

Working Group on Buildings

online

28 September 2022 | 16:00



Brought to you by outPHit

For deep retrofits made faster, cheaper and more reliable



**Oct 2020 – Sep 2023 | EU funded via H2020
with 10 partners from 7 countries**

Find out more at outphit.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957175. The presented contents are the author's sole responsibility and do not necessarily reflect the views of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.



outPHit wants to...

*...lower the barriers to the uptake of high quality deep retrofits by pairing **prefabrication and streamlined processes** with the rigour of the **EnerPHit Standard** for renovations according to Passive House principles.*

The outPHit approach

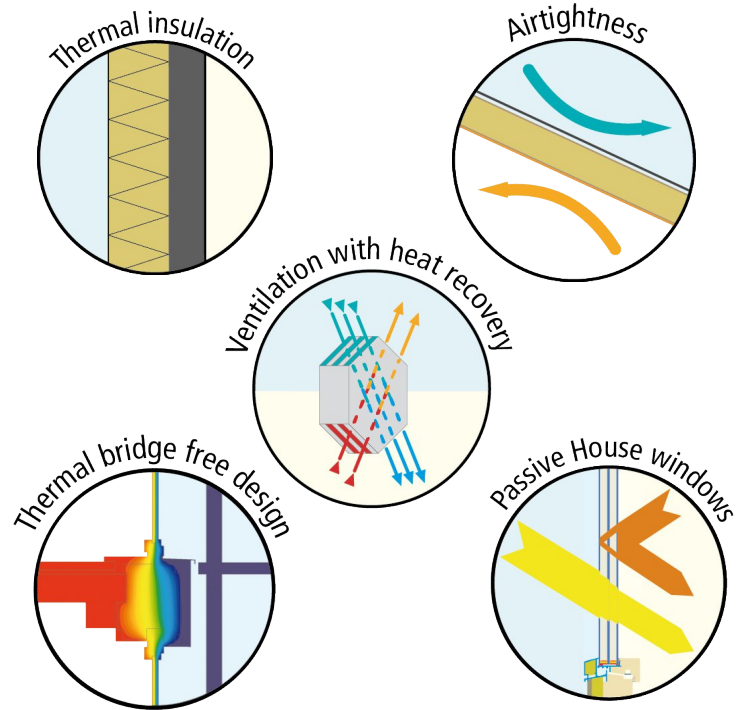
The EnerPHit Standard

- A sound basis in Passive House principles
- A focus on quality, comfort and outstanding performance



EnerPHit requirements
Passive House components and very low annual space heating demands*

* climate dependent; in Europe from 15 to 30 kWh/m²a



Energy Standards

Energy standards in PHI's certification scheme:



Passive House buildings are characterised by especially high levels of indoor comfort with minimum energy consumption. The Passive House Standard offers excellent economic efficiency especially for new builds.

The **Passive House Classes Classic, Plus or Premium** can be achieved depending on the use of renewable energy sources



EnerPHit is the established Standard for refurbishment of existing buildings using Passive House components. Despite the slightly higher energy demand, it offers most of the advantages of the Passive House Standard.

The **EnerPHit Classes Classic, Plus or Premium** can be achieved depending on the use of renewable energy sources



The **PHI Low Energy Building** Standard is suitable for buildings that, for various reasons, do not fully comply with the more ambitious Passive House criteria.

Introduction: EnerPHit



Passive House Institute
Dr. Wolfgang Feist
Rheinstraße 44-46
64283 Darmstadt, Germany

Certificate

The Passive House Institute hereby awards the EnerPHit certificate to the following building:

Passive House, Passivestr. 100, P-12345 Passivity



Client:	Paula Passive Passivestr. 100, 12345 Passivity, Country
Architecture:	Architect's Office Passivestr. 100, 12345 Passivity, Country
Building Services:	MEP-Engineering Office Passivestr. 100, 12345 Passivity, Country

This building was designed to meet the Passive House component energy retrofit criteria as defined by the Passive House Institute Darmstadt. Given appropriate on-site implementation, this building has the following characteristics:

Building characteristics:	Achieved	Required	
Annual specific space heating demand	99 kWh/m ² ≤	25 kWh/m ²	✓ ¹
Annual specific primary energy demand ² for heating, DHW, ventilation and all other electric appliances for standard use	999 kWh/m ² ≤	129 kWh/m ²	✓
Airtightness of building envelope (no door test result)	0.9 h ⁻¹	≤ 1.0 h ⁻¹	✓
Mean value of individual building component thermal protection:			
Exterior insulation to ambient ³ (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.18 W/m ² K	✓
Exterior insulation to ground ³ (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.19 W/m ² K	✓ ³
Interior insulation to ambient (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.35 W/m ² K	✓
Interior insulation to ground (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.51 W/m ² K	✓
Thermal bridges Δ, Building envelope (window installation excluded)	0.999 W/m ² K	No limiting value	✓
Windows (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.85 W/m ² K	✓
Exterior doors (Thermal transmittance (U-value))	0.999 W/m ² K	≤ 0.80 W/m ² K	✓
Ventilation unit (Effective efficiency of heat recovery)	99.9 %	≥ 75 %	✓

¹Limiting value is not relevant. ²Limiting value differs for each building. ³The requirements can not be met (exception applies).

Certification criteria met? <small>Selection of the evaluation method</small>	Space heating demand	✓
	Component quality	✓

Issued: _____
City, Date _____

Dr. Wolfgang Feist _____

EnerPHit Standard:

Quality assurance for retrofit of existing buildings

- Guideline and incentive for an optimal efficiency standard
- Quality assurance for building owners
- Market transparency

“Energy Retrofit with Passive House Components”

EnerPHit certification criteria: 2 ways

1) Based on component criteria for Certified Passive House Components

Component	Limit value
Opaque exterior components	Exterior insulation: $f_T * U \leq 0.15 \text{ W}/(\text{m}^2\text{K})$ Interior insulation: $f_t * U \leq 0.35 \text{ W}/(\text{m}^2\text{K})$
Opaque exterior components to ground and unheated basement	$f * U \leq 0.15 \text{ W}/(\text{m}^2\text{K})$ where f: "ground reduction factor" from PHPP "Ground" worksheet
Windows	$U_{w,installed} \leq 0.85 \text{ W}/(\text{m}^2\text{K})$ $g \cdot 1.6 \text{ W}/(\text{m}^2\text{K}) \geq U_g$
Ventilation system	$h_{\text{heat recovery,eff}} \geq 75 \%$ (incl. duct losses)
Airtightness	limit value: $n_{50} \leq 1.0 \text{ h}^{-1}$ target value: $n_{50} \leq 0.6 \text{ h}^{-1}$

2) Heating demand below 25 kWh/(m²a)

Certificate
Certified Passive House Component
 for cool, temperate climates; valid until 31.12.2014

Passive House Institute
 Dr. Wolfgang Feist
 64283 Darmstadt
 GERMANY

Category: **Window Frame**
 Manufacturer: **Green Building Store**
 HD7 4JW Huddersfield, UK
 Product name: **Ecocontract ULTRA**

