EuroPHit

D 6.12_Guideline for a streamlined process to ensure high quality of design and workmanship and certification

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

[Improving the energy performance of step-by-step refurbishment and integration of renewable energies]

Contract N°: SI2.645928

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Passivhaus Institut

Passive House Institute

Certification Guideline

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Passive House Institute

Basics

Skylabs, Heidelberg Bahnstadt
© Christian Buck

The Passive House advantage

Passive House is a building standard that is truly energy efficient, comfortable and affordable at the same time.

It is indeed a tried and true construction concept that can be applied by anyone, anywhere in the world.

The demand for Passive Houses as well as information on building and quality assurance methods have been increasing at an enormous pace, reflecting the trend-setting developments in this field.

Yet, a Passive House is much more than “just” a low-energy building.

The following pages provide an introduction to the Passive House Quality Assurance and Certification Process.

The Passive House Certification

Passive House provides an opportunity for combining optimum thermal comfort, maximum energy efficiency and minimum running costs in a cost-effective manner. The approach contributes significantly towards energy conservation and climate protection while simultaneously increasing the value of your property. The Passive House Institute in Darmstadt has defined the necessary quality standards for Passive Houses.

Planning and implementation of Passive House buildings, places high demands on those involved, making a high level of cooperation throughout planning more important than ever.

The Passive House Institute is the leading scientific research establishment for the Passive House Standard. The institute is not only a global leader in questions of energy efficiency in construction, it keeps with the state of the art in practical construction through intensive exchange with designers and component manufacturers regarding many consultation and certification projects.

Passive House Certification Seals
© Passive House Institute

This is the traditional Passive House. It offers excellent economic efficiency especially for new builds. High levels of indoor comfort with minimum energy consumption are achieved.

This is suitable for new builds which for various reasons do not fully comply with the more ambitious Passive House criteria.

Additional energy is generated and the buildings are said to produce about as mutch energy as residents consume in a year.

Far more energy is produced than needed. It is therefore a goal for the particularly amitious building owners and designers who want to go beyond what economic and ecological considerations already propose.

More information about the Passive House Classes here.

Passive House Institute

What about existing buildings?

When old buildings are renovated, it is often difficult to achieve Passive House standard. Typical reasons for this are unavoidable thermal bridges as well as a general building design, which was originally not optimized for compactness and energy efficiency. For such buildings, Passive House Institute (PHI) has introduced the EnerPHit standard in 2010.

The basic principle is to modernize all relevant parts of the building with Passive House components. This way almost all advantages of the Passive House standard can be realized in retrofits, even if the heating and cooling demand is not reduced all the way down to Passive House level.

EnerPHit Certification Seals
© Passive House Institute

Furthermore, many buildings are renovated step by step, whenever one or several parts have reached the end of their lifetime.

For such renovation projects, the EnerPHit Retrofit Plan (ERP), detailing the renovation steps is of eminent importance. The retrofit plan must be worked out before the first step is implemented. It clarifies the order of the individual steps as well as the position of the airtightness layer and the insulation layer in all parts of the thermal envelope, including also all connection details. When the first step has been carried out and the Renewable Primary Energy (PER) demand according to PHPP has been lowered by at least 20 % a precertification will be issued by the certifier. The precertification gives the designer and building owner the assurance that EnerPHit standard will be achieved in the end, if the plan is adhered to during all steps. If this is the case, a full EnerPHit certificate can be issued after the last step has been completed. The owner can also ask the certifier to additionally verify any intermediate steps.

Advantages of Certification

The Passive House Institute and its acredited certifiers are providing support during the planning and implementation of Passive House / EnerPHit projects. Many years of experience have shown that even experienced Passive House designers can receive valuable information through the double checking of work, especially with regard to the improvement of quality in implementation and the simplification and cost-checking of solutions.

During certification, we check whether the defined, energy--relevant standards have been met; you can thus be certain that the building commissioned really complies with the requirements for Passive House newbuilds or EnerPHit certified retrofits.

We check the energy balance calculation (using the Passive House Planning Package, PHPP) on the basis of all relevant implementation plans, product data sheets as well as the reports of the airtightness measurement and calibration of the ventilation system. Upon fulfilment of the certification criteria, we will issue the Certified Passive House / EnerPHit Certified Retrofit seal for your building.

We would be pleased to assist you with your project and hope that you find the answers to your questions regarding certification in this Guideline.

For further inquiries regarding building certification please contact us at building.certification@passiv.de

The complete list of Passive House acredited certifiers is available here.

NZ-1071 Glendowie House, New Zealand
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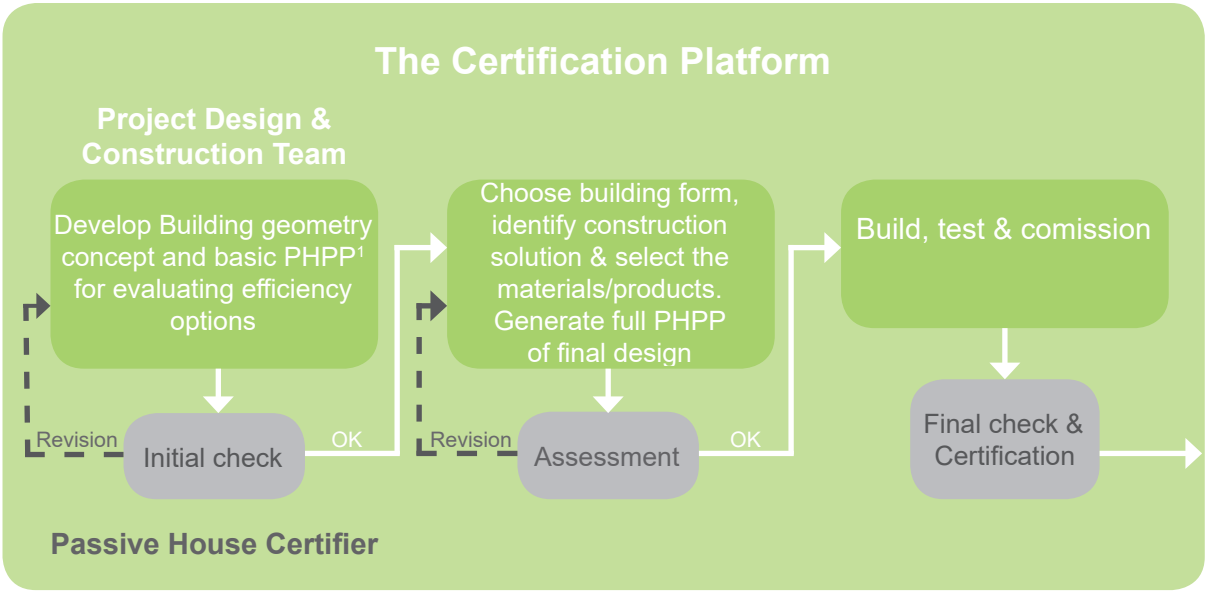
CHAPTER 1
general information

How does the quality assurance and certification actually work?

