EnerPHit Verification

Building:	5485 South Ellis Avenue		
Street:	5485 South Ellis Avenue		
Postcode/City:	Chicago	60615	
Province/Country:	Illinois		US-United States of America
Building type:	Single family, semi-detached, masonry construction		
Climate data set:	US0028a-Chicago		
Climate zone:	3: Cool-temperate	Altitude of location:	185 m
Home owner / Client:	Kenwood Construction Services		
Street:	5485 South Ellis Avenue		
Postcode/City:	Chicago	60615	
Province/Country:	Illinois		US-United States of America

Architecture:	Richard Kasemsarn, makeArchitecture		
Street:	559 West Surf Street		
Postcode/City:	Chicago	60615	
Province/Country:	Illinois		US-United States of America
Energy consultancy:	ZeroEnergy Design		
Street:	156 Milk Street, Suite 3		
Postcode/City:	Boston	2109	
Province/Country:	Massachusetts		US-United States of America

Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:	Peel Passive House Consulting		
Street:	118 Craigleith Road		
Postcode/City:	L9Y 0S3	Blue Mountains	
Province/Country:	Ontario		CA-Canada

Year of construction:	2017	Interior temperature winter [°C]:	20.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.3
No. of occupants:	3.1	Specific capacity [Wh/K per m² TFA]:	204
		Interior temp. summer [°C]:	25.0
		IHG cooling case [W/m²]:	2.3
		Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	239.8				
Space heating	Heating demand	kWh/(m²a)	25	≤	25	-	yes
	Heating load	W/m²	21	≤	-	-	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	13	≤	16	16	yes
	Cooling load	W/m²	14	≤	-	10	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0.6	≤	1.0		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	123	≤	132		yes
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	48	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	0	≥	-	-	

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

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

EnerPHit Classic? yes

Task:	First name:	Surname:	Signature:
2-Certifier	Andrew	Peel	

Certificate ID	Issued on:	City:
18585_APC_EP_20180719_AP	19 July 2018	Blue Mountains

A Note on the Building Certification

An in-room DHW Heat Pump is installed in the mechanical room. Since the heat source for the heat pump is the mechanical room air, there is a risk that the mechanical room's temperature will decrease to levels that are potentially uncomfortable and lead to risk of mould and condensation. If the temperature does drop to these levels, a means of mixing transferring heat from adjacent should be implemented (e.g. transfer fan).

Climate data

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Selection of climate data

Country:	US-United States of America
Region:	Illinois
	1-Sortierung: Alphabetisch
Climate data set:	US0028a-Chicago
Climate zone:	3: Cool-temperate

Altitude

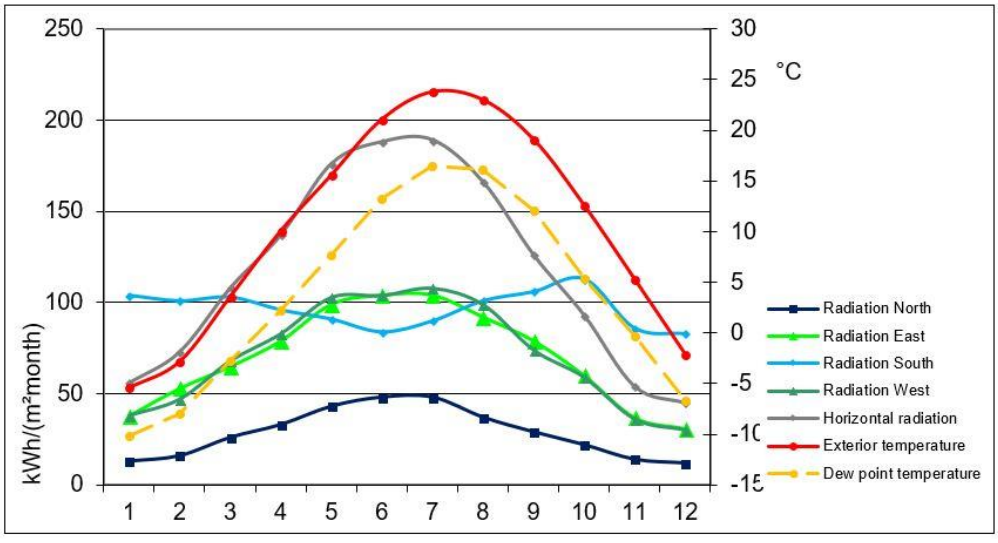
Weather station:	185.0	m
Building location:	185	m

Result overview

Annual heating demand	24.8	kWh/(m²a)
Heating load	21.0	W/m²
Frequency of overheating	-	%
Sensible cooling	13.4	kWh/(m²a)
Latent cooling	0.5	kWh/(m²a)
Cooling load	14.9	W/m²
PER demand	40.5	kWh/(m²a)

	Data for heating Annual method	Data from monthly balance Heating	Cooling	
Heating / cooling period	188	212	153	d/a
Heating / cooling degree hours	83	90	-18	kKh/a
Radiation North	111	136	205	kWh/(m²a)
Radiation East	298	363	478	kWh/(m²a)
Radiation South	577	668	478	kWh/(m²a)
Radiation West	295	325	452	kWh/(m²a)
Horizontal radiation	461	566	845	kWh/(m²a)

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating load		Cooling load		PER	
	Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Weather 1	Weather 2	factors	
	US0028a-Chicago	Latitude °	41.8	Longitude °	-87.8	Altitude [m]	185	Daily temperature swing Summer [K]			9.0			Radiation: [W/m²]		Radiation: [W/m²]			
°C	Exterior temperature	-5.4	-2.8	3.6	10.1	15.6	21.1	23.8	23.0	19.1	12.6	5.3	-2.1	-16.3	-14.5	29.0	29.0	1.20	Household electr
kWh/(m²month)	Radiation North	13	16	26	33	43	48	48	37	29	22	14	12	15	20	100	100	1.20	Domestic hot wa
kWh/(m²month)	Radiation East	38	53	65	79	99	104	104	92	79	60	37	31	40	30	190	190	1.65	Heating
kWh/(m²month)	Radiation South	104	101	103	96	91	84	90	101	106	113	86	83	95	65	160	160	1.40	Cooling
kWh/(m²month)	Radiation West	38	47	68	83	103	104	108	99	74	59	36	30	35	35	190	190	1.80	Dehumidification
kWh/(m²month)	Horizontal radiation	56	73	108	137	176	188	189	166	126	93	54	45	50	45	330	330		
°C	Dew point temperature	-10.2	-8.0	-2.7	2.2	7.7	13.2	16.5	16.1	12.1	5.4	-0.3	-6.7			19.5	19.5		
°C	Sky temperature	-27.6	-21.7	-11.0	-2.5	4.6	11.1	14.6	13.7	8.0	-3.0	-11.6	-22.2			17.7	19.5		
°C	Ground temperature	10.0	8.8	8.7	9.7	12.5	14.8	16.8	18.0	18.2	16.2	14.3	12.0	8.7	8.7	18.2	18.2		
	Comment:	Source: Meteonorm																	



U-value of building assemblies

EnerPHit with PHPP Version 9.6a

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

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

Assembly no.	Building assembly description	Interior insulation?
01ud	**Basement Slab**	

Heat transmission resistance [m²K/W]

Orientation of building element: **3-Floor** — interior R_{si}: 0.13
Adjacent to: **2-Ground** — exterior R_{se}: 0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete	**2.300**					**102**
Type IX EPS	**0.033**					**25**
XPS	**0.028**					**152**

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: **27.9** cm

U-value supplement: — W/(m²K) **U-value: 0.157** W/(m²K)

Assembly no.		Interior insulation?
02ud	**Below Grade Foundation - Existing - South/West**	**x**

Heat transmission resistance [m²K/W]

Orientation of building element: **2-Wall** — interior R_{si}: 0.13
Adjacent to: **2-Ground** — exterior R_{se}: 0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	**0.210**					**16**
Roxul Batts	**0.034**	**Framing**	**0.130**			**38**
Roxul Batts	**0.034**					**89**
Brick	**1.200**					**305**
Roxul Rigid	**0.036**					**76**

Percentage of sec. 1: 78% — Percentage of sec. 2: **21.9%** — Percentage of sec. 3: — Total: **52.4** cm

U-value supplement: — W/(m²K) **U-value: 0.166** W/(m²K)

Assembly no.		Interior insulation?
03ud	**Front Wall**	**x**

Heat transmission resistance [m²K/W]

Orientation of building element: **2-Wall** — interior R_{si}: 0.13
Adjacent to: **1-Outdoor air** — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	**0.210**					**16**
DPC	**0.039**	**Framing**	**0.130**			**89**
DPC	**0.039**					**76**
Brick	**1.200**					**203**
Limestone	**2.300**					**102**

Percentage of sec. 1: 91% — Percentage of sec. 2: **9.4%** — Percentage of sec. 3: — Total: **48.6** cm

U-value supplement: — W/(m²K) **U-value: 0.228** W/(m²K)

Assembly no. 04ud | **Side Wall - Masonry (western side)** | Interior insulation? x

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 3-Ventilated — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			89
Cellulose	0.039					38
Brick	1.200					203
Rigid Roxul	0.036					51

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		39.7 cm

U-value supplement: W/(m²K)

U-value: 0.206 W/(m²K)

Assembly no. 05ud | **Second Floor Main Roof** | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
DPC	0.039	Framing	0.130			241
Plywood	0.130					25
Comfortboard 110	0.036					76
Polyiso	0.028					25
Comfortboard 110	0.036					76
Plywood	0.130					25

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		48.6 cm

U-value supplement: W/(m²K)

U-value: 0.090 W/(m²K)

Assembly no. 06ud | **Addition Wall** | Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 3-Ventilated — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			89
Cellulose	0.039					25
CMU	1.200					143
Polyiso	0.028					76

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		34.9 cm

U-value supplement: W/(m²K)

U-value: 0.172 W/(m²K)

Assembly no. 07ud — **Party Wall** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 0.13 — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			89

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		10.5 cm

U-value supplement: W/(m²K)

U-value: 0.446 W/(m²K)

Assembly no. 08ud — **Existing Above Grade Foundation - South** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul Batts	0.034	Framing	0.130			89
Roxul Batts	0.034					165
Brick	1.200					203
Roxul Rigid	0.036					76

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		54.9 cm

U-value supplement: W/(m²K)

U-value: 0.103 W/(m²K)

Assembly no. 09ud — **Side Wall - Masonry (eastern side)** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 3-Ventilated — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			89
Cellulose	0.039					38
Brick	1.200					305
Roxul Rigid	0.036					127

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		57.5 cm

U-value supplement: W/(m²K)

U-value: 0.141 W/(m²K)

Assembly no. 10ud — **New Foundation (below grade)** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 2-Ground — exterior R_{se}: 0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul Batt	0.034	Framing	0.130			89
Roxul Batt	0.034					13
Concrete	1.200					203
Rigid Roxul	0.036					76

Percentage of sec. 1: 91% — Percentage of sec. 2: 9.4% — Percentage of sec. 3: — Total: 39.7 cm

U-value supplement: — W/(m²K)

U-value: 0.196 W/(m²K)

Assembly no. 11ud — **New Foundation (above grade)** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul Batt	0.034	Framing	0.130			89
Roxul Batt	0.034					13
Concrete	1.200					203
Polyiso	0.028					76

Percentage of sec. 1: 91% — Percentage of sec. 2: 9.4% — Percentage of sec. 3: — Total: 39.7 cm

U-value supplement: — W/(m²K)

U-value: 0.174 W/(m²K)

Assembly no. 12ud — **Above Grade Foundation - Existing - West** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul Batt	0.034	Framing	0.130			89
Roxul Batt	0.034					165
Fieldstone	2.100					203

Percentage of sec. 1: 91% — Percentage of sec. 2: 9.4% — Percentage of sec. 3: — Total: 47.3 cm

U-value supplement: — W/(m²K)

U-value: 0.133 W/(m²K)

Assembly no.		Interior insulation?
13ud	**Penthouse Roof**	

Heat transmission resistance [m²K/W]

Orientation of building element: **1-Roof** — interior R_{si}: 0.13

Adjacent to: **1-Outdoor air** — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul w/steel	0.140					203
Plywood	0.130					19
Polyiso	0.028					127
Roxul Rigid	0.036					76
Plywood	0.130					19
Polyiso	0.028					25

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			**48.6** cm

U-value supplement: W/(m²K)

U-value: 0.105 W/(m²K)

Assembly no.		Interior insulation?
14ud	**Penthouse N/S Wall**	

Heat transmission resistance [m²K/W]

Orientation of building element: **2-Wall** — interior R_{si}: 0.13

Adjacent to: **3-Ventilated** — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul batt	0.034	Framing	0.130			89
Gypsum Sheathing	0.210					38
Roxul w/steel	0.088					89
Gypsum Sheathing	0.210					38
Polyiso	0.028					76

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		**34.6** cm

U-value supplement: W/(m²K)

U-value: 0.150 W/(m²K)

Assembly no.		Interior insulation?
15ud	**Penthouse East Wall**	

Heat transmission resistance [m²K/W]

Orientation of building element: **2-Wall** — interior R_{si}: 0.13

Adjacent to: **3-Ventilated** — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					13
Roxul batts	0.034	framing	0.130			89
Gypsum Sheathing	0.210					38
Polyiso	0.028					127

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		**26.7** cm

U-value supplement: W/(m²K)

U-value: 0.137 W/(m²K)

Assembly no. 16ud — **Penthouse West Wall** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 3-Ventilated — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Roxul batts	0.034	framing	0.130			89
Gypsum Sheathing	0.210					38
Roxul batts	0.034	framing	0.130			89
Gypsum Sheathing	0.210					38
Polyiso	0.028					127

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		39.7 cm

U-value supplement: W/(m²K)

U-value: 0.103 W/(m²K)

Assembly no. 17ud — **Terrace Roof** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 1-Roof — interior R_{si}: 0.13

Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			235
Plywood	0.130					19
Polyiso	0.028			Framing	0.130	64
Roxul Rigid	0.036			Framing	0.130	51
Polyiso	0.028			Framing	0.130	64
Plywood	0.130					19

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
81%	9.4%	9.4%	46.7 cm

U-value supplement: W/(m²K)

U-value: 0.094 W/(m²K)

Assembly no. 18ud — **Wall 7 Construction (Masonry + Polyiso)** — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

Adjacent to: 3-Ventilated — exterior R_{se}: 0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
GWB	0.210					16
Cellulose	0.039	Framing	0.130			89
Cellulose	0.039					38
Brick	1.200					203
Polyiso	0.028					76

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		42.2 cm

U-value supplement: W/(m²K)

U-value: 0.162 W/(m²K)

Areas determination

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a] 7 Months	Radiation-load cooling period [kWh/a] 5 Months
	Treated floor area	1	**239.79**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**0.00**	m²			**North windows**			
A	**East windows**	3	**16.10**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0.811**	**1363**	**1834**
A	**South windows**	4	**23.19**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0.843**	**1386**	**1665**
A	**West windows**	5	**15.01**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0.908**	**1201**	**1680**
A	**Horizontal windows**	6	**1.40**	m²			**Horizontal windows**	**0.834**	**123**	**194**
A	**Exterior door**	7	**0.00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**			
A	**External wall - Ambient**	8	**307.62**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.166**	**192**	**315**
B	**External wall - Ground**	9	**41.40**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0.176**		
A	**Roof/Ceiling - Ambient**	10	**106.49**	m²			**Roof/Ceiling - Ambient**	**0.093**	**-19**	**121**
B	**Floor slab / Basement ceiling**	11	**107.89**	m²			**Floor slab / Basement ceiling**	**0.157**		
		12	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*					
		13	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X				
X	**Basement Ceiling**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**83%**	**Basement Ceiling**			

							Thermal bridges - Overview	**Ψ [W/(mK)]**
A	**Thermal bridges Ambient**	15	**205.51**	m	*Units in m*		**Thermal bridges Ambient**	**-0.024**
P	**Perimeter thermal bridges**	16	**47.52**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**0.095**
B	**Thermal bridges FS/BC**	17	**0.00**	m	*Units in m*		**Thermal bridges FS/BC**	
I	**Building element towards neigh**	18	**154.90**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**	0.446
Total thermal envelope			**619.10**	**m²**			**Average therm. envelope**	**0.213**

