



ZEPHIR

PASSIVHAUS
ITALIA

Affiliato iPHA

Burgas, 21 June 2018

The Passivhaus standard in Mediterranean climate

PRESENT and PERSPECTIVES



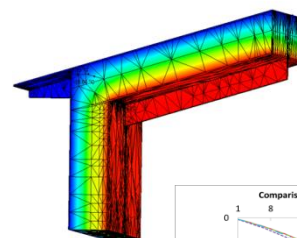
Dr. Phys. Francesco Nesi

passivhaus.academy
www.passivhausitalia.it

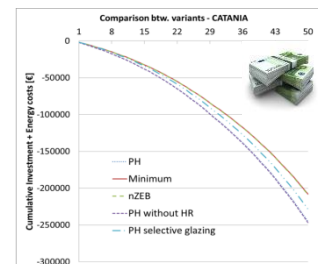
...since 7 yrs ZEPHIR Passivhaus Italia



CERTIFICATION
PH/EnerPHit



CONSULTANCY
living comfort,
economic analysis,
energy
modeling



TRAINING
designers, practitioners,
thermal bridges, PHPP



R&D



Passivhaus: what is it?

The idea of a "house without heating" is not properly correct:
a Passivhaus building needs a **very small amount of energy to be heated**

For instance, a single family house with a **100 m² TFA** can be heated in the worst day of the year with a power of



about 35 tea candles



**1 phon
of about 1 kW**



1 cow

Passive House criteria *

Heating demand ≤ 15
kWh/(m²yr)
OR
Heating load ≤ 10
W/m²

Cooling demand ≤ 15
kWh/(m²yr) **
OR
Cooling load ≤ 10
W/m²

* all based on
treated floor area
(TFA)

** 15 kWh/(m²yr) +
dehumidification
contribution

Primary Energy
demand ≤ 120
kWh/(m²yr) ***
OR
Primary Energy
Renewable demand
 ≤ 60 kWh/(m²yr) ***

Airtightness $n_{50} \leq$
0.6 1/h

*** including
DHW, heating,
cooling, auxiliary
and household
electricity

Source: PHI

PHPP: a "simple" tool

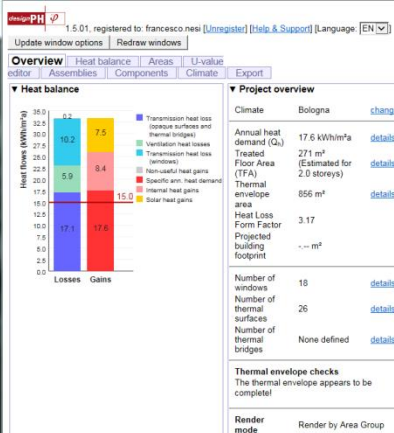
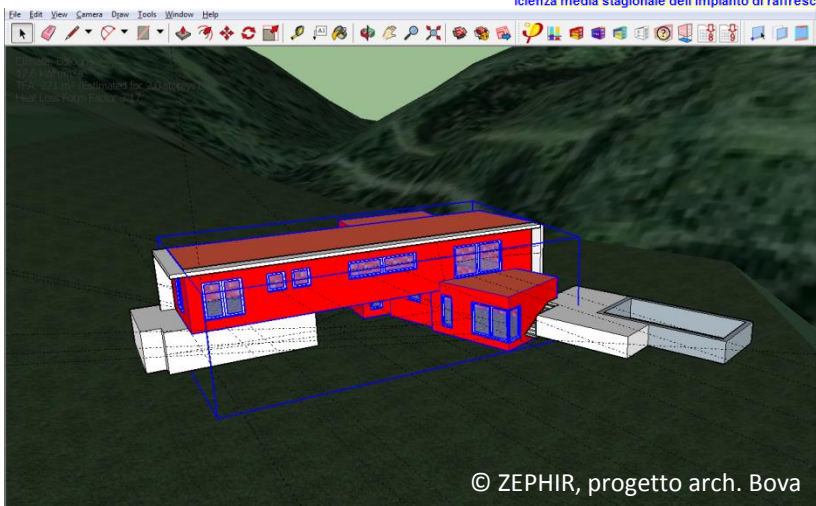
A	B	C	D	F	G	H	K	L
		Column for "Comparison" worksheet		Varianti aggiuntive				

Calcolo delle varianti

Passivhaus con Versione PHPP 9.6b

PH a schiera di testa Kranichstein / Clima: Roma (Pratica di Mare) / S_{utile}: 156 m² / Raffrescamento: 18.1 kWh/(m²a) / EPR: 31.8 kWh/(m²a)

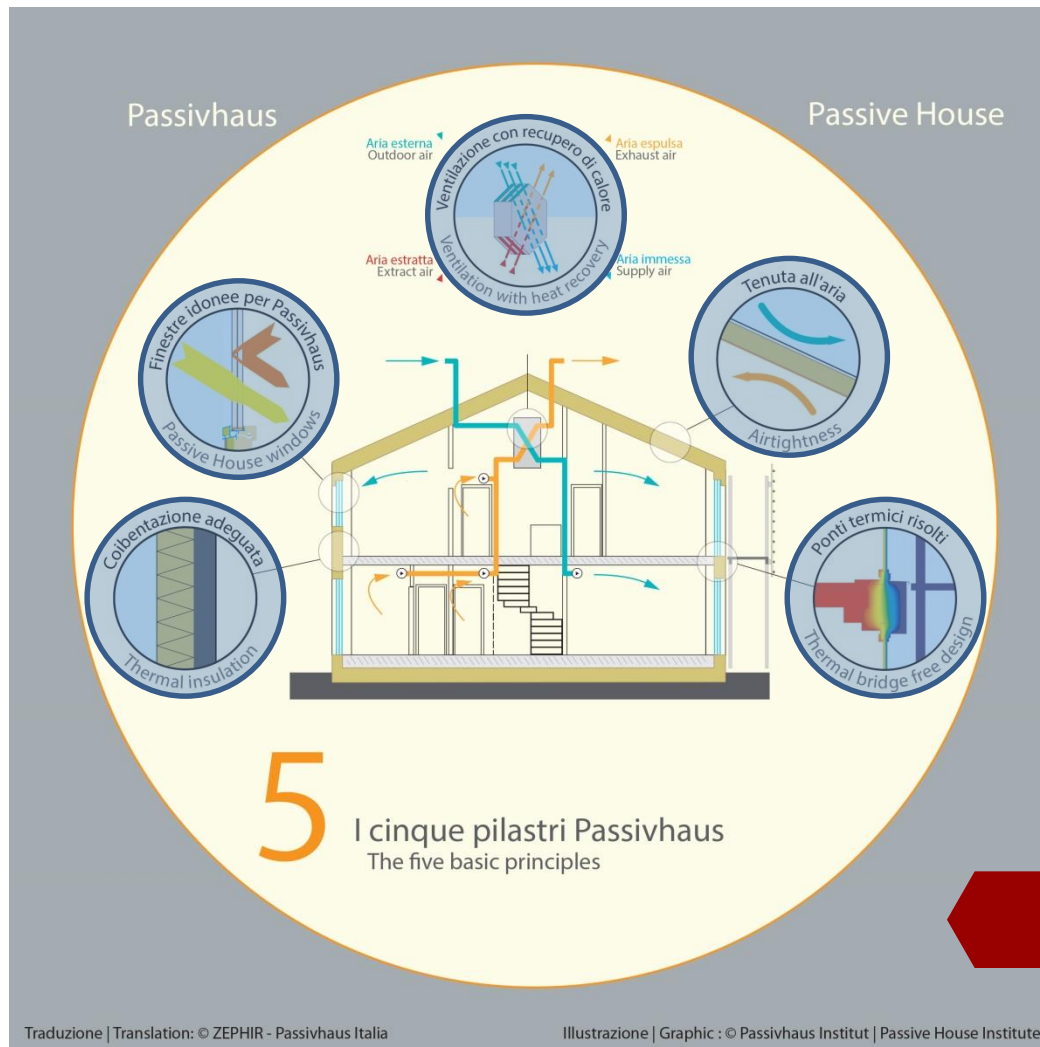
selezionare qui la variante attiva >>>>>	Unità di misura	Active					
		1-PH + PdC	PH + PdC	Minimo di legge DM 26/06/2015	Esistente	nZEB	PH + PdC + Selettivi
Risultati		1	2	3	6	7	
Fabb. termico annuo per risc.	kWh/(m ² a)	13.7	13.7	13.73	13.7	13.73	13.7
Carico termico	W/m ²	10.2	10.2	10.2	10.2	10.2	10.2
Fabb. frigorifero e di deumidif.	kWh/(m ² a)	0.1	0.09	0.1	0.1	0.1	0.1
Carico frigorifero	W/m ²	3.5	3.5	3.5	3.5	3.5	3.5
Frequenza di surriscaldamento (> 25 °C)	%	-	-	-	-	-	-
Fabbisogno EPR	kWh/(m ² a)	32.6	32.6	32.6	32.6	32.6	32.6
Passivhaus Premium?	si	si / no	si / no	si / no	si / no	si / no	si / no
Energia finale		-	-	-	-	-	-
Risultati personalizzati							
H't (da zona climatica e S/V: H't < 0,55)	W/m ² K	0.272	0.272	0.272	0.272	0.272	0.272
Efficienza media stagionale dell'impianto di riscaldamento η _h	>2	3.7431	3.7	3.7	3.7	3.7	3.7
Efficienza media stagionale dell'impianto per la produzione di acqua calda sanitaria η _{ws}	>2,5	4.200	4.2	4.2	4.2	4.2	4.2
Efficienza media stagionale dell'impianto di raffrescamento (esclusa deumidificazione) η _c	>2,5	3.0	3.0	3.0	3.0	3.0	3.0
		0.00	3.0	3.0	3.0	3.0	3.0
	i%	0.564	0.564	0.564	0.564	0.564	0.564
	%	0.574	0.574	0.6	0.574	0.574	0.574
	I.3	69.3	69.3	69.3	69.3	69.3	69.3



Available from ZEPHIR Passivhaus Italia

The five Passivhaus pillars

www.passivhausitalia.com



... since 1991

Passive House principles remain the same across the world!

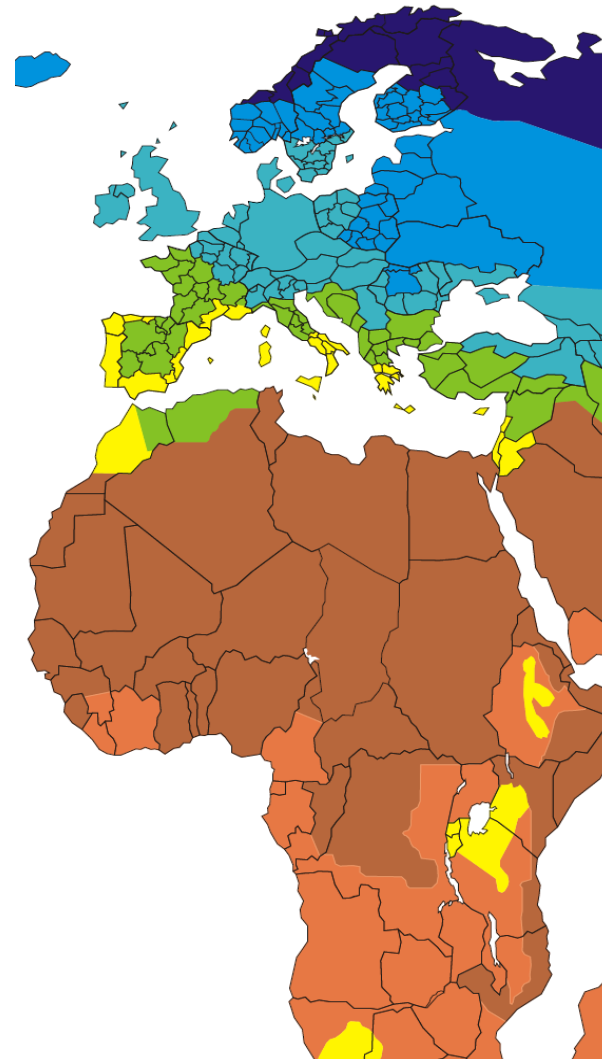
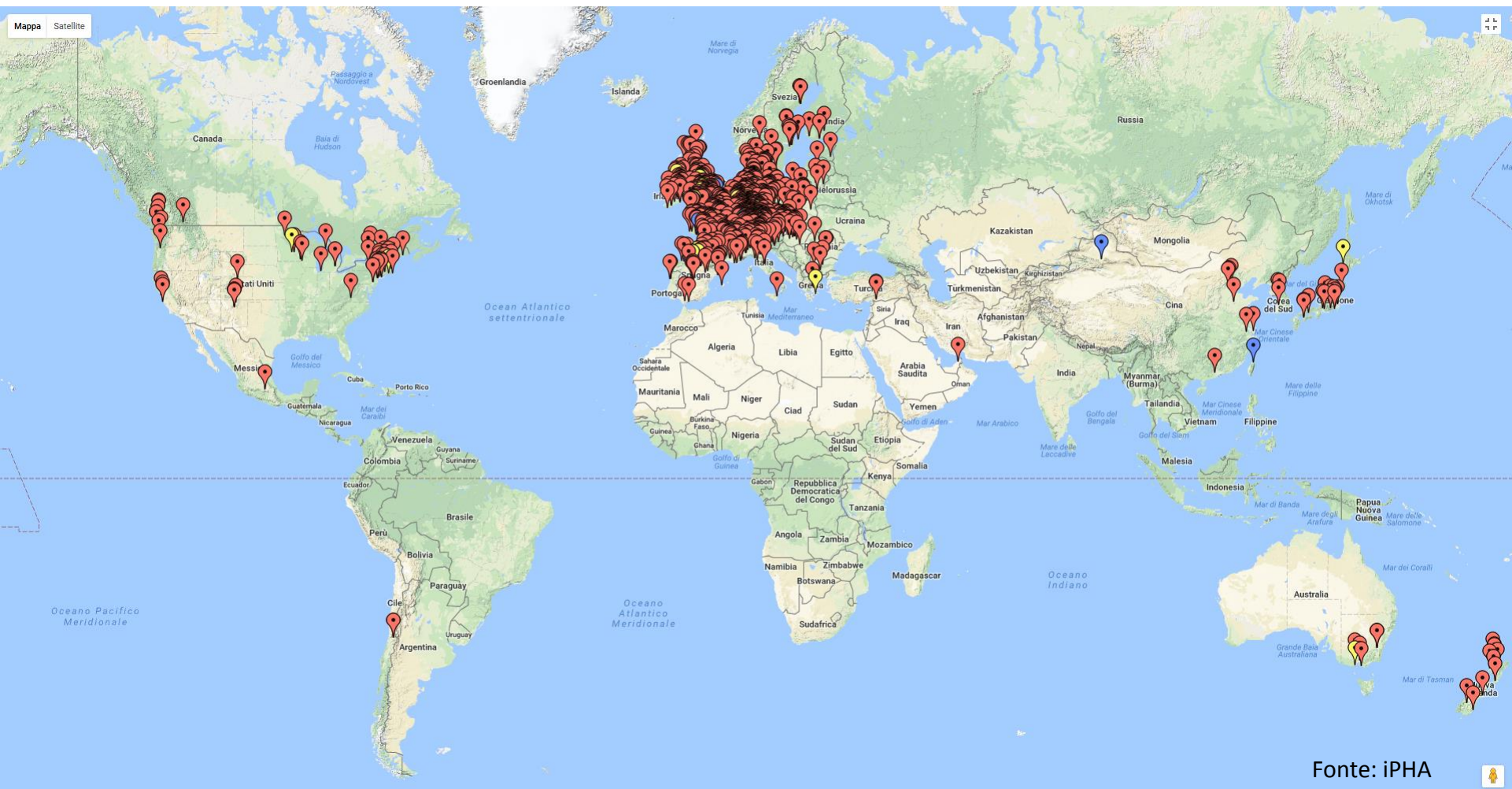