This certificate was awarded based on the following criteria:

Given a U_g value of $0.70 \text{ W}/(\text{m}^2\text{K})$ and a window size of 1.23 m by 1.48 m ,

$U_w = 0.80 \text{ W}/(\text{m}^2\text{K}) \leq 0.80 \text{ W}/(\text{m}^2\text{K})$

Taking into account the installation based thermal bridges and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the window meets the following criteria:

$U_{w,installed} \leq 0.85 \text{ W}/(\text{m}^2\text{K})$

Thermal data

	U_f -value [W/(m ² K)]	Width (mm)	ψ_g [W/(mK)]	$f_{Rsi=0.25}$ []
Spacer			Swisspacer Ultimate*	
Bottom	0.82	138	0.022	0.75
Side/top	0.84	120	0.023	

*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

For further information, please see the data sheet

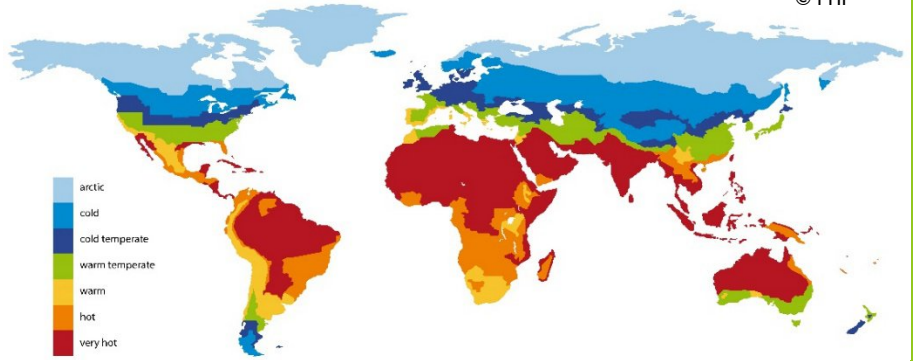
www.passivehouse.com 0579w103

Passive House Efficiency Class

- phA advanced component
- phB basic component
- phC certifiable component
- not suitable for Passive Houses

phB CERTIFIED COMPONENT
 Passive House Institute

Global EnerPHit Criteria



building component method:

Climate zone according to PHPP	Opaque envelope ¹ against...				Windows (including exterior doors)				Ventilation		
	...ground	...ambient air			Overall ⁴			Glazing ⁵	Solar load ⁶	Min. heat recovery rate ⁷	Min. humidity recovery rate ⁸
	Insulation	Exterior insulation	Interior insulation 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		
	Max. heat transfer coefficient (U-value)			Cool colours	(U _{D/W, installed})			-	[kWh/m ² a]	%	
	[W/(m ² K)]			-	[W/(m ² K)]			-	[kWh/m ² a]	%	
Arctic	Determined in PHPP from project specific heating and cooling degree days against ground.	0.09	0.25	-	0.45	0.50	0.60	$U_g - g \cdot 0.7 \leq 0$	100	80%	-
Cold		0.12	0.30	-	0.65	0.70	0.80	$U_g - g \cdot 1.0 \leq 0$		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	$U_g - g \cdot 1.6 \leq 0$		75%	-
Warm-temperate		0.30	0.50	-	1.05	1.10	1.20	$U_g - g \cdot 2.8 \leq -1$		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)		

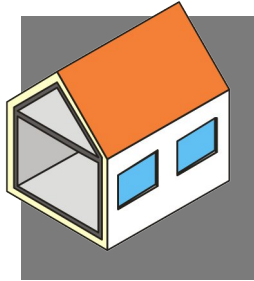
or alternatively, energy demand method:

Climate zone according to PHPP	Heating	Cooling
	Max. heating demand	Max. cooling + dehumidification demand
	[kWh/(m ² a)]	[kWh/(m ² a)]
Arctic	35	equal to Passive House requirement
Cold	30	
Cool-temperate	25	
Warm-temperate	20	
Warm	15	
Hot	-	
Very hot	-	

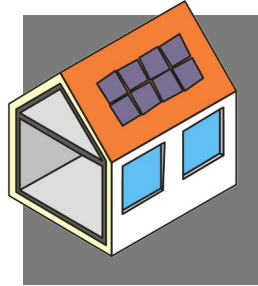
EnerPHit Standard: Efficiency first!