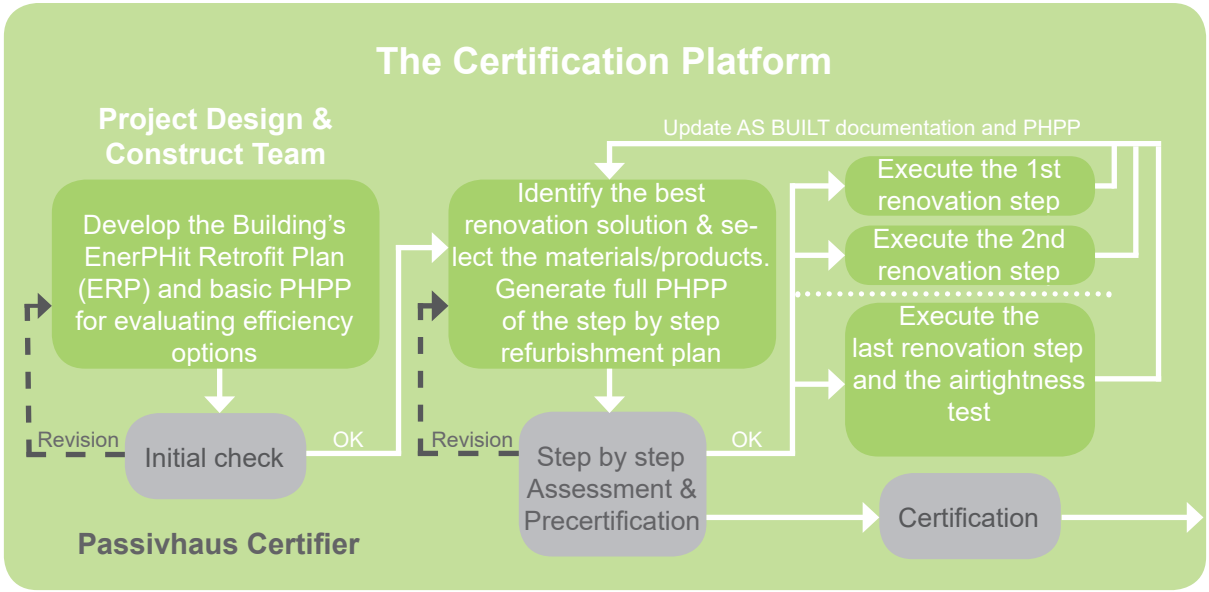
For new buildings and renovation of existing ones executed in ONE STEP.



1. The PHPP is an easy to use planning tool for energy efficiency for the use of architects and planning experts. The reliability of the calculation results and ease of use of this planning tool has already been experienced by several thousand users.

What a about STEP BY STEP retrofit of existing buildings?

Many buildings are renovated step by step, whenever one or several parts have reached the end of their lifetime.
For such renovation projects, an overall concept for all retrofit steps is of eminent importance. The concept should be worked out before the first step is implemented. It should clarify the order of the individual steps as well as the position of the airtightness layer and the insulation layer in all parts of the thermal envelope, including also all connection details. When the first step has been carried out and the Renewable Primary Energy (PER) demand according to PHPP has been lowered by at least 20 % a precertification will be issued by the certifier. The precertification gives the designer and building owner the assurance that EnerPHit standard will be achieved in the end, if the plan is adhered to during all steps.



The Certification Platform

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.

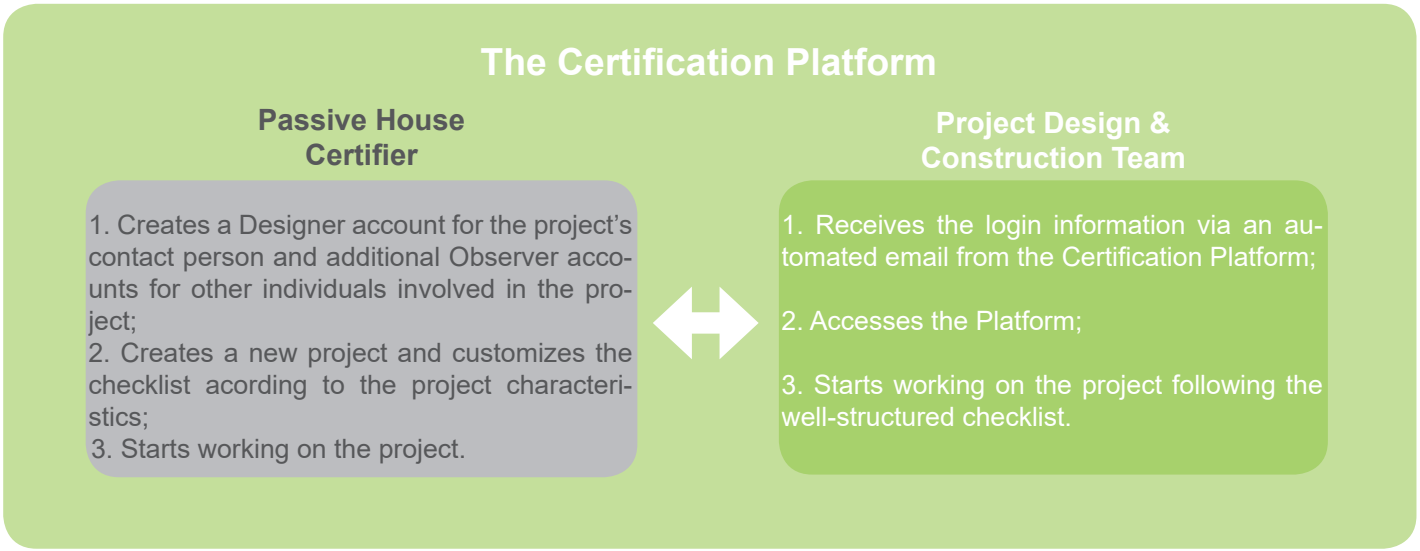
The Platform is a structured guideline, following an interactive workflow which is charted with comments, reminders and checkboxes. It is designed to improve quality assurance and speed-up the verification process.

