PHPP 概论

演讲者:
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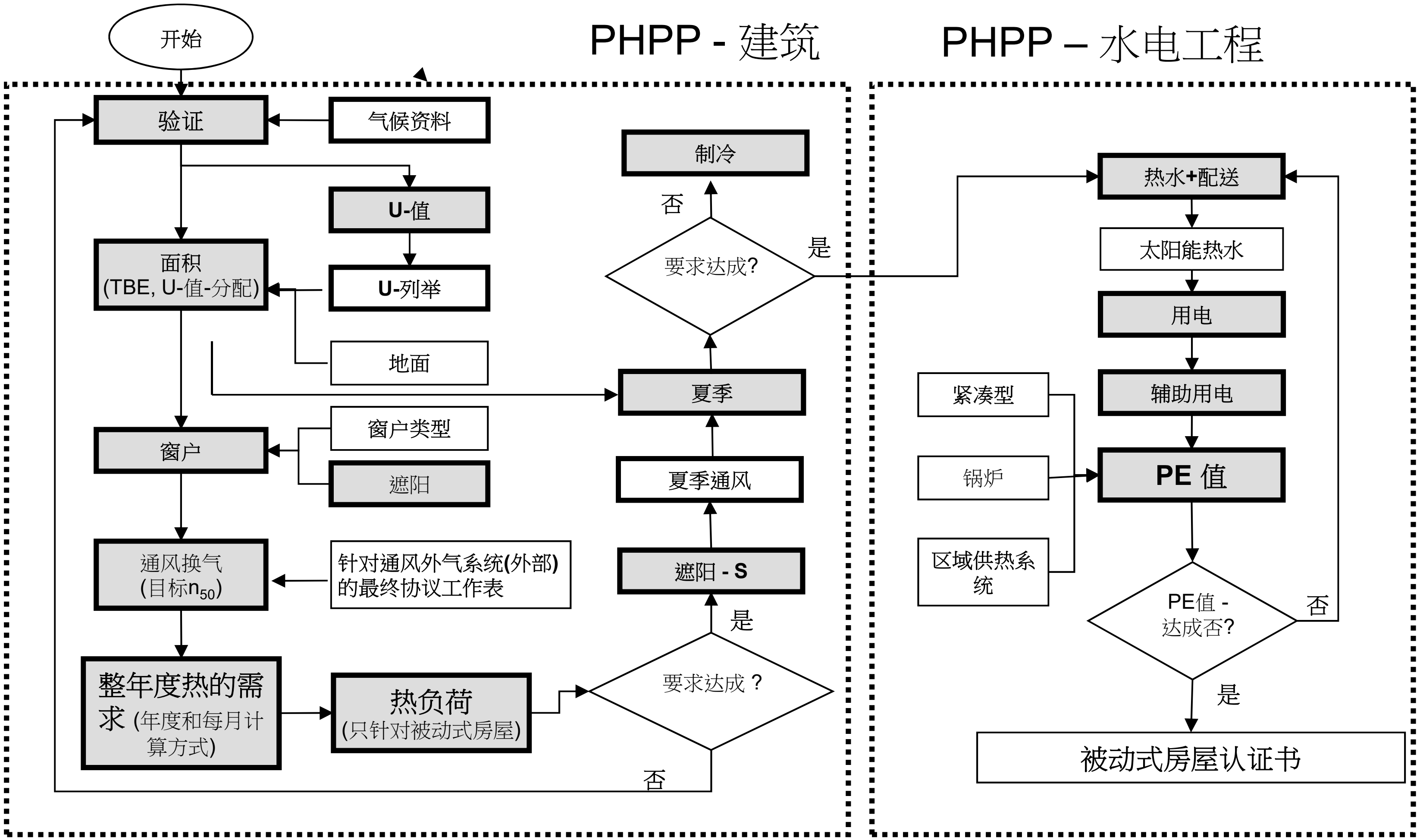
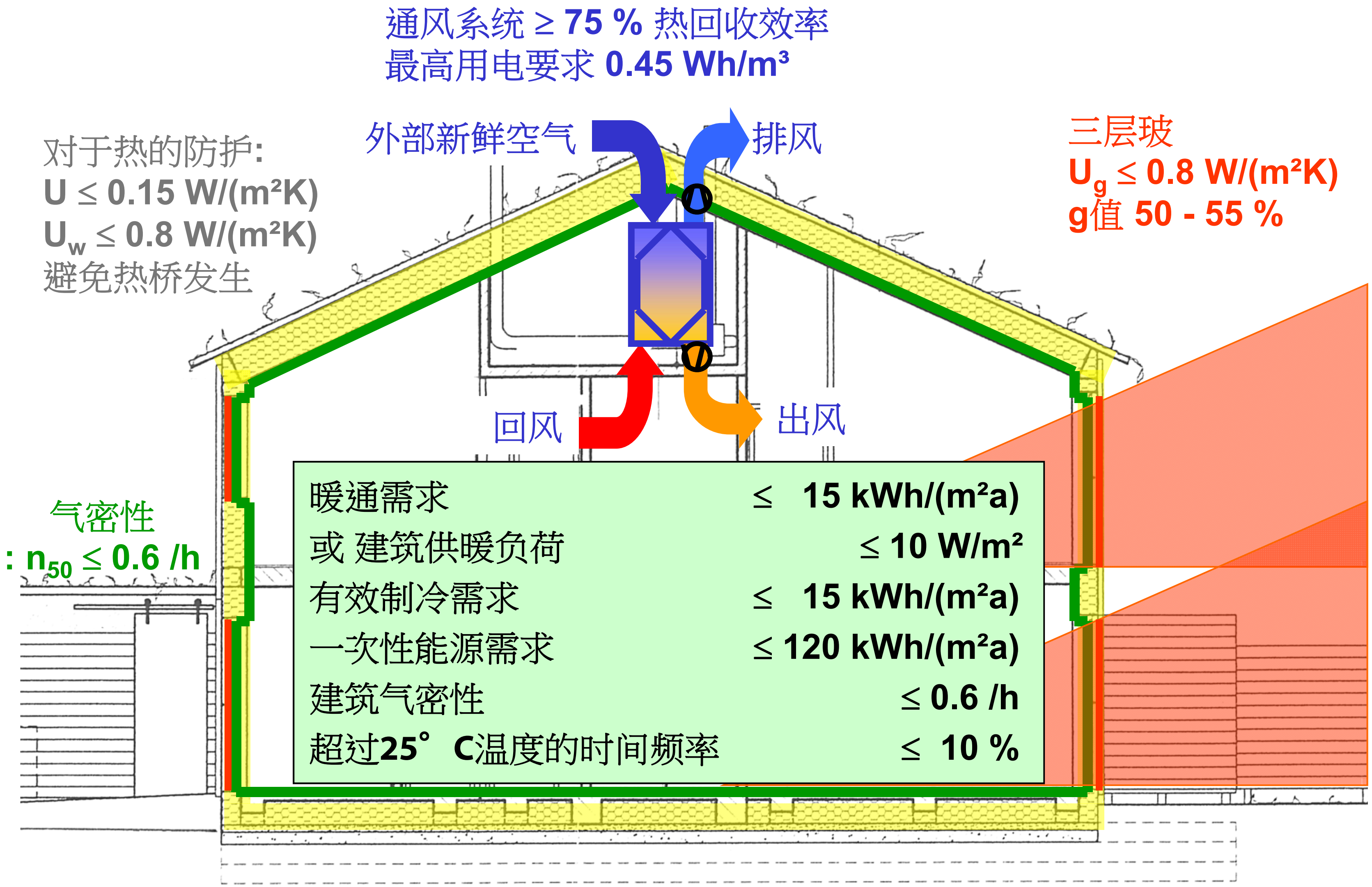
PHPP介绍: 内容

- 介绍
- 使用 PHPP: 排序
- 边界状况
- 非透明建筑材质
- 窗户
- 通风
- 热需求和热负荷
- 生活热水需求和热损
- 电力需求
- 一 次性能源需求
- 夏季时节应用

概要: PHPP 2007

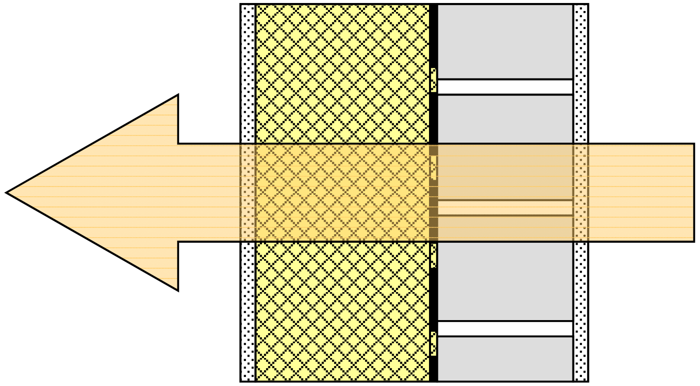

开始
PHPP - 建筑
PHPP – 水电工程
验证
气候资料
U-值
U-列举
面积
(TBE, U-值-分配)
地面
窗户类型
窗户
遮阳
通风换气
(目标n_{50})
针对通风外气系统(外部)的最终协议工作表
整年度热的需求 (年度和每月计算方式)
热负荷
(只针对被动式房屋)
要求达成？
是
否
遮阳 - S
夏季通风
夏季
要求达成?
否
制冷
是
热水+配送
太阳能热水
用电
辅助用电
紧凑型
锅炉
区域供热系统
PE 值
PE值 -
达成否?
否
是
被动式房屋认证书

被动式房屋准则



暖通需求	≤ 15 kWh/(m²a)
或 建筑供暖负荷	≤ 10 W/m²
有效制冷需求	≤ 15 kWh/(m²a)
一次性能源需求	≤ 120 kWh/(m²a)
建筑气密性	≤ 0.6 /h
超过25° C温度的时间频率	≤ 10 %

热传递

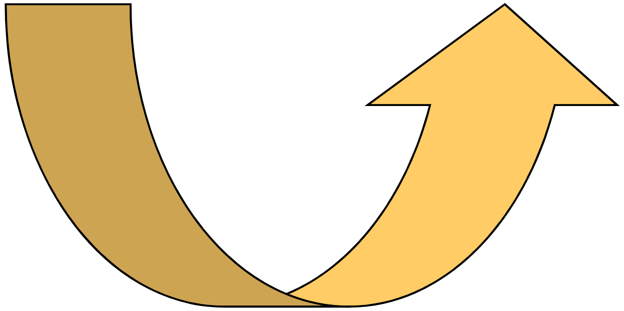


传递:

热平衡外围护的面积* U值 * 温度校正系数 * 热度时

$$Q_T = A * U * f_t * G_t$$

通风换气

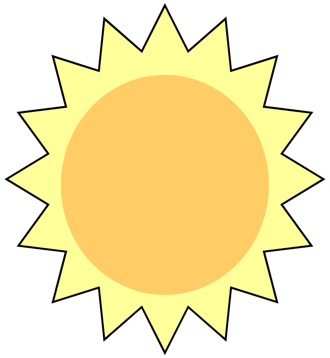


通风换气:

风量 * 等效换气 * 热容量(空气) * 热度时

$$Q_V = V * n_{equiv.} * c_p\rho * G_t$$

太阳辐射热得



太阳辐射热得:

折减系数 * **g**-值 * 窗户面积 * 总辐射

$$Q_S = r * g * A * G$$

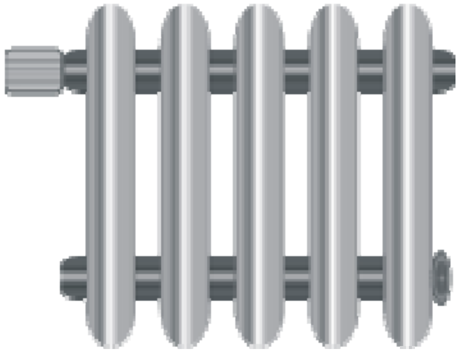
内部热得

内部热得:

供暖期时间长度 * 具体室内热得 * 实际居住面积

$$Q_I = t_{Heat} * q_i * A_{TFA}$$

暖通需求，依照整年度的计算过程



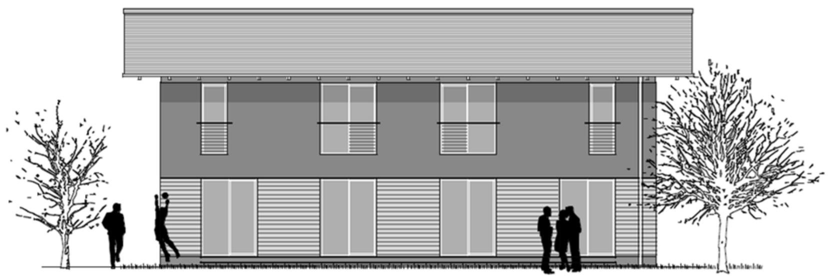
暖通需求:

剩余差额 = 热传递 + 通风换气 - η * (太阳辐射热+ 室内热得)