Basic requirement: Low heating / cooling demand

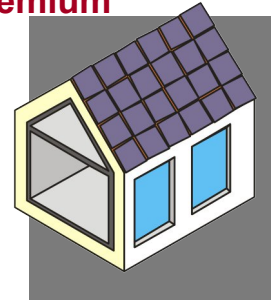
Classic



Plus



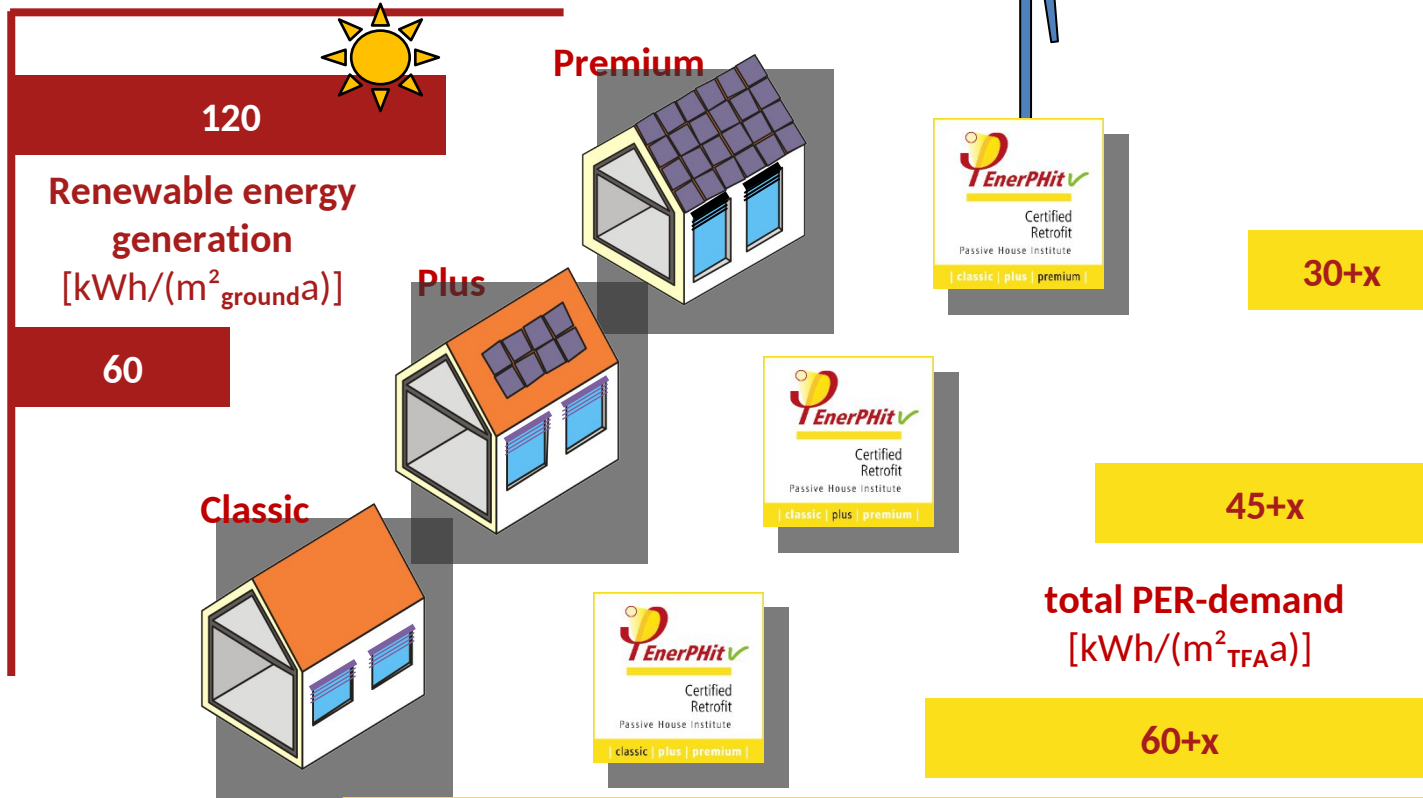
Premium



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PH components and high energy efficiency (PER) + RES

The EnerPHit Classes



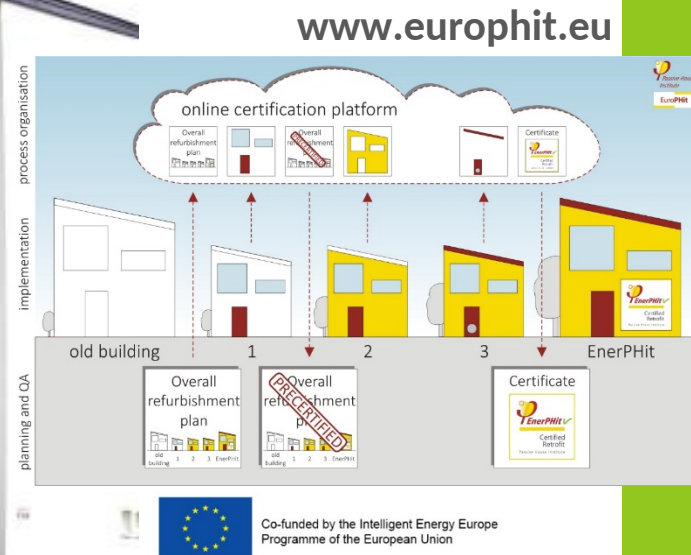
Step-by-step retrofits with EnerPHit Retrofit Plan



2017 Retrofit of one Apartment in MFH
Vienna, Austria | TFA: 70 m² (Apartment)
Passive House Database: [ID 3759](https://www.passivehouse.com/en/ID/3759)



2017 MFH IN28 step-by-step EnerPHit
Innsbruck, Austria | TFA: 4 206 m²
Passive House Database: [ID 5528](https://www.passivehouse.com/en/ID/5528)



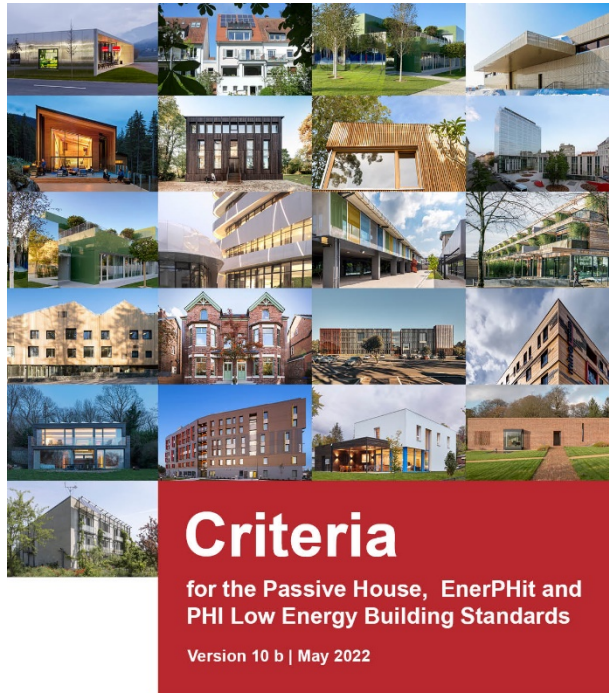
First EnerPHit plus building



Residential and Business building in 2016
Papagou (Griechenland)
Architekt: Athanasia Roditi
Consultancy: Stefanos Pallantz



The Criteria Document



Validity of the criteria

- Applicable **worldwide** in any climate
- Applicable for all common usage types like residential buildings, offices, schools, university buildings...
- Applicable for all construction types like masonry, timber, concrete, steel, ...
- Criteria are coupled to PHPP version
- English, German and Spanish versions are published by PHI. Translations into other languages are not verified by PHI and are for information only.

Certification Brochure



www.passivehouse.com > Certification > Buildings > Building Certification Guide

What does the client receive?



Certificate with ID



Seal as JPG file for use in context with the building

Passive House Verification

Building: End-of-terrace Passive House
Street: Example Street 99
Postcode/City: 99999 Example City
Province/Country: Example Province DE-Germany
Building type: Row house
Climate area: DE-9999-PHP-Standard
Climate zone: 2: Cool-temperate Abbr.: of location: ...
Home owner / Client: Passivhaus Association of Owners
Street: Example Street 99
Postcode/City: 99999 Example City
Province/Country: Example Province DE-Germany
Mechanical system: Example Mechanical Services Firm
Street: Example Street 99
Postcode/City: 99999 Example City
Province/Country: Example Province DE-Germany
Certification: Passive House Institute
Street: Fibelstr. 44466
Postcode/City: 64289 Darmstadt
Province/Country: DE-Germany

Year of construction: 2015
No. of dwelling units: 1
No. of occupants: 2,3

Interior temperature winter [C]: 20,0
Internal heat gains (RH) heating case [W/m²]: 2,4
Specific capacity [kWh/k per m² TFA]: 204
Interior temp. summer [C]: 25,0
RH cooling case [W/m²]: 2,4
Mechanical cooling: ...

