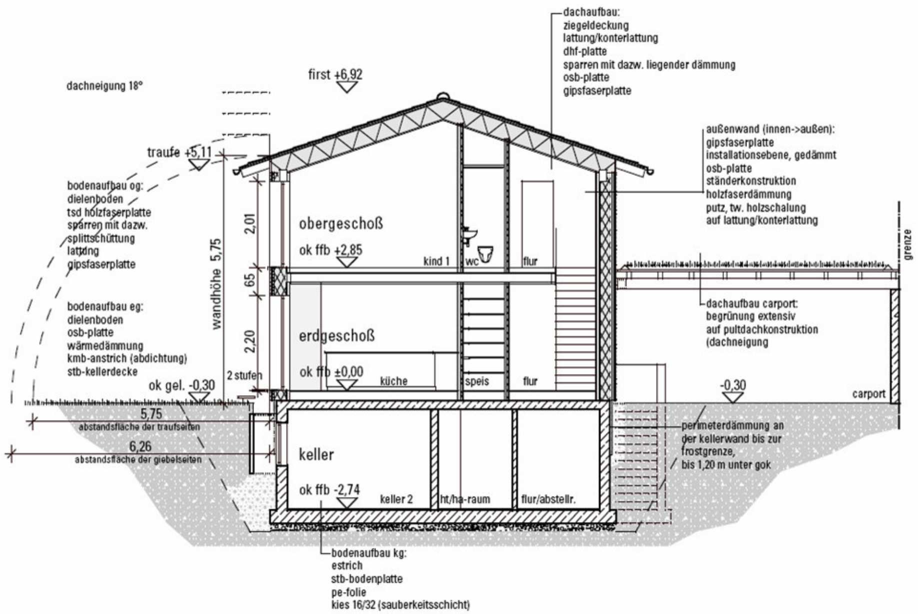
The PHPP System....

....the only way to achieve the Passive House standard???

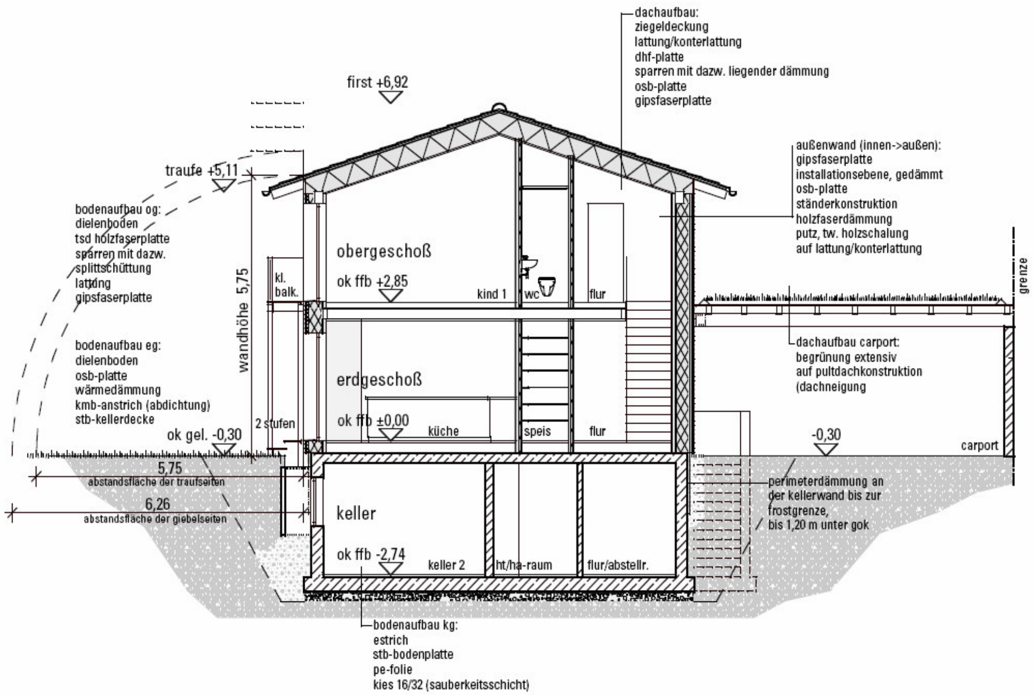
Passive House Institute Darmstadt
Dr.Jürgen Schnieders

Innovationszentrum Fensterbau
Di (FH) Franz Freundorfer
Lohbachstraße 3 D-83080 Oberaudorf
Tel.: (0049) 0170 / 34 66 0 99