$$Q_H = Q_T + Q_V - \eta^*(Q_S + Q_I)$$

实际住宅案例 Freundorfer, Oberaudorf

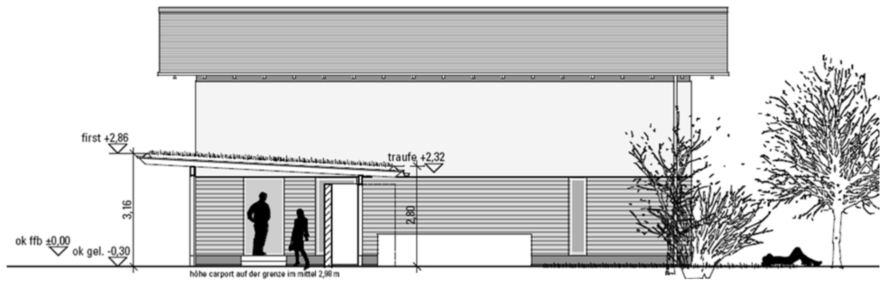
Freundorfer住宅: 立面



南向立面

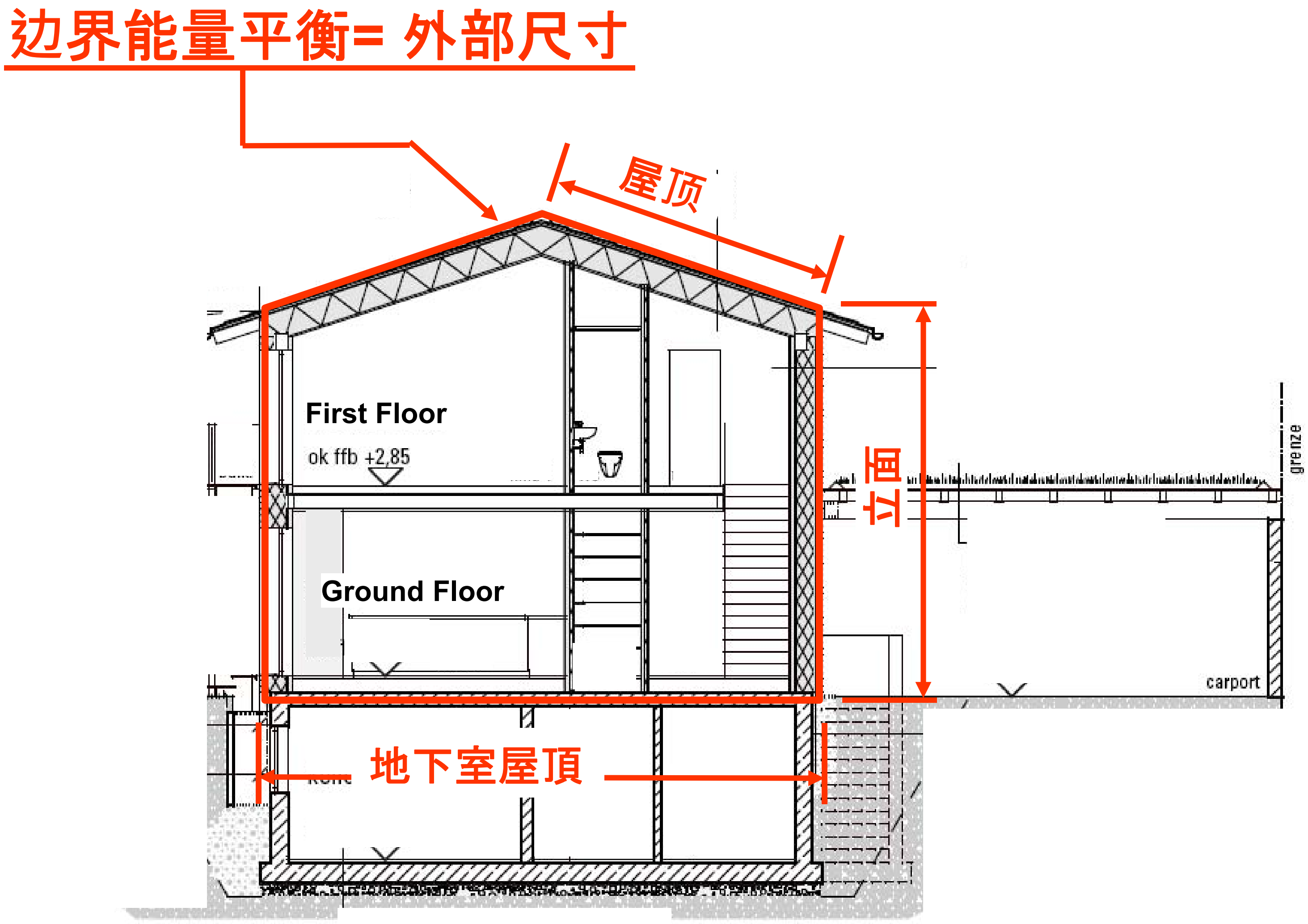
西向立面

东向立面



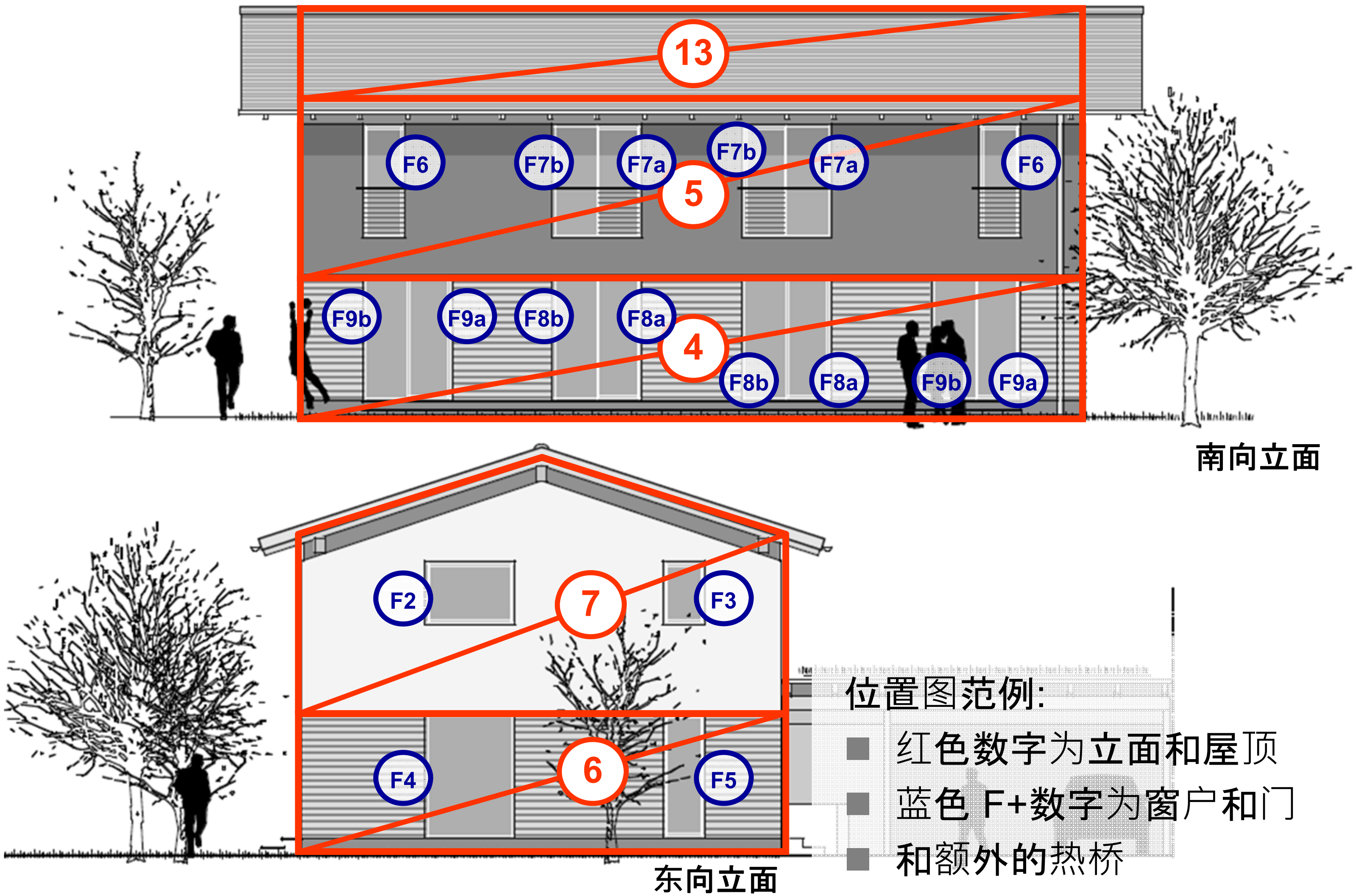
北向立面

Freundorfer 单一家庭住宅: 剖面



Freundorfer 单一家庭住宅: 立面 - 1

位置图:使用位置号码



位置图范例:

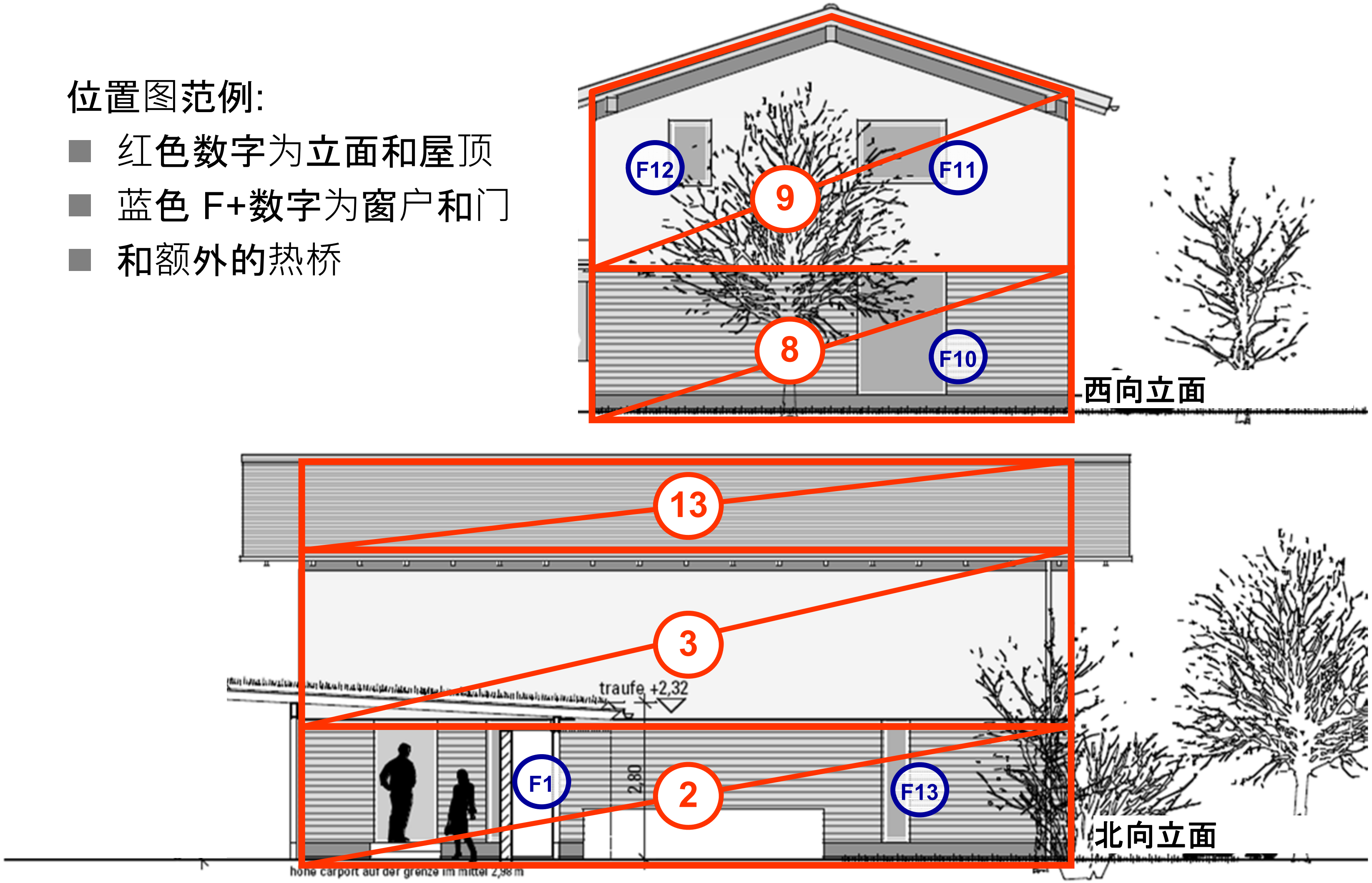
- 红色数字为立面和屋顶
- 蓝色 F+数字为窗户和门
- 和额外的热桥

Freundorfer 单一家庭住宅: 立面 - 2

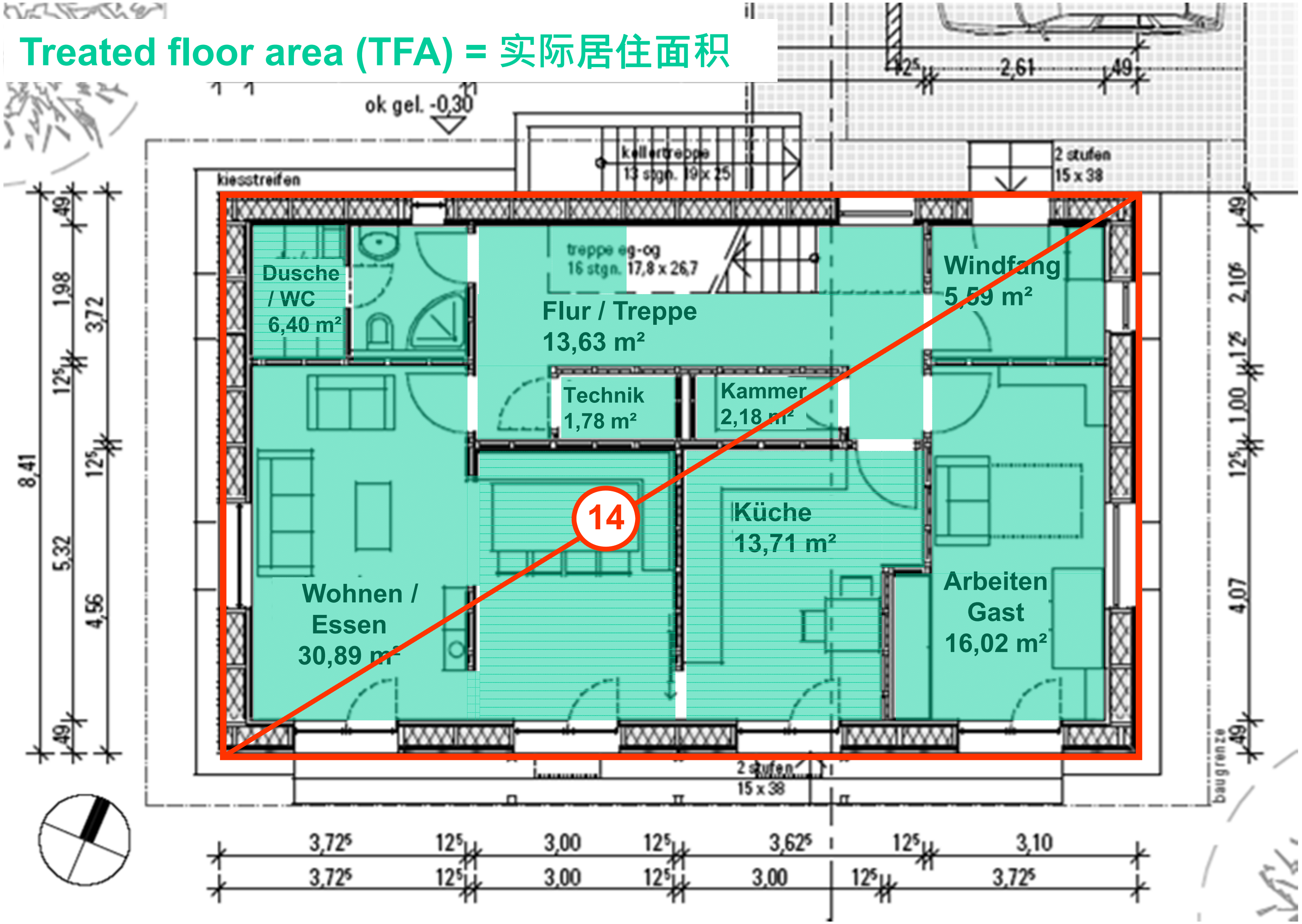
位置图:使用位置号码

位置图范例:

- 红色数字为立面和屋顶
- 蓝色 F+数字为窗户和门
- 和额外的热桥



Freundorfer 单一家庭住宅: 一楼平面图



输入外墙结构

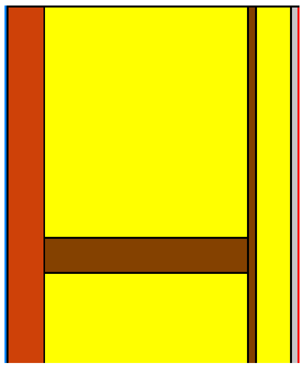
Assembly No.	Building Assembly Description
2	Exterior Wall Plastered

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

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)]	Total Width Thickness [mm]
1.	Gypsum Plasterboard	0,800					12
2.	Flax Insulation	0,040	Wooden Post 40mm, hor. Dis	0,130			60
3.	OSB Board	0,170					15
4.	Cellulose, Insulation	0,040			Wooden Post	0,130	340
5.	Wood Fibre Insulation Board	0,050					60
6.	Plaster	0,600					5
7.							
8.							
				Percentage of Sec. 2: 6,3%		Percentage of Sec. 3: 7,2%	Total: 49,2 cm

U-Value: 0,097 W/(m²K)



外墙组成Exterior Wall Plastered

12.5 mm Gypsum Plasterboard, λ=0.80 W/mK

60 mm Flax Insulation, λ=0,40 W/mK, 6.3% Wood

15 mm OSB, λ=0.17 W/mK

340 mm Cellulose, λ=0,04 W/mK, 7.2% Wood

60 mm Wood Fibre Insulation Board, λ=0.050 W/mK

5 mm Plaster, λ=0.80 W/mK

PHPP: 面积数据输入

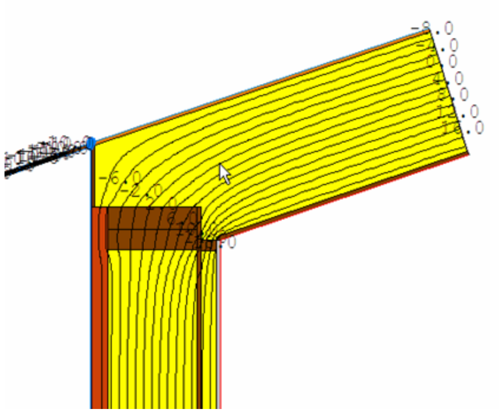
Area Input																
Area Nr.	Building Element Description	Group Nr.	Assigned to Group	Quan-tity	x (	a [m]	x	b [m]	+	User-Deter-mined [m²]	-	User Sub-traction [m²]	-	Subtraction Window Areas [m²]	) =	Area [m²]
	Treated Floor Area	1	Treated Floor Area		x (		x		+		-				) =	0,0
	North Windows	2	North Windows	Please complete in Windows worksheet only!												4,1
	East Windows	3	East Windows													8,2
	South Windows	4	South Windows													28,4
	West Windows	5	West Windows													6,5
	Horizontal Windows	6	Horizontal Windows													0,0
	Exterior Door	7	Exterior Door	1	x (	1,15	x	2,25	+		-		) -		=	2,6
1					x (		x		+		-		) -	0,0	=	
2	EXW North Ground Floor planked	8	Exterior Wall - Ambient	1	x (	13,77	x	2,86	+		-	2,59	) -	4,1	=	32,7
3	EXW North First Floor plastered	8	Exterior Wall - Ambient	1	x (	13,83	x	3,08	+		-		) -	0,0	=	42,6
4	EXW South Ground Floor planked	8	Exterior Wall - Ambient	1	x (	13,77	x	2,86	+		-		) -	16,2	=	23,2
5	EXW South First Floor plastered	8	Exterior Wall - Ambient	1	x (	13,83	x	3,08	+		-		) -	12,2	=	30,4
6	EXW East Ground Floor planked	8	Exterior Wall - Ambient	1	x (	8,40	x	2,86	+		-		) -	5,2	=	18,9
7	EXW East First Floor plastered	8	Exterior Wall - Ambient	1	x (	8,40	x	3,67	+		-		) -	3,0	=	27,8
8	EXW West Ground Floor plastered	8	Exterior Wall - Ambient	1	x (	8,40	x	2,86	+		-		) -	3,5	=	20,5
9	EXW West First Floor plastered	8	Exterior Wall - Ambient	1	x (	8,40	x	3,67	+		-		) -	3,0	=	27,8
10					x (		x		+		-		) -	0,0	=	
11					x (		x		+		-		) -	0,0	=	
12					x (		x		+		-		) -	0,0	=	
13	Roof	10	Roof/Ceiling - Ambient	2	x (	13,83	x	4,43	+		-		) -	0,0	=	122,5
14	Cellar Floor Slap	11	Floor Slab	1	x (	13,77	x	8,34	+		-		) -	0,0	=	114,8
15					x (		x		+		-		) -	0,0	=	

扣除窗户面积
(面积数据来自另一个工作表)

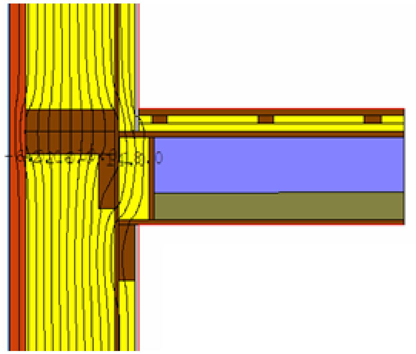
分配所属的组别，请参考
Summary rows 7-20

使用位置图的区域编号

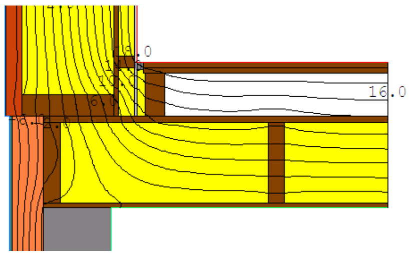
Freundorfer 单一家庭住宅的接合细部



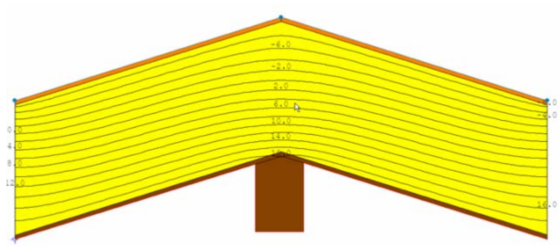
屋檐Eaves :
Ψ = -0.025 W/(mK)



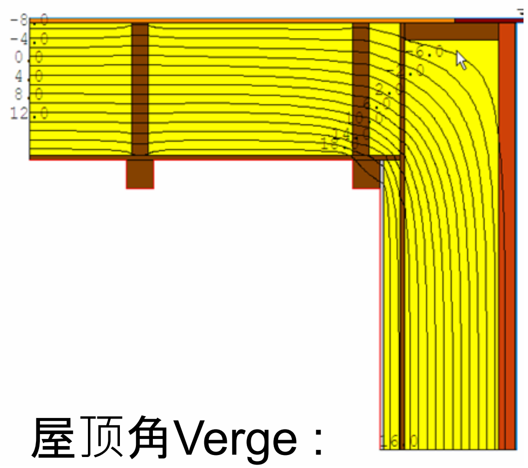
二楼楼板
First floor slab :
Ψ = +0.018 W/(mK)



