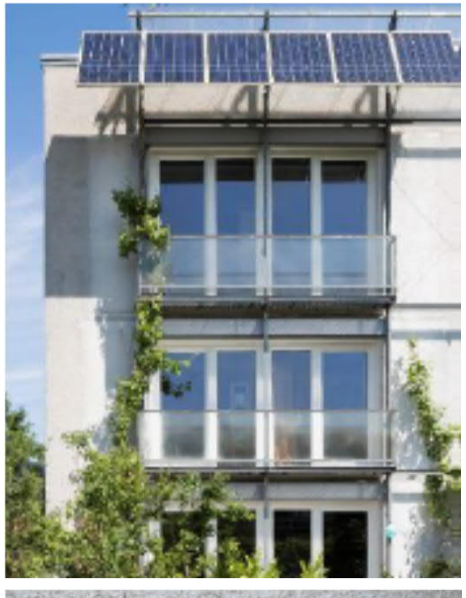
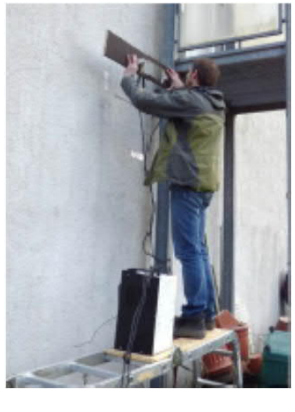
Workshop 'Prefabrication, deep retrofits and the municipal perspective'
by Climate Alliance in the framework of outPHit

Passive House an ideal basis for energy efficient building design …. new built and renovation (EnerPHit)





Dr. Berthold Kaufmann
Passive House Institute

2021-07-08

Passive House Building design in a nutshell……

Contents and Summary

what is essential for Energy Efficient Passive House buildings!

- thermal insulation layer (thick enough!) is absolutely needed
- thermal bridge optimized design, air-tightness and good windows
- fresh-air-ventilation system with heat recovery
- low power heating (AC) system including hot water preparation

everything is economically reasonable for new built and reftrofit

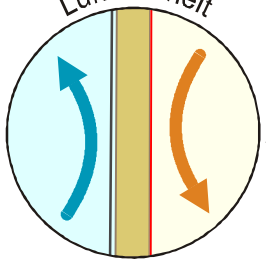
EnerPHit retrofit plan for stepwise retrofits

- Quality control has to be done during realization:
- … training of tradesperson is crucial!
- … provide mockup-installation for on-site-learning!
- Routine helps for Quality!…. repeat again, what you have learned once!