Go to building components list

Area input

2-Sorting: BY ID

Area no.	Building assembly description	To group No.	Assigned to group	Quantity	x (	a [m]	x	b [m]	+	User determined [m²]	-	User subtraction [m²]	-	Subtraction window areas [m²]	) =	Area [m²]	Selection building assembly / Building system	U-Value [W/(m²K)]	Deviation from North	Angle of inclination from the horizontal	Orientation	Reduction factor shading	Exterior absorptivity	Exterior emissivity
	Projected building footprint	**0**	Projected building footprint	**1**	x (		x		+	**107.89**	-		)		=	107.9								
	Treated floor area	**1**	Treated floor area	**1**	x (		x		+	**239.79**	-		)		=	239.8								
	Exterior door	**7**	Exterior door		x (		x		+		-		) -		=		Exterior door							
1	**Slab**	**11**	Floor slab / Basement ceiling	**1**	x (		x		+	**107.89**	-		) -	**0.0**	=	107.9	**01ud-Basement Slab**	**0.157**	**0**	**180**	**Hor**			
2	**Level 0 Wall 1**	**8**	External wall - Ambient	**1**	x (		x		+	**4.42**	-		) -	**0.0**	=	4.4	**12ud-Above Grade Foundation - Existing - West**	**0.133**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
3	**Level 0 Wall 2**	**8**	External wall - Ambient	**1**	x (		x		+	**3.75**	-		) -	**0.4**	=	3.3	**12ud-Above Grade Foundation - Existing - West**	**0.133**	**225**	**90**	**South**	**0.70**	**0.60**	**0.90**
4	**Level 0 Wall 3a**	**9**	External wall - Ground	**1**	x (		x		+	**2.34**	-		) -	**0.0**	=	2.3	**02ud-Below Grade Foundation - Existing - South/West**	**0.166**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
5	**Level 0 Wall 3b**	**8**	External wall - Ambient	**1**	x (		x		+	**2.69**	-		) -	**0.7**	=	2.0	**12ud-Above Grade Foundation - Existing - West**	**0.133**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
6	**Level 0 Wall 4a**	**9**	External wall - Ground	**1**	x (		x		+	**1.76**	-		) -	**0.0**	=	1.8	**02ud-Below Grade Foundation - Existing - South/West**	**0.166**	**315**	**90**	**West**	**0.70**	**0.60**	**0.90**
7	**Level 0 Wall 4b**	**8**	External wall - Ambient	**1**	x (		x		+	**2.03**	-		) -	**0.4**	=	1.6	**12ud-Above Grade Foundation - Existing - West**	**0.133**	**315**	**90**	**West**	**0.70**	**0.60**	**0.90**
8	**Level 0 Wall 5a**	**9**	External wall - Ground	**1**	x (		x		+	**0.21**	-		) -	**0.0**	=	0.2	**02ud-Below Grade Foundation - Existing - South/West**	**0.166**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
9	**Level 0 Wall 5b**	**8**	External wall - Ambient	**1**	x (		x		+	**0.24**	-		) -	**0.0**	=	0.2	**12ud-Above Grade Foundation - Existing - West**	**0.133**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
10	**Level 0 Wall 6**	**18**	Building element towards neight	**1**	x (		x		+	**48.55**	-		) -	**0.0**	=	48.6	**07ud-Party Wall**	**0.446**	**0**	**90**	**North**	**0.70**	**0.60**	**0.90**
11	**Level 0 Wall 7a**	**9**	External wall - Ground	**1**	x (		x		+	**0.93**	-		) -	**0.0**	=	0.9	**02ud-Below Grade Foundation - Existing - South/West**	**0.166**	**90**	**90**	**East**	**0.70**	**0.60**	**0.90**
12	**Level 0 Wall 7b**	**8**	External wall - Ambient	**1**	x (		x		+	**1.07**	-		) -	**0.0**	=	1.1	**08ud-Existing Above Grade Foundation - South**	**0.103**	**90**	**90**	**East**	**0.70**	**0.60**	**0.90**
13	**Level 0 Wall 8a**	**9**	External wall - Ground	**1**	x (		x		+	**6.66**	-		) -	**0.0**	=	6.7	**10ud-New Foundation (below grade)**	**0.196**	**0**	**90**	**North**	**0.70**	**0.60**	**0.90**
14	**Level 0 Wall 8b**	**8**	External wall - Ambient	**1**	x (		x		+	**7.53**	-		) -	**0.0**	=	7.5	**11ud-New Foundation (above grade)**	**0.174**	**0**	**90**	**North**	**0.70**	**0.60**	**0.90**
15	**Level 0 Wall 9**	**8**	External wall - Ambient	**1**	x (		x		+	**11.29**	-		) -	**4.5**	=	6.8	**11ud-New Foundation (above grade)**	**0.174**	**90**	**90**	**East**	**0.70**	**0.60**	**0.90**
16	**Level 0 Wall 10a**	**9**	External wall - Ground	**1**	x (		x		+	**6.66**	-		) -	**0.0**	=	6.7	**10ud-New Foundation (below grade)**	**0.196**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**
17	**Level 0 Wall 10b**	**8**	External wall - Ambient	**1**	x (		x		+	**7.66**	-		) -	**0.5**	=	7.2	**11ud-New Foundation (above grade)**	**0.174**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**
18	**Level 0 Wall 11a**	**9**	External wall - Ground	**1**	x (		x		+	**11.22**	-		) -	**0.0**	=	11.2	**02ud-Below Grade Foundation - Existing - South/West**	**0.166**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**
19	**Level 0 Wall 11b**	**8**	External wall - Ambient	**1**	x (		x		+	**12.91**	-		) -	**1.0**	=	11.9	**08ud-Existing Above Grade Foundation - South**	**0.103**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**

EnerPHit with PHPP Version 9.6a

Areas determination

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a] 7 Months	Radiation-load cooling period [kWh/a] 5 Months
	Treated floor area	1	**239.79**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**0.00**	m²			**North windows**			
A	**East windows**	3	**16.10**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0.811**	**1363**	**1834**
A	**South windows**	4	**23.19**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0.843**	**1386**	**1665**
A	**West windows**	5	**15.01**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0.908**	**1201**	**1680**
A	**Horizontal windows**	6	**1.40**	m²			**Horizontal windows**	**0.834**	**123**	**194**
A	**Exterior door**	7	**0.00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**			
A	**External wall - Ambient**	8	**307.62**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.166**	**192**	**315**
B	**External wall - Ground**	9	**41.40**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0.176**		
A	**Roof/Ceiling - Ambient**	10	**106.49**	m²			**Roof/Ceiling - Ambient**	**0.093**	**-19**	**121**
B	**Floor slab / Basement ceiling**	11	**107.89**	m²			**Floor slab / Basement ceiling**	**0.157**		
		12	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*					
		13	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X				
X	**Basement Ceiling**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**83%**	**Basement Ceiling**			
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**205.51**	m	*Units in m*		**Thermal bridges Ambient**	**-0.024**		
P	**Perimeter thermal bridges**	16	**47.52**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**0.095**		
B	**Thermal bridges FS/BC**	17	**0.00**	m	*Units in m*		**Thermal bridges FS/BC**			
I	**Building element towards neigh**	18	**154.90**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**	0.446		
Total thermal envelope			**619.10**	**m²**			**Average therm. envelope**	**0.213**		

Go to building components list

20	Level 0 Wall 12a	9	External wall - Ground	1	x (		x		+	2.02	-		) -	0.0	=	2.0	02ud-Below Grade Foundation - Existing - South/West	0.166	150	90	South	0.70	0.60	0.90
21	Level 0 Wall 12b	8	External wall - Ambient	1	x (		x		+	2.32	-		) -	0.5	=	1.8	08ud-Existing Above Grade Foundation - South	0.103	150	90	South	0.70	0.60	0.90
22	Level 0 Wall 13a	9	External wall - Ground	1	x (		x		+	9.62	-		) -	0.0	=	9.6	02ud-Below Grade Foundation - Existing - South/West	0.166	180	90	South	0.70	0.60	0.90
23	Level 0 Wall 13b	8	External wall - Ambient	1	x (		x		+	11.07	-		) -	1.5	=	9.6	08ud-Existing Above Grade Foundation - South	0.103	180	90	South	0.70	0.60	0.90
24	Level 1 Wall 1	8	External wall - Ambient	1	x (		x		+	4.83	-		) -	2.8	=	2.0	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
25	Level 1 Wall 2	8	External wall - Ambient	1	x (		x		+	3.95	-		) -	1.3	=	2.6	03ud-Front Wall	0.228	225	90	South	0.70	0.60	0.90
26	Level 1 Wall 3	8	External wall - Ambient	1	x (		x		+	5.29	-		) -	2.2	=	3.1	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
27	Level 1 Wall 4	8	External wall - Ambient	1	x (		x		+	3.99	-		) -	1.3	=	2.7	03ud-Front Wall	0.228	315	90	West	0.70	0.60	0.90
28	Level 1 Wall 5	8	External wall - Ambient	1	x (		x		+	0.97	-		) -	0.0	=	1.0	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
29	Level 1 Wall 6	18	Building element towards neight	1	x (		x		+	51.25	-		) -	0.0	=	51.3	07ud-Party Wall	0.446	0	90	North	0.70	0.60	0.90
30	Level 1 Wall 7	8	External wall - Ambient	1	x (		x		+	2.76	-		) -	0.0	=	2.8	18ud-Wall 7 Construction (Masonry + Polyiso)	0.162	90	90	East	0.70	0.60	0.90
31	Level 1 Wall 8	8	External wall - Ambient	1	x (		x		+	15.25	-		) -	0.0	=	15.3	06ud-Addition Wall	0.172	0	90	North	0.70	0.60	0.90
32	Level 1 Wall 9	8	External wall - Ambient	1	x (		x		+	12.26	-		) -	6.4	=	5.9	06ud-Addition Wall	0.172	90	90	East	0.70	0.60	0.90
33	Level 1 Wall 10	8	External wall - Ambient	1	x (		x		+	15.25	-		) -	4.1	=	11.1	06ud-Addition Wall	0.172	180	90	South	0.70	0.60	0.90
34	Level 1 Wall 11	8	External wall - Ambient	1	x (		x		+	13.18	-		) -	0.0	=	13.2	09ud-Side Wall - Masonry (eastern side)	0.141	180	90	South	0.70	0.60	0.90
35	Level 1 Wall 12	8	External wall - Ambient	1	x (		x		+	12.29	-		) -	4.1	=	8.2	09ud-Side Wall - Masonry (eastern side)	0.141	180	90	South	0.70	0.60	0.90
36	Level 1 Wall 13	8	External wall - Ambient	1	x (		x		+	4.60	-		) -	2.0	=	2.6	04ud-Side Wall - Masonry (western side)	0.206	150	90	South	0.70	0.60	0.90
37	Level 1 Wall 14	8	External wall - Ambient	1	x (		x		+	21.77	-		) -	0.0	=	21.8	04ud-Side Wall - Masonry (western side)	0.206	180	90	South	0.70	0.60	0.90
38	Level 2 Wall 1	8	External wall - Ambient	1	x (		x		+	5.19	-		) -	0.7	=	4.5	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
39	Level 2 Wall 2	8	External wall - Ambient	1	x (		x		+	4.24	-		) -	1.3	=	2.9	03ud-Front Wall	0.228	225	90	South	0.70	0.60	0.90
40	Level 2 Wall 3	8	External wall - Ambient	1	x (		x		+	5.69	-		) -	2.2	=	3.5	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
41	Level 2 Wall 4	8	External wall - Ambient	1	x (		x		+	4.29	-		) -	1.3	=	3.0	03ud-Front Wall	0.228	315	90	West	0.70	0.60	0.90
42	Level 2 Wall 5	8	External wall - Ambient	1	x (		x		+	1.04	-		) -	0.0	=	1.0	03ud-Front Wall	0.228	270	90	West	0.70	0.60	0.90
43	Level 2 Wall 6	18	Building element towards neight	1	x (		x		+	55.10	-		) -	0.0	=	55.1	07ud-Party Wall	0.446	0	90	North	0.70	0.60	0.90
44	Level 2 Wall 7	8	External wall - Ambient	1	x (		x		+	2.96	-		) -	0.0	=	3.0	18ud-Wall 7 Construction (Masonry + Polyiso)	0.162	90	90	East	0.70	0.60	0.90
45	Level 2 Wall 8	8	External wall - Ambient	1	x (		x		+	16.40	-		) -	0.0	=	16.4	06ud-Addition Wall	0.172	0	90	North	0.70	0.60	0.90
46	Level 2 Wall 9	8	External wall - Ambient	1	x (		x		+	13.18	-		) -	1.9	=	11.3	06ud-Addition Wall	0.172	90	90	East	0.70	0.60	0.90
47	Level 2 Wall 10	8	External wall - Ambient	1	x (		x		+	16.40	-		) -	1.1	=	15.3	06ud-Addition Wall	0.172	180	90	South	0.70	0.60	0.90
48	Level 2 Wall 11	8	External wall - Ambient	1	x (		x		+	14.17	-		) -	1.1	=	13.1	09ud-Side Wall - Masonry (eastern side)	0.141	180	90	South	0.70	0.60	0.90
49	Level 2 Wall 12	8	External wall - Ambient	1	x (		x		+	13.21	-		) -	1.7	=	11.6	09ud-Side Wall - Masonry (eastern side)	0.141	180	90	South	0.70	0.60	0.90

EnerPHit with PHPP Version 9.6a

Areas determination

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a] 7 Months	Radiation-load cooling period [kWh/a] 5 Months
	Treated floor area	1	**239.79**	m²	*Treated floor area according to PHPP manual*					
A	**North windows**	2	**0.00**	m²			**North windows**			
A	**East windows**	3	**16.10**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0.811**	**1363**	**1834**
A	**South windows**	4	**23.19**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0.843**	**1386**	**1665**
A	**West windows**	5	**15.01**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0.908**	**1201**	**1680**
A	**Horizontal windows**	6	**1.40**	m²			**Horizontal windows**	**0.834**	**123**	**194**
A	**Exterior door**	7	**0.00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**			
A	**External wall - Ambient**	8	**307.62**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.166**	**192**	**315**
B	**External wall - Ground**	9	**41.40**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0.176**		
A	**Roof/Ceiling - Ambient**	10	**106.49**	m²			**Roof/Ceiling - Ambient**	**0.093**	**-19**	**121**
B	**Floor slab / Basement ceiling**	11	**107.89**	m²			**Floor slab / Basement ceiling**	**0.157**		
		12	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*					
		13	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X				
X	**Basement Ceiling**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**83%**	**Basement Ceiling**			
							Thermal bridges - Overview	**Ψ [W/(mK)]**		
A	**Thermal bridges Ambient**	15	**205.51**	m	*Units in m*		**Thermal bridges Ambient**	**-0.024**		
P	**Perimeter thermal bridges**	16	**47.52**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**0.095**		
B	**Thermal bridges FS/BC**	17	**0.00**	m	*Units in m*		**Thermal bridges FS/BC**			
I	**Building element towards neigh**	18	**154.90**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**	0.446		
Total thermal envelope			**619.10**	**m²**			**Average therm. envelope**	**0.213**		

Go to building components list

50	**Level 2 Wall 13**	**8**	External wall - Ambient	**1**	x (		x		+	**4.94**	-		) -	**0.6**	=	4.3	**04ud-Side Wall - Masonry (western side)**	**0.206**	**150**	**90**	**South**	**0.70**	**0.60**	**0.90**
51	**Level 2 Wall 14**	**8**	External wall - Ambient	**1**	x (		x		+	**23.40**	-		) -	**0.0**	=	23.4	**04ud-Side Wall - Masonry (western side)**	**0.206**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**
52	**Level 3 Wall 1**	**8**	External wall - Ambient	**1**	x (		x		+	**14.80**	-		) -	**0.0**	=	14.8	**14ud-Penthouse N/S Wall**	**0.150**	**0**	**90**	**North**	**0.70**	**0.60**	**0.90**
53	**Level 3 Wall 2**	**8**	External wall - Ambient	**1**	x (		x		+	**11.92**	-		) -	**3.3**	=	8.6	**15ud-Penthouse E Wall**	**0.137**	**90**	**90**	**East**	**0.70**	**0.60**	**0.90**
54	**Level 3 Wall 3**	**8**	External wall - Ambient	**1**	x (		x		+	**14.80**	-		) -	**2.1**	=	12.7	**14ud-Penthouse N/S Wall**	**0.150**	**180**	**90**	**South**	**0.70**	**0.60**	**0.90**
55	**Level 3 Wall 4**	**8**	External wall - Ambient	**1**	x (		x		+	**11.92**	-		) -	**3.3**	=	8.6	**16ud-Penthouse West Wall**	**0.103**	**270**	**90**	**West**	**0.70**	**0.60**	**0.90**
56	**Level 2 Roof - Main**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**77.36**	-		) -	**1.4**	=	76.0	**05ud-Roof**	**0.090**	**0**	**0**	**Hor**	**0.70**	**0.60**	**0.90**
57	**Level 2 Roof - Terrace @ rear**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**11.90**	-		) -	**0.0**	=	11.9	**17ud-Terrace Roof**	**0.094**	**0**	**0**	**Hor**	**0.70**	**0.60**	**0.90**
58	**Level 3 Roof**	**10**	Roof/Ceiling - Ambient	**1**	x (		x		+	**18.63**	-		) -	**0.0**	=	18.6	**13ud-Penthouse Roof**	**0.105**	**0**	**0**	**Hor**	**0.70**	**0.60**	**0.90**
59					x (		x		+		-		) -	**0.0**	=									
60					x (		x		+		-		) -	**0.0**	=									
61					x (		x		+		-		) -	**0.0**	=									
62					x (		x		+		-		) -	**0.0**	=									
63					x (		x		+		-		) -	**0.0**	=									
64					x (		x		+		-		) -	**0.0**	=									
65					x (		x		+		-		) -	**0.0**	=									
66					x (		x		+		-		) -	**0.0**	=									
67					x (		x		+		-		) -	**0.0**	=									
68					x (		x		+		-		) -	**0.0**	=									
69					x (		x		+		-		) -	**0.0**	=									
70					x (		x		+		-		) -	**0.0**	=									
71					x (		x		+		-		) -	**0.0**	=									
72					x (		x		+		-		) -	**0.0**	=									
73					x (		x		+		-		) -	**0.0**	=									
74					x (		x		+		-		) -	**0.0**	=									
75					x (		x		+		-		) -	**0.0**	=									
76					x (		x		+		-		) -	**0.0**	=									
77					x (		x		+		-		) -	**0.0**	=									
78					x (		x		+		-		) -	**0.0**	=									
79					x (		x		+		-		) -	**0.0**	=									
80					x (		x		+		-		) -	**0.0**	=									
81					x (		x		+		-		) -	**0.0**	=									
82					x (		x		+		-		) -	**0.0**	=									
83					x (		x		+		-		) -	**0.0**	=									
84					x (		x		+		-		) -	**0.0**	=									
85					x (		x		+		-		) -	**0.0**	=									
86					x (		x		+		-		) -	**0.0**	=									
87					x (		x		+		-		) -	**0.0**	=									

Areas determination

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

Summary

Temp.-zone	Area group	Group no.	Area / Length	Unit	Comment		Building assembly overview	Average U-value [W/(m²K)]	Radiation-gains heating season [kWh/a] 7 Months
	Treated floor area	1	**239.79**	m²	*Treated floor area according to PHPP manual*				
A	**North windows**	2	**0.00**	m²			**North windows**		
A	**East windows**	3	**16.10**	m²	Results come from the 'Windows' worksheet.		**East windows**	**0.811**	**1363**
A	**South windows**	4	**23.19**	m²	Window areas are subtracted from individual opaque areas.		**South windows**	**0.843**	**1386**
A	**West windows**	5	**15.01**	m²	which is displayed in the 'Windows' worksheet.		**West windows**	**0.908**	**1201**
A	**Horizontal windows**	6	**1.40**	m²			**Horizontal windows**	**0.834**	**123**
A	**Exterior door**	7	**0.00**	m²	*Please subtract area of door from respective building assembly*		**Exterior door**		
A	**External wall - Ambient**	8	**307.62**	m²	*Temperature zone "A" is ambient air*		**External wall - Ambient**	**0.166**	**192**
B	**External wall - Ground**	9	**41.40**	m²	*Temperature zone "B" is the ground*		**External wall - Ground**	**0.176**	
A	**Roof/Ceiling - Ambient**	10	**106.49**	m²			**Roof/Ceiling - Ambient**	**0.093**	**-19**
B	**Floor slab / Basement ceiling**	11	**107.89**	m²			**Floor slab / Basement ceiling**	**0.157**	
		12	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*				
		13	**0.00**	m²	*Temperature zones "A", "B","P" and "X" may be used. NOT "I"*	Factor for X			
X	**Basement Ceiling**	14	**0.00**	m²	*Temperature zone "X": Please provide user-defined reduction factor (0 < ft < 1):*	**83%**	**Basement Ceiling**		
							Thermal bridges - Overview	**Ψ [W/(mK)]**	
A	**Thermal bridges Ambient**	15	**205.51**	m	*Units in m*		**Thermal bridges Ambient**	**-0.024**	
P	**Perimeter thermal bridges**	16	**47.52**	m	*Units in m; temperature zone "P" is perimeter (see 'Ground' worksheet)*		**Perimeter thermal bridges**	**0.095**	
B	**Thermal bridges FS/BC**	17	**0.00**	m	*Units in m*		**Thermal bridges FS/BC**		
I	**Building element towards neigh**	18	**154.90**	m²	*No heat losses, only considered for the heating load calculation*		**Building element towards neighbour**	0.446	
Total thermal envelope			**619.10**	**m²**			**Average therm. envelope**	**0.213**	

