-65	-96
Total transmission heat load P _T							-103	-711

V _V	n _{V,equi,fraction}	n _{V,equi,fraction}	C _{Air}	TempDiff 1	TempDiff 2	P _V 1	P _V 2
m³	1/h	1/h	Wh/(m³K)	K	K	W	W
Ventilation load ambient P _{V,a}	636	0.385	0.33	1.0	-4.3	80	-349
Ventilation load ground P _{V,g}	636	0.000	0.33	-13.1	-13.1	0	0
Ventilation load summer ventilation	636	0.000	0.33	0.0	0.0	0	0
Total ventilation heat load P _L						80	-349

Orientation of the area	Area	g-value	Reduction factor	Radiation 1	Radiation 2	P _T 1	P _T 2
	m²	(perp. radiation)	(see 'Windows' worksheet)	W/m²	W/m²	W	W
North	14.4	0.5	0.53	97	51	333	177
East	0.0	0.0	0.40	220	180	0	0
South	29.9	0.5	0.39	186	255	987	1350
West	0.0	0.0	0.40	220	180	0	0
Horizontal	0.0	0.0	0.40	320	260	0	0
Sum opaque areas						349	298
Total solar load P _S						1668	1825

Spec. power	A _{TFA}	P _I 1	P _I 2
W/m²	m²	W	W
2.5	255	634	634

Cooling load P _C		P _T + P _V + P _S + P _I	2280	1400
Cooling load P _C			2280	W
Area specific cooling load P _C / A _{TFA}			9.0	W/m²
For comparison: cooling capacity that can be transported by the supply air				
Please enter the minimum supply air temperature.		Supply air temperature without cooling θ _{Supply,Min}	26.0	20.7
			°C	
Cooling capacity that can be transported by the supply air P _{Supply air;max}			1448	1114
P _{Supply air; max} /A _{TFA}			5.7	4.4
			W	W/m²
Air conditioning over the supply air possible?			No	
Conductance values		Performance	Part of the day	P [W]
Transmittance	118.0	Transmission + Ventilation	13	-467
Ventilation conductance	80.9	Solar load	6 h - 12 h	4452
Conductance summer ventilation	0.0	Internal load	12 h - 18 h	5387
Heat capacity	15270	Night ventilation	18 h - 24 h	467
			Average value	2460
Cross check: daily indoor temperature fluctuation		Daily indoor temperature fluctuation		1.9
				K

Dehumidification load P _T				from 'Cooling' worksheet									
Humidity ambient air	14.4	or	12.1	g/kg	Humidity supply air	14.4	or	12.1	g/kg				
Outdoor air mass flow	64	or	64	kg/h	Supply air mass flow	225	or	225	kg/h				
Summer vent. air mass flow	0	or	0	kg/h	Hum. load, supply air	545	or	29	g/h				
Humidity load, outdoor air	155	or	8	g/h	Hum. load, internal	547	or	547	g/h				
Enthalpy of vaporisation					Humidity load		Humidity load						
Wh/kg				g/kg	g/h		g/h						
708				/	1000	*	1248	or	585	=	P _D 1		P _D 2
											W		W
											883	or	414

Minimum sensible share of the cooling load	=	100%
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Heat distribution and domestic hot water (DHW) system



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Interior temperature:	20	°C	Interior temperature summer:	25	°C
Building type:	3-Double house				
Treated floor area A _{TFA} :	255	m²			
Number or occupants per day:	5.5	Pers			
Number of dwelling units:	2				
Annual heating demand q _{Heating} :	4493	kWh/a	Annual useful cooling dem. q _{Cool} :	818	kWh/a
Length of heating period:	273	d/a	Length cooling period:	275	d/a
Average heating load P _{Average} :	0.9	kW	Average cooling load P _{Average} :	0.1	kW
Marginal usability of additional heat gains:	70%		Marginal usability of additional heat losses:	6%	

Heat delivery:

	Supply air
x	Radiators
	Underfloor heating or other panel heating
	Concrete core activation
	Split unit or similar
	Wood stove with direct heat emission
	Other

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 (forward + return flows)	L _H	m												
Nominal width of pipe		mm												
Insulation thickness		mm												
Reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient		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 bridging of pipework		W/K												
Total heat loss coefficient	Ψ	W/(mK)												
Room temperature	θ _x	°C	20	20	20	20	20							
Forward flow temperature	θ _v	°C	55	55	55	55	55	55	55	55	55	55		
System heating load	P _{heating}	kW	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2		
Flow temperature control?														
Common pipe Heating + DHW?														
Return flow temperature	θ _R	°C												
Heat emission pipe	q* _{HL}	kWh/(m·a)												
Utilisation factor of released heat	η _G	-												
Heat losses of heating distribution	Q _{HL}	kWh/a											kWh/a	kWh/(m²a)
Heat losses of heating storage		kWh/a											0	0.0
Total heat losses of heating		kWh/a											0	0.0
Performance ratio of space heating 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 drain water heat recovery (shower)		-	0%		
Effective DHW demand	V_{DHW}	litre/person/d	25		
Average cold water temperature of the supply	θ_{TW}	°C	11.9		
DHW demand for washing machines & dishwashers		kWh/a	0		
Useful heat of DHW	Q_{DHW}			kWh/a	kWh/(m²a)
				2787	11.0

Secondary calculation for determining the DHW requirements (for non-res)

DHW distribution

Room temperature θ_x °C

DHW circulation pipes or, for heat interface units, forward and return flows

Common pipe heating + DHW?					
Length of pipes (forward + return flows)	L_{HS}	m			
Nominal width of pipe		mm			
Insulation thickness		mm			
Reflective coating?		-			
Thermal conductivity of insulation		W/(mK)			
Heat loss coefficient		W/(mK)			
Insulation quality of mountings, pipe suspensions, etc.		-	1 - None	1 - None	1 - None
Thermal bridge surcharge mountings		W/K			
Total heat loss coefficient	Ψ	W/(mK)			
Daily operating time of circulation	t_{dCirc}	h/d	24	24	24
Forward flow temperature	θ_V	°C			
Pipes to heat interface unit?					
Return flow temperature	θ_R	°C			
Operating time of the circulation in winter	t_{Circ}	h/a			
Operating time of the circulation in summer	t_{Circ}	h/a			
Heat loss circulation pipes in winter	QZ	kWh/a			
Heat loss circulation pipes in summer	QZ	kWh/a			

DHW stub pipes / individual pipes

DHW temperature	θ_v	°C					
Exterior pipe diameter	d_{U_Pipe}	mm					
Total length of individual pipes	L_U	m					
Number of tapping points in building	$n_{tapping\ point}$	-					
Average pipe length per tapping point	$L_{U,\ average}$	m					
Tap openings per person per day		-	6	6	6	6	6
Utilisation days per year		d	365	365	365	365	365
Number of tap openings per year and person	n_{Tap}	Openings/a					
Heat emission per tap opening in winter	$q_{Individual}$	kWh/Opening					
Heat emission per tap opening in summer	$q_{Individual}$	kWh/Opening					
Heat emission from single pipes in winter	Q_U	kWh/a					
Heat emission from single pipes in summer	Q_U	kWh/a					

Total heat losses of DHW distribution

Total heat losses of DHW distribution Q_{WL}

Performance ratio of DHW distribution pipes

Performance ratio of DHW distribution pipes	ea_{HL}	-
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Outside thermal envelope				
1	2	3	4	5
11.0	11.0	11.0	11.0	11.0

1 - None	1 - None	1 - None	1 - None	1 - None
24	24	24	24	24

Total values	
Absolute	Specific

kWh/a	kWh/(m ² a)
0	0.0

6	6	6	6	6
365	365	365	365	365

kWh/a	kWh/(m ² a)
0	0.0

kWh/a	kWh/(m ² a)
0	0.0

100%

Storage heat losses

		Storage type 1	Storage type 2	Buffer storage tank (only heating)	Compact unit		
Selection of storage tank		0-No storage tank	0-No storage tank	0-No storage tank	0-No		
Storage necessary for HP		x	-----	(x)	-----		
Solar DHW connection				-----			
Heat loss rate	W/K						
Storage volume	litre				-----		
Standby fraction	-			-----	-----		
Location of storage tank, inside or outside of thermal envelope		1-Inside	1-Inside	1-Inside			
Temperature of mechanical room	°C						
Typical storage tank temperature	°C						
Manual entry of storage temperature	°C				-----		
Average standby heat losses storage tank	W						
Additional heat loss storage, solar system operation	W			-----	-----		
Possible utilisation factor of heat losses		-----	-----		-----		
Annual heat losses DHW storage tank	kWh/a					kWh/a	kWh/(m²a)
Annual heat losses buffer storage tank	kWh/a				-----	0	0.0
Auxiliary calculation - heat losses through storage tank according to EU efficiency classes							