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.

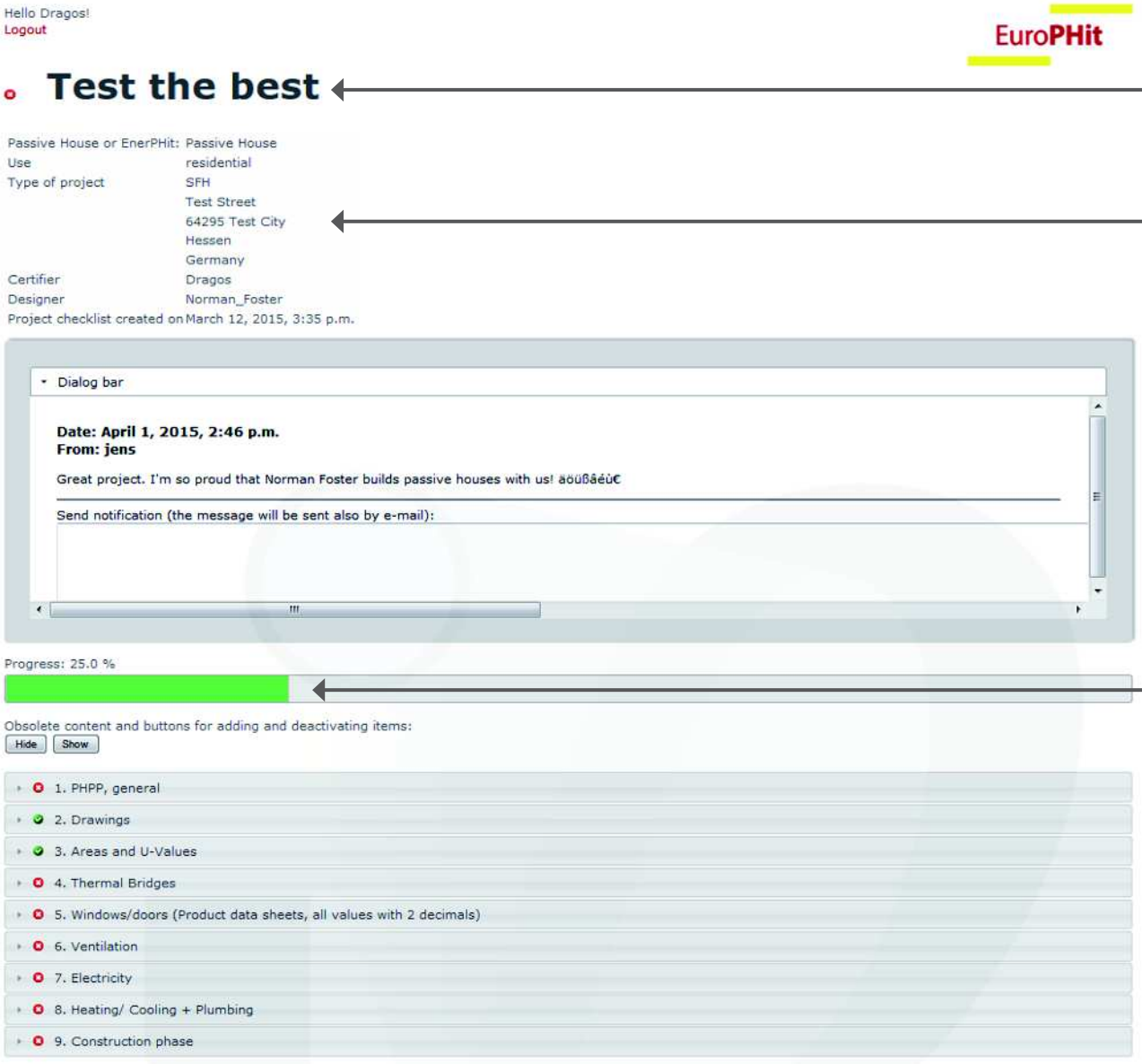
When dealing with a step-by-step retrofit project, every action must be correctly scheduled and carefully recorded, in order to allow further building improvements. The Online Certification Platform centralises the information, allowing the team to establish the optimal retrofit steps. When the time comes for the next refurbishment step, the information regarding what has already been done 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 is a major step forward towards quality assurance and energy efficiency in the built environment.