Go to building components list

Thermal bridge inputs

Sortierung ändern

No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [m]	-	Subtraction length [m]	)=	Length ℓ [m]	User determined psi value [W/(mK)]	User determined $f_{Rsi=0.25}$ (optional)	or	Selection building system	Ψ-Value [W/(mK)]	f_{Rsi}-Requirement met?
1	**Front Corner**	**15**	Thermal bridges Ambient	**1**	x (	**9.22**	-		) =	9.22	**-0.119**		or		**-0.119**	
2	**Rear Corner**	**15**	Thermal bridges Ambient	**2**	x (	**9.22**	-		) =	18.44	**-0.067**		or		**-0.067**	
3	**Bay Window Corner**	**15**	Thermal bridges Ambient	**2**	x (	**9.22**	-		) =	18.44	**-0.009**		or		**-0.009**	
4	**Slab-Foundation**	**16**	Perimeter thermal bridges	**1**	x (	**30.75**	-		) =	30.75	**0.140**		or		**0.140**	
5	**Penthouse NE/SE Corner**	**15**	Thermal bridges Ambient	**2**	x (	**3.08**	-		) =	6.15	**-0.038**		or		**-0.038**	
6	**Penthouse NW/SW Corner**	**15**	Thermal bridges Ambient	**2**	x (	**3.08**	-		) =	6.15	**-0.024**		or		**-0.024**	
7	**Side Wall / Main Roof - western half**	**15**	Thermal bridges Ambient	**1**	x (	**8.65**	-		) =	8.65	**-0.069**		or		**-0.069**	
8	**Side Wall / Main Roof - eastern half**	**15**	Thermal bridges Ambient	**1**	x (	**8.36**	-	**2.70**	) =	5.66	**-0.017**		or		**-0.017**	
9	**Penthouse N/S Wall/Roof**	**15**	Thermal bridges Ambient	**2**	x (	**4.81**	-		) =	9.62	**-0.050**		or		**-0.050**	
10	**Penthouse E Wall/Roof**	**15**	Thermal bridges Ambient	**1**	x (	**3.87**	-		) =	3.87	**-0.033**		or		**-0.033**	
11	**Penthouse W Wall/Roof**	**15**	Thermal bridges Ambient	**1**	x (	**3.87**	-		) =	3.87	**-0.036**		or		**-0.036**	
12	**Addition Wall / Terrace Roof**	**15**	Thermal bridges Ambient	**1**	x (	**14.03**	-	**4.23**	) =	9.80	**-0.036**		or		**-0.036**	
13	**Front Wall / Main Roof**	**15**	Thermal bridges Ambient	**1**	x (	**6.24**	-		) =	6.24	**-0.112**		or		**-0.112**	
14	**Side Wall / CMU Intersection**	**15**	Thermal bridges Ambient	**1**	x (	**6.32**	-		) =	6.32	**0.046**		or		**0.046**	
15	**Front Wall @ Neighbor**	**15**	Thermal bridges Ambient	**1**	x (	**9.22**	-		) =	9.22	**-0.001**		or		**-0.001**	
16	**Interior Corner + Rear Wall @ Neighbor**	**15**	Thermal bridges Ambient	**1**	x (	**9.22**	-		) =	9.22	**0.005**		or		**0.005**	
17	**Slab Edge @ Neighbor**	**16**	Perimeter thermal bridges	**1**	x (	**16.77**	-		) =	16.77	**0.012**		or		**0.012**	
18	**Wall/Floor Intersection @ Front Wall**	**15**	Thermal bridges Ambient	**2**	x (	**6.24**	-		) =	12.48	**0.002**		or		**0.002**	
19	**Wall/Floor Intersection @ Side Wall (Western Half)**	**15**	Thermal bridges Ambient	**2**	x (	**8.65**	-		) =	17.30	**-0.002**		or		**-0.002**	
20	**Wall/Floor Intersection @ Side Wall (Eastern Half)**	**15**	Thermal bridges Ambient	**2**	x (	**8.36**	-		) =	16.71	**0.003**		or		**0.003**	
21	**Wall/Floor Intersection @ Addition (North/South)**	**15**	Thermal bridges Ambient	**4**	x (	**5.00**	-		) =	20.02	**-0.002**		or		**-0.002**	
22	**Wall/Floor Intersection @ Addition (Eastern)**	**15**	Thermal bridges Ambient	**2**	x (	**4.02**	-		) =	8.05	**0.002**		or		**0.002**	
23	**Plumbing Vent Penetration**	**15**	Thermal bridges Ambient	**1**	x (	**0.06**	-		) =	0.06	**0.098**		or		**0.098**	
24					x (		-		) =				or			
25					x (		-		) =				or			
26					x (		-		) =				or			
27					x (		-		) =				or			
28					x (		-		) =				or			
29					x (		-		) =				or			
30					x (		-		) =				or			

Heat losses through the ground

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Building section 1

Ground characteristics			
Thermal conductivity	λ	2.0	W/(mK)
Heat capacity	ρc	2.0	MJ/(m³K)
Periodic penetration depth	δ	3.17	m

Climate data			
Avg indoor temp. winter	T_i	20.0	°C
Avg indoor temp. summer	T_i	25.0	°C
Avg ground surface temperature	$T_{g,ave}$	11.3	°C
Amplitude of $T_{g,ave}$	$T_{g,\wedge}$	14.6	°C
Phase shifting of $T_{e,m}$	τ	1.2	Months
Length of the heating period	n	6.2	Months
Heating degree hours - exterior	G_t	83.4	kKh/a

Building data				U-value floor slab/basement ceiling	U_f	0.157	W/(m²K)
Area of ground floor slab / basement	A	107.9	m²	TBs floor slab / basement ceiling	Ψ_B*l	-0.60	W/K
Perimeter length	P	30.8	m	U-value floor slab / basement ceiling	U_f'	0.151	W/(m²K)
Charact. dimension of floor slab	B'	7.01	m	Equivalent thickness floor	d_t	13.24	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)			
x	**Heated basement or floor slab completely / partially below ground level**						
	Basement wall height below ground l	z	1.35	m	U-Value wall below ground	U_{wB}	0.176 W/(m²K)
	Unheated basement						
	Height aboveground wall	h		m	U-Value wall above ground	U_W	W/(m²K)
	Basement wall height below ground l	z		m	U-Value wall below ground	U_{WB}	W/(m²K)
	Air change unheated basement	n	0.20	h^{-1}	U-Value basement floor slab	U_{fB}	W/(m²K)
	Air 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 -

Additional thermal bridge heat losses at perimeter				Steady-state fraction	$\Psi_{P,stat}$*l		W/K
Phase shift	β		Months	Harmonic fraction	$\Psi_{P,harm}$*l	0.000	W/K

Groundwater correction							
Depth of the groundwater table	z_w	3.0	m	Groundwater correction factor	G_w	1.01221291	-
Groundwater flow rate	q_w	0.05	m/d				

Interim results

Phase shift	β	1.41	Months	Steady-state heat flow	Φ_{stat}	166.5	W
Steady-state transmittance	L_S	19.19	W/K	Periodic heat flow	Φ_{harm}	47.2	W
Exterior periodic transmittance	L_{pe}	7.08	W/K	Heat losses during heating period	Q_{tot}	964	kWh
Transmittance building	L_0	23.60	W/K				

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

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	10.0	8.8	8.7	9.7	11.6	13.9	15.9	17.1	17.2	16.2	14.3	12.0	12.9
Summer	10.9	9.7	9.6	10.6	12.5	14.8	16.8	18.0	18.2	17.1	15.2	13.0	13.9

Design ground temperature for 'Heating load' worksheet 8.7 **For 'Cooling load' worksheet** 18.2

Reduction factor for 'Annual heating' worksheet 0.49

Total result (all building parts)

Phase shift	β	1.41	Months	Steady-state heat flow	Φ_{stat}	166.5	W
Steady-state transmittance	L_S	19.19	W/K	Periodic heat flow	Φ_{harm}	47.2	W
Exterior periodic transmittance	L_{pe}	7.08	W/K	Heat losses during heating period	Q_{tot}	964	kWh
Transmittance building	L_0	23.60	W/K	Charact. dimension of floor slab	B'	7.16	m

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

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg. value
Winter	10.0	8.8	8.7	9.7	11.6	13.9	15.9	17.1	17.2	16.2	14.3	12.0	12.9
Summer	10.9	9.7	9.6	10.6	12.5	14.8	16.8	18.0	18.2	17.1	15.2	13.0	13.9

Design ground temperature for 'Heating load' worksheet 8.7 **For 'Cooling load' worksheet** 18.2

Reduction factor for 'Annual heating' worksheet 0.49

Building assemblies (U-Values)

Recommended starting values for optimisation: U-values for walls and roofs | Floor slabs: 0.15 W/(m²K) | 0.38 W/(m²K)

		1			
ID	Building system	Building assembly	Total thickness	U-Value	Interior insulation
	Summary of the constructions calculated in 'U values' worksheet		m	W/(m²K)	-
01ud	Basement Slab	Basement Slab	0.279	0.157	0
02ud	Below Grade Foundation - Existing - South/V	Below Grade Foundation - Existing - South/V	0.524	0.166	1
03ud	Front Wall	Front Wall	0.486	0.228	1
04ud	Side Wall - Masonry (western side)	Side Wall - Masonry (western side)	0.397	0.206	1
05ud	Second Floor Main Roof	Second Floor Main Roof	0.486	0.090	0
06ud	Addition Wall	Addition Wall	0.349	0.172	0
07ud	Party Wall	Party Wall	0.105	0.446	0
08ud	Existing Above Grade Foundation - South	Existing Above Grade Foundation - South	0.549	0.103	0
09ud	Side Wall - Masonry (eastern side)	Side Wall - Masonry (eastern side)	0.575	0.141	0
10ud	New Foundation (below grade)	New Foundation (below grade)	0.397	0.196	0

Glazing

Glazing

	Recommended glazing type to start planning: Triple thermally insulated glazing (Please consider the comfort criterion!)		
ID	Description	g-Value	U_g-Value
			W/(m²K)
01ud	Saint-Gobin 52mm Triple glazing VT 64%	0.61	0.57
02ud	Skylight Glass	0.31	0.64

Window frames

Wind

		U-Value				Frame width				Glazing edge thermal bridge				Installation thermal bridge			
ID	Description	left	right	bottom	above	left	right	bottom	above	$\Psi_{Glazing\ edge}$ left	$\Psi_{Glazing\ edge}$ right	$\Psi_{Glazing\ edge}$ bottom	$\Psi_{Glazing\ edge}$ top	$\Psi_{Installation}$ left	$\Psi_{Installation}$ right	$\Psi_{Installation}$ bottom	$\Psi_{Installation}$ top
		W/(m²K)	W/(m²K)	W/(m²K)	W/(m²K)	m	m	m	m	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)	W/(mK)
01ud	Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.76	0.76	0.76	0.76	0.102	0.102	0.102	0.102	0.024	0.024	0.024	0.024	0.040	0.040	0.040	0.040
02ud	Lamilux Skylight	0.61	0.61	0.61	0.61	0.116	0.116	0.116	0.116	0.029	0.029	0.029	0.029	0.040	0.040	0.040	0.040
03ud	Klearwall Future Proof Door	0.90	0.90	1.90	0.90	0.150	0.150	0.143	0.150	0.030	0.030	0.030	0.030	0.040	0.040	0.040	0.040
04ud	Windows in Side Wall - Western	0.76	0.76	0.76	0.76	0.102	0.102	0.102	0.102	0.024	0.024	0.024	0.024	0.013	0.013	0.016	0.017
05ud	Windows in Side Wall - Eastern	0.76	0.76	0.76	0.76	0.102	0.102	0.102	0.102	0.024	0.024	0.024	0.024	0.017	0.017	0.019	0.019
06ud	Windows in Addition	0.76	0.76	0.76	0.76	0.102	0.102	0.102	0.102	0.024	0.024	0.024	0.024	-0.008	-0.008	-0.004	-0.006

Ventilation units with heat recovery

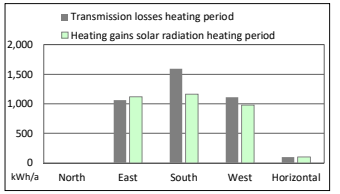
Ventilation units with hea

	Recommended specifications to start planning: Frost protection: Yes; Humidity recovery: Yes	75 %		0.45	Additional Device Data							
ID	Description	Effective heat recovery efficiency	Humidity recovery efficiency	Electric efficiency	Application range		External pressure per section	Fittings Dp_{intern}	Frost protection necessary	Noise protection		
	User defined area	%	%	Wh/m³	m³/h	m³/h	Pa	Pa		35 dB(A)	Supply air dB(A)	Extract air dB(A)
01ud	Zehnder - ComfoAir550, ComfoD550, WHR960	75%	60%	0.31	110	308	100	incl.	yes	/	48	48

Windows

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Window area orientation	Global radiation (main orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	g-Value	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation		Transmission losses heating period	Heating gains solar radiation heating period
Standard values →	kWh/(m²a)	0.75	0.95	0.85				m²	W/(m²K)	m²	kWh/(m²a)		kWh/a	kWh/a
North	111	1.00	0.95	0.85	0.00	0.00	0.00	0.00	0.00	0.00	111	North	0	0
East	298	0.73	0.95	0.85	0.64	0.61	0.38	16.10	0.79	10.37	298	East	1061	1118
South	577	0.30	0.95	0.85	0.61	0.61	0.15	23.19	0.82	14.09	561	South	1593	1165
West	295	0.80	0.95	0.85	0.62	0.61	0.40	15.01	0.89	9.26	270	West	1112	981
Horizontal	461	1.00	0.95	0.85	0.62	0.31	0.50	1.40	0.86	0.87	461	Horizontal	101	100
Total or average value for all windows.						0.60	0.29	55.70	0.83	34.58			3866	3364



Recommendation for $U_{W,installed}$ [W/(m²K)]

0.74	0.89	0.97	0.41

Heating degree hours [kKh/a]: 83.4

Go to glazing list
Go to window frames list

Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Window rough openings: Width	Window rough openings: Height	Installed in: Selection from 'Areas' worksheet	Glazing: Selection from 'Components' worksheet	Frame: Selection from 'Components' worksheet	g-Value: Perpen-dicular radiation	U-Value: Glazing	U-Value: Frames (avg.)	Ψ Glazing edge (Avg.)	Installation situation: left	right	bottom	top	Ψ Installation (Avg.)	Results: Window Area	Glazing area	U_w installed	Glazed fraction per window
		°	°		m	m		1-Sorting: LIKE LIST	1-Sorting: LIKE LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0				W/(mK)	m²	m²	W/(m²K)	%
1	Level 0/Azimuth90/ B10/Wall 9	90	90	East	1.346	1.715	15-Level 0 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	1	1	1	-0.007	2.3	1.73	0.65	75%
1	Level 0/Azimuth90/B1D1/Wall 9	90	90	East	1.026	2.134	15-Level 0 Wall 9	01ud-Klearwall Glass	03ud-Klearwall Future Proof Door	0.61	0.57	1.07	0.030	1	1	1	1	0.040	2.2	1.34	0.95	61%
1	Level 1/Azimuth90/F1-8a/Wall 9	90	90	East	1.346	2.134	32-Level 1 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	1	1	0	-0.007	2.9	2.20	0.65	77%
1	Level 1/Azimuth90/F1-8b/Wall 9	90	90	East	1.346	0.556	32-Level 1 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	1	0	1	-0.007	0.7	0.40	0.73	54%
1	Level 1/Azimuth90/F1-D2/Wall 9	90	90	East	1.051	2.134	32-Level 1 Wall 9	01ud-Klearwall Glass	03ud-Klearwall Future Proof Door	0.61	0.57	1.07	0.030	1	1	1	0	0.040	2.2	1.38	0.93	62%
1	Level 1/Azimuth90/F1-D3T/Wall 9	90	90	East	1.051	0.495	32-Level 1 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	1	0	1	-0.007	0.5	0.25	0.75	47%
1	Level 2/Azimuth90/2F-10a/Wall 9	90	90	East	0.673	1.410	46-Level 2 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	0	1	1	-0.006	0.9	0.57	0.71	60%
1	Level 2/Azimuth90/2F-10b/Wall 9	90	90	East	0.673	1.410	46-Level 2 Wall 9	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	0	1	1	1	-0.006	0.9	0.57	0.71	60%
2	Level 3/Azimuth90/3F/Wall 2	90	90	East	0.673	0.800	53-Level 3 Wall 2	01ud-Klearwall Glass	06ud-Windows in Addition	0.61	0.57	0.76	0.024	1	0	1	1	-0.006	1.1	0.56	0.73	52%
1	Level 3/Azimuth90/F3-D3/Wall 2	90	90	East	1.051	2.134	53-Level 3 Wall 2	01ud-Klearwall Glass	03ud-Klearwall Future Proof Door	0.61	0.57	1.07	0.030	1	1	1	1	0.040	2.2	1.38	0.95	62%
1	Level 0/Azimuth150/B6/Wall 12	150	90	South	0.775	0.622	21-Level 0 Wall 12b	01ud-Klearwall Glass	04ud-Windows in Side Wall - Western	0.61	0.57	0.76	0.024	1	1	1	1	0.015	0.5	0.24	0.85	50%
1	Level 1/Azimuth150/F1-4a/Wall 13	150	90	South	1.029	1.562	36-Level 1 Wall 13	01ud-Klearwall Glass	04ud-Windows in Side Wall - Western	0.61	0.57	0.76	0.024	1	1	1	0	0.014	1.6	1.12	0.73	70%
1	Level 1/Azimuth150/F1-4b/Wall 13	150	90	South	1.029	0.406	36-Level 1 Wall 13	01ud-Klearwall Glass	04ud-Windows in Side Wall - Western	0.61	0.57	0.76	0.024	1	1	0	1	0.016	0.4	0.17	0.87	40%
1	Level 2/Azimuth150/2F5/Wall 13	150	90	South	0.775	0.775	50-Level 2 Wall 13	01ud-Klearwall Glass	04ud-Windows in Side Wall - Western	0.61	0.57	0.76	0.024	1	1	1	1	0.015	0.6	0.33	0.82	54%
2	Level 0/Azimuth180/B4/B5/Wall 13	180	90	South	0.953	0.775	23-Level 0 Wall 13b	01ud-Klearwall Glass	04ud-Windows in Side Wall - Western	0.61	0.57	0.76	0.024	1	1	1	1	0.015	1.5	0.85	0.81	58%
1	Level 0/Azimuth180/B7/Wall 11	180	90	South	0.775	0.622	19-Level 0 Wall 11b	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	1	0.018	0.5	0.24	0.87	50%
1	Level 0/Azimuth180/B8/Wall 11	180	90	South	0.775	0.622	19-Level 0 Wall 11b	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	1	0.018	0.5	0.24	0.87	50%
1	Level 0/Azimuth180/B9/Wall 10	180	90	South	0.775	0.632	17-Level 0 Wall 10b	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	0.5	0.24	0.99	50%
2	Level 1/Azimuth180/F1-5a/F1-6a/Wall 12	180	90	South	1.029	1.562	35-Level 1 Wall 12	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	0	0.017	3.2	2.24	0.74	70%
2	Level 1/Azimuth180/F1-5b/F1-6b/Wall 12	180	90	South	1.029	0.406	35-Level 1 Wall 12	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	0	1	0.018	0.8	0.33	0.88	40%
2	Level 1/Azimuth180/F1-7a/Wall 10	180	90	South	0.978	1.410	33-Level 1 Wall 10	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	0	1	1	0.040	2.8	1.87	0.80	68%
1	Level 1/Azimuth180/F1-7b/Wall 10	180	90	South	0.978	1.410	33-Level 1 Wall 10	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	0	0	1	1	0.040	1.4	0.93	0.76	68%
1	Level 2/Azimuth180/2F-6/Wall 12	180	90	South	0.775	0.775	49-Level 2 Wall 12	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	1	0.018	0.6	0.33	0.84	54%

