EnerPHit standard and European ZEB requirements

outPHit

EnerPHit Certified Retrofit Passive House Institute

Photo: ecoworks

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Serial renovation @ Bouwbedrijf Joziasse

Serial renovation @ PHI

Zero Emission Buildings - ZEBs

1. Low Primary Energy Demand

The total annual primary energy use of a new zero-emission building shall comply with the maximum thresholds indicated in the table below.

EU climatic zone	Residential building	Office building	Other non-residential building	EU member states
Mediterranean	60 kWh/(m²a)	70 kWh/(m²a)	< NZEB	CY, HR, IT, EL, MT, ES, PT,
Oceanic	60 kWh/(m²a)	85 kWh/(m²a)	< NZEB	BE, DK, IE, DE, FR, LU, NL,
Continental	65 kWh/(m²a)	85 kWh/(m²a)	< NZEB	AT, BG, CZ, HU, PL, RO, SL, SK,
Nordic	75 kWh/(m²a)	90 kWh/(m²a)	< NZEB	EE, FI, LV, LT, SE.

First question: Household applications included or excluded?
Assumption: only lighting as part of the building is considered

Zero Emission Buildings - ZEBs

2. Zero Emmissions by Energy Balance

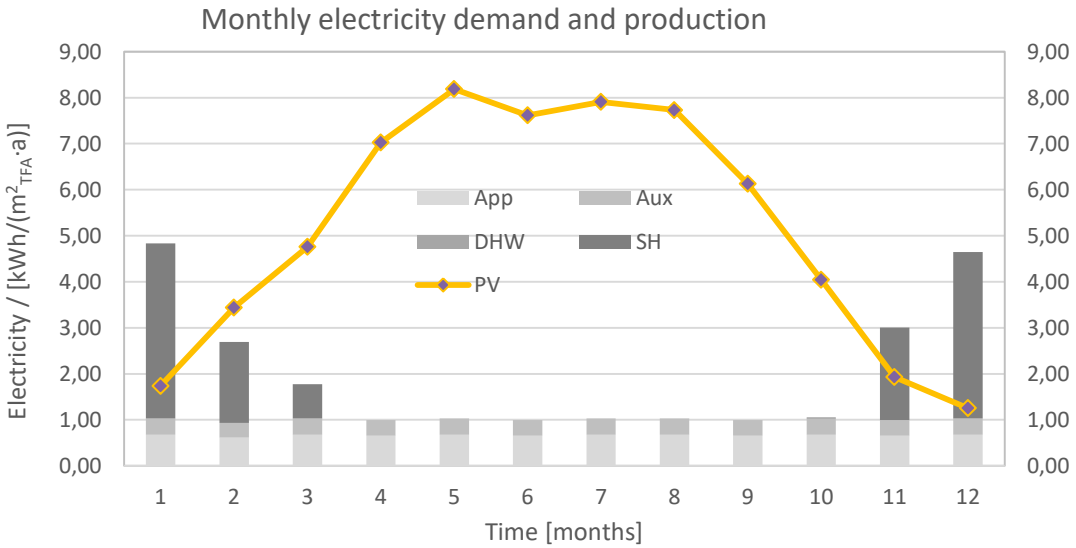
The total **annual primary energy use of a new or renovated zero-emission building shall be fully covered, on a net annual basis**, by:

- energy from renewable sources generated on-site
- renewable energy provided from a renewable energy community
- renewable energy and waste heat from an efficient district heating and cooling system

A zero-emission building shall not cause any on-site carbon emissions from fossil fuels…

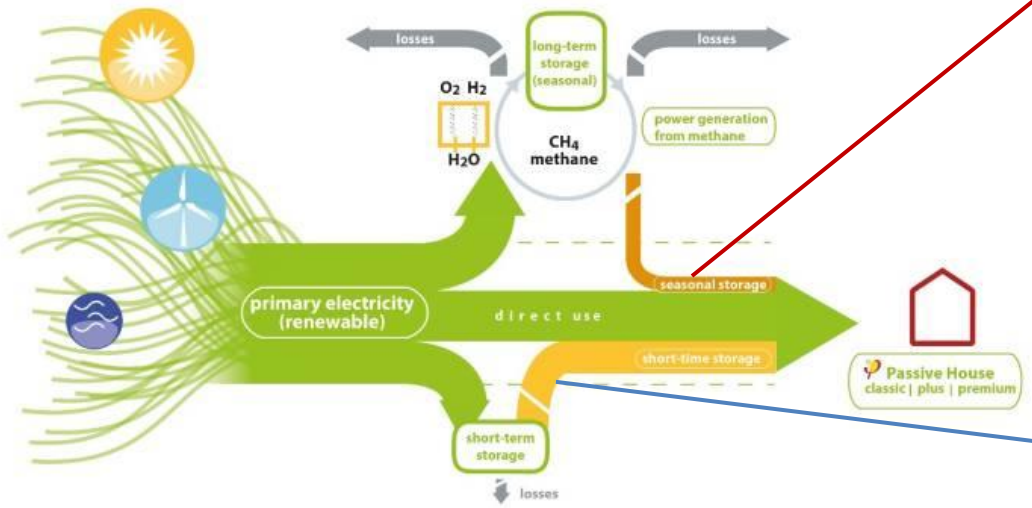
Zero Emission Buildings – first thoughts

2. Zero Emmissions by Energy Balance



We know an annual balance doesn´t work so well, due to the winter gap, not even for highly efficient buildings…