Illustration © Passive House Institute

Passivhaus adapts to different climates

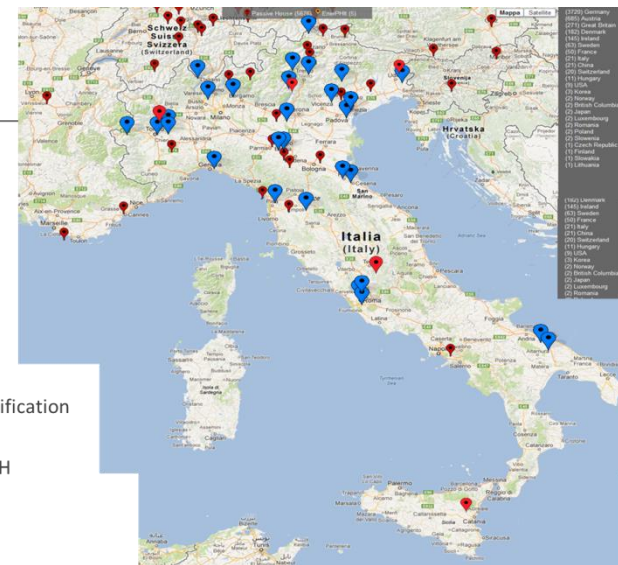
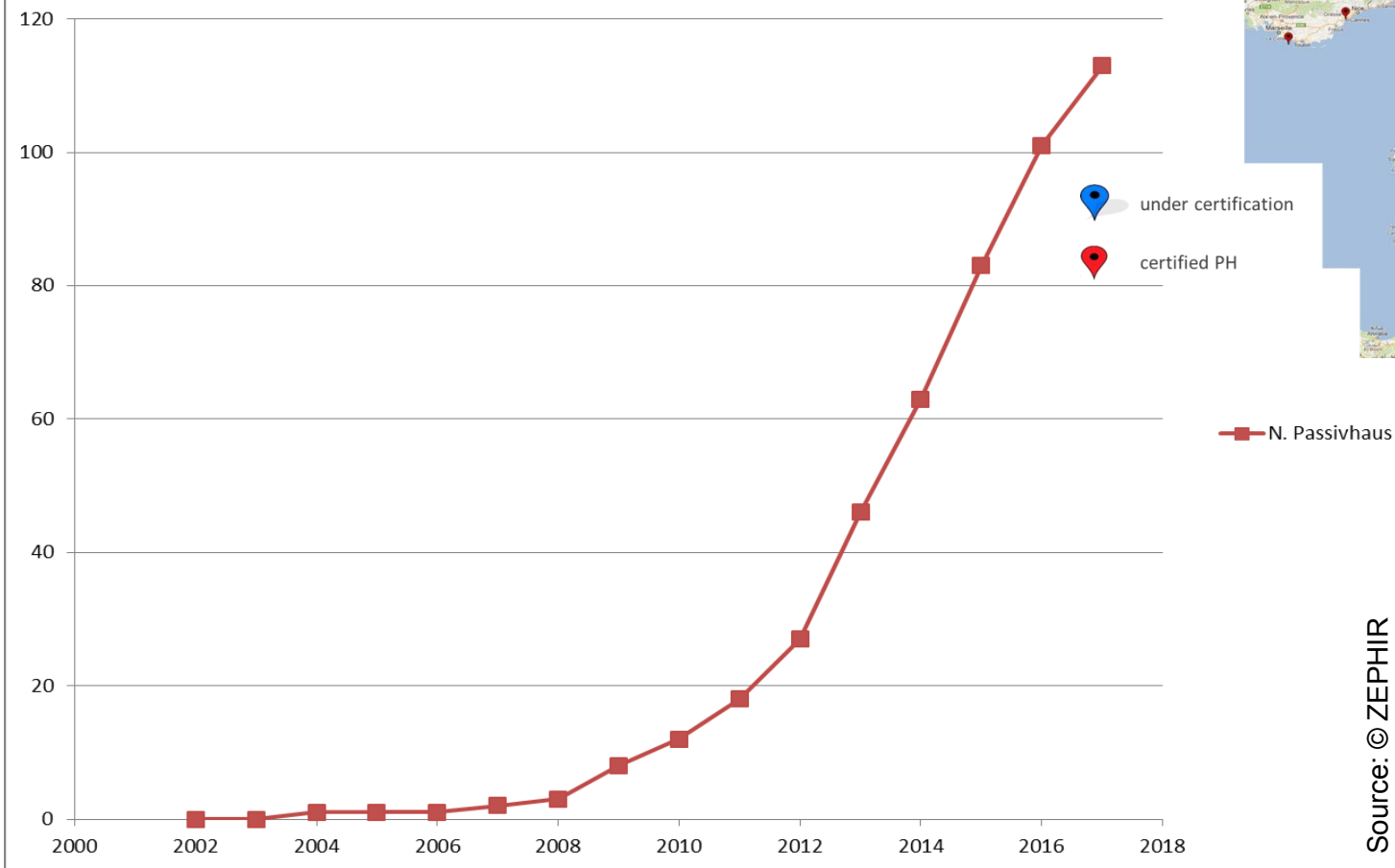
www.passivhausitalia.com



Fonte: iPHA

Passivhaus in Italy: exponential growth

Nr. Passivhaus buildings



Source: © ZEPHIR



Building types in Italy...

www.passivhausitalia.com



single fam. house



multifamily house



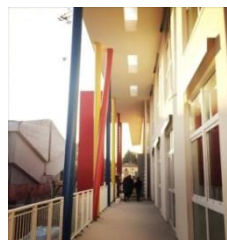
Hotel/B&B



canteen



elderly home



school



pizzeria/hotel



swimming pool



office building



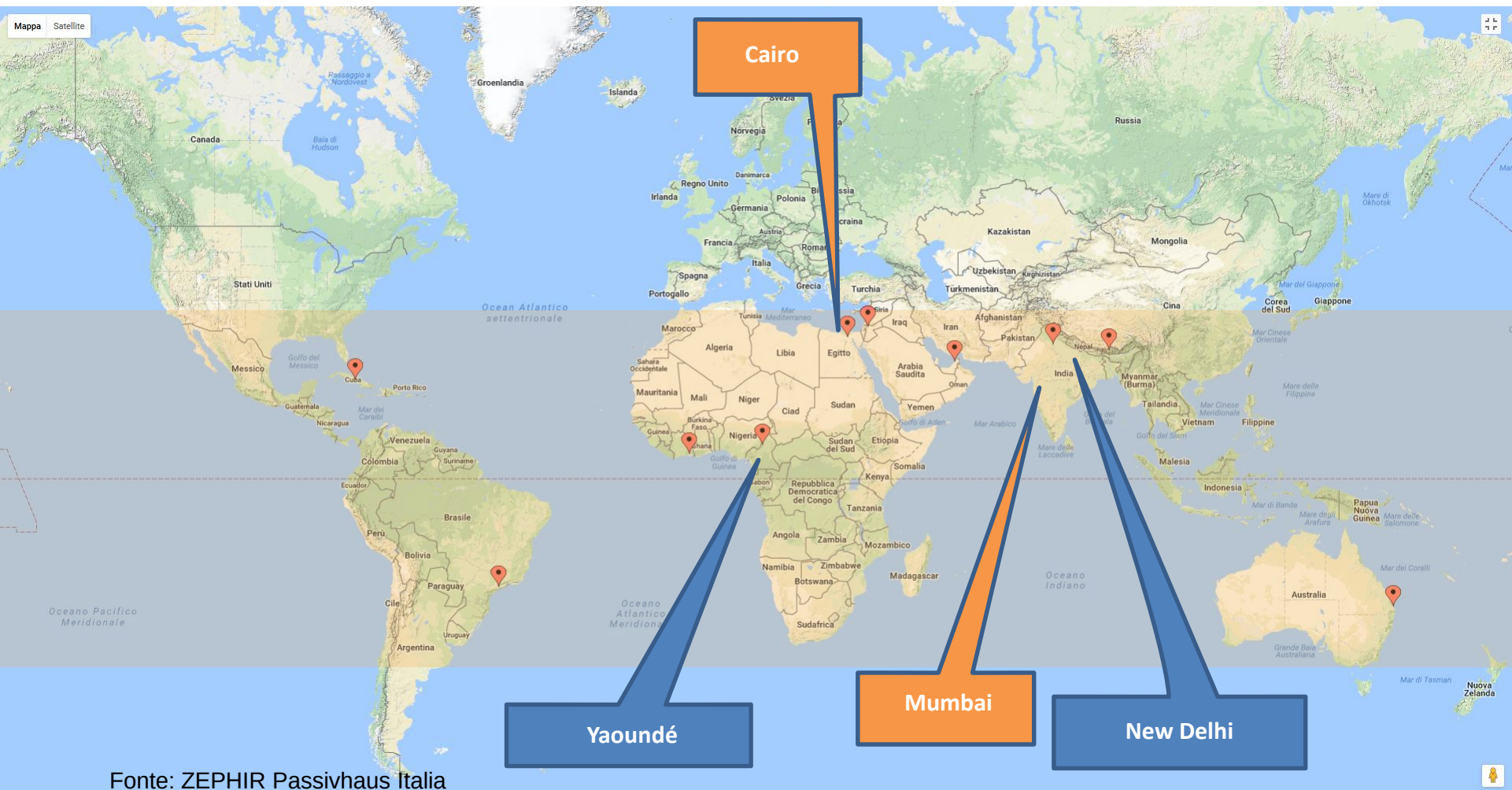
social housing



multifunctional bldg.

ZEPHIR - Passivhaus in tropical and sub-tropical climates

www.passivhausitalia.com



Fonte: ZEPHIR Passivhaus Italia

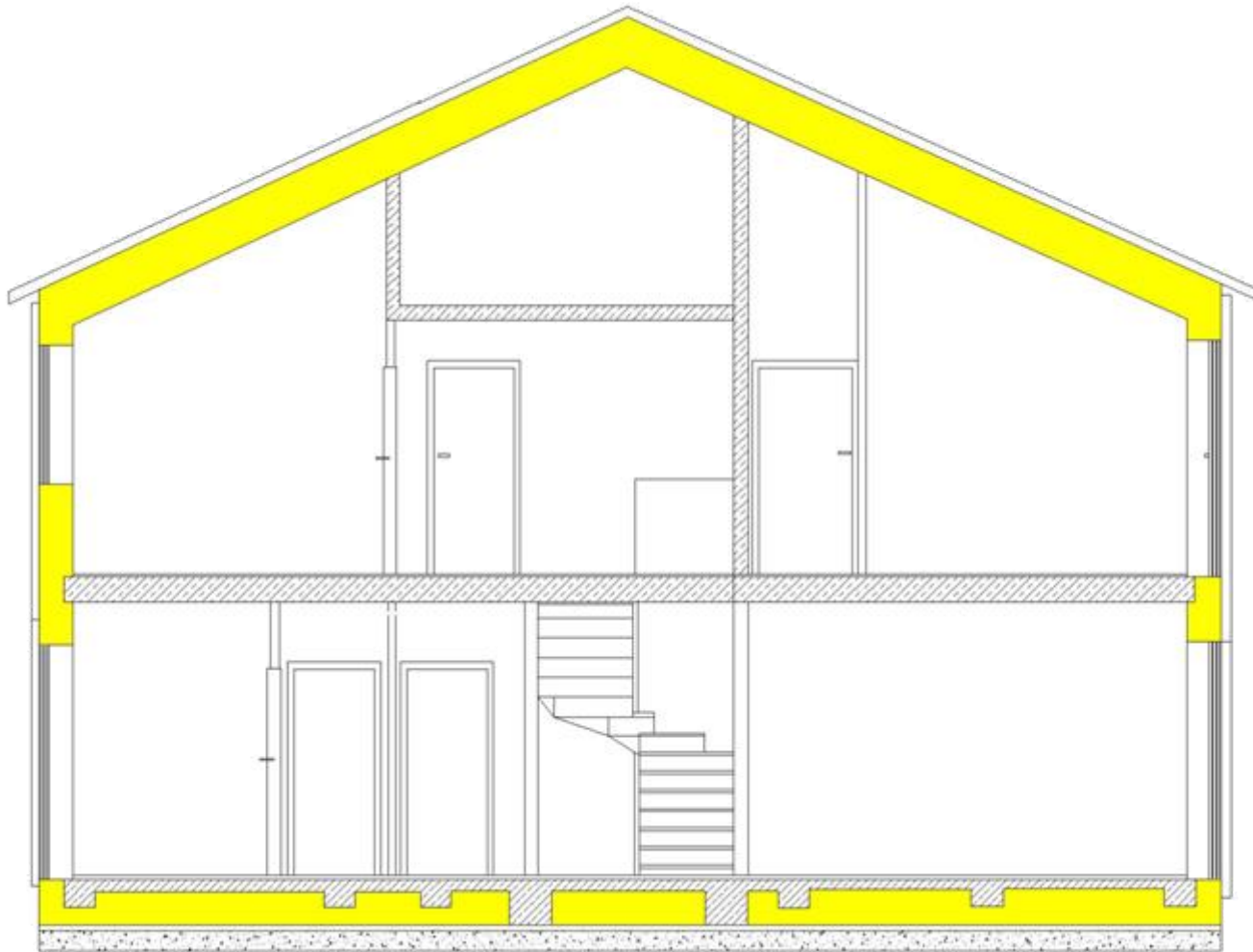
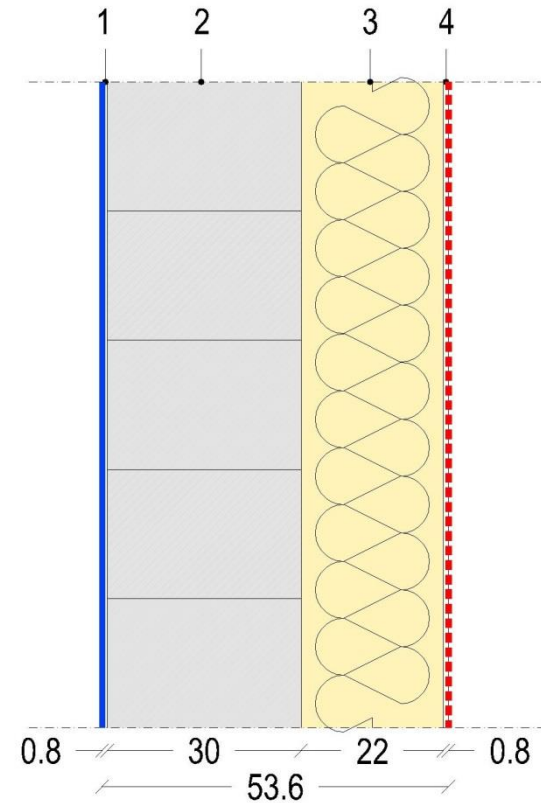