The five main features of PH buildings!
被动房五要素

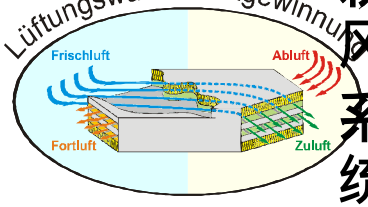
air-tightness

气密性



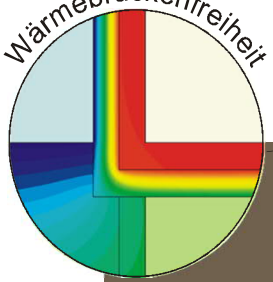
ventilation with heat recovery

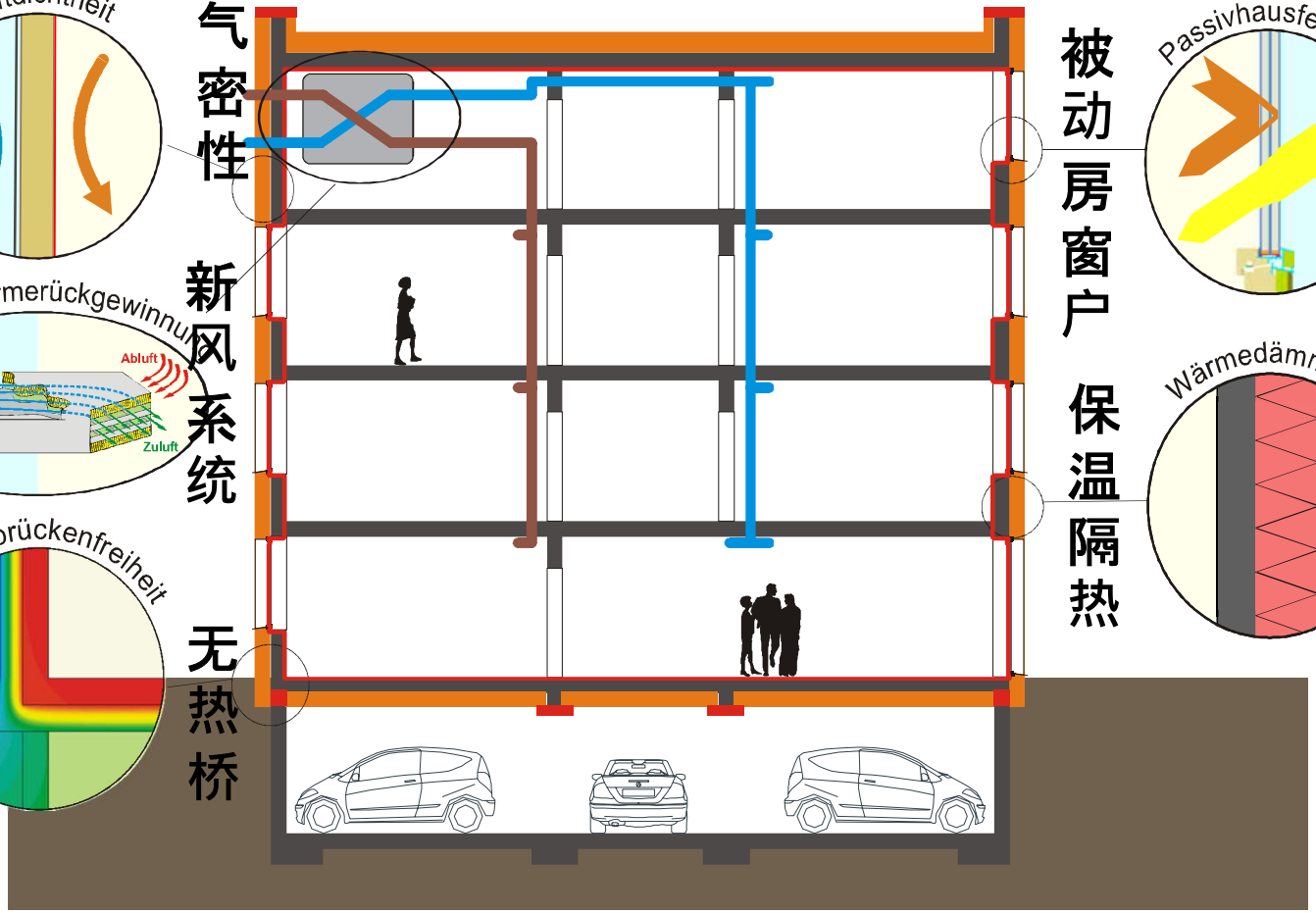
新风系统



no thermal bridging

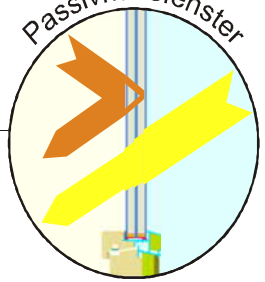
无热桥





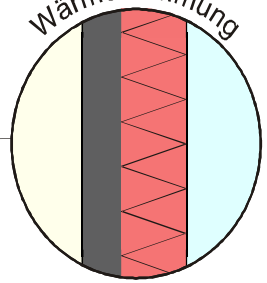
good windows

被动房窗户



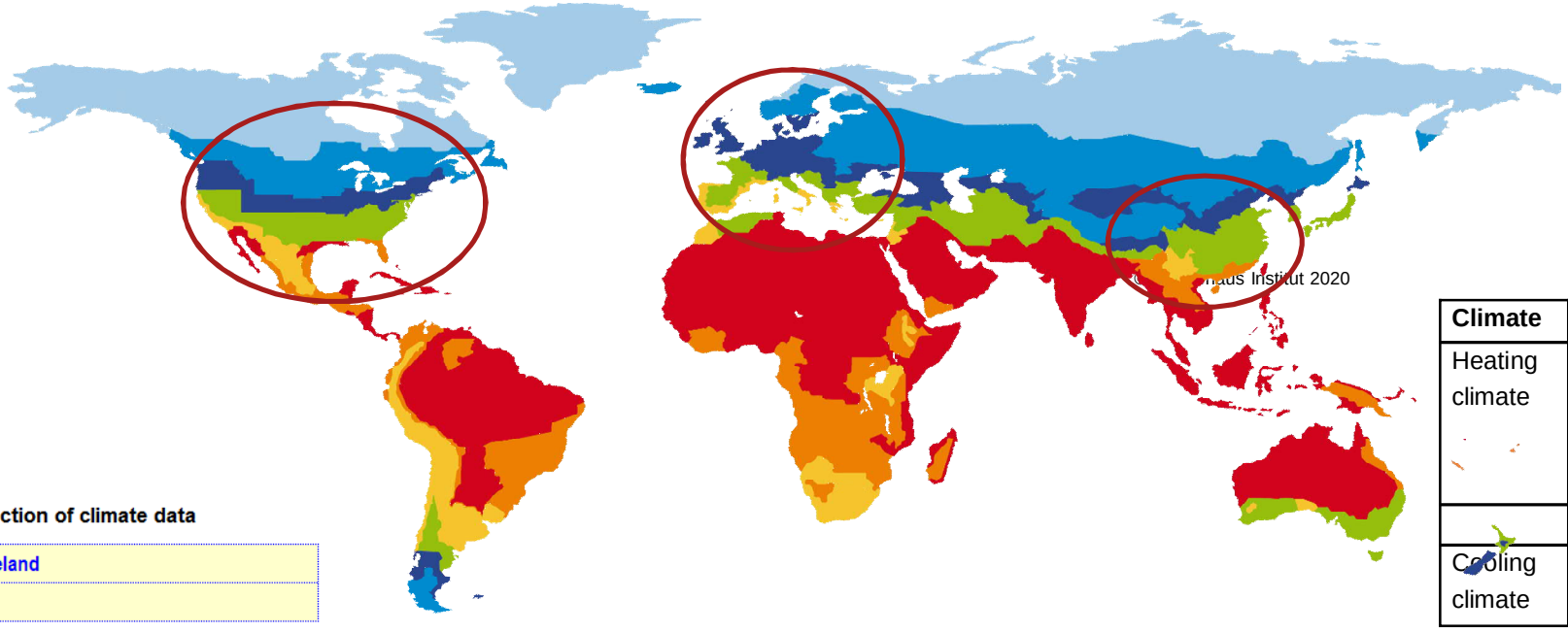
thermal insulation layer

保温隔热



Check with PHPP for all international climate zones

- Cooling load and dehumidification (latent cooling) is crucial in Climate Zone 4…7
- detailed check with PHPP should be done for each individual building



Selection of climate data

Country: IE-Ireland

Region: All

1-Alphabetic sorting

Climate data set: IE0001a-Dublin

Climate zone: 3: Cool-temperate

Climate	No	Region
Heating climate	1	Arctic
	2	Cold
	3	Cool-temperate
	4	Warm-temperate
	5	Warm
Cooling climate	6	Hot
	7	Very hot

Global EnerPHit Standard – use the same for retrofit

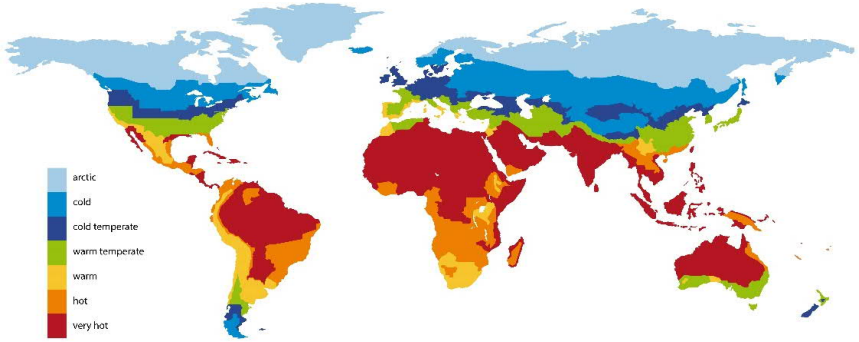
EnerPHit
Certified Retrofit
Passive House Institute
| classic | plus | premium |

EnerPHit Standard

- Guideline and incentive for an optimal efficiency standard for retrofits