Specific building characteristics with reference to the treated floor area	Criteria	Alternative criteria	Fulfilled?	
Space heating	Treated floor area m ²	150,0	15	yes
	Heating demand kWh/m ² a	13	15	yes
	Heating load W/m ²	10	10	yes
Space cooling	Cooling & dehum. demand kWh/m ² a	-	-	-
	Cooling load W/m ²	-	-	-
	Frequency of overheating (> 25 C) %	1	10	yes
	Frequency excessive high humidity (> 12 g/kg) %	0	20	yes
Airtightness	Presurization test result n ₅₀ 1/h	0,2	0,6	yes
Non-renewable Primary Energy (PE)	PEI demand kWh/m ² a	54	-	-
Primary Energy Renewable (PER)	PERI demand kWh/m ² a	30	60	yes
	Generation of renewable energy kWh/m ² a	135	100	yes

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

Passive House Classic? **yes**

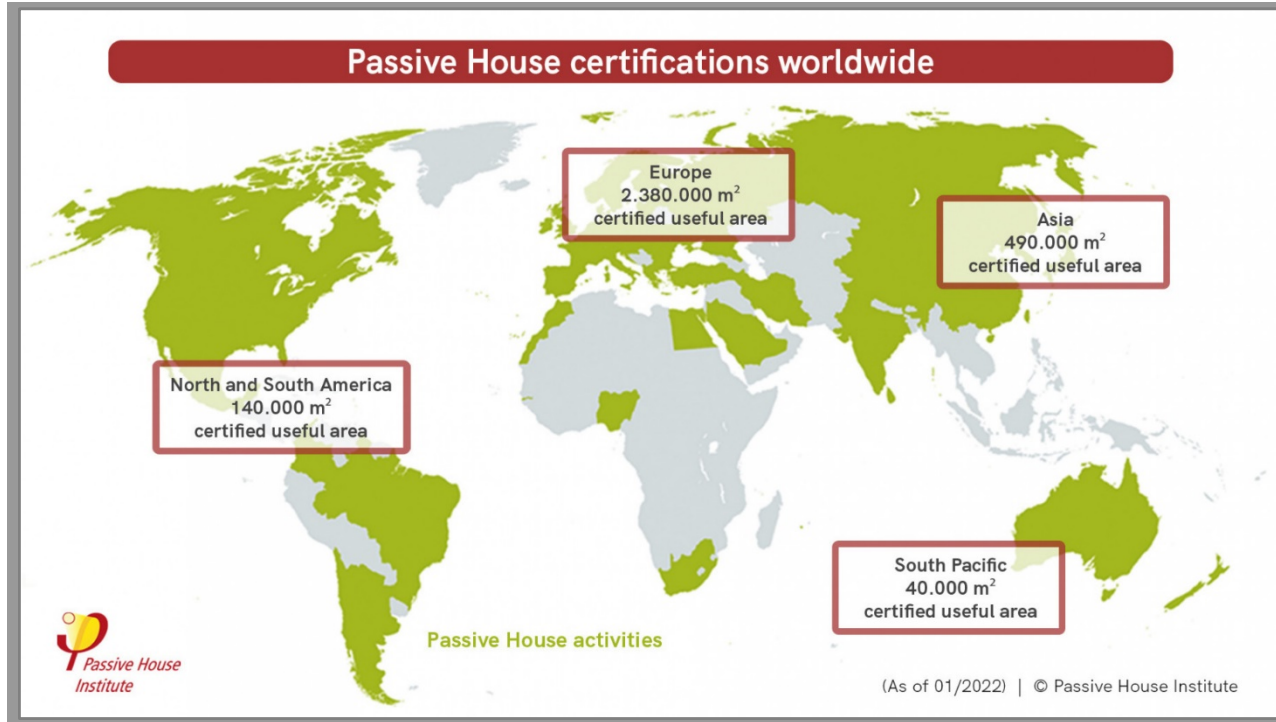
Task: _____ First name: _____ Surname: _____
 Issued on: _____ City: _____

Booklet (PHPP print-out)

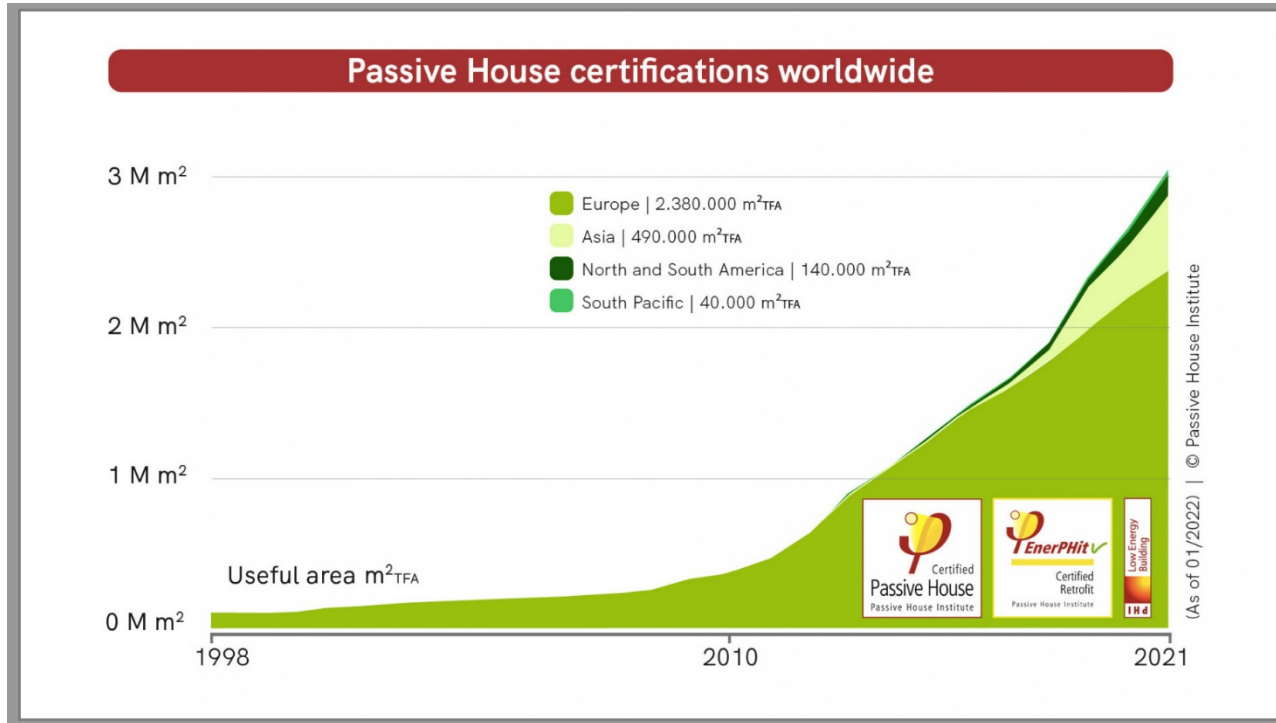


Wall plaque

Passive House all around the world!



Passive House all around the world!



Passive House all around the world!

3.4 Mio m² / 37,000 units certified Passive House (09/2022)



Why should I certify my Passive House?

Passive House Certification provides quality assurance.

Independent review by third

[Video](#)



Especially for new builds



For retrofit projects



... and even for difficult cases

My benefits as owner?