Energy Storage Losses neglected

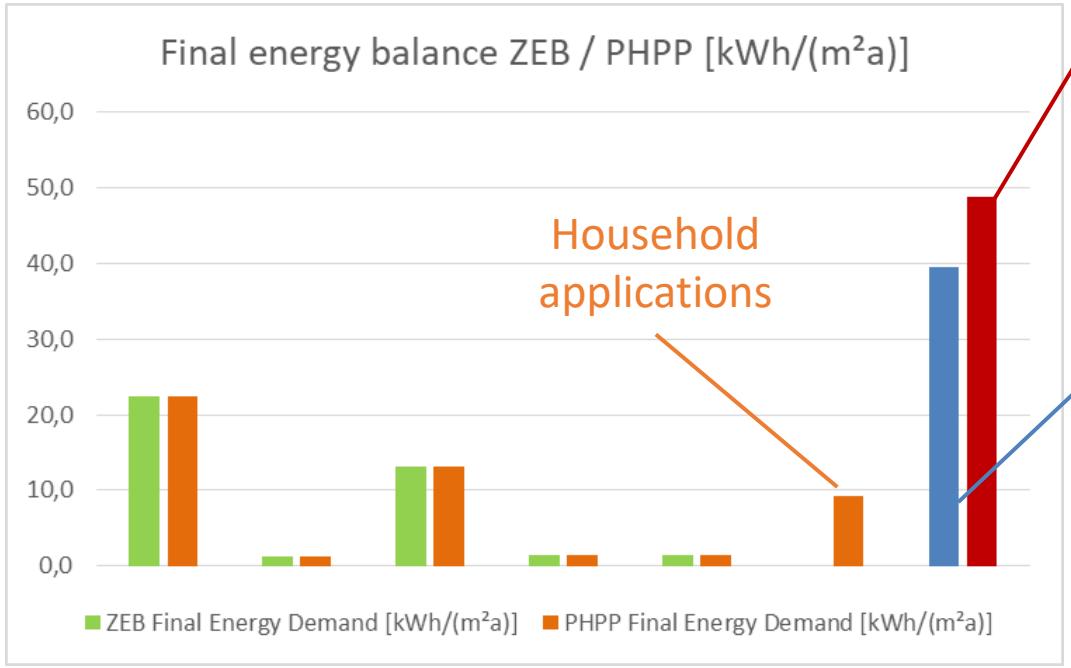


Considerable storage losses for heating in winter times

Fewer storage losses for short time storage

In a future energy supply environment, as it is foreseen for 2050, storage losses especially for heating have to be expected

Are Household applications included?



Household applications included in PHPP

Household applications excluded in ZEBs

In energy efficient buildings the electricity consumption by household applications becomes relevant > included in PHPP

Assumption: only lighting as part of the building is considered

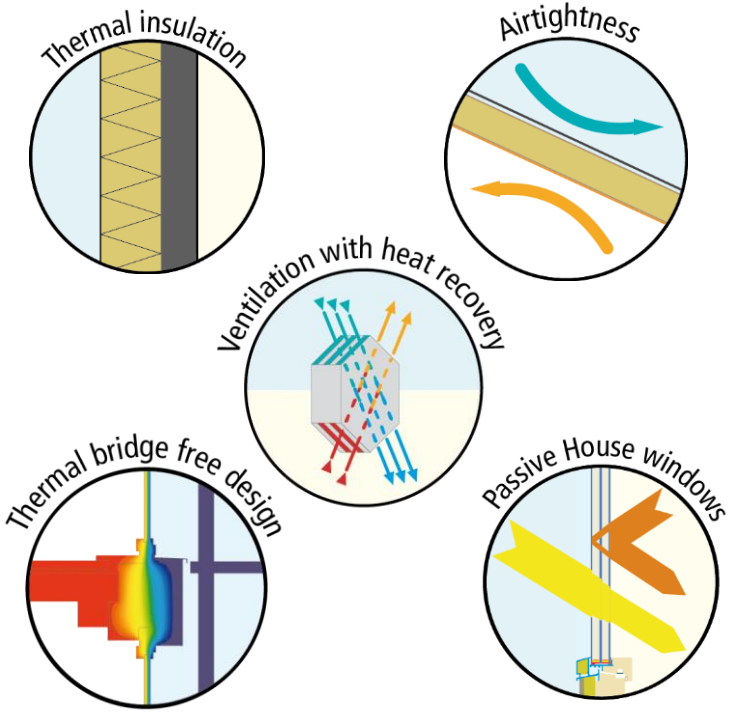
Evaluation approach

- We look at an existing building
- We renovate the building according to national minimum requirements AND according to the EnerPHit standard

Question: Does the EnerPHit standard achieve ZEB?

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

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



Passive House principles | © Passive House Institute

EnerPHit component method

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

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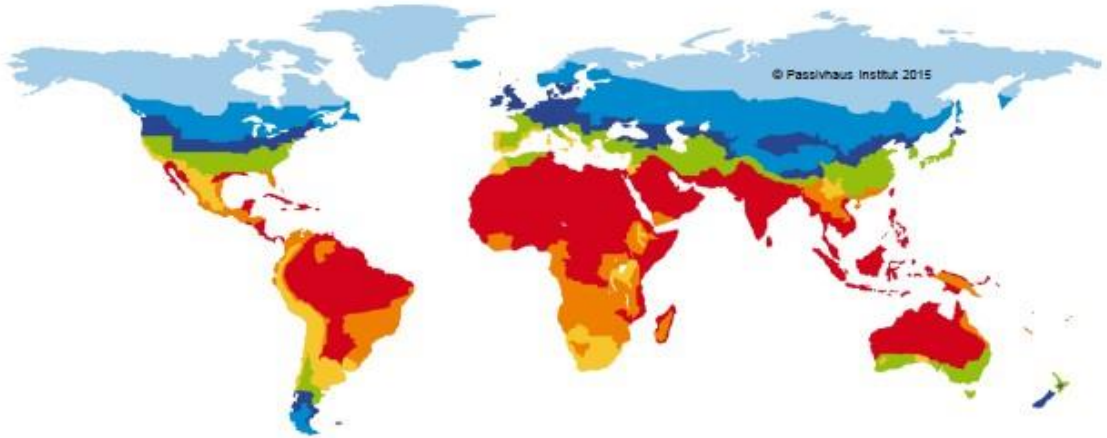