Illustration © PHI

U-values

AREAS

STRATIGRAFIE 1:10



1_PARETE RASATA 1

1 - Rasatura

2 - Blocco Ytong Clima

3 - ROFIX EPS F 031 LAMBDA POR (220 mm)

fissato mediante colla ROFIX UNISTAR LIGHT

4 - Rasatura



--- Thermal envelope
— Airtightness layer

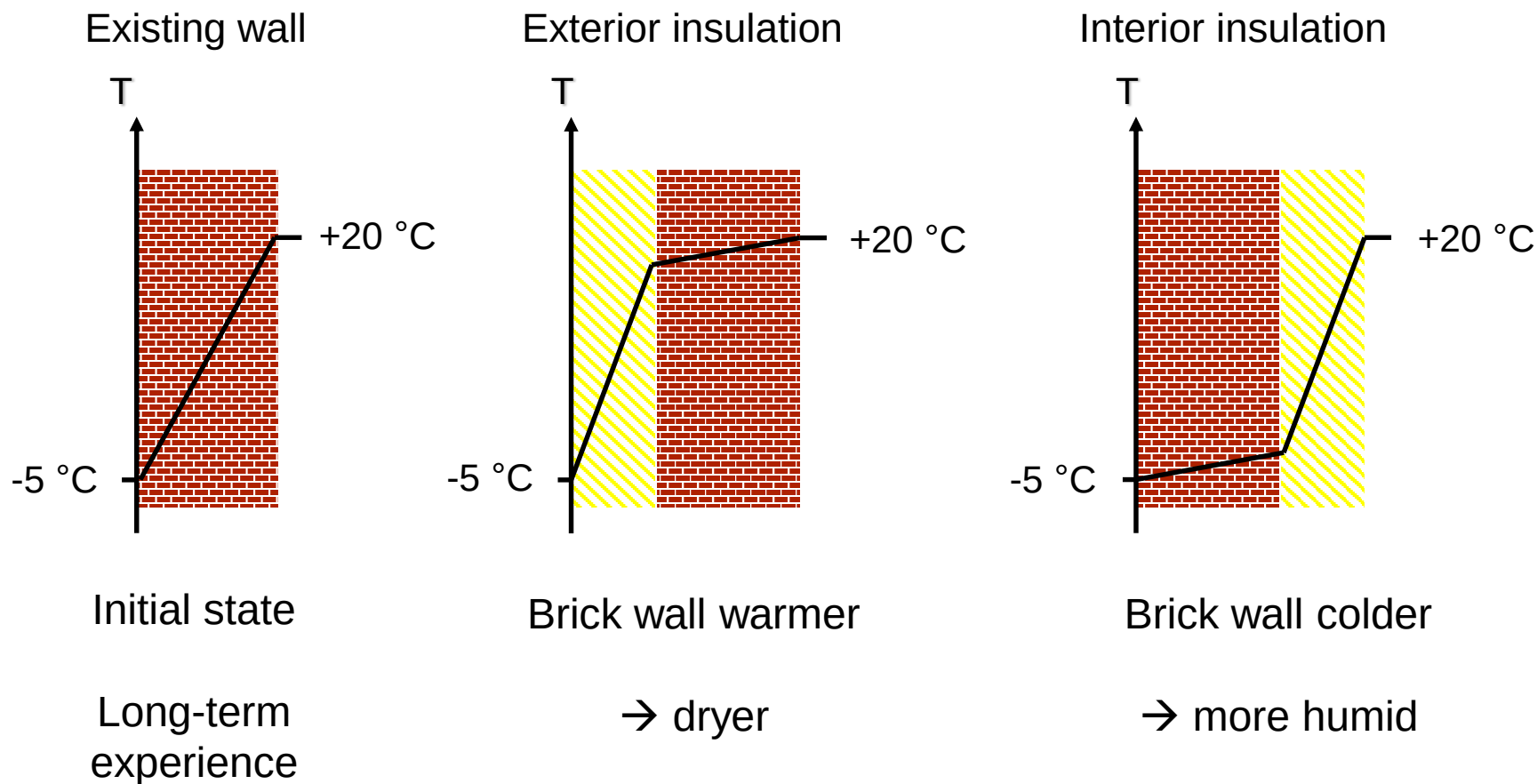
Source: Studio Carosso

Passivhaus pillars

Author: ZEPHIR – Passivhaus ITALIA

Interior vs. Exterior Insulation

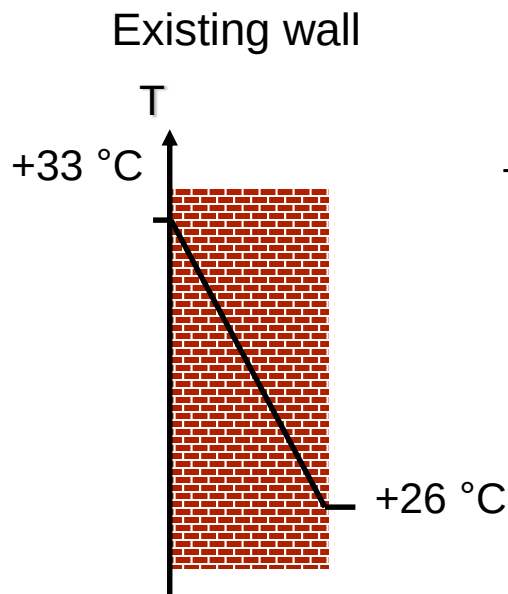
Temperature profiles



Interior vs. Exterior Insulation

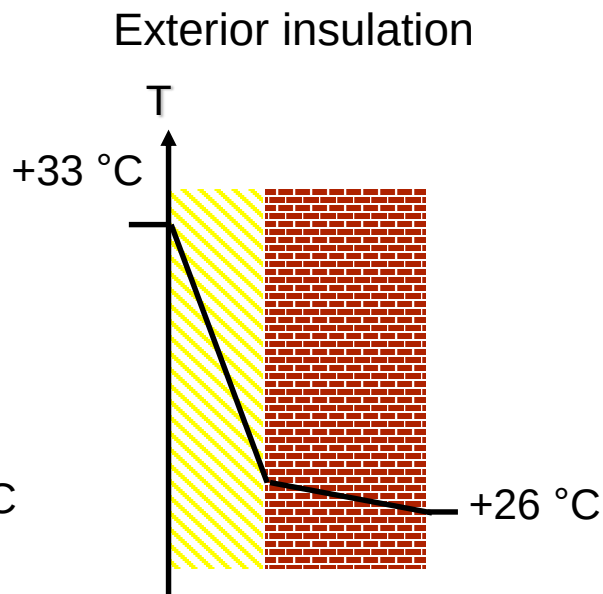
www.passivhausitalia.com

Temperature profiles



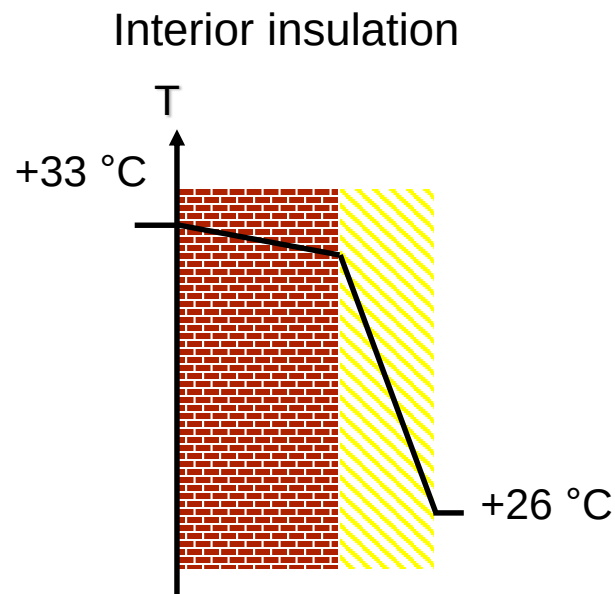
Initial state

Long-term
experience



Brick wall colder

→ dryer



Brick wall warmer

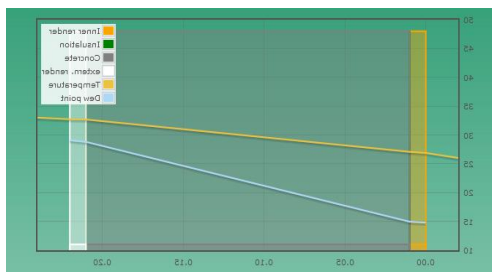
→ more humid

Interior vs. Exterior Insulation

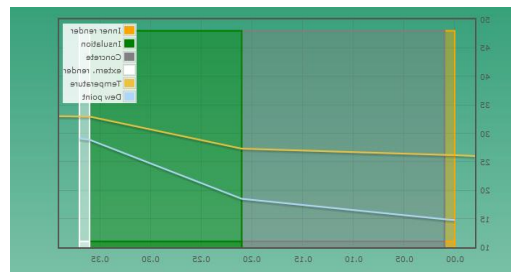
www.passivhausitalia.com

Temperature profiles

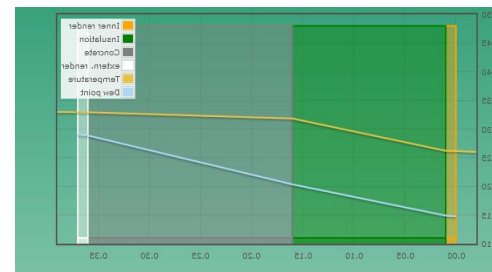
Existing wall



Exterior insulation



Interior insulation



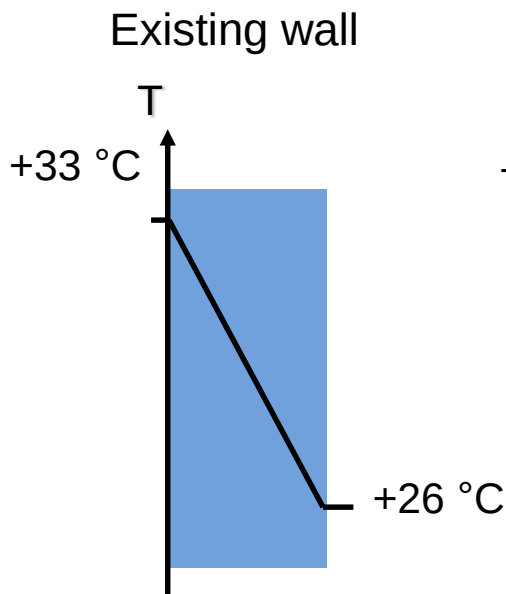
Boundary conditions: $\theta_e = 33\text{ }^{\circ}\text{C}$, RH = **80%** -- $\theta_i = 26\text{ }^{\circ}\text{C}$, RH = 50%,
15 cm EPS $\lambda = 0.035\text{ W/mK}$, 20 cm clay bricks $\lambda = 0.25\text{ W/mK}$

