



Passive House Institute

Building Certification Guide

Imprint and Disclaimer

Published by

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Scope of content and exclusion of liability

This Guide is intended to supplement to the "Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standards" ("Criteria") published by the Passive House Institute and posted online. It explains the Criteria's requirements given here in a brief and precise manner.

The Guide was compiled with the greatest care and to the best of our knowledge and belief. However, no liability can be accepted for any content-related shortcomings or errors. Any liability for the accuracy and completeness of the contents and data and in particular for any damage or consequences arising from the use of the information presented here is therefore excluded.

Welcome to the Building Certification Guide!

I am delighted that you are interested in the Passive House Institute's building certification quality assurance program. To date, thousands of builders around the world have already certified their buildings as Passive House projects or EnerPHit retrofits. Twenty years of experience shows that the high level of comfort and energy savings associated with these standards is achieved through independent quality testing.

I hope that this first edition of this guide will fully answer your questions about building certification. If you are still missing important information, please do not hesitate to contact us at:

building.certification@passiv.de

I wish you every success in your energy efficient construction or renovation project!



Zeno Bastian
Passive House Institute
Head of Building Certification

Sections one and **two** of this guide are aimed at building professionals and building owners who are interested in energy efficient construction and renovation. They present the energy standards of the Passive House Institute and explain the advantages and process of building certification.

The **third section** serves the Designers and Consultants as an aid in the certification process. It explains clearly what is meant by the precise requirements in the certification Criteria and what types of documents can be submitted as proof. However, the Guide does not replace the Criteria published on the website of the Passive House Institute. These remain the legally valid definition of the Passive House and EnerPHit Standards.

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1. Introduction

Benefits of certification

Quality assured!

During the building certification process, the **detailed planning** is carefully and comprehensively examined. Supporting documents from the **construction**, such as the airtightness test, complete the quality control. A certificate is only issued if the exact **Criteria** as defined are met without exception.

- Passive House Standard. **Construction costs** can be saved this way.
- With a **plaque** on the building's facade, the high efficiency Standard can be made visible to the public.

Advantages for the Designer


- **Prevention of errors** due to thorough external checking of planning prior to the start of construction.
- Recognition as a **Certified Passive House Designer** is possible by submitting a certified building.

Advantages for the owner

- Certainty that the **agreed-upon energy standard** will actually be achieved.
- **Increase in property value** through independent quality assessment.
- The reviewed energy balance using the Passive House Planning Package (PHPP) can be submitted for various **subsidy programs**.
- The Certifier can spot energy-saving measures which would be too costly and go above and beyond what is required for the


Certificate

Certified Passive House Premium



Passive House
Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany

End-of-terrace Passive House
Example Street 99, 99999 Example City, Germany



Client	Passivhaus Association of Owners Example Street 99 99999 Example City, Germany
Architect	Example Architectural Firm Example Street 99 99999 Example City, Germany
Building Services	Example Mechanical Services Firm Example Street 99 99999 Example City, Germany
Energy Consultant	Example Energy Consultant Example Street 99 99999 Example City, Germany

Passive House buildings offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned building meets the criteria defined by the Passive House Institute for the 'Passive House Premium' standard:

Building quality	This building	Criteria	Alternative criteria
Heating			
Heating demand [kWh/(m²a)]	13	≤ 15	-
Heating load [W/m²]	10	≤ -	10
Cooling			
Cooling + dehumidification demand [kWh/(m²a)]	-	≤ -	-
Cooling load [W/m²]	-	≤ -	-
Frequency of overheating (> 25 °C) [%]	1	≤ 10	
Frequency of excessively high humidity [%]	0	≤ 20	
Airtightness			
Pressurization test result (n ₅₀) [1/h]	0,2	≤ 0,6	
Non-renewable primary energy (PE)			
PE demand [kWh/(m²a)]	40	≤ -	
Renewable primary energy (PER)			
PER-demand [kWh/(m²a)]	32	≤ 30	32
Generation (reference to ground area) [kWh/(m²a)]	125	≥ 120	124

The associated certification booklet contains more characteristic values for this building.

Darmstadt, 01. June 2017
Certifier: John Smith, Passive House Institute

www.passivehouse.com

Energy Standards



Solin-AWW Architektur Werkstatt Valentin U. Jakob, Kanzleiter



LCT One Domborn picture: Norman A. Müller

Passive House

More comfort – less energy

Passive House buildings are characterised by particularly high levels of comfort with very low energy consumption. This is achieved primarily through the use of Passive House components (e.g. Passive House windows, insulation, heat recovery). From the outside, Passive House buildings do not differ from conventional buildings, because "Passive House" means a standard and not a particular type of construction.

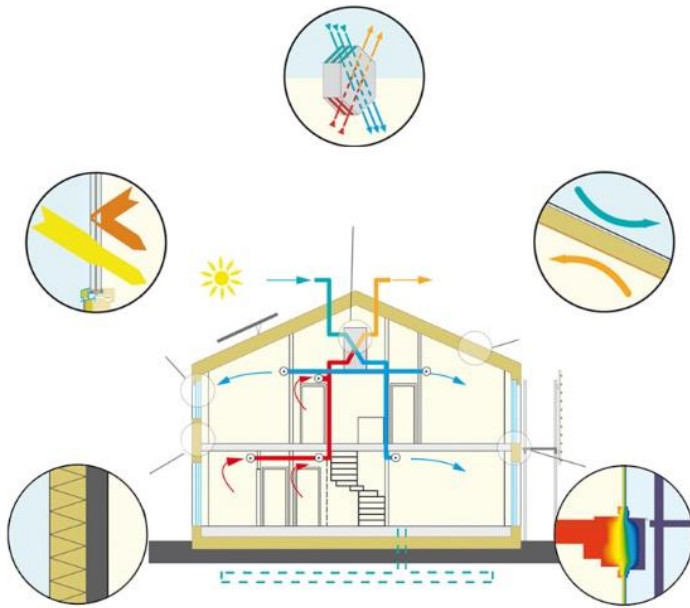
Why Passive House?

- Excellent levels of comfort
- Consistent fresh air all throughout the building
- Structurally-sound and durable construction
- Extremely low energy costs - even with rising energy prices
- Improved indoor air quality and hygiene
- Passive House buildings are eligible for subsidies in many countries / regions



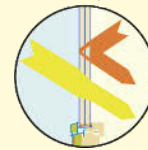
The Passive House Standard can be used worldwide.

Necessary measures differ depending on the local climate. Typically, the following 5 measures lead to the Passive House.



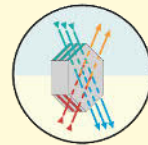
Five key principles

Passive House windows



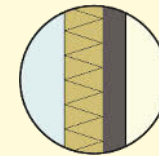
In temperate and cold climates, triple-glazing and insulated window frames ensure heat gains in winter. In warmer climates, double glazing is usually sufficient.

Adequate ventilation strategy



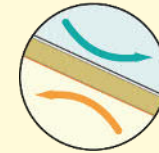
Passive House buildings are supplied with consistent fresh air via the ventilation system. The heat exchanger ensures that air is supplied to rooms at nearly the room temperature without the need for additional heating – cold and heat remain outside.

Thermal insulation



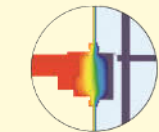
A well-insulated building keeps warmth in during winter and heat out during summer.

Airtightness



A Passive House building has a continuous airtight outer shell. This protects the building structure, prevents energy losses and improves comfort.

Thermal bridge reduced design



Especially in temperate and cold climates, Passive House buildings are planned without thermal bridges. This ensures even lower heating costs and prevents building damage.



EnerPHit

Passive House benefits also in existing buildings



The Passive House Standard cannot always be achieved in building renovations at a reasonable cost. This is due, for example, to unavoidable thermal bridges through existing basement walls. The Passive House Institute has developed the EnerPHit standard for such buildings.

The EnerPHit seal provides the certainty that an optimum thermal protection standard has been implemented for the respective existing building. Through the use of Passive House components, EnerPHit certified buildings offer nearly all the advantages of a Passive House building to the residents - while at the same time offering optimum cost-effectiveness.

An EnerPHit retrofit includes the insulation of the floor, exterior walls and roof with Passive House insulation thicknesses, installing Passive House windows and reducing air leaks. A ventilation system with heat recovery ensures reliable fresh air. Thermal bridges are reduced to a reasonable extent.

The Passive House Institute offers the [EnerPHit Retrofit Plan](#) for step-by-step refurbishments, as well as quality assurance through a pre-certification.

PHI Low Energy building

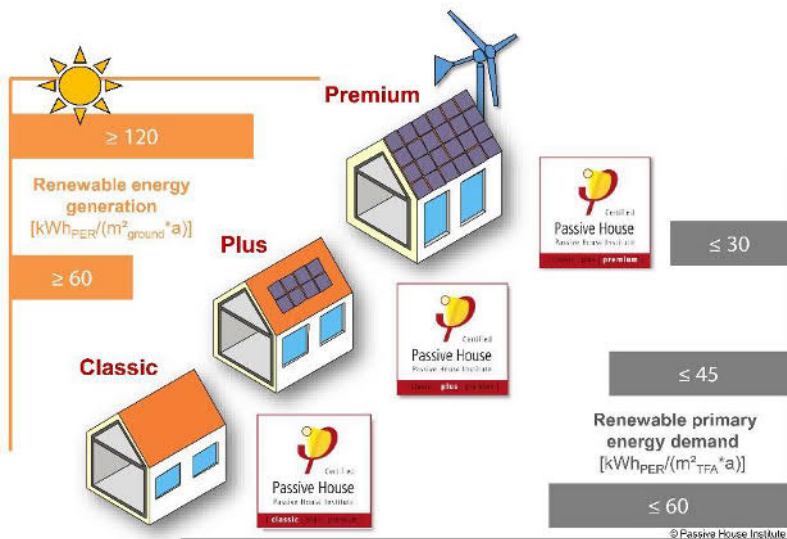
For the difficult cases



The PHI Low Energy Building Standard is suitable for buildings which, for a variety of reasons, may not quite reach the stringent Passive House Criteria:

- Small buildings in cold and shaded locations
- Countries in which suitable Passive House components are not yet fully available
- Buildings that aim for but miss the Passive House Standard due to errors in planning or execution

The requirements for energy demand, airtightness and comfort are lower than for Passive House buildings. The required documentation is the same as for the Passive House Standard, so that certification provides accurate assessment of the building's energy demand.



With "Plus" and "Premium" ready for a renewable energy future

The low energy demand of Passive House buildings can be easily supplied with renewable energy.

The Passive House Institute has developed an innovative method to optimize buildings in planning for the use of renewable energy. The benchmark for this is the need for renewable primary energy or PER (see box). The lower the PER demand, the less is the effort and the space required for solar energy or wind power to supply the building. In this way, the full renewable supply can be realized cost-effectively and in a way that is environmentally friendly

In addition to the tried-and-tested Passive House Classic Standard, buildings that have a particularly low PER demand and additionally produce renewable energy (for example with photovoltaic panels on the roof) can reach Passive House Plus or even Premium. Analogously, the EnerPHit classes Classic, Plus and Premium are available for retrofits of existing buildings.

The PER-method and the Passive House classes can be found [here](#).

Sustainable energy supply with the PER process

The supply of renewable energy naturally varies depending on solar radiation, wind strength and precipitation. For a future supply with 100% renewable energy, some of the generated electricity must be stored temporarily. This energy storage process invariably results in losses. Particularly in seasonal long-term storage e.g. the generation of storable methane gas, only about one third of the original energy is available. The PER demand expresses how much renewable energy has to be generated originally to cover the entire energy demand of a building. It also accounts for the storage losses.

Example: In regions remote from the equator electricity generated by photovoltaics is highest during summer. However, the energy demand for heating is greatest in winter. A low heating demand, as typical for Passive House buildings is therefore particularly useful in order to avoid storage losses and thus achieving a low PER demand.

Criteria

Transparent, clearly defined requirements

The Passive House Criteria were defined by the Passive House Institute 20 years ago. They precisely define the different requirements which a building must fulfil in order to achieve the highly efficient Passive House Standard. In addition to the Passive House Standard, the current document containing the Criteria also includes the EnerPHit Standard that was introduced in 2010 for building retrofits using Passive House components and the requirements for a PHI Low Energy Building which were introduced in 2015.

Anyone buying or commissioning a house built to one of these three standards should always expressly demand a **building in accordance with the definition set out by the Passive House Institute** – preferably with certification. This will ensure legal certainty in case of conflict.

The English version of the Criteria can be found [here](#).

Translations can be found [here](#).

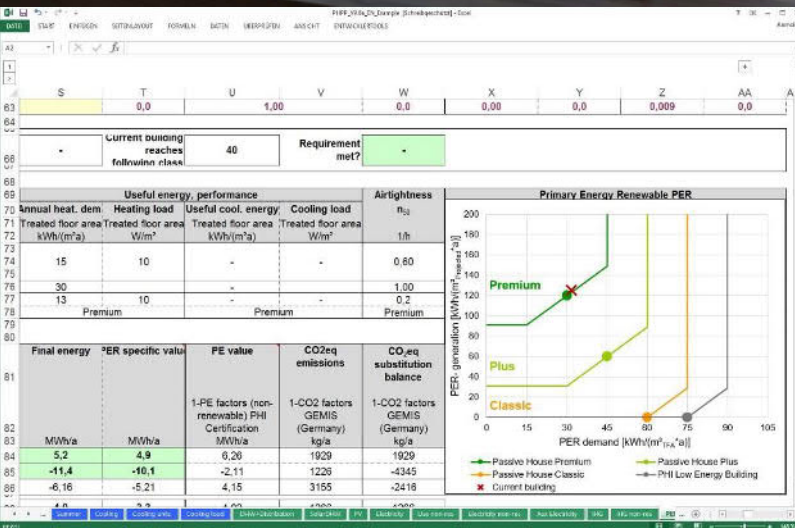
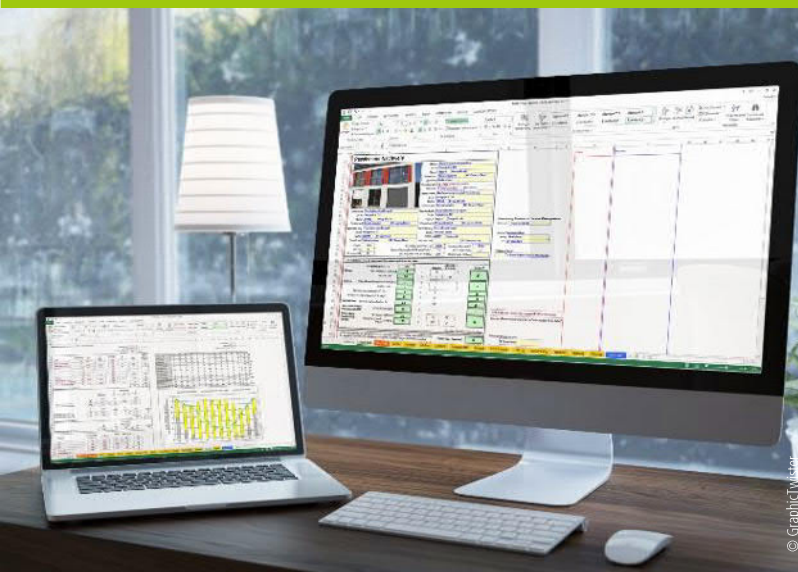
Where can I find the Criteria?

The latest version of the document "**Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard**" ("**Criteria**") is always available on the Passive House Institute website. The German, English and Spanish versions are published directly by the Passive House Institute. These represent the legally valid definition of the Passive House Standard.

International partners of the Passive House Institute have prepared translations of the Criteria in other languages on their own responsibility. Since the Passive House Institute does not check all these translations, they are only intended as information and in case of doubt are not legally binding. Translations may not necessarily contain the latest version of the Criteria.

In principle, certification will take place according to the currently valid version of the Criteria applicable at the start of the planning. New versions of the Criteria that are published during the course of the project do not have to be adopted.

Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard



Outline of the Criteria

The Criteria consist of two main parts besides the introduction: the actual Criteria and the "Technical regulations for building certification".

The requirements for the Passive House, EnerPHit and the PHI Low Energy Building Standards are fully specified in Section 2 "**Criteria**". In addition, this section also contains general minimum requirements for thermal comfort, user satisfaction and structural integrity that are not energy-relevant and which apply equally for all three standards.

Furthermore, the boundary conditions which are to be applied in the PHPP for verification of the three Standards are specified here – for example with reference to the indoor temperature or the hot water demand. Section 2 can also be used as a definition of the three Standards irrespective of certification, e.g. for a building specification.

Section 3 "**Technical Regulations for Building Certification**" describes how verification of compliance with the Criteria takes place in the context of certification. Besides specifying the testing procedure, in particular it also contains a list of all the documents to be submitted to the Certifier.