Heating degree hours [kKh/a]: 83.4

Quan-tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Window rough openings: Width	Window rough openings: Height	Installed in	Glazing	Frame	g-Value	U-Value		Ψ Glazing edge	Installation situation					Results			
														user determined value for $\Psi_{installation}$ or '1': $\Psi_{installation}$ from 'Components' worksheet '0': in the case of abutting windows								
		Perpen-dicular radiation	Glazing	Frames (avg.)	$\Psi_{Glazing\ edge}$ (Avg.)	left	right	bottom	top	$\Psi_{Installation}$ (Avg.)	Window Area	Glazing area	U_w installed	Glazed fraction per window								
		°	°		m	m	Selection from 'Areas' worksheet	1-Sorting: LIKE LIST	1-Sorting: LIKE LIST	-	W/(m²K)	W/(m²K)	W/(mK)	W/(mK) or 1/0					W/(mK)	m²	m²	W/(m²K)	%
1	Level 2/Azimuth180/2F-7/Wall 12	180	90	South	0.749	1.410	49-Level 2 Wall 12	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	1	0.018	1.1	0.66	0.79	62%
1	Level 2/Azimuth180/2F-8/Wall 11	180	90	South	0.749	1.410	48-Level 2 Wall 11	01ud-Klearwall Glass	05ud-Windows in Side Wall - Eastern	0.61	0.57	0.76	0.024	1	1	1	1	0.018	1.1	0.66	0.79	62%
1	Level 2/Azimuth180/2F-9/Wall 10	180	90	South	0.749	1.410	47-Level 2 Wall 10	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	1.1	0.66	0.88	62%
2	Level 3/Azimuth180/3Fa/Wall 3	180	90	South	0.749	1.410	54-Level 3 Wall 3	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	2.1	1.31	0.88	62%
1	Level 0/Azimuth225/B3/Wall 2	225	90	South	0.699	0.622	3-Level 0 Wall 2	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	0.4	0.21	1.01	48%
1	Level 1/Azimuth225/F1-3a/Wall 2	225	90	South	0.673	1.562	25-Level 1 Wall 2	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	0	0.040	1.1	0.64	0.87	61%
1	Level 1/Azimuth225/F1-3b/Wall 2	225	90	South	0.673	0.406	25-Level 1 Wall 2	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	0	1	0.040	0.3	0.09	1.03	35%
1	Level 2/Azimuth225/2F-3a/Wall 2	225	90	South	0.673	1.562	39-Level 2 Wall 2	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	0	0.040	1.1	0.64	0.87	61%
1	Level 2/Azimuth225/2F-3b/Wall 2	225	90	South	0.673	0.406	39-Level 2 Wall 2	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	0	1	0.040	0.3	0.09	1.03	35%
1	Level 0/Azimuth270/B2/Wall 3	270	90	West	1.105	0.622	5-Level 0 Wall 3b	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	0.7	0.38	0.95	55%
1	Level 1/Azimuth270/D10/Wall 1	270	90	West	1.051	2.286	24-Level 1 Wall 1	01ud-Klearwall Glass	03ud-Klearwall Future Proof Door	0.61	0.57	1.07	0.030	1	1	1	0	0.040	2.4	1.50	0.92	62%
1	Level 1/Azimuth270/W08/Wall 1	270	90	West	1.051	0.406	24-Level 1 Wall 1	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	0	1	0.040	0.4	0.17	0.98	40%
1	Level 1/Azimuth270/F1-2/Wall 3	270	90	West	1.105	1.969	26-Level 1 Wall 3	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	2.2	1.59	0.79	73%
1	Level 2/Azimuth270/2F-4/Wall 1	270	90	West	0.953	0.775	38-Level 2 Wall 1	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	0.7	0.43	0.92	58%
1	Level 2/Azimuth270/2F-2/Wall 3	270	90	West	1.105	1.969	40-Level 2 Wall 3	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	2.2	1.59	0.79	73%
2	Level 3/Azimuth270/3F-4/Wall 4	270	90	West	0.673	0.800	55-Level 3 Wall 4	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	0	1	1	0.040	1.1	0.56	0.91	52%
1	Level 3/Azimuth270/F3-D4/Wall 4	270	90	West	1.051	2.134	55-Level 3 Wall 4	01ud-Klearwall Glass	03ud-Klearwall Future Proof Door	0.61	0.57	1.07	0.030	1	1	1	1	0.040	2.2	1.38	0.95	62%
1	Level 0/Azimuth315/B1/Wall 4	315	90	West	0.699	0.622	7-Level 0 Wall 4b	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	1	0.040	0.4	0.21	1.01	48%
1	Level 1/Azimuth315/F1-1a/Wall 4	315	90	West	0.673	1.562	27-Level 1 Wall 4	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	0	0.040	1.1	0.64	0.87	61%
1	Level 1/Azimuth315/F1-1b/Wall 4	315	90	West	0.673	0.406	27-Level 1 Wall 4	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	0	1	0.040	0.3	0.09	1.03	35%
1	Level 2/Azimuth315/2F-1a/Wall 4	315	90	West	0.673	1.562	41-Level 2 Wall 4	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	1	0	0.040	1.1	0.64	0.87	61%
1	Level 2/Azimuth315/2F-1b/Wall 4	315	90	West	0.673	0.406	41-Level 2 Wall 4	01ud-Klearwall Glass	01ud-Munster Joinery - PassiV Future Proof - Super Spacer TriSeal / T-Spacer Premium	0.61	0.57	0.76	0.024	1	1	0	1	0.040	0.3	0.09	1.03	35%
1	SK01	0	0	Horizontal	1.727	0.813	56-Level 2 Roof	02ud-Skylight Glass	02ud-Lamilux Skylight	0.31	0.64	0.61	0.029	1	1	1	1	0.040	1.4	0.87	0.86	62%

Calculation of shading coefficients

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Latitude: 41.83 °

Orientation	Glazing area [m²]	Reduction factor winter r_v	Reduction factor cooling $r_{v,1}$	Reduction factor cooling load $r_{v,2}$	Solar load [kWh/(m²$_{Glazing}$a)]
North	0.00	100%	100%	100%	0
East	11.61	73%	70%	67%	175
South	17.52	29%	47%	45%	118
West	9.60	71%	69%	66%	163
Horizontal	0.87	100%	100%	100%	224

								Horizon		Lateral reveal		Reveal / Overhang						Reduction factors for shading in winter				Reduction factors for shading in summer				
Quantity	Description	Deviation from North	Angle of inclination from the horizontal	Orientation	Glazing width	Glazing height	Glazing area	Height of the shading object	Horizontal distance	Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	Additional reduction factor winter shading	Additional reduction factor summer shading	Reduction factor z for temporary sun protection	Regulated / transparent	Horizon	Reveal	Overhang	Total for heating case	Horizon	Reveal	Overhang	Total for cooling case	Total for cooling load
		[Degree]	[Degree]		w_G [m]	h_G [m]	A_G [m²]	h_{Hori} [m]	d_{Hori} [m]	o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	$r_{other,w}$ [%]	$r_{other,s}$ [%]	z [%]		r_H [%]	r_R [%]	r_O [%]	r_S [%]	r_H [%]	r_R [%]	r_O [%]	$r_{S,1}$ [%]	$r_{S,2}$ [%]
1	Level 0/Azimuth90/ B	90	90	East	1.32	1.51	2.0	0.65	2.62	0.10	0.102	0.10	0.10			80%		81%	95%	97%	74%	85%	98%	99%	71%	68%
1	Level 0/Azimuth90/B1	90	90	East	0.61	1.99	1.2	1.12	2.62	0.10	0.102	1.27	0.49			80%		70%	91%	78%	49%	75%	97%	79%	50%	47%
1	Level 1/Azimuth90/F1	90	90	East	1.56	1.86	2.9	9.75	36.58	0.10	0.102	0.10	0.10			80%		80%	95%	97%	74%	84%	98%	100%	70%	67%
1	Level 1/Azimuth90/F1	90	90	East	1.56	0.41	0.6	8.15	36.58	0.10	0.102	0.10	0.10			80%		83%	95%	91%	71%	86%	98%	96%	70%	66%
1	Level 1/Azimuth90/F1	90	90	East	0.61	1.84	1.1	9.37	36.58	0.10	0.150	0.10	0.15			80%		80%	91%	97%	71%	84%	97%	100%	70%	67%
1	Level 1/Azimuth90/F1	90	90	East	0.71	0.41	0.3	8.15	36.58	0.10	0.102	0.10	0.10			80%		83%	91%	91%	69%	86%	97%	96%	69%	65%
1	Level 2/Azimuth90/2F	90	90	East	0.66	1.32	0.9	3.07	22.80	0.10	0.102	0.10	0.10			80%		89%	91%	96%	78%	91%	97%	99%	75%	72%
1	Level 2/Azimuth90/2F	90	90	East	0.66	1.32	0.9	3.07	36.58	0.10	0.102	0.10	0.10			80%		93%	91%	96%	81%	94%	97%	99%	78%	74%
2	Level 3/Azimuth90/3F	90	90	East	0.62	0.61	0.7			0.10	0.102	0.61	1.13			80%			91%	88%	80%		97%	93%	77%	74%
1	Level 3/Azimuth90/F3	90	90	East	0.51	1.84	0.9			0.10	0.150	0.61	1.13			80%			90%	92%	83%		97%	96%	80%	76%
1	Level 0/Azimuth150/B	150	90	South	0.67	0.42	0.3	8.15	2.24	0.10	0.102	0.10	0.10			80%		13%	93%	93%	11%	38%	94%	89%	28%	26%
1	Level 1/Azimuth150/F	150	90	South	0.81	1.50	1.2	6.10	2.24	0.10	0.102	0.10	0.10			80%		16%	94%	97%	14%	45%	95%	98%	36%	35%
1	Level 1/Azimuth150/F	150	90	South	0.81	0.18	0.1	4.34	2.24	0.10	0.102	0.10	0.10			80%		21%	94%	89%	18%	54%	95%	76%	34%	32%
1	Level 2/Azimuth150/2	150	90	South	0.71	0.65	0.5	1.83	2.24	0.10	0.102	0.10	0.10			80%		53%	94%	95%	47%	75%	94%	94%	57%	54%
2	Level 0/Azimuth180/B	180	90	South	0.77	0.60	0.9	8.15	1.91	0.10	0.102	0.10	0.10			80%		10%	95%	95%	9%	39%	93%	92%	29%	27%
1	Level 0/Azimuth180/B	180	90	South	0.71	0.53	0.4	8.15	2.55	0.10	0.102	0.10	0.10			80%		12%	94%	94%	10%	47%	93%	90%	34%	32%
1	Level 0/Azimuth180/B	180	90	South	0.71	0.53	0.4	8.15	2.55	0.10	0.102	0.10	0.10			80%		12%	94%	94%	10%	47%	93%	90%	34%	32%
1	Level 0/Azimuth180/B	180	90	South	0.71	0.53	0.4	8.76	2.55	0.10	0.102	0.10	0.10			80%		11%	94%	94%	10%	45%	93%	90%	32%	31%
2	Level 1/Azimuth180/F	180	90	South	0.94	1.50	2.8	8.23	2.55	0.10	0.102	0.10	0.10			80%		12%	96%	98%	11%	46%	94%	98%	37%	35%
2	Level 1/Azimuth180/F	180	90	South	0.94	0.18	0.3	5.79	2.55	0.10	0.102	0.10	0.10			80%		16%	96%	90%	13%	56%	94%	71%	33%	31%
2	Level 1/Azimuth180/F	180	90	South	0.86	1.32	2.3	6.25	2.55	0.10	0.102	0.10	0.10			80%		14%	95%	97%	13%	54%	94%	98%	43%	41%
1	Level 1/Azimuth180/F	180	90	South	1.12	1.32	1.5	6.25	2.55	0.10	0.102	0.10	0.10			80%		14%	96%	97%	13%	54%	95%	98%	43%	41%
1	Level 2/Azimuth180/2	180	90	South	0.48	0.69	0.3	2.57	2.55	0.10	0.102	0.10	0.10			80%		42%	93%	95%	37%	76%	91%	93%	55%	53%
1	Level 2/Azimuth180/2	180	90	South	0.66	1.32	0.9	3.35	2.55	0.10	0.102	0.10	0.10			80%		30%	94%	97%	28%	70%	93%	98%	55%	52%
1	Level 2/Azimuth180/2	180	90	South	0.66	1.32	0.9	3.35	2.55	0.10	0.102	0.10	0.10			80%		30%	94%	97%	28%	70%	93%	98%	55%	52%
1	Level 2/Azimuth180/2	180	90	South	0.66	1.32	0.9	3.35	2.55	0.10	0.102	0.10	0.10			80%		30%	94%	97%	28%	70%	93%	98%	55%	52%
2	Level 3/Azimuth180/3	180	90	South	0.61	1.21	1.5			0.10	0.102	0.61	0.79			80%			94%	91%	86%		92%	79%	62%	59%
1	Level 0/Azimuth225/B	225	90	South	0.56	0.42	0.2	8.15	35.14	0.10	0.102	0.10	0.10			80%		88%	92%	92%	74%	90%	94%	91%	66%	63%
1	Level 1/Azimuth225/F	225	90	South	0.56	1.35	0.8	6.12	35.14	0.10	0.102	0.10	0.10			80%		91%	92%	97%	81%	92%	94%	98%	73%	70%
1	Level 1/Azimuth225/F	225	90	South	0.56	0.35	0.2	5.64	35.14	0.10	0.102	0.10	0.10			80%		92%	92%	91%	77%	93%	94%	89%	67%	64%
1	Level 2/Azimuth225/2	225	90	South	0.56	1.21	0.7	3.81	35.14	0.10	0.102	0.10	0.10			80%		95%	92%	96%	84%	95%	94%	98%	75%	72%
1	Level 2/Azimuth225/2	225	90	South	0.56	0.35	0.2	1.52	35.14	0.10	0.102	0.10	0.10			80%		98%	92%	91%	82%	98%	94%	89%	71%	67%
1	Level 0/Azimuth270/B	270	90	West	0.90	0.42	0.4	8.15	35.14	0.10	0.102	0.10	0.10			80%		82%	93%	91%	69%	86%	97%	96%	69%	65%
1	Level 1/Azimuth270/D	270	90	West	0.61	1.84	1.1	9.75	35.14	0.10	0.102	0.10	0.10			80%		79%	91%	97%	69%	83%	97%	100%	69%	66%
1	Level 1/Azimuth270/W	270	90	West	0.71	0.32	0.2	4.57	35.14	0.10	0.102	0.10	0.10			80%		89%	91%	89%	73%	92%	97%	94%	72%	69%
1	Level 1/Azimuth270/F	270	90	West	1.02	1.90	1.9	6.12	35.14	0.10	0.102	0.10	0.10			80%		86%	94%	97%	78%	89%	98%	100%	74%	71%
1	Level 2/Azimuth270/2	270	90	West	0.71	0.57	0.4	1.68	35.14	0.10	0.102	0.10	0.10			80%		96%	91%	93%	81%	97%	97%	97%	78%	75%
1	Level 2/Azimuth270/2	270	90	West	1.02	1.76	1.8	28.80	35.14	0.10	0.102	0.10	0.10			80%		52%	94%	97%	47%	60%	98%	100%	50%	48%
2	Level 3/Azimuth270/3	270	90	West	0.62	0.60	0.7			0.10	0.102	0.61	1.13			80%			91%	88%	80%		97%	93%	77%	74%
1	Level 3/Azimuth270/F	270	90	West	0.51	1.84	0.9			0.10	0.150	0.61	1.13			80%			90%	92%	83%		97%	96%	80%	76%

Ventilation data

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Treated floor area A_{TFA}	m²	240		*('Areas' worksheet)*
Room height h	m	2.50	2.50	
Volume of ventilated space (A_{TFA}*h) V_V	m³	599		*(Worksheet 'Annual heating')*

Ventilation type

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

Infiltration air change rate

Wind protection coefficients e and f		
Coefficient e for wind protection class	Several side exposed	One side exposed
No protection	0.10	0.03
Moderate protection	0.07	0.02
High protection	0.04	0.01
Coefficient f	15	20