- Top quality living standard for the occupants:
Comfortable and healthy



- Reliable energy performance



- Better solutions and lower risks due to thorough review by accredited expert € lower construction costs



- Increase in property value



- Standard recognition and eligibility for subsidies
passivehouse-international.org < [Passive House](#) < [Legislation & Funding](#)

Benefits for me as the Designer?



- Better solutions and lower risks due to thorough review by accredited expert € lower construction costs



- Recognition as a certified Passive House Designer
passivehouse.com/training



- Showcase the building via international Passive House database
passivehouse-database.org

BUT HOW? - Quality is Key to Success

Quality assurance of design and construction



Quality assurance of materials and components

- Identification of relevant parameters
- Measurement and calculation procedures
- Documentation and integration in whole building performance calculation

Prediction cannot be better than the actual building realisation and the quality of the components



Components and systems: reliable performance data

Capacity building: Training and certification of

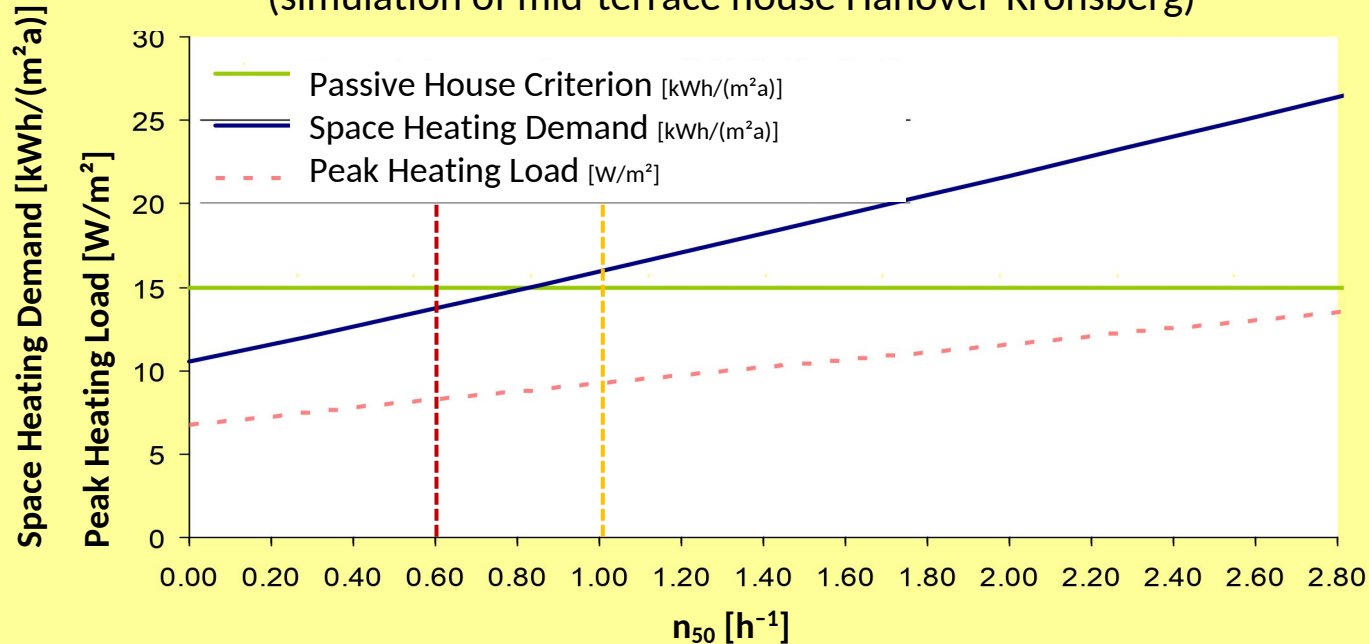
- Designers / Consultants (ca. 10.000)
- Craftsmen (ca. 4.000)



Airtightness and Energy Balance

Impact of airtightness on Space Heating Demand and Heating Load

(simulation of mid-terrace house Hanover-Kronsberg)

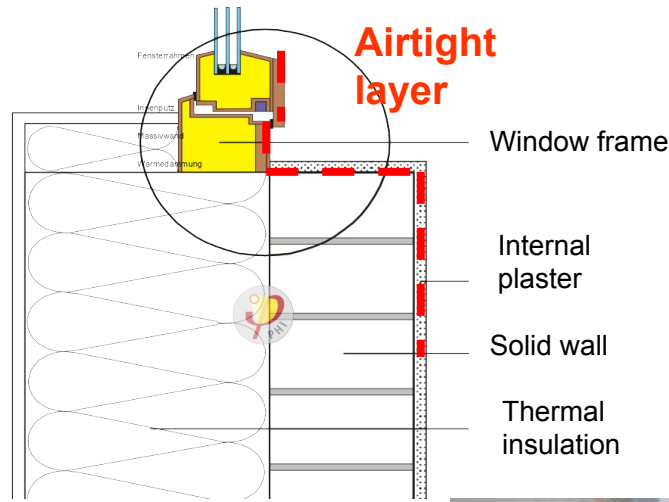


Airtightness

Prepare the connection on site.
Ideally, the surface should be

- dry
- grease-free
- dust-free.

Otherwise, adhesion will
not last for long.