Roof width L+R 4,43m

Hights of the wall L+R 5,94m
ridge 7,11m mean value 6,53m



schnitt mit balkon

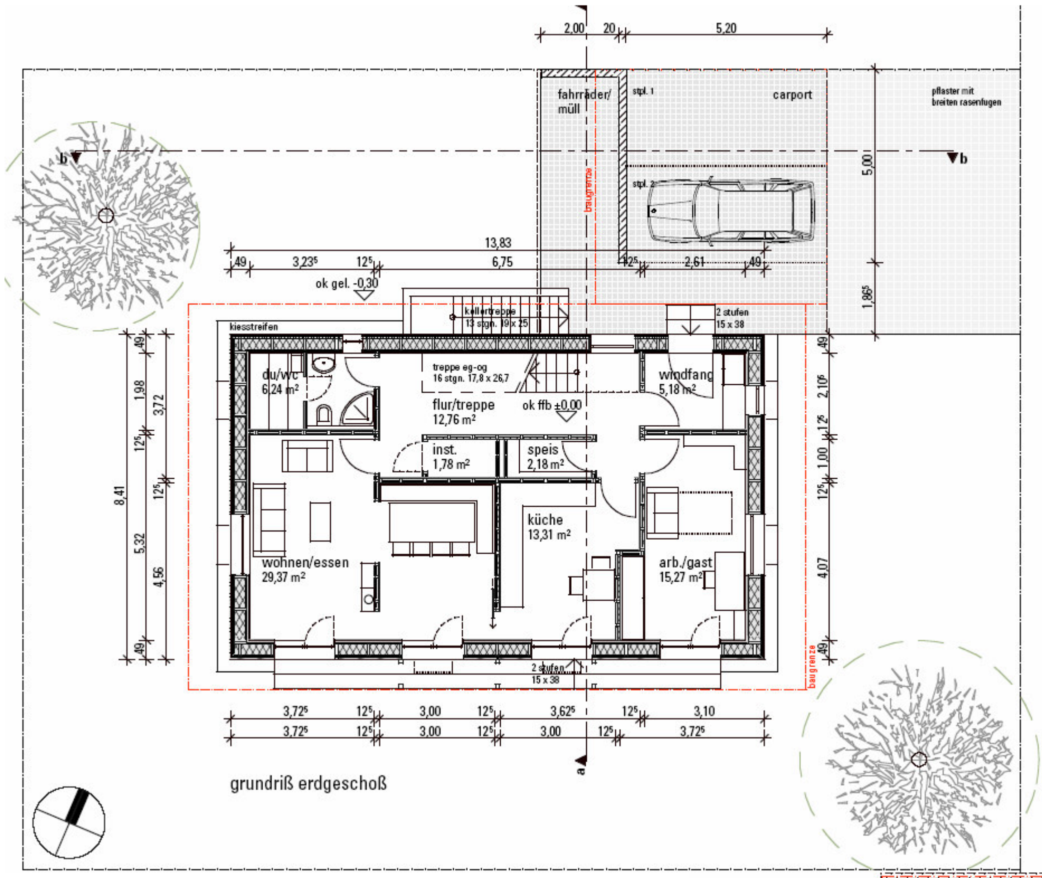
ostansicht

Fixed window first floor 1x 0,75x2,25
1x 1,50x2,25
Normal window top floor 1x 0,75x1,45
1x 1,50x1,45

Normal window top floor 1x 0,75x1,45
1x 1,50x1,45

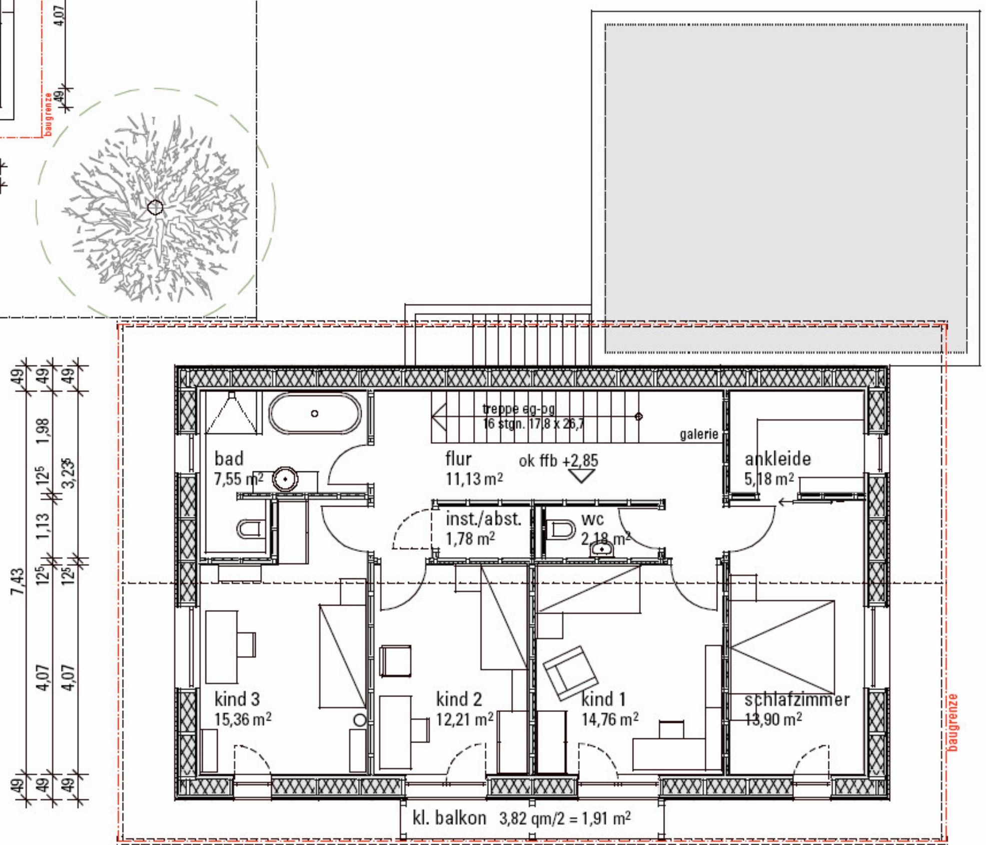
Fixed window first floor 1x 1,50x2,25

westansicht



footpoint 13,83 x 8,41

Treated floor area 169,53 m²



U-value wall =0,11 W/m²K, ceiling and roof =0,10 W/m²K

24.04.2006

südansicht

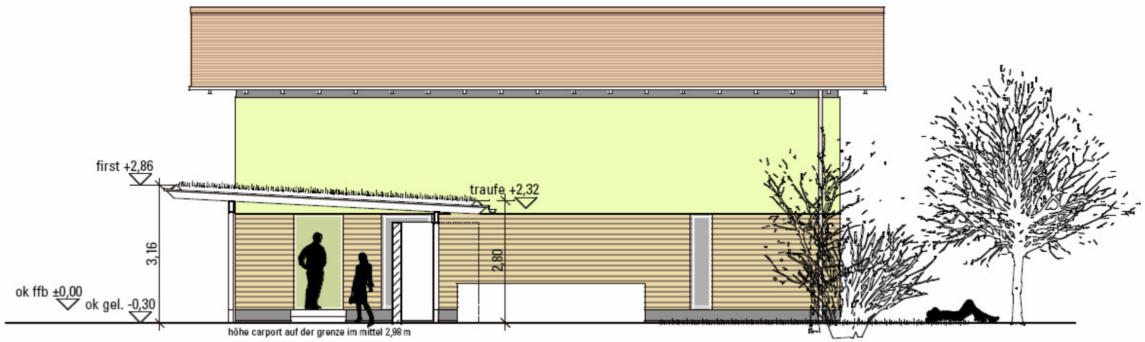
French door 2x 0,925x 2,25
6x 1,85 x 2,25

U_g-value = 0,60 W/m²K

g –value = 60%

U_D-value = 0,65 W/m²K

Outdoor I 1,15x2,25
Tilt window 0,925x2,25
Outdoor II 1,15x2,25



schnittansicht norden

Inputs to PHPP

- Sheet Verification, Climate Datat
- Calculate the U-values
- Input of the areas (all the walls with outside measure)
- Sheet WinTyp and Windows. Be careful with the orientation (Order east, south, west, north)
- Put in the windows single if they have different shading, make a own line for fixed windows
- Input of the shading
- Sheet ventilation.
- Summer overheating. Summer, Summer.S, SummVent

Excel sheet verification

passive house Freundorfer	
Oberbayern	Garmisch-P.
Martin Greif Straße 20	
83080 Oberaudorf	
bavaria	
one familiy house	

no standard climate

Josefa und Franz Freundorfer
Martin Greif Straße 20
83080 Oberaudorf

Dipl. Ing. Elke Kneißl
Morellstraße 27
86159 Augsburg

B.Tec Dr. Harald Krause
Sonnenfeld 9
83122 Samerberg

2006
1
742,0 m^3
5,0

Interior Temperature:	20,0	°C
Internal Heat Sources:	2,1	W/m²

Internal Heat Sources

Building Type: Residence

Standard Values used? Standard

Planned Number of Occupants:

5 Planning

Choose the climate region.