Source: Styrostone.in

Interior vs. Exterior Insulation

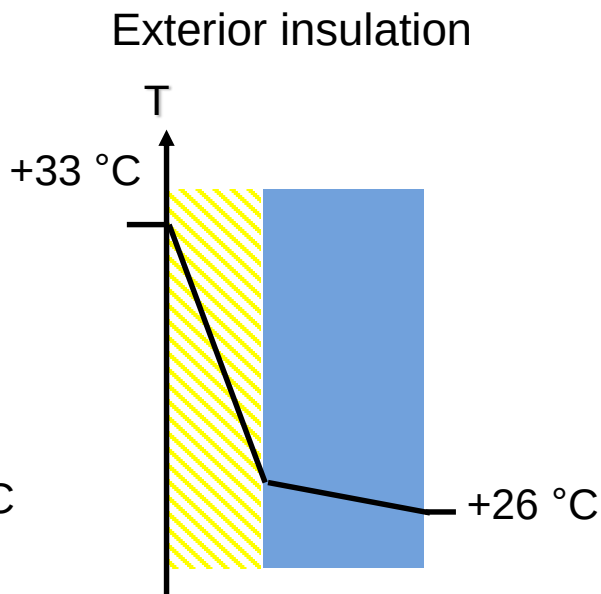
www.passivhausitalia.com

Temperature profiles



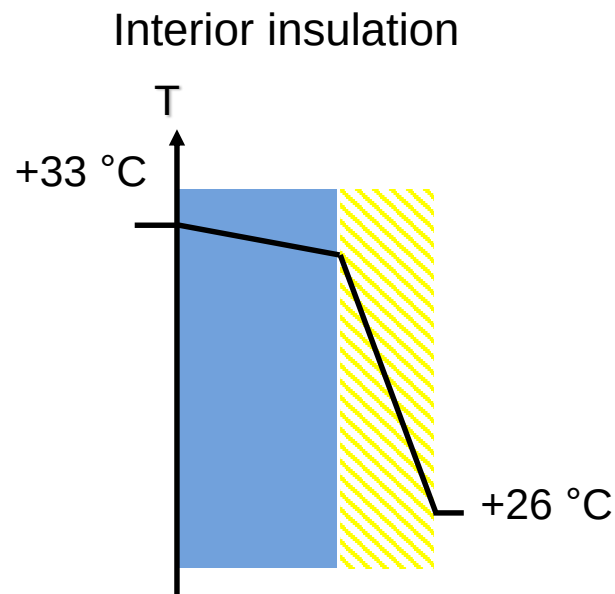
Initial state

Long-term
experience



Concrete wall colder

→ dryer

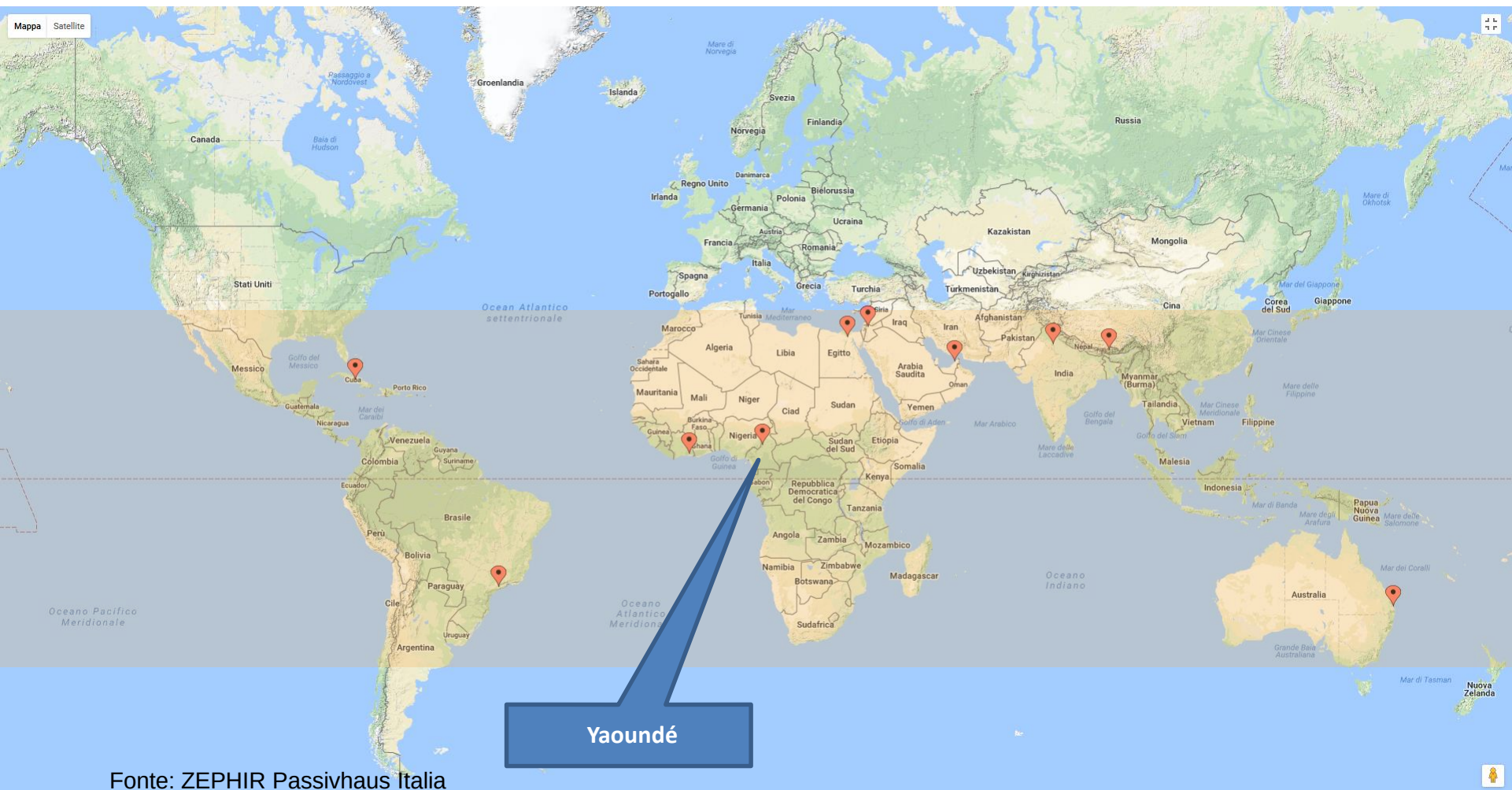


Concrete wall warmer

→ more humid

Passivhaus in tropical and sub-tropical climates

www.passivhausitalia.com



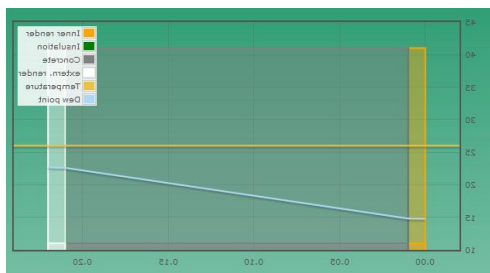
Interior vs. Exterior Insulation

www.passivhausitalia.com

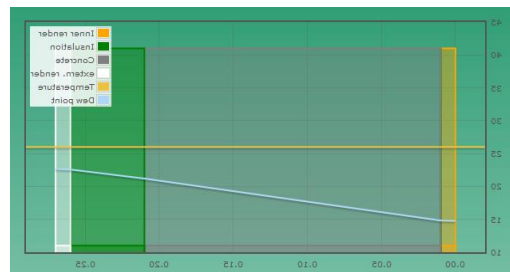
Example: Yaoundé

Temperature profiles

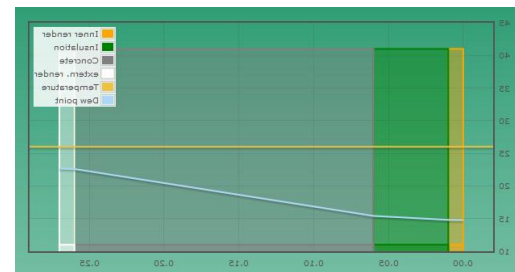
Existing wall



Exterior insulation



Interior insulation

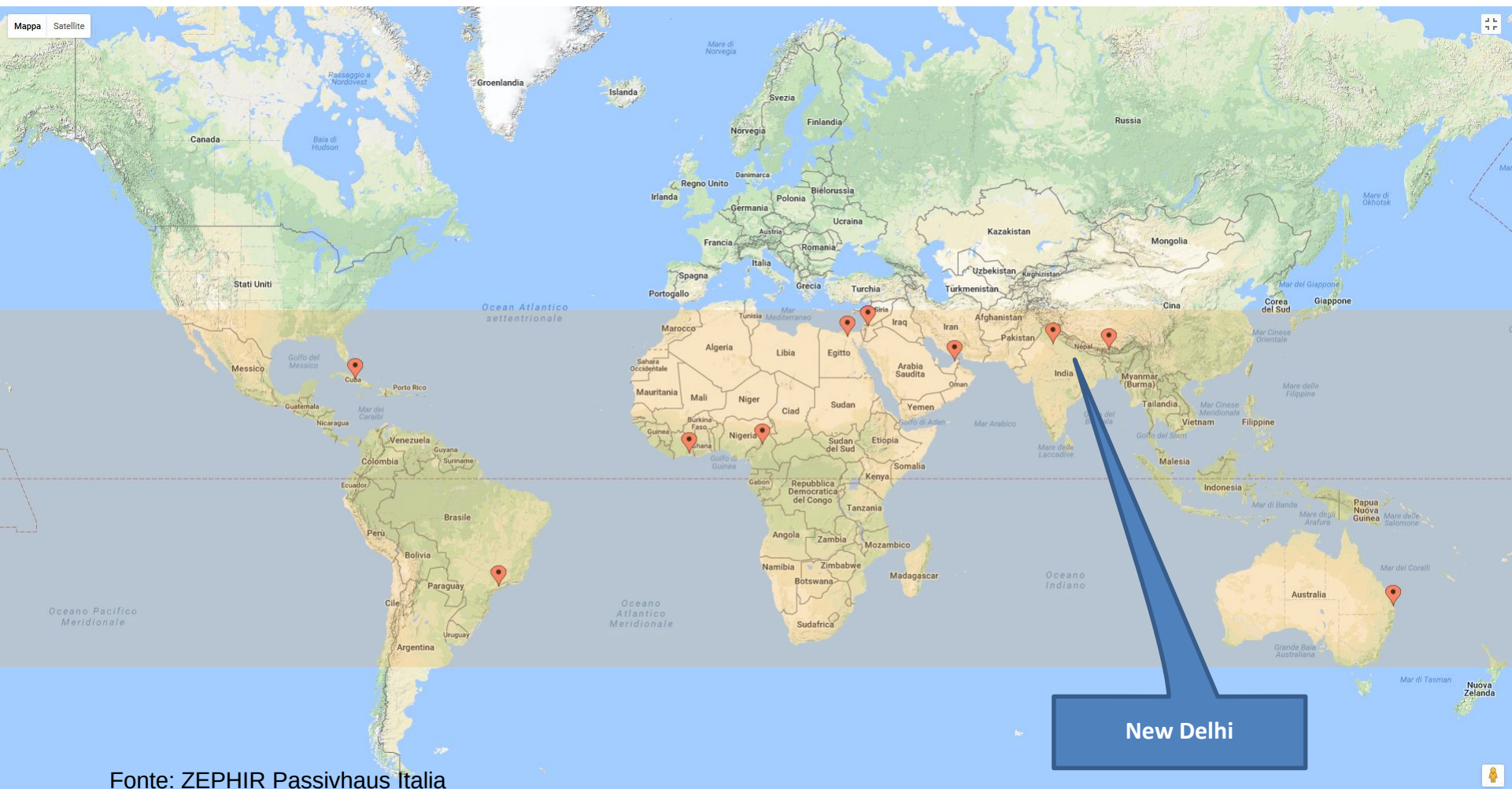


Boundary conditions: $\theta_e = 26^\circ\text{C}$, RH = 82% -- $\theta_i = 26^\circ\text{C}$, RH = 50%,
5 cm EPS $\lambda = 0.035$ W/mK, 20 cm concrete $\lambda = 2.1$ W/mK

Source: Styrostone.in

Passivhaus in tropical and sub-tropical climates

www.passivhausitalia.com



Fonte: ZEPHIR Passivhaus Italia

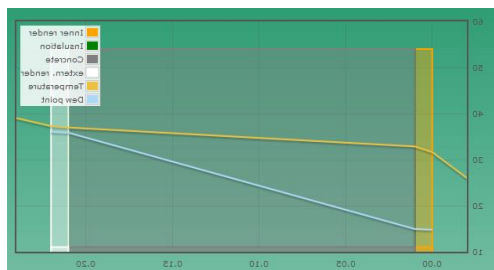
Interior vs. Exterior Insulation

www.passivhausitalia.com

Example: New Delhi

Temperature profiles

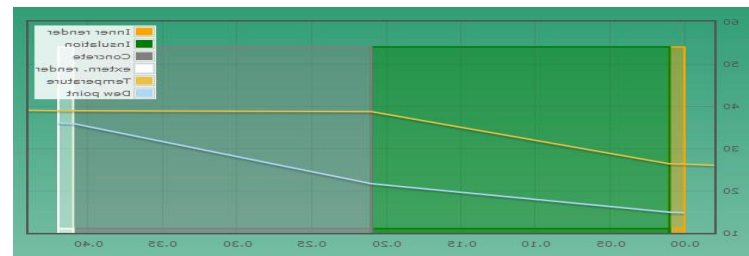
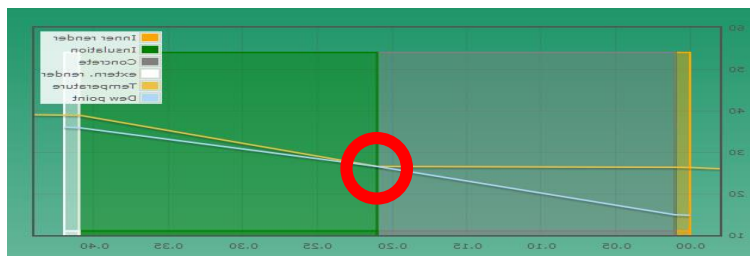
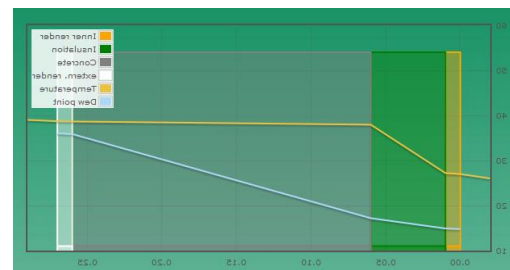
Existing wall



Exterior insulation



Interior insulation



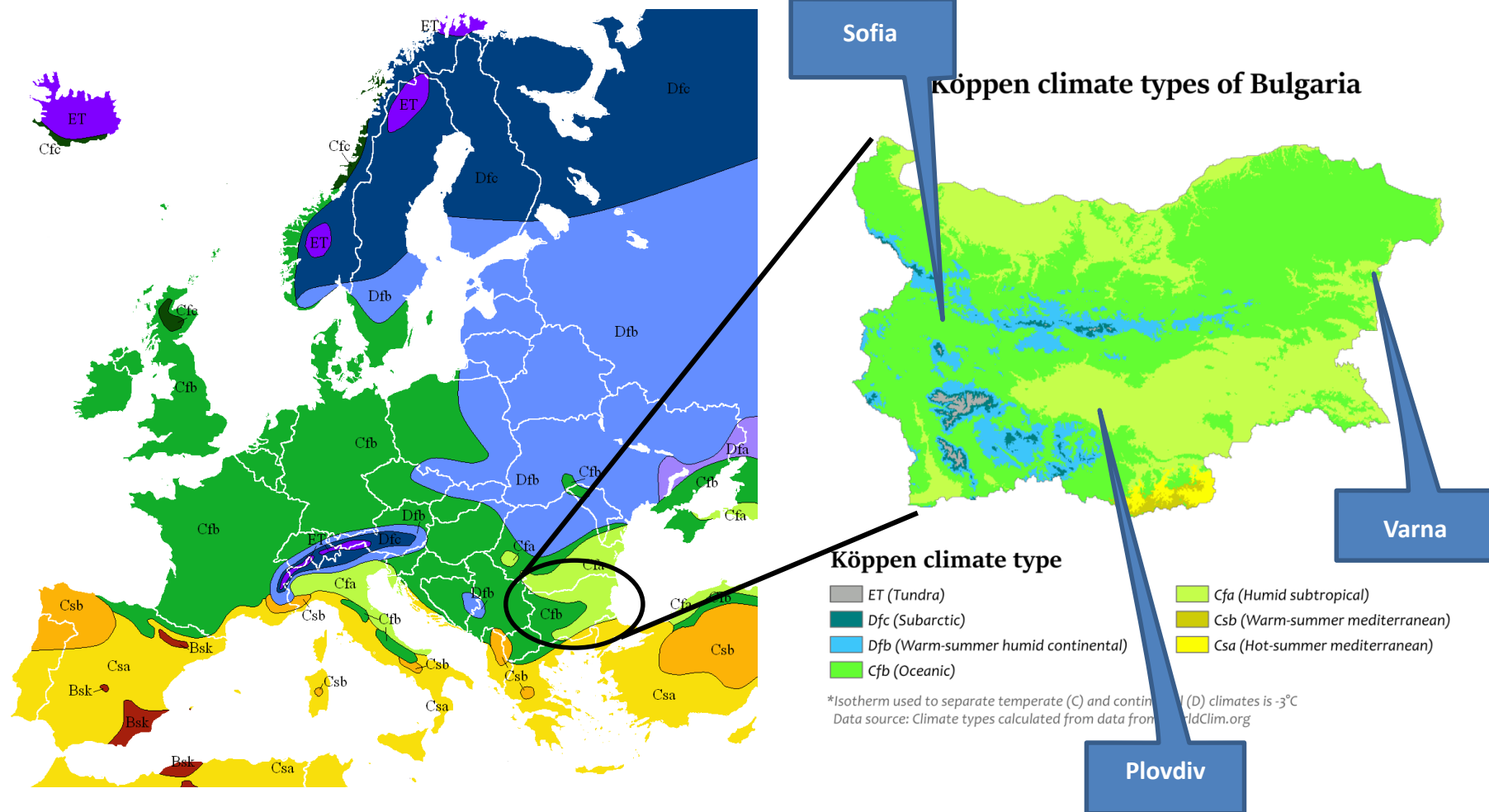
Boundary conditions: $\theta_e = 39\text{ }^{\circ}\text{C}$, RH = 85% -- $\theta_i = 26\text{ }^{\circ}\text{C}$, RH = 50%,
5/20 cm EPS $\lambda = 0.035\text{ W/mK}$, 20 cm concrete $\lambda = 2.1\text{ W/mK}$

Source: Styrostone.in

Interior vs. Exterior Insulation

www.passivhausitalia.com

Example: BULGARIA



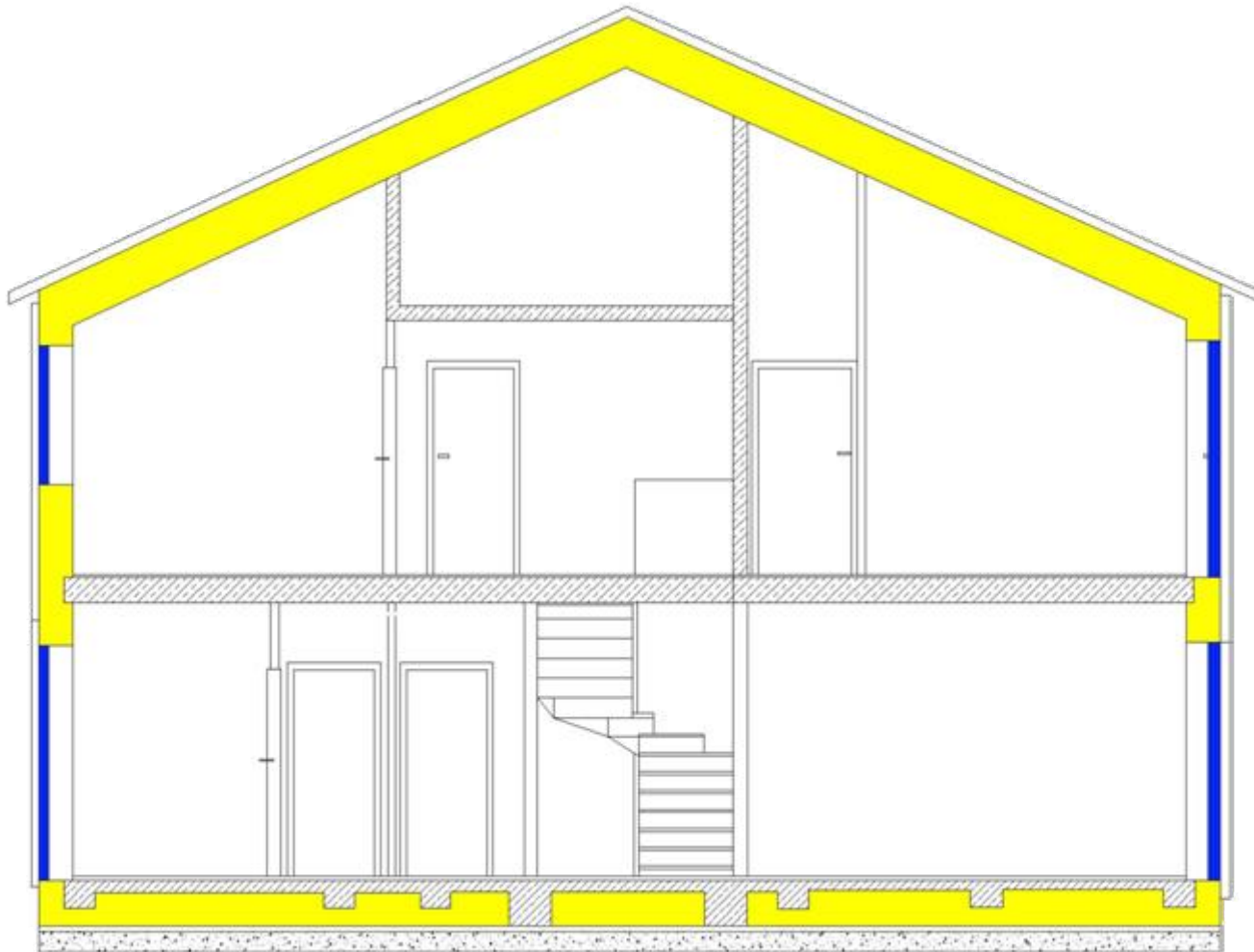
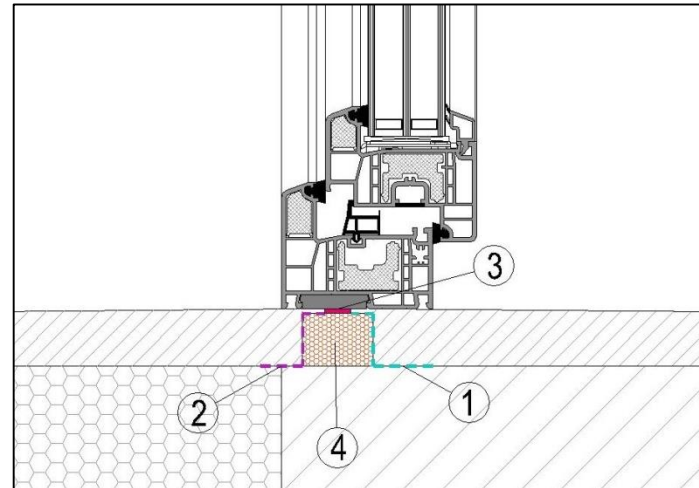