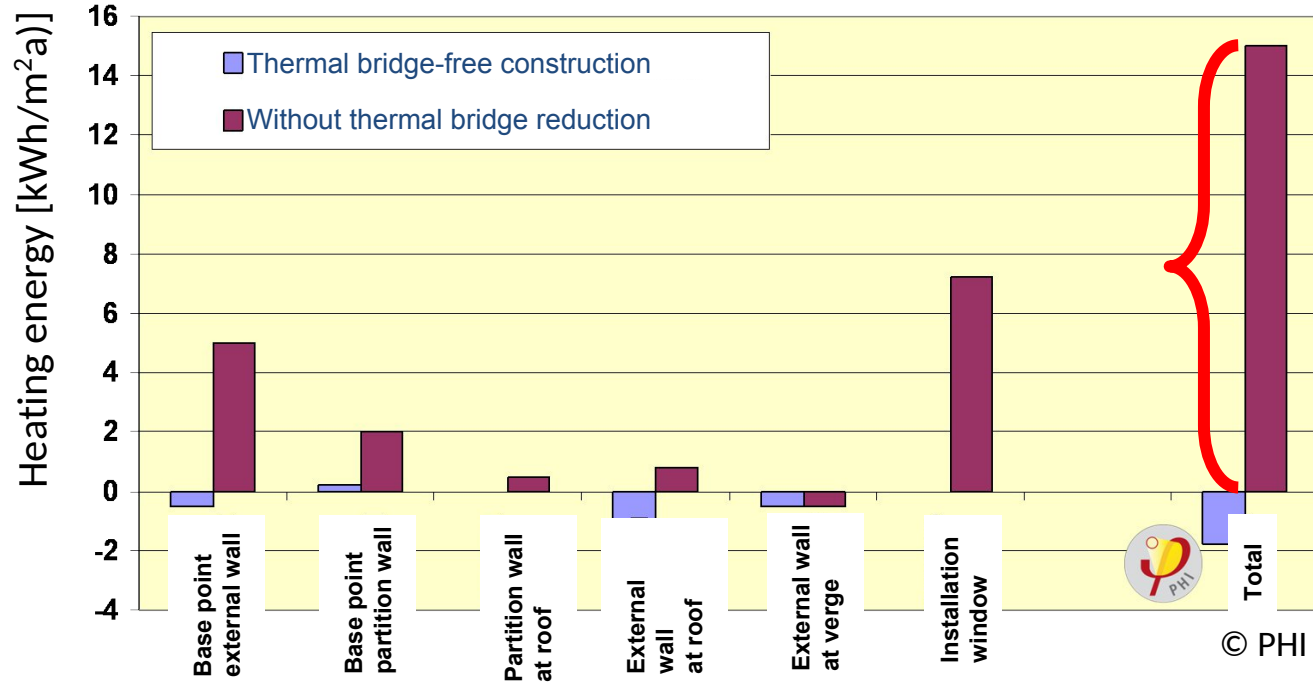
Photograph © PHI



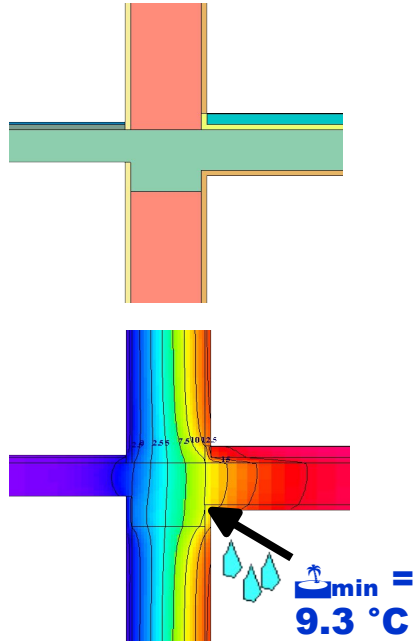
Source: © M. Ploss, [PHS 1.0]

Thermal Bridge-free Constructions

The total sum of heat losses caused by thermal bridge effects corresponds to $U_{TB} = 0.1 \text{ W}/(\text{m}^2\text{K})$



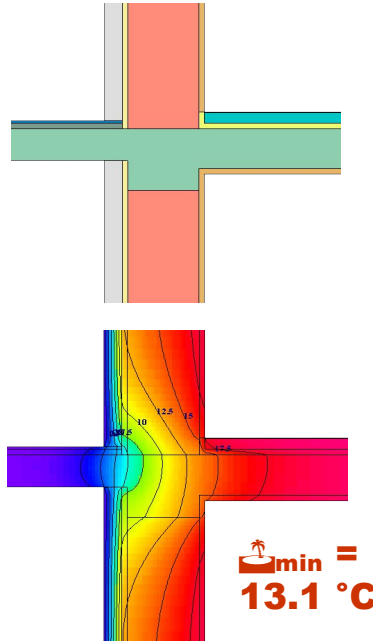
Improvement of Projecting Elements



not insulated

$U = 1.37 \text{ W}/(\text{m}^2\text{K})$

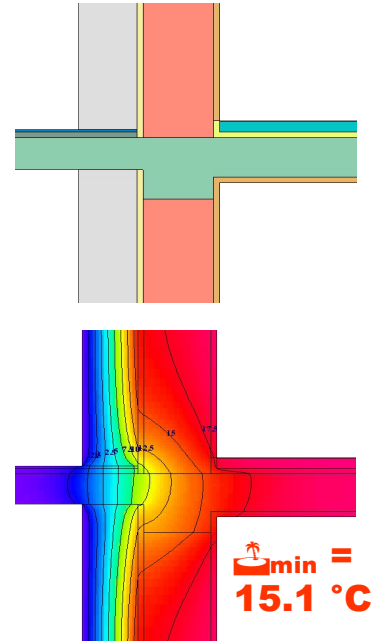
♥_{BS} = 0.41 W/(mK)



conventional

$U = 0.41 \text{ W}/(\text{m}^2\text{K})$

♥_{BS} = 0.57 W/(mK)



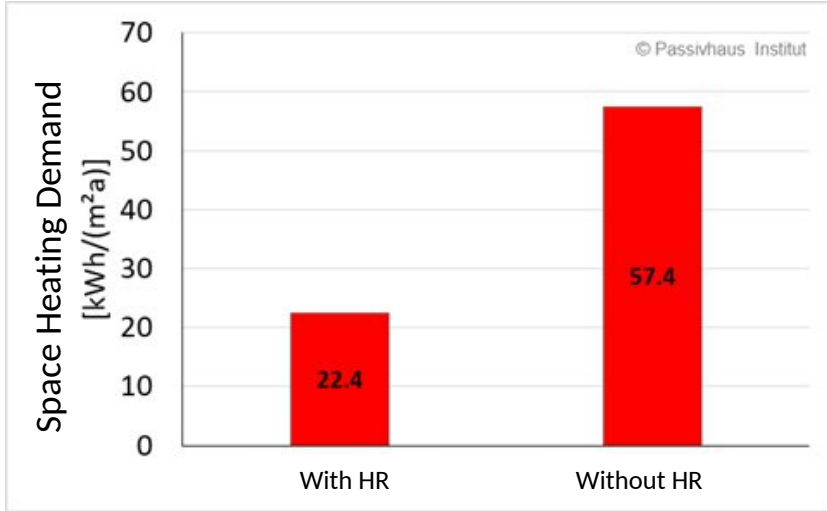
highly efficient

$U = 0.16 \text{ W}/(\text{m}^2\text{K})$

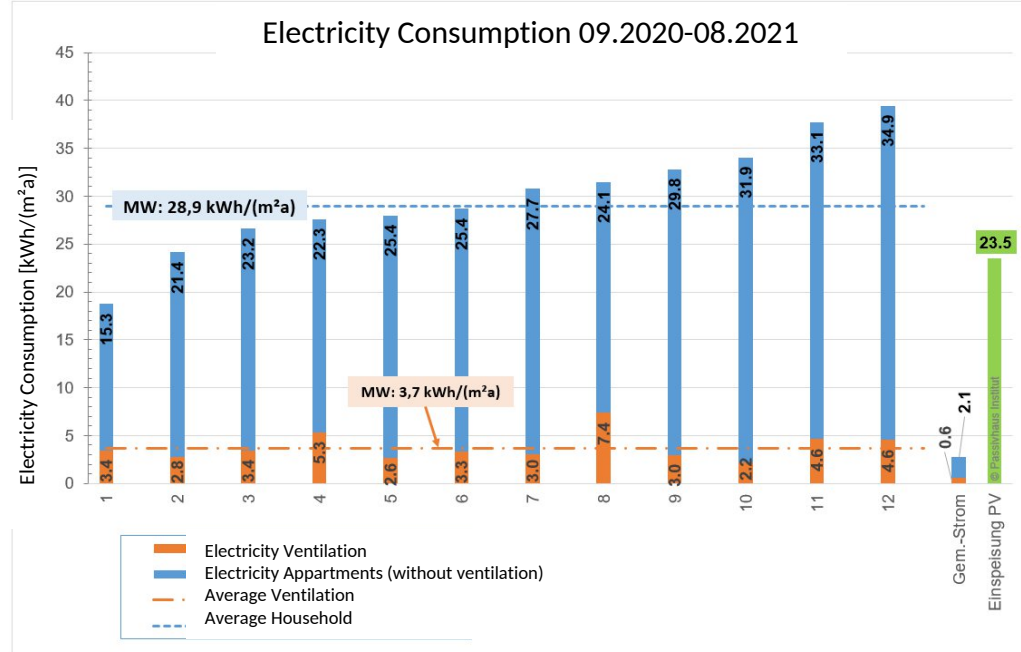
♥_{BS} = 0.50 W/(mK)