Passive House Planning

CLIMATE DATA

Standard/Regional Climate: Select Here.

Regional Climate Data

Germany (DIN 4108-6)

Choose the regional climate here:

Garmisch-P.

Climate Data for Heat Load

Heat Load Data Already Assigned

No Choice/Heat Load Data Assigned

Use Regional Data?	Yes
Climate Building	**Garmisch-P.**
Chosen Method Heat Requirement:	**Annual Method**
Monthly Data:	Garmisch-P. (Region
Annual Data:	0
Use Annual Climate Data Set	No

Annual Climate Data

	Carried over into Annual Method
H_T	**261**
G_t	**107**
East	**428**
South	**693**
West	**416**
North	**227**
Horizontal	**635**

Calculation of U-Values

Assembly No.	Building Assembly Description
1	wall plastered

Heat Transfer Resistance [m²K/W] interior R_{si} : 0,13
exterior R_{se}: 0,04

	Area of Section 1	λ [W/(mK)]	Area of Section 2 (optional)	λ [W/(mK)]	Area of Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.	plaster board	0,800					12
2.	fiber board	0,040	lightwood	0,130			60
3.	OSB board	0,170					15
4.	cellulose	0,040			timber frame	0,130	340
5.							
6.	fiber board inthermo	0,050					60
7.	outside plaster	0,600					5
8.							

Percentage of Sec. 2: 7,0%
Percentage of Sec. 3: 17,0%
Total: 49,2 cm

U-Value: 0,107 W/(m²K)

Assembly No.	Building Assembly Description
4	roof

Heat Transfer Resistance [m²K/W] interior R_{si} : 0,10
exterior R_{se}: 0,08

	Area of Section 1	λ [W/(mK)]	Area of Section 2 (optional)	λ [W/(mK)]	Area of Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.	timber board	0,130					15
2.	cellulose	0,040	timber	0,130			460
3.	MDF	0,160					16
4.							
5.							
6.							
7.							
8.							

Percentage of Sec. 2: 7,0%
Percentage of Sec. 3:
Total: 49,1 cm

U-Value: 0,096 W/(m²K)

Calculation of U-Values

Assembly No.	Building Assembly Description
2	wall timber

Heat Transfer Resistance [m²K/W] interior R_{si} : 0,13
exterior R_{se}: 0,08

	Area of Section 1	λ [W/(mK)]	Area of Section 2 (optional)	λ [W/(mK)]	Area of Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.	plaster board	0,800					12
2.	fiber board	0,040	lightwood	0,130			60
3.	OSB board	0,170					15
4.	cellulose	0,040			timber frame	0,130	340
5.							
6.	fiber board isolair	0,035					35
7.							
8.							

Percentage of Sec. 2: 7,0%
Percentage of Sec. 3: 17,0%
Total: 46,2 cm

U-Value: 0,110 W/(m²K)

Assembly No.	Building Assembly Description
3	ceiling to the basement

Heat Transfer Resistance [m²K/W] interior R_{si} : 0,17
exterior R_{se}: 0,04

	Area of Section 1	λ [W/(mK)]	Area of Section 2 (optional)	λ [W/(mK)]	Area of Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.	timber flooring	0,130					25
2.	OSB board	0,170					22
3.	cellulose	0,040	timber timb	0,130			160
4.	OSB board	0,170					22
5.	cellulose	0,040			timber	0,130	300
6.	OSB board	0,170					15
7.							
8.							

Percentage of Sec. 2: 10,0%
Percentage of Sec. 3: 16,0%
Total: 54,4 cm

U-Value: 0,099 W/(m²K)

Excel sheet U -List

Passive House Planr

U - L I S T

Sheet with compilation of calculated assemblies from U-Values worksheet and further assemblies from data banks

	Type						
Assembly Nr.	Assembly Description	Total Thickness	U-Value	Thickness of Insulation Layer	Thermal Conductivity of Insulation Layer	Spec. Capacity C_{eff}	Min. Moisture Diffusion
		m	$W/(m^2K)$	m	W/(mK)	kJ/m²/K	sd_{min} m
1	- none -						
2	wall plastered	0,492	0,11				
3	wall timber	0,462	0,11				
4	ceiling to the basement	0,544	0,10				
5	roof	0,491	0,10				
6							
7							
8							
9							

Excel sheet WinTyp

Pass

G L A Z I N G   T Y P E   I N   A C

To the frames from row: 64

	Type			
Assembly Nr.	**Glazing**	**g-Value**	**U_g-Value**	
			$W/(m^2K)$	
1	Triple glass Unitop	0,520	0,600	
2				
3				