Illustration © PHI

Components

Shading

WINDOWS

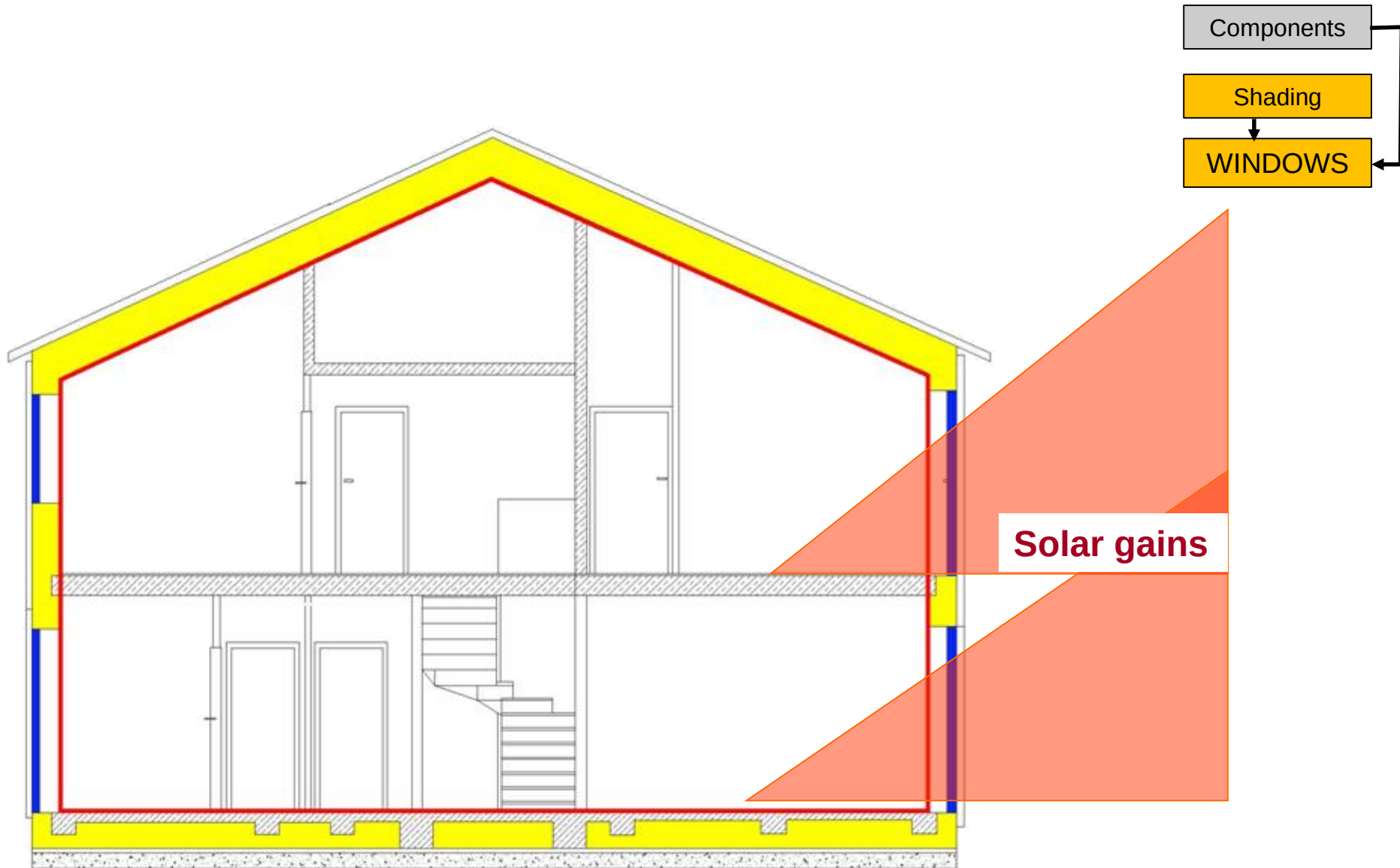


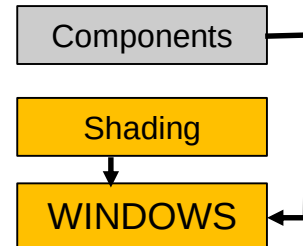
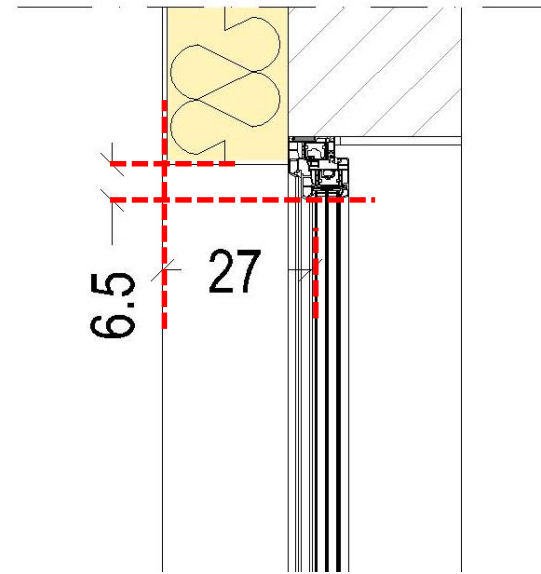
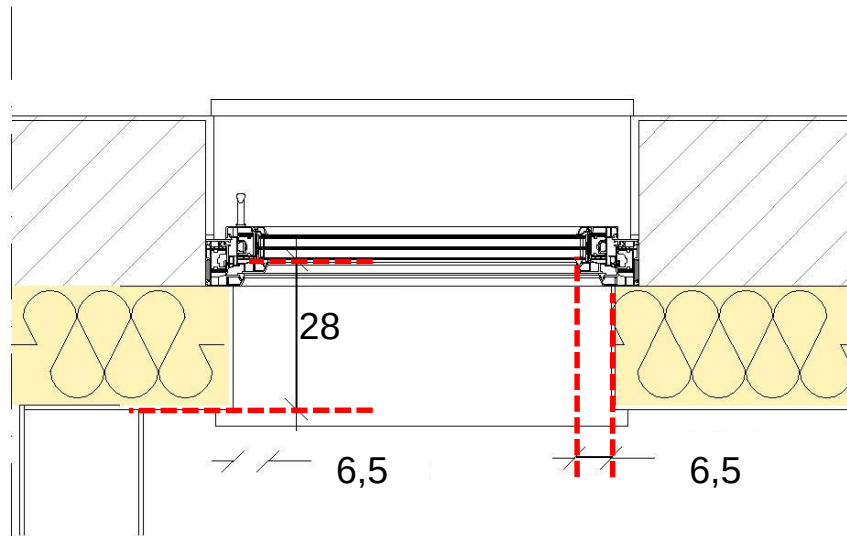
- ① Butyl tape 
- ② Butyl tape 
- ③ Self expanded tape 
- ④ Expanded polystyrene 

Installation thermal bridge

$\Psi_{\text{Installation left}}$	$\Psi_{\text{Installation right}}$	$\Psi_{\text{Installation bottom}}$	$\Psi_{\text{Installation top}}$
W/(mK)	W/(mK)	W/(mK)	W/(mK)
0,015	0,015	0,030	0,015
0,020	0,020	0,022	0,020
0,015	0,015	0,040	0,015

Source: Studio Carosso

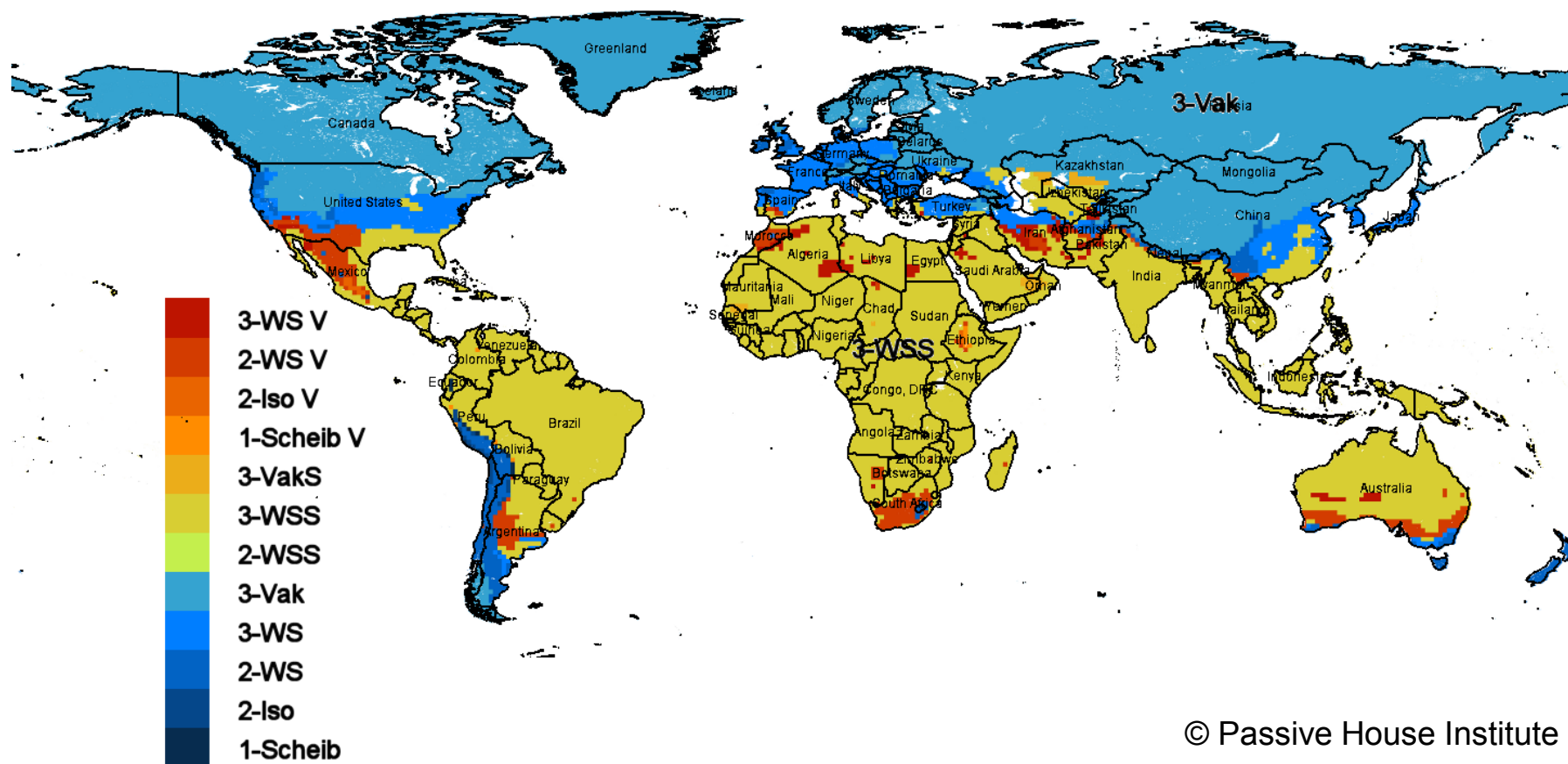




Lateral reveal		Reveal / Overhang		Total for heating case
Window reveal depth	Distance from glazing edge to reveal	Overhang depth	Distance from upper glazing edge to overhang	
o_{Reveal} [m]	d_{Reveal} [m]	o_{over} [m]	d_{over} [m]	r_s [%]
0,28	0,065	0,27	0,07	85%

Source: Studio Carosso

of cost-optimised houses



© Passive House Institute

mostly double/triple glazing

For very hot climates, a **selective glazing** is required!

OUTSIDE...

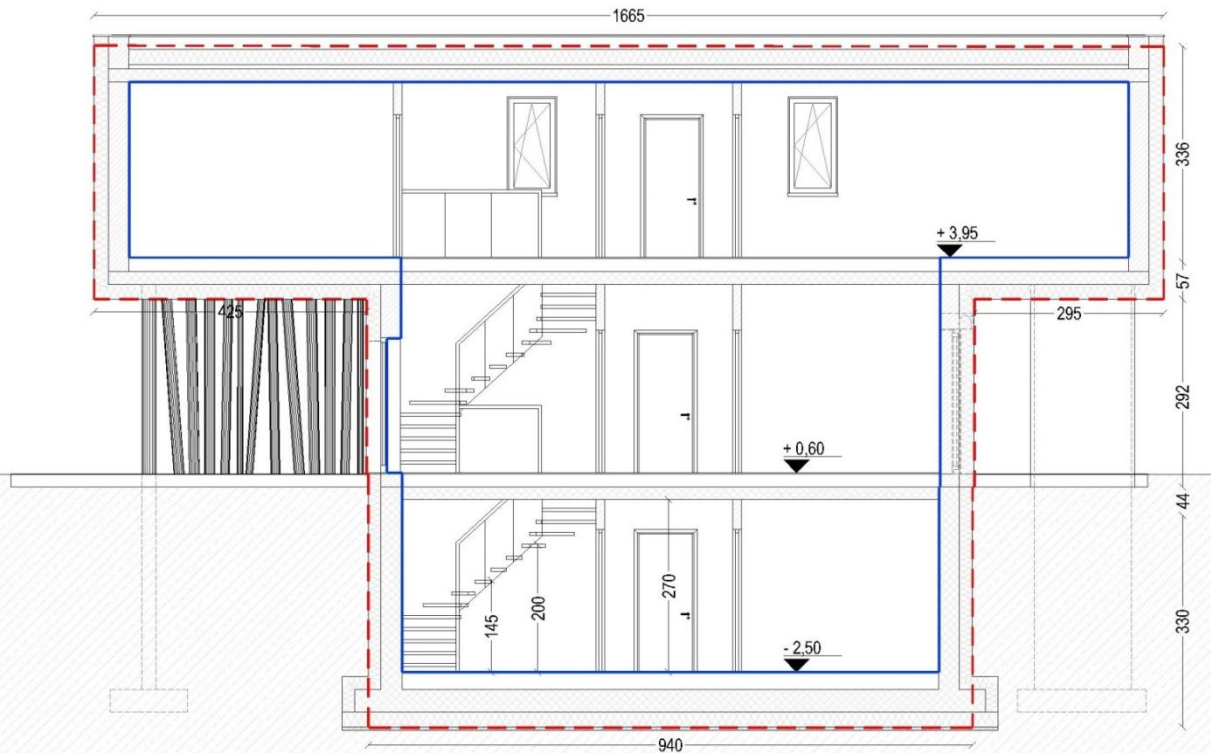


Illustration © ZEPHIR

...OR INSIDE!?