Total energy demand of DHW

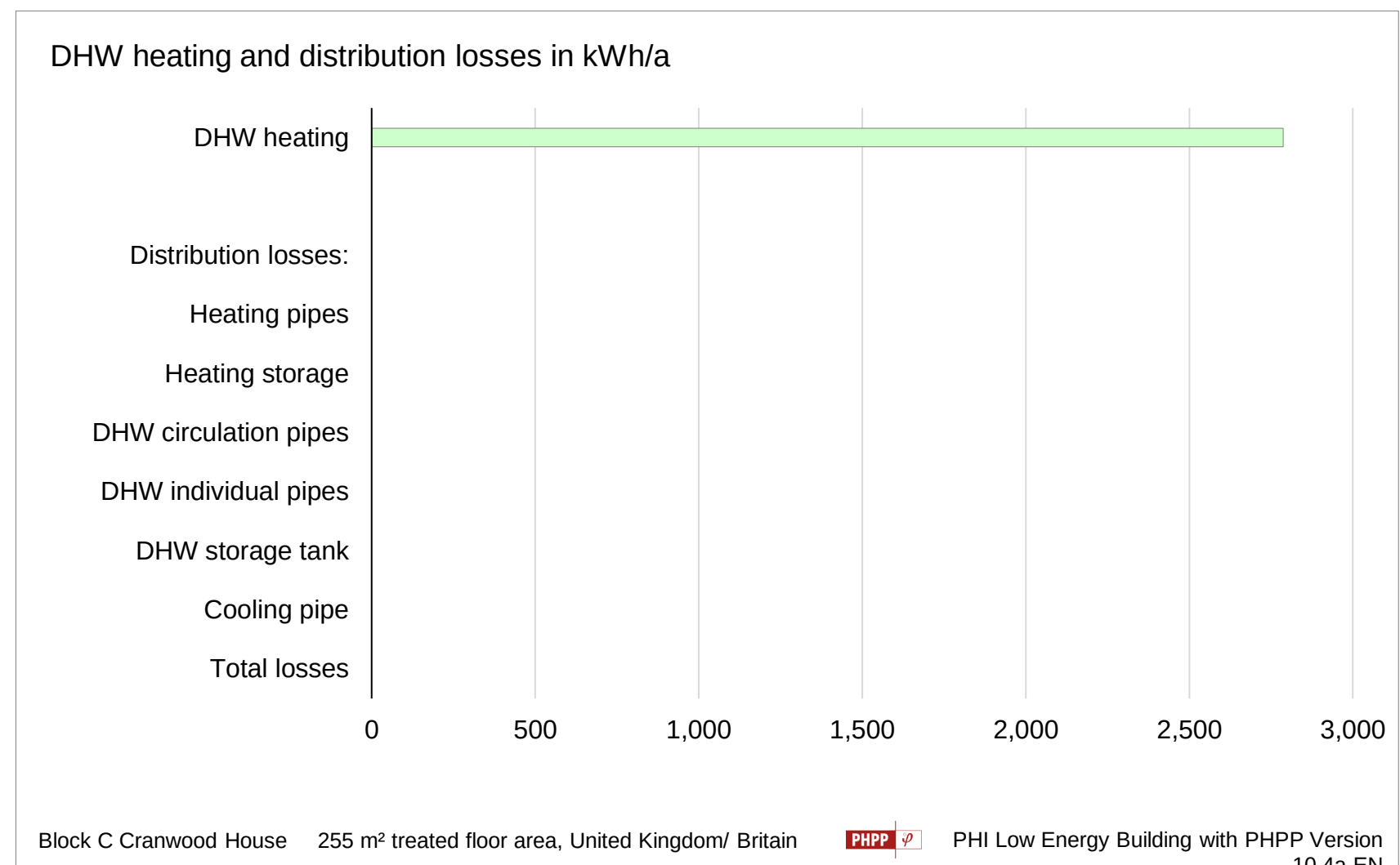
Heat losses of DHW distribution and storage	Q _{WL}	kWh/a	kWh/(m²a)
		0	0.0
Performance ratio DHW distribution + storage	e _{a,WL}	100%	
Total heat demand of DHW system including storage tank	Q _{gDHW}	kWh/a	kWh/(m²a)
		2787	11.0

Cooling distribution

Length of distribution pipes	L_H	m
Nominal width of pipe		mm
Insulation thickness		mm
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
Design flow temperature	θ_V	°C
System cooling load	P_{Cool}	kW
Flow temperature control ('x' if appropriate)		
Design return temperature	θ_R	°C
Annual heat absorption per m of pipe	q^*_{HL}	kWh/(m·a)
Possible utilisation factor of this heat absorption	η_G	-
Annual losses of cooling distribution	Q_{HL}	kWh/a
Performance ratio cold water distribution pipes	ea_{HL}	-

[illegible][illegible]

Total values	
Absolute	Specific
kWh/a	kWh/(m ² a)
0	0.0
100%	



Solar thermal system

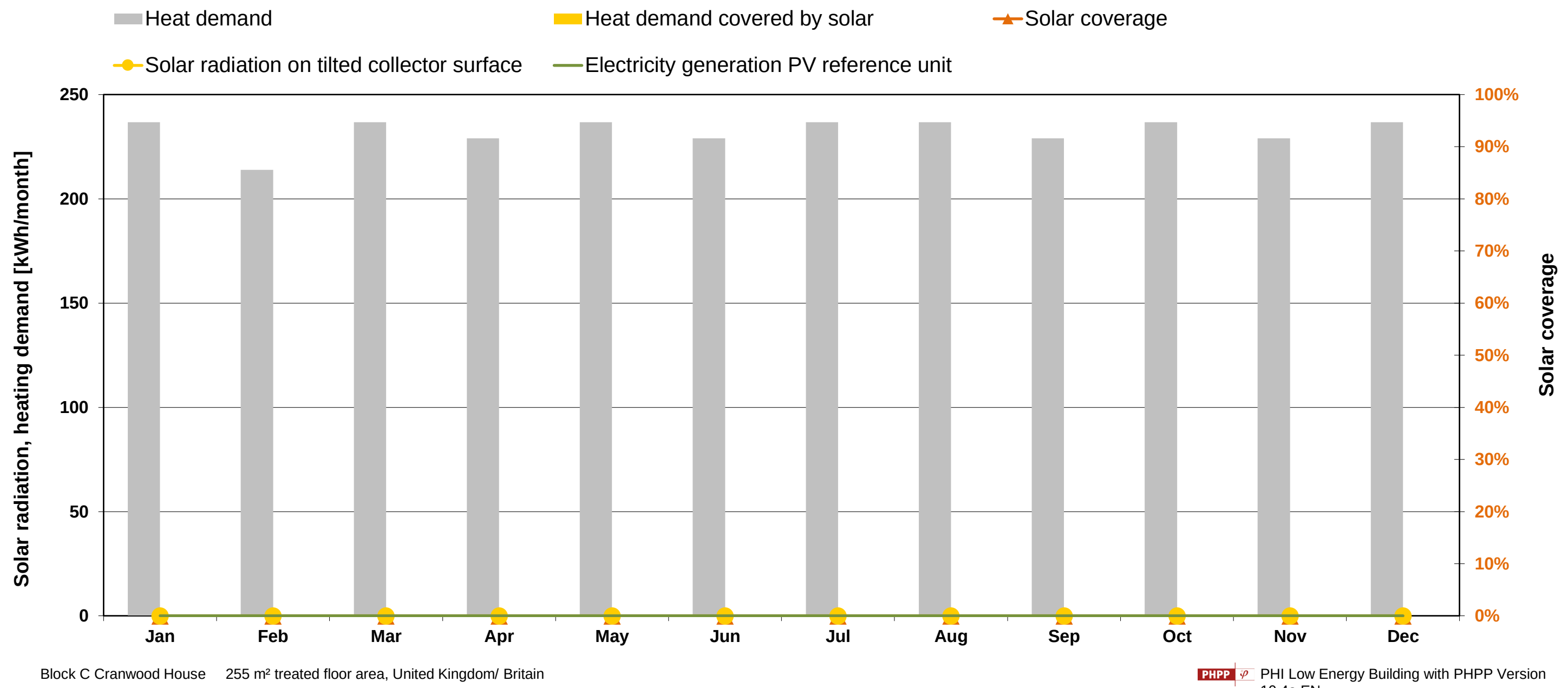
Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:	3-Double house	
Treated floor area A _{TFA} :	254.5	m²
Projected building footprint A _{Projected} :	143.8	m²
Latitude (<i>'Climate' worksheet</i>)	51.6	°
DHW heat demand (sheet DHW + distribution)	2787	kWh/a
Heating demand ('Heating' and 'DHW+Distribution' worksheets)	4493	kWh/a
No. of occupants	5.5	Persons