			For annual demand:	For heating load:				
Wind protection coefficient, e			0.07	0.18				
Wind protection coefficient, f			15	15	Net air volume for press. test	V_{n50}	Air permeability	q_{50}
Air change rate at press. test	n_{50}	1/h	0.65	0.65	703	m³	0.73	m³/(hm²)

			For annual demand:	For heating load:
Excess extract air		1/h	0.00	0.00
Infiltration air change rate	$n_{V,Rest}$	1/h	**0.053**	**0.133**

Selection of ventilation input - Results

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

	Ventilation unit / Heat recovery efficiency design		Average air flow rate m³/h	Average air change rate 1/h	Extract air excess (extract air system) 1/h	Effective heat recovery efficiency unit [-]	Humidity recovery efficiency [-]	Specific power input Wh/m³	Heat recovery efficiency SHX [-]
x	Standard design	*('Ventilation' worksheet, see below)*	**191**	**0.32**	**0.00**	**72.8%**	**60.0%**	**0.31**	**0.0%**
	Multiple ventilation units, non-res	*('Addl vent' worksheet)*							

Cooling recovery	Efficiency SHX η*SHX
	0%

Average interior humidity during winter operation

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29%	31%	38%	47%	-	-	-	-	-	55%	42%	33%

Specific energy for heating (annual method)

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Interior temperature: 20.0 °C
Building type: Single family, semi-detached, masc
Treated floor area A_{TFA}: 239.8 m²

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Temp. factor f_t		G_t kKh/a		kWh/a	Per m² of treated floor area
External wall - Ambient	A	307.6	*	0.166	*	1.00	*	83.4	=	4260	17.77
External wall - Ground	B	41.4	*	0.176	*	0.54	*	83.4	=	328	1.37
Roof/Ceiling - Ambient	A	106.5	*	0.093	*	1.00	*	83.4	=	827	3.45
Floor slab / Basement ceiling	B	107.9	*	0.157	*	0.54	*	83.4	=	761	3.17
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
Basement Ceiling	X		*		*	0.83	*		=		
Windows	A	55.7	*	0.833	*	1.00	*	83.4	=	3866	16.12
Exterior door	A		*		*	1.00	*		=		
Exterior TB (length/m)	A	205.5	*	-0.024	*	1.00	*	83.4	=	-418	-1.74
Perimeter TB (length/m)	P	47.5	*	0.095	*	0.54	*	83.4	=	203	0.85
Ground TB (length/m)	B		*		*	0.54	*		=		0.00
Total of all building envelope areas		619.1									kWh/(m²a)
Transmission heat losses Q_T									Total	9827	41.0

		A_{TFA} m²		Clear room height m	=	m³
Ventilation system:	Effective air volume, V_V	239.8	*	2.50	=	599.5
Effective heat recovery efficiency	η_{eff} 73%					
Efficiency of subsoil heat exchanger						
Heat recovery efficiency of SHX	η_{SHX} 0%					

	$n_{V,system}$ 1/h		η_{HR}		$n_{V,Res}$ 1/h	=	1/h
Energetically effective air changes nV	0.319	* (1 -	0.73	) +	0.053	=	0.140

	V_V m³		n_V 1/h		c_{Air} Wh/(m³K)		G_t kKh/a	=	kWh/a	kWh/(m²a)
Ventilation heat losses Q_V	599.5	*	0.140	*	0.33	*	83.4	=	2308	9.6

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend Saving	=	kWh/a	kWh/(m²a)
Total heat losses Q_L	(9827	+	2308	)	1.0	=	12135	**50.6**

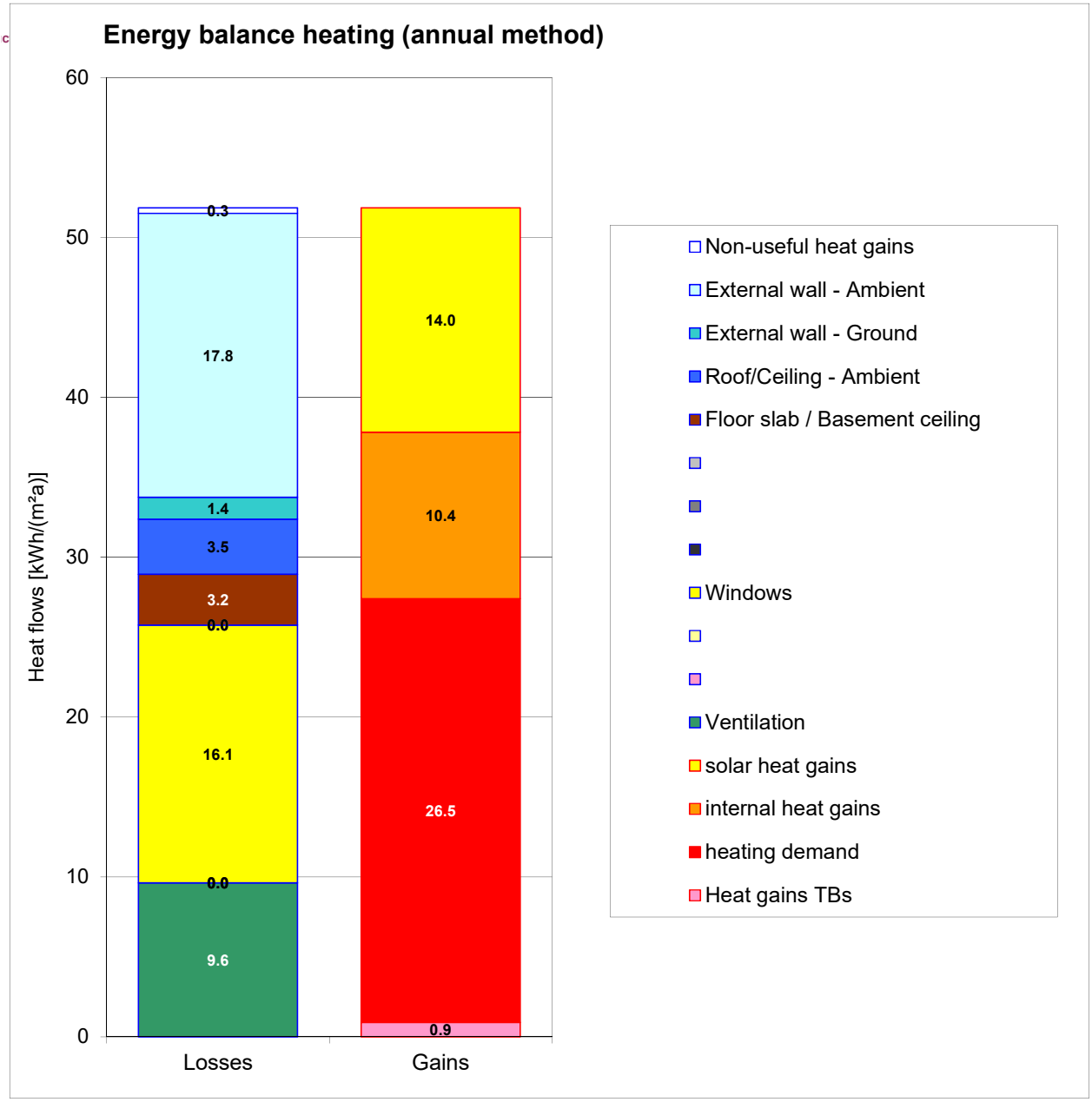
Orientation of the area	Reduction factor See 'Windows' sheet		g-Value (perp. radiation)		Area m²		Radiation HP kWh/(m²a)	=	kWh/a
North	0.00	*	0.00	*	0.00	*	111	=	0
East	0.38	*	0.61	*	16.10	*	298	=	1118
South	0.15	*	0.61	*	23.19	*	561	=	1165
West	0.40	*	0.61	*	15.01	*	270	=	981
Horizontal	0.50	*	0.31	*	1.40	*	461	=	100
Available solar heat gains Q_S								Total	3364

	kh/d		Length heating period d/a		Spec. power q_I W/m²		A_{TFA} m²	=	kWh/a	kWh/(m²a)
Internal heat gains Q_I	0.024	*	188	*	2.31	*	239.8	=	2496	10.4

			kWh/a	kWh/(m²a)
Free heat Q_F	$Q_S + Q_I$	=	5860	24.4
Ratio of free heat to losses	Q_F / Q_V	=	0.48	
Utilisation factor heat gains h_G	$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6)$	=	99%	
Heat gains Q_G	$\eta_G * Q_F$	=	5779	**24.1**

			kWh/a	kWh/(m²a)
Annual heating demand Q_H	$Q_L - Q_G$	=	6356	**27**

	kWh/(m²a)		(Yes/No)
Limiting value	25	**Requirement met?**	**No**


Energy balance heating (annual method)
Heat flows [kWh/(m²a)]
60
50
40
30
20
10
0
0.3
17.8
1.4
3.5
3.2
0.0
16.1
0.0
9.6
14.0
10.4
26.5
0.9
Losses
Gains
Non-useful heat gains
External wall - Ambient
External wall - Ground
Roof/Ceiling - Ambient
Floor slab / Basement ceiling
Windows
Ventilation
solar heat gains
internal heat gains
heating demand
Heat gains TBs

Specific energy for heating (monthly method)

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

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

Interior temperature:	20	°C
Building type:	Single family, semi-detached,	
Treated floor area A_{TFA}:	239.8	m²
Spec. Capacity:	204	Wh/(m²K)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Month. red. fac.		G_t kKh/a		kWh/a	Per m² of treated floor area
External wall - Ambient	A	307.6	*	0.166	*	1.00	*	90	=	4592	19.15
External wall - Ground	B	41.4	*	0.176	*	1.00	*	48	=	346	1.44
Roof/Ceiling - Ambient	A	106.5	*	0.093	*	1.00	*	90	=	892	3.72
Floor slab / Basement ceiling	B	107.9	*	0.157	*	1.00	*	48	=	804	3.35
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
Basement Ceiling	X		*		*	0.83	*		=		
Windows	A	55.7	*	0.833	*	1.00	*	90	=	4168	17.38
Exterior door	A		*		*	1.00	*		=		
Exterior TB (length/m)	A	205.5	*	-0.024	*	1.00	*	90	=	-451	-1.88
Perimeter TB (length/m)	P	47.5	*	0.095	*	1.00	*	48	=	214	0.89
Ground TB (length/m)	B		*		*	1.00	*		=		0.00
											kWh/(m²a)
Transmission heat losses Q_T									Total	10566	44.1

	Effective air volume V_V	A_{TFA} m²		Clear room height m		m³
		240	*	2.50	=	599

	$n_{V,system}$ 1/h		η*SHX		η_{HR}		$n_{V,Res}$ 1/h		$n_{V,equi,fraction}$ 1/h
Effective air change rate Ambient nV,e	0.319	*(1-	0%	)*(1-	0.73	)+	0.053	=	0.140
Effective air change rate Ground nV,g	0.319	*	0%	*(1-	0.73	)		=	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	599	*	0.140	*	0.33	*	90	=	2488	10.4
Ventilation losses ground $Q_{V,e}$	599	*	0.000	*	0.33	*	44	=	0	0.0
Ventilation heat losses Q_V								Total	2488	10.4

	Q_T kWh/a		Q_V kWh/a		Reduction factor night/weekend saving		kWh/a	kWh/(m²a)
Total heat losses Q_L	(10566	+	2488	) *	1.0	=	13055	**54.4**

Orientation of the area	Reduction factor see 'Windows' worksheet		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0.00	*	0.00	*	0.0	*	136	=	0
East	0.38	*	0.61	*	16.1	*	363	=	1363
South	0.15	*	0.61	*	23.2	*	667	=	1386
West	0.40	*	0.61	*	15.0	*	330	=	1201
Horizontal	0.50	*	0.31	*	1.4	*	566	=	123
Sum opaque areas									666
									kWh/(m²a)
Available solar heat gains Q_S								Total	4739	19.8

	kh/d		Length Heat. Period d/a		Spec. Power q_I W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0.024	*	212	*	2.3	*	239.8	=	2816	11.7

			kWh/a	kWh/(m²a)
Free heat Q_F	Q_S + Q_I	=	7555	31.5
Ratio free heat to losses	Q_F / Q_L	=	0.58	
Utilisation factor heat gains h_G		=	94%	
			kWh/a	kWh/(m²a)
Heat gains Q_G	η_G * Q_F	=	7083	**29.5**

			kWh/a	kWh/(m²a)
Annual heating demand Q_H	Q_L - Q_G	=	5972	**25**

	kWh/(m²*a)		(Yes/No)
Limiting value	25	**Requirement met?**	**Yes**

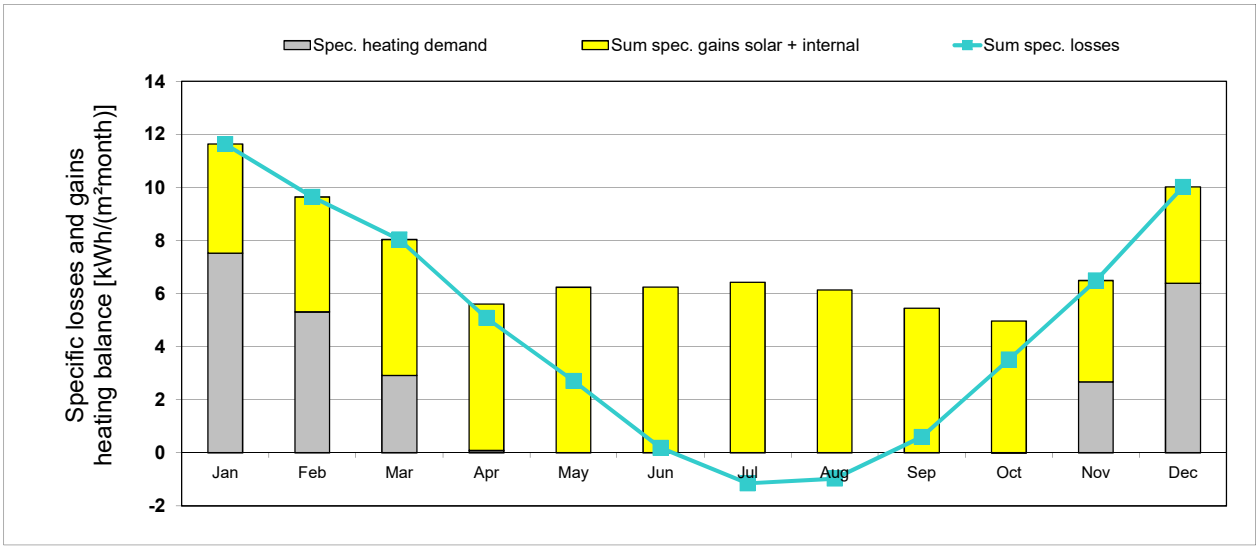
Specific energy for heating (monthly method)

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

nstruction

Interior temperature: 20 °C
Building type: Single family, semi-detached, masonry con
Treated floor area A_{TFA}: 240 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Externa	19.6	15.9	12.7	7.5	3.6	-0.5	-2.5	-1.9	1.0	6.0	11.1	17.1	90	kKh
Heating degree hours - Ground	8.4	8.7	9.7	8.4	6.2	3.8	1.8	0.6	0.5	2.1	3.9	6.3	60	kKh
Losses - Exterior	2550	2064	1648	978	472	-62	-328	-250	130	782	1445	2222	11652	kWh
Losses - Ground	240	249	279	241	177	108	53	17	14	61	113	182	1733	kWh
Sum spec. losses	11.6	9.6	8.0	5.1	2.7	0.2	-1.1	-1.0	0.6	3.5	6.5	10.0	55.8	kWh/m²
Solar gains - North	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar gains - East	143	199	244	297	372	390	390	345	297	225	139	116	3157	kWh
Solar gains - South	207	204	210	199	193	180	192	212	218	228	172	165	2380	kWh
Solar gains - West	124	155	228	281	352	357	370	336	249	196	119	98	2865	kWh
Solar gains - Horiz.	12	16	23	30	38	41	41	36	27	20	12	10	306	kWh
Solar gains - Opaque	88	94	110	117	131	131	135	132	119	110	77	71	1313	kWh
Internal heat gains	412	372	412	399	412	399	412	412	399	412	399	412	4849	kWh
Sum spec. gains solar + intern	4.1	4.3	5.1	5.5	6.2	6.2	6.4	6.1	5.5	5.0	3.8	3.6	62.0	kWh/m²
Utilisation factor	100%	100%	100%	91%	43%	3%	100%	100%	11%	71%	100%	100%	50%	
Annual heating demand	1805	1274	700	21	0	0	0	0	0	0	641	1532	5972	kWh
Spec. heating demand	**7.5**	**5.3**	**2.9**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.7**	**6.4**	**24.9**	kWh/m²



Annual heating demand: Comparison

Monthly method	*('Heating')*	5972	kWh/a	24.9	**kWh/(m²a)** reference to treated floor area according to PHPP
Annual method	*('Annual heati*	6356	kWh/a	26.5	**kWh/(m²a)** reference to treated floor area according to PHPP
		#REF!	kWh/a	#REF!	