Illustration © PHI



- Thermal envelope
- Airtightness layer

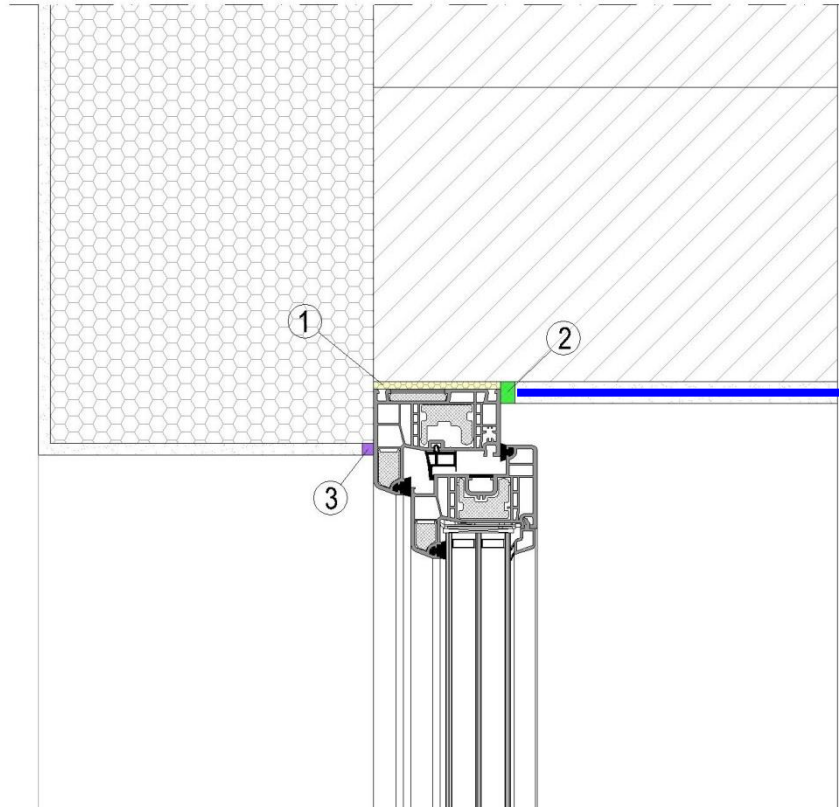
Airtightness layer with interior plaster.

Pay attention to the building service distribution!!!



Source: Studio Carosso

Window installation



- ① Polyurethane foam 
- ② Expanded metal plaster base 
- ③ Expanded metal plaster base 



Blowerdoor test



Prevents building damage
(condensation in the construction)

Energy savings

Increased standard of comfort: no
draughts

Fundamental for functioning of
ventilation system/heat recovery

Improved noise insulation

Testing airtightness in a building with a
pressure test

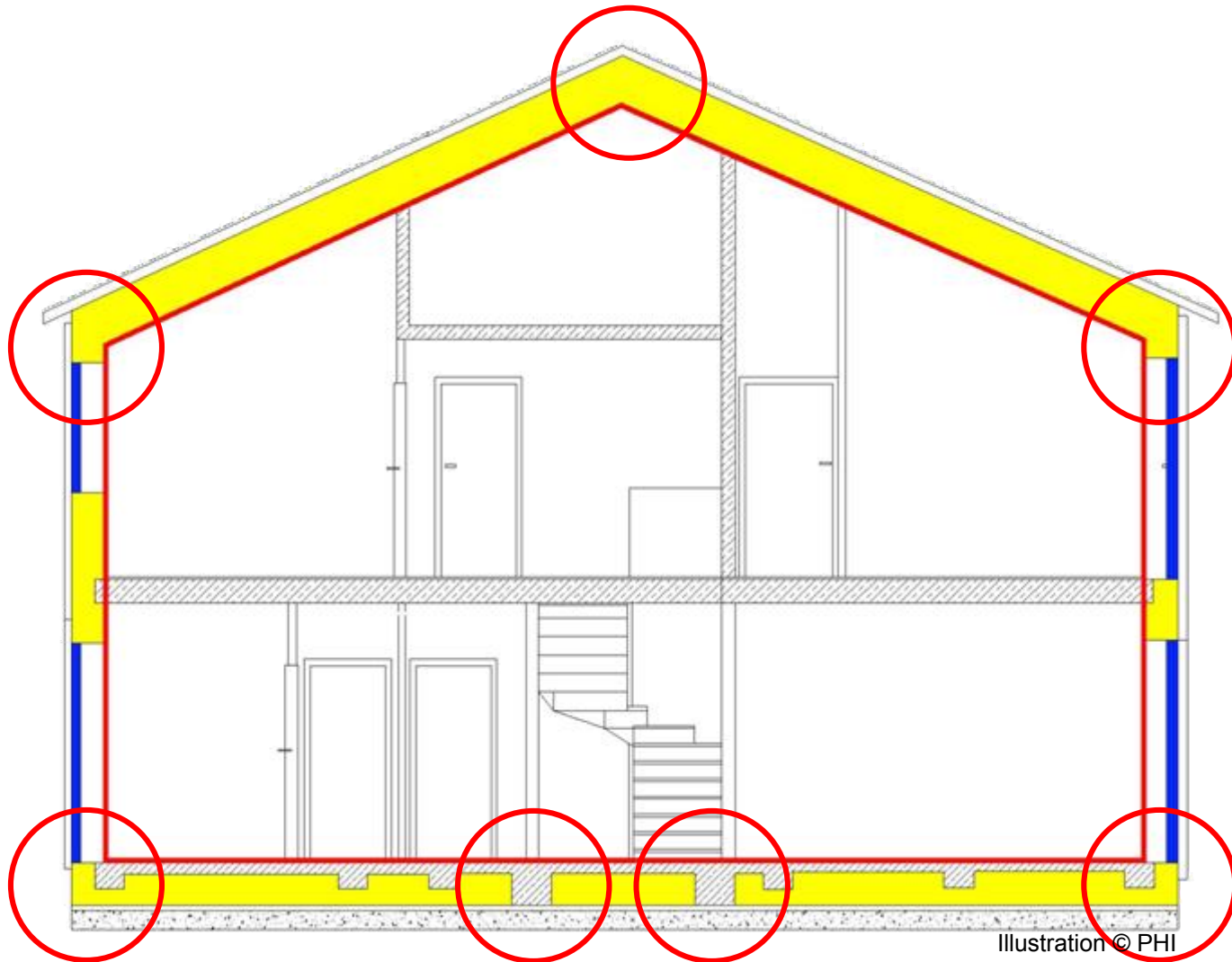
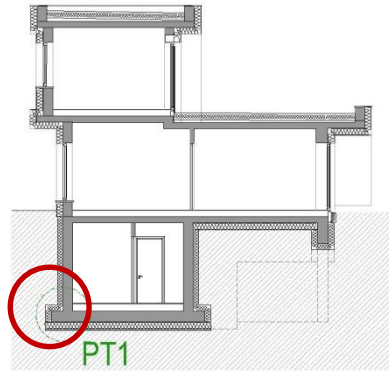


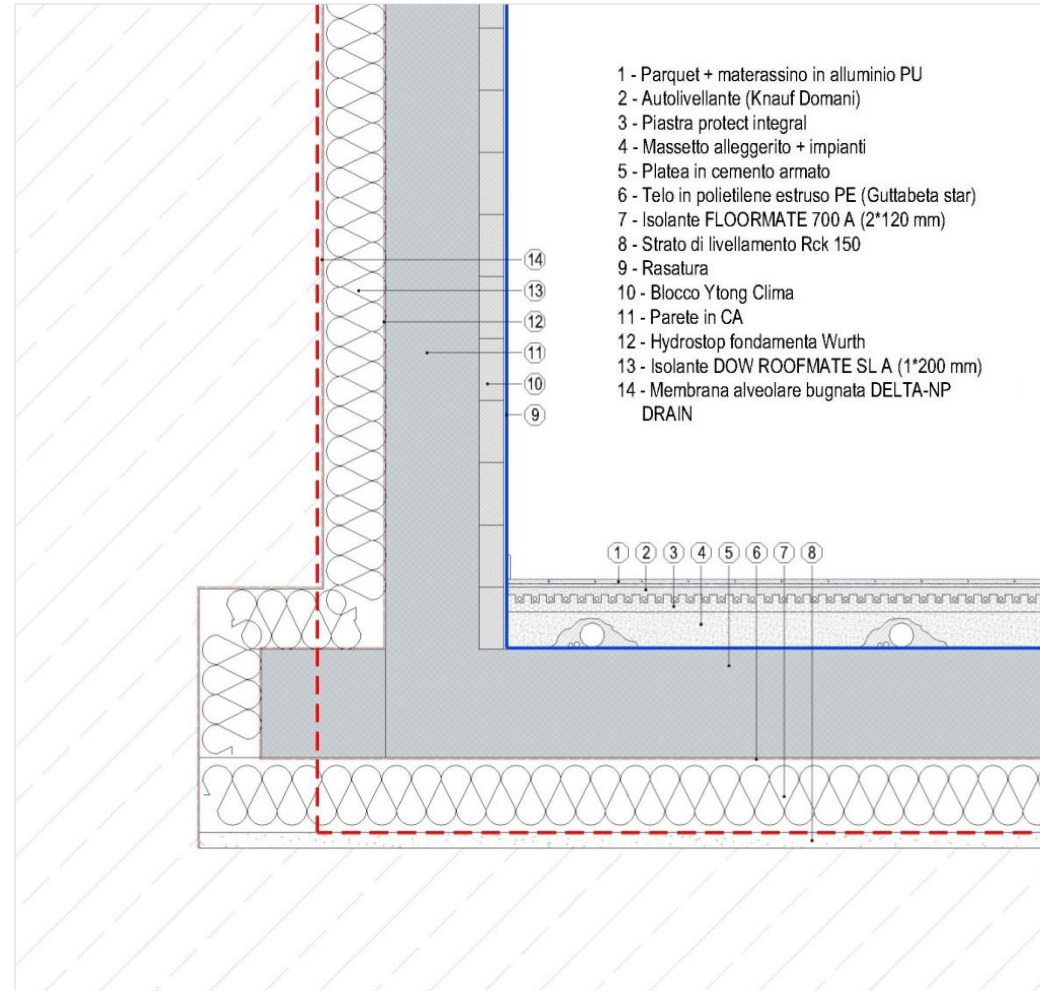
Illustration © PHI

THERMAL BRIDGES

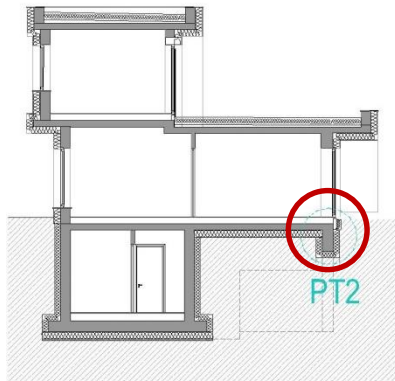


Thermal Bridge - Linear
PT1

--- Thermal envelope
— Airtightness layer

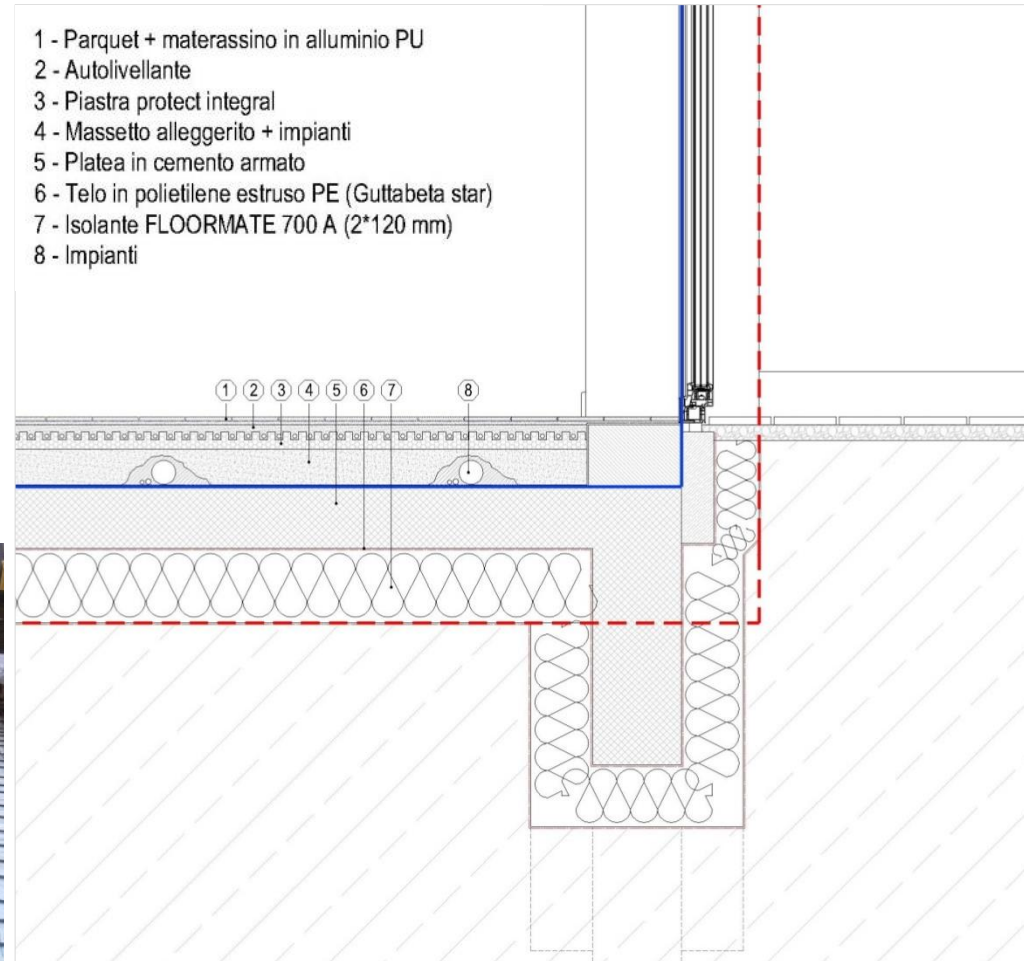


THERMAL BRIDGES



Thermal Bridge - Linear
PT2

--- Thermal envelope
— Airtightness layer

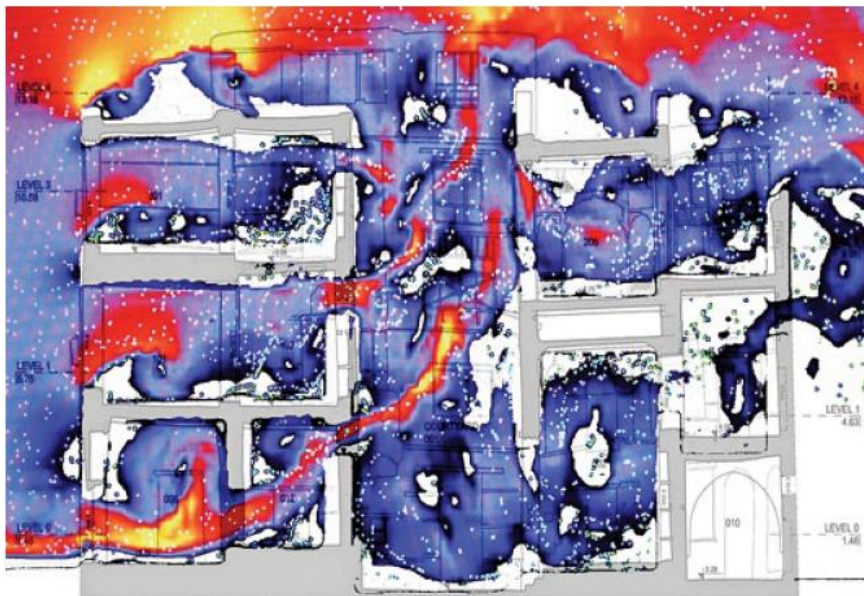


Source: Studio Carosso

Passivhaus pillars

Author: ZEPHİR – Passivhaus ITALIA

Natural ventilation: Jeddah, SA



Temperatures up to 40 °C
Humidity ratio up to 25 g/kg

Photos/Diagram:
C. Jäger-Klein et al.
Bauphysik, 2015





Watch out:
Mechanical night ventilation
requires $\Delta T > 5 \text{ K}$ to be better
than active cooling ($\text{COP} = 5$)