Location: Selection in 'Areas' worksheet			
Size of selected area		m²	
Free area (less solar thermal and electrical systems)		m²	
Deviation from North		°	
Angle of inclination from the horizontal		°	
Alternative input: deviation from North		°	
Alternative input: angle of inclination from the horizontal		°	
Solar collector area		m²	
Specific collector area	0.0	m²/Pers	
Height of the collector field		m	
Height of horizon	h _{Hori}	m	
Distance of horizon	a _{Hori}	m	
Additional reduction factor shading	r _{other}		
Collector			
Supplementary heating (check if appropriate)			
DHW priority (check if appropriate)			

Results	Projected building footprint area		Absolute
		kWh/(m² _{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
1-CO2 factors GEMIS (Germany)			
	kgCO2eq/kWhFinal	kgCO2eq/ a	kgCO2eq/a

Determination of PER factors		
Yield reference PV syst.	PER _{el}	PER _{sol.therm}
kWh _{el} /a	kWh _{prim-el} /kWh _{el}	$\frac{kWh_{el}}{kWh_{th}} * kWh_{prime}/kWh_{el}$
		-
	1.30	
	1.65	



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heat demand DHW generation	237	214	237	229	237	229	237	237	229	237	229	237	2787	kWh/month
Heat demand space heating	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heat demand	237	214	237	229	237	229	237	237	229	237	229	237	2787	kWh/month
Solar radiation on tilted collector surface	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Input: Solar yield DHW													0	kWh/month
Input: Solar yield heating													0	kWh/month
Heat demand covered by solar, DHW	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heat demand covered by solar, space heating	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Heat demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/month
Solar coverage	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-
Electricity generation PV reference unit														kWh/month

Photovoltaic systems

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)



Climate data set: GB0027a-Northolt, Altitude corrected

Building type: 3-Double house

Projected building footprint: 143.8 m²

Name of system	System 1	System 2	System 3	System 4	System 5	Reference PV syst.
Location: Selection from 'Areas' worksheet						
Size of selected area						m²
Deviation from North						°
Angle of inclination from horizontal						°
Alternative input: deviation from north						°
Alternative input: angle of inclination from horizontal						°

Information from the PV module data sheet for standard test conditions (STC)

Technology						4-Mono-Si	
Nominal current	I _{MPP0}					10.00	A
Nominal voltage	U _{MPP0}					34.00	V
Nominal power	P _n	0	0	0	0	340	Wp
Temperature coefficient short-circuit current	α					0.050	%/K
Temperature coefficient open-circuit voltage	β					-0.270	%/K
PV module dimensions: height						1.750	m
PV module dimensions: width						1.050	m
						1.8	PV module area [m²]

Further specifications

Number of PV modules	n_M						0.0	
Height of PV module array								m
Height of horizon	h_{Hori}							m
Distance of horizon	a_{Hori}							m
Additional reduction factor shading	r_{other}							
Efficiency of the inverter	η_{Inv}						95%	

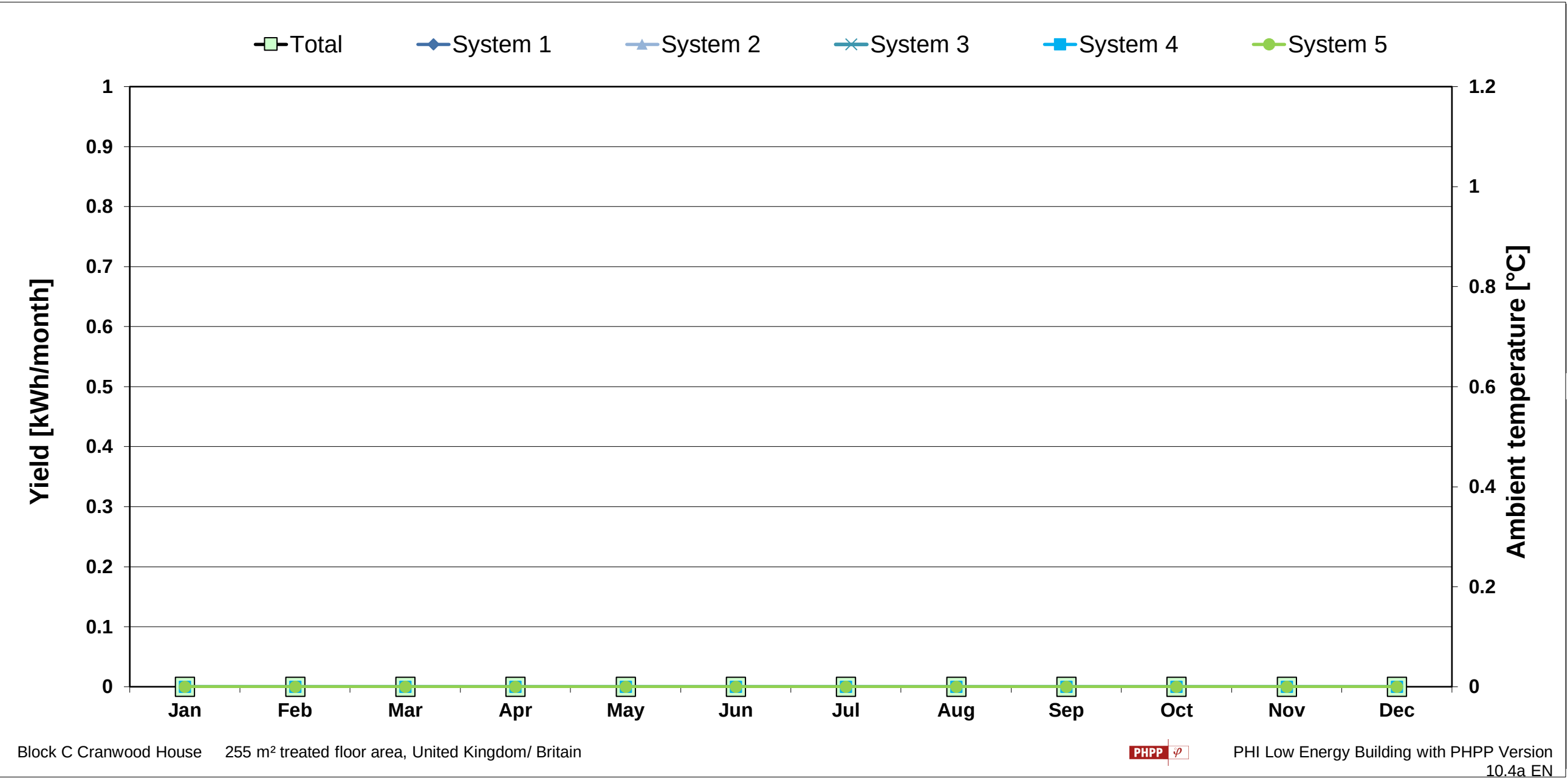
Results

Area of PV module array	0.0	0.0	0.0	0.0	0.0	0.0	m²
Free area on the selected building element							m²
Used fraction of building element							
Annual losses due to shading							kWh

Annual electricity yield after the inverter, absolute

Referred to projected building footprint area						0	kWh/a
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)						0	kWh/m²A _{Projected} *a
PE-factor according to 1-PE factors (non-renewable) PHI Certification						0.0	kg/a
					0.0	0.00	kWh _{prim} /kWh _{End}

Total



List of PV module technologies

	Technology	AEE kWh/Wp	CO ₂ kg/Wp	Lifespan years	PER factor kWh/kWh	1-PE factors (non-renewable) PHI Certification kWh/kWh	1-CO2 factors GEMIS (Germany) kg/kWh
1							
2	Amorph-Si	7.955	1.141695	30	1.00	0.00	0.063
3	CIGS	5.805	0.788184	30	1.00	0.00	0.063
4	Mono-Si	11.85	1.782135	30	1.00	0.00	0.130
5	Poly-Si	8.04	1.595889	30	1.00	0.00	0.063