Verification using the Passive House Planning Package (PHPP)

Compliance with the Criteria is verified specifically through the energy balance calculation using the PHPP. The PHPP automatically checks whether all requirements of the chosen Standard are complied with ("Verification" worksheet).

Because additions or minor adjustments are made to the Criteria from time to time, you must make sure that the Criteria are verified using the **appropriate version of the PHPP**. The version number can be found in the footer of the Criteria. The first digit of the version number of the PHPP and Criteria should be the same. For example, Version 9f of the Criteria is compatible with the PHPP Version 9.6, but is not compatible with PHPP Version 8.2.

Passive House Certifiers



The Passive House Institute itself provides certification in Germany, Austria and internationally. In addition, there are many accredited Passive House building Certifiers globally. These are contractually authorised by the Passive House Institute to perform certification using its seal and in accordance with its standards. Most certifiers operate mainly in their respective countries. In principle however, any Certifier may certify buildings in any other country if they know the language well and have the necessary expertise. There is no national monopoly for a specific Certifier.

The accredited Certifiers have extensive practical experience relating to Passive House buildings, supplemented by intensive two-stage training.



The exact requirements for becoming a Certifier can be found [here](#).



Passive House building Certifiers course, Darmstadt 2017

Passive House building Certifiers meeting, Darmstadt 2016

First steps



Which Certifier should I choose?

Certification can be done by the Passive House Institute or one of the accredited Certifiers. A full **list of all Certifiers** with contact data can be found on the Passive House Institute's website. If possible, it is advisable to engage a Certifier in your own country as they will be more familiar with the local construction technology and statutory provisions. In principle however, Certifiers from other countries may also be engaged. The languages in which certification can be performed are stated in the list of Certifiers.

The list of accredited building Certifiers can be found [here](#).

Request a quotation

If you have chosen a Certifier, you can contact them via e-mail or telephone and request an offer for the certification of your building. The Certifier will usually ask you for the following information, on the basis of which they can calculate an offer:

- Useful area of the building
- Approximate time schedule of the construction project

- Initial energy balance with the Passive House Planning Package (if available)
- (preliminary) design plans (floor plans, cross-sections, elevations)
- Brief project description (use, construction type)
- Total construction costs
- What previous Passive House experience do the Designers (architects and building services engineers) have?
- Other special features of the project

If the quotation corresponds with your expectations, you can engage the Certifier.

How much does certification cost?

There are no centrally fixed prices for certification. Each Certifier calculates their offer so that the expected expenses for meticulous checking of the respective building are covered. In addition, a modest fee is included in this calculation which every Certifier pays to the Passive House Institute to cover expenses for the on-going support and resources that it provides to all Certifiers.

Certification procedure

Each certified building will appear on a world map but the precise address of the building and the owner's name is not included.



Additionally, we recommend that you enter a more exact description of the building in the international **Passive House Database**. This database is often viewed by building owners looking for suitable Designers for their building projects using the reference projects.

Passive House Database:

<http://www.passivhausprojekte.de/>

We strongly recommend that you contact the Certifier at an **early stage of the planning** as any problems identified by the Certifier can still be remedied easily at this point in time. In principle, certification can also be applied for after the building has been completed.

As a rule, all energy-relevant planning documents and technical data of the construction products as well as the completed Passive House Planning Package (PHPP) calculation are to be submitted to the Certifier **before the start of construction work**.

After careful checking and comparison with the energy balance calculation, the Certifier will inform you of any necessary corrections. If all is well, they will confirm that the building will achieve the desired energy standard if constructed according to the planning.

After completion of the construction work, any changes in the building from the planning will be updated in the **final review** of documentation of the construction work (airtightness test, documentation of flow rate adjustment of the ventilation system, construction manager's declaration).

Checking execution of the construction work on site is not a required part of the certification procedure.

Additional quality assurance of the construction work by the certifying authority does however make sense if the construction management does not have any experience with the construction of Passive House buildings or EnerPHit retrofits.

If all Criteria have been fulfilled, the building owner will receive the following:

- The Certificate
- A supplementary booklet with documentation of the energy balance calculation and all relevant characteristic values of the building
- A wall plaque (optional)

The authenticity of the certificate will be confirmed by an identification number that will be specially issued to the Certifier by the Passive House Institute for each building. This can be found in the bottom of the certificate.

Consultancy services and energy balances



	F	G	H	I	J	K	L	M	N	O	P	Q	R
34		Treated floor area m²		156,0		Criteria		criteria		Fulfilled?			
35		Heating demand kWh/(m²a)		13	≤	15		+		yes			
36		Heating load W/m²		10	≤	-		10					
37		Cooling & dehum. demand kWh/(m²a)		-	≤	-		-		-			
38		Cooling load W/m²		-	≤	-		-					
39		Energy of overheating (> 25 °C) %		1	≤	10				yes			
40		Excessively high humidity (> 12 g/kg) %		0	≤	20				yes			
41		Pressurization test result n ₅₀ 1/h		0,2	≤	0,5				yes			
42		Energy (PE) PE demand kWh/(m²a)		40	≤	-				-			
43		PER demand kWh/(m²a)		32	≤	30		32					
44		Generation of renewable energy (in relation to pro- kWh/(m²a) selected building footprint area)		125	≥	120		124		yes			
45													
46													
47													
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Passive House project planning is an important part of the planning for a building. The most important tool for this purpose is the Passive House Planning Package (PHPP). An energy consultant uses PHPP to calculate the building's energy balance and annual demands.

The PHPP model shows exactly which measures will have to be planned and implemented to achieve the Passive House or EnerPHit Standard. For example, these may include the thickness of the thermal insulation and the quality of the windows and ventilation system.

The energy consultant should also make suggestions for building optimisation, e.g. for avoiding thermal bridges. The architect can then use this information in the planning. The design planning and execution planning together with the PHPP calculation are then submitted to the Certifier for checking.

We recommend that one of the more than 5000 **Certified Passive House Designers or Consultants** should be entrusted with the Passive House project planning. They have received training concluding with an examination set by the Passive House Institute. Many Certified Passive House Designers or Consultants have specialised in the construction of Passive House buildings and have extensive practical experience in addition.

The Passive House Institute as well as most of the accredited Certifiers offer consultancy services and Passive House project planning. However, in order to ensure impartial assessment, accredited Certifiers may not certify a building for which the Certifier has also performed project planning.

Search for a Certified Passive House Designer or Consultant [here](#).

Certification Platform

The Certification Platform

Passive House Certifier

1. Creates a Designer account for the project's contact person and additional Observer accounts for other individuals involved in the project
2. Creates a new project and customizes the checklist according to the project characteristics
3. Starts working on the project



Project Design & Construction Team

1. Receives the login information via an automated email from the Certification Platform
2. Accesses the Platform
3. Starts working on the project following the well-structured checklist

The Passive House Institute has created a free, interactive, comprehensive online platform (“**Platform**”) for the Designer and Certifier to use for communication and checking all requirements of the Criteria and their progress towards building certification.

The goal of the online platform is to offer guidance for Designers of Passive House buildings and Certifiers throughout the planning, building and certification processes. In this way, the quality assurance is set to the highest standards, optimizing the decision making process.

One of the key characteristics of the online certification platform is the capability to adapt every project type ranging from new building projects to step-by-step retrofits. This makes it valuable for implementing quality assurance in Passive House and EnerPHit projects.

The Platform is a structured checklist, following an interactive workflow which is charted with comments, reminders and checkboxes. It is designed to improve quality assurance and speed-up the certification process.

The communication between the Project Team and the Certifier is organised around a carefully designed checklist which makes reference to all the important aspects regarding the two main focus areas: energy efficiency and quality assurance.

With a step-by-step retrofit project, every action must be correctly scheduled and carefully recorded in order to allow and optimize future improvements. The Online Certification Platform centralises the information, allowing the team to establish the optimal retrofit steps. When the time comes for the next refurbishment step, the information regarding work already completed is available on the Platform, regardless if the team changes.

The Online Certification Platform is the backbone of the entire information exchange which takes place during the certification process between the Designer and the Certifier. It also creates a record of the process.

How does the Platform work?

The Dialogue Bar

This is the main communication method between the Certifier and the Designer.

When you have general comments regarding the project (for example: "Dear Designer / Certifier, I checked your uploads and I made comments in the Ventilation section. Please check."), you write them in the **Dialogue Bar** and click on "**Submit!**" (at the bottom of the page).

The Designer will receive a notification email containing the message on the **Dialogue Bar**.

Keep in mind that any other modifications or comments made to the **Checklist** will not automatically send a notification to the Designer. This happens only when you write in the **Dialogue Bar** and click "**Submit!**".

The Progress Bar

This offers a general visual overview of the project's status.

The Interactive Checklist

This is the place where you can upload documents, and make comments on submitted data. If the information submitted by the Designer / Certifier is not complete or correct / up-to-date, you can write a comment and / or upload a new document.

Project name

Project information

Dialogue bar

Progress bar

Interactive checklist

Certification Platform by Passive House Institute [English] [Deutsch] [español]

Hello gradeva! Logout

EXAMPLE PROJECT

You are certifier of this project. [Change this project...](#) [Delete this project...](#)

Project information

Project id	2017-01_177_DE_Gergina_Radeva_EXAMPLE PROJECT
Passive House or EnerPHit:	Passive House
Use	residential
Type of project	EFH
	Example street 1
	12345 Example city
	Hessen
	Germany
Certifier	Gergina Radeva (gradeva)
Designer	at aset (test)
Observers	
Project checklist created on	Jan. 17, 2017, 2:35 p.m.

Obsolete content and buttons for adding and deactivating items:

Show: ☐

Dialogue bar

Send notification (the message will be sent also by e-mail):

Message:

Source: [icons]

Styles: Normal Font Size A- A+ [icons]

body: Hi! I've just uploaded the last version of the [

Progress: 34.5 %

- 1. Passive House Planning Package (PHPP)
- 2. Planning documents for architecture
- 3. Standard and connection details
- 4. Windows/doors
- 5. Ventilation

Validation / notification

Write comments

Upload documents

Checkboxes with assignments / questions

Subcategory

Category

Interactive checklist

Progress: 34.5 %

1. Passive House Planning Package (PHPP)


1.1 Completed PHPP as *.xls file

Please check the corresponding checkboxes and upload the PHPP.

☒ Okay by designer

☒ Okay by certifier
☐ Notify designer

• Wed, 8 Mar 2017 16:22:45 +0100 gradeva:

◦  177/PHPP_V9.6a_EN_Example.xlsx

• New comment:

Durchsuchen... Keine Datei ausgewählt.

- ☒ 1.1.1 Have you made sure that the PHPP corresponds with the submitted documentation?
- ☒ 1.1.2 Are all the criteria for certification met?
- ☒ 1.1.3 Generally you should use the newest PHPP available, when the Client signed the contract with the Certifier. Have you done this?
- ☐ 1.1.4 Have additional worksheets been added to PHPP?
- ☒ 1.1.5 PHPP/Verification Sheet. Have you entered all information on the building, adress, type, use, construction year?
- ☒ 1.1.6 PHPP/Verification Sheet. Have you entered all information on building owner, architect?
- ☒ 1.1.7 PHPP/Climate. Does the chosen climate correspond to the site?
- ☒ 1.1.8 PHPP/Climate. Is the Climate Data validated by the Passive House Institute?
- ☐ 1.1.9 Other questions you find suitable

1.2 EnerPHit Retrofit Plan

1.3 Map Link

2. Planning documents for architecture

3. Standard and connection details

4. Windows/doors

5. Ventilation

6. Heating/ Cooling + Plumbing

7. Electricity

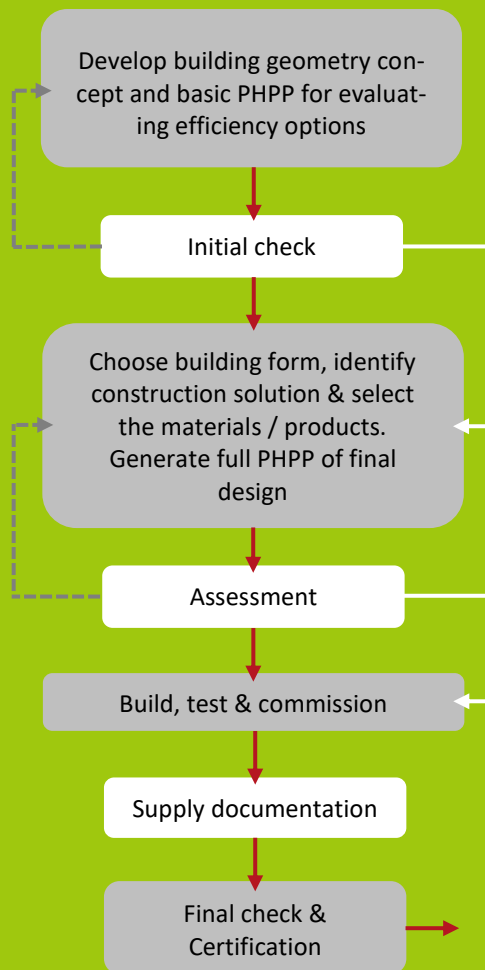
8. Renewable energy

9. Construction phase

Submit

Using the Certification Platform

Project Design & Construction Team



1. Login and check for new updated documents / comments from the Certifier. The items that have been completed / modified by the Certifier are marked with a yellow exclamation mark. ⚠️

2. Write your comments and upload documents in the Checklist, tick **"Notification seen"** (if applicable) and **"Notify Certifier"** where needed and click on **"Submit!"**. This will add a small exclamation sign next to the item, in the Checklist, which the Certifier will see when he logs onto the Platform. This way the Certifier will know exactly which item from the Checklist has been updated with new information.

If the Designer considers an item to be solved he can tick the **"OK by Designer"** box. The Certifier will see a yellow question mark 🟡 in front of the marked Item, which helps him identify the information pending for approval.

3. Write your message in the **"Dialogue Bar"**, containing a short summary of the new modifications / remarks on the project and click **"Submit!"**.

The Designer can log in and follow the same working protocol as the Certifier with small exceptions:

- the Designer is not able to modify the structure of the Checklist;
- the Designer is not able to declare an item solved (and turn on the green light).

Meaning of the icons

How to hide old documents / comments?

In order to keep record of the workflow the Platform does not allow files to be deleted, only to be hidden. You can do that by declaring them "**Obsolete**".

Click on "**Show tools**" > Navigate to the documents / comments you want to hide > Tick the "**Obsolete**" checkbox > Click "**Submit!**".

Important! Before completing the certification all the old and not valid documents should be declared "**Obsolete**".

We are constantly improving the Platform therefore, any feedback / remarks are welcome. Please report bugs and make improvements / suggestions on our bug tracker. The link is provided on the Platform, at the bottom of every page.

You can also contact us at the following address:

building.certification@passiv.de



This item has not been solved yet.

Not all items in this project, category or sub category have been solved yet, and there is no item that has been checked as "**Ok**" by the Designer.



The Certifier or Designer wants to notify the other that he or she should take a look at this project, category or sub category to check out an item where information has been updated. This sign appears after ticking the "**Notify Designer / Certifier**" box and when you tick it, it is visible only to the other person.

Keep in mind! The documents / comments will not be uploaded on the platform unless you click on the "**Submit!**" button.

A notification email will be sent only when you have written something in the **Dialogue Bar**.



This item has been marked as solved by the Designer (**Ok by Designer**), but not yet approved by the Certifier.

At least one item in this category or sub category, marked with this sign has been solved by the Designer (**Ok by Designer**), but not yet approved by the Certifier. This way the pending items can easily be found by the Certifier in the **Checklist**.



This item has been approved by the Certifier.

All items in this project, category or sub category have been approved by the Certifier.

3. Documents to be submitted



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© komfovent

The documents that must be submitted to the Certifier are listed in the section on "**Documents to be submitted**" in the Criteria. Among other things, these include the plans for the building envelope and building services and technical data sheets for the energy-relevant products. The Certifier will check whether the submitted documents contain the information required for verification and whether they correspond with the input in the PHPP. The section order in this chapter matches the section order of the Criteria and the one of the Certification Platform.

Meticulous planning is absolutely essential for implementing high quality construction work on site to achieve Passive House buildings and EnerPHit retrofits. If planning is **meticulous**, not only success is likely, but all the documents that are necessary for certification will already be present and these will only need to be submitted to the certification platform. The Designer's work assembling and uploading the documentation will be relatively easy.

Submitting documents digitally

All documents are submitted digitally via the **Platform** – unless the Certifier has agreed otherwise. Signed documents such as the Blower-Door report will be uploaded as a scan.

Certified Passive House components

The extensive use of Passive House components facilitates planning and certification because independently **certified energy relevant characteristic values** for the PHPP calculation are available for these. In principle, the installation of non-certified products is permissible; however, in this case it may be time-consuming or difficult to provide reliable proof of the characteristic values.