For EnerPHit, different component quality requirements are required for different climate zones

Germany is located in the cool-temperate climate zone

Retrofit based on component qualities

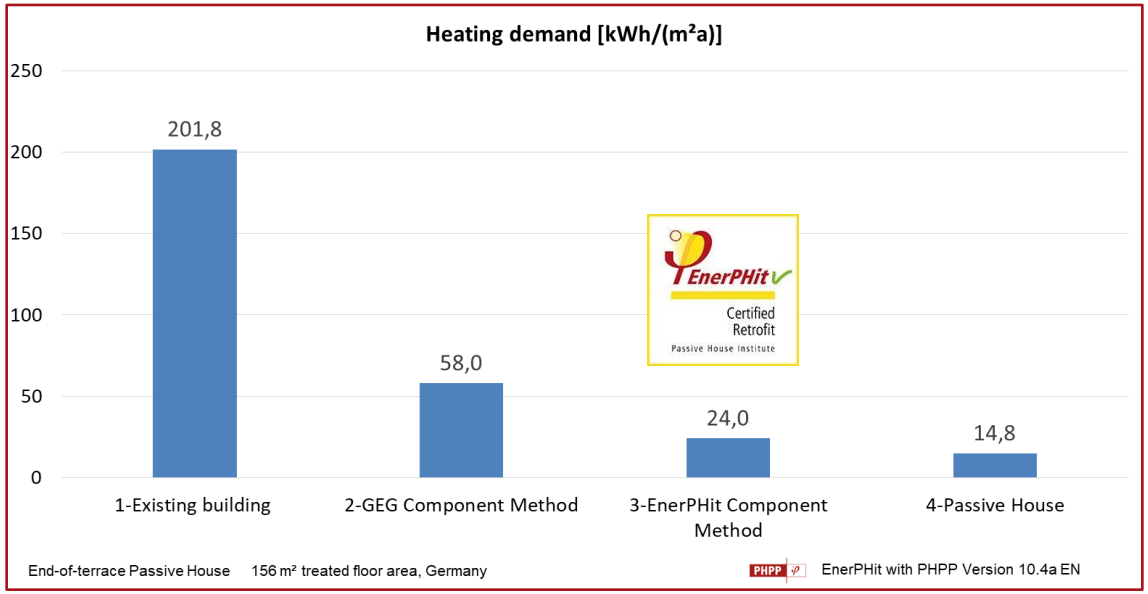
Building standard			GEG	EnerPHit	
		Existing	Component	Component	Passive
Building component	Unit	Building	Method	Method	House
U-Value External wall	[W/(m²K)]	1,38	0,24	0,15	0,13
U-Value Roof	[W/(m²K)]	0,52	0,20	0,15	0,12
U-Value Basement ceiling	[W/(m²K)]	0,72	0,30	0,24	0,19
U-Value Windows	[W/(m²K)]	1,55	1,30	0,79	0,67
U-Value Windows installed	[W/(m²K)]	1,67	1,42	0,85	0,69
Effective heat recovery efficiency	%	0,00	0,00	0,75	0,75
Airtightness	1/h	5,0	3,0	1,0	0,6
Heat generation		Gas boiler	Heat Pump	Heat Pump	Heat Pump

The EnerPHit standard based on component qualities requires better components for the building envelope, better airtightness, and ventialation with heat recovery

These component qualities are applied to the building + calculated with PHPP

The building to be renovated

- End of terrace house, assumed to be built in 1960ies
- A few centimeters roof insulation only
- Large windows to the south, already replaced in the 90ies

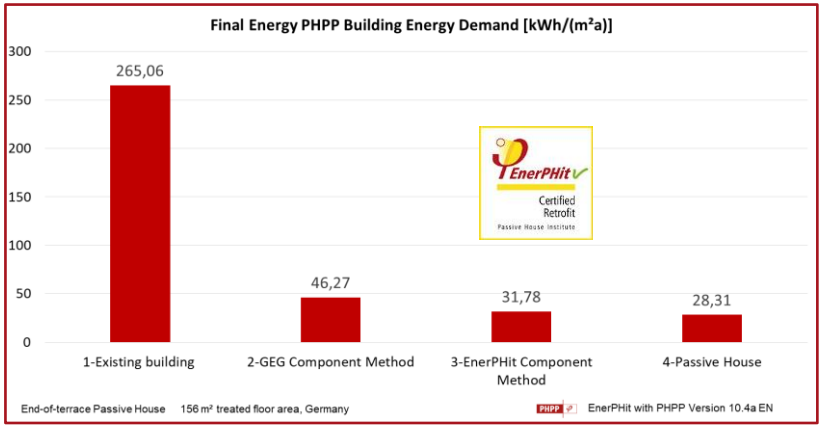


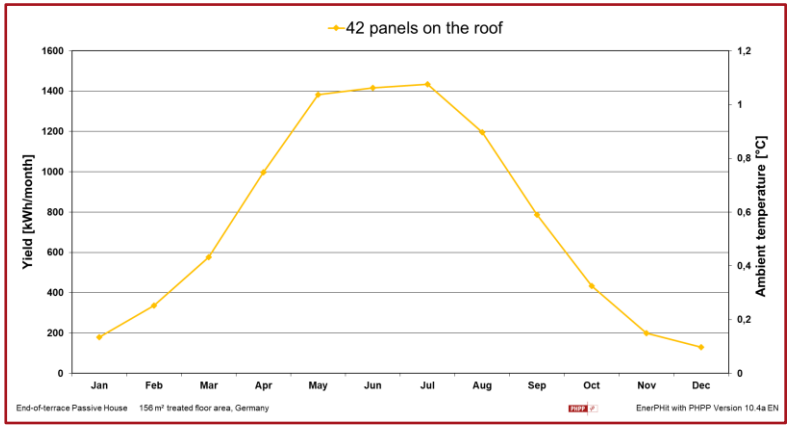
Energy demand compensation: 42 PV panels on the monopitched roof