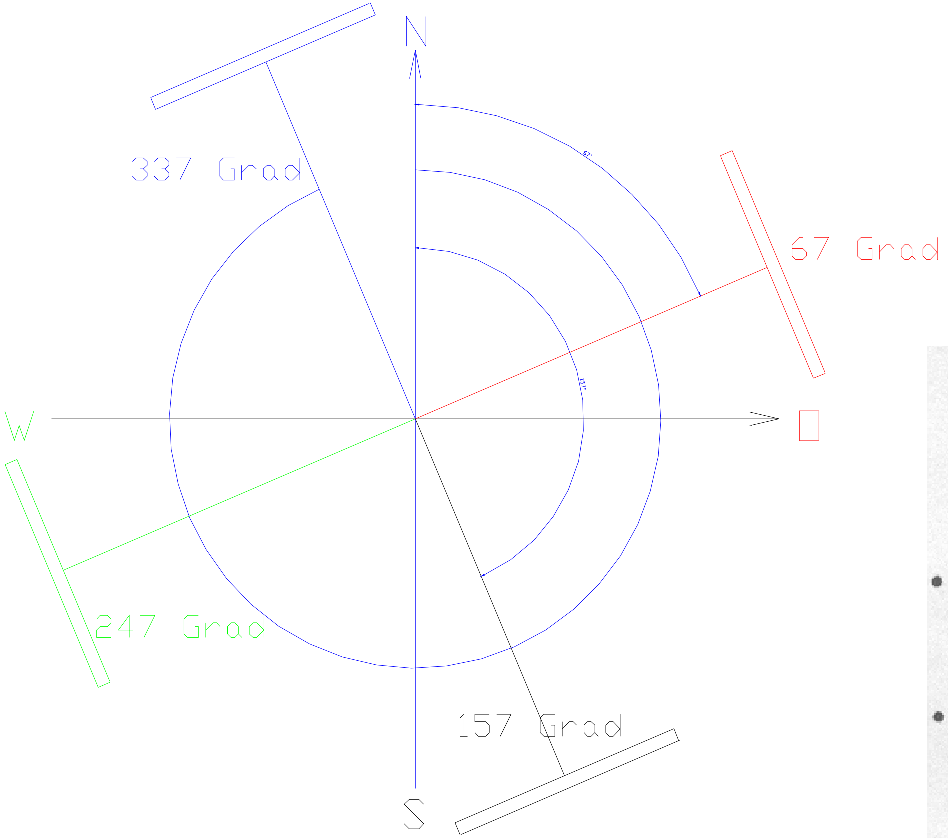
Excel sheet WinTyp

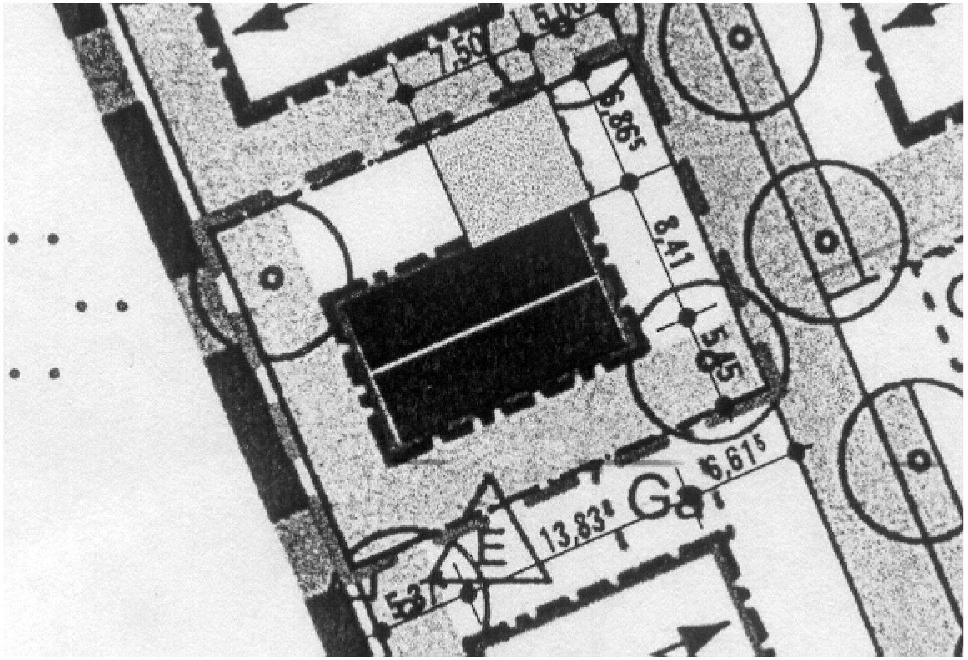
F R A M E   T Y P E   I N   A C C O R D A N C E   W

To the glazings from row: 2

	Type	U_w-Value	Frame Measurements				Thermal Bridge
Assembly Nr.	**Frame**	**Frame**	**Width - Left**	**Width - Right**	**Width - Below**	**Width - Above**	$\Psi_{glass\ edge}$
		$W/(m^2K)$	m	m	m	m	W/(mK)
1	Double wood normal	0,950	0,118	0,118	0,118	0,118	0,050
2	Double wood fixed	0,950	0,068	0,068	0,068	0,068	0,050
3							
4							
5							

Difference to northern orientation





Solar heat gain with average shading

g-Value	Reduction Factor for Solar Radiation	Window Areas	Window U-Values	Glazing Area	Average Global Radiation	Transmission Losses	Heat Gains Solar Radiation
						107,2	
		m^2	$W/(m^2K)$	m^2	$kWh/(m^2a)$	kWh/a	kWh/a
0,52	0,46	8,33	0,85	6,3	337	757	672
0,52	0,44	29,14	0,86	21,1	669	2686	4447
0,52	0,46	6,64	0,84	5,0	519	596	824
0,52	0,40	2,08	0,89	1,4	240	198	105
0,00	0,00	0,00	0,00	0,0	635	0	0
0,52	0,44	46,18	0,86	33,9		4237	6048