Heating load

EnerPHit with PHPP Version 9.6a

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Interior temperature: 20 °C
Building type: Single family, semi-detached, masonry
Treated floor area A_{TFA}: 239.8 m²

	Design temperature		Radiation:	North	East	South	West	Horizontal	
Weather 1:	-16.3	°C		15	40	95	35	50	W/m²
Weather 2:	-14.5	°C		20	30	65	35	45	W/m²
Ground design temp.	6.9	°C							

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Factor always 1 (except "X")		TempDiff 1 K		TempDiff 2 K		PT 1 W		PT 2 W
External wall - Ambient	A	307.6	*	0.166	*	1.00	*	36.3	or	34.5	=	1855	or	1763
External wall - Ground	B	41.4	*	0.176	*	1.00	*	13.1	or	13.1	=	95	or	95
Roof/Ceiling - Ambient	A	106.5	*	0.093	*	1.00	*	36.3	or	34.5	=	360	or	342
Floor slab / Basement ceiling	B	107.9	*	0.157	*	1.00	*	13.1	or	13.1	=	221	or	221
	A		*		*	1.00	*	36.3	or	34.5	=		or	
	A		*		*	1.00	*	36.3	or	34.5	=		or	
Basement Ceiling	X		*		*	0.83	*	36.3	or	34.5	=		or	
Windows	A	55.7	*	0.833	*	1.00	*	36.3	or	34.5	=	1683	or	1600
Exterior door	A		*		*	1.00	*	36.3	or	34.5	=		or	
Exterior TB (length/m)	A	205.5	*	-0.024	*	1.00	*	36.3	or	34.5	=	-182	or	-173
Perimeter TB (length/m)	P	47.5	*	0.095	*	1.00	*	13.1	or	13.1	=	59	or	59
Ground TB (length/m)	B		*		*	1.00	*	13.1	or	13.1	=		or	
Building element towards neighbour	I	154.9	*	0.446	*	1.00	*	3.0	or	3.0	=	207	or	207

Transmission heat load P_T

Total = 4299 or 4114

Ventilation system:

Effective air volume, V_V: A_{TFA} 239.8 m² * Clear room height 2.50 m = 599 m³

Heat recovery efficiency of the heat exchanger: η_{HR} 73%
Heat recovery efficiency SHX: 0% | Heat recovery efficiency SHX: $\eta_{SHX\ 1}$ 0% or $\eta_{SHX\ 2}$ 0%

Energetically effective air changes n_V: $n_{V,Res}$ (Heating Load) 0.133 1/h + $n_{V,system}$ 0.319 1/h *(1- Φ_{HP} 0.73 or Φ_{HP} 0.73) = 0.219 1/h or 0.219 1/h

Ventilation heat load P_V

V_V m³		n_V 1/h		n_V 1/h		c_{Air} Wh/(m³K)		TempDiff 1 K		TempDiff 2 K		P_V 1 W		P_V 2 W
599.5	*	0.219	or	0.219	*	0.33	*	36.3	or	34.5	=	1576	or	1498

Total heating load P_L

		PL 1 W		PL 2 W
$P_T + P_V$	=	5875	or	5613

Orientation of the area	Area m²		g-Value (perp. radiation)		Reduction factor (see 'Windows' worksheet)		Radiation 1 W/m²		Radiation 2 W/m²		P_T 1 W		P_T 2 W
North	0.0	*	0.0	*	0.40	*	15	or	20	=	0	or	0
East	16.1	*	0.6	*	0.38	*	40	or	30	=	150	or	113
South	23.2	*	0.6	*	0.15	*	91	or	63	=	190	or	131
West	15.0	*	0.6	*	0.40	*	32	or	33	=	115	or	120
Horizontal	1.4	*	0.3	*	0.50	*	50	or	45	=	11	or	10

Solar heating power P_S

Total = 466 or 373

Internal heating load P_I

Spec. power W/m² 1.8 * A_{TFA} 240 m² = P_I 1 434 W or P_I 2 434 W

Heating power (gains) P_G

$P_T + P_I$ = P_G 1 899 W or P_G 2 806 W

$P_L - P_G$ = 4976 or 4806

Heating load P_H = 4976 W

Area specific space heating load P_H / A_{TFA} = 20.8 W/m²

Input max. supply air temperature 52 °C
Max. supply air temperature $\vartheta_{Supply,Max}$ 52 °C
Supply air temperature without heating $\vartheta_{Supply,Min}$ 10.1 °C or 10.6 °C

For comparison: heating load transportable by the supply Air $P_{Supply\ Air,Max}$ = 2646 W specific: 11.0 W/m²

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

Summer ventilation

EnerPHit with PHPP Version 9.6a

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

			Building type:	Single family, semi-detached, masonry	
Building volume:	599	m³	Heat recovery efficiency:	73%	
Max. indoor absolute humidity:	12	g/kg	Humidity recovery efficiency:	60%	
Internal humidity sources:	100	g/(P*h)	Subsoil heat exchanger efficiency:	0%	

Results passive cooling			Results active cooling		
Frequency of overheating:	32.5%	at the overheating limit ϑ_{max} = 25 °C	Useful cooling demand:	12.6	kWh/(m²a)
max. humidity:	14.7	g/kg	Dehumidification demand:	0.5	kWh/(m²a)
Frequency of exceeded humidity:	8.8%		Frequency of exceeded humidity:	0.0%	

Summer basic ventilation to ensure adequate air quality

Air change rate via vent. system with supply a	0.32	1/h	HRV/ERV in summer (check only one field)	
			None	
			Automatic bypass, controlled by temperature difference	x
			Automatic bypass, controlled by enthalpy difference	
			Always	
Air change rate via extract air system:		1/h		
			Specific power consumption (for extract air system)	0.20 Wh/m³
Window ventilation air change rate:	0.20	1/h		

Effective air change rate

	$n_{V,system}$ 1/h		η*SHX		η_{HP}		$n_{V,equi,fraction}$ 1/h
Exterior $n_{V,e}$	0.319	*(1-	0%	)*(1-	0.73	) =	0.087
without HR	0.319	*(1-	0%	)		=	0.319
Ground $n_{L,g}$	0.319	*	0%	*(1-	0.73	) =	0.000
without HR	0.319	*	0%			=	0.000

Ventilation conductance

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{Air} Wh/(m³K)			
exterior $H_{V,e}$	599	*	0.087	*	0.33	=	17.2	W/K
without HR	599	*	0.319	*	0.33	=	63.2	W/K
ground $H_{V,g}$	599	*	0.000	*	0.33	=	0.0	W/K
without HR	599	*	0.000	*	0.33	=	0.0	W/K
Infiltration, window, extract air system	599	*	0.253	*	0.33	=	50.1	W/K

Additional summer ventilation for cooling

Additional ventilation regulation

Minimum acceptable indoor temp. 20.0 °C

Type of additional ventilation

Window night ventilation, manual	Night ventilation value	0.15	1/h	
Mechanical, automatically Controlled ventilation	Corresponding air change rate during operation, in addition to basic air change		1/h	Controlled by (please check)
	Specific power consumption		Wh/m³	Temperature diff. x
				Humidity diff.

Summer: Passive cooling

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Building type: **Single family, semi-detached, masonry construction**
Upper temperature limit: **25** °C
Nominal humidity: **12** g/kg
Spec. capacity: **204** Wh/(m²K)

Treated floor area A_{TFA}: **239.8** m²
Building volume: **599** m³
Internal humidity sources: **1.3** g/(m²h)

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Red. factor $f_{T,Summer}$		H_{Summer} heat conductance
External wall - Ambient	A	307.6	*	0.166	*	1.00	=	51.1
External wall - Ground	B	41.4	*	0.176	*	1.00	=	7.3
Roof/Ceiling - Ambient	A	106.5	*	0.093	*	1.00	=	9.9
Floor slab / Basement ceiling	B	107.9	*	0.157	*	1.00	=	16.9
	A		*		*	1.00	=	
	A		*		*	1.00	=	
Basement Ceiling	X		*		*	0.83	=	
Windows	A	55.7	*	0.833	*	1.00	=	46.4
Exterior door	A		*		*	1.00	=	
Exterior TB (length/m)	A	205.5	*	-0.024	*	1.00	=	-5.0
Perimeter TB (length/m)	P	47.5	*	0.095	*	1.00	=	4.5
Ground TB (length/m)	B		*		*	1.00	=	

Exterior thermal transmittance, $H_{T,e}$ 102.4 W/K
Ground thermal transmittance, $H_{T,g}$ 28.7 W/K

Summer ventilation

from 'SummVent' worksheet

Ventilation unit conductance

exterior $H_{V,e}$	17.2	W/K
without HR	63.2	W/K
ground $H_{V,g}$	0.0	W/K
without HR	0.0	W/K

Ventilation conductance, others

exterior	50.1	W/K

Ventilation parameter

Temperature amplitude summer	9.0	K
Minimum acceptable indoor temperature	20.0	°C
Heat capacity air	0.33	Wh/(m³K)
Supply air changes	0.32	1/h
Outdoor air changes	0.25	1/h
Window night ventilation air change rate, manual @ 1K	0.15	1/h
Air change rate due to mech. automatically controlled vent.	0.00	1/h
Specific power consumption for	0.00	Wh/m³
η_{HR}	73%	
η_{ERV}	60%	
η^*_{SHX}	0%	

Summer ventilation regulation

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

Orientation of the area	Angle factor Summer		Shading factor Summer		Shading dirt		g-Value (perp. radiation)		Area m²		Portion of glazing	=	**Aperture** m²
North	0.9	*	1.00	*	0.95	*	0.00	*	0.0	*	0%	=	0.0
East	0.9	*	0.68	*	0.95	*	0.61	*	16.1	*	64%	=	3.7
South	0.9	*	0.45	*	0.95	*	0.61	*	23.2	*	61%	=	3.3
West	0.9	*	0.72	*	0.95	*	0.61	*	15.0	*	62%	=	3.5
Horizontal	0.9	*	1.00	*	0.95	*	0.31	*	1.4	*	62%	=	0.2
Sum opaque areas													1.3

Solar aperture Total 12.0 m² — 0.05 m²/m²

Internal heat gains Q_I

Specif. power q_I W/m²		A_{TFA} m²	=	W	W/m²
2.3	*	240	=	554	2.3

Frequency of overheating $h_{\vartheta \geq Jmax}$ **32.5%** **At the overheating limit ϑ_{max} = 25 °C**

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

Daily internal temperature fluctuation

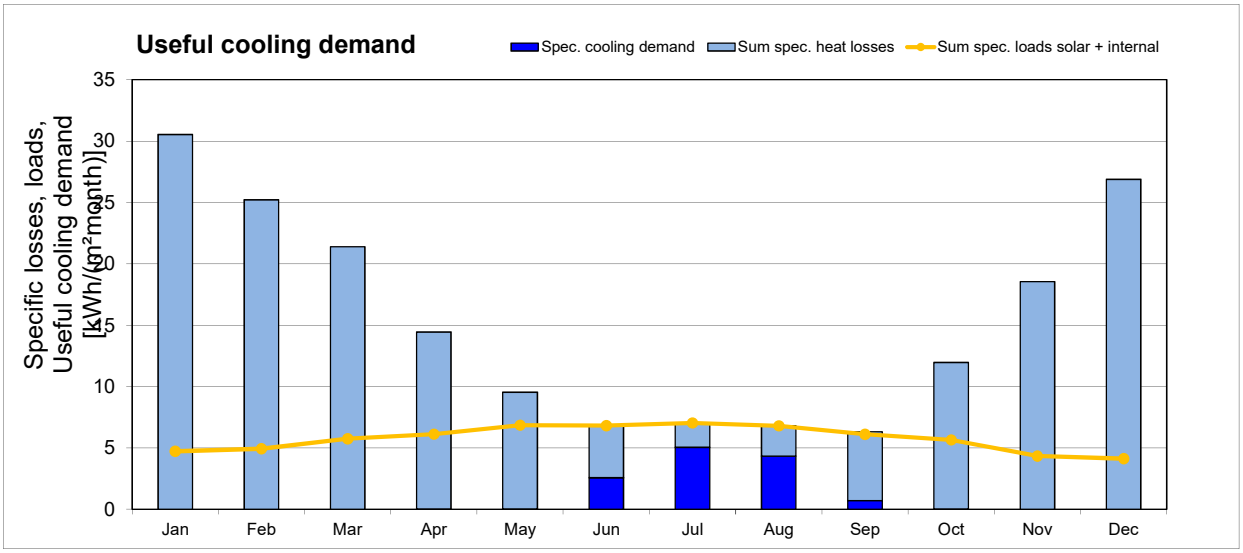
Transmission kWh/d		Ventilation kWh/d		Solar load kWh/d		1/k		Spec. capacity Wh/(m²K)		A_{TFA}: m²		
(11.1	+	16.1	+	52.6	) *	1000	/ (	204	*	240	) =	**1.6** K

Cooling: energy value for useful cooling energy

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Interior Temperature: 25 °C
Building type: Single family, semi-detached, masonry c
Treated Floor Area A_{TFA}: 240 m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating degree hours - Exterior	23.5	19.3	16.5	11.2	7.4	3.2	1.3	1.9	4.7	9.8	14.8	20.9	135	kKh
Heating degree hours - Ground	12.1	12.1	13.5	12.0	9.9	7.4	5.6	4.3	4.1	5.9	7.5	10.1	104	kKh
Losses - Exterior	5072	4184	3566	2413	1586	659	247	367	981	2097	3191	4522	28884	kWh
Losses - Ground	292	291	325	290	239	178	134	104	98	141	182	243	2519	kWh
Losses summer ventilation	1956	1570	1237	759	455	183	96	116	269	628	1076	1681	10028	kWh
Sum spec. heat losses	30.5	25.2	21.4	14.4	9.5	4.3	2.0	2.5	5.6	12.0	18.6	26.9	172.8	kWh/m²
Solar load North	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar load East	146	203	249	303	380	399	399	353	303	230	142	119	3227	kWh
Solar load South	347	341	352	334	323	301	321	354	365	382	288	277	3986	kWh
Solar load West	125	156	231	284	355	361	374	339	251	198	120	99	2892	kWh
Solar load Horiz.	13	17	25	31	40	43	43	38	29	21	12	10	324	kWh
Solar load Opaque	88	94	110	117	131	131	135	132	119	110	77	71	1313	kWh
Internal heat gains	412	372	412	399	412	399	412	412	399	412	399	412	4849	kWh
Sum spec. loads solar + internal	4.7	4.9	5.7	6.1	6.8	6.8	7.0	6.8	6.1	5.6	4.3	4.1	69.2	kWh/m²
Utilisation factor losses	15%	20%	27%	42%	72%	100%	100%	100%	96%	47%	23%	15%	33%	
Useful cooling energy demand	0	0	0	0	5	614	1207	1040	167	0	0	0	3033	kWh
Spec. cooling demand	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**	**5.0**	**4.3**	**0.7**	**0.0**	**0.0**	**0.0**	**12.6**	kWh/m²
Specif. dehumidification demand	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	91%	99%	100%	100%	100%	100%	96%	



Cooling: energy value for useful cooling energy

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

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

Building type:	Single family, semi-detached, masonry construction		Treated floor area A_{TFA}:	239.8	m²
Interior temperature summer:	25	°C	Building volume:	599	m³
Nominal humidity:	12	g/kg	Internal humidity sources:	1.3	g/(m²h)
Spec. capacity:	204	Wh/(m²K)			

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Mon. red. fac.		G_t kKh/a		kWh/a	per m² treated floor area
External wall - Ambient	A	307.6	*	0.166	*	1.00	*	18	=	940	3.92
External wall - Ground	B	41.4	*	0.176	*	1.00	*	31	=	227	0.95
Roof/Ceiling - Ambient	A	106.5	*	0.093	*	1.00	*	18	=	183	0.76
Floor slab / Basement ceiling	B	107.9	*	0.157	*	1.00	*	31	=	527	2.20
	A		*		*	1.00	*		=		
	A		*		*	1.00	*		=		
Basement Ceiling	X		*		*	0.83	*		=		
Windows	A	55.7	*	0.833	*	1.00	*	18	=	853	3.56
Exterior door	A		*		*	1.00	*		=		
Exterior TB (length/m)	A	205.5	*	-0.024	*	1.00	*	18	=	-92	-0.39
Perimeter TB (length/m)	P	47.5	*	0.095	*	1.00	*	18	=	83	0.35
Ground TB (length/m)	B		*		*	1.00	*		=		0.00
										kWh/(m²a)	
Transmission losses Q_T (negative: heat loads)									Total	2721	11.3

Summer ventilation

from 'SummVent' worksheet

Ventilation conductance, vent. unit

exterior $H_{V,e}$	17.2	W/K
without HR	63.2	W/K
ground $H_{V,g}$	0.0	W/K
without HR	0.0	W/K

Ventilation conductance, others

exterior	50.1	W/K

Ventilation parameter

Temperature amplitude summer	9.0	K
Minimum acceptable indoor temperature	20.0	°C
Heat capacity air	0.33	Wh/(m³K)
Supply air changes	0.32	1/h
Outdoor air changes	0.25	1/h
Window night vent. air change rate, manual @ 1K	0.15	1/h
Air changes rate due to mech., autom. controlled vent.	0.00	1/h
Specific power consumption for	0.00	Wh/m³
η_{HR}	73%	
η_{ERV}	60%	
η^*_{SHX}	0%	

Summer ventilation regulation

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

	$n_{V,system}$ 1/h		η^*_{SHX}		η_{HR} (considers bypass)		$n_{V,Rest}$ 1/h		$n_{V,equi,fraction}$ 1/h
Hygienic air change									
Effective air change rate Ambient $n_{V,e}$	0.319	*(1-	0%	)*(1-	0.08	)+	0.253	=	0.547
Effective air change rate Ground $n_{V,g}$	0.319	*	0%	*(1-	0.08	)		=	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	599	*	0.547	*	0.33	*	17	=	1873	7.8
Ventilation losses ground $Q_{V,e}$	599	*	0.000	*	0.33	*	0	=	0	0.0
Heat losses summer ventilation	599	*	0.190	*	0.33	*	30	=	1121	4.7
Ventilation heat losses Q_V								Total	2994	12.5

	Q_T kWh/a		Q_V kWh/a		kWh/a	kWh/(m²a)
Total heat losses Q_L	2721	+	2994	=	5715	**23.8**

Orientation of the area	Reduction factor		g-Value (perp. radiation)		Area m²		Global radiation kWh/(m²a)		kWh/a
North	0.40	*	0.00	*	0.0	*	205	=	0
East	0.39	*	0.61	*	16.1	*	478	=	1834
South	0.25	*	0.61	*	23.2	*	478	=	1665
West	0.40	*	0.61	*	15.0	*	458	=	1680
Horizontal	0.53	*	0.31	*	1.4	*	845	=	194
Sum opaque areas									647
Available solar heat gains Q_S								Total	6019

	kh/d		Length heat. period d/a		Spec. power q_I W/m²		A_{TFA} m²		kWh/a	kWh/(m²a)
Internal heat gains Q_I	0.024	*	153	*	2.3	*	239.8	=	2033	8.5

			kWh/a	kWh/(m²a)
Sum heat loads Q_F	Q_S + Q_I	=	8052	**33.6**
Ratio of losses to free heat gains	Q_L / Q_F	=	0.71	
Utilisation factor heat losses η_G		=	88%	
Useful heat losses $Q_{V,n}$	η_G * Q_L	=	5019	**20.9**
Useful cooling demand Q_K	Q_F - $Q_{V,n}$	=	3033	**13**

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

Compressor - cooling units

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Building type:	Single family, semi-detached, masonry construction		Treated floor area A_{TFA}:	239.8	m²
Interior temperature summer:	25.0	°C	Mechanical cooling:	x	
Nominal humidity:	12.0	g/kg	Air change rate via ventilation system with supply air:	0.3	
Internal humidity sources:	1.3	g/(m²h)			