System 1

Use non-residential buildings



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Latitude [°]: 51.6

	2	5	6	7	8	9	10	11		15	16	17	18	20	27
	Utilisation profile	Begin utilisation	End utilisation	Daily utilisation hours	Annual utilisation days	Annual utilisation hours	Annual utilisation hours during daytime	Annual utilisation hours during nighttime		Illumination level	User-defined data: height of utilisation level [0.8 or 0.0 m]	applied height of utilisation level	Occupants: Relative presence	Part use factor for lighting	Average No. of occupants
		h	h	h/d	d/a	h/a	h/a	h/a		lux	m	m			m²/person
1				0		0	0	0				0.8			
2				0		0	0	0				0.8			
3				0		0	0	0				0.8			
4				0		0	0	0				0.8			
5				0		0	0	0				0.8			
6				0		0	0	0				0.8			
7				0		0	0	0				0.8			
8				0		0	0	0				0.8			
9				0		0	0	0				0.8			
10				0		0	0	0				0.8			
11				0		0	0	0				0.8			
12				0		0	0	0				0.8			
13				0		0	0	0				0.8			
14				0		0	0	0				0.8			
15				0		0	0	0				0.8			
16				0		0	0	0				0.8			
17				0		0	0	0				0.8			
18				0		0	0	0				0.8			
19				0		0	0	0				0.8			
20				0		0	0	0				0.8			
21				0		0	0	0				0.8			
22				0		0	0	0				0.8			
23				0		0	0	0				0.8			
24				0		0	0	0				0.8			
25				0		0	0	0				0.8			
26				0		0	0	0				0.8			
27				0		0	0	0				0.8			
28				0		0	0	0				0.8			
29				0		0	0	0				0.8			
30				0		0	0	0				0.8			
31				0		0	0	0				0.8			
32				0		0	0	0				0.8			
33				0		0	0	0				0.8			
34				0		0	0	0				0.8			
35				0		0	0	0				0.8			
36				0		0	0	0				0.8			
37				0		0	0	0				0.8			
38				0		0	0	0				0.8			
39				0		0	0	0				0.8			
40				0		0	0	0				0.8			
41				0		0	0	0				0.8			
42				0		0	0	0				0.8			
43				0		0	0	0				0.8			
44				0		0	0	0				0.8			
45				0		0	0	0				0.8			
46				0		0	0	0				0.8			
47				0		0	0	0				0.8			
48				0		0	0	0				0.8			
49				0		0	0	0				0.8			
50				0		0	0	0				0.8			
51				0		0	0	0				0.8			
52				0		0	0	0				0.8			
53				0		0	0	0				0.8			
54				0		0	0	0				0.8			
55				0		0	0	0				0.8			
56				0		0	0	0				0.8			
57				0		0	0	0				0.8			
58				0		0	0	0				0.8			
59				0		0	0	0				0.8			
60				0		0	0	0				0.8			

Building type:3-Double house

Treated floor area A_{TFA}:254.5 m²

For dishwasher + washing machine with DHW connection:

Solar fraction of DHW:0%

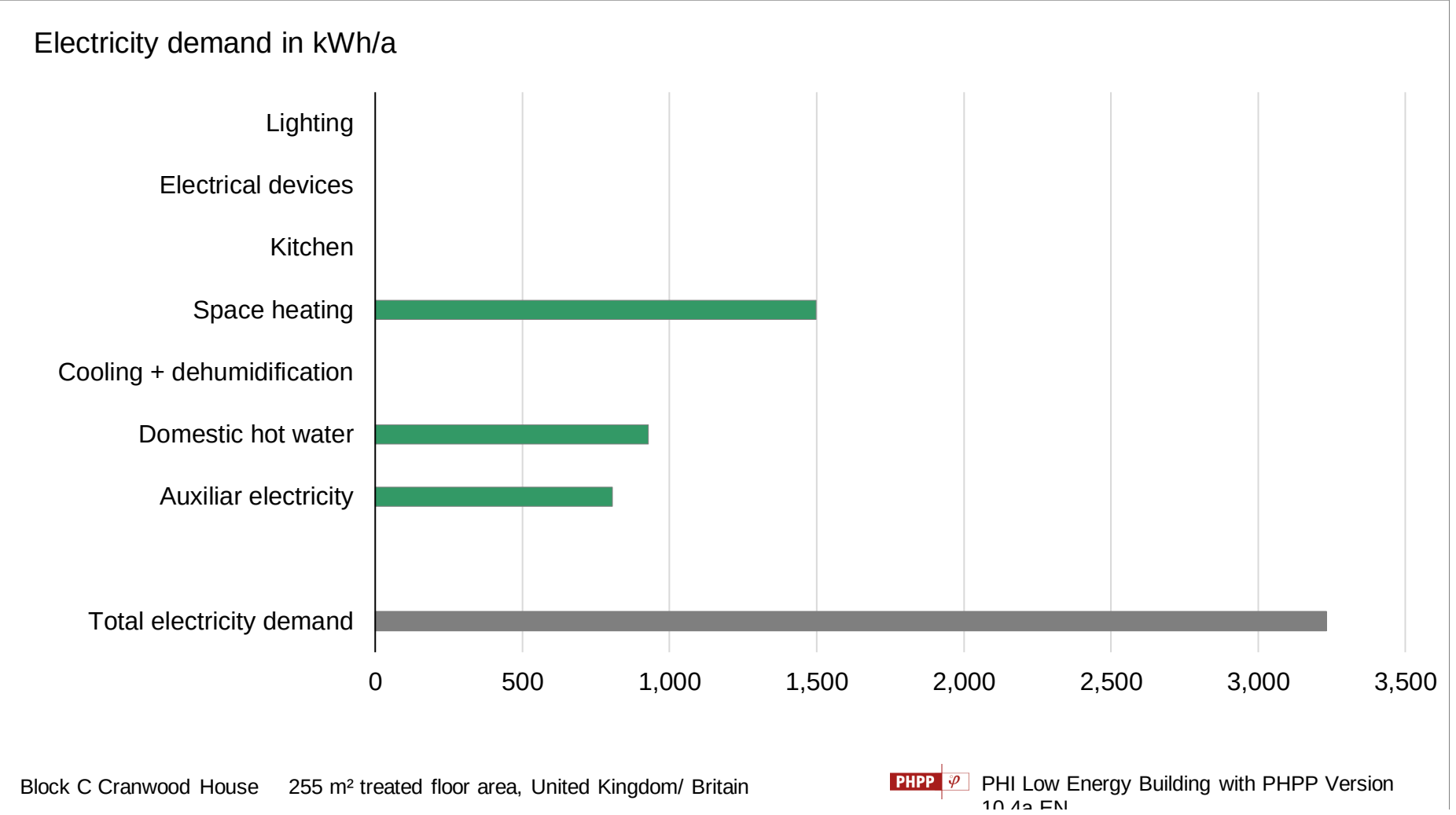
Marginal performance ratio DHW:33%

Electricity: RE gas / Natural gas: Energy carrier for DHW:	PER factors		PE factors	
	1.30	1.5	kWh/kWh	
	1.75	1.1	kWh/kWh	
	1.30	1.5	kWh/kWh	

Lighting			Façade with windows					Geometry: input of a typical room					Daylight utilisation		Nominal illuminance	Installed lighting power				Lighting control	Motion detector used?	Utilisation hours per year	User-defined: full load hours of lighting	Full load hours of lighting		Electricity demand	Specific electricity demand (per m² room area)	PER demand	PE demand
Net floor area	Utilisation profile	Window existing?	Deviation from North	Orientation	Factor	Light transmission glazing	Room depth	Room width	Room height	Lintel height (top of window)	Window width	h/a				h/d													
Room / Zone	m²		[x]	Degrees			-	m	m	m	m	m				Lux	W/m²	W/m²	W/(m²*100lux)						[x]				
							69%										1-Manual												
							69%										1-Manual												
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Kitchen	Used ?	Utilisation profile (predominant use of the building)	Consider for IHC?	Days of utilisation per year	Number of meals per day of use	Norm consumption	Useful energy											Additional heat demand			Electricity demand			PER demand	PE demand																										
Application	[1/0]	Application		d/a	Meal/d	0.25	0											kWh/a			kWh/a			kWh/a	kWh/a																										
Cooking:	1	62-Group office	0	250			0	{ *	100%	Electric fraction												0.0		0	0																										
1-Electricity					kWh / Meal				{ *	0%	Gas fraction										0			0	0																										
Dishwashing	1	62-Group office	0	250	0	0.10	0	{ *		100%	Electric fraction												0.0		0	0																									
2-Cold water connection					kWh / Place setting				{ *	0%	DHW fraction * (1+ 0.30) * 0.33 *(1- 0.00) =										0			0	0																										
					kWh/d																	0.0		0	0																										
							0															0.0		0	0																										
							0															0.0		0	0																										
							0															0.0		0	0																										
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							0															0.0		0	0																										
							0															0.0		0	0																										
Total useful energy kitchen							0	kWh/a										DHW for dishwashing; additional heat demand										0	kWh/a										Total additional heat demand kitchen										0	0	kWh/a
Total electricity demand kitchen																	0	kWh/a										0										0	kWh/a												

PHPP, Electricity non-res



Aux Electricity

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Heating period	229	d/a	Runtime vent. syst in winter	4.83	kh/a	Treated floor area	255	m²	
Cooling period	135	d/a	Runtime vent. syst in summer	3.93	kh/a	Boiler design output	15	kW	
Dwelling units	2		Heat recovery efficiency ventilation	0.75		DHW system heat demand	2787	kWh/a	
Reference volume for the vent. system	636	m³	Air change rate	0.30	h ⁻¹	Design flow temperature	55	°C	
								PE factor for electricity	1.50