- Certification as quality assurance for building owners

Energy Retrofit with Passive House Components

Global EnerPHit Criteria



the building component method for retrofit:

Climate zone according to PHPP	Opaque envelope[1] against...				Windows (including exterior doors)					Ventilation	
	...ground	...ambient air			Overall[4]			Glazing[5]	Solar load[6]		
	Insu-lation	Exterior insulation	Interior in-sulation[2]	Exterior paint[3]	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat reco-very rate[7]	Min. hu-midity re-covery rate[8]
	Max. heat transfer coefficient (U-value)			Cool colours							
	[W/(m²K)]			-	[W/(m²K)]			-	[kWh/m²a]	%	
Arctic	Deter-mined in PHPP from project specific heating and cooling degree days against ground.	0.09	0.25	-	0.45	0.50	0.60	U_g - g*0.7 ≤ 0	100	80%	-
Cold		0.12	0.30	-	0.65	0.70	0.80	U_g - g*1.0 ≤ 0		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	U_g - g*1.6 ≤ 0		75%	-
Warm-temperate		0.30	0.50	-	1.05	1.10	1.20	U_g - g*2.8 ≤ -1		75%	-
Warm		0.50	0.75	-	1.25	1.30	1.40	-		-	-
Hot		0.50	0.75	Yes	1.25	1.30	1.40	-		-	60 % (humid climate)
Very hot		0.25	0.45	Yes	1.05	1.10	1.20	-		-	60 % (humid climate)

or alternatively,
energy demand method:

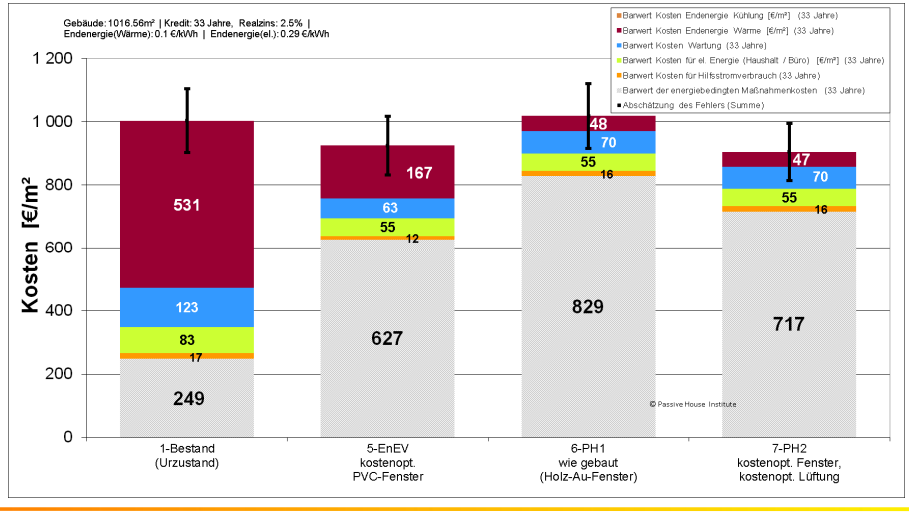
Climate zone according to PHPP	Heating	Cooling
	Max. heating demand	Max. cooling + dehumidification demand
	[kWh/(m²a)]	[kWh/(m²a)]
Arctic	35	equal to Passive House requirement
Cold	30	
Cool-temperate	25	
Warm-temperate	20	
Warm	15	
Hot	-	
Very hot	-	

© PHI

Everything is economically reasonable: School building

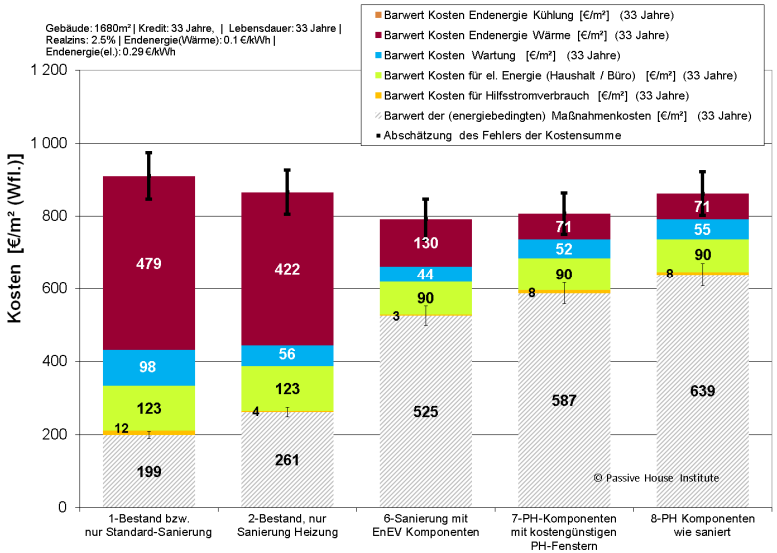
- School building Baesweiler, retrofit 2012
- Total lifecycle costs are crucial!
- Investment to Energy Efficiency reduces operational costs!

Source: Annex61 EDLIG (2018) Evaluierung und Optimierung der Wirtschaftlichkeit von integralen Gebäudesanierungen



Everything is economically reasonable: Office building

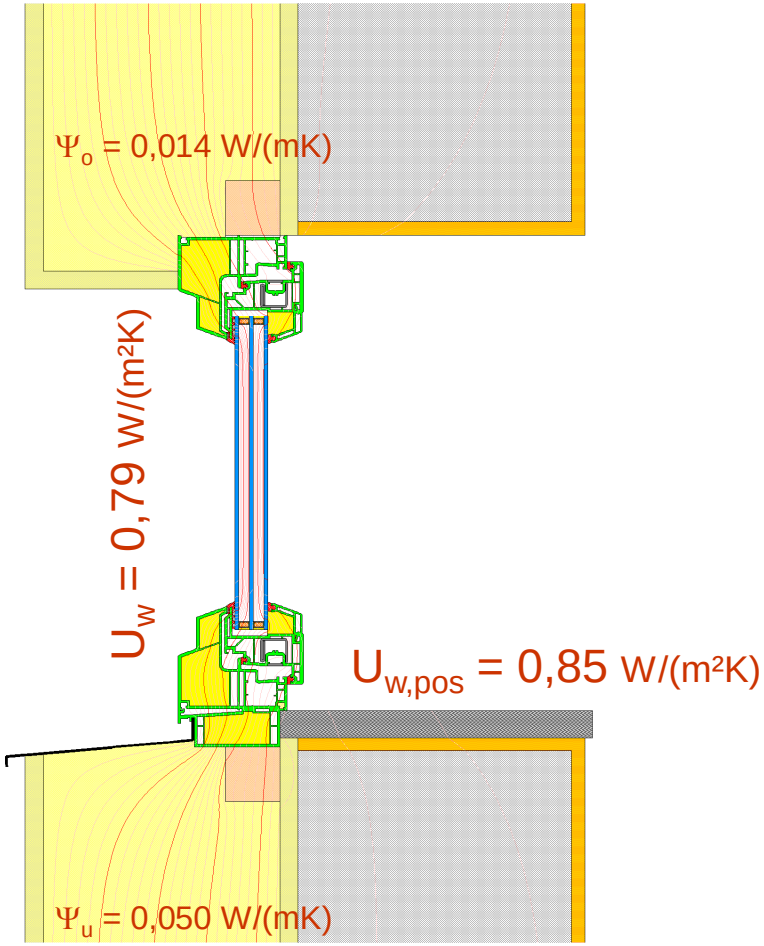
- Institut Wohnen Umwelt (IWU) Darmstadt
- Office building (1960) Retrofit in 2012
- Located at busy main city street
  (Noise reduction is crucial!)