Calculation of shading at the windows

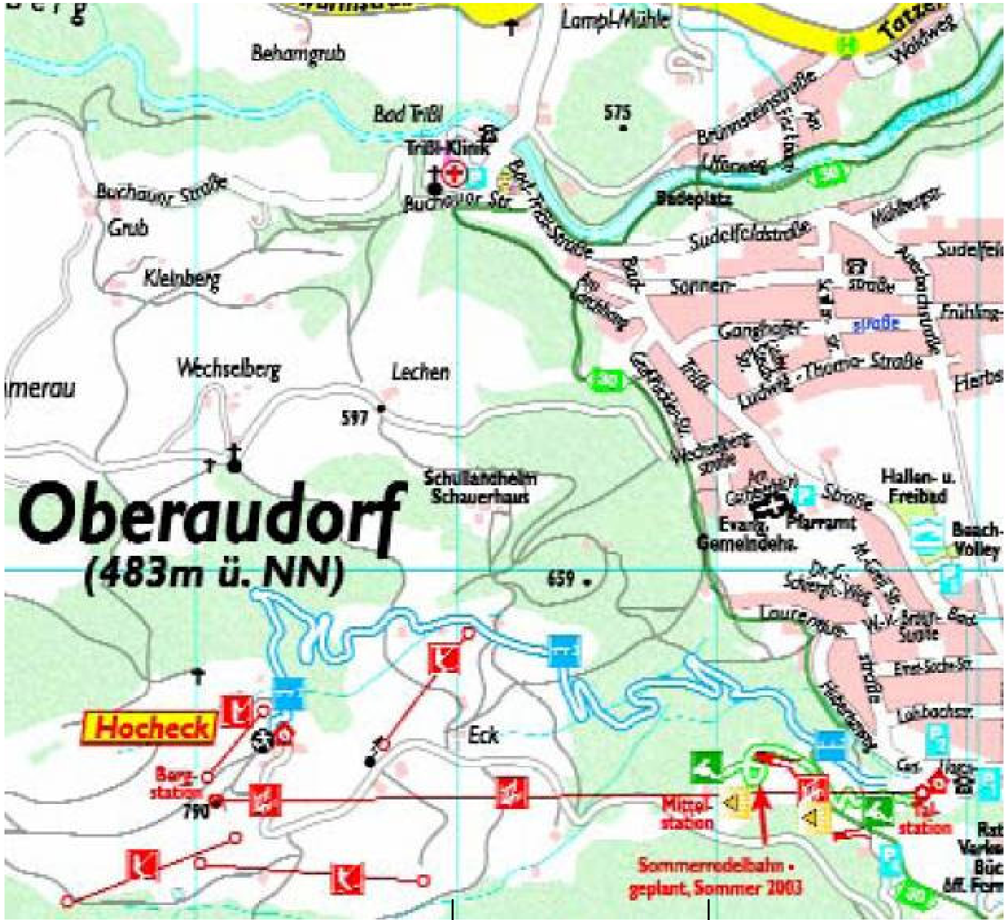
- We are looking out of every window and add the values to the PHPP in three cases

- Trees, houses, mountains ......

- Reveal

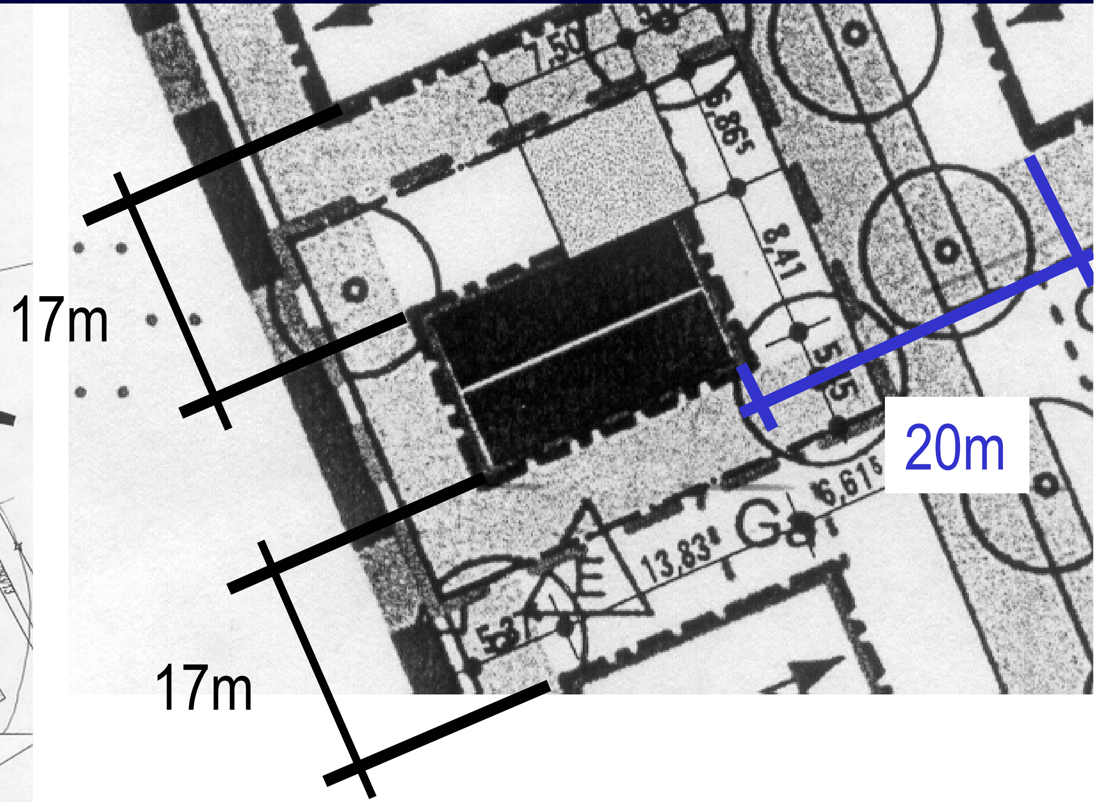
- Overhang: roof, balkony...