Total PV yield
= 9.000 kWh/a

Referred to footprint area
= 112 kWh/m²$_{footprint}$ a)

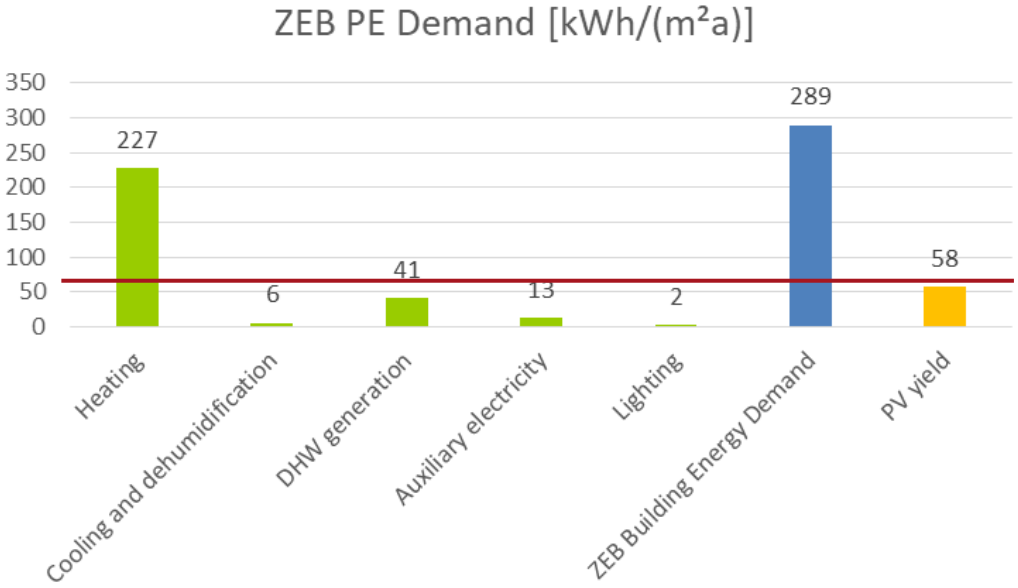
Referred to TFA
= 58 kWh/(m²$_{TFA}$ a)





Zero Emission Building - Potential

Existing building / Heating Demand 200 kWh/(m²a)

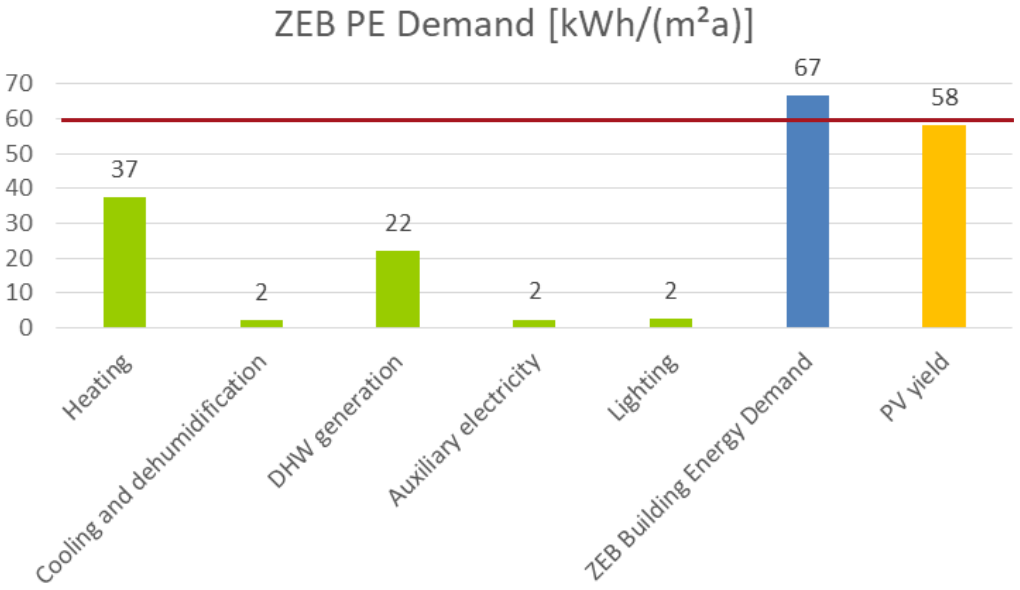


Threshold PE Demand
< 60 kWh/(m²a)

The heating demand is very relevant,
the PE demand is 5 times higher than the PV yield

Zero Emission Building - Potential

GEG renovation / Heating Demand 58 kWh/(m²a)