Certified component database:

<https://database.passivehouse.com/en/components/>

Plans

All plans are to be submitted in a **file format** that can be read by the Certifier, usually as a .pdf, .dwg or .dxf file. These must be to scale and must include all necessary **dimensions** for determining the areas (cubic measures, envelope surfaces, uninstalled window opening sizes). All area sections of the façade, windows etc. that are entered in the PHPP must be easily identifiable in the plans. If necessary, additional markings (in colour) and labelling or position numbers should be added to the plans.



Passive House Planning Package (PHPP)



Whether a building achieves the energy standard defined by the Passive House Institute is always verified by means of an energy balance calculation using the PHPP. At the same time, the PHPP is an accurate, well organized energy efficiency planning tool for architects and specialised planners.

The energy demand calculated with the PHPP was compared with the measured energy consumption for a large number of buildings – and found to be in excellent agreement. The PHPP is used worldwide and is now available in over 20 languages. As an addition to the PHPP, the 3D planning tool designPH facilitates design modelling and data input.

Passive House Designer also includes a PHPP basic course.

Compliance with the Criteria must be verified using the latest version of the PHPP available when planning started. However, transferral to a newer version introduced after the planning process started is not necessary. The PHPP calculation should be submitted as an Excel file (not as a printout or a .pdf file).

PHPP-Workshops can be found [here](#)

PHPP and **designPH** can be purchased [here](#)



Preparing the energy balance for the building using the PHPP

We recommend that a **Certified Passive House Designer** should be entrusted with the preparation of the PHPP calculation for your building. In principle however, anyone who is sufficiently qualified can prepare a PHPP calculation for certification. Participation in a **PHPP Workshop** is recommended if you do not have any experience in using the PHPP. Training as a certified



The energy balance and design tool for efficient buildings and retrofits



PHPP: Rules for certification

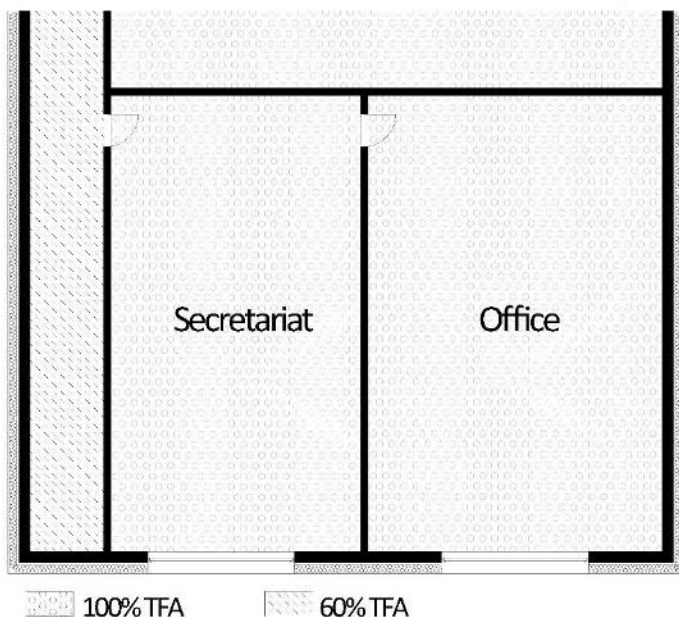
For certification, all PHPP worksheets that are relevant for the respective building must be filled in. PHPP worksheets with calculations that are not relevant for the building may remain empty of course – for example the worksheet "Cooling units" will remain empty if the building is not actively cooled.

The Criteria specify boundary conditions for the PHPP calculation, which must be applied. As a rule, these are already pre-set in the PHPP and may not be changed without consultation with the certifier.

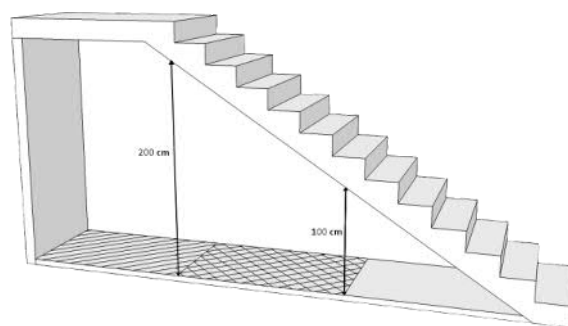
Similarly, for certification, the methods described in the PHPP Manual must be adhered to. For example, in the manual it is described how the treated floor area should be calculated.

Because the PHPP is an Excel file, in principle the user has the option of changing the mathematical formulae. This allows for greater flexibility of the calculation, for example in the case of buildings with special uses. However, this must always be agreed upon with the certifier. For buildings with common uses such as residential buildings, offices, and schools, formulae generally do not need to be changed. The certifier usually exports the values into an empty PHPP file prior to checking in order to exclude any manipulation of the formula

Architectural planning documents



Example rooms / access areas in non-residential buildings



TFA stairs

File formats and reference to the PHPP

As explained on [page 26](#), dimensions and other values inserted in PHPP must be clearly set out in plans and other supporting documentation so the Certifier can easily and quickly find them.

In particular, plans and optional other supporting files (e.g., Excel calculators, CAD drawings, etc.) must support and calculate these three important measurements: treated floor area, the volume for air leakage testing, and the volume for ventilation rates.

Treated floor area

The treated floor area (TFA) is approximately equivalent to the net usable floor area. This is the **reference area** on which all the characteristic values for the energy demand in the PHPP are based. This means that the total energy demand e.g. for space heating is divided by the number of square metres of treated floor area, which results in an area-specific value. In this way, identical limit values can be specified for buildings of varying sizes and it is easy to compare buildings with each other.

Careful ascertainment of the TFA is absolutely essential as it is the denominator in calculating the area-specific values of the Criteria. If the Certifier calculates a smaller TFA, those area-specific values increase, and the building may not meet the Criteria or be certified.

The rules for determining TFA are described in the PHPP Manual in the section relating to the "Areas" worksheet. The calculation must be documented with dimensions and calculations for every room, either in the PHPP worksheet "Areas" or as a separate spreadsheet. The names of rooms used in this calculation sheet must correspond with the names used in the floor plans.

Example plans

Site plan

Neighbouring buildings including their height and distance to the proposed building must be represented on the site plan if they shade the building. Show topography if possible.

Angle of deviation from North

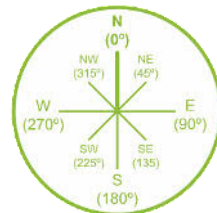
Neighbouring vegetation or / and any other elements which shade the building, including height and type of vegetation (e.g. coniferous or deciduous)

Graphic identification of the building envelope intended for certification



J Passive House, Romania | blipsz architecture

See page 26 for acceptable file formats and general requirements



Scale:

1:200

Angle of deviation
from North:

206°

Complete address:

Passive House str. 1

Passive City, 12345

Geographic coordinates:

44 °00'N, 25°30'E,

Height above the sea level:

+/-0.00=556.0m

Floor plan

Cross section

Dimensions

Clear and accurate representation of walls, windows, and doors

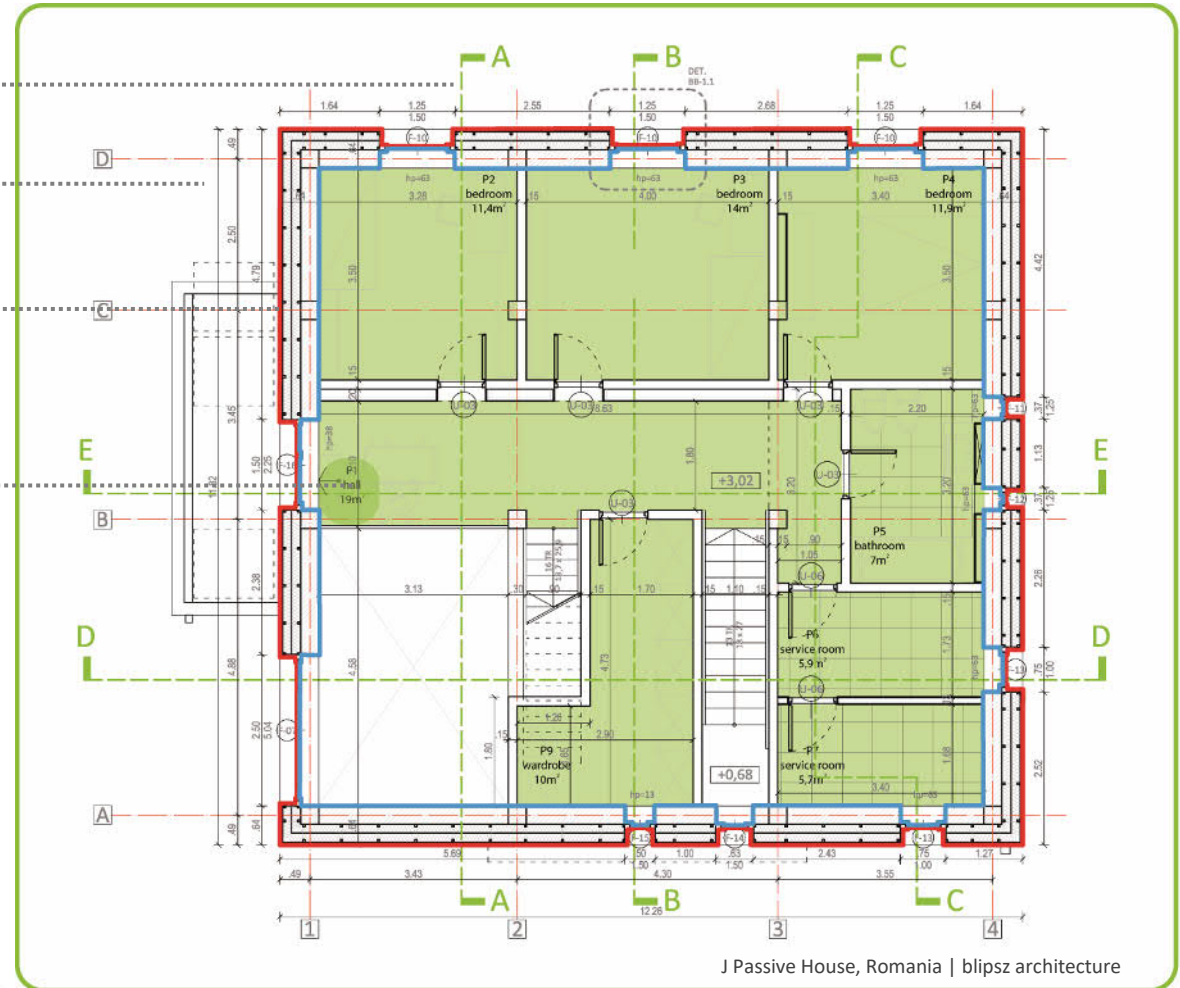
Graphic identification and calculation of each assigned TFA together with the surface calculated, and code names and the percentage used in the calculation

Graphic identification of areas where the room height is below 1 m or 2 m to support TFA calculation

Any unconditioned (i.e. non-heated) adjacent spaces must be marked and named accordingly

Scale:
1:50
or
1:100

See page 26 for acceptable file formats and general requirements



Graphic identification and external dimensions of the thermal envelope

Graphic identification of the airtight layer

Section

Roof build-up 1

30 mm roof vegetation
40 mm extensive soil layer
Metal profile
Geotextile membrane
70mm 15-30 g gravel
Drainage layer
Mechanical protection layer
Synthetic waterproof membrane, resistant to root penetration
200 mm thermal insulation EPS + slope
EPS
200 mm thermal insulation EPS
Diffusion and vapour barrier membrane
130 mm reinforced concrete slab
Gypsum board ceiling

Correct representation of walls, windows, doors, roofs, and floor

Description of each envelope assembly (including mixed layers, e.g.: wood/insulation) with their features: manufacturer and product, thickness, thermal conductivity

Dimensions

Scale:

1:50

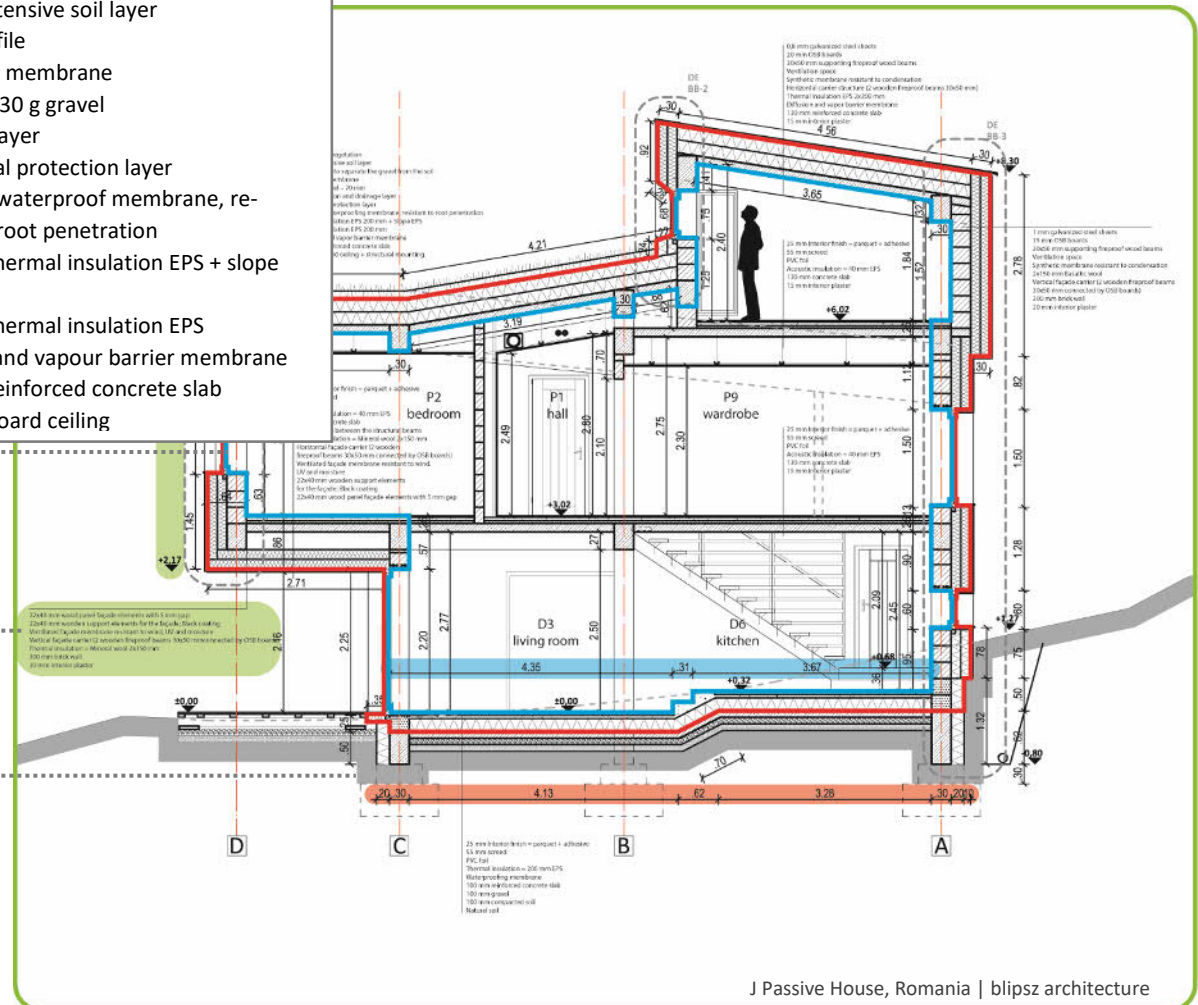
or

1:100

See page 26 for acceptable file formats and general requirements

Graphic identification and external dimensions of the thermal envelope

Graphic identification of the airtight layer



Elevation

Show outside and outgoing air vents, grid types, distance from ground

Make sure to show clearly and to name any non-heated adjacent rooms accordingly

Show the different type of surfaces

Make sure to name all surfaces and windows using the same coding both on the drawings and in the PHPP