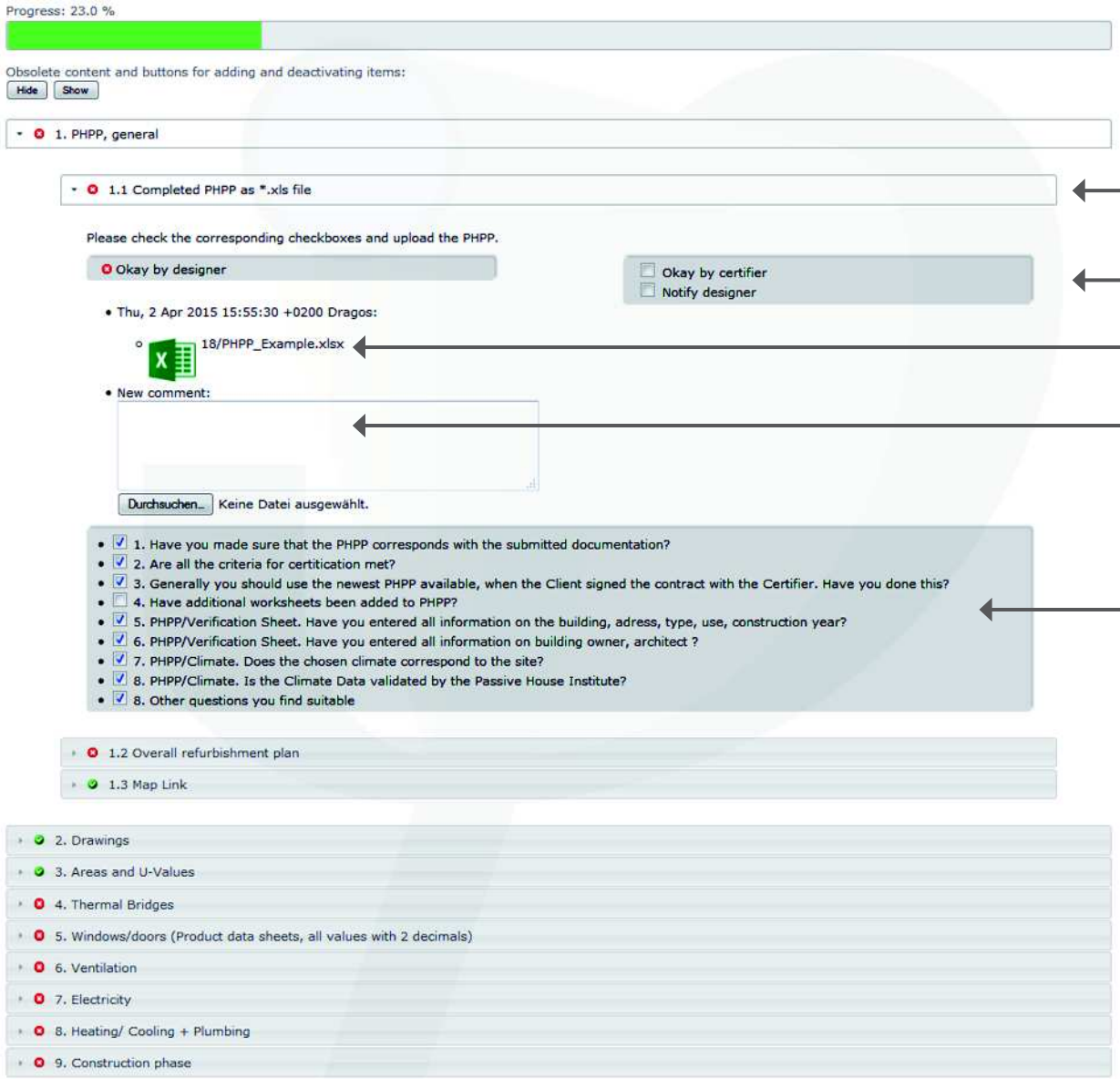
How does the Platform work?
Getting started



How does the Platform work?



How does the Platform work?



Category

Subcategory

Validation/Notification

Upload documents

Write comments

Checkboxes with assignments/questions

Interactive Checklist

The Certification Platform - Features and functionality

The Dialog Bar: 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 punctual comments in the Ventilation section. Please check.”), you write them in the Dialog Bar and click on ”Submit”(at the bottom of the page);
The designer will recieve a notification email containing the message on the Dialog Bar;
Keep in mind that any other modifications or comments made to the Checklist will not automaticaly send a notification to the designer. This happens only when you write in the **Dialog Bar** and click ”**Submit**”.

The Progress Bar: offers a general visual overview of the project’s status.

The Interactive Checklist: 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.

The Certifier’s workflow when creating a new project

1. Access the following link and login on the Platform: **certification.passivehouse.com/login**
2. Create access accounts for the following project partners:
    - **Designer** - the person responsible for submitting the project for certification. It can be only one person/project.
    - **Observers** - individuals connected to the project. They need/want to be kept up-to-date with the progress of the project, but they have no possibility to upload/edit documents or write comments.
3. Create a new project and assign it to the coresponding **Designer/Observers**;
4. Customize the checklist. You can add or delete categories/subcategories/issues from the checklist by using the ”**Show/Hide**” as follows:

Activating/deactivating a category/subcategory: Click on ”**Show**” > Navigate to the desired category > Click the ”**Deactivate category/subcategory**” button, found under the name of the category > Tick the ”**Deactivate category/subcategory (name)**” checkbox > Click ”**Submit**”. The activation is done following the same procedure.

- Activating/deactivating an issue: Click on ”**Show**” > Navigate to the desired issue > Tick the ”**Deactivate”** checkbox > Click ”**Submit**”. The activation is done following the same procedure.
You can also write extra explanatory comments for important topics in the checklist;

The Certifier's workflow when verifying a project

1. Login and check for new updated documents/comments from the designer
2. Write your comments and upload your revised documents in the Checklist, tick "**Notification seen**" (if aplicable) and "**Notify Designer**" in the fields you have worked and click on "Submit". This will add **a small exclamation mark**  next to the issue, in the Checklist, which the designer will see when he logs onto the Platform. This way the designer will know exactly which issue from the Checklist has been updated with new information.
3. Write your notification email in the "**Dialog Bar**", containing a short resume of the modifications/remarks you have made on the project and click "**Submit**". When writing in the **Dialog Bar**, the message will be sent by email only to the **designer**, not to the **Observers**.
4. In case an issue from the checklist has been successfuly solved, the Certifier will tick the "**Ok by Certifier**" cell, marking the issue 
The Certifier can at any point undo the step by unticking the "Ok by certifier" cell.

The Designer's workflow

1. Login and check for new updated documents/comments from the Certifier. The issues that have been completed/modified by the Certifier are marked with a yellow exclamation point.
2. Write your comments and upload documents in the Checklist, tick "**Notification seen**" (if aplicable) and "**Notify Certifier**" where needed and click on "**Submit**". This will add **a small exclamation sign**  next to the Issue, in the Checklist, which the Certifier will see when he logs onto the Platform. This way the Certifier will know exactly which issue from the Checklist has been updated with new information. If the designer considers an issue to be solved he can tick the "**OK by Designer**" box. The Certifier will see a yellow question mark  in front of the marked issue, which helps him identify the information pending for approval.
3. Write your message in the "**Dialog Bar**", containing a short resume of the new modifications/remarks on the project and click "**Submit**"
The designer will login 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 issue solved (and turn on the green light);

Additional information regarding the meaning of the logos

 - This issue has not been solved yet.
- Not all issues in this project, category or sub category have been solved yet, and there is no issue 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 issue 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.