墙基座Plinth :
Ψ = -0.039 W/(mK)



屋脊Ridge :
Ψ = -0.064 W/(mK)



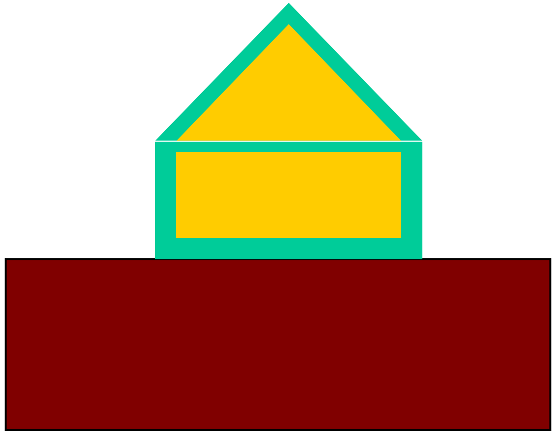
屋顶角Verge :
Ψ = -0.041 W/(mK)

在"Area"工作表输入热桥值

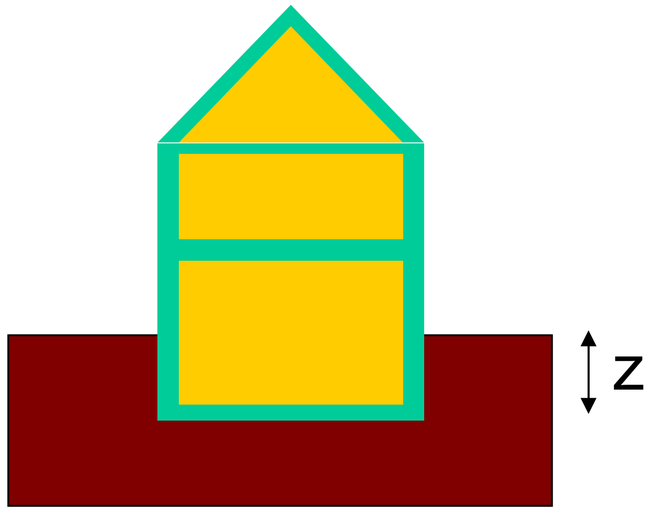
Thermal Bridge Inputs												
Nr. of Thermal Bridge	Thermal Bridge Description	Group Nr.	Assigned to Group	Quantity	x (	User Deter-mined Length [m]	-	Subtraction User-Determined Length [m]	)=	Length l [m]	Input of Thermal Bridge Heat Loss Coefficient W/(mK)	Ψ W/(mK)
1	EXW-Corner	15	Thermal Bridges Ambient	4	x (	5,96	-		) =	23,84	EXW-Corner	-0,065
2	EXW-Roof (Eaves	15	Thermal Bridges Ambient	1	x (	46,21	-		) =	46,21	EXW-Roof (Eaves, Verg	-0,041
3	EXW-Cellar Floo	16	Perimeter Thermal Bridge	1	x (	44,48	-		) =	44,48	EXW-Cellar Floor Slap	-0,039
4	Roof Ridge	15	Thermal Bridges Ambient	1	x (	13,83	-		) =	13,83	Roof Ridge	-0,064
5	INW-Roof	15	Thermal Bridges Ambient	1	x (	37,00	-		) =	37,00	INW-Roof	-0,001
6	EXW-INW	15	Thermal Bridges Ambient	1	x (	39,00	-		) =	39,00	EXW-INW	0,004
7	INW-Cellar Floo	15	Thermal Bridges Ambient	1	x (	36,10	-		) =	36,10	INW-Cellar Floor Slap	0,014
8	EXW-intermediat	15	Thermal Bridges Ambient	1	x (	44,48	-	4,00	) =	40,48	EXW-intermediat Floor	0,018
9	Window-Roller J	15	Thermal Bridges Ambient	2	x (	1,60	-		) =	3,20	Window-Roller Jalousie	0,015
10					x (		-		) =			

来自于底板的热损失

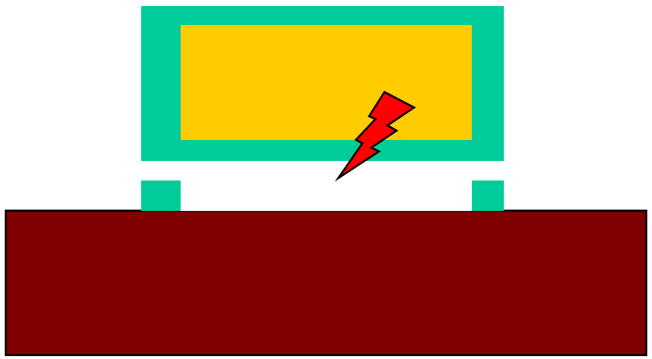
基于 ISO 13370的计算



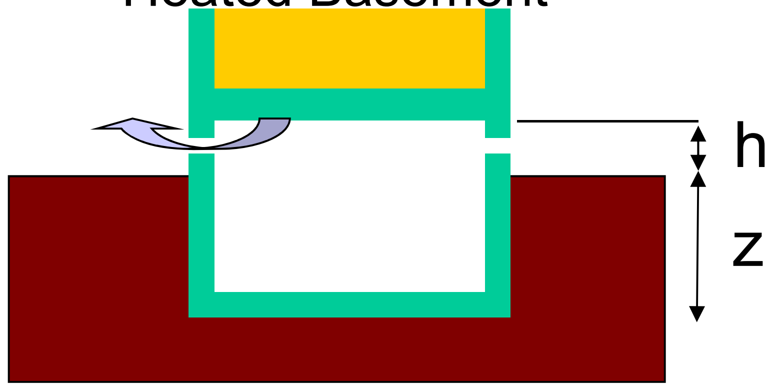
放置于表土的楼板
Floor slab on grade



有采暖的地下室
Heated Basement

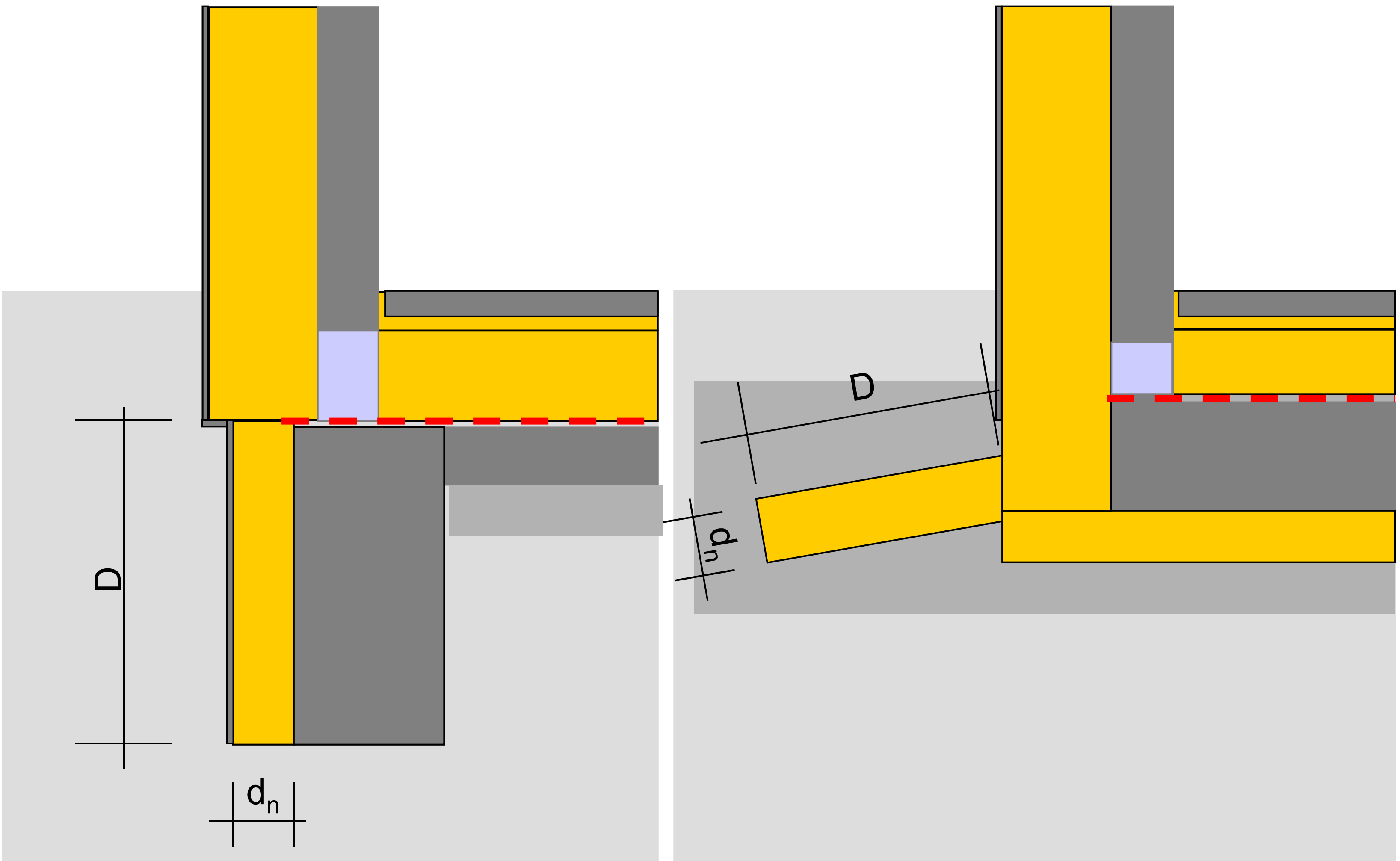


架高的底板
suspended floor slab

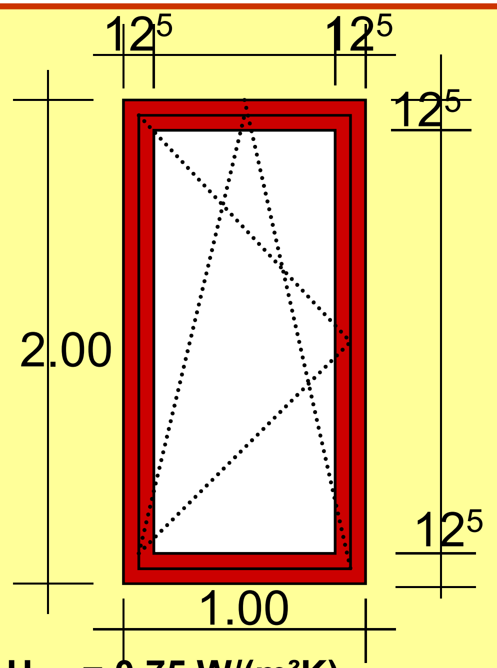


无采暖的地下室
unheated basement

保温裙摆



练习: 评估窗户U-值



U_f = 0.75 W/(m²K)
Ψ_g = 0.040 W/(mK)
U_g = 0.70 W/(m²K)
g-value = 55%
$\Psi_{install}$ = 0.025 W/(mK) to average

在质量和数量方面评估结果

评估窗户本身:

窗户U_w 值0.82 W/(m²K)略高于0.80 W/(m²K)的门坎。

改善窗框或玻璃边缘的断热。透过降低Ψ_g 至0.033 W/(mK)，窗户U-值U_w 则为0.80 W/(m²K)。

评估含安装的窗户:

窗户U-值(含安装) $U_{w, install}$ 0.89 W/(m²K) 高于0.85 W/(m²K)的门坎，故改善保温材并让其覆盖窗框或改善玻璃边缘的断热。

降低窗框安装的热桥Ψ_f至0.010 W/(mK)，$U_{w, install}$ 则可降低至0.85 W/(m²K)

或改善玻璃U-值U_g 至0.60 W/(m²K)，$U_{w, install}$ 则可降低至0.83 W/(m²K)

WinTyp 工作表数据 (玻璃和窗框)

GLAZING ACCORDING TO CERTIFICATION

for frame types, go to row: 71

	Type		
Assembly No.	Glazing	g-Value	U_g-Value
			W/(m²K)
1	Schwabenglas	0,520	0,600
2			
3			
4			
45	iPlus 3 CE - INTERPANE	0,47	0,56
46	iPlus 3 CE - INTERPANE	0,47	0,66
47	GDG iplus 3S - Glas Dreisbusch	0,52	0,74
48	RX WARM 0,58 - Reflex d.o.o.	0,47	0,58
49	RX WARM 0,64 - Reflex d.o.o.	0,47	0,64

FRAME TYPE ACCORDING TO CERTIFICATION

for glazings, go to row: 2

	Type	U_f-Value	Frame Dimensions				Thermal Bridge	Thermal Bridge
Assembly No.	Frame	Frame	Width - Left	Width - Right	Width - Below	Width - Above	Ψ_{Spacer}	$\Psi_{Installation}$
		W/(m²K)	m	m	m	m	W/(mK)	W/(mK)
1	Zwoa2Wood with Sash	0,97	0,118	0,118	0,118	0,118	0,040	0,023
2	Zwoa2Wood Fix	0,97	0,081	0,081	0,081	0,081	0,040	0,023
3								
4								
95	OPTIWIN - installation wood construction (OPTIWIN Zwoa2Holz)	0,97	0,122	0,122	0,115	0,122	0,028	-0,005

别忘记遮阳!

- 遮阳是一个决定性的因素
- 常见错误
- 优化潜力
- 透明的区域
- 范例: 外部墙面窗户的位置

Biburg/Alling, Arch. G. Vallentin
单一家庭被动房

遮阳的信息输入

Window Area Orientation	Global Radiation (Cardinal Points)	Shading	Dirt	Non-Perpendicu-lar Incident Radiation	Glazing Fraction	g-Value	Reduction Factor for Solar Radiation
maximum:	kWh/(m²a)	0,75	0,95	0,85			
North	151	0,39	0,95	0,85	0,669	0,52	0,21
East	296	0,80	0,95	0,85	0,745	0,52	0,48
South	559	0,72	0,95	0,85	0,707	0,52	0,41
West	291	0,64	0,95	0,85	0,749	0,52	0,39
Horizontal	425	0,75	0,95	0,85	0,000	0,00	0,00
		Total or Average Value for All Windows.				0,52	0,40