Application	Used?	Consider for IHG?	Final energy demand								Internal heat gains (IHG)				PER		PE											
			Norm demand or power	Utilisation factor	Period of operatio kh/a	Reference value	Electricity demand	Availability	Utilisation period	Winter	Summer	PER factor	PER demand	PE demand														
Column no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14														
Heating, ventilation winter																												
Ventilation system																												
Ventilation in winter	1		0.45	Wh/m³	0.30	h ⁻¹	4.83	636	m³	415		IHG included in heat recovery efficiency			1.65	685	623											
Defroster HX	1	1	From worksheet 'Ventilation/Addl. Vent'						53		0.3			5.49	2	1.65	88	80										
Heating system																												
Circulation pump heating		1	73	W	1.00		5.49	0		1.0			5.49	0	1.65			0	0									
Regulated?				W user-defined pump nominal power						0.0			5.49	0	1.65			0	0									
Aux. energy - Heat. boiler	0	0	55	W	1.00		0.00	0		0.0			5.49	0	1.65			0	0									
				W user-defined el. power at 30% load																								
Aux. energy - wood-burning/pellet boiler															0	0	from 'Boiler' worksheet, incl. aux. energy for DHW						0	1.65			0	0
Fan coils		1		W	0.23		5.49	0		1.0			5.49	0	1.65			0	0									
				kWh/a						0	0.0			5.49	0	1.65			0	0								
				kWh/a						0	0.0			5.49	0	1.65			0	0								
				kWh/a						0	0.0			5.49	0	1.65			0	0								
				kWh/a						0	0.0			5.49	0	1.65			0	0								
				kWh/a						0	0.0			5.49	0	1.65			0	0								
				kWh/a						0	0.0			5.49	0	1.65			0	0								
Total aux. electricity heating, ventilation winter								468		2			773			703												

Cooling, ventilation in summer																
Ventilation system																
Ventilation in summer		1		0.45	Wh/m³	0.30	h ⁻¹	3.93	636	m³			1.00	337	506	
Additional vent. summer		0		0.00	Wh/m³	0.00	h ⁻¹	3.93	636	m³			1.00	0	0	
Cooling system																
Circulation pump cooling			1		W	0.0		3.3					1.00	0	0	
Fan coils (recirculation cooling)			1		W	0.0		3.3					1.00	0	0	
Cooling server rooms			0		kWh/a			0					1.00	0	0	
					kWh/a			0					1.00	0	0	
					kWh/a			0					1.00	0	0	
					kWh/a			0					1.00	0	0	
					kWh/a			0					1.00	0	0	
					kWh/a			0					1.00	0	0	
Total aux. electricity cooling, ventilation summer								337			0		337	506		

Dehumidification																
					kWh/a			0					1.15	0	0	
					kWh/a			0					1.15	0	0	
					kWh/a			0					1.15	0	0	
Total aux. electricity dehumidification								0			0		0	0		

DHW system																
Circulation pump DHW		0	0	30	W		8.76	kh/a		0			1.30	0	0	
					W user-defined nominal power of the pump											
Storage load pump DHW			0	64	W		1.10	kh/a		0			1.30	0	0	
					W user-defined nominal power of the pump											
DHW boiler aux. energy		0	0	165	W		0.00	kh/a		0			1.30	0	0	
					W user-defined nominal power of the pump											
Solar aux. electricity			0	47	W		1.75	kh/a		0			1.30	0	0	
					W user-defined nominal power of the pump											
Total aux. electricity DHW+Solar								0		0	0		0	0		

Other																
Inverter		0		0	W in winter		0	W in summer								
Elevator					kWh/a			0					1.30	0	0	
					kWh/a			0					1.30	0	0	
					kWh/a			0					1.30	0	0	
					kWh/a			0					1.30	0	0	
					kWh/a			0					1.30	0	0	
Total aux. electricity other								0		0	0		0	0		

Total internal heat gains										Winter	Summer		
										2	0	W	
										0.0	0.0	W/m²	

Total auxiliary electricity										Final energy		PER		PE	
										806	kWh/a	1110	1209		
										3.17	kWh/(m² _{TFA} a)	4.4	4.8		

Internal heat gains for residential buildings (IHG)

PHI Low Energy Building with PHPP Version 10.4a EN



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Number of occupants 5.5 P
Treated floor area 255 m²

Building use: 10-Residential building: Residential
Values used for IHG: 2-Standard
[Link to drop-down list](#)

IHG winter
IHG summer
No input necessary
Used for energy balance: 2.49 2.49 W/m²

Application	Number / number of occupants		Consider for IHG?	Norm consumption		Utilisation factor	Frequency		Useful energy (kWh/a)		Included in electricity balance?		Availability		Utilisation period [kh/a]		IHG winter [W]	IHG summer [W]
Persons	5	P	1	80.0	W/P	1.00	8.76	kh/a	3837	*			0.55	/	8.76	=	241	241
Evaporation	5	P	1	-25.0	W/P	1.00	8.76	kh/a	-1199	*			1.00	/	8.76	=	-137	-137
Refrigerator	0		1	0.3	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0	0
Freezer	0		1	0.6	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0	0
Refrigerator-freezer combination	1		1	0.6	kWh/d	1.00	365	d/a	445	*			1.00	/	8.76	=	51	51
Cooking	1		1	0.3	kWh/Use	1.00	500	/(P*a)	684	*			0.50	/	8.76	=	39	39
Dishwashing	1		1	1.0	kWh/Use	1.00	65	/(P*a)	340	*			0.30	/	8.76	=	12	12
Clothes washing	1		1	0.8	kWh/Use	1.00	57	/(P*a)	259	*			0.30	/	8.76	=	9	9
Drying with Condensation dryer	1		1	2.2	kWh/Use	0.75	57	/(P*a)	524	*			0.70	/	8.76	=	42	42
Gas demand (for gas dryers)			1	0.0	kWh/Use				0	*			0.80	/	8.76	=	0	0
Energy demand from evaporation																=	0	0
Lighting inside of dwelling unit	1		1	12.0	W	4.20	1.2	kh/(P*a)	331	*			1.00	/	8.76	=	38	38
Lighting outside of dwelling unit	0		1						0	*			1.00	/	8.76	=	0	0
Other devices (see 'Electricity' worksheet)	1		1.0						1169	*			1	/	8.76	=	133	133
Auxiliary appliances (cf. 'Aux electricity' worksheet)																=	2	0
																=		
																=		
DHW - circulation	0		0														0	0
DHW - individual pipes	1		1														0	0

DHW storage tank	0	P	0	0.0	0.0	W	=	0	0	
Cold water	5		1	-16.3	-18.9	W/P	=	-89	-104	
Internal heat gains (IHG)							341	324	W	
							1.34	1.27	W/m²	

Building use:

10-Residential building: Residential

Values used for IHG:

2-Standard

[Link to drop-down list](#)

Number of occupants:

5.5

P

Treated floor area:

254.5

m²

Room temperature:

20

°C

No input necessary

Applied in energy balance:

IHG winter

IHG summer

2.49

2.49

W/m²

Persons	Selection of utilisation profile	Activity of persons	Planning	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	Used in period [h/a]	IHG winter [W]	IHG summer [W]				
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Persons in				{ }*	or { }	*		*	0	*	0.00	/	8760	=		
Evaporation (person specific)				0	*		-15	*	0	*	0.00	/	8760	=	0	0
User applications and aux electricity						Contribution for IHG	Useful energy [kWh/a]		Availability	used in period [h/a]	IHG Winter [W]	IHG Summer [W]				
Lighting						1.0	0		* 1	/ 8.76	= 0	= 0				
Electrical devices						0.0	0		* 1	/ 8.76	= 0	= 0				
Cooking						0.0	0		* 0.5	/ 8.76	= 0	= 0				
Washing up						0.0	0		* 0.3	/ 8.76	= 0	= 0				
Kitchen other						0.0	0		* 1	/ 8.76	= 0	= 0				
Auxiliary appliances (see 'Aux Electricity' worksheet)											= 2	= 0				
											=	=				
											=	=				
Water pipes		Power winter or summer				Contribution for IHG	Useful energy winter or summer		Usage period winter or summer		IHG Winter [W]	IHG Summer [W]				
DHW - circulation						0	0 or 0		4.83 or 3.93		0	0				
DHW - individual pipes						0	0 or 0		4.83 or 3.93		0	0				
DHW storage tank winter		0.0	0.0			0					0	0				
	On/off	Predominant utilisation	Cold water temperature [K]	No. of WCs (user-defined)	School?	applied										
Cold water pipe and WC flushing		62-Group office	10.4 or 13.8			0	0 or 0		4.83 or 3.93		0	0				
Internal heat gains (IHG)												2	0	W		
												0.0	0.0	W/m²		

Heat emitted by people (sensible heat) with different activities [W/P]

Sitting, <= 10 years	60
Sitting, > 10 years	80
Standing, light activity, > 10 years	100