 - This issue has been marked as solved by the designer (Ok by Designer), but not yet approved by the Certifier.
- At least one issue 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 issues can easily be found by the Certifier in the Checklist.

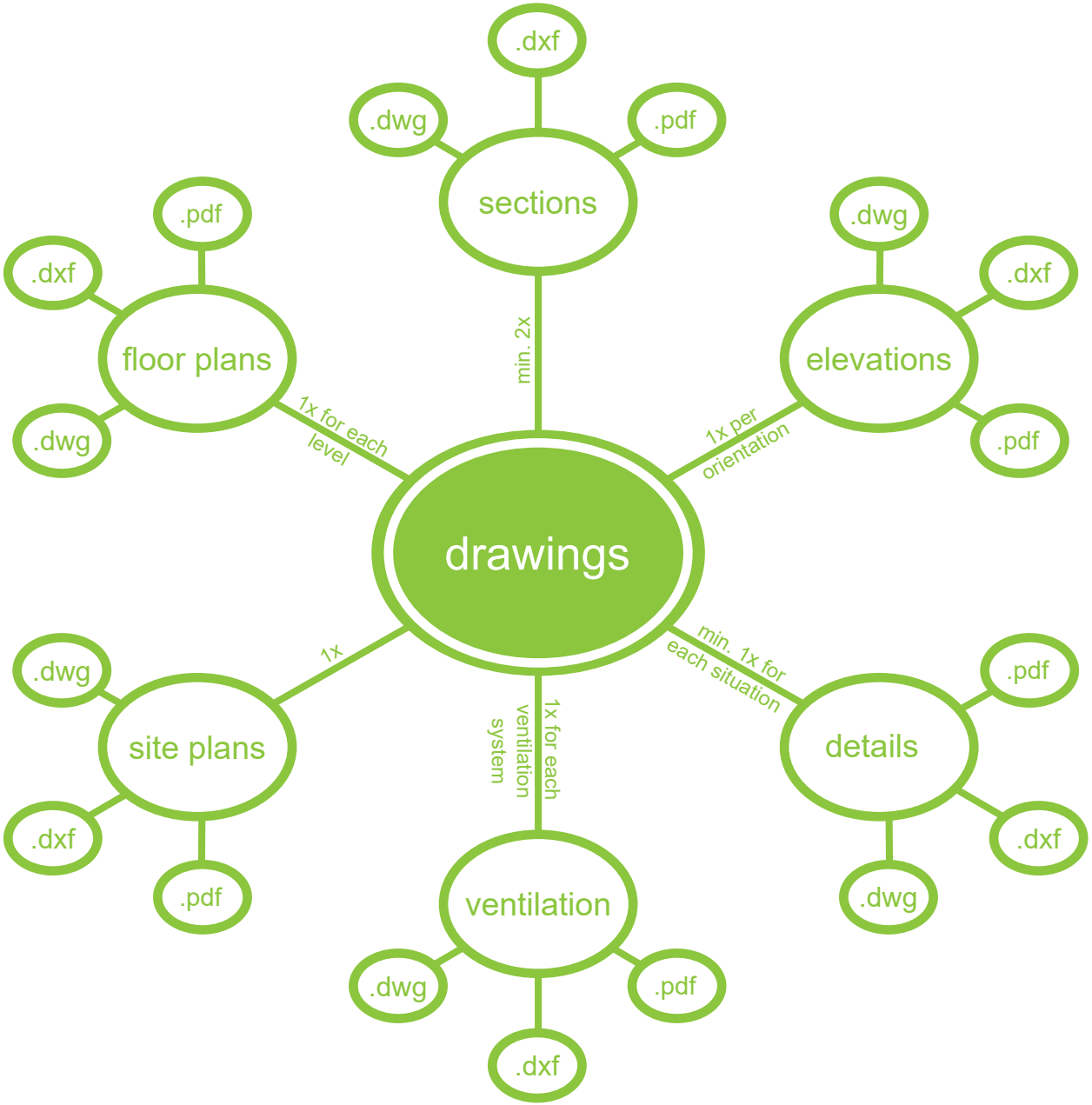
 - This issue has been approved by the Certifier.
- All issues in this project, category or sub category have been approved by the Certifier.

 - This category, sub category or issue has been deactivated by the certifier. Only visible to the Certifier when he/she previously deactivated a category/sub category/issue.

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**” > Navigate to the documents/comments you want to hide > Tick the ”**Obsolete**” checkbox > Click ”**Submit**”

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 Dialog Bar.

CHAPTER 2
architecture drawings



Passive House Institute

SITE PLAN

estimated distances from property boundaries

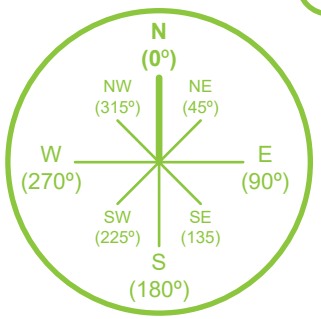
borders of the plot

neighbouring buildings including their nominal height and distance to the proposed building must be represented on the site plan

angle of deviation from North

graphic identification of the building envelope intended for certification

neighbouring vegetation or/and any other elements which can impose shadows, hight and type of vegetation



scale:
1:200
angle of deviation from North:
206°

complete adress:
Zona Szaszok Tabora, Fnr., Nr.Cad. 58743, Mun. Odorheiu Secuiesc