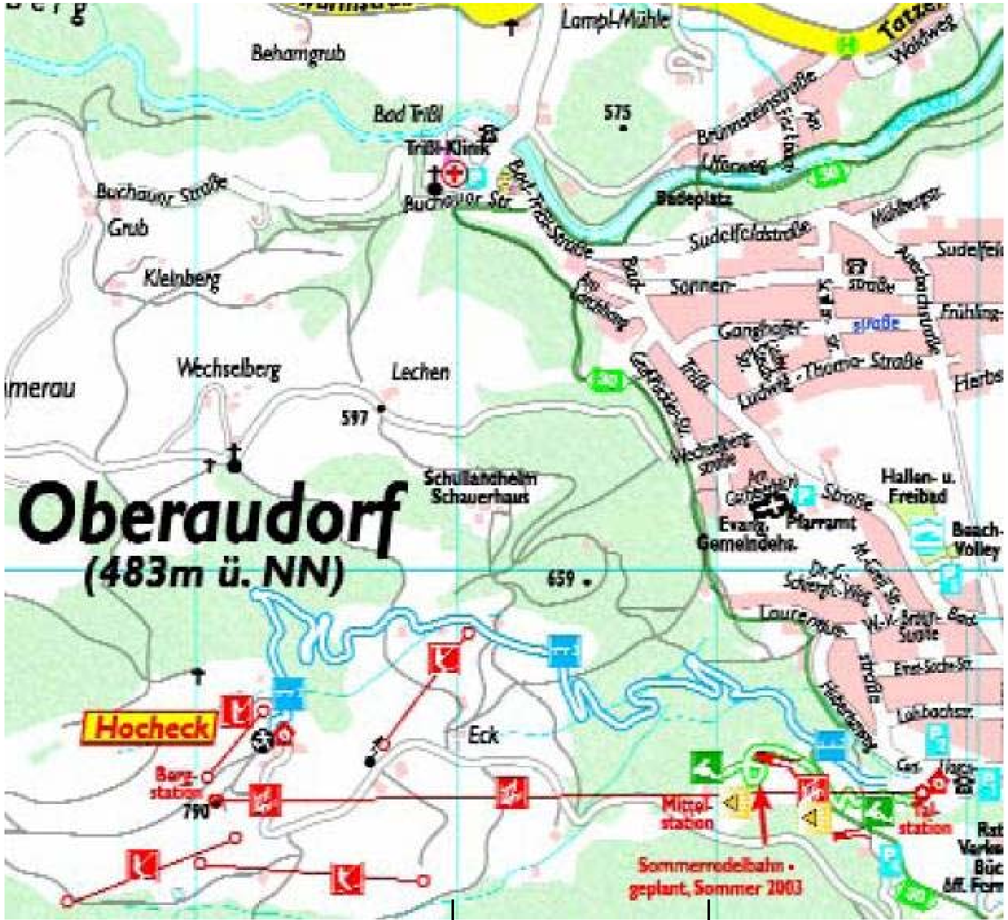
窗户遮阳的设定

- 方法:每个窗户需要一个单独的遮阳设定

- 3种遮阳方式

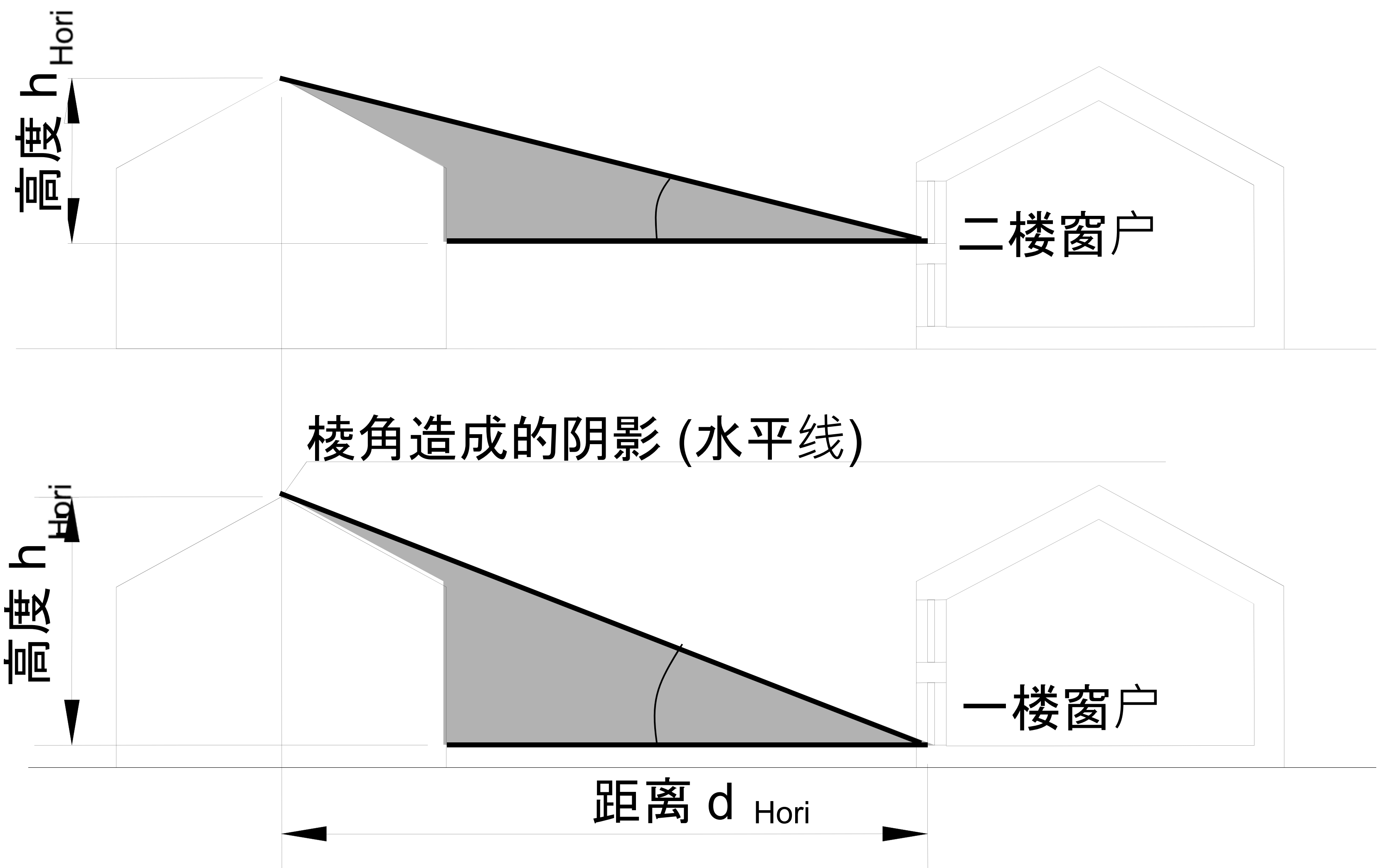
  - 树木, 建筑物, 山群 ......
  - 建筑物外部侧面
  - 出挑

基地配置图 – 来自群山的遮阳

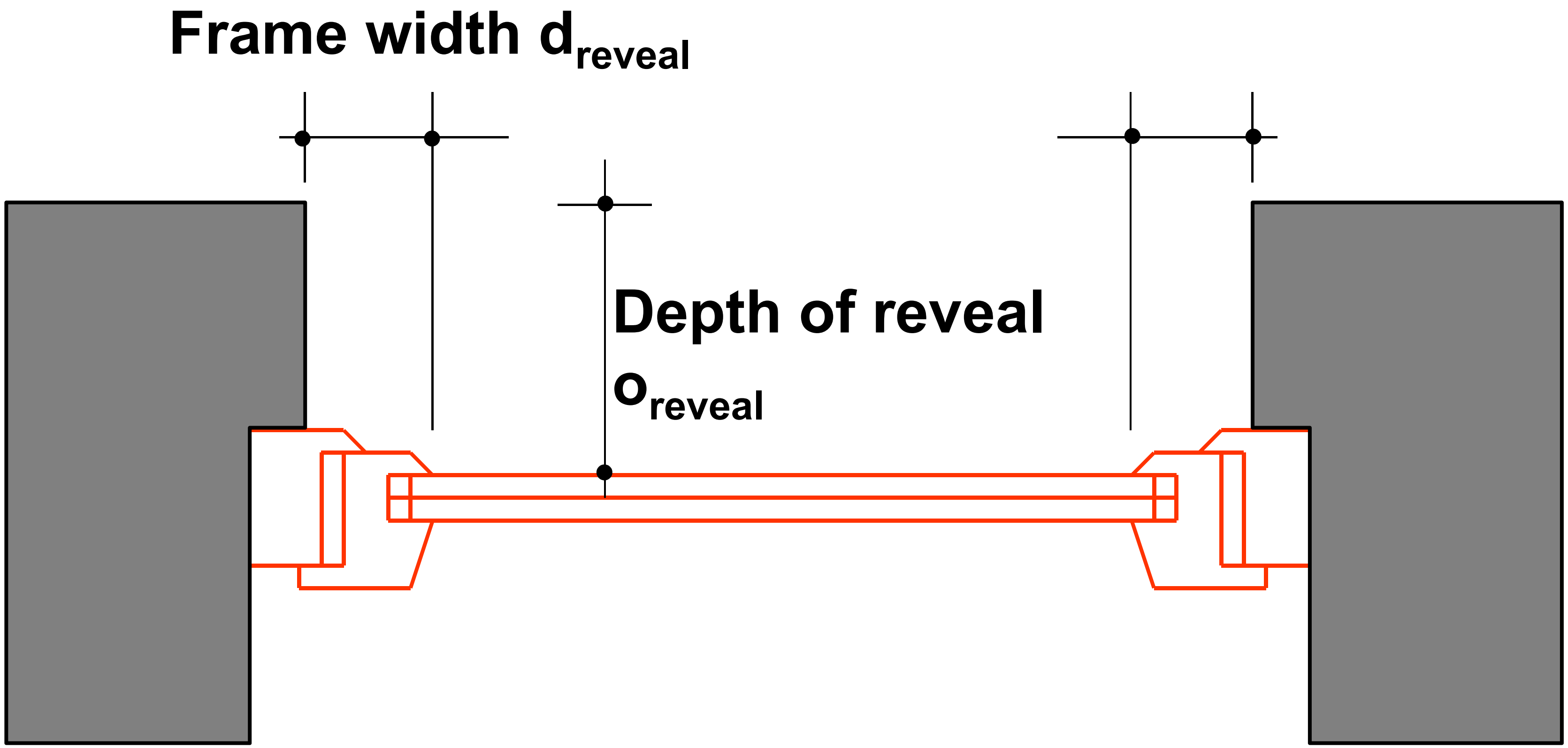


500 m

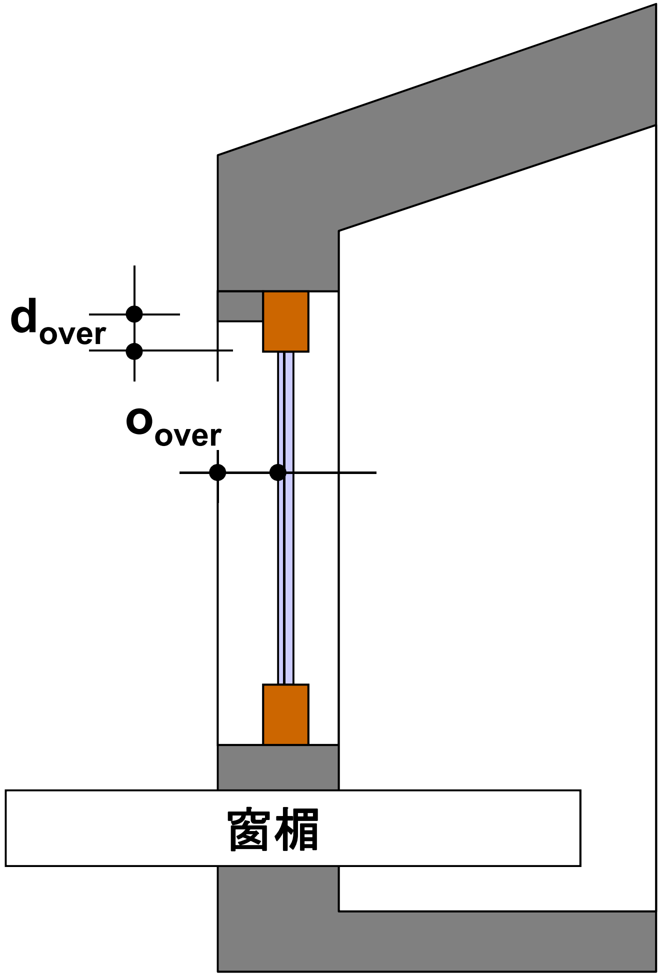
水平遮阳



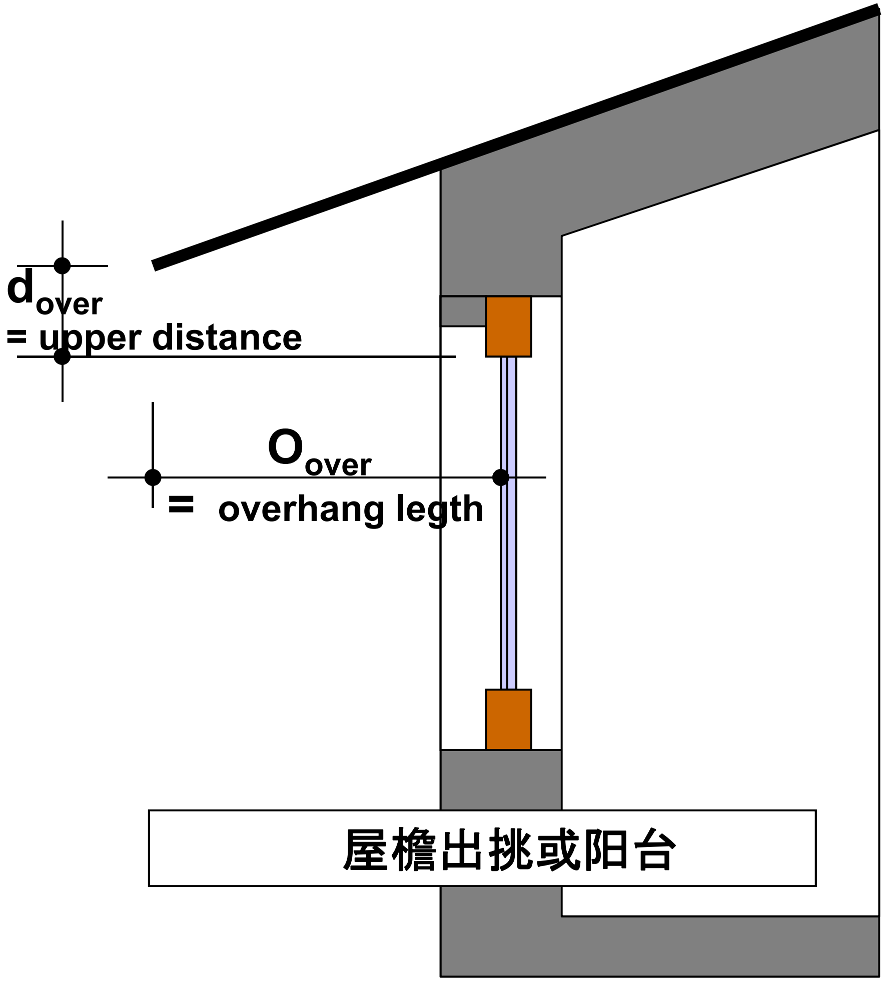
窗户侧墙面所造成的遮阳



出挑遮阳



d over
o over
窗楣



d over
= upper distance
O over
= overhang legth
屋檐出挑或阳台

PHPP: 遮阳设定

水平遮阳

窗户侧墙面遮阳

出挑遮阳

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 Shading Reduction Factor	Horizontal Shading Reduction Factor	Reveal Shading Reduction Factor	Overhang Shading Reduction Factor	Total Shading Reduction Factor
m	m	m	m	m	m	%	%	%	%	%
h_{Hori}	d_{Hori}	o_{Reveal}	d_{Reveal}	o_{over}	d_{over}	r_{other}	r_H	r_R	r_O	r_S
7,00	17,00	0,10	0,05	6,85	0,30	100%	72%	94%	36%	24%
		0,10	0,05	1,00	1,40	100%	100%	95%	86%	82%
3,25	20,00	0,10	0,05	1,00	1,20	100%	86%	88%	85%	64%
		0,13	0,00	0,13	0,00	100%	100%	93%	96%	90%
7,00	20,00	0,10	0,00	0,10	0,00	100%	74%	87%	97%	62%
3,25	16,00	0,10	0,05	0,80	0,25	100%	92%	94%	89%	76%
3,25	16,00	0,10	0,05	0,80	0,25	100%	92%	94%	89%	76%
3,25	16,00	0,00	0,00	0,80	0,25	100%	92%	100%	90%	82%
6,00	16,00	0,10	0,05	0,80	0,25	100%	78%	94%	89%	65%
6,00	16,00	0,00	0,00	0,80	0,25	100%	78%	100%	90%	70%
6,00	16,00	0,10	0,05	0,80	0,25	100%	78%	94%	89%	65%
6,00	16,00	0,00	0,00	0,80	0,25	100%	78%	100%	90%	70%
175,00	500,00	0,13	0,00	0,13	0,00	100%	74%	93%	97%	67%
175,00	500,00	0,10	0,05	1,00	1,40	100%	74%	95%	87%	62%
175,00	500,00	0,10	0,05	1,00	1,20	100%	74%	88%	86%	56%
7,00	17,00	0,10	0,05	0,10	0,05	100%	72%	90%	97%	63%

太阳光热的取得

$$Q_S = r * g * A_F * G$$

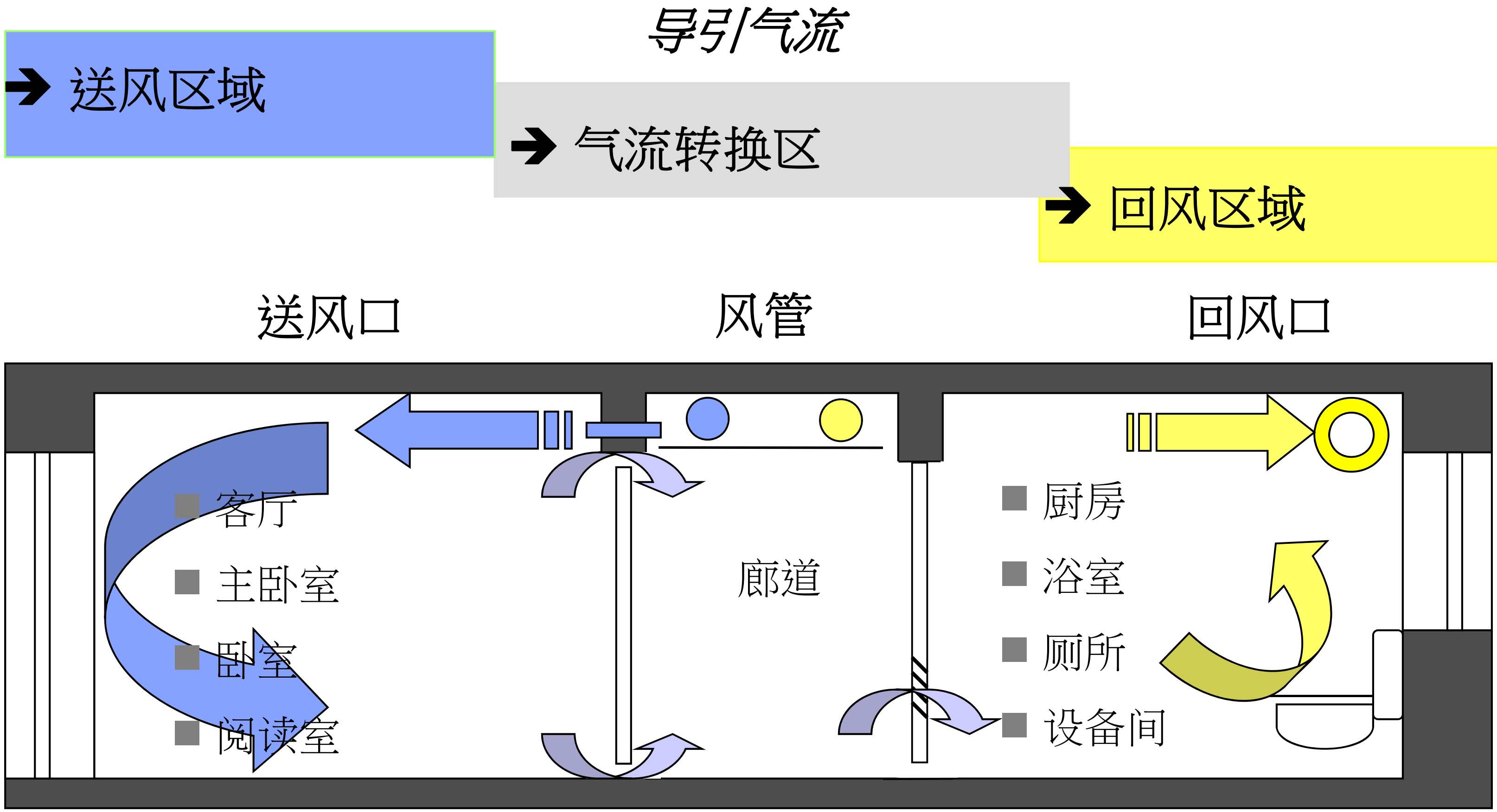
r: 窗框所占比例、遮阳、灰尘和辐射的入射角等会造成的衰减系数

g: 垂直太阳辐射穿过玻璃窗的总透射率

G: 在供暖时期天体的热辐射 (*气候工作表*)