Internal heat gains (IGH) in W/m²

IHG winter

IHG summer

Block C Cranwood House 255 m² treated floor area, United Kingdom/ Britain

PHPP PHI Low Energy Building with PHPP Version 10.4a EN

Primary Energy Renewable PER

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)



Selection of the heat generation system

2-Heat pump(s)

-

-

-

Additionally:

Solar thermal

Contribution (useful energy)

Heating

DHW

100%

100%

0.0

0.0

kWh/(m²a)

Building type:

3-Double house

Treated floor area A_{TFA}:

255

m²

Projected building footprint A_{Projected}:

144

m²

Heating demand incl. distribution & hydr. frost protection

17.7

kWh/(m²a)

Cooling energy demand incl. dehumidification

kWh/(m²a)

DHW demand including distribution:

11.0

kWh/(m²a)

Biomass contingent (PER):

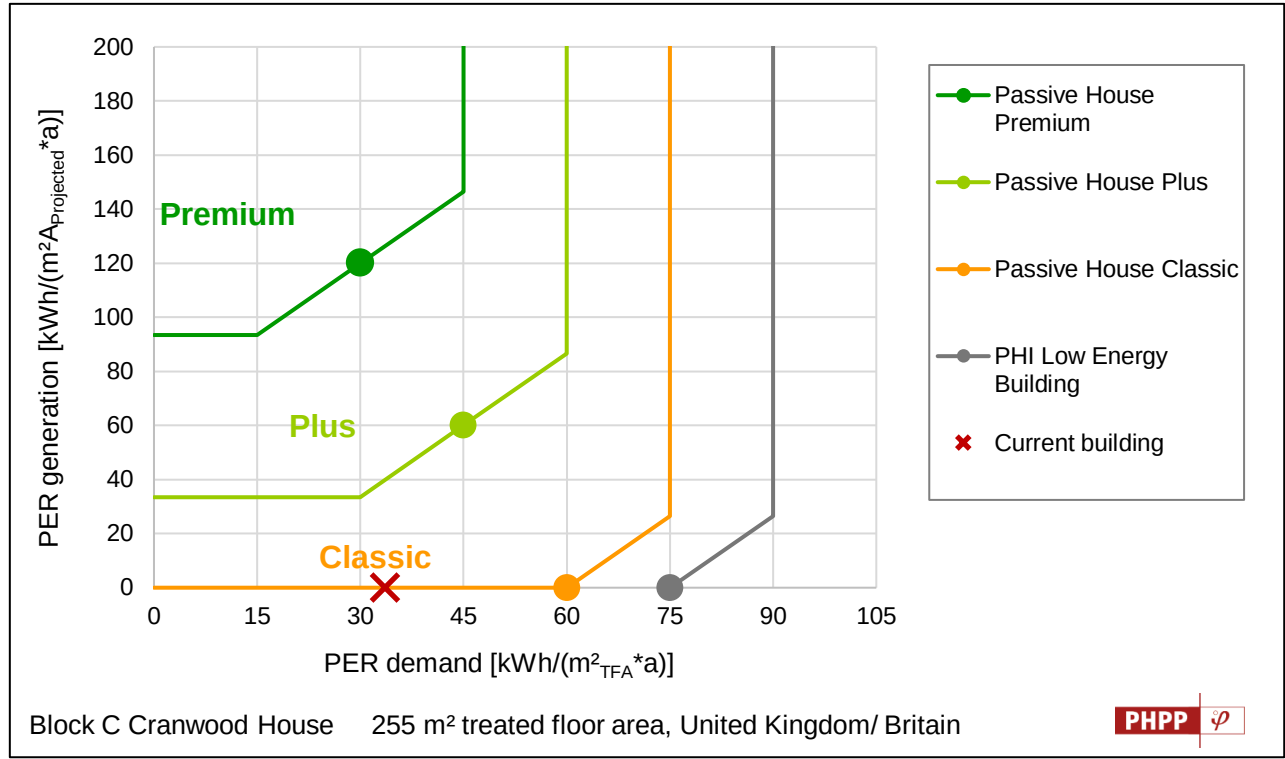
20

kWh/(m²a)

Energy demand	Efficiency	Useful energy	Final energy	PER	PER	PE	PE	CO ₂		
referred to treated floor area	Calcula- tion	User defined	Covered fraction	demand	PER factor	PER demand	PE factor	PE demand	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
	-	-		kWh/(m²a)	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
							1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
Heating			100%							
Electricity (HP compact unit)					1.65		1.50		0.363	
Electricity (heat pump)	3.72	3.00	100%	5.9	1.65	9.7	1.50	8.8	0.363	544
Other (heating)					1.65		1.50		0.363	
Boiler					0.00					
District heating					0.91		0.30		0.000	
Solar thermal system										
Aux. electricity (heating, wintertime ventilation)				1.8	1.65	3.0	1.50	2.8	0.363	170
Total heating						12.7		11.6		714
Cooling and dehumidification					PER		PE		CO ₂	
Electricity cooling (HP)					1.00		1.50		0.363	
Electricity dehumidification (HP)					1.15		1.50		0.363	
Auxiliary electricity cooling, ventilation summer				1.3	1.00	1.3	1.50	2.0	0.363	122.5
Auxiliary electricity (dehumidification)					1.15		1.50		0.363	
Total cooling and dehumidification						1.33		1.99		122.45
DHW generation			100%		PER		PE		CO ₂	
Electricity (HP compact unit)					1.30		1.50		0.363	
Electricity (heat pump)		3.00	100%	3.7	1.30	4.7	1.50	5.5	0.363	337
Electricity (direct)					1.30		1.50		0.363	
Boiler					0.00					
District heating					0.87		0.30		0.000	
Solar thermal system										
Aux. electricity (DHW + solar DHW)					1.30		1.50		0.363	
Total DHW						4.7		5.5		337
Household electricity + Auxiliary electricity (other)					PER		PE		CO ₂	
Household electricity (lighting, electrical devices, etc.)				14.7	1.30	19.2	1.50	22.1	0.363	1362
Auxiliary electricity (other)					1.30		1.50		0.363	
Total household electricity and auxiliary electricity						19.2		22.1		1362
Additional gas demand					PER		PE		CO ₂	
Drying/Cooking				0.0	1.75	0.0	0.00	0.0	0.000	
Total additional gas demand						0.00		0.00		0
Total PER demand without bioenergy budget							38.0			
Bioenergy utilisation							-4.4			
The bioenergy budget will be used with 7.4 kWh/(m²a).										
Total energy demand kWh/(m² _{TFA} a)					PER:	33.6	PE:	41.2	CO ₂ :	2536
										kg/a

Energy generation	Final energy	PER	PE	CO ₂
referred to projected building footprint	Final energy generation	PER factor	PER generation	Emission factor (CO ₂ -eq)
	kWh/a	kWh/kWh	kWh/(m²A _{Projected} a)	kg/kWh
PV electricity	0	1.00	0.0	0 0.363
Solar thermal system	0	-	0.0	
	0.0			
Total energy production kWh/(m² _{Projected building footprint} a)				
PER:		0.00	PE:	0.00
CO ₂ :		0	0	

Verification Passive House/EnerPHit standard



Classes in subdivisions:				PHI Criteria Low Energy Building	Criteria Passive House :			Achieved class
Current value:					Classic	Plus	Premium	
Heating demand referred to TFA	18 kWh/(m²a)	≤		30		15		Not achieved
Heating load referred to TFA	13 W/m²	≤		-		10		
Cooling and dehumidification demand referred to TFA	- kWh/(m²a)	≤		-		-		-
Airtightness n ₅₀	0.6 1/h	≤		1		0.6		Premium
PER demand referred to TFA	34 kWh/(m²a)	≤		75	60	45	30	Classic
PER generation referred to projected building footprint	0 kWh/(m²a)	≥		-	0	60	120	
PE demand (non-renewable primary energy)	41 kWh/(m²a)	≤		85		85		Classic
Energy standard of the whole building								With the selected verification method PER (renewable) the following class can be reached: Not achieved

Standard criteria

Summary	Final energy	PER (renewable primary energy)	PE (non-renewable primary energy)	CO ₂ eq emissions	CO ₂ eq substitution
Different final energy sources are added up here. Though this is not scientifically correct, it is required by other single verifications.			1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7.0	8.6	10.48	2536	2536
Generation	0.0	0.0	0.00	0	0
Cumulated demand and generation (annual balance)	6.99	8.56	10.48	2536	2536
Demand without occupant electricity consumption	3.23	3.68	4.85	-344151	-344151
Demand without occupant electricity consumption, accumulated generation	3.23	3.68	4.85	-344151	-344151

Passive House compact unit with exhaust air heat pump



Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Calculation based on measured values of laboratory evaluation for component certification