height above the sea level:
+/-0.00=556.00 m

format:
.pdf
.dwg
.dxf

PLAN FOR EACH FLOOR

groundfloor

cross section lines

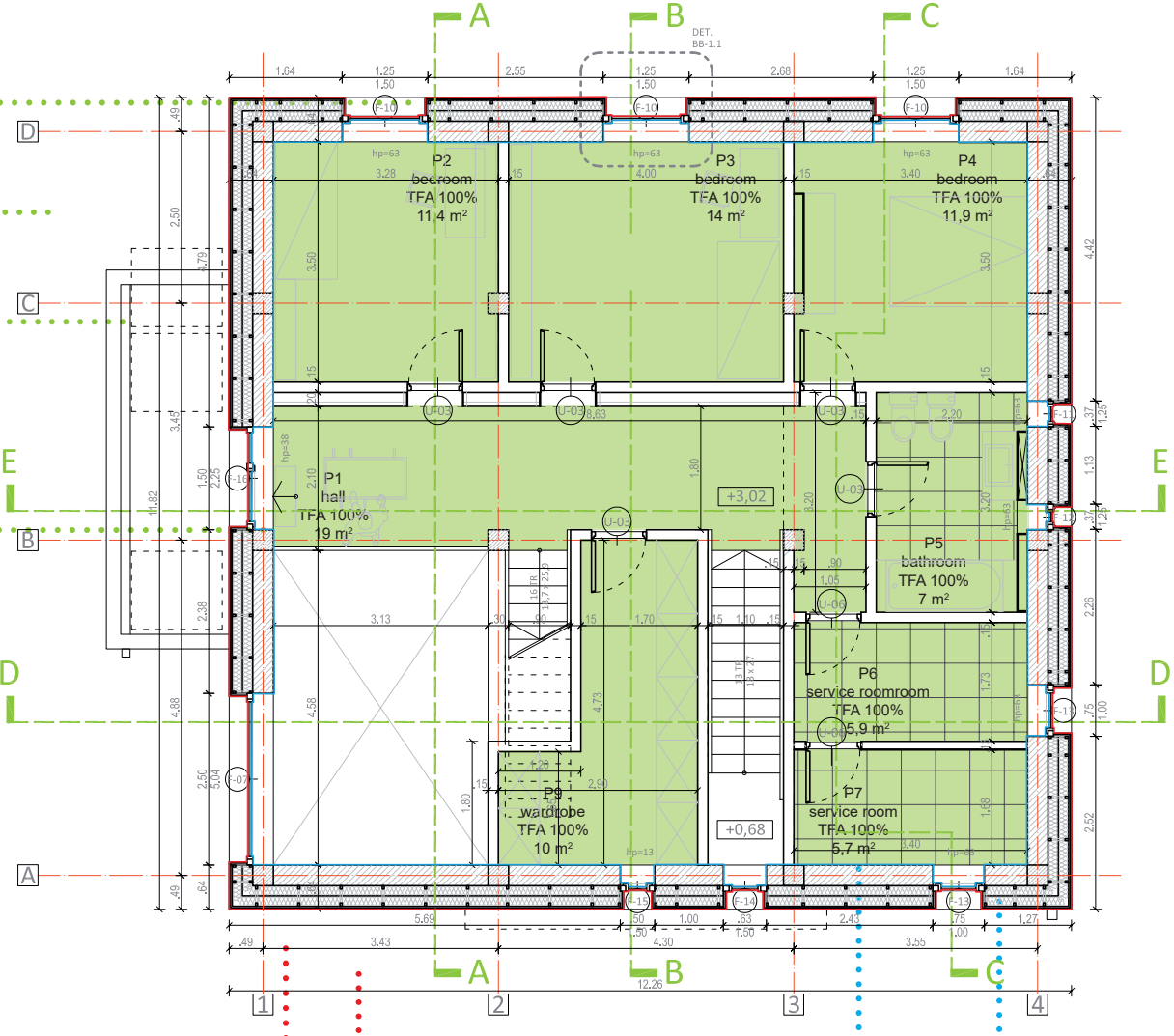
measurements

correct representation of walls and windows

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

*TFA is the reference surface for evaluating the building's energy balance. It is the summ of all floor areas within the thermal envelope. The surfaces are given different usage percentages, depending on the designated activity of every space/room and the clear hight. The calculation procedure is based on the Second German Floor Area Ordinance (II. Berechnungsverordnung). It has been simplified to a few points and was adapted by the Passive House Institute to the requirements of the energy balance calculation.

graphic identifiaction of different zones where the room height is below 2.00 m (respectively below 1m if present in the project)



graphic identification and external dimensioning of the thermal envelope (the red line is optional)

graphic identification of the airtight layer (the blue line is optional)

scale:
1:50
or
1:100

format:
.pdf
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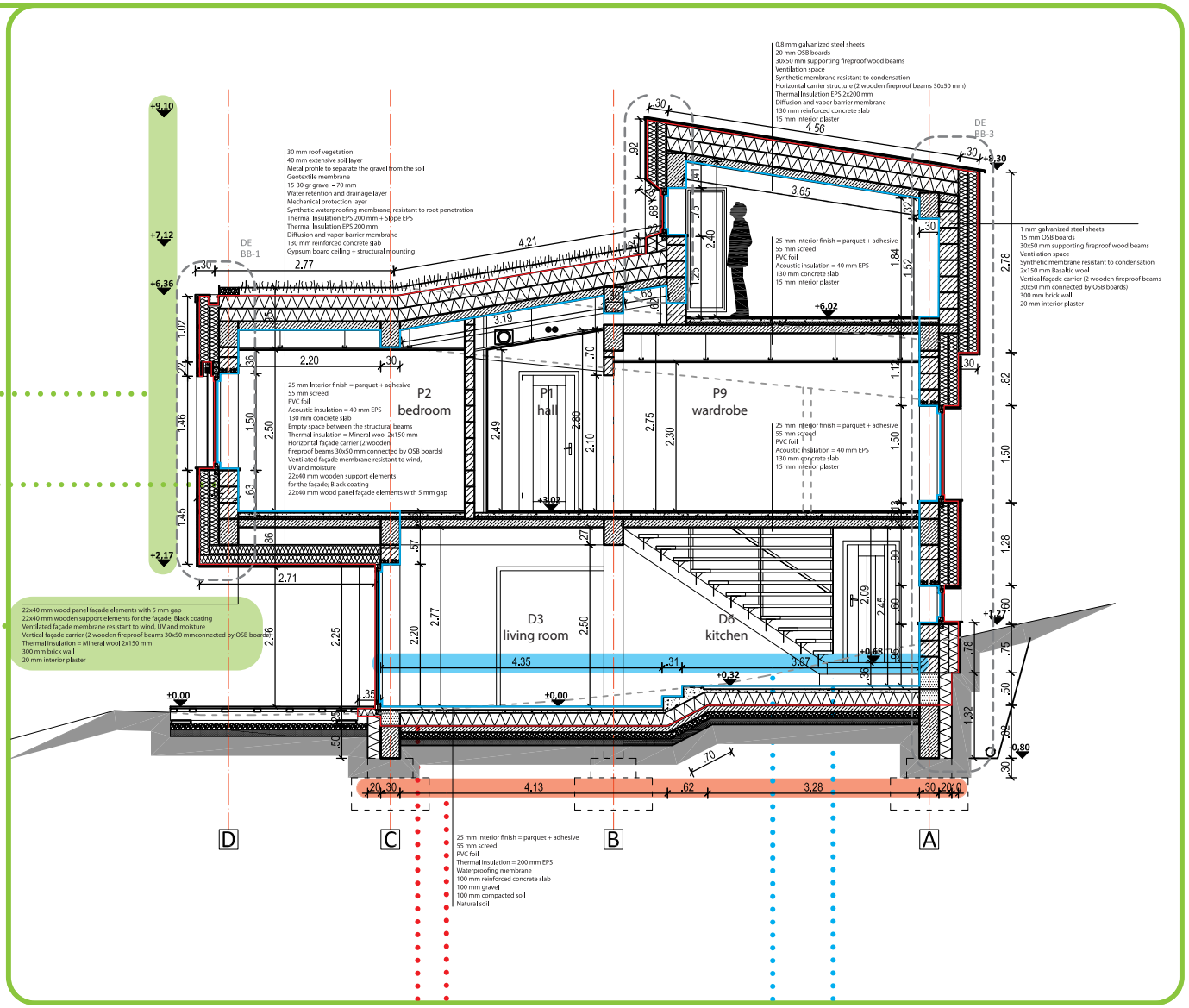
RELEVANT SECTIONS