Plan of surrounding area for the shading of mountains

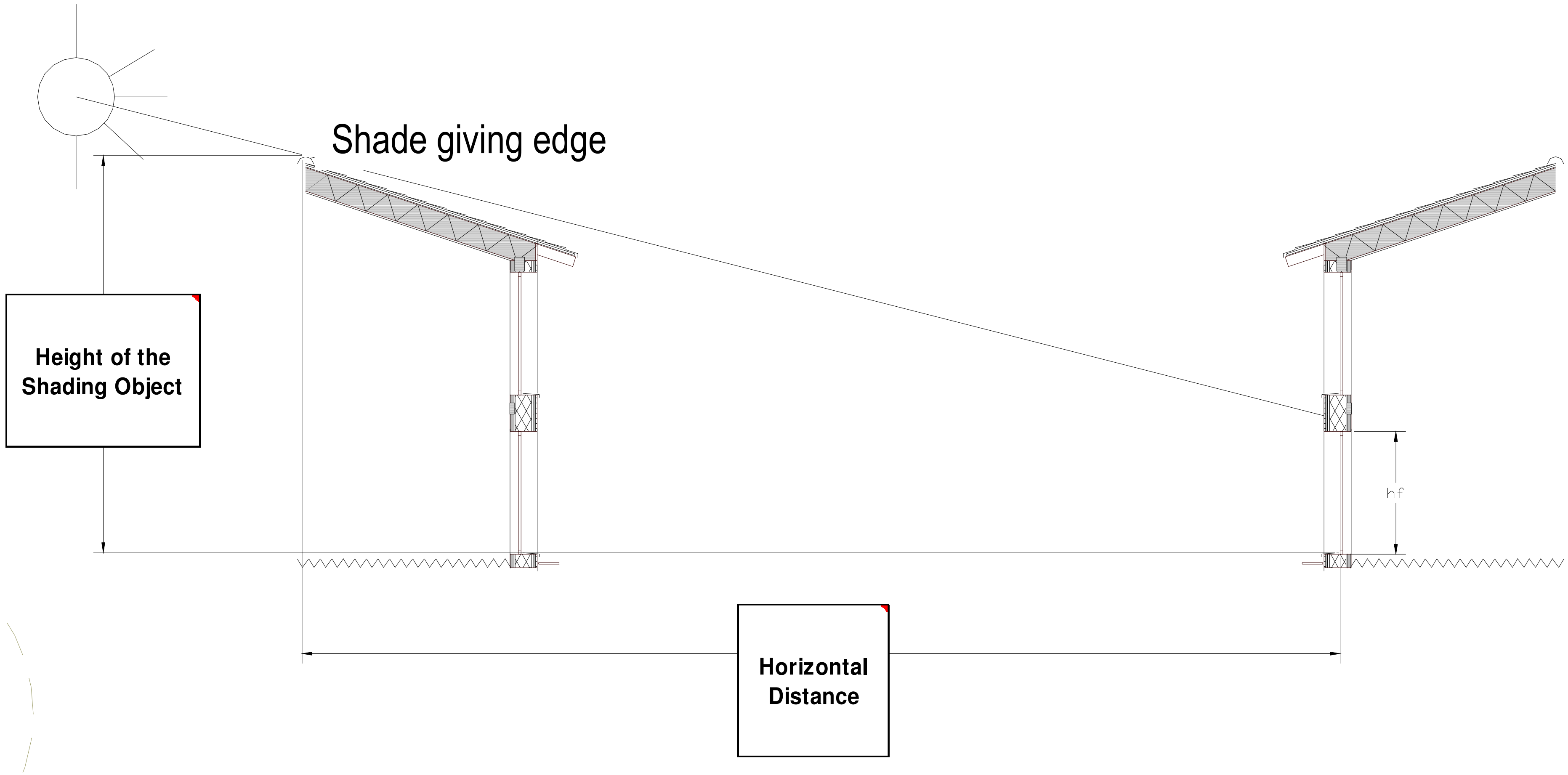


500 m

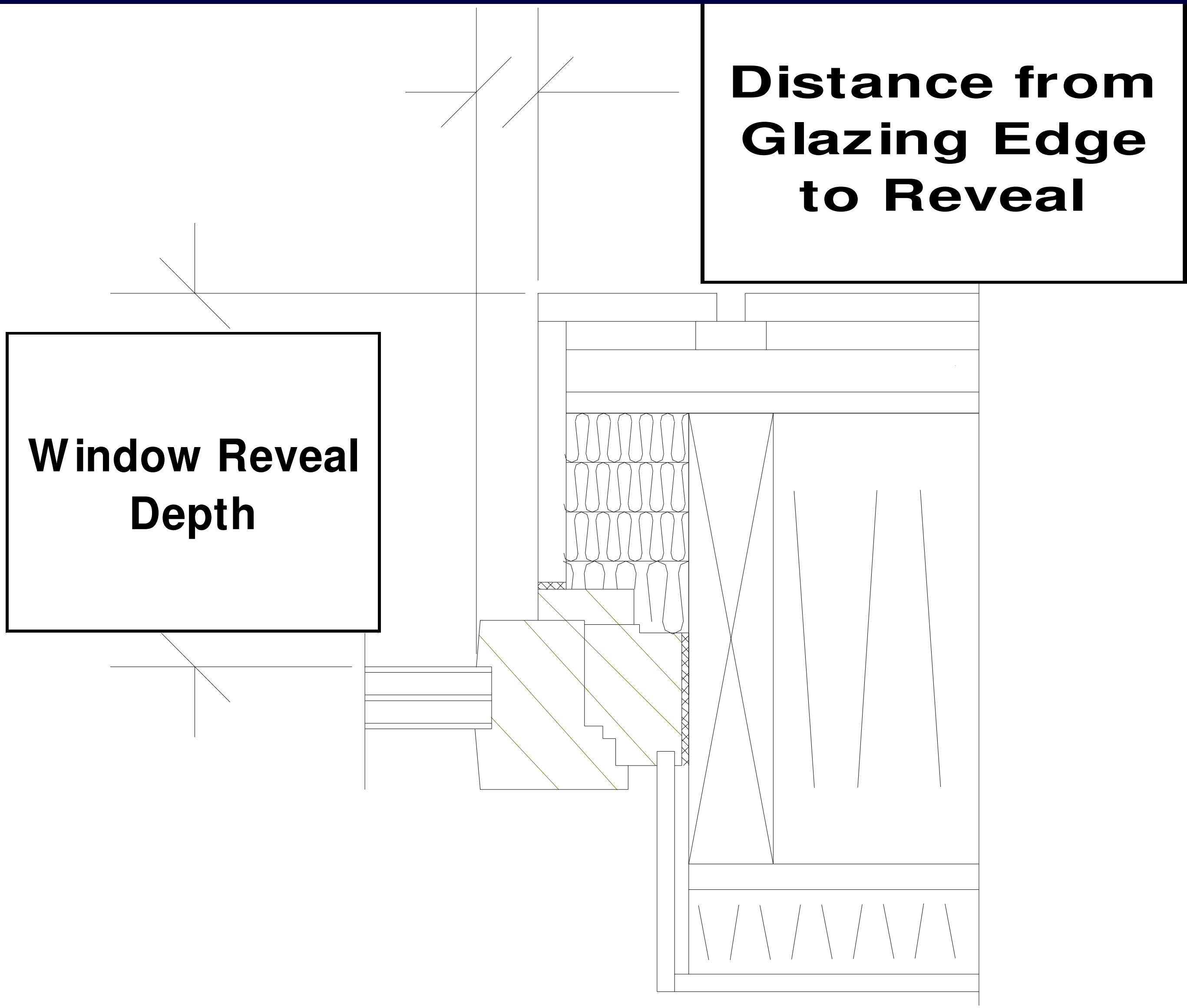
Position plan is needed for the input of shading