© PHI

Ventilation with heat recovery



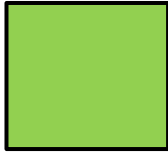
© PHI



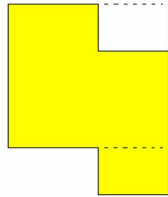
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Compactness

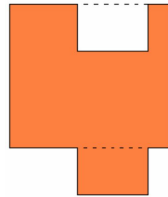
Influence of an increased building perimeter at the same area



Compact situation



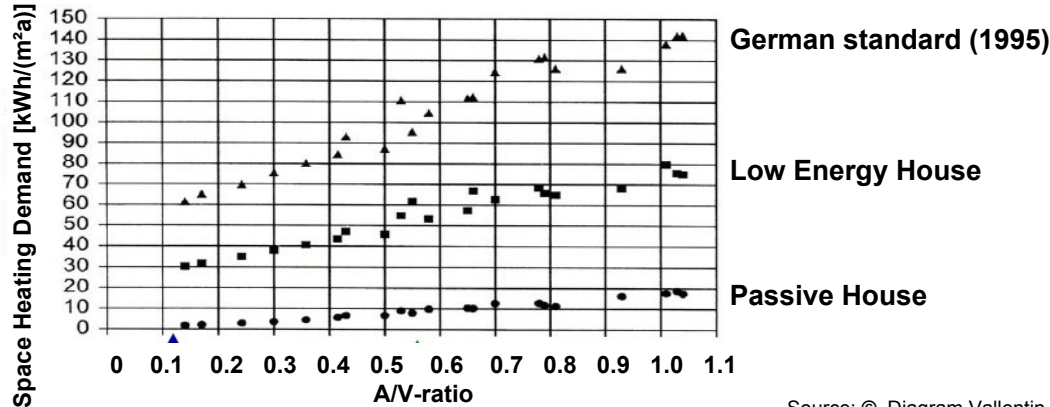
Increase of 10%
Insulation = 20 mm



Increase of 20%
Insulation = 40 mm

Source:
© R. Borsch-Laaks,
[PHS 1.0]

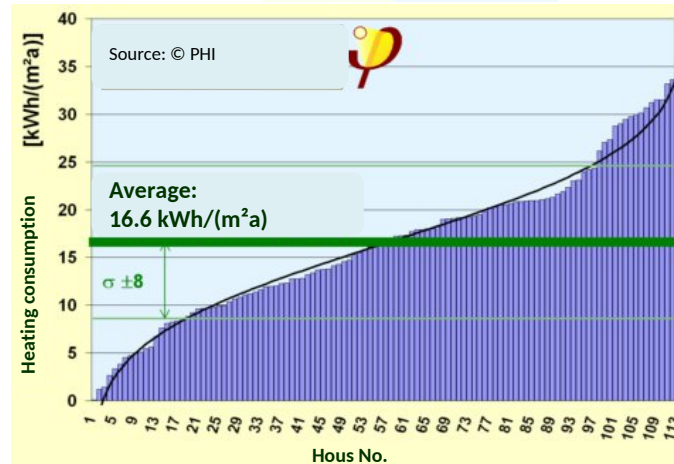
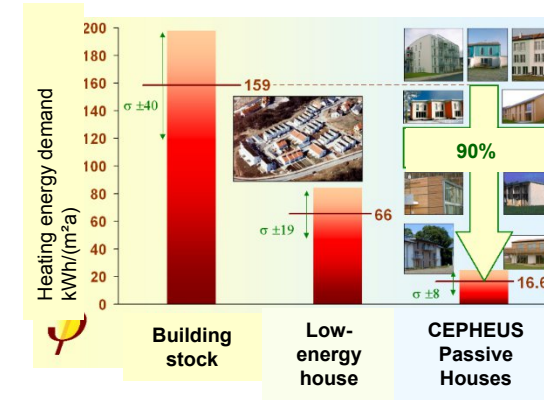
Space heating demand (SHD) varies with area/volume (A/V) ratio



Source: © Diagram Vallentin [AkkP 19]

Passive Houses in Europe

CEPHEUS (1998-2001)