Correct representation of walls, windows, and doors

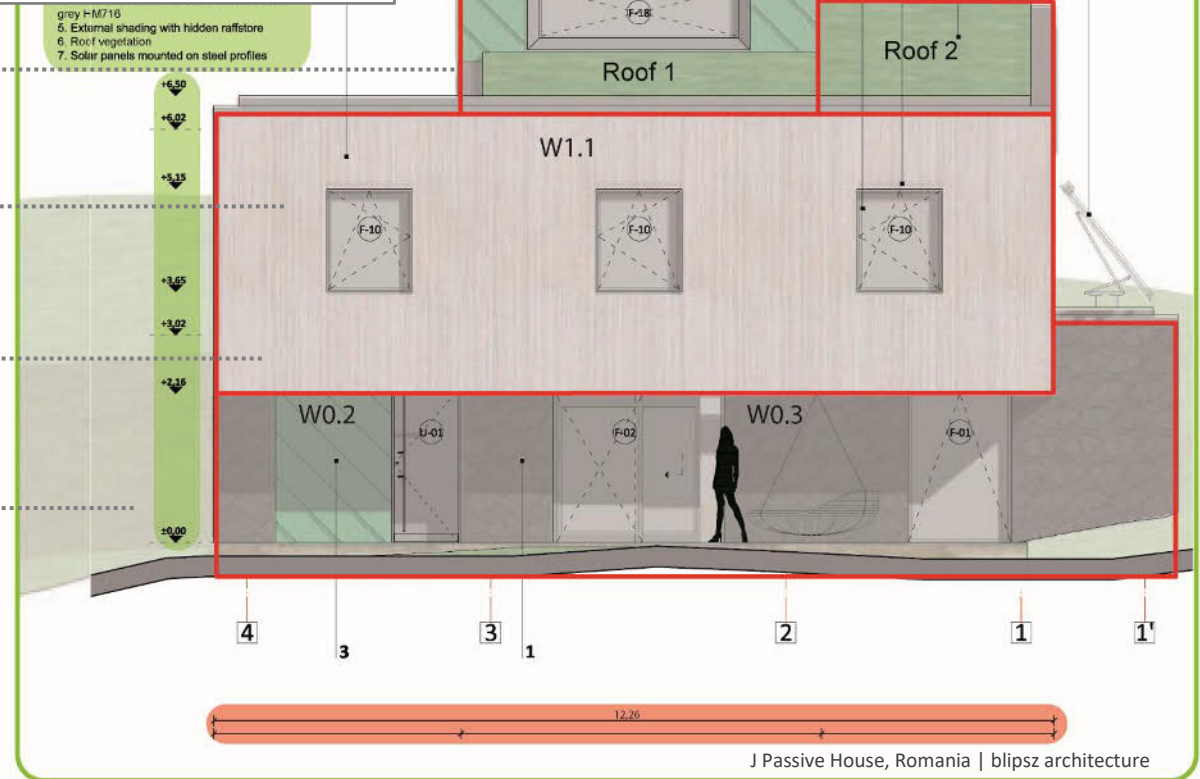
Make sure to show clearly the wall surfaces in contact with the ground as well as the ground line for semi-buried walls

Dimensions

Scale:
1:50
or
1:100

See page 26 for acceptable file formats and general requirements

1. Facade cladding panel – dark grey NU073
2. 22x40 mm wood panel façade elements with 5 mm gap
3. 0,8 mm galvanized steel sheets – Green RAL 6024
4. Timber/Aluminium Window frames - dark grey HM716
5. External shading with hidden blinds
6. Roof vegetation
7. Solar panels mounted on steel profiles



J Passive House, Romania | blipsz architecture

Graphic identification and external dimensions of the thermal envelope

Standard and connection details

Detailed **execution planning** should be prepared and submitted to the Certifier for all standard assemblies and connections of the building envelope. The thermal bridge details must be easily assignable to the input in the PHPP.

Thickness in mm of heterogeneous

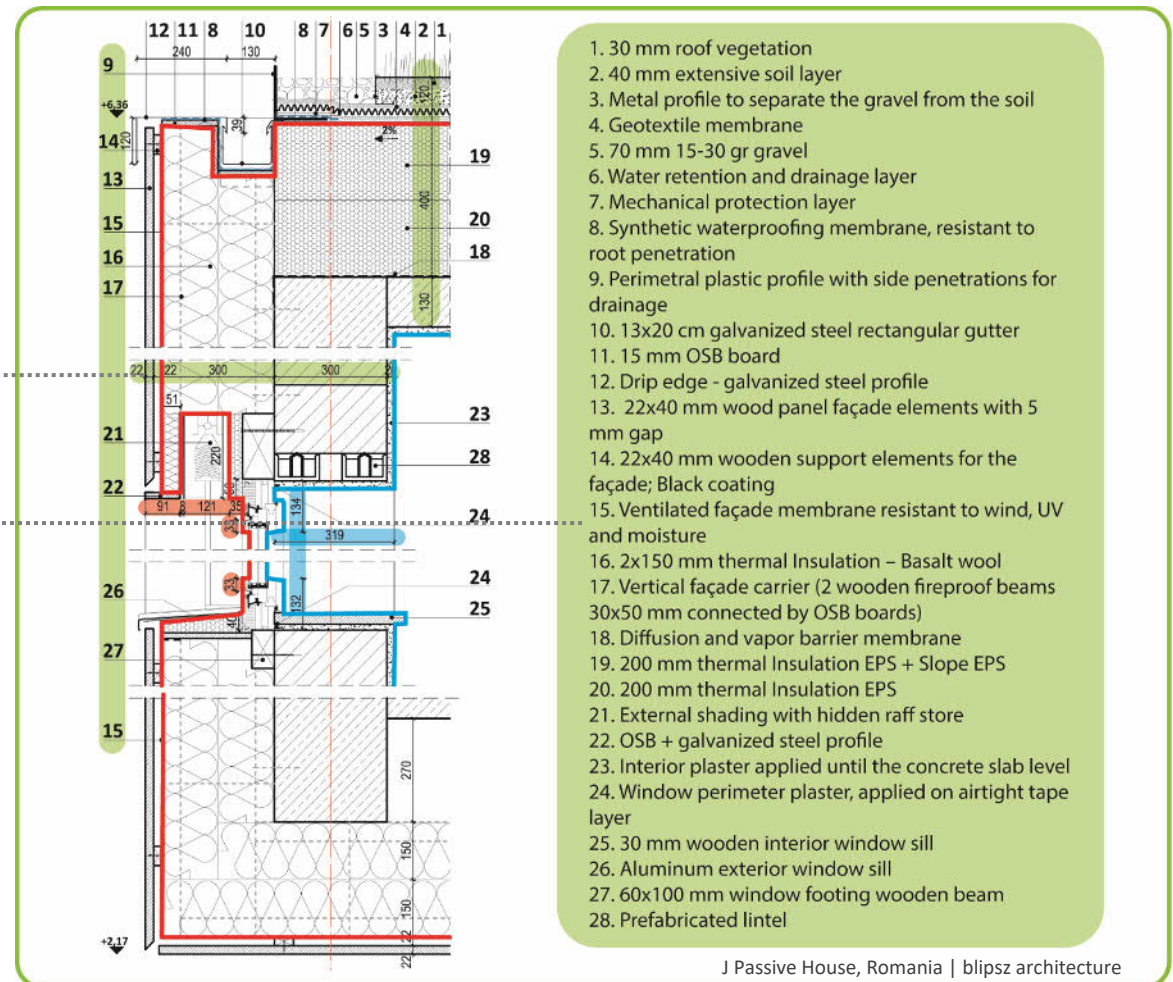
Description of each component of the detail (incl. mixed layers), product manufacturer and name, thickness [mm], thermal conductivity

For masonry/concrete materials:
a| resistance class
b| reinforcement degree
c| volume density

Scale:

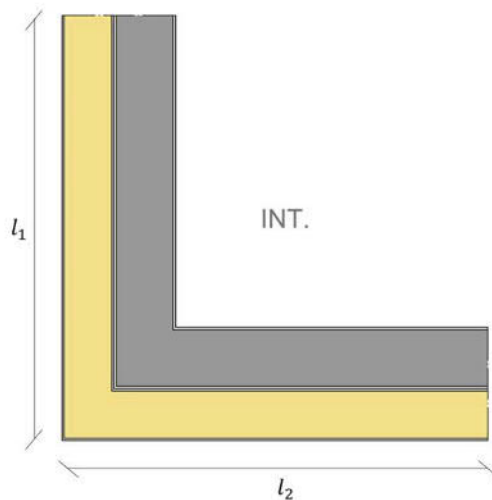
1:5
or
1:10
or
1:20






See page 26 for acceptable file formats and general requirements

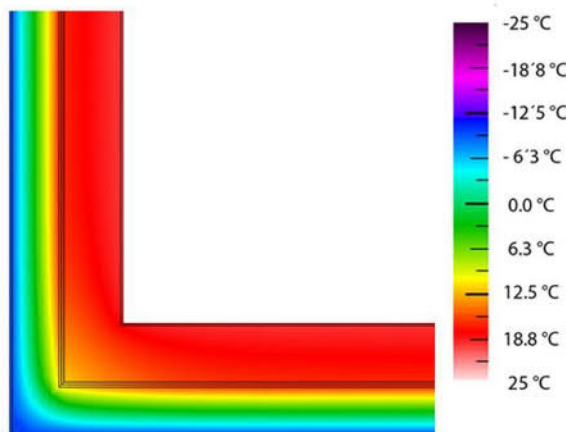


Graphic identification and external dimensions of the thermal envelope

Graphic identification of the airtight layer



	Insulation ($\lambda = 0.035 \text{ W/(m}^2\text{K)}$)
	Internal Render ($\lambda = 0.70 \text{ W/(m}^2\text{K)}$)
	External Render ($\lambda = 0.87 \text{ W/(m}^2\text{K)}$)
	Glue ($\lambda = 0.87 \text{ W/(m}^2\text{K)}$)
	Brick Wall ($\lambda = 0.42 \text{ W/(m}^2\text{K)}$)



Required product verification

- Manufacturer, model type and technical data sheets especially of **insulation materials** with a very low thermal conductivity ($< 0.032 \text{ W/(mK)}$). Rated values of the thermal conductivity according to national norms or building authority approval are admissible.
- In hot and very hot climates: verification of the **radiation characteristics** of the surface of walls and roofs.
- **Verification of moisture protection** (see further below) particularly in the case of interior insulation and in hot, humid climates (if there are doubts regarding protection against excessive moisture accumulation on the part of the Certifier).

Thermal bridge calculations

Passive House buildings should be planned in a **thermal bridge free** manner as far as possible. This is the case when the insulation thickness is not reduced at the connection detail and if there are no penetrations of the insulation layer by materials with a higher thermal conductivity. If that is the case, then thermal bridge calculations will not be necessary for Passive House verification.

The use of certified Passive House construction systems with predefined connection details facilitates thermal bridge free construction.

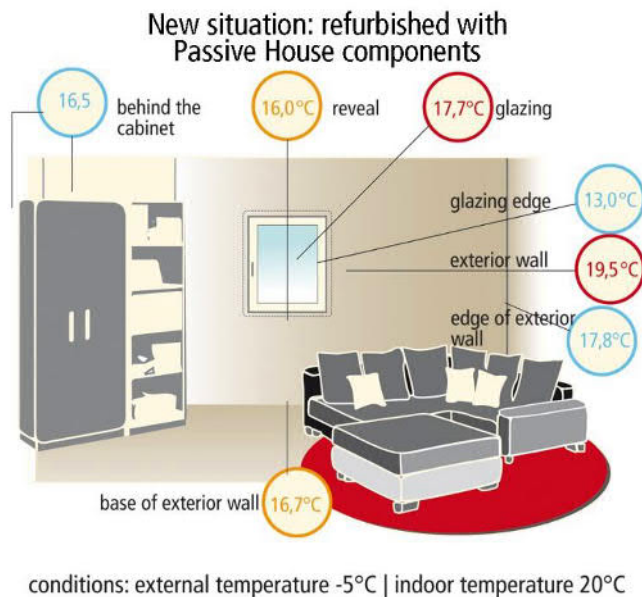
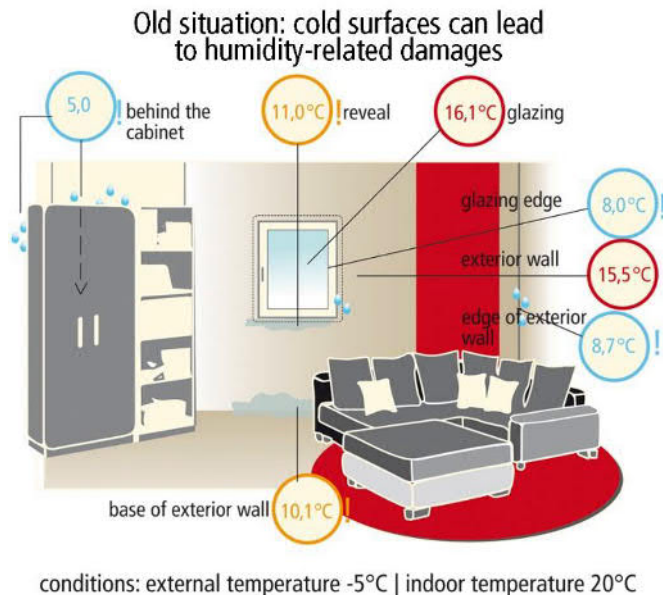
If thermal bridges are unavoidable, then **thermal bridge coefficient** (Ψ value) must be verified. Where possible, documented catalogue values of comparable constructions are sufficient verification. Otherwise, a thermal bridge calculation in accordance with EN ISO 10211 will be necessary.

Calculated thermal bridge details for all relevant connection points are available for certified Passive House wall and construction systems and can be requested from the manufacturer. These are admissible as verification for the thermal bridge coefficient if the actual implementation corresponds with the calculated details to a large extent.

Certified wall and construction systems can be found [here](#).

Documentation of a thermal bridge calculation for a connection detail adjacent to the outside air can be found in the [appendix](#).

Documentation of a thermal bridge calculation for a connection detail adjacent to the ground can be found in the [appendix](#).



Verification of protection against moisture

For most typical Passive House constructions, proof of protection against moisture is not necessary. Verification will be required by the Certifier only in rare cases where there are doubts regarding the flawless functioning of the building component assembly.

Verification of moisture protection for interior insulation (in climates requiring heating)

In the case of interior insulation it is often difficult to provide verification of protection against moisture. A **hygrothermal simulation** is ideal for this purpose. It provides comprehensive information about the processes taking place within a building component and is therefore suitable for evaluating the functional efficiency and durability of constructions. The prerequisites for a positive evaluation of a construction in the context of building certification are fulfilled if:

- **durability** is not diminished by the insulation measure, and
- if health impairment due to the measure is not likely to occur or a construction that was previously problematic is positively influenced by the interior insulation.

These Criteria will be deemed to have been met if:

- **moisture accumulation** does not occur
- the critical moisture content of the building materials is not exceeded
- the **risk of mould growth** in the building component layers of the old interior plaster, the interior insulation and the new interior surface is considered to be small.

Verification of moisture protection in other cases

Other cases in which verification of moisture protection may be required are e.g. insulation measures in hot, humid climates and certain flat roof constructions in climates requiring heating.

Windows and doors

In the PHPP the **characteristic values** for windows are separately calculated from the product data of the separate components (see the following table). Verifications which state only the charac-

teristic values for an entire window of a standard size (U_w -value) are not enough for certification. Besides the characteristic values of window in the

façade, verification for roof windows, light domes, smoke exhaust flaps etc. are also necessary. The following remarks apply also for these products.