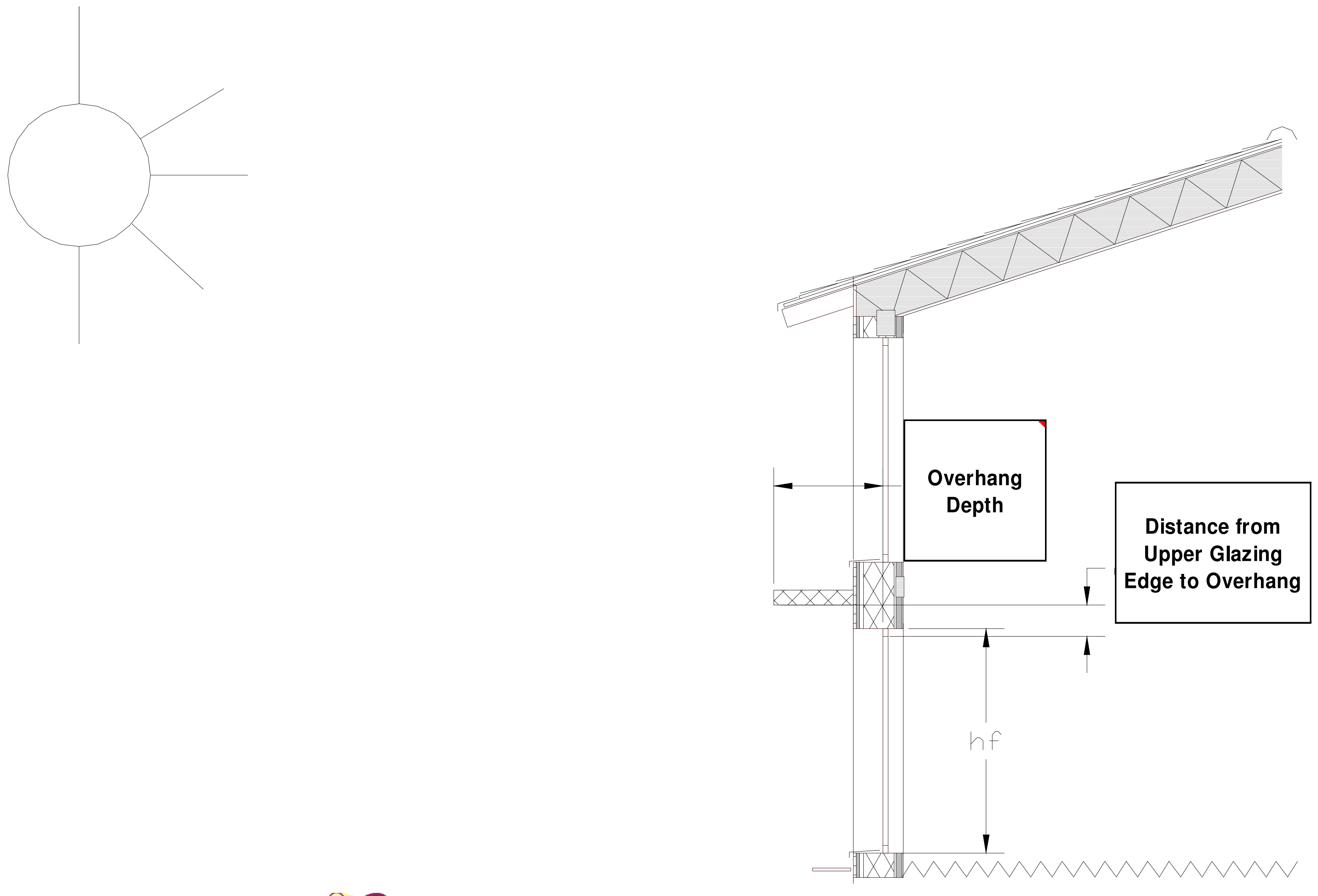
Shading of a house by a window on the first floor



Emprasure by windows



Shading of a supernatant: roof, balkony...



Solar heat gain with exact shading

g-Value	Reduction Factor for Solar Radiation	Window Areas	Window U-Values	Glazing Area	Average Global Radiation	Transmission Losses	Heat Gains Solar Radiation
		m^2	$W/(m^2K)$	m^2	$kWh/(m^2a)$	kWh/a	kWh/a
0,52	0,51	8,33	0,85	6,3	337	757	745
0,52	0,39	29,14	0,86	21,1	669	2686	3991
0,52	0,43	6,64	0,84	5,0	519	596	767
0,52	0,33	2,08	0,89	1,4	240	198	86
0,00	0,00	0,00	0,00	0,0	635	0	0
0,52	0,42	46,18	0,86	33,9		4237	5589

With average shading the value was: **4237** **6048**

The input of the ventilation data

Building: passive house Freundorfer

Treated Floor Area A_{TFA}	m^2	165	*(Areas worksheet)*
Room Height, h	m	2,5	*(Annual Heat Requirement worksheet)*
Room Ventilation Volume (A_{TFA}*h) = V_{RAX}	m^3	413	*(Annual Heat Requirement worksheet)*

Ventilation System Layout - Standard Operation

Occupancy	m^2/P	33				
Number of Occupants	P	5,0				
Supply Air per Person	m^3/(P*h)	30				
Supply Air Requirement	m^3/h	150				
Extract Air Rooms		Kitchen	Bathroom	Shower	WC	thing,wasch
Quantity		1	1	1	1	1
Extract Air Requirement per Room	m^3/h	60	40	20	20	25
Total Extract Air Requirement	m^3/h	165				

Design Air Flow Rate (Maximum) m^3/h 165

Average Air Change Rate Calculation

Type of Operation	Daily Operation Times h/d	Factors Referenced to Maximum	Air Flow Rate m^3/h	Air Change Rate 1/h
Maximum	0,0	1,00	165	0,40
Standard	24,0	0,77	127	0,31
Basic	0,0	0,54	89	0,22
Minimum		0,40	66	0,16

x Residential Building	**Average Value** 0,77	Average Airflow Volume (m^3/h) 127	Average Air Change Rate 0,31

The input of the ventilation data

Infiltration Air Change Rate Following DIN EN 832.

Wind Protection Coefficients, e and f, in Accordance With EN 832.		
Coefficient e for Screening Class	Several Sides Exposed	One Side Exposed
No screening	0,10	0,03
Moderate Screening	0,07	0,02
High Screening	0,04	0,01
Coefficient f	15	20

			for Ann. Reqment:	for Heat Load:	Net Air Volume for Press. Test
Wind Protection Coefficient, e			0,07	0,18	
Wind Protection Coefficient, f			15	15	
Air change rate at Press. Test	n_{50}	1/h	0,40	0,40	413

Type of Ventilation System

				for Ann. Reqment:	for Heat Load:
x	Balanced PH Ventilation	*Please check.*			
	Pure Extract Air				
	Excess Extract Air		1/h	0,00	0,00
	Infiltration Air Change Rate	$n_{V,Res}$	1/h	0,028	0,070

Actual efficiency of the ventilation system with heat recovery

	Central unit within the thermal envelope.
x	Central unit outside of the thermal envelope.