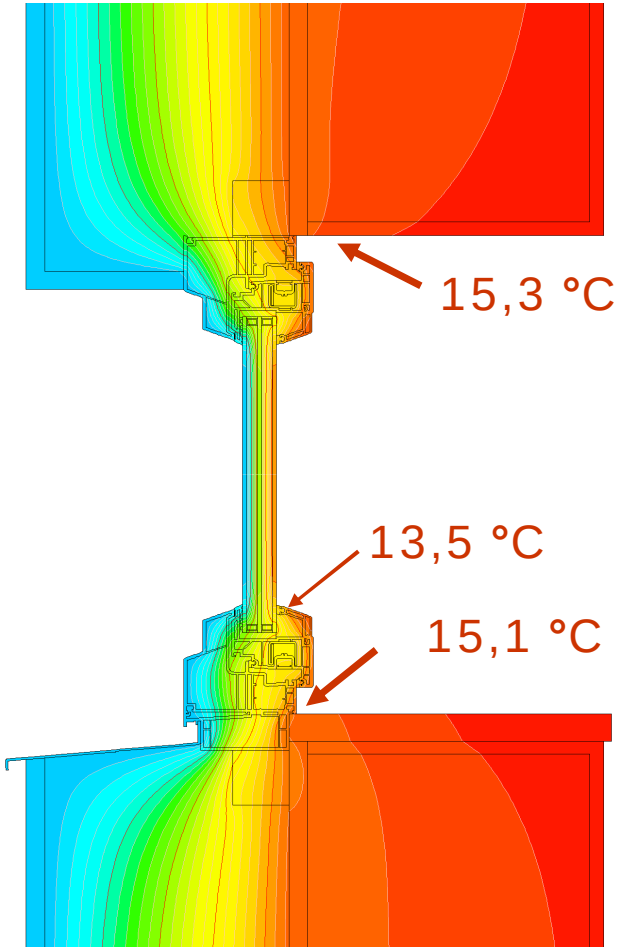


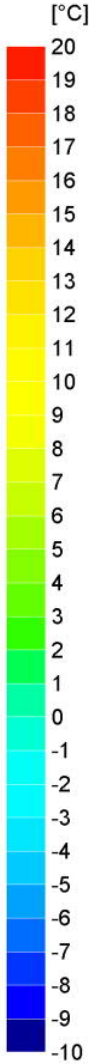
Source: Annex61 EDLIG (2018) Evaluierung und Optimierung der Wirtschaftlichkeit von integralen Gebäudesanierungen

thermal insulation layer and good window frame

... optimized positioning in wall (insulation layer)







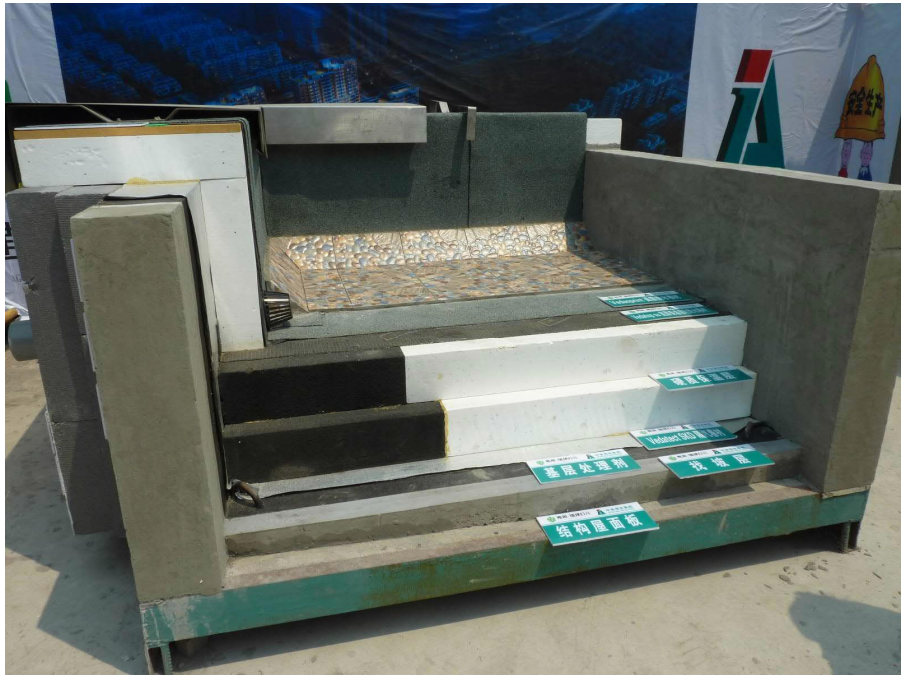
windows pushed out...

Training of workers is essential for quality!