Supply air cooling
check as appropriate

On/Off mode (check as appropriate)		
Max. cooling capacity (sensible + latent)		kW
Temperature reduction dry	0.0	K
Seasonal energy efficiency ratio		

x Recirculation cooling
check as appropriate

On/Off mode (check as appropriate)		
Max. cooling capacity (sensible + latent)	14.1	kW
Volume flow rate at nominal power	4329.2	m³/h
Temperature reduction dry	9.6	K
Variable air volume (check if appropriate)	x	
Seasonal energy efficiency ratio	2.5	

Additional dehumidification
check as appropriate

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

Panel cooling
check as appropriate

Seasonal energy efficiency ratio		

	Sensible kWh/(m²a)		Latent kWh/(m²a)		COP		Electricity demand (kWh/a) kWh/(m²a)	Sensible fraction
Useful cooling total	12.6		0.5					96%
Cooling contribution by:								
Supply air cooling	(	+		) /	0.0	=		
Recirculation cooling	(12.6	+	5.0	) /	2.5	=	7.1	71%
Dehumidification				/		=		0%
Remaining for panel cooling				/	0.0	=		100%
Cooling distribution				/	2.5	=		100%
Total	(12.6	+	5.0	) /	2.5	=	7.1	71%

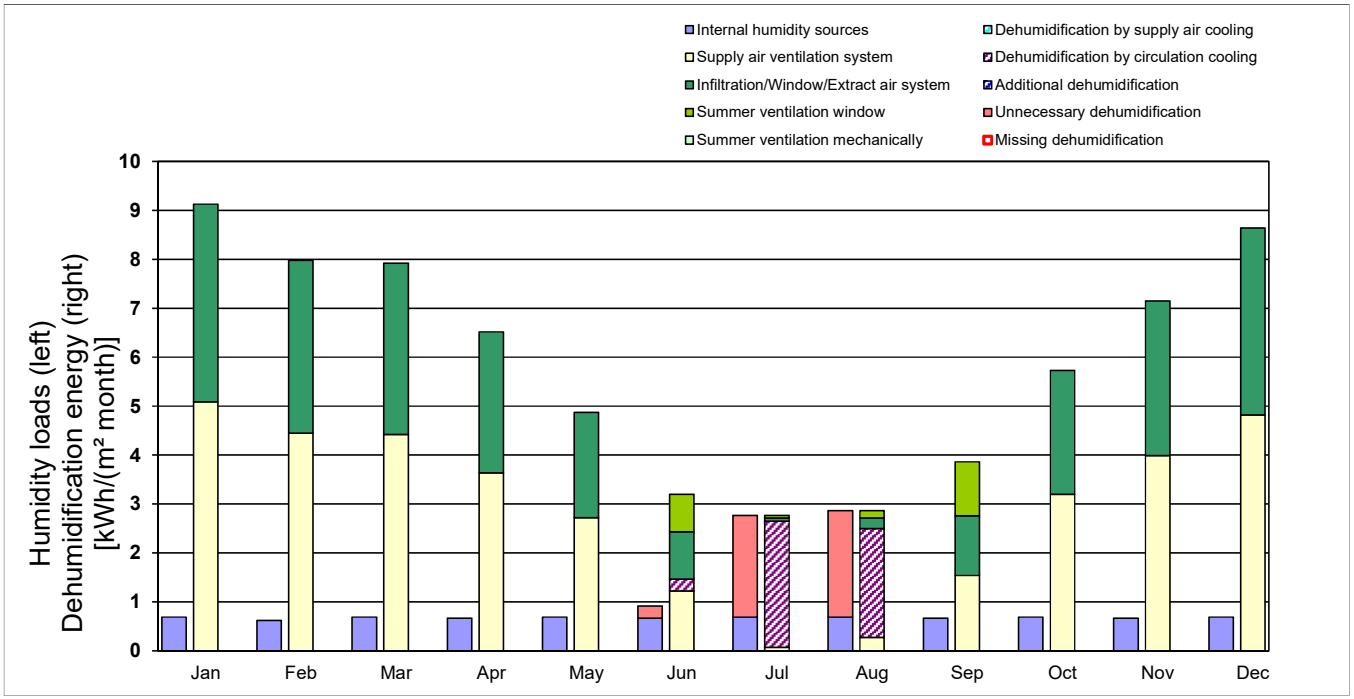
		(Yes/No)	
Unsatisfied demand	0.0	0.0	**Cooling demand covered?** Yes

Compressor - cooling units

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Humidity loads and humidity removal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Internal humidity sources	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8	kWh/m²
Infiltration/Window/Extract air system	-4.0	-3.5	-3.5	-2.9	-2.2	-1.0	-0.1	-0.2	-1.2	-2.5	-3.2	-3.8	-28	kWh/m²
Supply air ventilation system	-5.1	-4.5	-4.4	-3.6	-2.7	-1.2	-0.1	-0.3	-1.5	-3.2	-4.0	-4.8	-35	kWh/m²
Summer ventilation window	0.0	0.0	0.0	0.0	0.0	-0.8	-0.1	-0.1	-1.1	0.0	0.0	0.0	-2	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	0.5	0.0	0.0	0.0	0.0	0.0	1	kWh/m²
Dehumidification by supply air cooling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	kWh/m²
Dehumidification by circulation cooling	0.0	0.0	0.0	0.0	0.0	0.2	2.6	2.2	0.0	0.0	0.0	0.0	5	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	0.2	2.6	2.2	0.0	0.0	0.0	0.0	5	
Unnecessary dehumidification	0.0	0.0	0.0	0.0	0.0	0.2	2.1	2.2	0.0	0.0	0.0	0.0	5	kWh/m²
Missing dehumidification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	kWh/m²



Cooling load

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Building type: Single family, semi-detached, masonry construction

Treated floor area A_{TFA}: 239.8 m² | Building volume: 599 m³ | Interior temperature: 25 °C

Spec. capacity: 204 Wh/(m²K) | Nominal humidity: 12.0 g/kg | Internal humidity sources: 1.3 g/(m²h)

Temperature:	Outdoor air	Dew point	Sky
Weather 1:	29.0 °C	19.5 °C	17.7 °C
Weather 2:	29.0 °C	19.5 °C	19.5 °C
Ground design temp.	19.3 °C	SHX	11.3 °C

Radiation:	North	East	South	West	Horizontal
	100	190	160	190	330 W/m²
	100	190	160	190	330 W/m²

Building assembly	Temperature zone	Area m²	U-Value W/(m²K)	Factor always 1 (except "X")	TempDiff 1 K	TempDiff 2 K	P_T 1 W	P_T 2 W
External wall - Ambient	A	307.6	0.166	1.00	4.0	4.0	204	204
External wall - Ground	B	41.4	0.176	1.00	-5.7	-5.7	-41	-41
Roof/Ceiling - Ambient	A	106.5	0.093	1.00	4.0	4.0	40	40
Floor slab / Basement ceiling	B	107.9	0.157	1.00	-5.7	-5.7	-96	-96
	A			1.00	4.0	4.0		
	A			1.00	4.0	4.0		
Basement Ceiling	X			0.83	4.0	4.0		
Windows	A	55.7	0.833	1.00	4.0	4.0	185	185
Exterior door	A			1.00	4.0	4.0		
Exterior TB (length/m)	A	205.5	-0.024	1.00	4.0	4.0	-20	-20
Perimeter TB (length/m)	P	47.5	0.095	1.00	-5.7	-5.7	-25	-25
Ground TB (length/m)	B			1.00	-5.7	-5.7		
Building element towards neighbour	I	154.9	0.446	1.00	3.0	3.0	207	207
Radiation correction outdoor air			$L_{ambient}$ W/K	-5.8	4.0	4.0	-23	-23
Radiation correction sky			L_{Sky} W/K	5.7	-7.3	-5.5	-42	-31

Transmission heat load P_T — Total: 389 | 400

Ventilation load	V_V m³	$n_{V,equi,fraction}$ 1/h	$n_{V,equi,fraction}$ 1/h	c_{Air} Wh/(m³K)	TempDiff 1 K	TempDiff 2 K	P_V 1 W	P_V 2 W
Exterior $P_{V,o}$	599	0.340	0.340	0.33	4.0	4.0	269	269
Ground $P_{L,e}$	599	0.000	0.000	0.33	-13.7	-13.7	0	0
Summer ventilation $P_{L,S}$	599	0.000	0.000	0.33	0.0	0.0	0	0

Ventilation heat load P_V — Total: 269 | 269

Orientation of the area	Area m²	g-Value (perp. radiation)	Reduction factor (see 'Windows' worksheet)	Radiation 1 W/m²	Radiation 2 W/m²	P_T 1 W	P_T 2 W
North	0.0	0.0	0.40	100	100	0	0
East	16.1	0.6	0.37	190	190	695	695
South	23.2	0.6	0.23	164	164	544	544
West	15.0	0.6	0.38	181	181	633	633
Horizontal	1.4	0.3	0.53	330	330	76	76
Sum opaque areas						243	243

Solar load P_S — Total: 2190 | 2190

Internal heating load P_I	Spec. power W/m²	A_{TFA} m²	P_I 1 W	P_I 2 W
	2.3	240	554	554

$P_T + P_V + P_S + P_I$ = 3402 | 3412

Cooling load P_C = 3412 W

Area specific cooling load P_C / A_{TFA} = 14.2 W/m²

Please enter the minimum supply air temperature. °C

Supply air temperature without cooling $\vartheta_{Supply,Min}$ = 26.1 °C | 26.1 °C

For comparison: cooling load, transportable through the supply air $P_{Supply;Max}$ = 1648 W | 1648 W

specific: 6.9 W/m² | 6.9 W/m²

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

Daily internal temperature stroke

(Transmission 399.7 W + Ventilation 269.2 W + Solar load 2189.9 W) * Time 24 h/d / (Spec. capacity 204 Wh/(m²K) * A_{TFA} 240 m²) = 1.4 K

Dehumidific. load from 'Cooling' worksheet

Absolute humidity exterior air	14.2	14.2 g/kg	Absolute humid. supply air	12.9	12.9 g/kg
Outdoor air mass flow	179	179 kg/h	Supply air mass flow	226	226 kg/h
Summer vent. air mass flow	0	0 kg/h	**Humid. load, supply air**	202	202 g/h
Humidity load, outdoor air	401	401 g/h	**Humidity load, internal**	314	314 g/h

Enthalpy of vaporisation 707.639 Wh/kg / 1000 g/kg * Humidity load 917 g/h or 917 g/h = P_D 1 649 W | P_D 2 649 W

Dehumidification load P_T = 649 W

Area specific dehumidification load P_T / A_{TFA} = 2.7 W/m²

Monthly average values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Specific cooling demand	0.0	0.0	0.0	0.0	0.0	2.6	5.0	4.3	0.7	0.0	0.0	0.0	kWh/m²
Specific dehumidification demand	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	kWh/m²
Sensible fraction	100%	100%	100%	100%	100%	100%	91%	99%	100%	100%	100%	100%	

Minimum of sensible cooling load fraction occurred 100%

Electricity demand for residential buildings

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Households	1
Persons	3.1
Living area (m²)	240
Heating demand [kWh/(m²a)]	24.8

PER and PE factors (KWh/kWh)		
Electricity:	1.20	3.2
Non-electric energy carrier for cooking, drying:	1.20	3.2
Energy carrier for heating:	1.16	3.2
Energy carrier for DHW:	1.20	3.2

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

Column no.	1	2	3		4		5		6		7		8	8a		9		10		11		12		13
Application	Used ? (1/0)	Within the thermal envelope? (1/0)	Norm demand		Utilisation factor		Frequency		Reference quantity		Useful energy (kWh/a)		Electric fraction	Non-electric fraction		Electricity demand (kWh/a)		Additional demand		Marginal performance ratio		Solar fraction		Non-electric demand (kWh/a)
Dishwashing	1	1	1.00	kWh/Use	* 1.00	*	65	l/(P*a)	* 3.1	P	= 204	*	50%		=	102								
1-DHW connection												*		50%			* (1+	0.30	) *	0.00	*(1-	0.00	) =	0
Clothes washing	1	1	0.28	kWh/Use	* 1.00	*	57	l/(P*a)	* 3.1	P	= 50	*	55%		=	28								
1-DHW connection												*		45%			* (1+	0.05	) *	0.00	*(1-	0.00	) =	0
Clothes drying with:	1	1	3.50	kWh/Use	Residual dampness 0.50	0.75	*	57	l/(P*a)	* 3.1	P	= 470		100%	=	470								
4-Condensation dryer											= 0			0%						1.00	*			0
Energy consumed by evaporation	0	1	3.13	kWh/Use	* 0.50	*	57	l/(P*a)	* 3.1	P	= 0	*		100%			* (1+	0.00	) *	0.00	*(1-	0.70	) =	0
Refrigerating	0	1	0.78	kWh/d	* 1.00	*	365	d/a	* 1	HH	= 0	*	100%		=	0								
Freezing	0	1	0.88	kWh/d	* 1.00	*	365	d/a	* 1	HH	= 0	*	100%		=	0								
or combination	1	1	1.37	kWh/d	* 1.00	*	365	d/a	* 1	HH	= 500	*	100%		=	500								
Cooking with:	1	1	0.20	kWh/Use	* 1.00	*	500	l/(P*a)	* 3.1	P	= 314	*	100%		=	314								
1-Electricity				Average lamp efficiency [lm/W]								*		0%										0
Lighting	1	1	11	W	65	* 1.00	*	2.90	kh/(P*a	* 3.1	P	= 101	*	100%	=	101								
Consumer electronics	1	1	80	W		* 1.00	*	0.55	kh/(P*a	* 3.1	P	= 138	*	100%	=	138								
Small appliances, etc.	1	1	50	kWh		* 1.00	*	1.00	l/(P*a)	* 3.1	P	= 157	*	100%	=	157								
Total aux. electricity											1152					1152								
Other:																								
				kWh/a							0					0								
				kWh/a							0					0								
				kWh/a							0					0								
Total											3085	kWh				2960	kWh			DHW Non-Electric - Wash&Dish 156	kWh			0
Specific demand																12.3	kWh/(m²a)			0.7	kWh/(m²a)			0.0
Recommended maximum value																18								

Non-Renewable Non-Electric DHW Wash&Dish

Aux Electricity

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Treated floor area	240	m²
Heating period	188	d
Air volume	599	m³
Dwelling units	1	HH

Heat recovery efficiency ventilation unit	0.73	
Operation vent. system Winter	4.51	kh/a
Operation vent. system Summer	4.25	kh/a
Air change rate	0.32	h^{-1}

Annual space heating demand	25	kWh/(m²a)
Boiler rated power	18	kW
DHW system heating demand	3193	kWh/a
Design forward flow temperature	27	°C

Column no.	1	2	3		4		5		6		7		8		9		10	11
Application	Existing [1/0]	Within the thermal envelope [1/0]	Norm demand		Utilisation factor		Period of operation		Reference size		Electricity demand [kWh/a]		Available as interior heat		Utilisation period [h/a]		Internal heat gains winter [W]	Internal heat gains summer [W]
Ventilation system																		
Winter ventilation	1		0.31	Wh/m³ *	0.32	h^{-1} *	4.5	kh/a *	599	m³ =	268		considered in heat recovery efficiency					
Defroster HX	1	1	Data entries in 'Ventilation' worksheet or in 'Addl vent'								632	*	0.3	/	4.51	=	38	
Summer ventilation	1	0.90	0.31	Wh/m³ *	0.32	h^{-1} *	4.3	kh/a *	599	m³ =	252	*	1.0	/	4.25	=		53
																	Internal heat sources ' Additional summer ventilation'	0.0
Additional vent. summer	0	0.90	0.00	Wh/m³ *	0.00	h^{-1} *	4.3	kh/a *	599	m³ =	0	*	1.0	/	4.25	=		74.4
Heating system			Controlled / non controlled [1/0]															
Enter the rated power of the pump				W														
Circulator pump heating			127	W *	1.0	*	4.5	kh/a *	1	=	0	*	1.0	/	4.51	=	0	
Boiler electricity consumption at 30% load				W														
Aux. energy - Heat. boiler	0	0	60	W *	1.00	*	0.00	kh/a *	1	=	0	*	1.0	/	4.51	=	0	
Aux. energy - Wood fired/Pellet boiler	0	0	Data entries in 'Boiler' worksheet. Aux. energy demand including possible drinking water production.								0	*	1.0	/	4.51	=	0	
DHW system																		
Enter average power consumption of pump				W														
Circulation pump DHW	0		29	W *	1.00	*	5.2	kh/a *	1	=	0	*	1.0	/	8.76	=	0	0
Enter the rated power of the pump				W														
Storage load pump DHW			62	W *	1.00	*	0.2	kh/a *	1	=	0	*	1.0	/	8.76	=	0	0
Boiler electricity consumption at 100% load				W														
DHW boiler aux. energy	0	0	180	W *	1.00	*	0.0	kh/a *	1	=	0	*	1.0	/	8.76	=	0	0
Enter the rated power of the solar DHW pump				W														
Solar aux. electricity	0		46	W *	1.00	*	1.8	kh/a *	1	=	0	*	1.0	/	8.76	=	0	0
Aux. electricity cooling and dehumidification																		
Aux. electricity cooling				kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	4.25	=		0
Aux. electricity dehum.				kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	4.25	=		0
Misc. aux. electricity																		
Misc. aux. electricity				kWh/a *	1.00	*	1.0	*	1	=	0	*	1.0	/	8.76	=	0	0
Total											1152						38	128
Specific demand	kWh/(m²a) (treated floor area)										4.8							

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

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.8 kWh/(m²a) / Cooling: 13.9 kWh/(m²a) / PER: 40.5 kWh/(m²a)