Energy Use IS Predictable



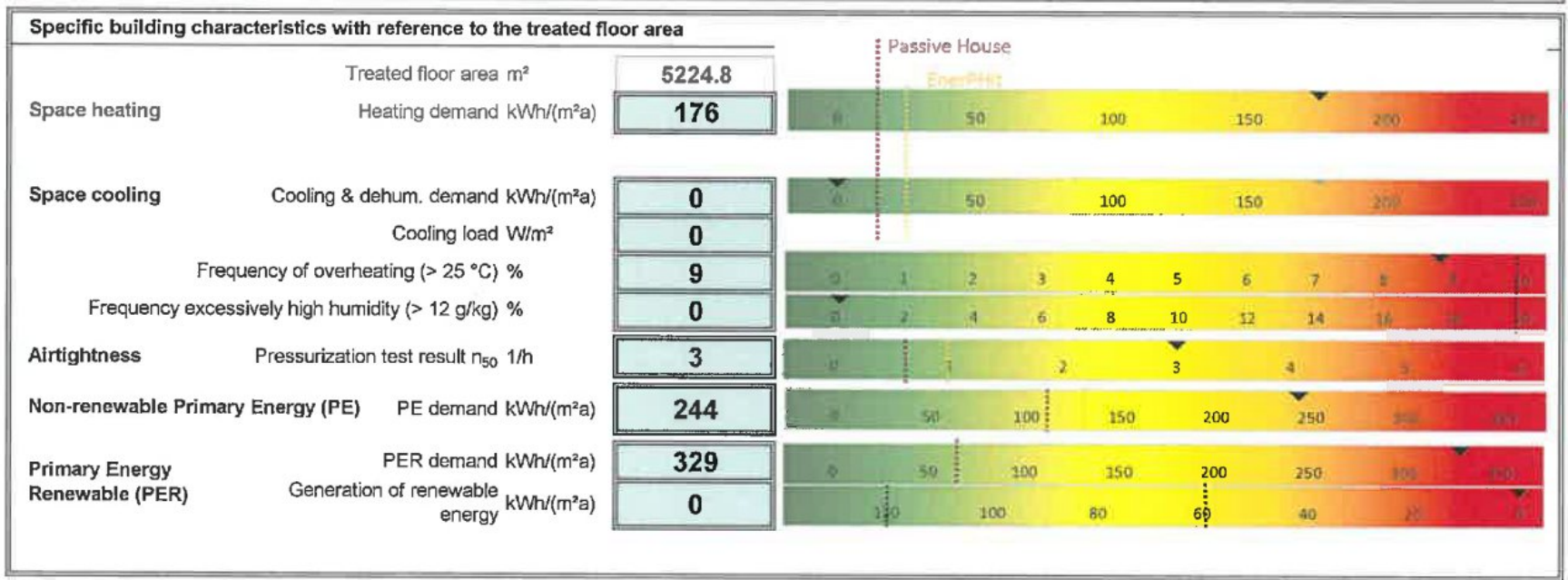
Predictable Performance

*) useful living space

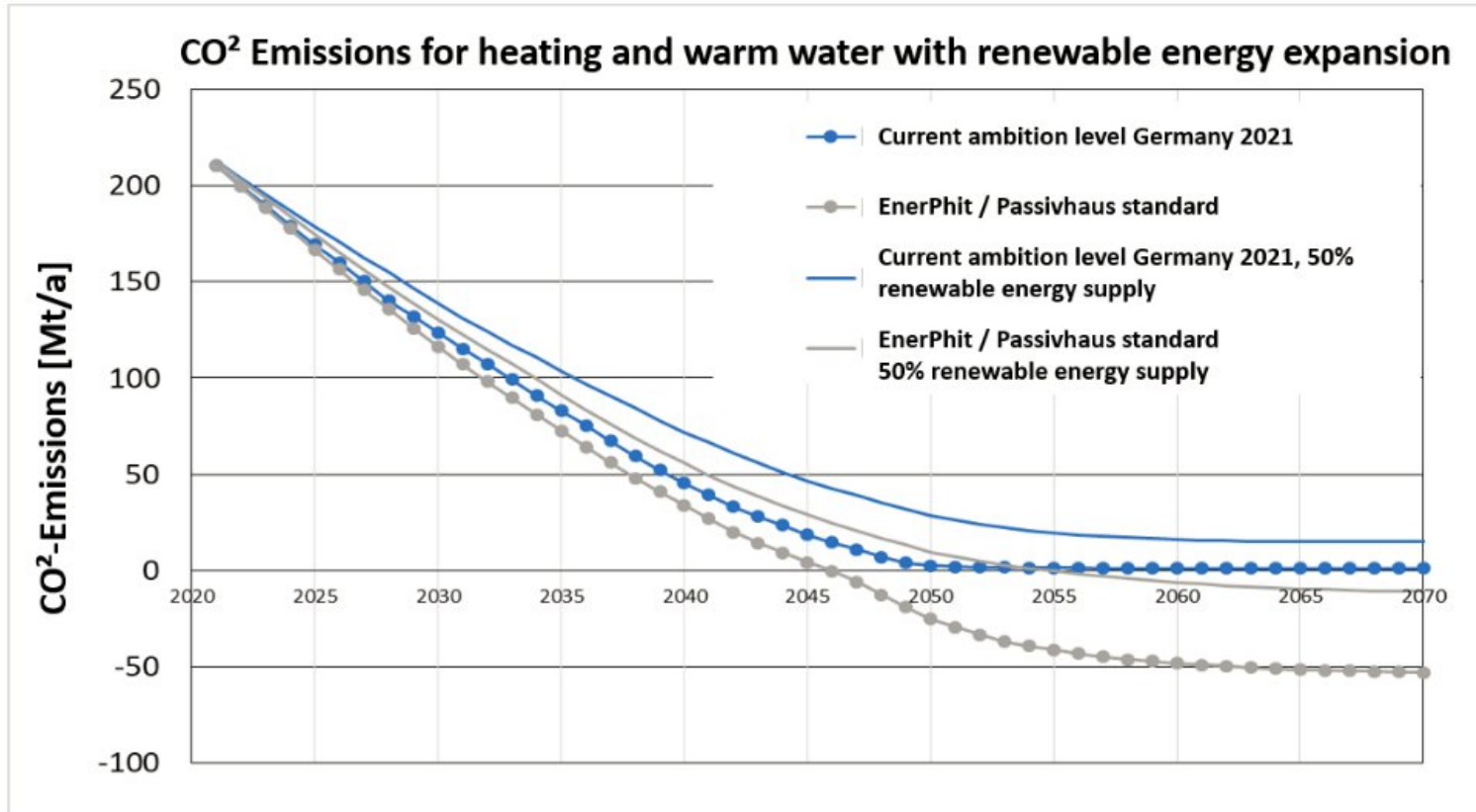
Building stock Belgiersiedlung Kassel, 98 flats	LEH 41 h. Niedernhausen	Passive House Settlements 106 houses Wiesbaden Kronsberg Hannover Feuerbach Stuttgart
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© PHI

An EPC within the PHPP:



Benefits of going beyond requirements:



outPHit pilot projects



CS02_Papagos / GR



CS09_Lons le Saulnier / FR



CS23_St. Johann in Tirol / AT



CS25_Hamburg / DE



CS29_Bonneuil sur Marne /
DE



S17_Teruel / ES



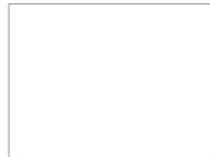
CS12_Ansoain / ES



OP06_Tavros / GR



CS11_Coulanges-sur-Yonne /
FR



Bruno-Sander-Haus

OP21_Innsbruck / AT



CS03_Cholargos / GR



CS27_Frankfurt am Main / DE



OP01_Papagou / GR



CS14_Mendillorri / ES



OP28_Hamburg / DE



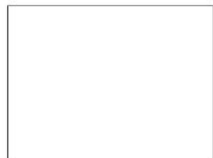
CS22_St. Johann in Tirol / AT



CS13_Pamplona / ES



CS24_St. Johann in Tirol / AT



CS04_Marousi / GR



CS26_Bünde / DE



OP06_Chalandri / GR



CS07_Bagnères / FR

What to expect

Renovation systems

Tender documents

Performance certification scheme

Financial and technical monitoring

Technical equipment packages

Deep renovation guidelines

Contracting concepts

Renovation system certification

Manufacturer support

A municipal practitioner network

Design-stage approval concepts

The Facts

- **PROJECT LEAD** Passive House Institute
- **PROJECT PARTNERS** 10 partners from 8 countries (AT, BE, FR, DE, GR, NL, ES, BG)
- **PROJECT DURATION** 36 months, until August 2023
- **OVERALL BUDGET** € 2.5 million
- **FUNDING AUTHORITY** European Union's Horizon 2020 programme



Project team



Climate Alliance



Want to learn more?
Get in touch with jan.steiger@passiv.de
or visit outphit.eu