Overview of the window components and the characteristic values that are to be verified

	Verification required			
Component	Product	Characteristic value		Hints
Glazing	Manufacturer and product name	Thermal transmission coefficient (U_g -value)	Passive House Certificate or manufacturer's calculation in accordance with EN 673 (U_g) and EN 410 (g-value) → example verification in the appendix	To two decimal places for values below 1.0; only modelled values; not values from physical testing
		Solar energy gain coefficient (g-value)		To two decimal places
Frame	Manufacturer and product name of the frame	Thermal transmission coefficient (U_f -value)	Passive House Certificate or mathematical verification in accordance with EN ISO 10077-2	To two decimal places for values below 1.0; only modelled values; not values from physical testing
		Facing frame width	From the Passive House Certificate or drawings of the frame profiles	
	Manufacturer and product name of the spacer	Glazing edge thermal bridge	Passive House Certificate (only if same combination of frame and spacer), thermal bridge calculation in accordance with EN ISO 10077-2 link to the component database	
Installation in the wall		Installation thermal bridge	Passive House Certificate (if installation situation matches), example installation situations from the PHPP User Manual (if matching) or thermal bridge calculation	
Shading elements	Possibly manufacturer and product name	Reduction factor for temporary solar protection such as blinds or roller shutters	E.g. tabular value from PHPP User Manual, Section on "Shading; information on regulation of solar protection (manual / automatic)	
Overall window	Window schedule manufacturer with dimensions and product information about the frames, glazing and spacers for each different window			

Window schedule

Make sure to use the same naming convention on the drawings and the PHPP

Dimensions

Type of glazing and frame
(U-values, lambda)

Area

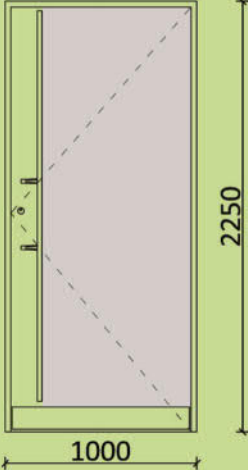
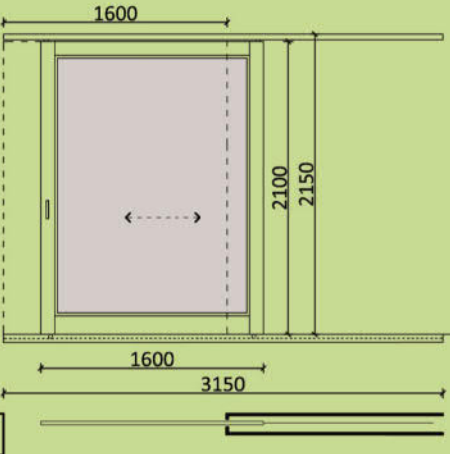
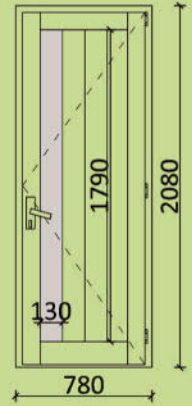
Materials

Scale:

1:50

or

1:100

	U-01 (Internorm HT300 CO21B)	U-02	U-03
opening direction	left	right	4 x left, 3 x right
type	exterior (frame mounted on brickwork)	interior (sliding door)	interior (frame with ventilation channels)
quantity	1	1	7
			
dimensions	1000 x 2250 mm	1600 (3150) x 2150 mm	800 x 2100 mm
area	2,25 m ²	3,36 m ²	1,62 m ²
U-value (total)	0,97 W/(m ² K)	-	-
opaque materials	wood U-value 1,30 W/(m ² K)	wood, transparent coating	wood, transparent coating
glazing	triple pane Ug-value 0,60 g-value 0,54	clear glass; 2,48m ² ; Ug-value 0,60 g-value 0,54	frosted glass; 0,23m ² ; Ug-value 0,60 g-value 0,54
spacer	3,4 (mK/W)	3,4 (mK/W)	3,552 (mK/W)



Note: Sometimes special requirements for sound insulation, safety, privacy etc. apply for specific windows. This often has a significant negative influence on the U_g and g -values. For the certification, these values must be verified for each window and used in the PHPP, already during preliminary planning.

Explanation of terms

Thermal transmission coefficient of glazing (U_g -value)

This value describes the thermal insulation effect of the glazing (without the glazing edge). The lower this value is, the lower the heat losses will be in winter and heat gain will be in summer. With values below $1.0 \text{ W/m}^2\text{K}$, verification must always be given to two decimal places. If this is not possible, the Certifier will use a less favourable value rounding up.

Verification through:

- Passive House Certificate
- Calculation in accordance with EN 673 or ISO 15099 made available by the manufacturer

Energy transmission (g -value)

This value gives the percentage of solar radiation striking the outer surface of the window which passes into the building through the glazing and acts as a heat source (heating period) or as a heating load (cooling period) here. This is between 1 (100% transparent) and 0 (no radiation passes through).

Verification through:

- Passive House Certificate
- Calculation in accordance with EN 410 or ISO 15099 made available by the manufacturer

Thermal transmission of the frame (U_f -value)

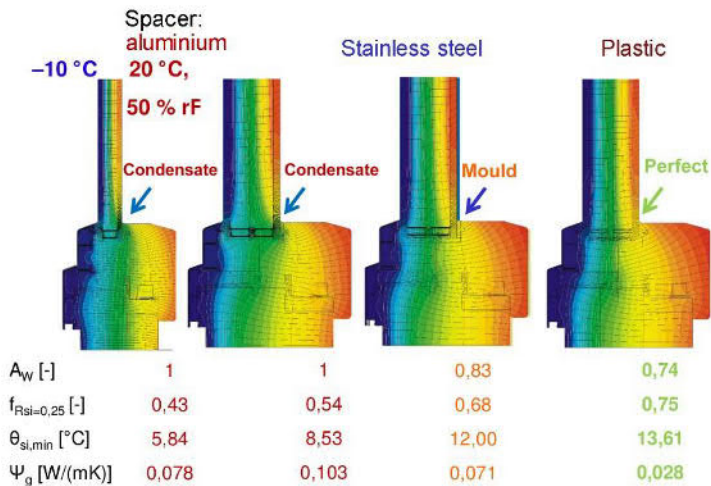
This value describes the thermal insulation effect of the window frame. Only calculated values may be used for Passive House certification (not values from physical testing). In the case of plastic frames, any reinforcements that are present must be taken into account.

Verification through:

- Passive House Certificate
- Calculation in accordance EN ISO 10077-2 made available by the manufacturer

Installation thermal bridge

Additional heat losses (winter) and gains (summer) occur where the window frame connects to the wall. PHPP accounts for these as "installation thermal bridges". The installation thermal bridge is smaller if the window is installed in the insulation layer and the frame is covered with insulation on the outside.



Caution: PHPP contains an example installation thermal bridge value of 0.040 W/(mK) which can be used as a preliminary value to save time when beginning design of a building. This value is not a default value. Certification requires verification of the precise installation thermal bridge psi-value.

A detail drawing must be prepared for each different installation situation for each window side (top, bottom, sides) as well as for any implementation variants with and without roller shutters etc. The distance between the outer reveal edge and the glazing edge must also be recognisable in the drawing – this is relevant for calculating the shading in the PHPP.

Verification through:

- For certification as a Passive House suitable component, installation thermal bridges are also calculated for different installation situations. These can be used if the installation situation matches that of the present project.
- Other example situations that can be used are included in the PHPP User Manual.
- If no values can be determined in any other way, then it will be necessary to calculate the installation thermal bridge for the window details that exist in the building. Simplified calculations in which the thermal conductivity of a substitute panel is determined using the window U-value and used as a

substitute object in the heat flow calculation may lead to incorrect results and are therefore not permitted.

Glazing edge thermal bridge:

The value for the glazing edge thermal bridge $\Psi_{\text{Glazing edge}}$ represents the additional heat losses caused by the spacer at the glazing edge. It is determined by the thermal characteristics of the particular spacer, the glazing, and the installation situation of the glazing in the frame.

Verification through:

- The glazing edge thermal bridge is stated in the certificate for the Passive House suitable window frame. If the same spacer is used as that stated in the certificate, then this value can be assumed for the certification.
- For certified Passive House spacers, values for the glazing edge thermal bridge are available for a large number of frame types. The values for the frame type that matches best with the frames used in the building can be used.
- Tabular values can be used if these are sufficiently on the safe side. Generally the glazing edge thermal bridge becomes smaller if the glass unit is thicker or if the frame covers more of the glass and if the extended frame is insulated better. These rules can be applied to find out if the tabular value for the respective situation is justifiable.
- Thermal bridge calculation for the specific combination of frame and spacer based on ISO 10077-2



Windows in the component database can be found [here](#).

Spacer in the component database can be found [here](#).

Glazing in the component database can be found [here](#).

Shading elements



Movable shading elements

A product data sheet should be submitted for **movable shading elements** which states the type of element, and if relevant, its geometry. There are three possibilities for verification of the shading factor:

- Standard factors from the table in the section on "Temporary solar protection" in the PHPP User Manual
- Using the values calculated by the manufacturer. In doing so, the U-value of the glazing installed in the building must not be greater than that used in the calculation
- Calculation according to EN 13363

Fixed shading elements

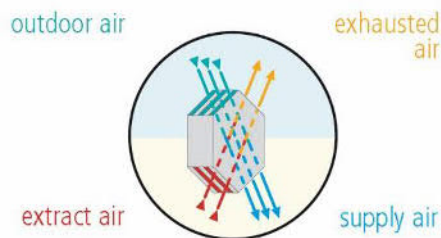
For **fixed shading elements** a detail section should be submitted stating the shading characteristics that are relevant for the PHPP. Usually this is the horizontal and vertical distance of the outermost shading edge of the element from the upper edge of the glazing.



Ventilation



Picture: Aerex Haustechniksysteme



Ventilation heat recovery

Component database for smaller ventilation systems (<600m³/h) can be found [here](#).

Component database for bigger ventilation systems (>600m³/h) can be found [here](#).

In order to ensure excellent indoor air quality, Passive Houses always have a **comfort ventilation system mechanically ventilating all rooms in the building**. In most climates, a heat recovery unit ensures that the ventilation heat losses remain extremely low.

Ventilation unit

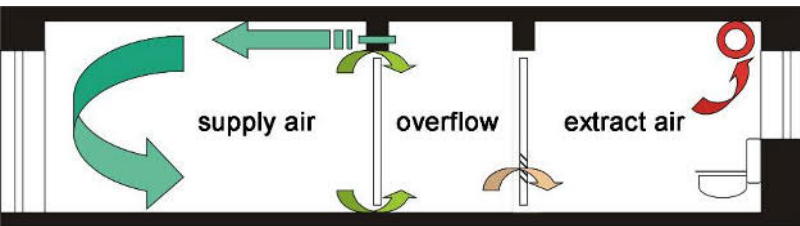
The efficiency of the ventilation system heat recovery unit plays an important role for the energy demand of a Passive House. The **heat recovery efficiency** indicates the percentage of the heat from the stale air extracted from the rooms and exhausted from the building that is transferred to the fresh air from outdoors that is supplied to rooms. Modern devices have efficiency of up to 90% or higher so that very little heat desired in winter is lost (or undesirable heat in summer is gained).

For realistic calculation of the ventilation heat losses in the PHPP, it is essential that the heat recovery efficiency of the device used is determined by means of a test bench measurement of the temperatures in the two ducts connecting the device with the outside (outdoor air and exhaust air).

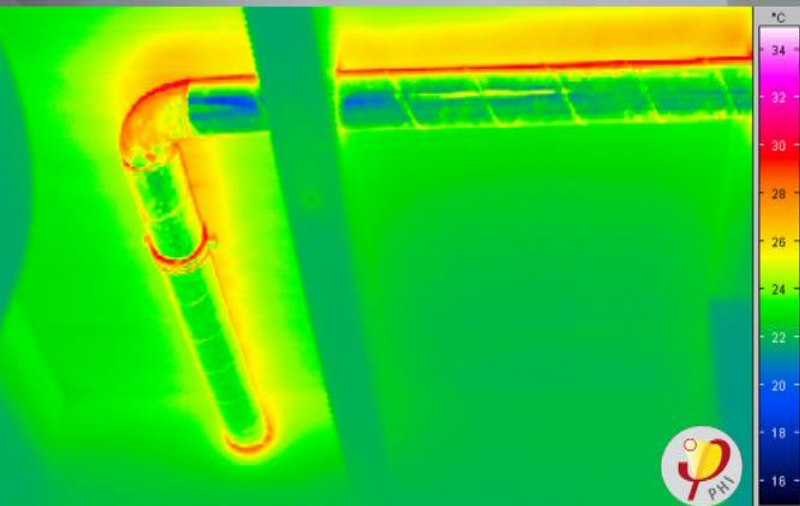
Apart from this, condensation must not form inside the heat exchanger during the measurement. In most evaluation procedures, the temperature difference is measured at the ducts on the room side (supply air and extract air). These values are unsuitable for accurate energy balances for buildings and are therefore not permissible for use in the PHPP.

For devices with a **Passive House Certificate** the efficiency values were correctly ascertained and can be used directly for the PHPP and certification, as long as the device is operated at the output range stated in the certificate.

It may be difficult to determine permissible efficiency values in the case of non-certified devices. If so, then safety margins may be necessary in order to ensure the building will actually function as a Passive House. In the case of non-certified devices, the applicable heat recovery efficiency should therefore definitely be clarified with the Certifier at an early stage. In the case of large orders, e.g. for a multi-storey building, manufacturers of ventilation units can often be convinced of the advantages of product certification.



Zoning of the comfort ventilation systems with supply and extract air and heat recovery



Thermography of supply air pipes

Secondly, the **electricity demand** of the ventilation unit in watt-hours per cubic metre of supply air should be verified – for the standard volumetric flow that is planned for the building and including the consumption for the device control unit. This value can also be taken from the Passive House Certificate. For non-certified units the values calculated by the manufacturer for the volumetric flow and pressure loss present in the respective building are acceptable.

Dimensioning the ventilation system

For certification, the Designer must submit complete dimensioning of the planned system including at least the following information:

- Dimensioning of the **total volumetric flow** and the **individual volumetric flows** at each valve and at air transfer openings
- For some buildings the Certifier may require **pressure loss calculation** of the duct network and the electricity demand resulting from this (including standby demand and electricity for the control unit)

Requirements for volumetric flows:

- **Residential buildings:** Average volumetric flow of 20-30 m³/h per person, at least 0.3 fold air exchange according to the PHPP calculation; the average volumetric flow and not the maximum volumetric flow is used in the PHPP

- **Non-residential buildings:** Volumetric flow should be determined for the specific project, with 15-30 m³/h per person; different operating times and stages should be taken into account; written confirmation by the building owner / user regarding the planned mode of operation should be submitted as verification
- **Avoid dry air:** During the heating period, avoid excessively high air change rates causing relative humidity levels of less than 30% (according to the PHPP worksheet "Ventilation")

Ventilation plans

Complete plans of the ventilation system are necessary. The plans must include at least the following information:

- **Ventilation ducts:**
 - position
 - length
 - cross section dimensions
 - if necessary insulation thickness and insulation materials with the thermal conductivity
- **Ventilation outlets:**
 - position and type of the supply and extract air outlets
 - position of the outdoor and exhaust air openings



Measurement of the volume flow rate

PH Luft - Software programme which aids Designers of Passive House ventilation systems can be found [here](#).

Example documentation of flow rate adjustment in the [appendix](#).

- air transfer openings: position and cross-section
- **Built-in parts of ducts:**
 - sound absorber: position and type
 - additional sound protection measures for the ventilation unit are necessary in the installation room if 25 db (A) in living areas or 30 db (A) in non-residential buildings or in extract air rooms in residential buildings are exceeded
 - filter: position and filter class in outdoor air and extract air ducts
 - frost protection mechanisms
 - heating coils
 - other built-in parts of ducts (fire safety dampers etc.)
- **Ground-coupled heat exchanger**
 - length
 - laying depth and method
 - material of tubes and diameter

Verification and technical data sheets of ventilation components

Besides the ventilation unit, product data sheets should also be submitted for the following components (if present):

- Frost protection mechanism (e.g. pre-heating coil)
- Post-heating coil

- Ground-coupled heat exchanger:
 - calculation of the heat recovery efficiency
 - in case of brine heat exchangers: data sheets for the pump and other components if necessary

Documentation of flow rate adjustment

After installing the ventilation system the **air volume flow** must be adjusted at all valves to the planned levels. This is the only way to ensure that the ventilation system will work as intended and that the energy consumption corresponds with the calculations.

This procedure will be documented by the ventilation engineer in the documentation of flow rate adjustment.

The CD that comes with the PHPP contains a blank template for flow rate adjustment documentation, called the "**FINAL PROTOCOL WORKSHEET for Ventilation Systems**". However, other templates may also be used as long as the flow rate adjustment documentation includes at least the following information:

- Object name
- Address of the building site
- Name and address of the tester
- Time of adjustment



- Manufacturer and model type of the ventilation system
- Standard operation volumetric flows
- Adjusted volumetric flows for standard operation
- Calibration (mass or volumetric flows) of outdoor air and exhaust air (10% is the maximum allowable imbalance)

It is strongly recommended that for measuring the volume flows, devices should be used which utilise the method known as zero-pressure compensation. Only in this way will it be possible to ensure reasonable accuracy of the measurement.

Apart from this, it must be noted that most measuring devices for determining smaller volume flows, such as those which occur at individual supply air or extract air valves in Passive Houses, are only suitable to a limited extent as the volume flows to be measured lie in the lowest measurement range of the devices.

The measurement inaccuracy here is often much more than 10% of the measured value. In any case, it should be ensured that measuring devices are used that have a measurement range which matches the volume flow to be determined.

Documented adjustment of all supply air and extract air valves must take place.

If this is not possible technically in the case of individual non-residential buildings, then at least the volumetric flows in the ventilation unit (outdoor air / exhaust air) and in the main ducts of the ventilation system should be measured.