section B-B



measurements

correct representation of walls, windows, roofs and slabs

description of each envelope component (including mixed layers, ex.: wood/insulation) with their features: manufacturer and product, thickness, thermal conductivity

scale:
1:50
or
1:100

format:
.pdf
.dwg
.dxf

graphic identification and external dimensioning of the thermal envelope (the red line is optional)

graphic identification of the airtight layer (the blue line is optional)

ELEVATION - ONE VIEW PER ORIENTATION

elevation west

show the different type of surfaces

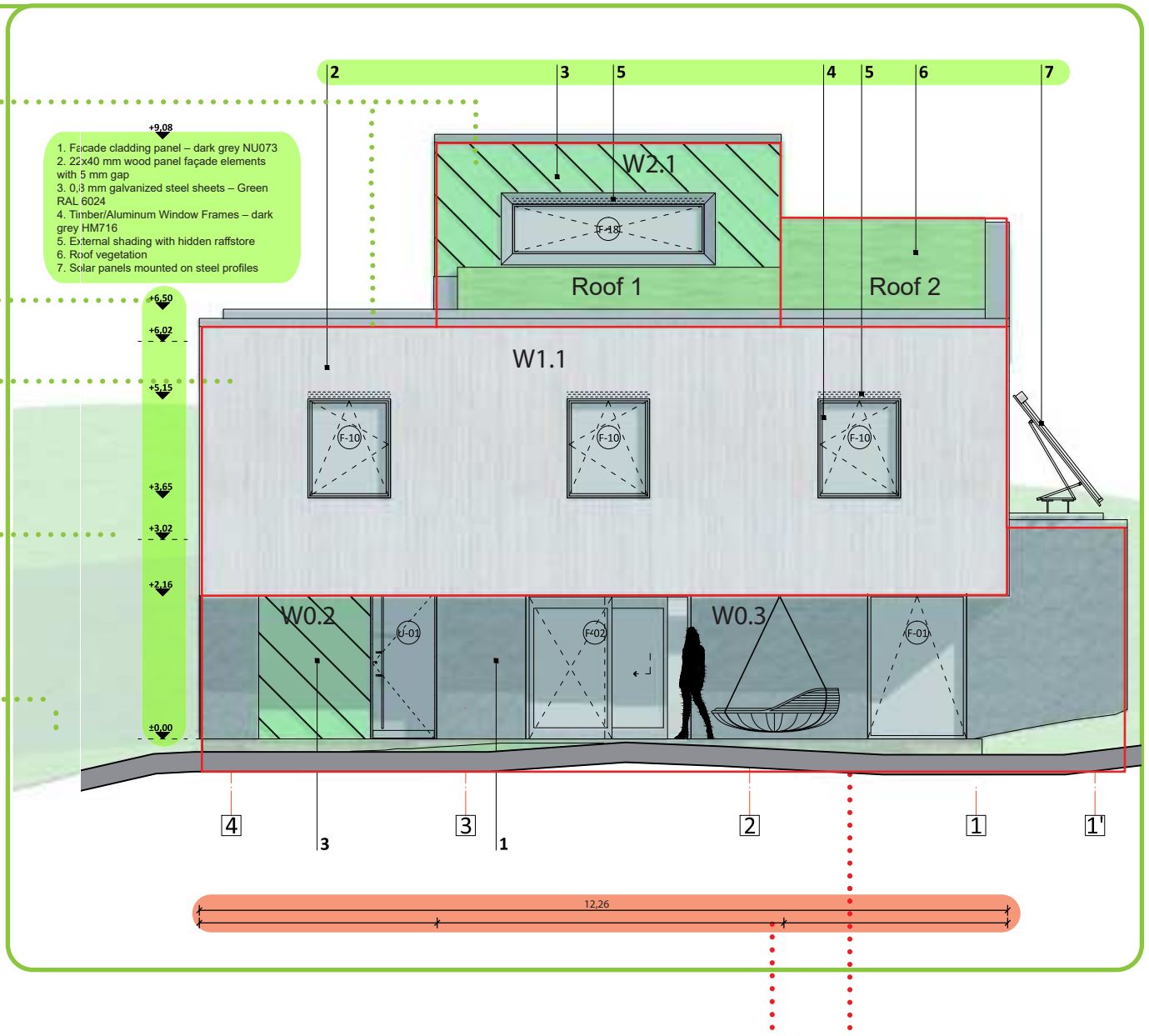
outside and outgoing air vents, grid types, distance from ground

measurements

correct representation of walls and windows

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

the wall surfaces in contact with the ground, for semi-buried walls, the level of the facade must be clearly shown by a comtinous line



graphic identification and external dimensioning of the thermal envelope (continous red line)