Window Area Orientation	Global Radiation (Cardinal Points)	Shading	Dirt	Non-Perpendicular Incident Radiation	Glazing Fraction	g-Value	Reduction Factor for Solar Radiation
maximum:	kWh/(m²a)	0,75	0,95	0,85			
North	151	0,39	0,95	0,85	0,669	0,52	0,21
East	296	0,80	0,95	0,85	0,745	0,52	0,48
South	559	0,72	0,95	0,85	0,707	0,52	0,41
West	291	0,64	0,95	0,85	0,749	0,52	0,39
Horizontal	425	0,75	0,95	0,85	0,000	0,00	0,00
		Total or Average Value for All Windows.				0,52	0,40

概念: 送风和回风的对流通风准则



开口提供气流移转

标注空气量

针对住宅建筑物进行验证和测试:

送风:	**20 to 30 m³/**小时**/**人 (e.g. according to DIN 1946-6) 传送给整个建筑物，而并非只是单独的房间	
回风:	房间	空气流量
	厨房	60 m³/h
	浴室	40 m³/h
	厕所, 储藏室,...	20 m³/h
至少:	空气替换率 **0.3** (相对于整个公寓的面积和2.5米的室内高度)	

范例:

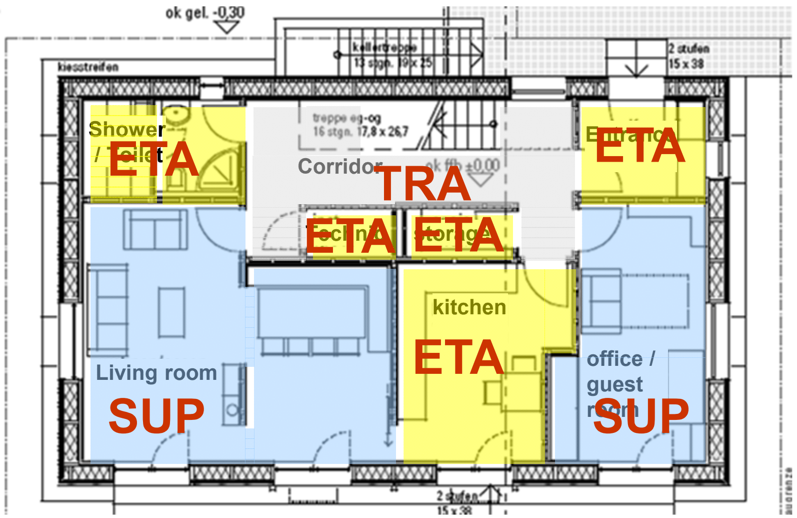
3人居住公寓**, 85 m² **客厅**: 3 **房间**, 1 **厨房**, 1 **浴室

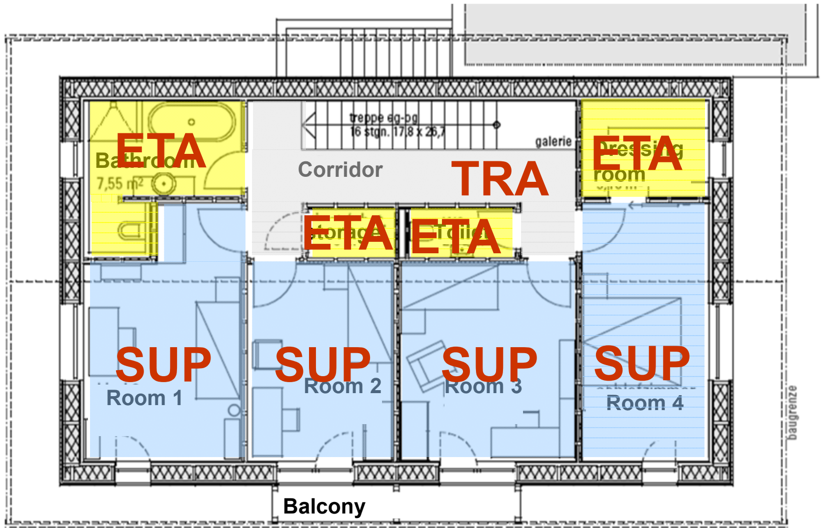
新鲜空气要求**: 3 **人** x 30 m³/**小时**/**人 **= 90 m³/**小时

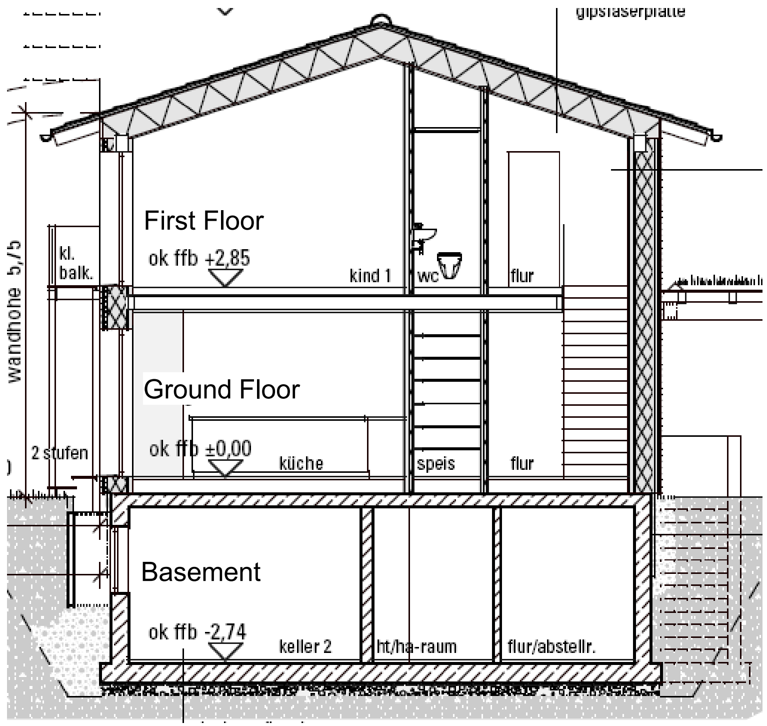
空气回风要求**: 60 + 40 = 100 m³/h**

空气最小替换**: 0.30 /h x 85 m² x 2.5 m = 64 m³/**小时

一楼平面图


ok gel. -0,30
kiesstreifen
kellertreppe
13 stgn. 19 x 25
2 stufen
15 x 38
Shower / toilet
ETA
treppe eg-og
16 stgn. 17,8 x 26,7
Corridor
ok ffb ±0,00
TRA
ETA
ETA
Entrance
ETA
kitchen
ETA
Living room
SUP
office / guest room
SUP
2 stufen
15 x 38


ETA
Bathroom
7,55 m²
treppe eg-og
16 stgn. 17,8 x 26,7
galerie
Corridor
TRA
ETA
Dressing room
ETA
ETA
SUP
Room 1
SUP
Room 2
SUP
Room 3
SUP
Room 4
Balcony
baugrenze


gipsfaserplatte
wandhöhe 5,75
kl. balk.
First Floor
ok ffb +2,85
kind 1
wc
flur
Ground Floor
2 stufen
ok ffb ±0,00
küche
speis
flur
Basement
ok ffb -2,74
keller 2
ht/ha-raum
flur/abstellr.

体积流量的通风计划

3. Distribution of the airflow volume flow rate

Nr.	Room	Area	Clear Height	Room Volume	Air Volume Flow Rate			Air Change Rate	Type of Flow-Off Vent
	(each valve individually)	A	h	A x h	V_{SU}	V_{EX}	$V_{THROUGH}$	n	(door gap, grid in door leaf
		m²	m	m³	m³/h	m³/h	m³/h	1/h	door frame, valve …)
1	Ground Floor Entrance	5,59	2,50	14,0			15	1,07	door gap
2	Ground Floor Corridor	13,63	2,50	34,1			10	0,29	different
3	Ground Floor Stairs	0,00	2,50	0,0			10	#DIV/0!	different
4	Ground Floor Shower / T	6,40	2,50	16,0		15		0,94	grid
5	Ground Floor Living roo	18,27	2,50	45,7	30			0,66	door gap
6	Ground Floor Living roo	12,62	2,50	31,5	15			0,48	door gap
7	Ground Floor Kitchen	13,71	2,50	34,3		45		1,31	door gap
8	Ground Floor Office / G	16,02	2,50	40,0	15			0,37	door frame
9	Ground Floor Technic	1,78	2,50	4,5		5		1,12	door gap
10	Ground Floor Storage	2,18	2,50	5,5		5		0,92	door gap
11	First Floor Room 1	15,57	2,50	38,9	15			0,39	door frame
12	First Floor Room 2	12,62	2,50	31,5	15			0,48	door frame
13	First Floor Room 3	15,16	2,50	37,9	15			0,40	door frame
14	First Floor Room 4	14,09	2,50	35,2	30			0,85	door frame
15	First Floor Corridor	10,83	2,50	27,1			75	2,77	different
16	First Floor Stairs	0,00	2,50	0,0			75	#DIV/0!	different
17	First Floor Storage	1,78	2,50	4,5		5		1,12	door gap
18	First Floor Toilet	2,18	2,50	5,5		15		2,75	door gap
19	First Floor Bathroom	8,27	2,50	20,7		35		1,69	grid
20	First Floor Dressing ro	5,17	2,50	12,9		10		0,77	door gap
	sum:	175,86	---	439,65	135,0	135,0	---	0,31	

PHPP: 平均的空气替换率

Treated Floor Area A_{TFA}	m²	176	*(Areas worksheet)*
Room Height h	m	2,5	*(Annual Heat Demand worksheet)*
Room Ventilation Volume (A_{TFA}*h) = V_V	m³	440	*(Annual Heat Demand worksheet)*

Ventilation System Design - Standard Operation

Occupancy	m²/P	35				
Number of Occupants	P	5,0				
Supply Air per Person	m³/(P*h)	30				
Supply Air Requirement	m³/h	150				
Extract Air Rooms		Kitchen	Bathroom	Shower	WC	other
Quantity		1	1	1	1	5
Extract Air Requirement per Room	m³/h	60	40	20	20	12
Total Extract Air Requirement	m³/h	200				
Design Air Flow Rate (Maximum)	m³/h	200				

房间的数量

通风系统必须能够供应: 多于30% 的设定通风量

Average Air Change Rate Calculation

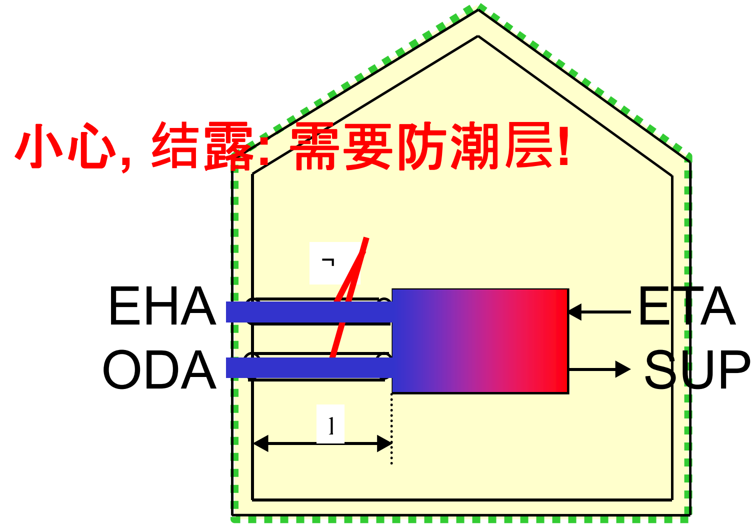
Type of Operation	Daily Operation Duration h/d	Factors Referenced to Maximum	Air Flow Rate m³/h	Air Change Rate 1/h
Maximum		1,00	200	0,45
Standard	24,0	0,75	150	0,34
Basic		0,54	108	0,24
Minimum		0,40	80	0,18
x Residential Building	Average value	0,75	Average Air Flow Rate (m³/h): 150	Average Air Change Rate (1/h): 0,34

通风设备的平均空气替换率

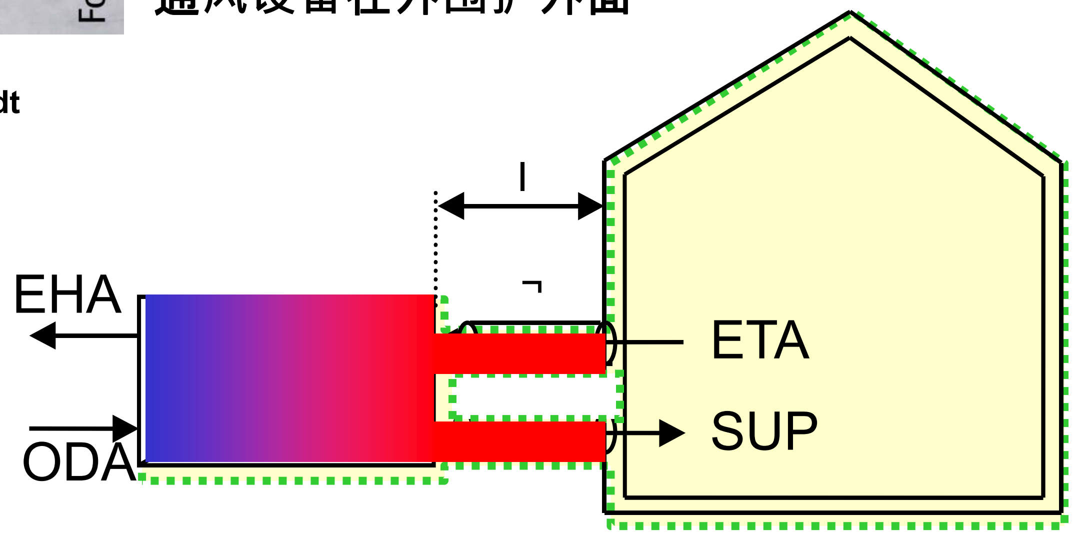
外围护边界 – 设备安装

照片+ 绘制:
Passive House Institute, Darmstadt

通风设备在外围护内



通风设备在外围护外面



PHPP: 标注热回收效率

Effective Heat Recovery 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	η_{HR}		0,78	Drexel & Weiss Aerosilent classic		
Transmittance Supply Air Duct	Ψ	W/(mK)	0,340	Calculation see Secondary Calculation		
Length Supply Air Duct		m	2			
Transmittance Extract Air Duct	Ψ	W/(mK)	0,340	Calculation see Secondary Calculation		
Length Extract Air Duct		m	2		Room Temperature (°C)	
Temperature of Mechanical Services Room		°C	12		Av. Ambient Temp. Heating P. (°C)	
(Enter only if the central unit is outside of the thermal envelope.)					Av. Ground Temp (°C)	

Effective Heat Recovery Efficiency	$\eta_{HR,eff}$	77,3%

Effective Heat Recovery Efficiency Subsoil Heat Exchanger

SHX Efficiency	η^*_{SHX}	60%
Heat Recovery Efficiency SHX	η_{SHX}	20%

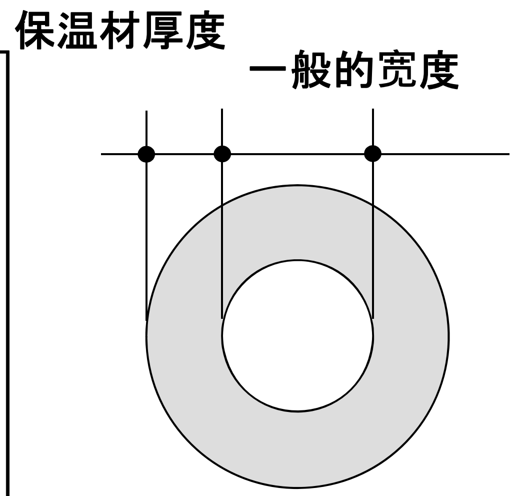
设备和建筑外围护结构之间的管道尽可能越短越好!

PHPP:风管的热传输值

Secondary Calculation:

Ψ-value Supply or Ambient Air Duct

Nominal Width		160	mm
	Insul. Thickness:	60	mm
	Reflective? Please mark with an "x"!		
	Yes		
x	No		
	Thermal Conductivity	0,035	W/(mK)
	Nominal Air Flow Rate	150	m^3/h
	$\Delta\vartheta$	8	K
	Interior Duct Diameter	0,160	m
	Interior Diameter	0,160	m
	Exterior Diameter	0,280	m
	α-Interior	9,96	$W/(m^2K)$
	α–Surface	5,74	$W/(m^2K)$
	Ψ-value	**0,340**	**W/(mK)**
	Surface Temperature Difference	1,081	K



PHPP暖气管道

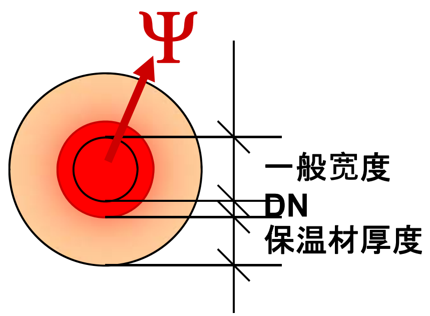
				Warm Region	Cold Region		Total	
Space Heat Distribution				1	2	3		
Length of Distribution Pipes	L_H	*(Project)*		24,00	6,00			m
Heat Loss Coefficient per m Pipe	Ψ	*(Project)*		0,134	0,134			W/(mK)
Temperature of the Room Through Which the Pipes	ϑ_X	*Mechanical Room*		20	10,0			°C
Design Flow Temperature	ϑ_{dist}	*Flow, Design Value*		55,0	55,0			°C
Design System Heat Load	$P_{heating}$	*(exist./calc.)*		0,5	0,5			kW
Flow Temperature Control (check)				j	j			
Design Return Temperature	ϑ_R		$=0.714*(\vartheta_{dist}-20)+20$	45,0	45,0			°C
Annual Heat Emission per m of Plumbing	q^*_{HL}		$= \Psi\,(\vartheta_m-\vartheta_X)\,t_{Heating}*0.024$	20	26		Total 1,2,3	kWh/(m·a)
Possible Utilization Factor of Released Heat	η_G			74%	0%			-
Annual Losses	Q_{HL}		$= L_H \cdot q^*_{HL} \cdot (1-\eta_G)$	122	158	0	280	kWh/a
Specif. Losses	q_{HL}		$= \Sigma Q_{HL} / A_{TFA}$					kWh/(m²a)
Utilisation Factor of Space Heat Distribution	$h_{a,HL}$		$= q_H / (q_H + q_{HL})$				91%	-

输入:

- 出流+ 回流管道的长度
- 每米管道的热损失系数
- 出流温度/控制
- 热负荷

结果:

- 利用系数, 剩余热损失



PHPP: 家用热水需求和管循环

DHW: Standard Useful Heat

DHW Consumption per Person and Day (60 °C)	V_{DHW}	*(Project or Average Value 25 Litres/P/d)*		25,0	Litre/Person/d
Average Cold Water Temperature of the Supply	ϑ_{DW}	*Temperature of Drinking Water (10°)*		7,5	°C
DHW Non-Electric Wash and Dish		*(Electricity worksheet)*		0	kWh/a
Useful Heat - DHW	Q_{DHW}			**2779**	kWh/a
Specif. Useful Heat - DHW	q_{DHW}		$= Q_{DHW} / A_{TFA}$		kWh/(m²a)

DHW Distribution and Storage

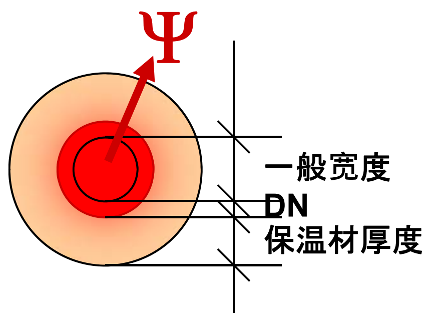
				Warm Region	Cold Region		Total	
Length of Circulation Pipes (Flow + Return)	L_{HS}	*(Project)*		33,8	6,0			m
Heat Loss Coefficient per m Pipe	Ψ	*(Project)*		0,134	0,134			W/m/K
Temperature of the Room Through Which the Pipes	ϑ_X	*Mechanical Room*		20	10,0			°C
Design Flow Temperature	ϑ_{dist}	*Flow, Design Value*		45,0	45,0			°C
Daily circulation period of operation.	td_{Circ}	*(Project)*		6,0	6,0			h/d
Design Return Temperature	ϑ_R		$=0.875*(\vartheta_{dist}-20)+20$	42	42			°C
Circulation period of operation per year	t_{Circ}		$= 365\ td_{Circ}$	2190	2190			h/a
Annual Heat Released per m of Pipe	q^*_Z		$= \Psi\ (\vartheta_m - \vartheta_X)\ t_{Circ}$	6,9	9,8			kWh/m/a
Possible Utilization Factor of Released Heat	η_{GDHW}		$=t_{heating}/365d * \eta_G$	41,6%	0,0%			-
Annual Heat Loss from Circulation Lines	Q_Z		$= L_{HS} \cdot q^*_Z \cdot (1-\eta_{GDHW})$	**136**	**59**		**194**	kWh/a

输入:

- 每人家用热水的数量, 冷水温度
- 热水管 + 循环管的长度
- 每米管道的热损失系数
- 出流温度/ 运作时间

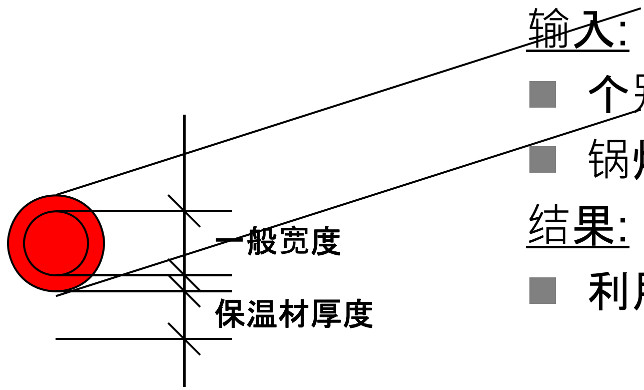
结果:

- 利用系数, 剩余热损失



PHPP: 个别管道和锅炉的热损失

Total Length of Individual Pipes	L_U *(Project)*		21,17				m
Exterior Pipe Diameter	d_{U_Pipe} *(Project)*		0,020				m
Heat Loss Per Tap Opening	$q_{Individual}$	$=(c_{pH2O}V_{H2O}+c_{pMat}V_{Mat})(\vartheta_{dist}-\vartheta_X)$	0,1527				kWh/tap open
Occupancy Coefficient	n_{Tap}	$= n_{Pers} . 3 . 365 / n_{LU}$	5475				Tap openings
Annual Heat Loss	q_U	$= n_{Tap} \cdot q_{Individual}$	836,0				kWh/a
Possible Utilization Factor of Released Heat	η_{G_U}	$=t_{heating}/8760*\eta_G$	41,6%				-
Annual Heat Loss of Individual Pipes	Q_U	$= q_U \cdot(1-\eta_{G\_U})$	488,2			488	kWh/a
						Total 1,2,3	
Average Heat Released From Storage	P_S			32			W
Possible Utilization Factor of Released Heat	η_{G_S}	$=t_{heating}/8760*\eta_G$		0,0%			
Annual Heat Losses from Storage	Q_S	$= P_S \cdot 8.760\ kh \cdot (1-\eta_{G\_S})$		280,3		280	kWh/a
						Total 1,2,3	
Total Heat Losses of the DHW System	Q_{WL}	$= Q_Z+Q_U+Q_S$				963	kWh/a
Specif. Losses of the DHW System	q_{WL}	$= Q_{WL} / A_{TFA}$					kWh/(m²a)
Utilisation Factor DHW Distrib and Storage	$\eta_{a,WL}$	$= q_{DHW} / (q_{DHW} + q_{WV})$				74,3%	-
Total Heat Demand of DHW system	Q_{gDHW}	$= Q_{DHW}+Q_{WL}$				3742	kWh/a



输入:

- 个别管道的总长度+管道外径
- 锅炉预备时间的热损失

结果:

- 利用系数, 剩余热损失

PHPP: 太阳能热水供应

<u>输入:</u>

- 集热器类型的选择
- Aperture光圈
- 座向
- 选择储存的类型
- 储存的大小

<u>结果:</u>

- 预估满足家用热水需求的太阳系数
- 储存损失
- 图示说明每月平均值

HOT WATER PROVIDED BY SOLAR

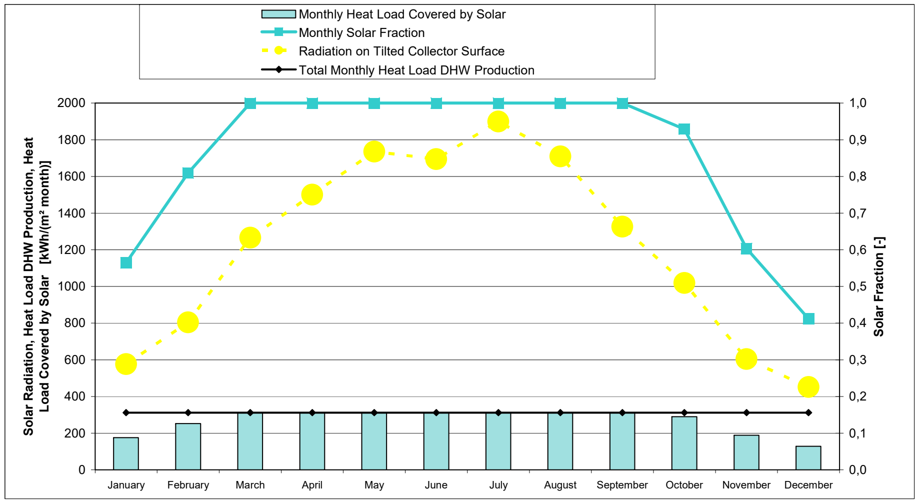
Building:	Sonnen-Passivhaus Freundorfer	Building Type/Use:	Einfamilienhaus
Location:	Oberbayern Voralpenland	Treated Floor Area A_{TFA}:	175,9 m²

Solar Fraction with DHW Demand including Washing and Dish-Washing

Heat Demand DHW	q_{gDHW}	3742	kWh/a	from DHW+Distribution worksheet
Latitude:		47,5	°	from Climate Data worksheet
Selection of collector from list (see below):		7	Selection:	7 Improved Flat Plate Collector
Solar Collector Area		11,00	m²	
Deviation from North		157	°	
Angle of Inclination from the Horizontal		18	°	
Height of the Collector Field			m	
Height of Horizon	h_{Hori}		m	
Horizontal Distance	a_{Hori}		m	
Additional Reduction Factor Shading	r_{other}		%	
Occupancy		5,0	Persons	
Specific Collector Area		2,2	m²/Pers	
Estimated Solar Fraction of DHW Production		**86%**		
Solar Contribution to Useful Heat		**3217**	kWh/a	**18** kWh/(m²a)

Secondary Calculation of Storage Losses

Selection of DHW storage from list (see below):	17	Selection:	17 Stratified Solar Storage with DHW Heat Exchanger anger
Total Storage Volume	1000	litre	
Volume Standby Part (above)	300	litre	
Volume Solar Part (below)	700	litre	
Specific Heat Losses Storage (total)	3,1	W/K	
Typical Temperature DHW	55	°C	
Room Temperature	10	°C	
Storage Heat Losses (Standby Part Only)	**99**	W	
Total Storage Heat Losses	**140**	W	



PHPP 电力

# Households	1	HH
Persons	5,0	P
Living Area	176	m²
Annual Heat Deman	15	kWh/(m²a)

Solar Fraction of DHW Wash&Dish	
Marginal Performance Ratio DHW	125%
Marginal Performance Ratio Heating	125%

Prim. Energy Factors:	Electricity	2,7	kWh/kWh
	Natural Gas	1,1	kWh/kWh
Energy Carrier for Space Heating/DHW:			

Column Nr.	1	2	3			4	5		6		7	8	8a	9	10	11	12	13	14
Application	Used ? (1/0)	Within the Thermal Envelope? (1/0)	Norm Demand			Utilization 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)**	**Primary Energy-Demand (kWh/a)**
Dishwashing	1	1	1,20	kWh/Use		1,00	65	/(P*a)	5,0	P	390	100%		**390**					**1053**
Cold Water Connect													0%		0,30	1,25			
Clothes Washing	1	1	1,10	kWh/Use		1,00	57	/(P*a)	5,0	P	314	100%		**314**					**846**
Cold Water Connection													0%		0,05	1,25			
Clothes Drying with:	1	1	3,50	kWh/Use	Residual dampness	0,88	57	/(P*a)	5,0	P	873	100%		**873**					**2357**
Condensation Dryer					0,60						0		0%			1,00		0	**0**
Energy Consumed by Evaporation	0	1	3,13	kWh/Use		0,60	57	/(P*a)	5,0	P	0		####		0,00	1,25	0,68	0	**0**
Refrigerating	1	1	0,78	kWh/d		1,00	365	d/a	1	HH	285	100%		**285**					**769**
Freezing	1	1	0,88	kWh/d		1,00	365	d/a	1	HH	321	100%		**321**					**867**
or Combined Unit	0	1	1,00	kWh/d		1,00	365	d/a	1	HH	0	100%		**0**					**0**
Cooking with:	1	1	0,25	kWh/Use		1,00	500	/(P*a)	5,0	P	625	100%		**625**					**1688**
Electricity					Percentage CFLs								0%					0	**0**
Lighting	1	1	60	W	0%	1,00	2,90	kh/(P*a)	5,0	P	870	100%		**870**					**2349**
Consumer Electronic	1	1	80	W		1,00	0,55	kh/(P*a)	5,0	P	220	100%		**220**					**594**
Small Appliances, etc	1	1	50	kWh		1,00	1,00	/(P*a)	5,0	P	250	100%		**250**					**675**
Total Aux. Electricity											965			**965**					**2605**
Other:																			
											0			**0**					**0**
											0			**0**					**0**
											0			**0**					**0**
Total											**5112 kWh**			**5112** kWh	DHW Non-Electric - Wash&Dish	0	kWh	**0**	**13803**
Specific Demand														**29,1** kWh/(m²a)	Non-Renewable Non-Electric DHW Wash&Dish	0,0	kWh/(m²a)	**0,0**	**78,5**
Recommended Maximum Value														**18**					**50**

PHPP 辅助电力

1	Living Area	176	m²
2	Heating Period	205	d
3	Air Volume	440	m³
4	Dwelling Units	1	HH
5	Enclosed Volume	769	m³

Operation Vent. System Winter	4,91	kh/a
Operation Vent. System Summe	3,85	kh/a
Air Change Rate	0,34	h^{-1}
Defrosting HX from		°C

Primary Energy Factor - Electricity	2,7	kWh/kWh
Annual Space Heat Demand	15	kWh/(m²a)
Boiler Rated Power	10	kW
DHW System Heat Demand	3742	kWh/a
Design Flow Temperature	55	°C

Column Nr.	1	2	3			4			5			6			7		8		9		10	11
Application	Used ? (1/0)	Within the Thermal Envelope? (1/0)	Norm Demand			Utilization Factor			Period of Operation			Reference Size			Electricity Demand (kWh/a)		Available as Interior Heat		Used During Time Period (kh/a)		Internal Heat Source (W)	Primary Energy Demand (kWh/a)
Ventilation System																						
Winter Ventilation	1	0	0,40	Wh/m³	*	0,34	h^{-1}	*	4,9	kh/a	*	439,653	m³	=	295		considered in heat recovery efficiency					795
Summer Ventilation	1	0	0,40	Wh/m³	*	0,34	h^{-1}	*	3,9	kh/a	*	439,653	m³	=	231		no summer contribution to IHG					624
Defroster HX	0	0	0	W	*	1,00		*	0,2	kh/a	*	1		=	0	*	1,0	/	4,91	=	0	0
Heating System						Controlled/Uncontrolled (1/0)																
Enter the Rated Power of the Pump			40	W		1																
Circulation Pump	1	0	40	W	*	0,8		*	4,9	kh/a	*	1		=	149	*	1,0	/	4,91	=	0	402
Boiler Electricity Consumption at 30% Load				W																		
Aux. Energy - Heat. Boiler	1	0	45	W	*	1,00		*	0,00	kh/a	*	1		=	0	*	1,0	/	4,91	=	0	0
DHW system																						
Enter Average Power Consumption of Pump				W																		
Circulation Pump	1	0	29	W	*	1,00		*	5,0	kh/a	*	1		=	144	*	0,6	/	8,76	=	0	390
Enter the Rated Power of the Pump				W																		
Storage Load Pump DHW	1	0	59	W	*	1,00		*	0,4	kh/a	*	1		=	22	*	1,0	/	4,91	=	0	59
Boiler Electricity Consumption at 100% Load				W																		
DHW Boiler Aux. Energy	1	0	136	W	*	1,00		*	0,0	kh/a	*	1		=	0	*	1,0	/	4,91	=	0	0
Enter the Rated Power of the Solar DHW Pump				W																		
Solar Aux Electricity	1	1	42	W	*	1,00		*	1,8	kh/a	*	1		=	74	*	0,6	/	8,76	=	5	200
Misc. Aux. Electricity																						
Misc. Aux. Electricity	1	0	50	kWh/a	*	1,00		*	1,0		*	1	HH	=	50	*	1,0	/	8,76	=	0	135
Total															965						5	2605
Specific Demand	kWh/(m²a)		Divide by Living Area:												5,5							14,8

PHPP 一次性能源值

<u>输入:</u>

分配热能产生器：

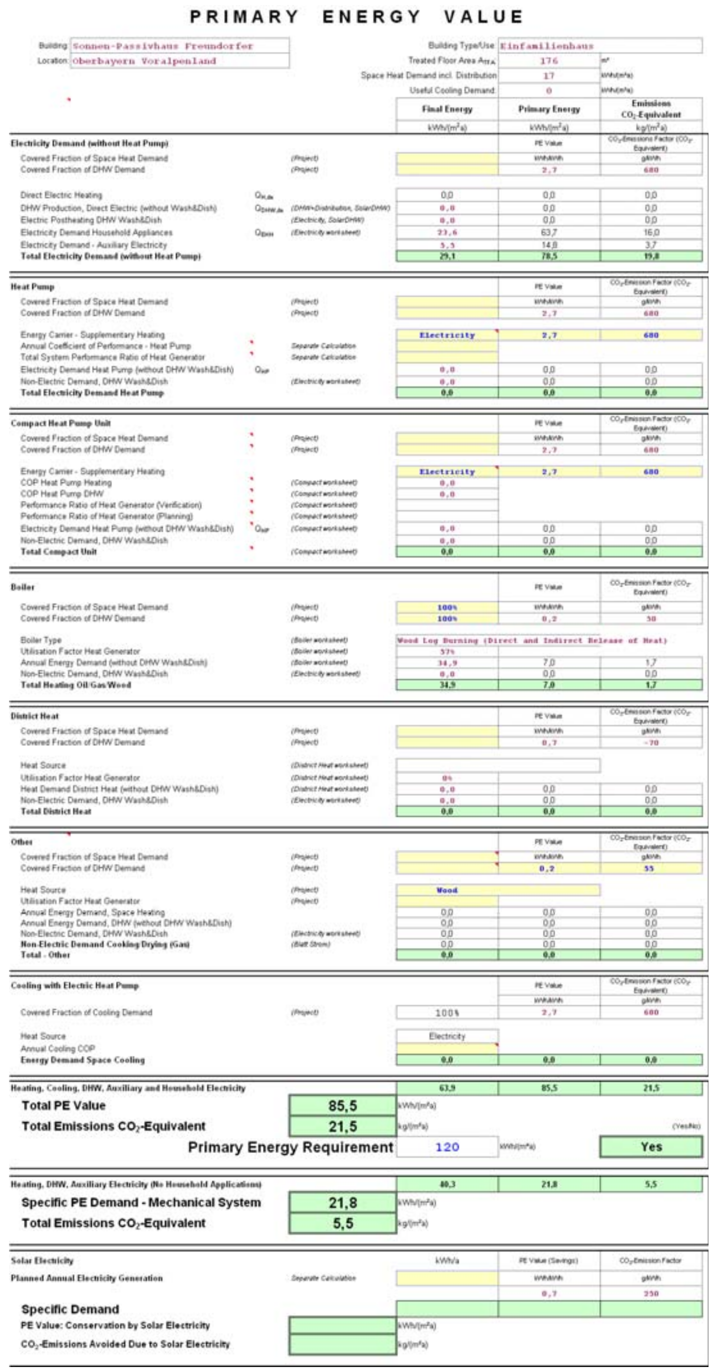
- 暖气能源需求的分配比例
- 生活热水需求的分配比例

年收益损失比

- 直接输入或
- 额外表格供输入(锅炉、紧凑型设备或区域性热水供暖)