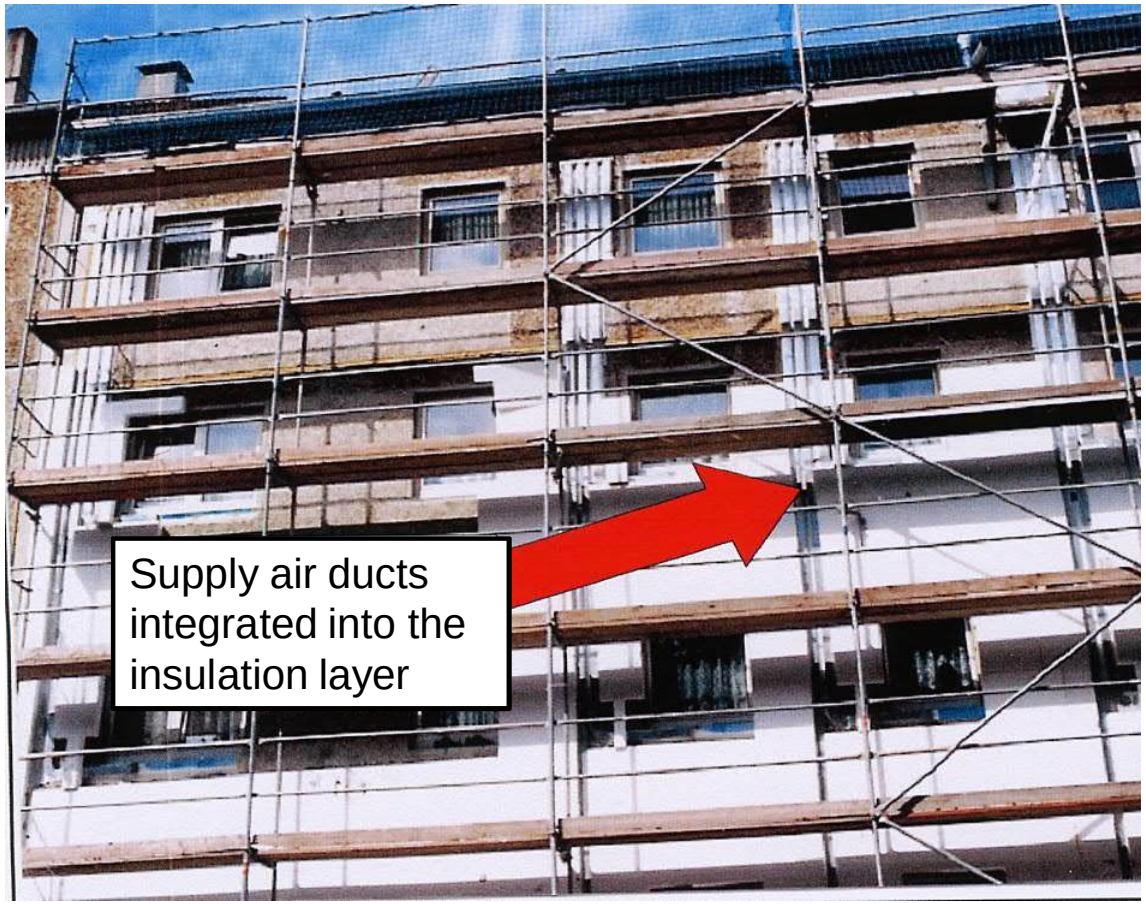
- mockup-installation: layers of EIFS and position and fixing of windows

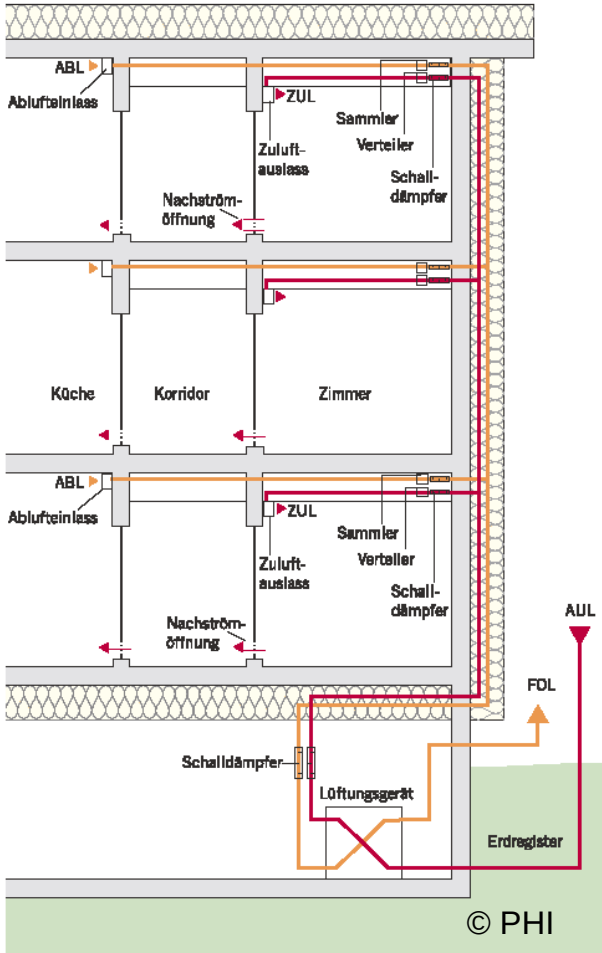
Training of workers is essential for quality!