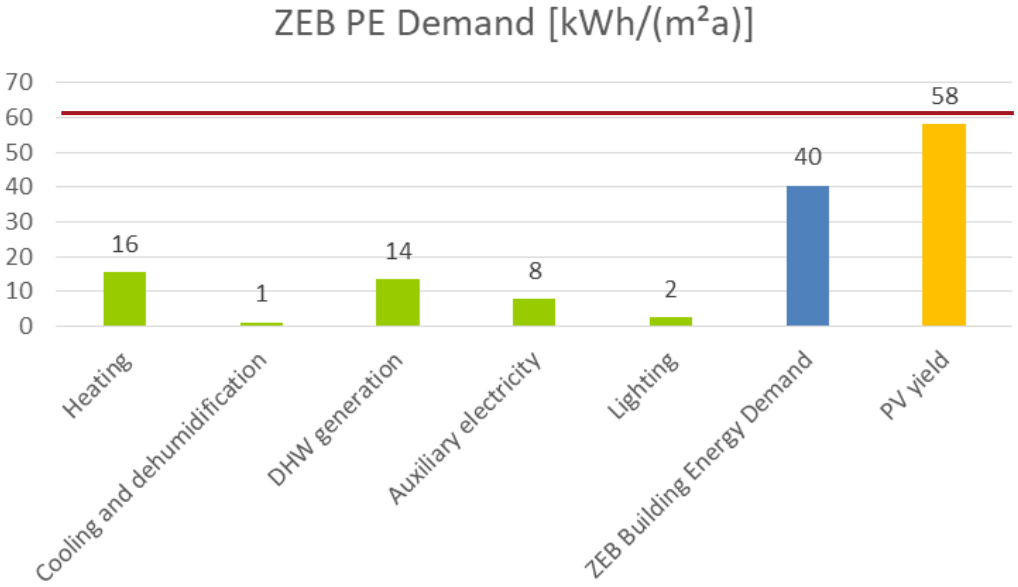


Threshold PE Demand
< 60 kWh/(m²a)

Renovation (component) quality not good enough fulfill ZEB requirements, even with a heat pump

Zero Emission Building - Potential

EnerPHit renovation / Heating Demand 24 kWh/(m²a)

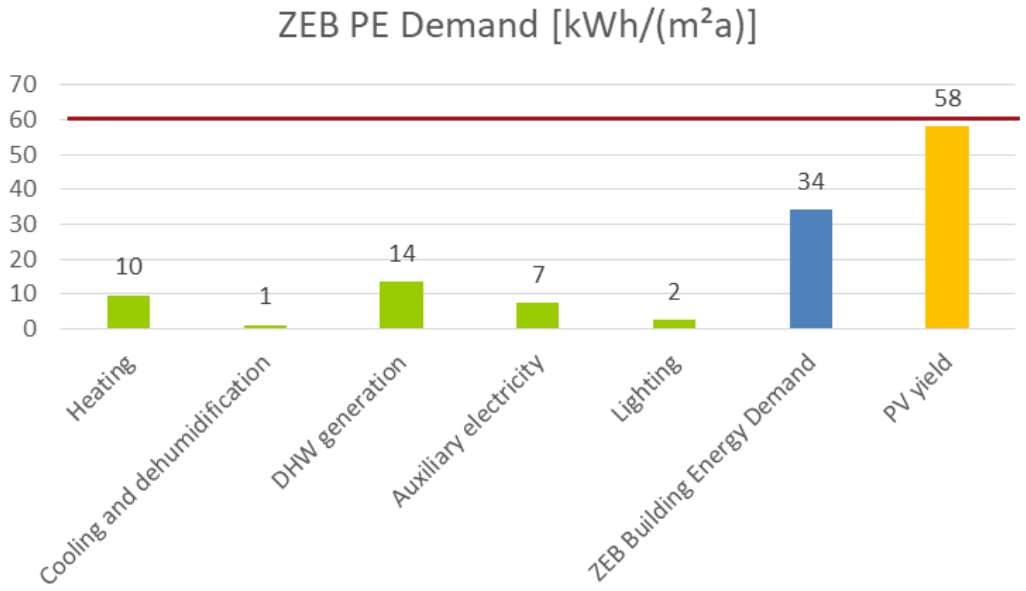


Threshold PE Demand
< 60 kWh/(m²a)

PE demand is below threshold and
PE demand can be fully covered by PV

Zero Emission Building - Potential

Passive House / Heating Demand 15 kWh/(m²a)



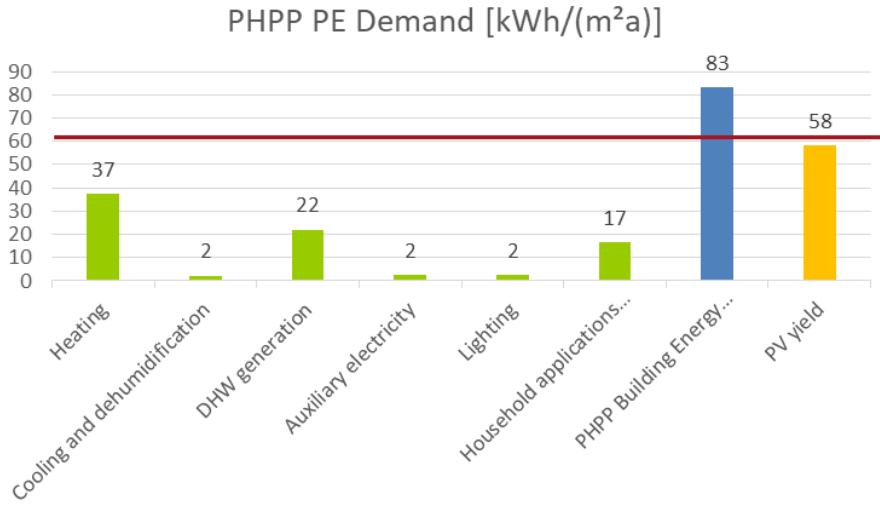
Threshold PE Demand
< 60 kWh/(m²a)