Savings potential: up to 10 kWh/(m²a)

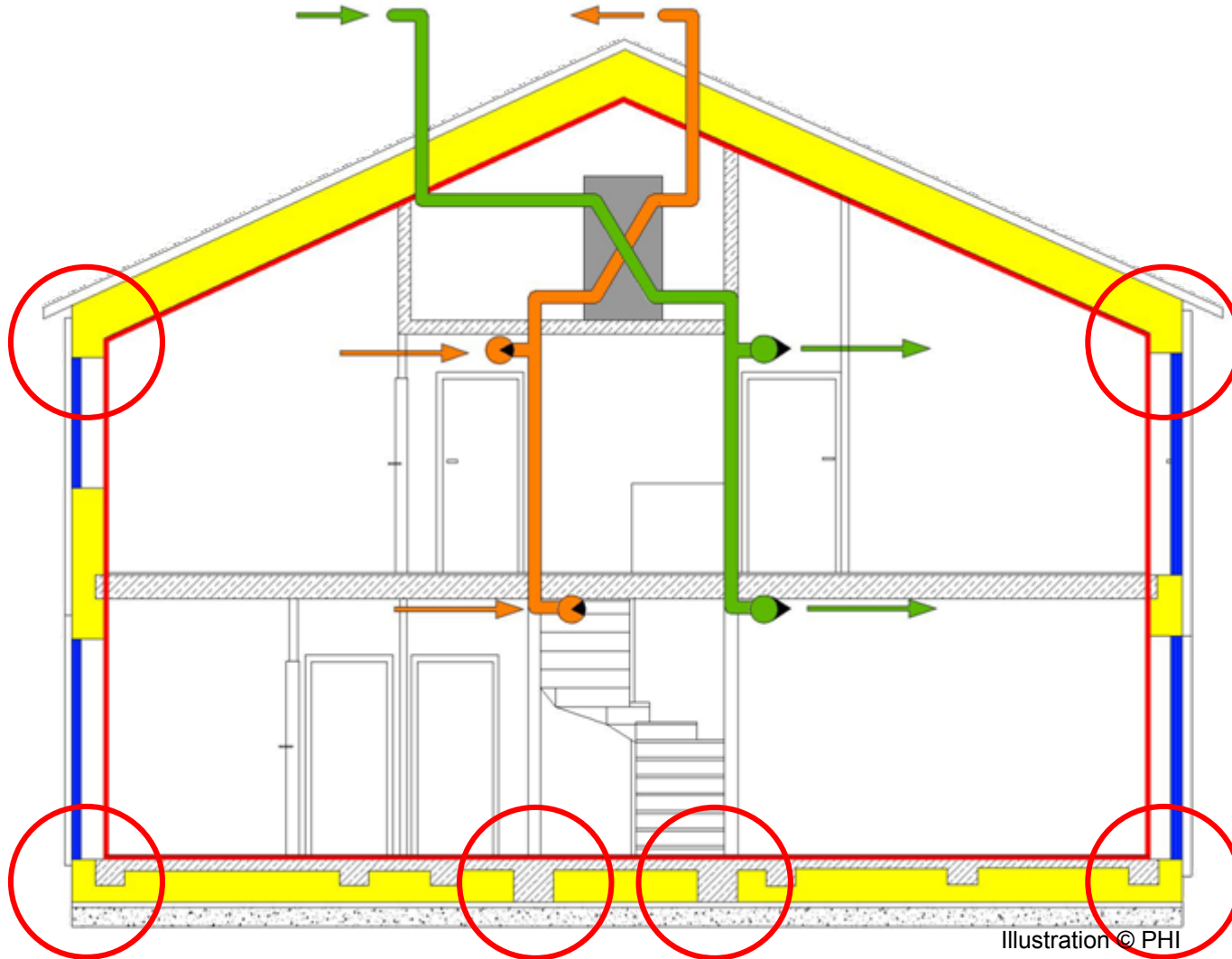
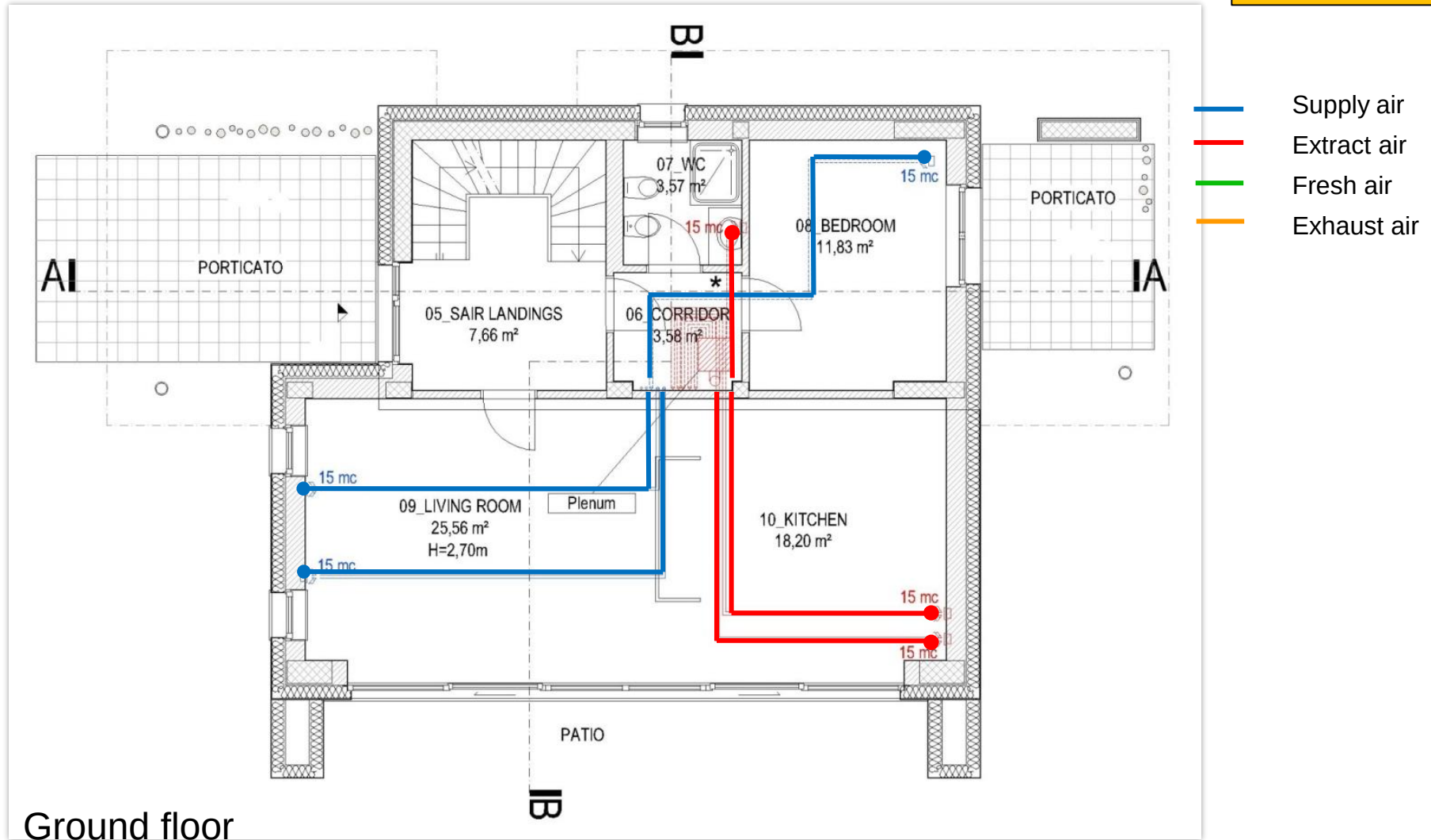