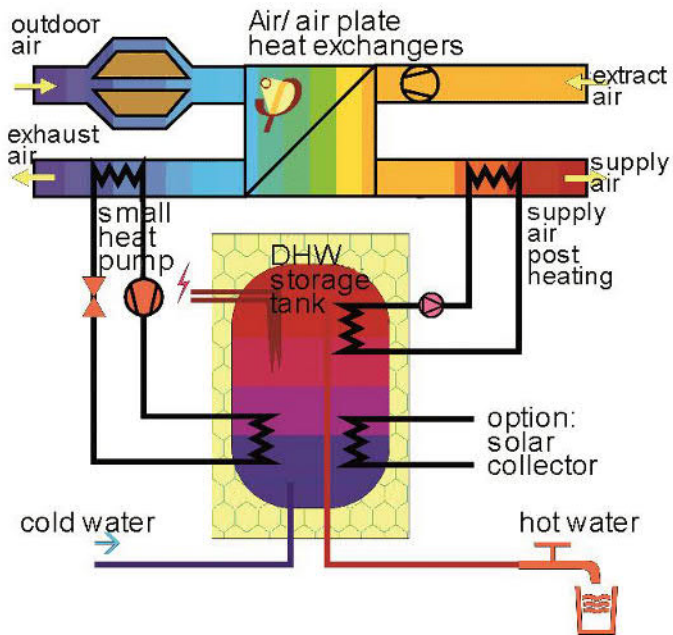
There are three possible methods of **calibration**:

- Recommended: measurement of the central volumetric flows at the **outdoor air intake and the exhaust air outlet** - opening must be easily accessible
- Alternative 1: the central device has a sufficiently accurate **internal volumetric flow measurement system**
- Alternative 2: calibration using the **sum of the adjusted supply air and extract air volume flows** (only suitable for systems with only a few valves)

Summer ventilation

In case of doubt the Certifier may demand a **written confirmation** from the owner or future user stating that the summer ventilation strategy given in the PHPP will and can actually be implemented – e.g. if night-time window ventilation is entered for a residential building located on a high-traffic road.

Heating and domestic hot water



Function diagram of a Passive House compact unit with exhaust air heat pump



© Drexel&Weiss

Compact heat pump unit

The remaining, extremely small heating demand of a Passive House can be met using **simple, cost-effective technology**. Because the energy demand for hot water generation is of a scale similar to that for heating the building, attention should be given to efficient technology also for hot water generation.

Heat generators

Compact heat pump units

All relevant data for **certified Passive House compact heat pump units** can be found in the certificate.

In the case of **non-certified devices**, the parameters of the integrated ventilation with heat recovery are important for adequately accurate calculation in the PHPP worksheet "Compact". Evidence of these must be provided similarly to the parameters of ventilation units (section "Ventilation Unit").

Apart from that, the values for heat capacity and efficiency (COP - coefficient of performance) for different operating points are required for assessing the heat pump. For heating operation, the heat capacity and the COP value must be known for different outdoor air tem-

peratures (heat source, typically for $-7\text{ }^{\circ}\text{C}$, $0\text{ }^{\circ}\text{C}$ and $+7\text{ }^{\circ}\text{C}$) for this purpose.

For hot water generation (heating up and post-heating), the heat capacity and the COP value for an external temperature of $20\text{ }^{\circ}\text{C}$ must also be known in addition in order to be able to assess hot water operation in the summer. Measured values for at least three operating points and for hot water at $20\text{ }^{\circ}\text{C}$ must be provided. It is desirable to have values that have been measured by an independent test laboratory.

Heat pumps

Space heating with heat pumps

For a sufficiently accurate calculation in the PHPP worksheet "HP", values for the performance and efficiency (COP - coefficient of performance) of the heat pump for different outdoor air (heat source) and hot water temperatures (heat sink) are required. Measured values must be available for at least three testing points. It would be desirable to have values that have been measured by an independent test laboratory; however, data from the manufacturer's product data sheet is also admissible.

Certified heat pump compact units can be found [here](#).

Hot water generation with heat pumps

For heat pumps that utilise indoor air as a heat source, the actual efficiency (COP value) in climates requiring heating is always equivalent to 1 during the heating season. This can increase the primary energy demand significantly. The COP from the data sheet of the hot water heat pump may only be used if the heat generator for space heating is also a heat pump.

Borehole heat exchangers and ground collectors

The **configuration planning** by the planning engineers or the contracting company should be submitted. At least the length and number of borehole heat exchangers must be evident from this. The pre-set values may be used for the other entries in the PHPP worksheet "HP Ground". For more accurate calculation, project specific values may also be entered for the other input if these are evident in the submitted configuration planning as well.

Verification is also required for the **soil type** selected in the PHPP, e.g. from national guidelines on utilisation of geothermal energy.

Boiler

The PHPP worksheet "Boiler" provides the calculation of the boiler efficiency and the final energy demand with **standard values** for certain boiler types. User-defined input can also be used alternatively. A product data sheet for the boiler should be submitted in

both cases. For the user-defined calculation, all parameters entered in the PHPP must be apparent from this data sheet.

District heating

District heating supply and its primary energy performance is calculated in the PHPP-worksheet "District heating".

If the requirement for the **primary energy demand according to the classic method (PE)** is met, then evidence of the PE factors for the used heat source must be provided. As a rule, one of the power plants specified in the PHPP must be used for this. Should there be any deviations from the standard values in the PHPP, then this must be agreed with the Certifier in advance.

If the **primary energy demand is calculated according to the new method (PER)** then the following input will be required in the PHPP:

Under the point 'heat network' the percentage of the useful heat which is supplied by the district heating network at the boundary of the building plot must be entered against the energy fed into the heat network by the energy provider. If 70% is entered, this means 30% network losses and only 70% useful energy. If exact data is not provided, it will suffice to roughly estimate the heat losses in the network by means of the auxiliary calculation included in the PHPP from Version 9.7 onwards.

In the section for 'CHP plant and peak load boiler', only the percentages of the CHP plant and peak load boiler (if used) must be entered. All the information mentioned above must be provided by the supplier.

The performance ratio or the **utilisation factor of the district heating transfer** station should be verified with the relevant product data sheet that should be made available by the building services engineer (typical values are between 90% and 95%).

Solar energy system

The characteristic values entered in the PHPP for solar collectors should be verified using the relevant product data sheet or test report. If no data is available it is permitted to use the **standard characteristic values** given in the PHPP for one of the three types: flat collector, improved flat collector or vacuum tube collector.

Solar energy storage: see section "Hot water storage tank".

Storage and distribution

Pipes

Building services plans should be submitted giving the following information for all **heating pipes**, as well as for **hot water circulation pipes** and **distribution pipes**:

- Position
- Length
- Nominal width of pipe
- Thermal insulation: type, thickness and thermal conductivity

Thermal bridge free installation particularly of hot water pipes has a big influence on the energy demand. In the PHPP worksheet "DHW+Distribution", if 'moderate' or 'good' is selected under 'insulation quality of fittings, pipe fasteners etc.' then evidence of the corresponding implemented quality should be provided by means of example photographs. The measures required for this are described in the PHPP User Manual.

Pumps

The **standard values** given in the PHPP may be used for the **electricity demand** of the heating circulation pump and for the hot water circulation and storage tank charging pump. If lower values are to be used, then verification of the power consumption should be provided by means of the appropriate product data sheets.

Hot water storage tank

A product data sheet containing the **heat loss rate** in W/K should be provided for the hot water storage tank. If only information relating to the EU efficiency

class is available, then as an alternative the heat loss rate can be calculated using an auxiliary calculation in the PHPP worksheet "DHW+Distribution". For solar storage tanks, in addition to information about the **storage tank volume** in litres the **standby proportion** as a percentage should also be included in the data sheet.

Heat recovery from shower waste water

If heat recovery from the draining shower water takes place, then for **certified devices** this can be taken into account simply by selecting the appropriate component.

Non-certified devices can also be taken into account. The following assessment without more exact verification will be accepted for this: efficiencies which are measured in accordance with NEN 7120 (Dutch KIWA certificate), CAPE/RE-CADO-PQE (French measurement in accordance with CSTB, measured value for hot and cold water connection) or CSA B55 (Canadian test standard) are entered as steady-state efficiencies. The effective dead time of 10 seconds per litre of fresh water content of the device can be assumed.

Certified drain water heat recovery systems can be found [here](#).

Waste water pipes (and rainwater down-pipe within the envelope)

If possible, waste water pipes within the building envelope should be equipped with an **air admittance valve** instead of a through-roof vent. If this is not possible, or if in the case of rainwater downpipes inside the thermal envelope, the additional heat losses must be taken into account in the PHPP (see PHPP User Manual, worksheet "Areas"). The position, length, type of venting, and the type, thickness and thermal conductivity of the pipe insulation must be recognizable in the submitted technology planning.

Hot water demand

The hot water demand for **residential buildings** is specified as 25 l per person and day (translated to a water temperature of 60 °C). This standard value must not be deviated from. Water saving fittings for residential buildings cannot be taken into account at present.

For **non-residential buildings** the hot water demand in the PHPP should be calculated specifically for the respective building. For typical office use, a demand of 12 l/(P*d) can be set if detailed calculation is dispensed with.

Cooling

Passive cooling measures such as shading elements and night-time ventilation are adequate for many Passive House buildings in the summer.

Depending on the climate, building, and usage, additional **active cooling** measures and equipment may be necessary. In this case, limits on useful energy demand for cooling and dehumidification apply, and the numerical value for those limits depends on the climate, the internal heating and moisture loads and (in the case of non-residential buildings) the air change rate. For higher cooling demand values, there may also be additional limit (for the cooling load). The requirements for a specific application are given in the "Verification" worksheet in the PHPP.

Complete plans showing the construction and mode of operation of the cooling system will be required for the certification.

Furthermore, verification of the efficiency of the used **cooling devices** must be submitted. Proof of the device properties must be provided using manufacturers' data sheets. Specifically, the following must be considered:

Split devices (direct delivery of cooling or as ducted units): the usual information relating to the SEER/ESEER is too optimistic as a value for the seasonal performance factor and is therefore unsuitable. Unless specified otherwise, the EER (measured at an outdoor

temperature of 35 °C and indoor temperature of 27 °C) should be used for the seasonal performance factor.

This value is no longer used in the European energy label but can be derived from the manufacturer's data sheet. The power rating and the respective circulating air volume flow and the type of regulation should be verified by means of data sheets.

Water-based cooling, e.g. concrete core temperature control, cooling ceilings, chilled beams, cold-water cooling coils: the seasonal performance factor results from the manufacturer's data sheet for an outdoor temperature of 35 °C and a typical cold water temperature. With free cooling, for instance through borehole heat exchangers in cool, temperate climates, the pump power consumption must be verified and taken into account in the PHPP calculation.

Separate dehumidifier: Information regarding the efficiency at 26.7 °C and 60% air humidity, as is common in the USA can be used directly after conversion from l/kWh into kWh/kWh (multiplied by 0.7 kWh/l). European data is often based on 30 °C/80% and is therefore unsuitable; such values can be converted to common boundary conditions by division by a factor of 1.4.

The Certifier will require further documentation that the existing technology can meet the cooling and dehumidification loads. If the cooling and dehumidification functions are not separate, it will also be checked whether the sensible heat ratio (SHR) of the installed devices is sufficient for dehumidification in general.

Cooling distribution

Losses from any cooling distribution system will only occur if pipes lie outside of the thermal envelope of the building, or if pipe networks on the inside are operated in the warm season even when cooling is not necessary. In this case **building services plans** should be submitted showing the following information for all **cooling distribution pipes**:

- Position
- Length
- Nominal width of the pipe
- Thermal insulation: type, thickness and thermal conductivity
- Design forward flow temperature

Refrigerant pipes of split devices that are inside the building are not taken into account in the PHPP, therefore verification does not have to be submitted for this.

Electrical appliances and lighting



Single family home in Pirmas © Steffen Spitzner



Bonifatius-School Frankfurt am Main

Because heating and cooling demands are very small for Passive House buildings and EnerPHit retrofits, the energy demand for other purposes is a larger percentage of the total primary energy demand. Therefore, **efficient use of electricity** is even more important.

Balance boundary

In the PHPP only the electricity consumption that occurs **within the heated building envelope** is considered. This corresponds to the balance boundary, which also applies for all other characteristic values of the energy balance. The lighting for the underground car park or the circulating pump for the pool in the garden thus will not be taken into account. There are exceptions to this rule for appliances which are commonly located both inside and outside of the heated envelope. For example, energy demand of washing machines must also be taken into account even if they are located outside of the heated building envelope in the unheated basement. The exact rules are described in the Criteria in the section on "Boundary conditions for the PHPP calculation".

Residential buildings

For residential buildings, the **standard values** pre-set in the "Electricity" sheet may be used. Verification of the characteristic values of individual devices is not necessary.

Note: the example PHPP calculation in the CD that comes with the PHPP contains lower characteristic values for household appliances. These may not be used as standard values!

If appliances that are more efficient than those specified are used in the building, then alternatively **individual verification** may be provided for those devices. In that case provide the appropriate data sheets showing their standard electricity consumption to the Certifier.

Non-residential buildings

In contrast with residential buildings, there are no standard values for the electricity demand for non-residential buildings, therefore **individual verification** is always necessary in the PHPP worksheet "Electricity non-res".



Lighting

If detailed planning for lighting is not available, then a value for the installed lighting and the full load hours will be calculated in the PHPP based on the usage profile in the worksheet "Use non-res". Alternatively, user-defined values can be used if these can be verified with the appropriate lighting planning.

Office applications

All applications with a significant electricity demand such as PCs with monitors, photocopiers, printers, servers etc. must be taken into account in the PHPP. Data sheets should be submitted which show the **power consumption** in the normal and energy-saving (standby) modes.

Kitchen

As a rule, **standard values** for the energy demand per warm meal can be used for cooking and washing. Separate verification for these device will not be necessary in this case.

Alternatively, **detailed verification** can be provided with which lower characteristic values can be achieved, in which case technical data sheets should be submitted showing the consumption information of the cooking and dishwashing appliances.

For refrigerators and freezers, and for other relevant appliances which are not directly used for preparing meals, separate verification of the electricity demand is always necessary because these are not included in the standard value.

Other electricity demands

Appropriate data sheets verifying the characteristic values entered in the PHPP should be submitted for all other electricity loads with significant demands, e.g. elevators or furnaces.

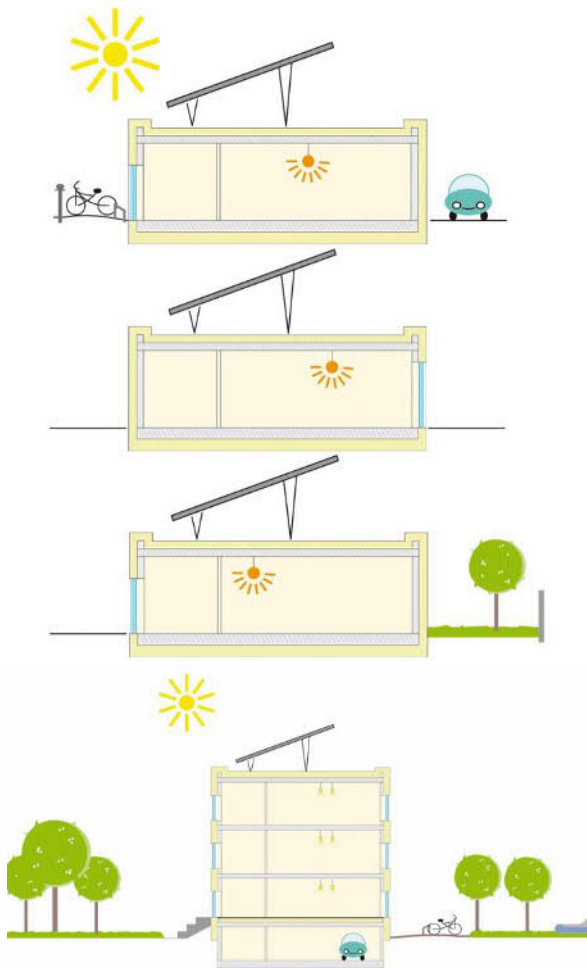
A tool for calculating the electricity demand for elevators can be found [here](#).

Hints for energy efficient server can be found on [Passipedia](#).

Usage profile

The usage profiles used in the PHPP ("Use non-res" worksheet) must be verified through **written confirmation by the building user**.

Renewable energy



Energy efficiency and renewable energy generation

The energy revolution can only succeed with the simultaneous advancement of high energy efficiency and the use of renewable energy. Due to their small energy demand, Passive Houses and EnerPHit retrofits offer optimum conditions for the cost-effective supply with renewable energy. In order to achieve the Passive House / EnerPHit classes Plus and Premium, **proof of renewable energy generation** is necessary. Without energy generation, a building can achieve only the Classic Standard.

The generated renewable energy cannot be deducted from the energy demand. However, the PER limit will be increased to a limited extent if more renewable energy is generated than is necessary to meet the renewable energy generation requirement. Conversely, the renewable energy generation requirement is reduced if the PER demand is smaller than the limit value.

Note: In the same way, for verification with the PHPP it does not matter how much of the generated electricity is used on site. There is no differentiation between the electricity that is fed into the public grid and can then be buffered or used directly by others, and the electricity used on site!