PE demand is almost at 50% of threshold
And can be fully covered with PV

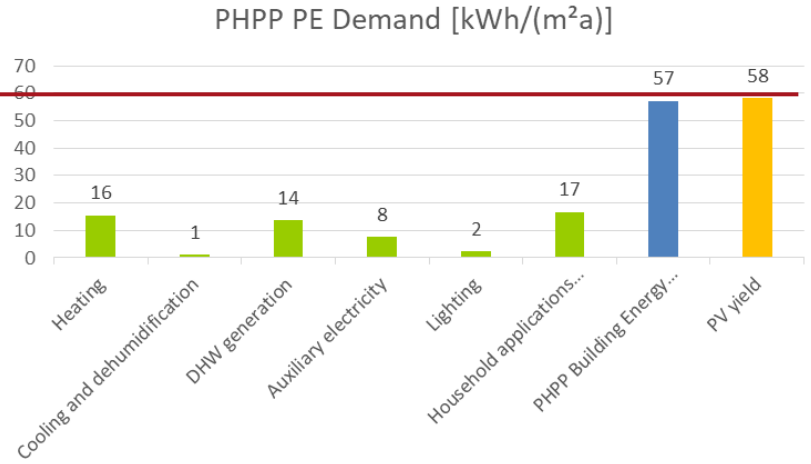
ZEBs including household applications

PE demand GEG / EnerPHit WITH household applications

GEG renovation



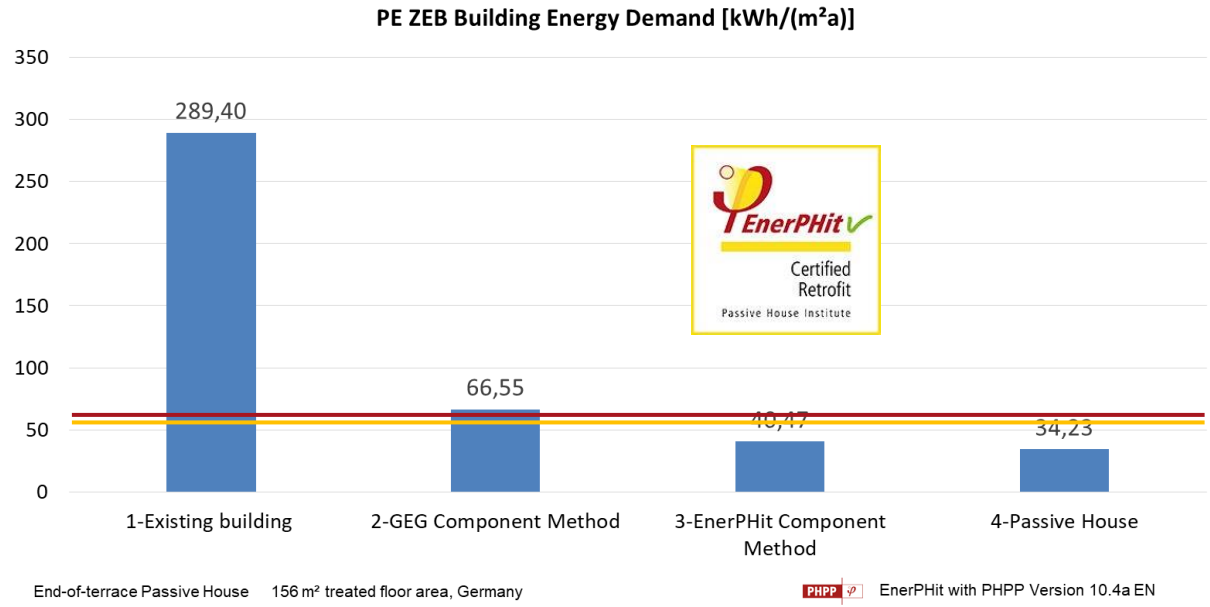
EnerPHit renovation



PE demand of EnerPHit renovation is still below the threshold and can be fully covered with PV with the EnerPHit standard

Conclusion for EnerPHit in Germany

EnerPHit and Passive House below the threshold



Threshold PE Demand
< 60 kWh/(m²a)

PV yield
= 58 kWh/(m²a)

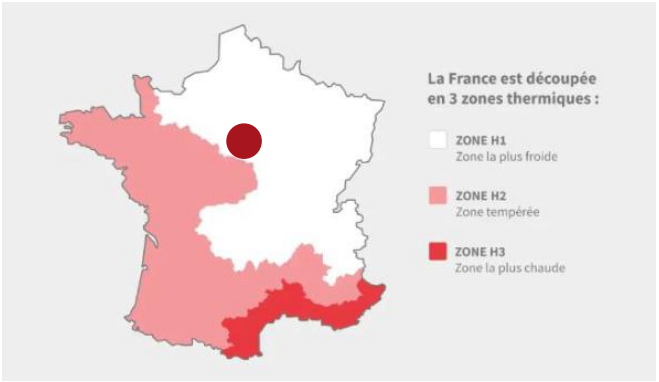
With Passive House AND EnerPHit, ZEB can be achieved, as long as enough RES are available to cover the demand

Retrofit standards in different countries

- Germany: **GEG** / 1 climate zone (reference city Potsdam) with the same requirements for the whole of Germany / $PE_{electricity}$ = 1,8
- France: **RT existant** / 3 climate zones + requirements / $PE_{electricity}$ = 2,6
- Spain: **CET** / 5 climate zones with different requirements, zones partially depending on altitudes / $PE_{electricity}$ = 2,01