Efficiency of Heat Recovery	$\eta_{eff,HR}$		92%	
Conductance Supply Air Duct	Ψ	W/(mK)	0,337	Calculation see Secondary Calculati
Supply Air Duct Length		m	2	
Conductance Extract Air Duct	Ψ	W/(mK)	0,337	Calculation see Secondary Calculati
Extract Air Duct Length		m	2	Room Temperatur
Temperature of Mechanical Service Room		°C	12	Average Exterior T
(Enter only if the central unit is outside of the thermal envelope.)				

Actual Efficiency of Heat Recovery	$\eta_{HR,eff}$	91%
Efficiency of Heat Recovery of Subsoil Heat Exchanger	η_{SHX}	20%

Secondary Calculation:

Ψ-Value Supply or Outdoor Air Duct

Nominal Width	160	mm
Insul. Thickness:	60	mm
Reflecting surface? Please mark with an "x"!		
Yes		
No	x	
Thermal Conductivity	0,035	W/(mK)
Nominal Air Flow Rate	127	m³/h
$\Delta\vartheta$	8	K
Interior Duct Diameter	0,160	m
Exterior Duct Diameter	0,160	m
Exterior Diameter	0,280	m
α–Interior	8,71	W/(m²K)
α–Surface Area	5,77	W/(m²K)
Ψ-Value	**0,337**	**W/(mK)**
Surface temperature difference	1,145	K

Wellbeing without overheating (sheet Summer)

Interior Heat Sources Q_I	2,10	*	165	=	347	2,1

Frequency of Overheating $h_{\vartheta \geq \vartheta max}$ **43,9%** **at an overheating limit of ϑ_{max} = 25 °C**

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

S U M M E R

Climate:	Garmisch-P.	Interior Temperature:	20 °C
Building:	passive house Freundorfer	Building Type/Use:	one familiy house
Location:	Oberbayern	Treated Floor Area A_{TFA}:	165,2 m²
Specific Capacity	84 Wh/K per m² FS	Standard Occupancy:	5,0 Pers
Overheating Limit:	25 °C		

	Building Element	Temperature Zone	Area m²		U-Value W/(m²K)		Red. Factor fT,Summer		H_{Summer} Heat Conducance
1,	Exterior Wall - Ambie	A	230,4	*	0,108	*	0,92	=	23,0
2,	Exterior Wall - Groun	B	116,3	*	0,099	*	1,00	=	11,5
6,		A		*		*	0,92	=	
7,		X		*		*	0,69	=	
8,	Windows	A	46,2	*	0,856	*	1,00	=	39,5
9,	Exterior Door	A	5,0	*	0,650	*	1,00	=	3,2
10,	Exterior Thermal Brid	A	158,2	*	-0,032	*	0,92	=	-4,7
11,	Perimeter Thermal Bri	P	43,7	*	-0,020	*	1,00	=	-0,9
12,	Ground Thermal Bridge	B		*		*	1,00	=	

The capacity for buffering energie depends on the used materials.

Exterior Heat Flow Coefficient, $H_{T,e}$	68,4	W/K
Ground Heat Flow Coefficient, $H_{T,g}$	10,6	W/K

Wellbeing without overheating (sheet Summer)

Exterior Heat Flow Coefficient, $H_{T,e}$	68,4	W/K
Ground Heat Flow Coefficient, $H_{T,g}$	10,6	W/K

Efficiency of Heat Recovery of the plate heat exchanger η_{HR} 91%

effective Air Volume V_V: A_{TFA} (m²) 165,2 * Room Clearance (m) 2,50 = 413 m³

Mark with 'x':

	Free Ventilation (Windows + Cracks):	**Summer Air Change Rate:** 1/h	0,60
	Mech. Exhaust Only	0,60 1/h	
	Supply and Exhaust Air as During Winter Operation, With HR.		
x	**Supply/Exh. w/o HR**	0,20	η_{SHX} **Subsoil Heat Excha**

Energetically Effective Air Exchange n_V: 0,000 + 0,600 (1/h) * (1 - 0,000 (η_{HR})) + 0,028 ($n_{V,Rest}$ 1/h)

V_V m³ | $n_{V,equi\ Portion}$ 1/h | c_{Air} Wh/(m³K)

Ext.

Grou

Can come from natur or mechanical Ventilation (without heat recovery)

Q_T W/K | Q_L W/K | kWh/a

Input sheet Summer-Shading

	Distance from Upper Glazing Edge to Overhang	Additional Shading Reduction Factor (Summer)	Summer Temporary Shading Reduction Factor, z	Summer Horizontal Shading Reduction Factor	Reveal Shading Reduction Factor	Overhang Shading Reduction Factor	Total Summer Shading Reduction Factor
	m	%	%	%	%	%	%
	d_{Over}			r_H	r_L	r_O	r_V
North	0,00	100%	100%	78%	83%	98%	63%
East	1,40	100%	100%	100%	96%	93%	89%
East	1,20	100%	100%	93%	90%	92%	77%
East	0,00	100%	10%	100%	96%	99%	10%
East	0,00	100%	100%	82%	90%	99%	73%
South	0,25	100%	100%	92%	89%	66%	54%
South	0,25	100%	100%	92%	89%	66%	54%
South	0,25	100%	100%	92%	100%	67%	61%
South	0,25	100%	100%	87%	89%	66%	51%
South	0,25	100%	100%	87%	100%	67%	58%
South	0,25	100%	100%	87%	89%	66%	51%
South	0,25	100%	100%	87%	100%	67%	58%
West	0,00	100%	10%	85%	96%	99%	8%
West	1,40	100%	100%	85%	96%	87%	72%
West							%

East and west windows are typical overheating elements. Put in the z value of the used shading system.

The PHPP System....

....the only way to achieve the Passive House standard!!!

Passive House Institute Darmstadt
Dr.Jürgen Schnieders

Innovationszentrum Fensterbau
Di (FH) Franz Freundorfer
Lohbachstraße 3 D-83080 Oberaudorf
Tel.: (0049) 0170 / 34 66 0 99