- mockup-installation: layers of EIFS and position and fixing of windows

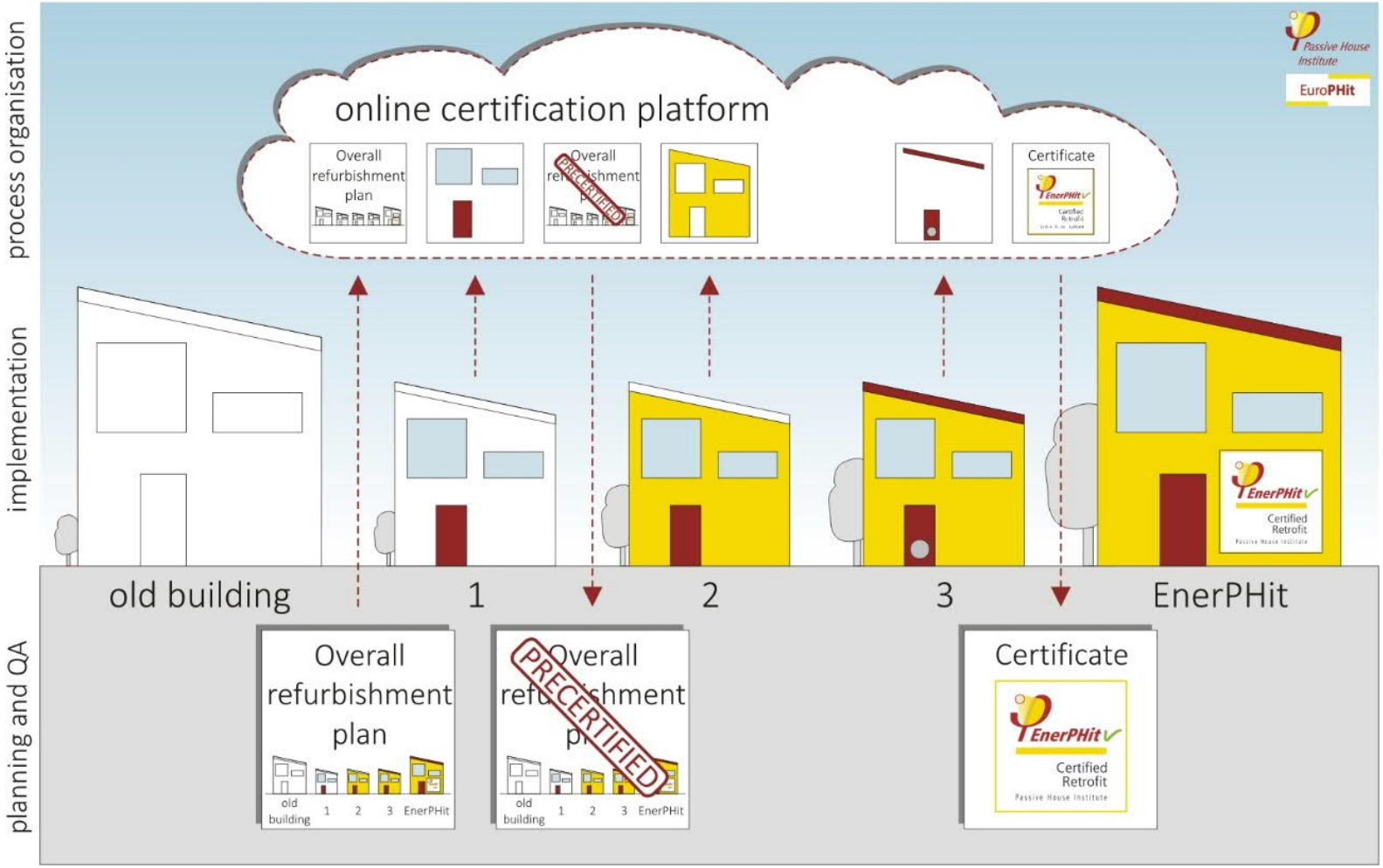


Ventilation for EnerPHit: Airducts into the Insulation Layer





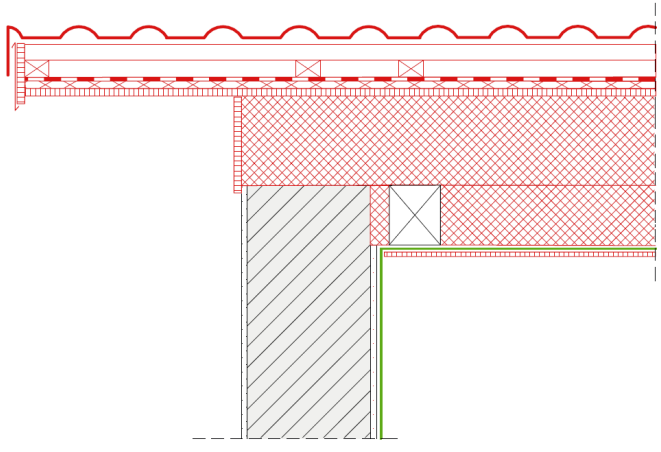
Step-by-step renovation – EnerPHit Retrofit Plan (ERP)