Potsdam

Paris

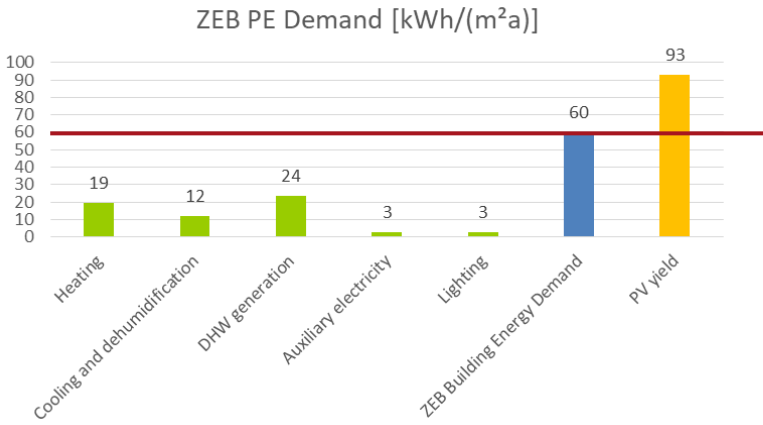


Madrid

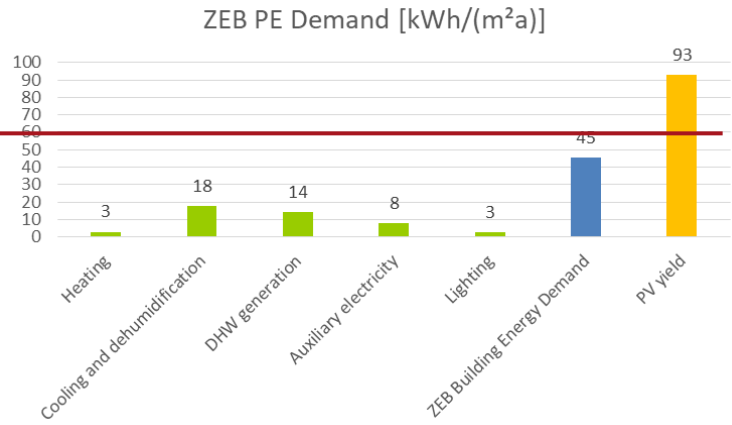
Renovation in Spain

Renovation of the building in Madrid / Zone D

CET / Spanish regulations Zone D



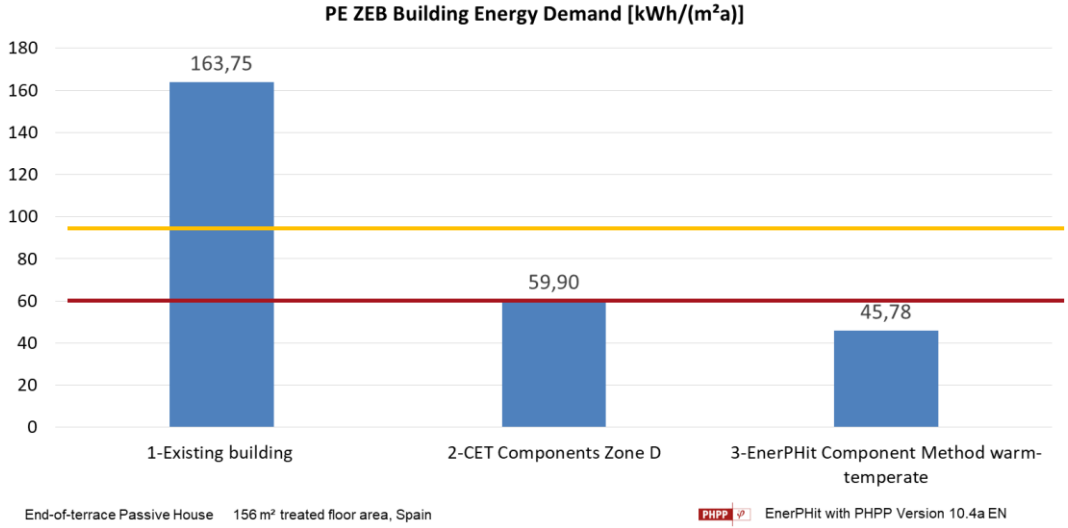
EnerPHit / Warm-Temperate Climate



With both, the national standard and with the EnerPHit standard, the ZEB requirements should be achievable

Spain: ZEBs through high PV yield

PE demand CET / EnerPHit in Madrid



PV yield
= 93 kWh/(m²a)

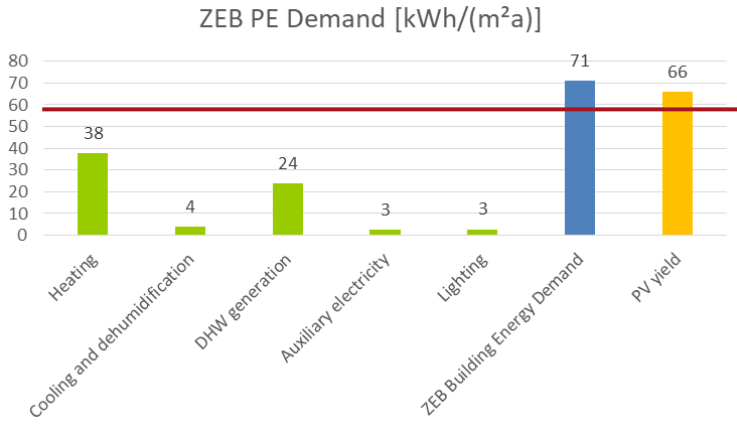
Threshold PE Demand
< 60 kWh/(m²a)

In the Spanish climate, the PV yield is considerably higher than the threshold.