The Passive House with the "Plus"

Area reference for renewable energy

In the PHPP, the energy demand for heating, cooling, primary energy etc. is based on the treated floor area (roughly corresponding with the living or useful area). This makes sense because the energy demand can be depicted per square metre of useful area in this way.

This is different in the case of renewable energy generation. If a building parameter or limit value based on the living/useful area was also used here, then single-storey bungalows would be preferred over multi-storey buildings because for the former, the potential generation area (e.g. a roof for mounting solar thermal or photovoltaic systems) is relatively large compared to a small living area.

However, single storey buildings have higher space consumption and use of natural resources, and therefore shouldn't be preferred over multi-storey buildings in the PER evaluation. That is why in the PHPP the generated renewable energy is based on the "**projected building foot-print**". This is equal to the largest exterior dimensions of the building, which equates to the roof area that is useable for a photovoltaic system and also equates to the base area that is occupied by the building. Thus a similar renewable energy generation requirement applies for all buildings regardless of the number of storeys.

Note: Because the parameters for the energy demand and renewable energy generation refer to different areas, they cannot be directly compared with one another.

What kinds of renewable energy can be taken into account?

Generation of renewable energy typically takes place **on site or near the building** mostly by means of photovoltaic modules on the roof. The cost / benefit ratio is not always optimal in the case of small systems. With some buildings the conditions are also unfavourable, e.g. with strong shading or unfavourable orientation.

Therefore, as an alternative the building owner or (long term user) may satisfy the requirement by investing in new renewable energy generation systems which are **not spatially associated with the building**, e.g. by participating in the financing for the construction of a wind farm. It is only possible to satisfy the requirement by investment in new systems; purchase of existing renewable energy generation systems does not count. The amount of electricity that can be counted will be determined according to the ownership share of the owner / user in the total investment.

Many kinds of renewable energy can be taken into account, i.e. **photovoltaic systems, solar power plants, wind power, and hydro power**.



Calculation of the projected building footprint



Picture: Björn



The following **may not be taken into account**:

- **Biomass utilisation** (is already taken into account in the PHPP in the biomass budget)
- **Waste-to-energy plants and geothermal energy use** (are not sustainably "renewable")
- **Solar thermal energy** (is considered part of the heat generator, thus it reduces the PER demand in the PHPP and therefore cannot additionally be taken into account as renewable energy)

Necessary verification for renewable energy generation

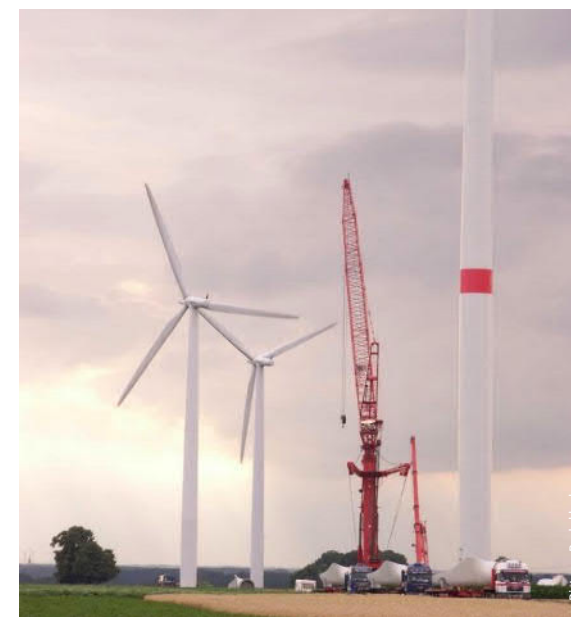
The characteristic values of **photovoltaic systems which are installed on the building or on the building plot** are entered in the PHPP in order to calculate the annual electricity yield after the power inverter. The following documents must be submitted for verification of the characteristic values entered in the PHPP:

- **Module data sheet** with:
 - rated current, rated voltage and rated power
 - temperature coefficient of the short-circuit current and the open-circuit voltage
- **Efficiency of the inverter** taken from the data sheet

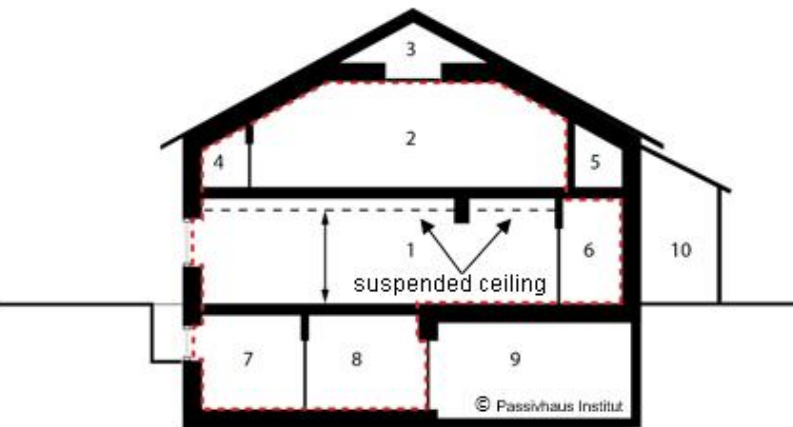
- **Number of the modules**, proof of this e.g. through purchase receipts
- **Alignment, inclination and shading** from the corresponding planning

The following verification must be submitted for renewable energy generation **systems that are not installed on the building**:

- appropriate **proof of ownership**
- possibly with evidence of the **ownership share** as a percentage of the overall system
- Verification of the forecasted **annual electricity generation** of the system (simulation)



Airtight building envelope



Room	Within airtight envelope?	Volume calculation
1	Yes	Clear height up to the (planned) suspended ceiling; joist is not deducted from the volume
2	Yes	Full volume (taking into account of ceiling slopes)
3	No	Volume is not taken into account (outside of envelope)
4	Yes	Full volume (taking into account of ceiling slopes)
5	No	Volume is not taken into account (outside of envelope)
6	Yes	Clear height up to ceiling
7	Yes	Basement: full volume
8	Yes	Basement: full volume
9	No	Basement: volume is not taken into account (outside of envelope)
10	No	Porch/ conservatory: volume is not taken into account (outside of envelope)

Figure 1: Information for calculating the air volume within the airtight layer of a building. The dotted red outline represents the airtight layer.

An excellent level of airtightness of the building envelope is essential for low energy consumption, thermal comfort and structural integrity, therefore airtightness must be verified by means of a measurement (known as the **Blower-Door-Test**). For certification, a completed test report signed by the tester is to be submitted (as a scan) which proves compliance with the limit value.

The airtightness measurement must be performed in accordance with **EN 13829 (Method A)**. Alternatively, the measurement may also be performed in accordance with ISO 9972 (Method 1). However, in this case the net air volume according to EN 13829 must be used for calculating the n_{50} -value. **In deviation from the norms, one series of measurements each for positive pressure AND for negative pressure will be necessary.**

Room	Width	Depth	Area	Height	Factor	Volume
	[m]	[m]	[m²]	[m]		[m³]
GF-011	4	5	20,0	2,75		55,00
GF-012	3,3	2,7	8,25	2,85		25,86
GF-xyz	...	...	...	...		...
Total volume ground floor						80,86
UF-01 (without sloped ceilings)	2,75	5,2	14,3	3,5		50,05
UF 01 Volume of sloped ceilings	2,75	5,2	14,3	1,5	0,5	10,73
UF-02	1,25	2,75	3,44	3,5		12,03
UF-xyz	...	...	...	...		...
Total volume upper floor						72,81
Total volume						153,67

Figure 2: Example of documentation of the volume calculated separately for each room.

Volume calculation

The air volume V_{n50} within the heated building envelope which is to be used for calculating the n_{50} air leakage value should be determined **separately for each room**. The calculation must be clearly documented in the report and should correspond to the value entered in the PHPP. The **total air volume** within the thermal envelope should be taken into account (including staircases). A more exact explanation of special features is given in Figure 1.

Regardless of the degree of completion of the building, the **dimensions as at completion** should always be used (e.g. if screed has not been applied). Volumes above suspended ceilings do NOT count towards the air volume. This is irrespective of whether the ceiling already exists, is airtightly connected with the wall, or has various holes in it ("acoustic ceiling"). The reduction in the volume due to plaster layers does not have to be taken into account.

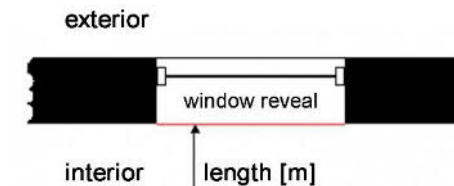
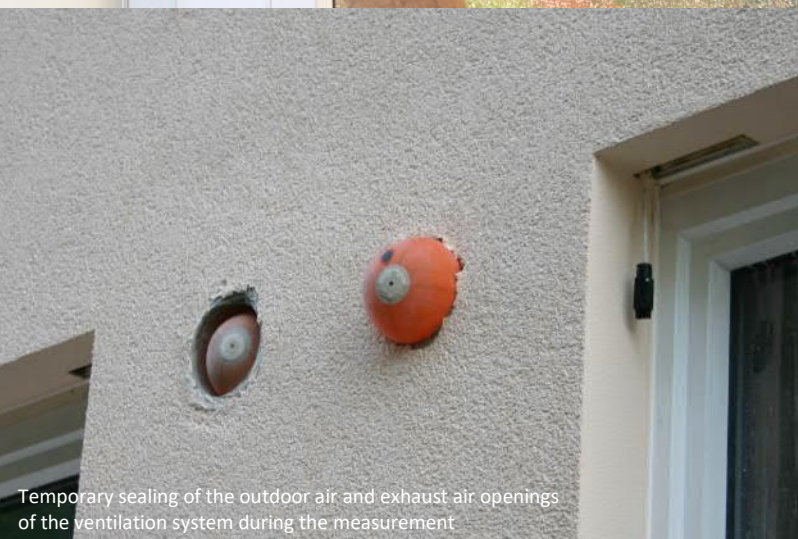


Figure 3: The volume of window reveals, doors and passages are not taken into account in the volume calculation.



Measurement of the air speed during the pressure test at one not yet correctly adjusted window using an anemometer



Temporary sealing of the outdoor air and exhaust air openings of the ventilation system during the measurement

Time of the measurement

Airtightness of the fully completed building controls, so test after the building is completed. However, all work for fittings, screed, cladding etc. is already completed at this point and therefore many important connections and penetrations of the airtight layer can no longer be accessed in a non-destructive manner. Remaining leaks in the airtight layer can then no longer be rectified. This would not be appropriate.

For this reason, air leakage should be measured immediately after the **completion of the airtight layer** (e.g. window installation, airtightness membrane in the roof, etc.) so that leaks are easily located and repaired. Missing building envelope components at the time of the measurement will complicate and compromise this result, and if you rely on this testing before construction is complete, a result where components are missing is acceptable for certification in only exceptional cases.

After this “construction-stage” air leakage measurement, the building management in charge should ensure that subsequent construction does not damage the airtight layer. If for any reason there are concerns in this regard, then another measurement should be carried out. **In normal cases, one airtightness measurement is sufficient.**

Carrying out the measurement

Method A or B?

For the energy balance of a building in the PHPP, the utilisation conditions during normal building operation are of significance, therefore the airtightness measurements in Passive Houses must be performed according to EN 13829 **Method A**. However, in the case of Passive Houses there is normally no difference between the Method A (utilisation conditions) and Method B (testing of the building envelope). The outdoor air and exhaust air openings of the ventilation system are the only purposely intended openings, which are sealed for the measurement. Exact and comprehensible documentation for all **temporary sealing** is required for the measurement used for certification.

In non-residential buildings with intermittent operation, **existing louvres** must be closed during the airtightness measurement, however they must not be additionally taped.

Other sealing work

No other sealing work for the building envelope should be carried out for the measurement (key-holes, non-airtight windows, cat-flaps etc.).

The only exceptions are temporary taping over for missing **building components** which can affect the airtightness (e.g. missing door threshold, missing odour trap in a water pipe). Again, this taping over should be documented in detail.

Photographs



The construction progress should be documented with **illustrative photographs**. However, full photographic documentation of all measures is not necessary. Pictures should be taken preferably at a time when the installation situation is not yet covered by cladding etc. Typically, photographs of the following areas should be taken:

- **Thermal insulation** of the building envelope (preferably with a measuring ruler in the picture to show the insulation thickness)
 - floor slab or basement ceiling
 - perimeter area
 - wall insulation
 - roof insulation
- Product date labels of
 - windows frames and glazing
 - heating and cooling units
 - ventilation unit
- Insulation of the **air ducts**
- Insulation and attachment of heating, hot water and cooling **pipes**
- Other energy-relevant construction details, e.g. **thermal bridges**

Example illustrative photographs

Construction manager's declaration



In order to limit the costs for the certification, supervision of the construction work by the Certifier is not required for the building certification. Instead, with the construction manager's declaration the person appointed by the building owner for supervising the construction work assumes the legal responsibility for ensuring that the work has been carried out in accordance with the documents submitted for the certification. A template for the construction manager's declaration can be found in the Appendix. It will suffice to submit the signed declaration as a scan.

4. Appendix

Other sources of information

Passive House and EnerPHit - general information

Passipedia

The continually growing database of knowledge relating to energy efficient construction and building modernisation based on more than two decades of experience with research and application of this knowledge.

<https://passipedia.org/>

Active for More Comfort: The Passive House

Free information brochure with basic information about the Passive House Standard and retrofitting with Passive House components.

https://passivehouse-international.org/index.php?page_id=70

Criteria for the Passive House, EnerPHit and PHI Low Energy Building standards

Building Criteria of the Passive House Institute and description of the certification procedure.

http://passiv.de/downloads/03_building_criteria_en.pdf

Built projects

Passive House Database

Database with pictures and descriptions of several thousand built Passive House buildings and EnerPHit retrofits.

<http://passivhausprojekte.de/>

Detailed object documentations

Detailed technical documentations for a large number of built Passive House buildings and EnerPHit retrofits.

http://passivhausplaner.eu/index.php?page_id=294&level1_id=265

Events

International Passive House Open Days

Passive Houses around the world open their doors to the public on these days.

https://passivehouse-international.org/index.php?page_id=262

International Passive House Conference

The most important international Passive House event where about 1000 international experts come together.

<https://passivhaustagung.de/en/>

Certification and further training

Passive House and EnerPHit certification

Information about the quality assurance programme of the Passive House Institute.

http://passivehouse.com/03_certification/02_certification_buildings/01_benefits-of-certification/01_benefits-of-certification.htm

Component Database

Comprehensive database of certified Passive House suitable products.

<https://database.passivehouse.com/en/components/>

Passive House Designer

Information about the further training programme of the Passive House Institute and the largest database with thousands of certified Passive House Designers.

<http://passivhausplaner.eu/>

Passive House Tradesperson

Information about the further training programme of the Passive House Institute and the largest database with thousands of certified Passive House Tradespersons.

<http://www.passivehouse-trades.org/>

Organisations

Passive House Institute

Independent research institute which has played a key role in the development of the Passive House Standard.

<http://passivehouse.com/>

International Passive House Association

A global network connecting Passive House experts around the world.

<https://passivehouse-international.org/>

Can parts of a building be excluded from certification, e.g. retail spaces on the ground floor of a building with residential and commercial use?

Yes, in certain situations. Fundamentally, it is always the entirety of an insulated and airtight building envelope that is certified, e.g. a row of terraced houses, apartment block or office building. It is not permitted to exclude parts of a building from the energy balance. In deviation from this fundamental rule, certification is possible for the following building parts:

- Individual houses in a [row of terraced housing](#)
- Annexes of existing buildings as long as they have at least one exterior wall, a roof and a floor slab/basement ceiling
- The upper floors of a building with mixed use without the business or retail floor spaces on the ground floor, under the conditions described [here](#)
- If individual apartments in an apartment block are being modernised, then pre-certification on the basis of an EnerPHit Retrofit Plan is possible

For certification, must each separate house in a row of terraced housing comply with the requirements individually?

Yes, but certification can take place either through an overall calculation for the row of houses as a whole, or through separate calculations for each terraced house.

Exact description of the procedure can be found [here](#).

Is it only permitted to install certified Passive House components or building parts which meet the requirements for certified components?

No, but extensive use of Passive House components all throughout facilitates planning and certification because independently tested energy relevant characteristic values are available for the PHPP calculation. However, installation of non-certified products is also permitted, but it may be time-consuming or difficult to provide reliable proof of the performance values in that case.

For Passive House standard, EnerPHit standard according to the energy demand method, and for the PHI Low Energy Building standard, components

may also be installed which do not meet the Criteria for Passive House suitable components. The prerequisite is that thermal comfort and protection against moisture are not impaired.

May only Certified Passive House Consultants and Designers prepare the PHPP calculation for building certification?

The Passive House Institute recommends that a Passive House Consultant or Designer should be entrusted with the PHPP calculation. However, basically anyone who is sufficiently qualified may prepare and submit this calculation to the Certifier.