结果:

- 所有家用设备的PE-demand
- 无家庭用设备的PE-demand
- 由 PV-发电的PE-替代电力



PRIMARY ENERGY VALUE

Building:	Sonnen-Passivhaus Freundorfer	Building Type/Use	Einfamilienhaus	
Location:	Oberbayern Voralpenland	Treated Floor Area A_{TFA}	176	m²
		Space Heat Demand incl. Distribution	17	kWh/(m²a)
		Useful Cooling Demand	0	kWh/(m²a)

			Final Energy kWh/(m²a)	Primary Energy kWh/(m²a)	Emissions CO_2-Equivalent kg/(m²a)
Electricity Demand (without Heat Pump)				PE Value	CO_2-Emissions Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)		kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)		2,7	680
Direct Electric Heating	$Q_{H,dir}$		0,0	0,0	0,0
DHW Production, Direct Electric (without Wash&Dish)	$Q_{DHW,dir}$	(DHW+Distribution, SolarDHW)	0,0	0,0	0,0
Electric Postheating DHW Wash&Dish		(Electricity, SolarDHW)	0,0	0,0	0,0
Electricity Demand Household Appliances	Q_{Ehh}	(Electricity worksheet)	23,6	63,7	16,0
Electricity Demand - Auxiliary Electricity			5,5	14,8	3,7
Total Electricity Demand (without Heat Pump)			29,1	78,5	19,8
Heat Pump				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)		kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)		2,7	680
Energy Carrier - Supplementary Heating			Electricity	2,7	680
Annual Coefficient of Performance - Heat Pump		Separate Calculation			
Total System Performance Ratio of Heat Generator		Separate Calculation			
Electricity Demand Heat Pump (without DHW Wash&Dish)	Q_{HP}		0,0	0,0	0,0
Non-Electric Demand, DHW Wash&Dish		(Electricity worksheet)	0,0	0,0	0,0
Total Electricity Demand Heat Pump			0,0	0,0	0,0
Compact Heat Pump Unit				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)		kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)		2,7	680
Energy Carrier - Supplementary Heating			Electricity	2,7	680
COP Heat Pump Heating		(Compact worksheet)	0,0		
COP Heat Pump DHW		(Compact worksheet)	0,0		
Performance Ratio of Heat Generator (Verification)		(Compact worksheet)			
Performance Ratio of Heat Generator (Planning)		(Compact worksheet)			
Electricity Demand Heat Pump (without DHW Wash&Dish)	Q_{HP}	(Compact worksheet)	0,0	0,0	0,0
Non-Electric Demand, DHW Wash&Dish			0,0	0,0	0,0
Total Compact Unit		(Compact worksheet)	0,0	0,0	0,0
Boiler				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)	100%	kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)	100%	0,2	50
Boiler Type		(Boiler worksheet)	Wood Log Burning (Direct and Indirect Release of Heat)		
Utilisation Factor Heat Generator		(Boiler worksheet)	57%		
Annual Energy Demand (without DHW Wash&Dish)		(Boiler worksheet)	34,9	7,0	1,7
Non-Electric Demand, DHW Wash&Dish		(Electricity worksheet)	0,0	0,0	0,0
Total Heating Oil/Gas/Wood			34,9	7,0	1,7
District Heat				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)		kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)		0,7	-70
Heat Source		(District Heat worksheet)			
Utilisation Factor Heat Generator		(District Heat worksheet)	0%		
Heat Demand District Heat (without DHW Wash&Dish)		(District Heat worksheet)	0,0	0,0	0,0
Non-Electric Demand, DHW Wash&Dish		(Electricity worksheet)	0,0	0,0	0,0
Total District Heat			0,0	0,0	0,0
Other				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
Covered Fraction of Space Heat Demand		(Project)		kWh/kWh	g/kWh
Covered Fraction of DHW Demand		(Project)		0,2	55
Heat Source		(Project)	Wood		
Utilisation Factor Heat Generator		(Project)			
Annual Energy Demand, Space Heating			0,0	0,0	0,0
Annual Energy Demand, DHW (without DHW Wash&Dish)			0,0	0,0	0,0
Non-Electric Demand, DHW Wash&Dish		(Electricity worksheet)	0,0	0,0	0,0
Non-Electric Demand Cooking Drying (Gas)		(Blatt Strom)	0,0	0,0	0,0
Total - Other			0,0	0,0	0,0
Cooling with Electric Heat Pump				PE Value	CO_2-Emission Factor (CO_2-Equivalent)
				kWh/kWh	g/kWh
Covered Fraction of Cooling Demand		(Project)	100%	2,7	680
Heat Source			Electricity		
Annual Cooling COP					
Energy Demand Space Cooling			0,0	0,0	0,0
Heating, Cooling, DHW, Auxiliary and Household Electricity			63,9	85,5	21,5

Total PE Value	85,5	kWh/(m²a)	
Total Emissions CO_2-Equivalent	21,5	kg/(m²a)	(Yes/No)
Primary Energy Requirement	120	kWh/(m²a)	Yes

	Final Energy	Primary Energy	Emissions
Heating, DHW, Auxiliary Electricity (No Household Applications)	40,3	21,8	5,5

Specific PE Demand - Mechanical System	21,8	kWh/(m²a)
Total Emissions CO_2-Equivalent	5,5	kg/(m²a)

		kWh/a	PE Value (Savings)	CO_2-Emission Factor
Solar Electricity				
Planned Annual Electricity Generation	Separate Calculation		kWh/kWh	g/kWh
			0,7	250
Specific Demand				
PE Value: Conservation by Solar Electricity		kWh/(m²a)		
CO_2-Emissions Avoided Due to Solar Electricity		kg/(m²a)		

PHPP – “Boiler”工作表

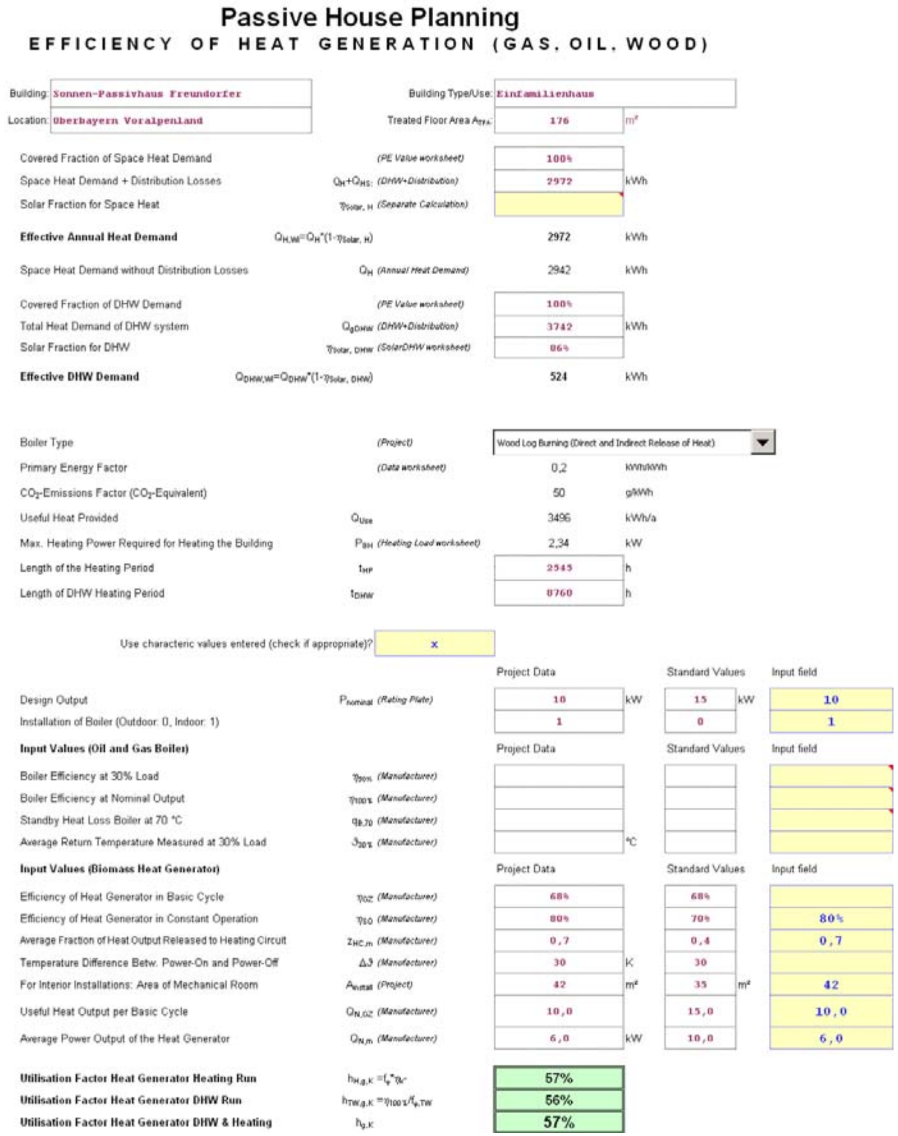
选择锅炉类型

输入:

- 输出
- 位置
- 性能数据

结果:

- 收益损失率被转移到”PE-value”的工作表



Passive House Planning

EFFICIENCY OF HEAT GENERATION (GAS, OIL, WOOD)

Building: Sonnen-Passivhaus Freundorfer | Building Type/Use: Einfamilienhaus

Location: Oberbayern Voralpenland | Treated Floor Area A_{TFA}: 176 m²

Covered Fraction of Space Heat Demand		(PE Value worksheet)	100%	
Space Heat Demand + Distribution Losses	Q_H+Q_{HS}:	(DHW+Distribution)	2972	kWh
Solar Fraction for Space Heat	$\eta_{Solar,H}$	(Separate Calculation)		
Effective Annual Heat Demand	$Q_{H,wi}=Q_H*(1-\eta_{Solar,H})$		2972	kWh
Space Heat Demand without Distribution Losses	Q_H	(Annual Heat Demand)	2942	kWh
Covered Fraction of DHW Demand		(PE Value worksheet)	100%	
Total Heat Demand of DHW system	Q_{gDHW}	(DHW+Distribution)	3742	kWh
Solar Fraction for DHW	$\eta_{Solar,DHW}$	(SolarDHW worksheet)	86%	
Effective DHW Demand	$Q_{DHW,wi}=Q_{DHW}*(1-\eta_{Solar,DHW})$		524	kWh
Boiler Type		(Project)	Wood Log Burning (Direct and Indirect Release of Heat)	
Primary Energy Factor		(Data worksheet)	0,2	kWh/kWh
CO_2-Emissions Factor (CO_2-Equivalent)			50	g/kWh
Useful Heat Provided	Q_{Use}		3496	kWh/a
Max. Heating Power Required for Heating the Building	P_{BH}	(Heating Load worksheet)	2,34	kW
Length of the Heating Period	t_{HP}		2545	h
Length of DHW Heating Period	t_{DHW}		8760	h

Use characteric values entered (check if appropriate)? x

			Project Data		Standard Values		Input field
Design Output	$P_{Nominal}$	(Rating Plate)	10	kW	15	kW	10
Installation of Boiler (Outdoor: 0, Indoor: 1)			1		0		1
Input Values (Oil and Gas Boiler)			Project Data		Standard Values		Input field
Boiler Efficiency at 30% Load	$\eta_{30\%}$	(Manufacturer)					
Boiler Efficiency at Nominal Output	$\eta_{100\%}$	(Manufacturer)					
Standby Heat Loss Boiler at 70 °C	$q_{B,70}$	(Manufacturer)					
Average Return Temperature Measured at 30% Load	$\vartheta_{30\%}$	(Manufacturer)		°C			
Input Values (Biomass Heat Generator)			Project Data		Standard Values		Input field
Efficiency of Heat Generator in Basic Cycle	η_{0Z}	(Manufacturer)	68%		68%		
Efficiency of Heat Generator in Constant Operation	η_{S0}	(Manufacturer)	80%		70%		80%
Average Fraction of Heat Output Released to Heating Circuit	$z_{HC,m}$	(Manufacturer)	0,7		0,4		0,7
Temperature Difference Betw. Power-On and Power-Off	$\Delta\vartheta$	(Manufacturer)	30	K	30		
For Interior Installations: Area of Mechanical Room	$A_{Install}$	(Project)	42	m²	35	m²	42
Useful Heat Output per Basic Cycle	$Q_{N,0Z}$	(Manufacturer)	10,0		15,0		10,0
Average Power Output of the Heat Generator	$Q_{N,m}$	(Manufacturer)	6,0	kW	10,0		6,0

Utilisation Factor Heat Generator Heating Run	$h_{H,g,K}=f_e*\eta_K$	57%
Utilisation Factor Heat Generator DHW Run	$h_{TW,g,K}=\eta_{100\%}/f_{e,TW}$	56%
Utilisation Factor Heat Generator DHW & Heating	$h_{g,K}$	57%

PHPP – “Compact”工作表 (附有排风热泵)

选择紧凑型类型:

- 根据PHI证书的数据库将数据输入于相同的工作表

结果 :

- 性能比值被转换到”PE-Value”工作表

COMPACT UNIT WITH EXHAUST AIR HEAT PUMP

Selection of Compact Unit (Data Inputs from Row 173): compact heat pump unit type 1

Measured Values from Laboratory Test

Ventilation

Effective Heat Recovery Efficiency	η_{eff}	*(Test Stand)*	78%	
Electric Efficiency		*(Test Stand)*	0,40	Wh/m³

Heating

		Test Point 1	*Test Point 2*	*Test Point 3*	*Test Point 4*	
Ambient Air Temperature	T_{amb}	-2,0	2,0	7,0		°C
Measured Thermal Power Heat Pump Heating	$P_{HP,Heating}$	1,03	1,18	1,34		kW
Measured COP Heating	$COP_{Heating}$	2,22	2,73	3,07		-

DHW

		Test Point 1	*Test Point 2*	*Test Point 3*	*Test Point 4*	
Ambient Air Temperature	T_{amb}	-2,0	2,0	7,0	20,0	°C
Measured Thermal Power DHW Storage Heating-Up	$P_{DHW,Heating-Up}$	0,92	1,13	1,28	1,49	kW
Measured Thermal Power DHW Storage Reload	$P_{DHW,Reload}$	0,88	1,10	1,28	1,41	kW
Measured COP DHW Storage Heating-Up	$COP_{DHW,Heating-Up}$	2,51	2,93	3,26	3,47	-
Measured COP DHW Storage Reload	$COP_{DHW,Reload}$	2,08	2,39	2,71	2,71	-

Standby (Inputs required only if different from storage reload)

		Test Point 1	*Test Point 2*	*Test Point 3*	*Test Point 4*	
Ambient Air Temperature	T_{amb}					°C
Measured Thermal Power Heat Pump Standby	$P_{HP,Standby}$					kW
Measured COP Standby	$COP_{Standby}$					-

Specific Heat Loss Storage incl. Connections	$U * A_{Storage}$	*(Test Stand)*	1,60	W/K
Average Storage Temperature in Standby Mode	$T_{DHW,Standby}$	*(Test Stand)*	47	°C

Performance Ratio of Heat Generator, DHW & Space Heating		**66%**
Annual Coefficient of Performance	COP	1,5

PHPP 区域热水供暖系统

输入:

- 太阳对于暖通覆盖的贡献比例。
- 选择**区域热水供暖的**类型
- 热传输**站的**性能比例

结果:

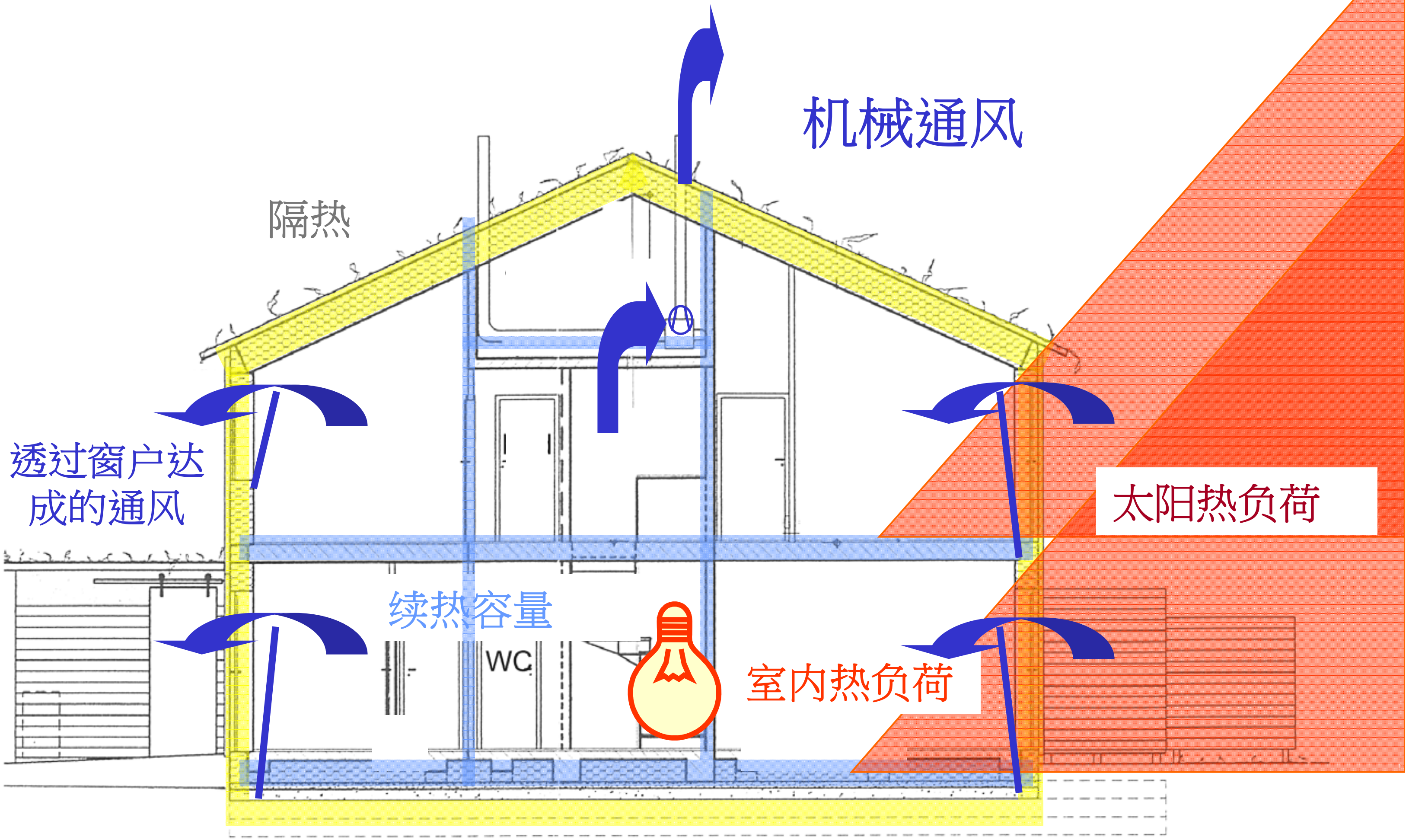
- 家用热水的PE-需求

EFFICIENCY OF DISTRICT HEATING STATIONS

Building:	Sonnen-Passivhaus Freundorfer	Building Type/Use:	Einfamilienhaus	
Location:	Oberbayern Voralpenland	Treated Floor Area A_{TFA}:	176	m²
Covered Fraction of Space Heat Demand		*(PE Value worksheet)*	100%	
Annual Heat Demand kWh/a	Q_H	*(DHW+Distribution)*	2972	kWh
Solar Fraction for Space Heat	$\eta_{Solar,\ H}$	*(Separate Calculation)*		
Effective Annual Heat Demand	$Q_{H,WI}=Q_H*(1-\eta_{Solar,\ H})$		2972	kWh
Covered Fraction of DHW Demand		*(PE Value worksheet)*	100%	
DHW Demand	Q_{DHW}	*(DHW+Distribution)*	3742	kWh
Solar Fraction for DHW	$\eta_{Solar,\ DHW}$	*SolarDHW worksheet)*	86%	
Effective DHW Demand	$Q_{DHW,WI}=Q_{DHW}*(1-\eta_{Solar,\ DHW})$		524	kWh
Heat Source			Gas CGS 35% PHC	
Primary Energy Factor		*(Data worksheet)*	1,1	kWh/kWh
CO_2-Emissions factor (CO_2-Equivalent)		*(Data worksheet)*	130	g/kWh
Utilisation Factor Heat Transfer Station	$\eta_{a,HX}$		107%	

		kWh/a	kWh/(m²a)
Final Energy Demand Heat Generation	$Q_{final} = Q_{Use} * e_{a,DH}$	3267	18,6
Annual Primary Energy Demand		3594	20,4
		kg/a	kg/(m²a)
Annual CO_2-Equivalent Emissions		425	2,4