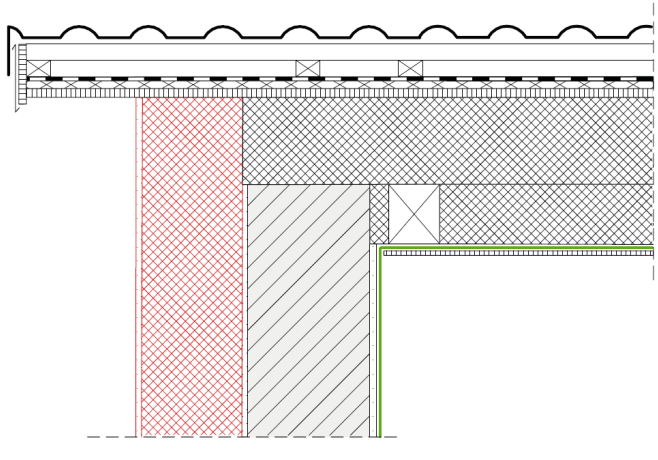


www.europhit.eu

Co-funded by the Intelligent Energy Europe Programme of the European Union

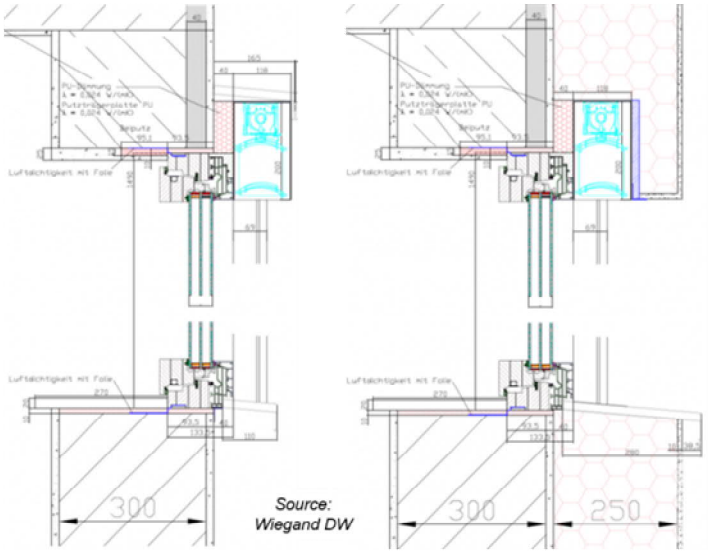
Think ahead : intermediate connections





Component Award 2015: Windows for step-by-step retrofits

CASE 1.
The window is installed in front of the existing wall, it remains in place when insulation is added.



Source: Wiegand DW

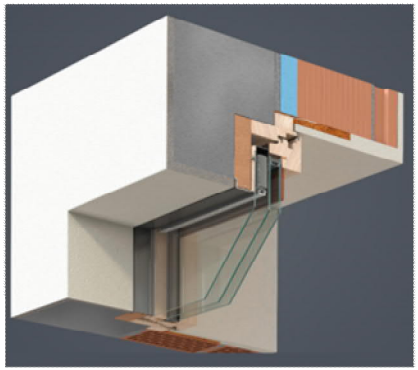
1. New window is installed on the edge of the existing wall.

2. Insulation is installed around the window at a later stage.

CASE 2.
Window is installed in the same position, and moved into the insulation layer when the latter is installed.

1. New window is installed in the same position as the old window.

Source: Lorber / Pro Passivhausfenster



2. When the insulation layer is added, the window is moved to the ideal installation situation.

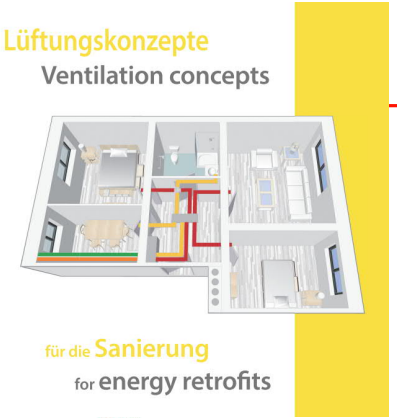
COMPONENT AWARD 2015
Passive House Institute

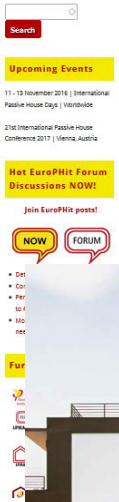
EnerPHit
STEP-BY-STEP RETROFIT
Passive House Institute

More information

Free online handbook, 120 pages

www.europhit.eu





Kriterien
für den Passivhaus-, EnerPHit- und
PHI-Energiesparhaus-Standard

PHI building criteria

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Thank you!

Further information

- www.passivehouse.com
- www.passipedia.org
- www.passivehouse-international.org
- www.europhit.eu

International Passive House Conference