Utilisation: 10-Dwelling

Type of values used: 2-Standard

IHG heating 2.31 W/m²

IHG cooling 2.31 W/m²

No input is necessary

Go to utilisation pattern selection

Persons	3.1	P
Living area	240	m²

Heating demand	25	kWh/(m²a)
Heating period	188	d/a

Application	Existing [1/0] or occupancy	Within the thermal envelope [1/0]	Norm consumption		Utilisation factor	Frequency		Useful energy [kWh/a]		Included in electricity balance?		Availability		Utilisation period [h/a]		Internal heat gains [W]
Dishwashing	1	1	1.0	kWh/Use	1.00	65	/(P*a)	204	*			0.30	/	8.76	=	7
Clothes washing	1	1	0.3	kWh/Use	1.00	57	/(P*a)	50	*			0.30	/	8.76	=	2
Clothes drying with:	1	1	3.5	kWh/Use	0.75	57	/(P*a)	470	*			0.70	/	8.76	=	38
4-Condensation dryer		1	0.0					0				0.80				
Energy consumed by evaporation	0	1	-3.1	kWh/Use	0.50	57	/(P*a)	0	* (1-	0	) *	0.00	/	8.76	=	0
Refrigerating	0	1	0.8	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0
Freezing	0	1	0.9	kWh/d	1.00	365	d/a	0	*			1.00	/	8.76	=	0
or combination	1	1	1.4	kWh/d	1.00	365	d/a	500	*			1.00	/	8.76	=	57
Cooking	1	1	0.2	kWh/Use	1.00	500	/(P*a)	314	*			0.50	/	8.76	=	18
Lighting	1	1	11.1	W	1.00	2.9	kh/(P*a)	101	*			1.00	/	8.76	=	12
Consumer electronics	1	1	80.0	W	1.00	0.55	kh/(P*a)	138	*			1.00	/	8.76	=	16
Household appliances/Other	1	1	50.0	kWh	1.00	1.0	/(P*a)	157	*			1.00	/	8.76	=	18
Auxiliary appliances (cf. aux Electricity sheet)															=	38
Other applications (cf. Electricity sheet)	0	0.0						0	*				/	8.76	=	0
Persons	3	1	80.0	W/P	1.00	8.76	kh/a	2199	*			0.55	/	8.76	=	138
Cold water	3	1	-14.7	W/P	1.00	8.76	kh/a								=	-46
DHW - circulation	0	0	0.0	W	1.00	8.76	kh/a	0	*			1.00	/	8.76	=	0
DHW - individual pipes	1	1	42.1	W	1.00	8.76	kh/a	368	*			1.00	/	8.76	=	42
DHW storage tank heating case	1	1	120.0	W	1.00	8.76	kh/a	1051	*			1.00	/	8.76	=	120
DHW storage tank cooling case	1	0	0.0	W	1.00	8.76	kh/a	0	*			1.00	/	8.76	=	0
Evaporation	3	1	-25.0	W/P	1.00	8.76	kh/a	-687	*			1.00	/	8.76	=	-78
Total IHG														W		380
Specific IHG														W/m²		1.59
Heat available from internal sources										188	d/a			kWh/(m²a)		7.1

Heat distribution and domestic hot water (DHW) system

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

Interior temperature:	20	°C	Interior temperature summer:	25	°C
Building type:	Single family, semi-detached, masonry construction				
Treated floor area A_{TFA}:	240	m²			
Occupancy:	3.1	Pers			
Number of dwelling units:	1				
Annual heating demand $q_{Heating}$	6051	kWh/a	Annual useful cooling dem. q_{Cool}	3024	kWh/a
Length of heating period:	188	d	Length cooling period:	153	d
Average heating load P_{ave}:	1.3	kW	Average cooling load $P_{Average}$:	0.8	kW
Marginal usability of additional heat gains:	93%		Marginal utility of additional heat losses:	73%	

Space heat distribution

			Inside thermal envelope					Outside thermal envelope					Total values	
			1	2	3	4	5	1	2	3	4	5	Absolute	Specific
Length of distribution pipes	L_H	m												
Nominal width of pipe		mm												
Insulation thickness		mm												
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient per m of insulated pipe		W/(mK)												
Insulation quality of mountings, pipe suspensions, etc.		-	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None	1-None		
Thermal bridge supplement		W/K												
Total heating loss coefficient per m of pipe	Ψ	W/(mK)												
Temp. of the room through which the pipes pass	ϑ_X	°C	20	20	20	20	20	20.0	20.0	20.0	20.0	20.0		
Design forward flow temperature	ϑ_V	°C	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7		
Design system heating load	$P_{heating}$	kW	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		
Forward flow temperature control ('x' if appropriate)														
Design return flow temperature	ϑ_R	°C												
Annual heat emission per m of plumbing	q^*_{HL}	kWh/(m·a)												
Possible utilisation factor of released heat	η_G	-												
Annual heat losses of heating distribution	Q_{HL}	kWh/a											kWh/a: **0**	kWh/(m²a): **0.0**
Annual heat losses of heating storage		kWh/a											**36**	**0.1**
Annual heat losses of heating		kWh/a											**36**	**0.1**
Performance ratio of heat distribution	$ea_{,HL}$	-											**101%**	

DHW useful heat

DHW demand for showers, per person and day (with 60°C)		litre/person/d	16.0
DHW demand others, per person and day (with 60°C)		litre/person/d	9.0
Performance of shower drain-water heat recovery		-	0%
Effective DHW demand	V_{DHW}	litre/person/d	25
Average cold water temperature of the supply	ϑ_{TW}	°C	11.3
DHW demand for washing machines and dishwashers non-ele		kWh/a	156
Effective useful heat DHW	Q_{DHW}	kWh/a	1773

kWh/a	kWh/(m²a)
1773	7.4

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

DHW distribution

			Inside thermal envelope					Outside thermal envelope					Total values	
			1	2	3	4	5	1	2	3	4	5	Absolute	Specific
Temp. of room through which the pipes pass	ϑ_X	°C	20.0	20.0	20.0	20.0	20.0							
Design forward flow temperature	ϑ_{dist}	°C	**60.0**	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0		
DHW circulation pipes														
Length of circulation pipes (forward + return flow)	L_{HS}	m												
Nominal width of pipe		mm												
Insulation thickness		mm												
Insulation reflective coating?		-												
Thermal conductivity of insulation		W/(mK)												
Heat loss coefficient per m of insulated pipe		W/(mK)												
Insulation quality of mountings, pipe suspensions, etc.		-	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**	**1-None**		
Thermal bridge supplement		W/K												
Total heating loss coefficient per m of pipe	Ψ	W/(mK)												
Daily circulation period of operation.	td_{Circ}	h/d												
Design return flow temperature	ϑ_R	°C												
Circulation period of operation per year	t_{Circ}	h/a												
Annual heat released per m of pipe	q^*_Z	kWh/m/a												
Annual heat loss from circulation lines	QZ	kWh/a											kWh/a	kWh/(m²a)
													0	**0.0**
DHW individual pipes														
Exterior pipe diameter	d_{U_Pipe}	m	**0.016**											
Accumulated length per single pipes	L_U	m	**70.41**											
Amount of tapping points in building	$n_{tapping\ poin}$	-	**9.00**											
Average pipe length per tapping point	$L_{U,\ average}$	m	7.8											
Tap openings per person per day		-	**6**											
Utilisation days per year		d	**365**											
Heat loss per tap opening	$q_{Individual}$	h/tap opening	0.0536											
Amount of tap openings per year and person	n_{Tap}	ings per year	2190											
Annual heat loss of individual pipes	Q_U	kWh/a	**368**										kWh/a	kWh/(m²a)
													368	**1.5**
Total heat losses of DHW distribution	Q_{WL}												kWh/a	kWh/(m²a)
													368	**1.5**
Performance ratio of DHW distribution pipes	$ea_{,HL}$	-											**121%**	

Storage heat losses

		Storage 1	Storage 2	Buffer storage tank (only heating)	Compact unit		
Selection of storage tank		2-DHW only	0-No storage tank	1-Existing storage tank	0-No		
Storage necessary for HP		x		(x)			
Solar DHW connection							
Heat loss rate	W/K	5.5		3.0			
Storage volume	litre	189		150	---		
Standby fraction	-						
Location of storage tank, inside or outside of thermal envelope		1-Inside	1-Inside	1-Inside			
Temperature of mechanical room	°C	20.0		20.0			
Typical storage tank temperature	°C	60.0		58.5			
Manual entry of storage temperature	°C						
Average standby heat losses storage tank	W	219		116			
Additional heat losses storage tank, solar operation	W			---	---		
Possibly utilisation factor of heat losses		---	---	93%	---		
Annual heat losses DHW storage tank	kWh/a	1917		---		kWh/a	kWh/(m²a)
						1917	**8.0**
Annual heat losses buffer storage tank		---	---	36	---		

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

Total energy demand of domestic hot water

		kWh/a	kWh/(m²a)
Heat losses of DHW distribution and storage	Q_{WL}	**2285**	**9.5**
Performance ratio DHW-distribution + storage	$e_{a,WL}$	**229%**	
Total heating demand of DHW system		kWh/a	kWh/(m²a)
Including storage tank	Q_{gDHW}	**4058**	**16.9**

Primary Energy Renewable PER

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 24.9 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 47.6 kWh/(m²a)

Building type:	Single family, semi-detached,		
Treated floor area A_{TFA}:	240	m²	
Projected building footprint $A_{Projected}$:	108	m²	
Heating demand incl. distribution & hydr. frost protection	25	kWh/(m²a)	
Cooling energy dem. incl. dehumidification	18	kWh/(m²a)	
DHW demand including distribution:	17	kWh/(m²a)	

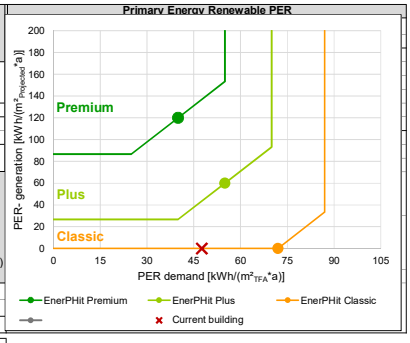
Selection of heat generation system(s)	Contribution margin (useful energy)		Addl. input in following worksheets
Primary heat generation type	Heating	DHW	
6-Other	100%	0%	-
Secondary heat generation type (optional & different)			
2-Heat pump	0%	100%	HP, possibly HP ground

Energy demand Reference: Treated floor area	Efficiency: Calculation -	Efficiency: User defined value -	Final energy: Contribution (final energy)	Final energy: Final energy demand kWh/(m²a)	PER: PER factor kWh/kWh	PER: Effective PER factor (including biomass) kWh/kWh	PER: PER specific value kWh/(m²a)	PE: PE factor kWh/kWh	PE: PE value kWh/(m²a)	CO_2: CO_2 emissions factor (CO_2-eq) kg/kWh	CO_2: CO_2eq emissions kg/(m²a)
								1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
							47.6		122.9		20.7
Heating			0%			1.16	19.6	3.16	53.5		9.0
Electricity (HP compact unit)					1.65			3.16		0.532	
Electricity (heat pump)					1.65			3.16		0.532	
District heating: 1-None					2.8|4.5|3.3					0.000	
Wood and other biomass					1.10			-		-	
Natural gas / RE gas					1.75			1.10		0.250	
Heating oil / RE methanol					2.30			1.10		0.320	
Solar thermal system											
Electricity (direct)					1.65			3.16		0.532	
Mitsubishi MXZ-8C48NAHZ		1.90		13.2	1.65	1.10	14.5	3.16	41.7	0.532	7.0
Aux. electricity (heating, wintertime ventilation)				3.8	1.65	1.36	5.1	3.16	11.9	0.532	2.0
Cooling and dehumidification					1.40		11.4		25.7		4.3
Electricity cooling (heat pump)	2.50			7.1	1.40		9.9	3.16	22.4	0.532	3.8
Auxiliary electricity cooling, ventilation summer				1.1	1.40		1.5	3.16	3.3	0.532	0.6
Electricity dehumidification (heat pump)					1.80			3.16		0.532	
Auxiliary electricity (dehumidification)					1.80			3.16		0.532	
DHW generation			100%			1.20	7.5	3.16	19.8		3.3
Electricity (HP compact unit)					1.20			3.16		0.532	
Electricity (heat pump)	2.70		100%	6.3	1.20	1.20	7.5	3.16	19.8	0.532	3.3
District heating: 1-None					2.8|4.5|3.3					0.000	
Wood and other biomass					1.10			-		-	
Natural gas / RE gas					1.75			1.10		0.250	
Heating oil / Methanol					2.30			1.10		0.320	
Solar thermal system											
Electricity (direct)					1.20			3.16		0.532	
Reliance 10 50 DHPHT NE		2.80			1.20			3.16		0.532	
Aux. electricity (DHW + solar DHW)					1.20			3.16		0.532	
Household electricity				7.5		1.20	9.1		23.8		4.0
Electricity (household or non-residential lighting, etc.)				7.5	1.20	1.20	9.1	3.16	23.8	0.532	4.0
Auxiliary electricity (other)					1.20			3.16		0.532	
Gas / RE gas dry/cook				0.0	1.75		0.0	3.16	0.0	0.270	0.0

Energy generation Reference: Projected building footprint area	Final energy: Final energy generation kWh/a	Final energy: Final energy generation kWh/(m²$A_{Projected}$*a)	PER: PER factor kWh/kWh	PER: PER specific value kWh/(m²$A_{Projected}$a)	PE: PE factor kWh/kWh	PE: PE Value kWh/(m²a)	CO_2: Emission factor (CO_2-eq) kg/kWh	CO_2: CO_2eq emissions kg/a
				0.0		0.0		0.0
PV electricity	0	0.0	1.00	0.0	-		-	
Solar thermal system	0	0.0	-	0.0	1.22	0.0		
		0.0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	131.8867709	Current building reaches following class	123	Requirement met?	yes

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance: Annual heat. dem. Treated floor area kWh/(m²a)	Useful energy, performance: Heating load Treated floor area W/m²	Useful energy, performance: Useful cool. energy Treated floor area kWh/(m²a)	Useful energy, performance: Cooling load Treated floor area W/m²	Airtightness n_{50} 1/h
Requirement EnerPHit Premium					
Requirement EnerPHit Plus	25		16	10	1.00
Requirement EnerPHit Classic					
Requirement					
Current building reaches following class for aspec	25	21	13	14	0.6
	Premium		Premium		Premium



Summary Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	Final energy MWh/a	PER specific value MWh/a	PE value 1-PE factors (non-renewable) PHI Certification MWh/a	CO2eq emissions 1-CO2 factors GEMIS (Germany) kg/a	CO_2eq substitution balance 1-CO2 factors GEMIS (Germany) kg/a
Demand	9.3	11.4	29.47	4961	4961
Generation	0.0	0.0	0.00	0	0
Demand, cumulative generation (annual balance)	9.32	11.40	29.47	4961	4961
Demand w/o household electricity	7.5	9.2	23.75	3998	3998
Demand w/o household electricity, cum. generation	7.52	9.23	23.75	3998	3998

Heat pump

5485 South Ellis Avenue / Climate: Chicago / TFA: 240 m² / Heating: 25.2 kWh/(m²a) / Cooling: 13.2 kWh/(m²a) / PER: 42.3 kWh/(m²a)

			Building type:	Single family, semi-detached, masonry construction	
			Treated floor area A_{TFA}:	240	m²
Covered fraction of space heating demand		*('PER' worksheet)*		0%	
Space heating demand + distribution losses		Q_H+Q_{HL}: *(DHW+Distribution)*		6087	kWh/a
Solar fraction for space heat		$\eta_{Solar,\ H}$ *('SolarDHW' worksheet)*		0%	
Effective annual heating demand	$Q_{H,Wi}=Q_H*(1-\eta_{Solar,\ H})$			**0**	kWh/a
Covered fraction of DHW demand		*('PER' worksheet)*		100%	
Total heating demand of DHW system		Q_{gDHW} *(DHW+Distribution)*		3902	kWh/a
Solar fraction for DHW		$\eta_{Solar,\ DHW}$ *('SolarDHW' worksheet)*		0%	
Effective DHW demand	$Q_{DHW,Wi}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$			**3902**	kWh/a
Number of heat pumps in the system				1	
Functionality				DHW	
Heating					
Selection of HP: 0-None		Heat source:			
Selection of distribution system				2-Radiators	
Design distribution temperature		θ_{design} *(DHW+Distribution)*		26.66	°C
Nominal power of distribution system		P_{nom}		0.00	kW
Distribution system (to be completed by experienced users only)					
Nominal power of distribution system		P_{nom}			kW
Radiator exponent		n			
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)				1-Yes	
Specific heat losses storage		U * $A_{Storage}$		3.0	W/K
Storage location in thermal envelope				1-Inside	
Room temperature (storage location: outside of thermal envelope)			*(DHW+Distribution)*	20.00	°C
Sink temperature of heat pump for heating		θ_{snk}		60.00	°C
Entries in relation to the domestic hot water system					
Selection of HP: 2-Reliance 10 50 DHPHT NE		Heat source:		1-Outdoor air	
DHW temperature			*(DHW+Distribution)*	60.00	°C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)				1-Inside	
Specific heat losses storage		U * $A_{Storage}$		5.5	W/K
Room temperature (storage location: outside of thermal envelope)			*(DHW+Distribution)*	20.00	°C
Type of backup heater				1-Elec. Immersion heater	
Δθ of electric continuous flow water heater					K
Additional options in case of <u>one</u> heat pump for both functions: Heating & DHW					
Same heat pump's sink temperature for Heating and for DHW				0-No	
Heat pump priority			*(Manufacturer, tech. data)*	2-Heating priority	
Control strategy					
Heat pump control strategy				2-Ideal	
Heating					
Depth ground water / Ground collector / Ground probe		z			m
Power of pump for ground heat exchanger		P_{pump}			kW

Heating

Heat pump:

Source:

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

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

DHW

Heat pump: Reliance 10 50 DHPHT NE

Source: 1-Outdoor air

	θ_source °C	θ_sink °C	Heating capacity kW	COP
Test point 1	20.0	70.0	4.5	2.9
Test point 2	20.0	70.0	4.5	2.9
Test point 3	20.0	70.0	4.5	2.9
Test point 4	20.0	70.0	4.5	2.9
Test point 5	20.0	70.0	4.5	2.9
Test point 6	20.0	70.0	4.5	2.9
Test point 7	20.0	70.0	4.5	2.9
Test point 8	20.0	70.0	4.5	2.9
Test point 9	20.0	70.0	4.5	2.9
Test point 10	20.0	70.0	4.5	2.9
Test point 11	20.0	70.0	4.5	2.9
Test point 12	20.0	70.0	4.5	2.9
Test point 13	20.0	70.0	4.5	2.9
Test point 14	20.0	70.0	4.5	2.9
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 0.0 K

Electr. energy consumption pump (grnd. water / ground)	$Q_{El,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{El,dir}$	0	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	0	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	1082	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	2820	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	0	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	550	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	1435	kWh/a
Electrical consumption of HP	Qel_{HP}	1392	kWh/a

		1. HP: Heating or heating & DHW	2. HP: Domestic hot
Seasonal performance factor of heat pump	SPF_{H-1}	2.80	
		kWh/a	kWh/(m²a)
Final electrical energy demand heat generation	Q_{final}	1392	5.8
Annual primary energy demand		4400	18.3
		kg/a	kg/(m²a)
Annual CO_2-equivalent emissions		741	3.1