被动式房屋夏季时分



PHPP – “Summer”工作表

输入:

- 具体的储热容量:轻质和重结构的总和
- 舒适限制:
  25 or 26° C
- 白天经由窗户的机械式通风或单纯窗户通风
- 在夜间经由窗户的机械式通风或单纯窗户通风

结果:

- 过热的频率
- 由于太阳热负荷所造成的每日温度波动

Passive House Planning

SUMMER

Climate: Garmisch-Partenkirchen
Building: Sonnen-Passivhaus Freundorfer
Location: Oberbayern Voralpenland
Spec. Capacity: 84 Wh/K pro m² TFA
Overheating Limit: 25 °C

Interior Temperature: 20 °C
Building Type/Use: Einfamilienhaus
Treated Floor Area A_{TFA}: 175,9 m²

	Building Element	Temperature Zone	Area m²		U-Value W/(m²K)		Red. Factor $f_{T,Summer}$		H_{Summer} Heat Conductance
1.	Exterior Wall - Ambi	A	223,8	*	0,098	*	1,00	=	21,9
2.	Exterior Wall - Grou	B		*		*	1,00	=	
3.	Roof/Ceiling - Ambie	A	122,5	*	0,096	*	1,00	=	11,8
4.	Floor Slab	B	114,8	*	0,091	*	1,00	=	10,4
5.		A		*		*	1,00	=	
6.		A		*		*	1,00	=	
7.		X		*		*	0,75	=	
8.	Windows	A	47,3	*	0,863	*	1,00	=	40,8
9.	Exterior Door	A	2,6	*	0,650	*	1,00	=	1,7
10.	Exterior TB (length/	A	239,7	*	-0,012	*	1,00	=	-2,9
11.	Perimeter TB (length	P	44,5	*	-0,039	*	1,00	=	-1,7
12.	Ground TB (length/m)	B		*		*	1,00	=	

Exterior Thermal Transmittance, $H_{T,e}$ 73,2 W/K
Ground Thermal Transmittance, $H_{T,g}$ 8,7 W/K

Heat Recovery Efficiency η_{HR} 77%
SHX Efficiency η^*_{SHX} 60%

Effective Air Volume V_v: A_{TFA} 175,9 m² * Clear Room Height 2,50 m = 440 m³

Summer Ventilation continuous ventilation to provide sufficient indoor air quality

Air Change Rate by Natural (Windows & Leakages) or Exhaust-Only Mechanical Ventilation, Summer: 0,27 1/h

Mechanical Ventilation Summer: 0,30 1/h with HR (check if applicable)

Energetically Effective Airchange Rate n_V: $n_{L,nat}$ 0,273 1/h + $n_{V,system}$ 0,300 1/h * (1 - Φ_{HR} 0,000) + $n_{V,Rest}$ 0,000 1/h = 0,573 1/h

	V_V m³		$n_{V,equi,fraction}$ 1/h		c_{air} Wh/(m³K)		
Ventilation Transm. Ambient $H_{V,e}$	440	*	0,393	*	0,33	=	57,0 W/K
Ventilation Transm. Ground $H_{V,g}$	440	*	0,180	*	0,33	=	26,1 W/K

Additional Summer Ventilation for Cooling Temperature Amplitude Summer 10,1 K

Select: x Window Night Ventilation, Manual
Mechanical, Automatically Controlled Ventilation

Corresponding Air Change Rate 0,13 1/h
(for window ventilation: at 1 K temperature difference indoor - outdoor)

Minimum Acceptable Indoor Temperature 22,0 °C

	Orientation of the Area	Angle Factor Summer		Shading Factor Summer		Dirt		g-Value (perp. radiation)		Area m²		Portion of Glazing		Aperture m²
1	North	0,9	*	0,43	*	0,95	*	0,52	*	4,1	*	67%	=	0,5
2	East	0,9	*	0,56	*	0,95	*	0,52	*	8,2	*	75%	=	1,5
3	South	0,9	*	0,53	*	0,95	*	0,52	*	20,4	*	71%	=	4,7
4	West	0,9	*	0,41	*	0,95	*	0,52	*	6,5	*	75%	=	0,9
5	Horizontal	0,9	*	1,00	*	0,95	*	0,00	*	0,0	*	0%	=	0,0
6	Sum Opaque Areas													0,9

Solar Aperture Total 8,6 0,05 m²/m²

Internal Heat Gains Q_I Specif. Power q_I 2,10 W/m² * A_{TFA} 176 m² = 369 W 2,1 W/m²

Frequency of Overheating $h_{\vartheta \geq \vartheta max}$ **0,0%** at the overheating limit ϑ_{max} = 25 °C

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

Daily Temperature Swing due to Solar Load: Solar Load 40,2 Wh/d * 1000 1/k / (Spec. Capacity 84 Wh/(m²K) * A_{TFA} 176 m²) = **2,7** K

“Summer” 工作表

S U M M E R

Climate:	Garmisch-Partenkirchen	Interior Temperature:	20 °C
Building:	Sonnen-Passivhaus Freundorfer	Building Type/Use:	Einfamilienhaus
Location:	Oberbayern Voralpenland	Treated Floor Area A_{TFA}:	175,9 m²
Spec. Capacity:	84 Wh/K pro m² TFA		
Overheating Limit:	25 °C		

	Building Element	Temperature Zone	Area m²		U-Value W/(m²K)		Red. Factor $f_{T,Summer}$		H_{Summer} Heat Conductance
1,	Exterior Wall - Ambi	A	223,8	*	0,098	*	1,00	=	21,9
2,	Exterior Wall - Grou	B		*		*	1,00	=	
3,	Roof/Ceiling - Ambie	A	122,5	*	0,096	*	1,00	=	11,8
4,	Floor Slab	B	114,8	*	0,091	*	1,00	=	10,4
5,		A		*		*	1,00	=	
6,		A		*		*	1,00	=	
7,		X		*		*	0,75	=	
8,	Windows	A	47,3	*	0,863	*	1,00	=	40,8
9,	Exterior Door	A	2,6	*	0,650	*	1,00	=	1,7
10,	Exterior TB (length/	A	239,7	*	-0,012	*	1,00	=	-2,9
11,	Perimeter TB (length/	P	44,5	*	-0,039	*	1,00	=	-1,7
12,	Ground TB (length/m)	B		*		*	1,00	=	

Exterior Thermal Transmittance, $H_{T,e}$	73,2	W/K
Ground Thermal Transmittance, $H_{T,g}$	8,7	W/K

Frequency of Overheating $h_{\vartheta \geq \vartheta max}$ **0,0%** **at the overheating limit ϑ_{max} = 25 °C**

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

“Summer” 工作表

Summer Ventilation

continuous ventilation to provide sufficient indoor air quality

Air Change Rate by Natural (Windows & Leakages) or Exhaust-Only Mechanical Ventilation, Summer: **0,27** 1/h

Mechanical Ventilation Summer: **0,30** 1/h   [ ] with HR (check if applicable)

	$n_{L,nat}$		$n_{V,system}$		Φ_{HR}		$n_{V,Rest}$		
	1/h		1/h				1/h		1/h
Energetically Effective Airchange Rate n_V	0,273	+	0,300	* (1 -	0,000	) +	0,000	=	0,573

	V_V		$n_{V,equi,fraction}$		c_{Air}			
	m³		1/h		Wh/(m³K)			
Ventilation Transm. Ambient $H_{V,e}$	440	*	0,393	*	0,33	=	57,0	W/K
Ventilation Transm. Ground $H_{V,g}$	440	*	0,180	*	0,33	=	26,1	W/K

Additional Summer Ventilation for Cooling

Temperature Amplitude Summer **10,1** K

Select: [X] Window Night Ventilation, Manual   Corresponding Air Change Rate **0,13** 1/h

[ ] Mechanical, Automatically Controlled Ventilatioi (for window ventilation: at 1 K temperature difference indoor - outd(

Minimum Acceptable Indoor Temperatu **22,0** °C

	Orientation of the Area	Angle Factor Summer		Shading Factor Summer		Dirt		g-Value (perp. radiation)		Area m²		Portion of Glazing		**Aperture** m²
1.	North	0,9	*	0,43	*	0,95	*	0,52	*	4,1	*	67%	=	0,5
2.	East	0,9	*	0,56	*	0,95	*	0,52	*	8,2	*	75%	=	1,5
3.	South	0,9	*	0,53	*	0,95	*	0,52	*	28,4	*	71%	=	4,7
4.	West	0,9	*	0,41	*	0,95	*	0,52	*	6,5	*	75%	=	0,9
5.	Horizontal	0,9	*	1,00	*	0,95	*	0,00	*	0,0	*	0%	=	0,0
6	Sum Opaque Areas													0,9

Solar Aperture

Total 8,6   m²/m² ##

“Summer” 工作表

	Specif. Power q_I		A_{TFA}			
	W/m²		m²		W	W/m²
Internal Heat Gains Q_I	2,10	*	176	=	369	2,1

Frequency of Overheating $h_{\vartheta \geq \vartheta max}$ **0,4%** **at the overheating limit ϑ_{max} = 25 °C**

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

Caution: Large daily temperature swing. Calculation of overheating frequency is not reliable.

	Solar Load				Spec. Capacity		A_{TFA}			
	kWh/d		1/k		Wh/(m²K)		m²			
Daily Temperature Swing due to Solar Load	40,2	*	1000	/ (	60	*	176	) =	**3,8**	**K**

10%的过热频率意味着超过10%以上的时间温度达到25-28 (被认为是“正常”)

20%的过热频率意味着超过20%以上的时间温度达到25-32 (被认为是不能忍受)

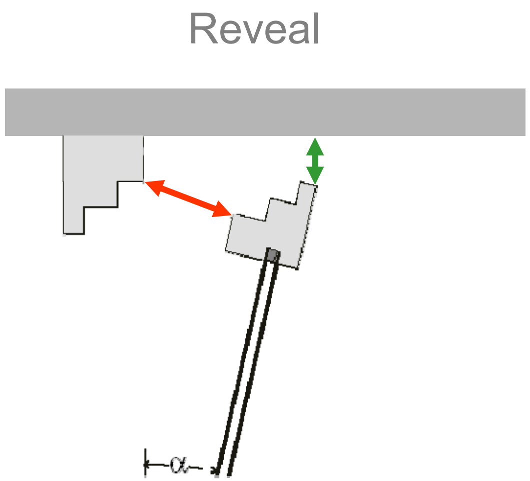
(使用隐藏在78至149行的建筑模拟来计算)

"SummVent"的工作表

S U M M E R   V E N T I L A T I O N

Building:	Sonnen-Passivhaus Freundorfer	Building Type/Use:	Einfamilien
Location:	Oberbayern Voralpenland	Building Volume	440

Description	Day GRF	Day FIF		Night
Fraction of Opening Duration	13%	50%		50%
Climate Boundary Conditions				
Temperature Diff Interior - Exterior	4	4		1
Wind Velocity	1	1		0
Window Group 1				
Quantity	4	4		1
Clear Width	0,78	0,78		0,99
Clear Height	2,12	2,12		2,12
Tilting Windows?	x	x		x
Opening Width (for tilting windows)	0,060	0,060		0,060
Window Group 2 (Cross Ventilation)				
Quantity				4
Clear Width				0,78
Clear Height				2,12
Tilting Windows?				x
Opening Width (for Tilting Windows)				0,060
Difference in Height to Window 1				2,80
Single-Sided Ventilation 1 - Airflow Volume	191	191	0	20
Single-Sided Ventilation 2 - Airflow Volume	0	0	0	93
Cross Ventilation Airflow Volume	191	191	0	113
Contribution to Air Change Rate	0,06	0,22	0,00	0,13



Summary of Summer Ventilation Distribution

Description Ventilation Type		Daily Average Air Change Rate	
Day GRF		0,06	1/h
Day FIF		0,22	1/h
Night		0,13	1/h

给"Summer"工作表

气候数据: 选择

C L I M A T E   D A T A

Standard/Regional Climate: Select here.

Regional Climate Data

Select Region Here

Germany

Select regional climate here:

Garmisch-Partenkirchen

Building: Sonnen-Passivhaus Freundorfer

Use Regional Data: Yes

Climate Building: Garmisch-Partenkirchen

Chosen Method for Annual Heat Demand: Monthly Method

Monthly Data: Garmisch-Partenkirchen

Annual Data:

Use Annual Climate Data Set: No

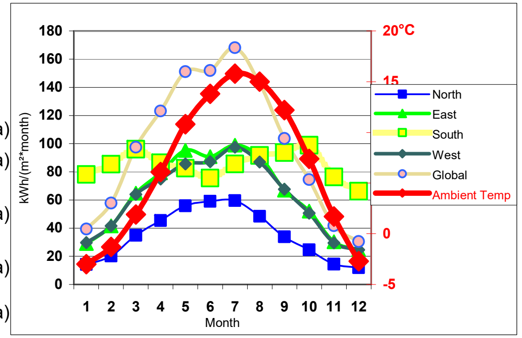
Results:

Annual Heat Demand: 15,3 kWh/(m²a)

Heat Load: 13,3 W/m²

Transfer to Annual Method

H_T	205	d/a
G_t	93	kKh/a
North	151	kWh/(m²a)
East	296	kWh/(m²a)
South	559	kWh/(m²a)
West	291	kWh/(m²a)
Horizontal	425	kWh/(m²a)



	Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
	Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
Parameters for PHPP Calculated Ground Temperatures:	Garmisch-Partenkirchen	Latitude:	47,5	Longitude ° East	11,1	Altitude m	719			Daily Temperature Swing Summer (K)	10,1	Radiation Data:	kWh/(m²*month)	Radiation: W/m²		W/m²
Phase Shift Months	Ambient Temp	-3,0	-1,3	1,9	6,1	10,8	13,8	15,8	15,0	12,2	7,4	1,7	-2,7	-10,6	-7,8	23,0
2,00	North	14	20	35	45	56	59	60	48	34	25	14	12	20	10	100
Damping	East	29	42	65	79	95	91	99	91	67	52	30	25	40	15	210
-1,05	South	78	85	96	86	83	76	86	92	94	99	76	66	80	20	190
Depth m	West	30	42	64	75	86	87	97	87	68	51	30	25	35	15	210
3,32	Global	39	58	97	123	151	152	168	143	104	74	42	31	50	20	350
Shift of Average Temperature K	Dew Point	-4,8	-3,7	-0,9	2,7	6,7	10,2	11,7	11,5	9,1	4,9	0,2	-3,3			
1,60	Sky Temp	-13,8	-12,2	-8,0	-2,7	2,9	7,7	9,7	9,5	6,2	0,4	-6,3	-11,5			12,8
	Ground Temp	8,9	8,8	8,8	9,0	9,3	9,6	10,5	10,6	9,9	9,7	9,4	9,1	8,8	8,8	10,6

气候数据输入: 各自的气候数据

Annual Method (Name)	Month	Jan	Feb	Mar
	Example	Latitude:	50,2	Longitude ° East
° C	Ambient Temp	0,9	2	5,3
kWh/(m²*month)	North	9,0	15,0	23,0
kWh/(m²*month)	East	14,0	21,0	31,0
kWh/(m²*month)	South	30,0	33,0	39,0
kWh/(m²*month)	West	14,0	19,0	30,0
kWh/(m²*month)	Global	23,0	34,0	52,0
° C	Dew Point	0,3	-0,9	1,5
° C	Sky Temp	-9,0	-8,6	-4,7
	Data1	Latitude:		Longitude ° East
° C	Ambient Temp			
kWh/(m²*month)	North			
kWh/(m²*month)	East			
kWh/(m²*month)	South			
kWh/(m²*month)	West			
kWh/(m²*month)	Global			
° C	Dew Point			
° C	Sky Temp			

输入每月的外部空气温度和辐射数据

■输入数据组的名称