	Building type:	3-Double house	
	Treated floor area A _{TFA} :	255	m²
Covered fraction of space heating demand	(‘PER’ worksheet)	0%	
Space heating demand + distribution losses	Q _H +Q _{HL} : (DHW+Distribution)	4493	kWh/a
Solar contribution for space heating	η _{Solar, H} (‘SolarDHW’ worksheet)	0%	
Effective annual heating demand	Q _{H,Wi} =Q _H *(1-η _{Solar, H})	0	kWh/a
Covered fraction of DHW demand	(‘PER’ worksheet)	0%	
Total heating demand of DHW system	Q _{gDHW} (DHW+Distribution)	2787	kWh/a
Solar contribution for DHW generation	η _{Solar, DHW} (‘SolarDHW’ worksheet)	0%	
Effective DHW demand	Q _{DHW,Wi} =Q _{DHW} *(1-η _{Solar, DHW})	0	kWh/a
1-Sort as list			
Compact unit selection:			
Number of (similar) compact devices for e.g. MFH (default = 1)			
Measured values from laboratory test			
Ventilation			
Effective heat recovery efficiency	η _{eff} (Test value)		
Electric efficiency	(Test value)	Wh/m³	
Heating			
Ambient air temperature	T _{amb}	Test point 1	Test point 2
Measured thermal power heat pump heating	P _{HP,Heating}	Test point 3	Test point 4
Measured COP heating	COP _{Heating}		
Domestic hot water			
Outdoor air temperature	T _{amb}	Test point 1	Test point 2
Measured thermal power DHW storage heating-up	P _{DHW,Heating-Up}	Test point 3	Test point 4
Measured thermal power DHW storage reload	P _{DHW,Reload}		
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
Outdoor air temperature	T _{amb}	Test point 3	Test point 4
Measured thermal power heat pump standby	P _{HP,Standby}		
Measured COP standby	COP _{Standby}		
		0%	
Specific heat loss storage incl. connections	U * A _{Storage} (Test value)	W/K	
Average storage temperature in standby mode	T _{DHW,Standby} (Test value)	°C	
Heat pump priority	Separate heat pumps	DHW priority	Heating priority
	Room temperature (°C)	20	
	Avg. ambient temp. htg. period (°C)	8	
	Avg. ground temp (°C)	12	
Efficiency SHX exhaust air mixing	η*SHX		
Heat recovery efficiency SHX exhaust air mixing (if applicable)	η _{SHX,add} (Design Value)	0%	
Volume flow rate of added exhaust air (if applicable)	V _{add} (Test value)		m³/h
Hydraulic frost protection			
Heat supplied by direct electricity	Q _{E,dir}		kWh/a
Space heat supplied by HP	Q _{HP,Heating}		kWh/a
Winter DHW supplied by HP	Q _{HP,DHW,Winter}	0	kWh/a
Winter standby heat supplied by HP	Q _{HP,Standby,Winter}		kWh/a
Summer DHW supplied by HP	Q _{HP,DHW,Summer}	0	kWh/a
Summer standby heat supplied by HP	Q _{HP,Standby,Summer}		kWh/a
		Electricity demand	COP
			1.00

Results					
Electrical energy consumption pump (ground water / brine)	$Q_{El,Pump}$	0	kWh/a		
Electricity demand for heat supply direct electric	$Q_{El,direct}$	0	kWh/a		
Electrical consumption of HP	$Q_{El,HP}$	820	kWh/a		
		without storage losses	with storage losses		
Space heat supplied by HP	$Q_{HP,Heating}$	4493	4493	kWh/a	
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	880	880	kWh/a	
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	1908	1908	kWh/a	
		1st HP: Heating	2nd HP: DHW		
Seasonal performance factor of heat pump	SPF_{H-1}	3.72	-7.22		
Seasonal performance factor system	SPF_{H-3}	3.72	-7.22		
Performance ratio of heat generator, space heating		27%			
Final electrical energy demand heat generation	Q_{final}	820	kWh/a	3.2	kWh/(m²a)
Annual PER demand (renewable primary energy)		3679	kWh/a	14.5	kWh/(m²a)
Annual PE demand (non-renewable primary energy)		1231	kWh/a	4.8	kWh/(m²a)
Annual CO ₂ -equivalent emissions		298	kg/a	1.2	kg/(m²a)

Heat pump ground (ground collectors / ground probes)

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

Building type:3-Double house

Treated floor area A_{TFA}:

255

m²

Ground probes

Probe field configuration

Length of probe

Probes spacing/distance

Depth (z=H/2)

Type of probe

Borehole radius

Inner radius of pipe

Exterior pipe radius

Distance between pipes

Interior radius of pipe casing (only coaxial)

Exterior radius pipe casing (only coaxial)

Thermal conductivity of pipe

Thermal conductivity of back fill

Probe time constant

Internal borehole resistance

Borehole resistance

(HP' worksheet)

A

Individual probe

H

0

m

B

10

m

z

0

m

A

Double-U

r_b

0.090

m

r_i

0.013

m

r_a

0.016

m

B_U

0.070

m

r_{i2}

0.050

m

r_{a2}

0.052

m

λ_R

0.42

W/(mK)

λ_F

2.00

W/(mK)

t_p

0

d

R_a

Km/W

R_b

Km/W

Ground

Soil type

Density of the ground

Heat capacity of ground

Thermal conductivity of ground

Soil temperature conductivity

Ground temperature gradient

J

Other soil type

ρ_E

2000

kg/m³

c_{pE}

1000

J/(kgK)

λ_E

2.0

W/(mK)

α_E

0.000001

m²/s

Δ_{TG}

0.022

K/m

Brine

Brine (characteristics at 2 °C)

Density of the brine

dynamic viscosity of the brine

Heat capacity brine

Thermal conductivity of brine

Brine - mass flow

E

Brine

ρ_S

1036

kg/m³

η_S

0.0052

kg/(ms)

c_{pS}

3815

J/(kgK)

λ_S

0.4405

W/(mK)

m_S

0.6

kg/s

Operation type

Waste heat from active cooling to ground probe? Please check if appropriate.

Heat pump operation duration

Specific heat extraction rate as an annual average

x

h/a

q_{ex}

W/m

H/R_b

W/K

Ground collectors

Inner radius of pipe

Exterior pipe radius

Thermal conductivity of pipe

Pipe depth

Ground water depth

Pipe spacing

Base area

Pipe outer surface

Pipe length

r_i

r_a

λ_r

z_{pipe}

z_{gw}

D

L

0.013

0.016

0.420

0.4

80

20.1

200.0

m

m

W/(mK)

m

m

m

m²

m²

m

Brine

Brine (characteristics at 2 °C)

Density of brine

Dynamic viscosity of brine

Heat capacity of brine

Thermal conductivity of brine

Brine mass flow

E

Brine

ρ_S

1036

kg/m³

η_S

0.0052

kg/(ms)

c_{pS}

3815

J/(kgK)

λ_S

0.4405

W/(mK)

m_S

0.5

kg/s

Specific heat extraction rate

q_{ex}

W/m²

U * A

2361

W/K

Climate

Period duration

Average ground surface temp.

Surface temperature amplitude

Phase shift surface

T_{m0}

T₁

t₀₂

365

11.9

6.7

37

d

°C

°C

d

Ground characteristics							
		Thermal conductivity	Density	Heat capacity	Heat capacity	Thermal conductivity	Source
		[W/(mK)]	[kg/m³]	[J/(kgK)]	[MJ/(m³K)]	[10 ⁻⁷ m²/s]	
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	Density	Heat capacity	Thermal conductivity	Dynamic viscosity
		[°C]	[kg/m³]	[J/(kg K)]	[W/(mK)]	[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	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Boiler (gas, oil and wood)

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)

	Building type:	3-Double house	
	Treated floor area A _{TFA} :	255	m²
Covered fraction of space heating demand	(‘PER’ worksheet)	0%	
Space heating demand + distribution losses	Q _H +Q _{HS} : (DHW+Distribution)	4493	kWh/a
Solar contribution for space heating	η _{Solar, H} (‘SolarDHW’ worksheet)	0%	
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})	0	kWh/a
Space heating demand without distribution losses	Q _H (‘Verification’ worksheet)	4493	kWh/a
Covered fraction of DHW demand	(‘PER’ worksheet)	0%	
Total heating demand of DHW system	Q _{gDHW} (DHW+Distribution)	2787	kWh/a
Solar contribution for DHW generation	η _{Solar, DHW} (‘SolarDHW’ worksheet)	0%	
Effective DHW demand	Q _{DHW,WI} =Q _{DHW} *(1-η _{Solar, DHW})	0	kWh/a

Boiler type		1-None	
Fuel		-	
PER factors (renewable primary energy)	(‘Data’ worksheet)	0.00	kWh _{PER} /kWh _{Final}
PE factor (non-renewable primary energy)	(‘Data’ worksheet)		kWh _{PE} /kWh _{Final}
CO ₂ emissions factor (CO ₂ -equivalent)	(‘Data’ worksheet)		kg/kWh
Useful heat provided	Q _{Useful}		kWh/a
Max. heating capacity required for heating the building	P _{BH} (‘Heating load’ worksheet)	3.25	kW
Length of the heating period	t _{HP}	5491	h/a
Length of DHW heating period	t _{DHW}	8760	h/a

Apply user-defined values entered (check if appropriate)?