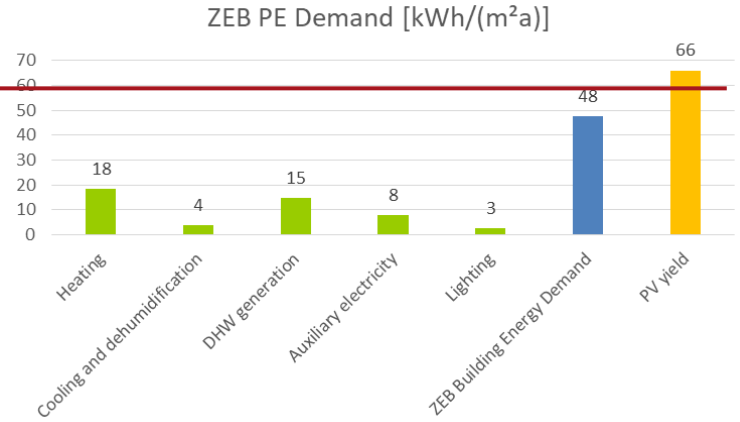
Renovation in France

Renovation of the building in Paris / Zone H1

RT existant / French regulations Zone 1



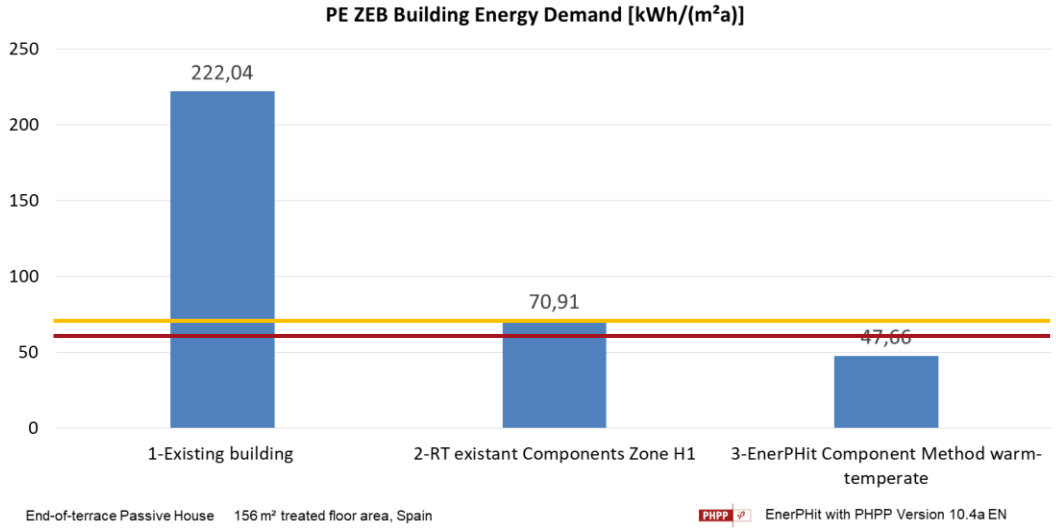
EnerPHit / Warm-Temperate Climate



With the EnerPHit standard, the ZEB requirements can better be achieved

France: PV yield higher but windows

PE demand RT existant / EnerPHit in Paris



PV yield
= 66 kWh/(m²a)

Threshold PE Demand
< 60 kWh/(m²a)

In the France, the PE demand threshold is only fulfilled with the EnerPHit renovation

What makes EnerPHit different?

EnerPHit windows are always better!

In Germany:
EnerPHit components are consideraly better

In France:
Opaque components are even better than EnerPHit

			Frankfurt		Paris	Madrid	
			Germany	**EnerPHit**	**France**	**Spain**	**EnerPHit**
Building standard	**Unit**	**Existing building**	**GEG**	**Cool**	**RT Existant**	**CTE**	**Warm**
			Table	**Temperate**	**Zone**	**Zone**	**Temperate**
Building component			**7**	**Climate**	**H1**	**D**	**Climate**
U-Value External wall	[W/(m²K)]	1,38	0,24	0,15	0,31	0,41	0,30
U-Value Roof	[W/(m²K)]	0,52	0,20	0,15	0,22	0,35	0,30
U-Value Basement ceiling	[W/(m²K)]	0,72	0,30	0,24	0,33	0,65	0,50
U-Value Windows	[W/(m²K)]	1,55	**1,30**	**0,80**	**1,90**	**1,80**	**1,00**
Effective heat recovery efficiency	%	0%	**0%**	**75%**	**0%**	**0%**	**75%**
Airtightness	1/h	5,0	**3,0**	**1,0**	**3,0**	**3,0**	**1,0**
Heat generation		Gas boiler	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump

EnerPHit requires ventilation with HR!

EnerPHit achives (better) airtightness!

Conclusions

- With **EnerPHit**, it should already be possible to achive ZEB standard in deep renovation projects in many cases, in several countries
- At least the **Primary Energy Demand threshold of 60 kWh/(m²a)** can be achieved for average buildings
- If the compensation of the PE demand by renewables can be achieved, **depends considerably roof area and on the size and compactness** of the buildings

- National requirements may be able to achieve the PE threshold in the warmer climate of Spain, bot not in Germany or France
- Qualities like **high performance windows** (U-values at around 1,0 W/m²K, for Germany better still), **better (quality assured) airtightness** and especially **ventilation with heat recovery** would help national standards to better achieve the energy demand requirement set out by the EPBD recast

to be tested in 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

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

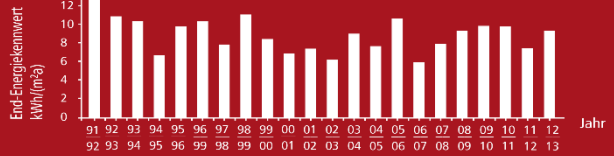

CS07_Bagnères / FR

Thank You

for your attention

The EnerPHit standard

- ☑ High comfort
- ☑ Highly efficient
- ☑ Cost effective
- ☑ Sustainable
- ☑ Approved
- ☑ User friendly
- ☑ **ZEB**-ready



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outPHit

Deep retrofits made faster, cheaper and more reliable

outPHit pairs such approaches with the rigour of Passive House principles to make deep retrofits cost-effective, faster and more reliable. On the basis of case studies across Europe and in collaboration with a wide variety of stakeholders, outPHit is addressing barriers to the uptake of high quality deep retrofits while facilitating the development of high performance renovation systems, tools for decision making and quality assurance safeguards

Find out more at **outphit.eu**

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