Can I call my building a Passive House even if it is not certified?

The Passive House Standard has been defined by the Passive House Institute but purposely has not been protected as a trademark. Even without certification it is possible for e.g. an energy consultant to prepare Passive House verification using the PHPP. If all the Criteria have been met then the building can be labelled as a "Passive House" even

without certification. Nevertheless, the Seal "Certified Passive House" with the Passive House Institute logo cannot be used in connection with the building in that case.

What is the difference between a certified Passive House Designer and a Passive House Certifier?

Certified Passive House Designers or Consultants have attained an approved qualification through the Passive House Institute for calculating or planning a Passive House building. There are several thousand certified Designers worldwide, see www.passivhausplaner.eu.

Passive House Certifiers are contractually authorised by the Passive House Institute to certify Passive House buildings in its name and in accordance with its methodology. In most countries there is only one Certifier or only a few Certifiers. Link to [list of Certifiers](#).

Is it possible to certify buildings with special uses, such as swimming pools, supermarkets or hospitals as Passive House buildings?

Passive House certification is also possible for special use buildings. The requirements may differ slightly from the normal Passive House Criteria,

therefore consultation with the Passive House Institute at an early stage of planning is essential. For some uses certification can only be carried out by the Passive House Institute but not by other accredited Certifiers.

My building has a very high electricity demand due to the type of usage. Is compliance with the limit value for primary energy still necessary for the building?

If a very high electricity demand arises in the case of special use buildings (e.g. a hospital) then in consultation with the Passive House Institute the primary energy demand may also be exceeded. Verification of efficient utilisation of electrical energy for all large electrical applications will be necessary for this purpose. Which uses are considered to be "efficient utilisation" in each case will be agreed with the Certifier. A description is available for server rooms on [Passipedia](#).

Glossary

Air change rate [1/h]

This indicates how often the volume of air inside the building is replaced with fresh air from outside the building in one hour. In residential Passive House buildings this value is usually between 0.3 and 0.5 1/h.

Airtightness

An excellent level of airtightness of the building envelope is necessary for achieving the advantages of a Passive House: a low energy demand, thermal comfort, a damage-free construction. It is also a prerequisite for efficient and reliable functioning of the ventilation system. The airtightness of a building is determined by means of a differential pressure test (Blower-Door test).

Airtight layer

The building component layer of the building envelope which prevents air from entering or escaping through the envelope. To achieve an excellent level of airtightness of the building envelope, there should be only one airtight layer which encloses the entire heated / cooled building volume without any breaks. The airtight layer may be created using sheeting, plaster layers or building components consisting of impervious materials (e.g. reinforced concrete).

Balance boundary

For verification using the Passive House Planning Package, the balance boundary constitutes the insulated and airtight building envelope which encloses the heated or cooled building volume. The energy flows which occur at this envelope surface (e.g. heat losses due to thermal conductivity or air exchange) are taken into account in this balance calculation.

Construction manager's declaration

Building certification by the Passive House Institute is predominantly based on a review of the planning documents and PHPP. To verify that the work is executed and the building is constructed in accordance with the reviewed planning documents, the construction manager responsible for the project signs a declaration to this effect. The Certifier will provide you with a template.

Cooling and dehumidification demand [kWh/(m²a)]

The useful energy which is necessary to maintain the desired indoor air conditions for cooling (PHPP standard design temperature maximum 25 °C and 12 g/kg air humidity). This does not take into account the efficiency of the equipment removing heat and humidity from the air.

Cool colours

Cool colours are colours that have a low absorption coefficient in the infrared range of the solar spectrum. As a result of this, exterior surfaces that are coated with these colours absorb less heat in sunlight. In the EnerPHit building component procedure there is a requirement that cool colours should be used in hot and very hot climates.

Cooling load [W/(m²a)]

The cooling load is the heat load that must be removed out of the building in order to maintain the specified indoor air conditions even in the most unfavourable case (high outdoor temperature and solar irradiation).

Climate zone

Every location in the world belongs in one of the seven climate zones defined by the Passive House Institute. In order to achieve the Passive House Standard, similar efficiency measures are usually necessary in those locations which lie in the same climate zone. The requirements of the EnerPHit building component method are based on the respective climate zone. In the Passive House Planning Package (PHPP) the climate zone

is ascertained from the climate data of the building location.

Documentation of flow rate adjustment

After installation of the ventilation system, the volume flows should be adjusted at all supply air and extract air valves according to the planned flows. Apart from this, it should be checked whether the overall mass flow of the air which enters the building via the ventilation system corresponds with that which leaves the building. This procedure is also known as commissioning. For building certification by the Passive House Institute, a signed and completed protocol of adjustment must always be provided to verify that adjustment has taken place.

Efficiency of a ground-coupled heat exchanger: η_{GHE} [%]

Ground-coupled heat exchangers are used for pre-heating the outdoor air in winter or for pre-cooling in summer before it enters the building. In the simplest case, the outdoor air passes through tubes laid in the ground. This efficiency is a measure of the efficiency of the ground-coupled heat exchanger and indicates to what proportion the temperature difference between the outdoor air and the annual average ground temperature is compensated.

EnerPHit

EnerPHit is a building standard that was developed by the Passive House Institute for existing buildings which would only achieve the Passive House Standard with great difficulty. Passive House components are used for EnerPHit buildings so that except for the slightly higher energy demand, these buildings can benefit from almost all the advantages of a Passive House.

EnerPHit Retrofit Plan

The EnerPHit Retrofit Plan (ERP) is a document for building owners which contains a well thought-out overall concept for step-by-step energy-efficiency modernisation of the building. It takes into account important interrelationships between the different energy saving measures. In this way, an optimal final result can be achieved reliably and with manageable effort throughout the steps. The ERP file included in the PHPP CD generates a basic outline for the EnerPHit Retrofit Plan when a completed PHPP calculation is imported.

Frequency of overheating

This describes the percentage of hours in a year on which the average indoor temperature exceeds 25 °C in buildings that are not actively cooled. For the building energy standards of the Passive House Institute, this may not be higher than 10%. Values below 5% are recommended.

Frequency of excessive humidity

The number of hours in the year when the absolute humidity of the indoor air is higher than 12 g/kg.

f_{RSI} : temperature factor

The temperature factor is a dimensionless measure for the ratio of the outdoor air temperature and the minimum indoor surface temperature and can be used as an indicator for the risk of mould and condensation formation. The following applies for this: the higher the temperature factor is, the warmer the indoor surface and the less the risk of mould or condensation will be.

g-value

The total solar energy transmission factor, the g-value for short, refers to the energy transmission of a transparent building component, such as glazing. The g-value is the sum of the direct transmission of solar radiation plus the secondary inward emission of heat through radiation and convection. A g-value of 1 thus corresponds to a heat gain of 100%. In modern triple-layer glazing, this value is about 0.55.

Heating demand [kWh/(m²a)]

The heating demand is the useful energy which is necessary for keeping the rooms inside the thermal envelope of the building at the desired indoor temperature (standard design temperature

20 °C). This does not include the losses of the heat generator (e.g. boiler) and the auxiliary electricity necessary for heat generation and distribution.

Heating load [W/(m²a)]

The heating load is the heat emitted by the heating system which must be supplied to the heated rooms in order to maintain the desired indoor temperature even under unfavourable conditions (cold outdoor temperatures/ no solar irradiation).

Heat recovery efficiency [%]

Put simply, the heat recovery efficiency of the ventilation unit describes the percentage of the heat energy contained in the stale air extracted from the building that is transferred to the supply air by the heat exchanger and therefore is not lost. The method for determining the heat recovery efficiency that is used for Passive House verification ensures correct calculation of the energy flows in terms of physics. Values determined in other ways are generally unsuitable for Passive House verification.

The effective heat recovery efficiency of the ventilation system is calculated using the heat recovery efficiency of the ventilation unit and a deduction for heat losses through the ventilation ducts between the unit and the thermal envelope of the building.

IHG: internal heat gains

The internal heat gains consist of the total heat emitted by persons and appliances inside the building. In the winter these gains contribute to heating of the building, while in the summer they increase the cooling demand in the form of undesirable heating loads. For residential buildings and some types of non-residential buildings, standard values for the IHG are specified in the PHPP, which must be used for the certification.

Minimum thermal protection

The minimum thermal protection describes the standard which a building or the building envelope must comply with in order to meet the minimum requirements for structural integrity of the building (condensation/mould) and for thermal comfort. As a rule, Passive House buildings and EnerPHit modernisations automatically meet these relatively minimal requirements due to their excellent standard of thermal protection. The building Criteria of the Passive House Institute contain specific requirements for the minimum standard of thermal protection.

Moisture recovery efficiency [%]

Some ventilation units also have moisture recovery in addition to heat recovery. The moisture recovery efficiency indicates the ratio of the transferred absolute humidity to the maximum transferable moisture.

Passive House

Passive House buildings are extremely energy efficient, comfortable, affordable and environmentally friendly at the same time. "Passive House" is not a brand name, it is a building concept that is accessible for all. With tens of thousands of buildings worldwide, the Passive House Standard has proved itself in practice for more than 25 years.

Passive House Classes

A Passive House Classic is very energy efficient in itself. With the classes Plus and Premium, the building is optimised even further for the efficient use of renewable energy and also generates renewable energy, e.g. by means of photovoltaic modules on the roof. Similar classifications apply for the EnerPHit Standard.

Passive House components

These are building products such as windows, thermal insulation, ventilation systems etc. which are suitable for use in Passive House buildings or EnerPHit retrofits. The Passive House Institute specifies the requirements for Passive House components and reviews performance assessment of components submitted to it for certification. Reliable characteristic values are available for the almost 1000 Passive House components which have now been certified, which makes possible the realistic calculation of the energy demand of a building.

PER: Renewable primary energy ([kWh]/(m²a))

The availability of renewable energies fluctuates in dependence on solar radiation, wind force, and precipitation quantity. For a 100% renewable energy supply in the future, some of the generated power must therefore be stored intermediately. This storage is inevitably associated with losses. Only a third of the original amount of generated electricity will be available ultimately, particularly in the case of seasonal long term storage, e.g. due to generation of storable methane gas. The PER demand expresses the amount of renewable energy that must be generated originally in order to meet the total energy demand of a building. Thus it also includes the storage losses. The PER method was developed by the Passive House Institute so that buildings can already be optimised during the planning for the use of renewable energy.

PHI Low Energy Building

The PHI Low Energy Building Standard is suitable for buildings that do not quite achieve the Passive House Standard for various reasons. The requirements for the energy demand and thermal comfort are less stringent than for Passive House buildings. As for Passive House buildings, verification takes place using the Passive House Planning Package (PHPP).

PHPP: Passive House Planning Package

The PHPP is a clearly structured and easy to use energy balance software program. It is used for energy relevant planning and verification for the energy standards defined by the Passive House Institute. Excellent correlation of the calculation and the actual energy consumption measurements in the building has been proved for a large number of projects. The PHPP can be ordered from the Passive House Institute's website.

Pressure test air change rate n_{50} [1/h]

Series of measurements at negative pressure AND at positive pressure with a pressure difference of at least 50 Pascals between the surroundings and the inside of the building that is being measured. If this is divided by the net indoor air volume, this will result in an air change rate n at 50 Pascal: this is the n_{50} value. In a Passive House this value may not exceed 0.6 1/h.

Projected building footprint

Orthogonal projection of the heated or air-conditioned building envelope on a horizontal plane. This is used to describe the ground surface occupied by the building. The projected building footprint serves as a reference area for assessing renewable energy generation as it basically corresponds to the area that is usable for the production of solar energy.

Psi-value: thermal bridge coefficient [W/(mK)] or [W/K]

For Passive House verification according to ISO 10211, the thermal bridge coefficient or Ψ -value (Psi value) is calculated based on the exterior dimensions (it must be identical to the reference dimensions of the building envelope area). It describes the additional heat losses in comparison to the uninterrupted regular building component at a component connection (linear thermal bridge) or a punctiform penetration.

Solar heat gains / solar load

During the heating period, desirable solar radiation through windows reduces the heating demand. In the cooling period, undesirable solar incidence on windows, roof and walls increases the cooling demand in the form of the solar load. In the EnerPHit Criteria according to the building component method, for actively cooled buildings there is a requirement for the maximum solar load that enters the building through the glazing surface.

SRI: Solar reflection index

The SRI is a parameter for the exterior surfaces of the building which describes the extent to which exposure to sunlight heats them. It takes into account the absorption as well as the emissivity of the surface. The higher the SRI value is, the less the surface will heat up. In the EnerPHit building

component method there is a requirement for the SRI for hot and very hot climates.

Thermal comfort

Thermal comfort is a subjective perception of the body and is based on whether or not a person feels comfortable in the surroundings. Among other things, the indoor air temperature, the surface temperature of the building components and the air velocity affect the perception of comfort (or absence of discomfort). The building Criteria of the Passive House Institute contain the minimum requirements for thermal comfort, particularly for the U-value of windows.

Thermal conductivity [W/(mK)]

The thermal conductivity (also called the lambda value) describes how well a material conducts heat. Insulation materials have a very low thermal conductivity and therefore prevent unwanted heat conduction e.g. through the wall of a heated building towards the outside.

Transmission heat losses

This is the heat flow through the exterior building components depending on the temperature difference in degree kelvin. The smaller this value is, the better the insulation effect of the building envelope will be.

Treated floor area (TFA)

This is the net floor area of a building which is to be heated or air-conditioned. The TFA approximately equates to the living area or useful area. It is therefore a measure for use of the building. The areas are weighted differently depending on the use of the rooms – with 100% or 60%. The rules for determining the TFA are explained in the PHPP User Manual.

U-value [W/(m²K)]

The thermal transmission (U-value) is a measure for the heat flow through one or more layers of materials if different temperatures prevail on both sides. The unit for the U-value (W/m²K) defines the amount of energy per time unit which flows through an area of one square metre if the air temperature on both sides differs by one kelvin. The smaller this value is, the better the insulation effect of the building envelope will be.

U_f: U-value of a window frame [W/(m²K)]

The U-value of a window frame indicates the energy losses through the window frame.

U_g: U-value of glazing [W/(m²K)]

U-value of glazing indicates the energy losses through the window glazing. For Passive House verification this value must be given to two decimal places.

U_w: U-value of a window [W/(m²K)]

The U-value of a window (U_w) indicates the energy losses through the entire window, therefore it does not automatically provide exact information about the quality of the frame. This must be examined more closely.

U_{w installed} [W/(m²K)]

The U_w-value when installed in a particular situation under consideration of the installation thermal bridge.

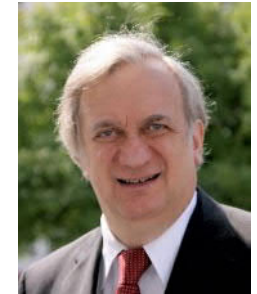
Ventilation heat losses

The heat losses which result from air exchange with outdoor air during the heating period – either due to specific exchange via the ventilation system or window ventilation or from unintended exchange due to the escape of warm indoor air through leaks in the building envelope. In Passive House buildings, ventilation heat losses are reduced to a minimum due to ventilation system heat recovery and a very airtight building envelope.



The Passive House Institute introduces itself

The Passive House Institute (PHI) is an **independent research institute** led by Dr. Wolfgang Feist with a continuously growing interdisciplinary team of employees. The PHI has played a particularly important role in the development of the Passive House concept.



Since then, the Passive House Institute has assumed a leading position with regard to research on and development of construction concepts, building components, planning tools and quality assurance for particularly energy efficient buildings.

The Passive House Institute makes its knowledge available to everyone. Findings relating to the Passive House Standard, certification and training programmes, as well as the marketing of planning tools such as the Passive House Planning Package (PHPP) and designPH thus cannot be considered a monopoly of any local institution in any country. The Passive House Institute does not enter into exclusive contracts. Provided that all prerequisites are met, the Passive House Institute is happy to collaborate with suitable partners at any time and in any country. The Passive House Institute may be contacted directly in case of questions regarding the certification of professionals, buildings and building components as well as all relevant consultancy services.

Example documents

The following are links to examples of the most important documents that must be submitted for certification. They serve as an illustrative supplement to the documentation requirements described in the guide.

- Completed [Passive House Planning Package \(PHPP\)](#) for a residential building as PDF
- Documentation of a [thermal bridge calculation](#) for a connection detail adjacent to the outside air
- Documentation of a [thermal bride calculation](#) for a connection detail adjacent to the ground
- [Glazing](#) data sheet
- Completed [documentation of flow rate adjustment](#) based on the “ventilation specification sheet”
- Record of a [airtightness test](#)
- Template for the [construction manager clarification](#)
- Completed [EnerPHit Retrofit Plan](#) for a step-by-step renovation to the EnerPHit Standard