		Project data		Standard values		User-defined
Design output	P _{nom} (Rating plate)	15	kW	15	kW	
Installation of boiler (Outdoor: 0, Indoor: 1)		0		0		
Input values (oil and gas boiler)		Project data		Standard values		User-defined
Boiler efficiency at 30% load	η _{30%} (Manufacturer)					
Boiler efficiency at nominal output	η _{100%} (Manufacturer)					
Standby heat loss boiler at 70 °C	Q _{B,70} (Manufacturer)					
Average return temperature measured at 30% load	ϑ _{30%} (Manufacturer)		°C			
Input values (biomass heat generator)		Project data		Standard values		User-defined
Efficiency of heat generator in basic cycle	η _{GZ} (Manufacturer)			60%		
Efficiency of heat generator in steady-state operation	η _{SO} (Manufacturer)			70%		
Average fraction of heat output released to heating circuit	Z _{HC,m} (Manufacturer)			0.4		
Temperature difference betw. power-on and power-off	Δϑ (Manufacturer)		K	30	K	
In case of inside installation: area of installation room	A _{install} (Project)		m²	0	m²	
Useful heat output per basic cycle	Q _{N,GZ} (Manufacturer)		kWh	22.5	kWh	
Average power output of the heat generator	Q _{N,m} (Manufacturer)		kW	15.0	kW	
Heat generator with built in conveyor for pellets						
Unit only with regulation (no fan / no starting aid)						
Auxiliary energy demand for a basic cycle	Q _{HE,GZ} (Manufacturer)		kWh		kWh	kWh
Power consumption in steady-state operation	P _{el,SB} (Manufacturer)		W		W	W
Performance ratio heat generator space heating	h _{H,g,K} =f _j * h _k ''	0%				
Performance ratio heat generator DHW	h _{DW,g,K} =h _{100%} / f _{j,DW}	0%				
Performance ratio of heat generator, DHW & space heating	h _{g,K}	0%				
		kWh/a		kWh/(m²a)		
Final energy demand space heating	Q _{Final,HE} = Q _{H,WI} * e _{H,g,K}	0				
Final energy demand DHW	Q _{Final,TW} = Q _{DHW,WI} * e _{TW,g,K}	0				
Total final energy demand	Q _{Final} = Q _{Final,HE} + Q _{Final,TW}	0		0.0		
Annual PER demand (renewable primary energy)						
Annual PE demand (non-renewable primary energy)						
		kg/a		kg/(m²a)		
Annual CO ₂ -equivalent emissions						

District heating and combined heat and power (CHP)

Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)



	Building type:	3-Double house	
	Treated floor area A _{TFA} :	255	m²
Covered fraction of space heating demand	(‘PER’ worksheet)	0%	
Heating demand	Q _H (DHW+Distribution)	4493	kWh/a
Solar contribution for space heating	η _{Solar, H} (‘SolarDHW’ worksheet)	0%	
Effective annual heating demand	Q _{H,WI} = Q _H * (1 - η _{Solar, H})	0	kWh/a
Covered fraction of DHW demand	(‘PER’ worksheet)	0%	
DHW demand	Q _{DHW} (DHW+Distribution)	2787	kWh/a
Solar contribution for DHW generation	η _{Solar, DHW} (‘SolarDHW’ worksheet)	0%	
Effective DHW demand	Q _{DHW,WI} = Q _{DHW} * (1 - η _{Solar, DHW})	0	kWh/a

Standard procedure				
Entries in this area take precedence over the detailed calculation below.				
PER (renewable energy)		PE, CO ₂ (non-renewable energy)		PE factor
Reference district heating:		Standard heat generator	x	1-None
Detailed calculation:		Detailed calculation:	(see below)	
		User-defined:		

Detailed calculation

Utilisation factor of heat transfer station	η _{a,HX}	95%			
Performance ratio of heat transfer station	h _{a,HX}	105%			
Final energy demand heat generation	Q _{Final} = Q _{Useful} * e _{a,HX}		kWh/a		kWh/(m²a)
Annual PER demand (renewable primary energy)			kWh/a		kWh/(m²a)
Annual PE demand (non-renewable primary energy)			kWh/a		kWh/(m²a)
Annual CO ₂ -equivalent emissions			kg/a		kg/(m²a)

	PER factor	Bioenergy budget			PE factor result	PE factor for verification		CO ₂ factor	
		PER factor	Used budget						
Heating	0.91	0.37	0.99		0.00	0.30		0.00	
Domestic hot water	0.87	0.50	0.75						

PHPP Version

10.4a

Language

EN

Header:
Block C Cranwood House / Climate: Northolt / TFA: 255 m² / Heating: 17.7 kWh/(m²a) / Overheating: 9 % / PER: 33.6 kWh/(m²a)
PHI Low Energy Building with PHPP Version 10.4a EN

for diagrams
Block C Cranwood House 255 m² treated floor area, United Kingdom/ Britain

Table of PER and PE factors as well as CO ₂ -equivalent emission factors of different energy carriers and uses from different sources					
Energy type	Number	Energy carrier	Transfer to 'PER' worksheet		
			PER factor	1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)
			kWh _{prim-el} / kWh _{Final}	kWh _{prim} / kWh _{Final}	kg _{CO2eq} / kWh _{Final}
Fuels within bioenergy budget			1.1		
	10	None			
Fuels above bioenergy budget	20	Heating oil	2.30	1.10	0.320
	30	Natural gas	1.75	1.10	0.250
	31	LPG	1.75	1.10	0.270
	41	Hard coal	2.30	1.10	0.444
	42	Brown coal	2.30	1.20	0.455
	32	Biogas	1.75	1.10	-
	21	Pyrolysis oil or bio oil	1.75	1.10	-
	43	Wood	1.75	0.20	-
	44	Wood logs	1.75	0.20	0.017
	50	Pellets	1.75	0.20	0.025
	46	Forest woodchips	1.75	0.20	0.026
	47	Poplar woodchips (SRF)	1.75	0.20	0.037
	33	RE-Gas	1.75		
	22	RE-Methanol	2.30		
	48	Biomass	1.75		
Electricity	60	Electricity-mix		1.50	0.363
	61	Displacement electricity mix		2.40	0.860
	00	Primary electricity	1.00		
	01	Occupant electricity consumption	1.30	1.50	-
	02	Electricity for DHW	1.30	1.50	-
	03	Electricity for heating	1.65	1.50	-
	04	Electricity for cooling	1.00	1.50	-
	05	Electricity for dehumidification	1.15	1.50	-
	06	RE summer	1.10	1.50	-
	62	Electricity from photovoltaics	1.00	0.00	-
	63	Monocrystalline PV panels	1.00	0.00	0.130
	64	Polycrystalline PV panels	1.00	0.00	0.063
	65	Onshore wind power	1.00	0.00	0.009
	66	Offshore wind power	1.00	0.00	0.022
	67	Hydro power station > 10MW	1.00	0.00	0.003
Environmental energy, solar thermal energy	71	Ground heat, geothermal energy	1.00	0.00	-
	72	Ambient heat	0.00	0.00	-
	73	Ambient cold	0.00	0.00	-
	80	Solar thermal flat plate (generation)	1.00	0.00	0.045
	81	Vacuum tube (generation)	1.00	0.00	0.025
	74	Waste heat	0.20	0.00	-
User defined energy carrier (for generation, please ente	98	User defined energy carrier (generation, please enter			
tors for demand please enter on the far right)	99	factors for demand on the far right)			
District heat	1	1-None		0.00	0.000
	10	10-Hard coal-CHP plant (>70% CHP)		0.80	0.240
	11	11-Hard coal-CHP plant (>35% CHP)		1.10	0.320
	12	12-Hard coal HP (0% CHP)		1.50	0.410
Gas CHP plant	20	20-Gas CHP plant (70% CHP)	Calculation	0.70	-0.070
	21	21-Gas CHP plant (35% CHP)	in	1.10	0.130
	22	22-Gas HP (0% CHP)	'District	1.50	0.320
Heating oil CHP plant	30	30-Oil CHP plant (70% CHP)	heating'	0.80	0.100
	31	31-Oil CHP plant (35% CHP)	worksheet	1.10	0.250
	32	32-Oil HP (0% CHP)		1.50	0.410
District heat: User-defined	40	40-User-defined		0.00	0.000
District heat from combined heat and power (CHP)	13	Fossil fuel		0.70	-
	14	Renewable fuel		0.00	-
District heat from heating plant	15	Fossil fuel		1.30	-
	16	Renewable fuel		0.10	0.117