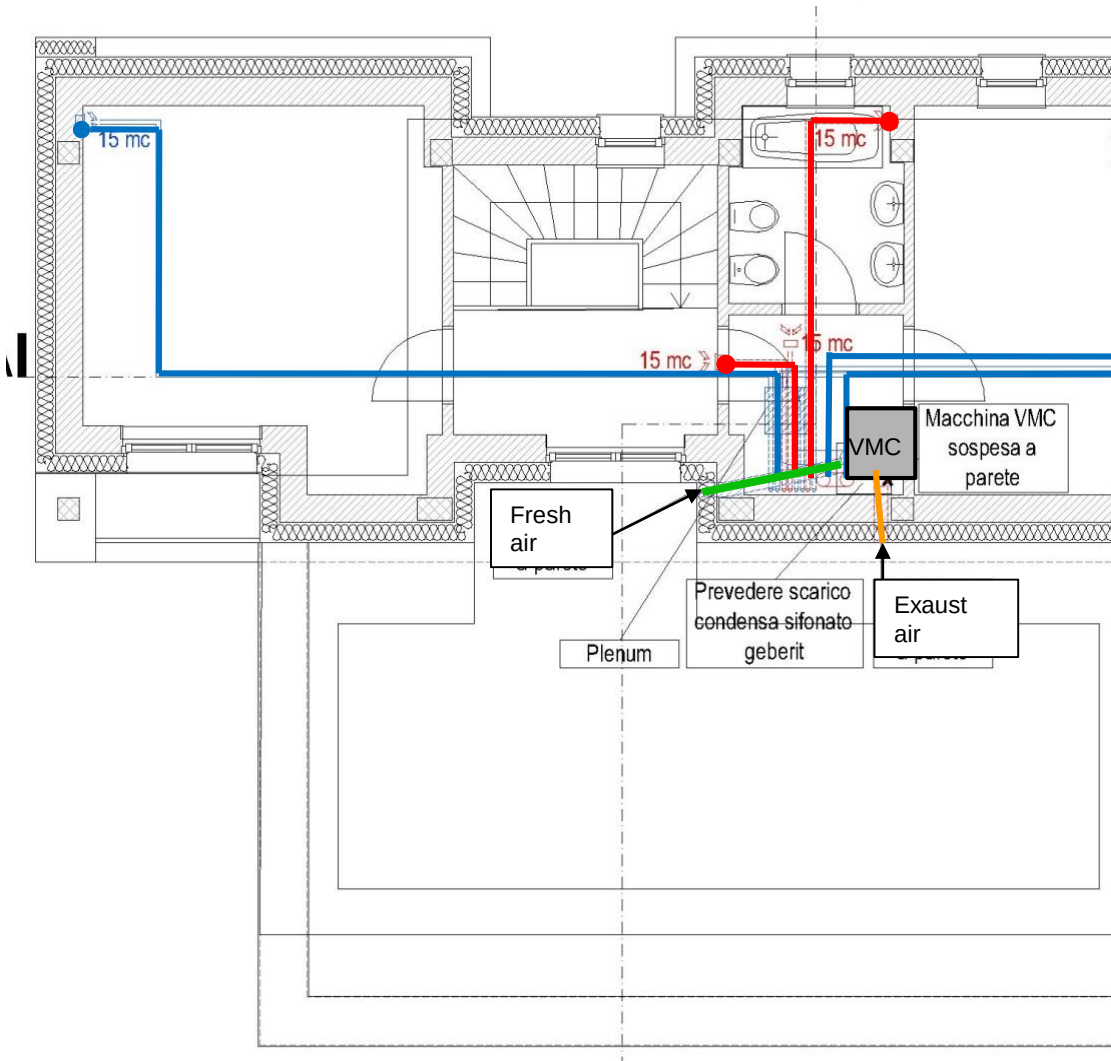
Illustration © PHI

VENTILATION

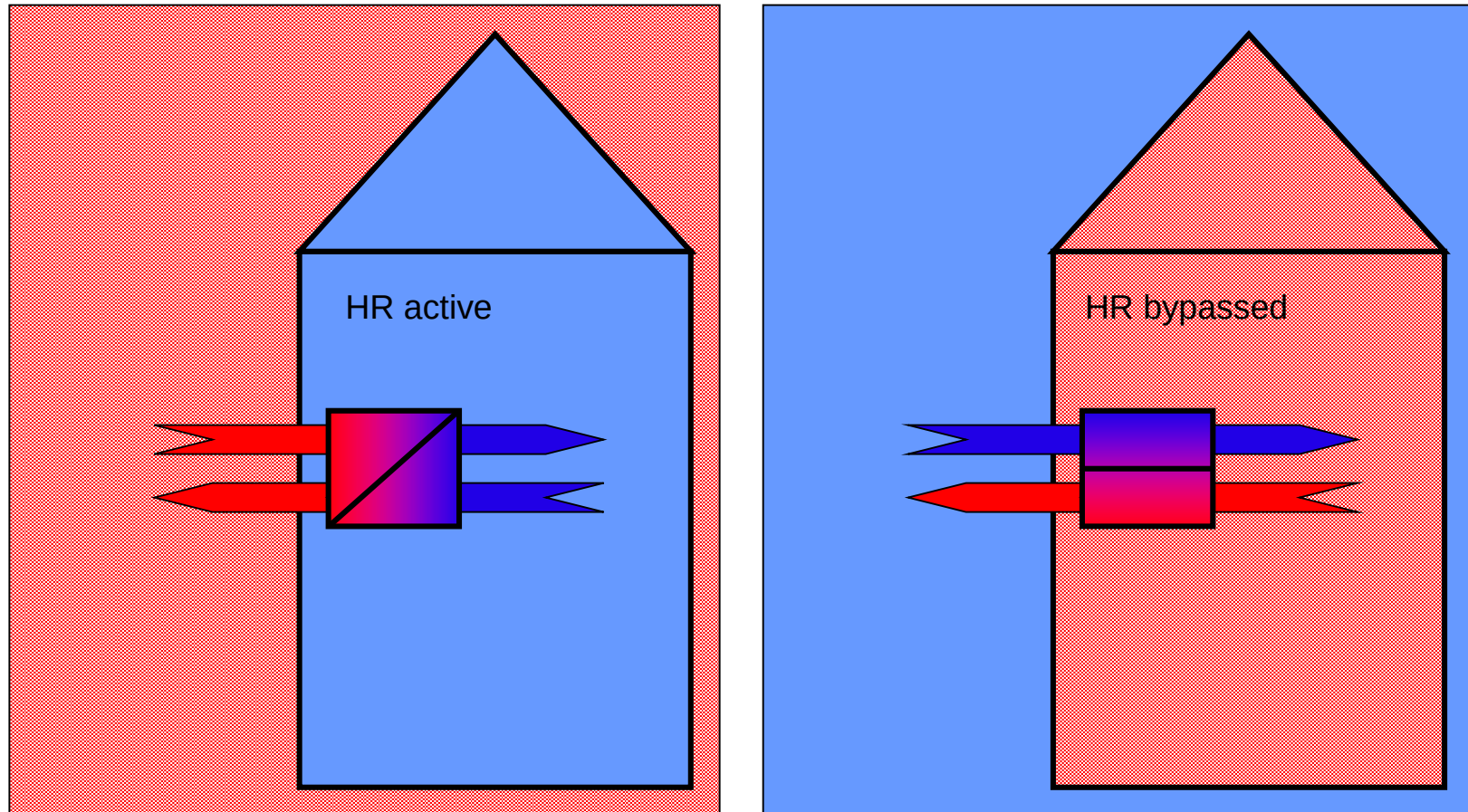


Ground floor

VENTILATION



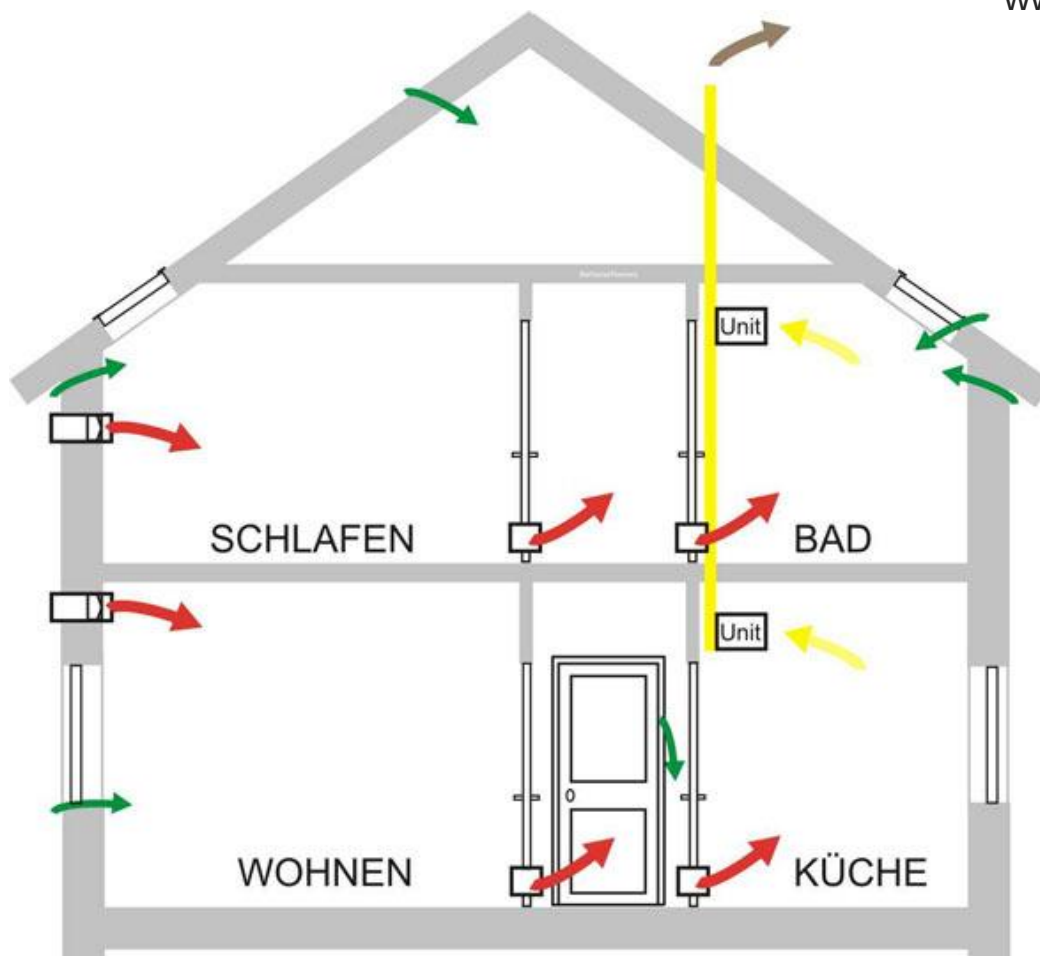
Passive Cooling: HRV bypass



Savings potential: up to 5 kWh/(m²a)

...and in warm climate: pure **EXTRACTION** vent. system

www.passivhausitalia.com

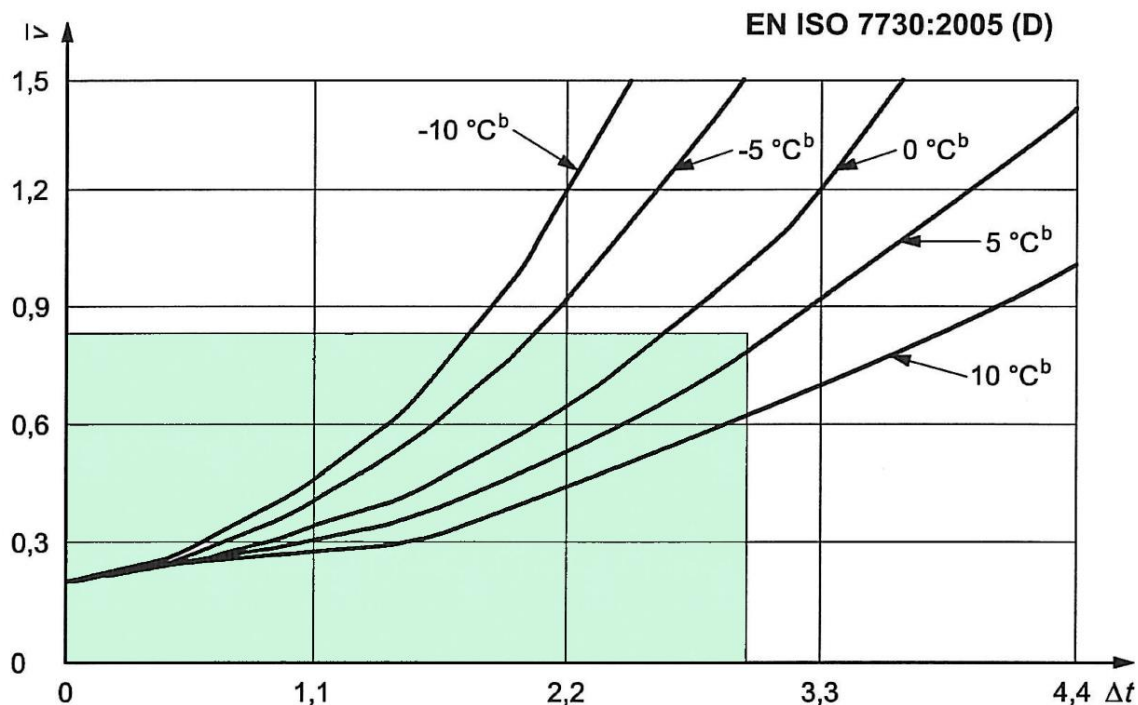


Fonte: <http://www.heizungsfinder.de/heizung/wohnraumlueftung/abluftanlage>

Passive Cooling: Ceiling fans



- increase comfort temperature by up to 3 K
- big differences between individual preferred air speed
- individual control required



Savings potential: up to 10 kWh/(m²a), but **questionable**

In any case: Solar control

Overhangs, exterior movable shading,
solar protective glazing,
cool colours



Photo: © PHI

www.passivhausprojekte.de, ID: 4439
Harley Truong / Andrew Verri, Canberra, Australia

Savings potential up to 30 kWh/(m²a)

Perforation for
some transparency



Light may be reflected
to ceiling

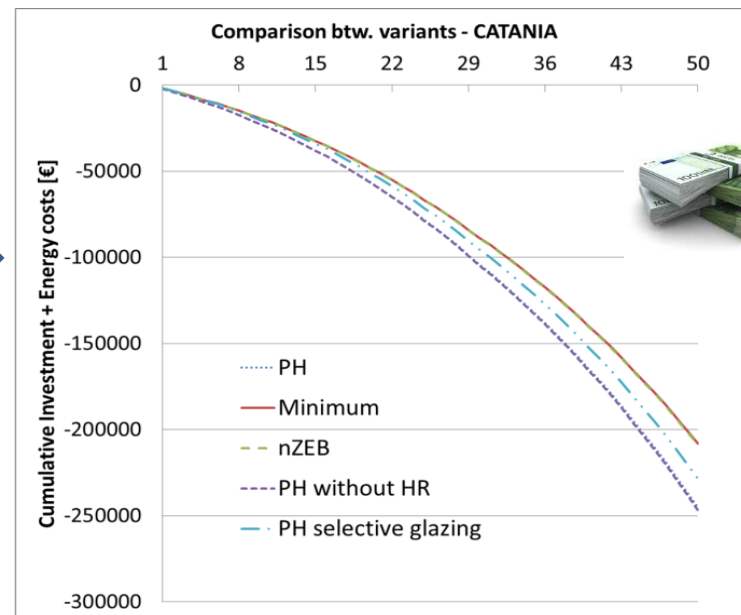
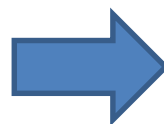


Source: © Fa. Flexalum

"How much": cost-optimum?



PHPP



Economic convenience of Passivhaus standard in energy retrofits in Mediterranean climate



Francesco NESI¹, Ileana IANNONE², Matteo TSELIFIS³

¹ ZEPHIR Passivhaus Italia, loc. Fratte, 18/3 – 38057 Pergine Valsugana (TN), f.nesi@zephir.ph

² ZEPHIR Passivhaus Italia, loc. Fratte, 18/3 – 38057 Pergine Valsugana (TN), i.iannone@zephir.ph

³ ZEPHIR Passivhaus Italia, loc. Fratte, 18/3 – 38057 Pergine Valsugana (TN), m.tselifis@zephir.ph



The worksheet VARIANTS in the PHPP9

Column for 'Comparison' worksheet ►

Additional variants ►

Variant calculation

Passive House with PHPP Version 9.6a

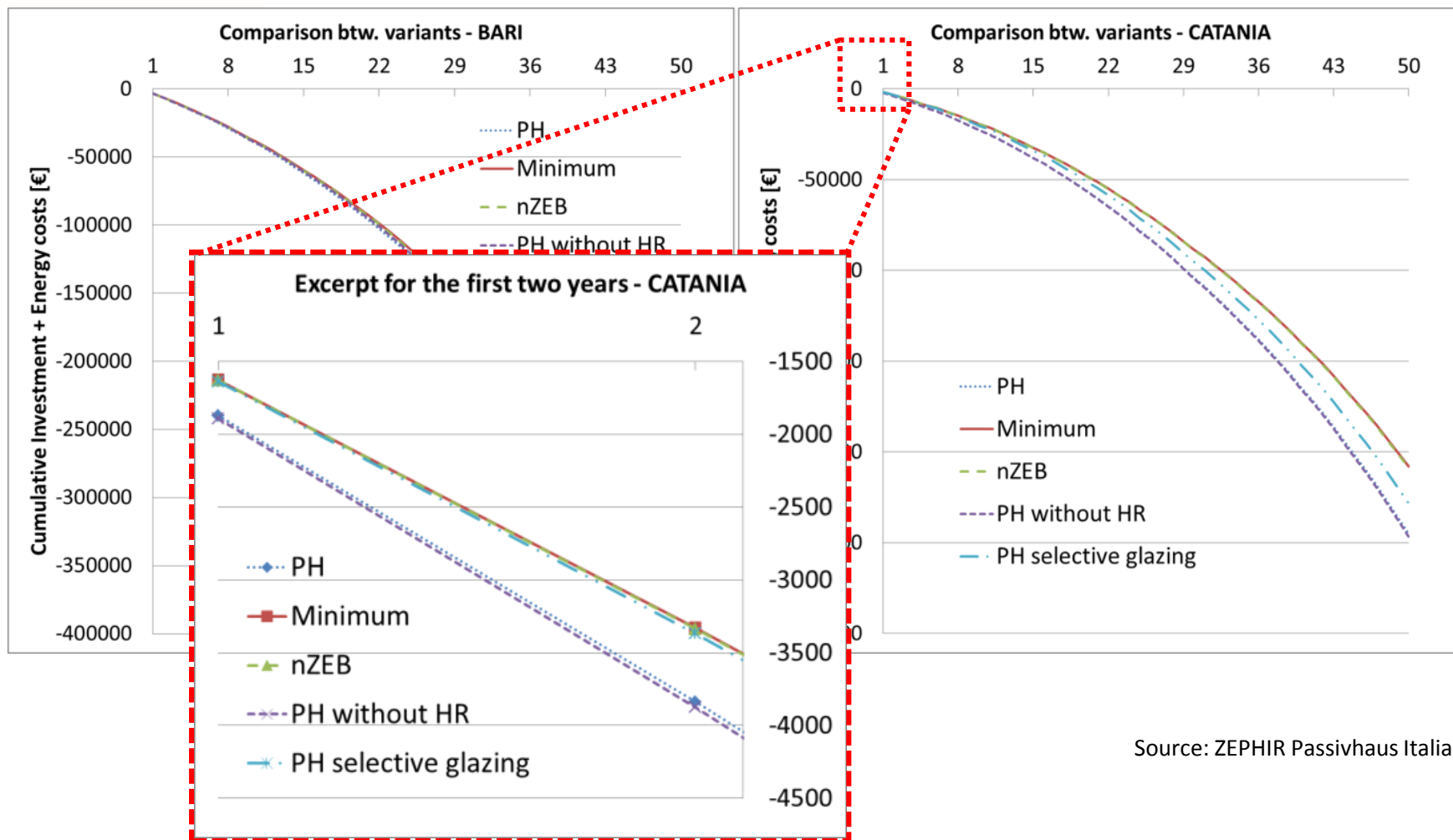
/ Climate: Catania / TFA: 338 m² / Heating: 162.6 kWh/(m²a) / Cooling: 33.2 kWh/(m²a) / PER: 391.5 kWh/(m²a)

 Select the active variant here >>>>>>		Active						
		3-Existing	PH	Minimum italian standard regulation	Existing	PH without HRV	nZEB	PH - selective glazing
Results	Units	3	1	2	3	4	6	7
Heating demand	kWh/(m ² a)	162.6	6.8	21.0	162.6	7.8	19.9	14.7
Heating load	W/m ²	86.7	11.2	20.4	86.7	10.9	20.0	11.3
Cooling & dehum. demand	kWh/(m ² a)	33.2	14.2	16.5	33.2	14.0	16.5	11.2
Cooling load	W/m ²	37.2	8.9	12.3	37.2	9.1	12.2	7.6
Frequency of overheating (> 25 °C)	%							
PER demand	kWh/(m ² a)	391.5	41.0	49.8	391.5	41.4	49.5	42.5
Passive House Classic?	yes / no	no	yes	no	no	yes	no	yes
Variants Comparison Economica Climate U-Values Areas Ground Components Windows Shading Ventilation Additional Vent Annual heating Heating Heating Load SummVent Summer Cooling								

Fonte: © ZEPHIR

Price reference: pricelist of the Engineers' Chamber, Editor: DEI (DEI Tipografia del Genio Civile, 2017)

Our cash-flow analysis on PHPP9



Source: ZEPHIR Passivhaus Italia

PASSIVHAUS is the most economically
convenient solution!

modern, sustainable and easy

...even in tropical and subtropical climates!

6^A CONFERENZA NAZIONALE PASSIVHAUS



**1st - 5th National
Passivhaus Conferences**
4000 people

**NEXT CONFERENCE:
November 2018**
You're invited!



Be the change you want to see in the world
Mahatma Gandhi

Thank you for your attention!



Foto © PHI

ZEPHIR – PASSIVHAUS ITALIA
Zero Energy and Passivhaus Institute for Research



Dr. Phys. Francesco Nesi
Mobile: +39 346 6247437
Email: f.nesi@zephir.ph