scale:
1:50
or
1:100

format:
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CONSTRUCTION DETAIL OF THE BUILDING ENVELOPE - AT LEAST 1 DETAIL DRAWING

detail of the roof, wall, window

measurements

thickness in mm of heterogenous layers

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:
1:50
or
1:100

format:
.pdf
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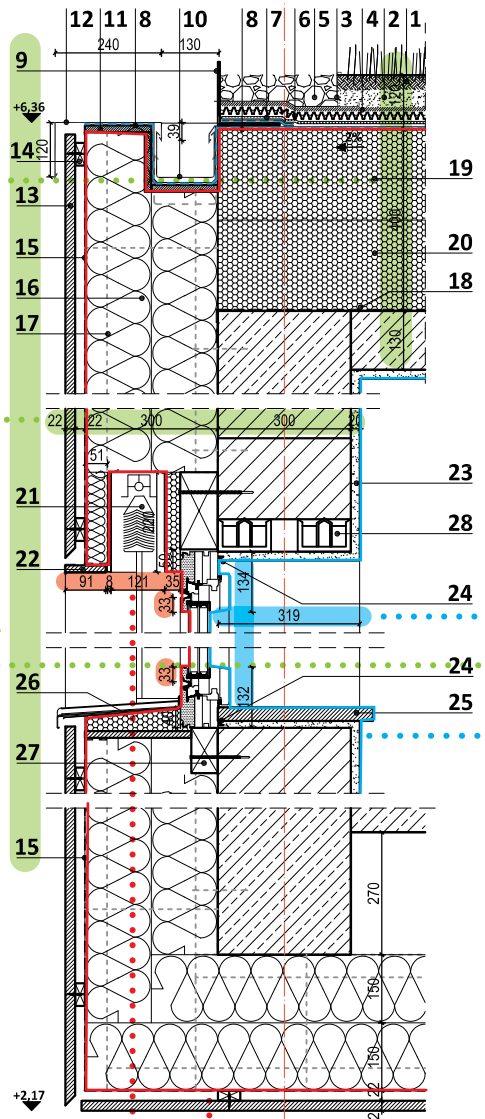


1. 30 mm roof vegetation
2. 40 mm extensive soil layer
3. Metal profile to separate the gravel from the soil
4. Geotextile membrane
5. 15-30 gr gravel – 70 mm
6. Water retention and drainage layer
7. Mechanical protection layer
8. Synthetic waterproofing membrane, resistant to root penetration
9. Perimetral plastic profile with side penetrations for drainage
10. Galvanized steel rectangular gutter, 13x20 cm
11. 15 mm OSB board
12. Drip edge - galvanized steel profile
13. 22x40 mm wood panel façade elements with 5 mm gap
14. 22x40 mm wooden support elements for the façade; Black coating
15. Ventilated façade membrane resistant to wind, UV and moisture
16. Thermal Insulation – Basalt wool 2x150 mm
17. Vertical façade carrier (2 wooden fireproof beams 30x50 mm connected by OSB boards)
18. Diffusion and vapor barrier membrane
19. Thermal Insulation EPS 200 mm + Slope EPS
20. Thermal Insulation EPS 200 mm
21. External shading with hidden raff store
22. OSB + galvanized steel profile
23. Interior plaster applied until the concrete slab level
24. Window perimeter plaster, applied on airtight tape layer.
25. 30 mm wooden interior window sill
26. Aluminum exterior window sill
27. Window footing 60x100 mm wooden beam
28. Prefabricated lintel

graphic identification of the thermal envelope (the red line is optional)

graphic identification of the airtight layer (the blue line is optional)

LIST AND DESCRIPTION OF WINDOWS AND DOORS

technical information
about windows and doors

make sure to use the same name codes on the drawings and the PHPP

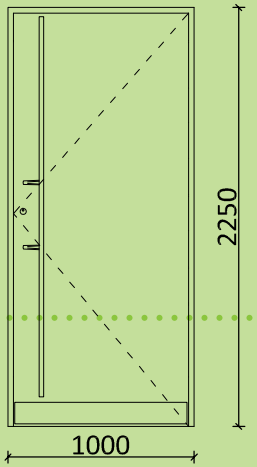
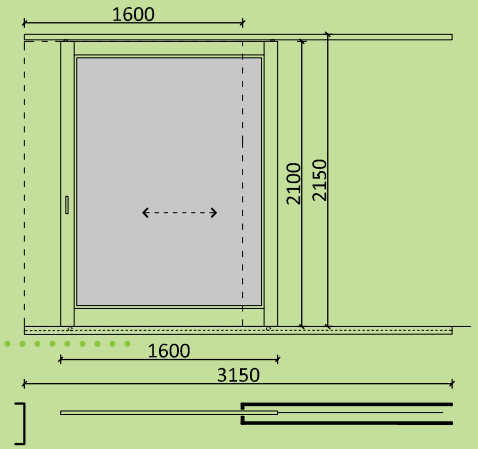
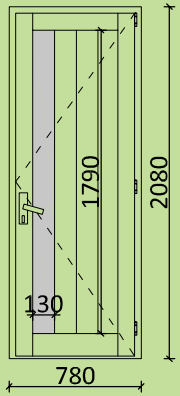
dimensions

type of glazing and framing (U-values, lambda)

area

materials

scale:
1:50
or
1:100

code	U-01 (Internorm HT300 COZ1B)	U-02	U-03
opening direction	stanga	dreapta	4 x stanga, 3 x dreapta
type	exterioara (montata pe rama in ext. zidariei)	interioara, usa glisanta in perete GK	interioara (toc cu canale de ventilatie)
quantity	1	1	7
	vedere din: EXTERIOR deschidere in: INTERIOR 		vedere din: INTERIOR deschidere in: INTERIOR 
dimensions	1000 x 2250 mm	1600 (3150) x 2150 mm	800 x 2100 mm
area	2,22 m²	3,36 m²	1,62 m²
threshold	2 cm, aluminiu	sina de ghidaj aluminiu, profil U	-
exterior material	tabla zincata, cul. gri verzui	-	-
glazing	-	sticla clara; 2,48m²	sticla mata; 0,23m²
material	lemn / aluminiu, cul. gri inchis (HM716)	lemn stratificat / bait transparent, cul. natur	lemn stratificat / bait transparent, cul. natur

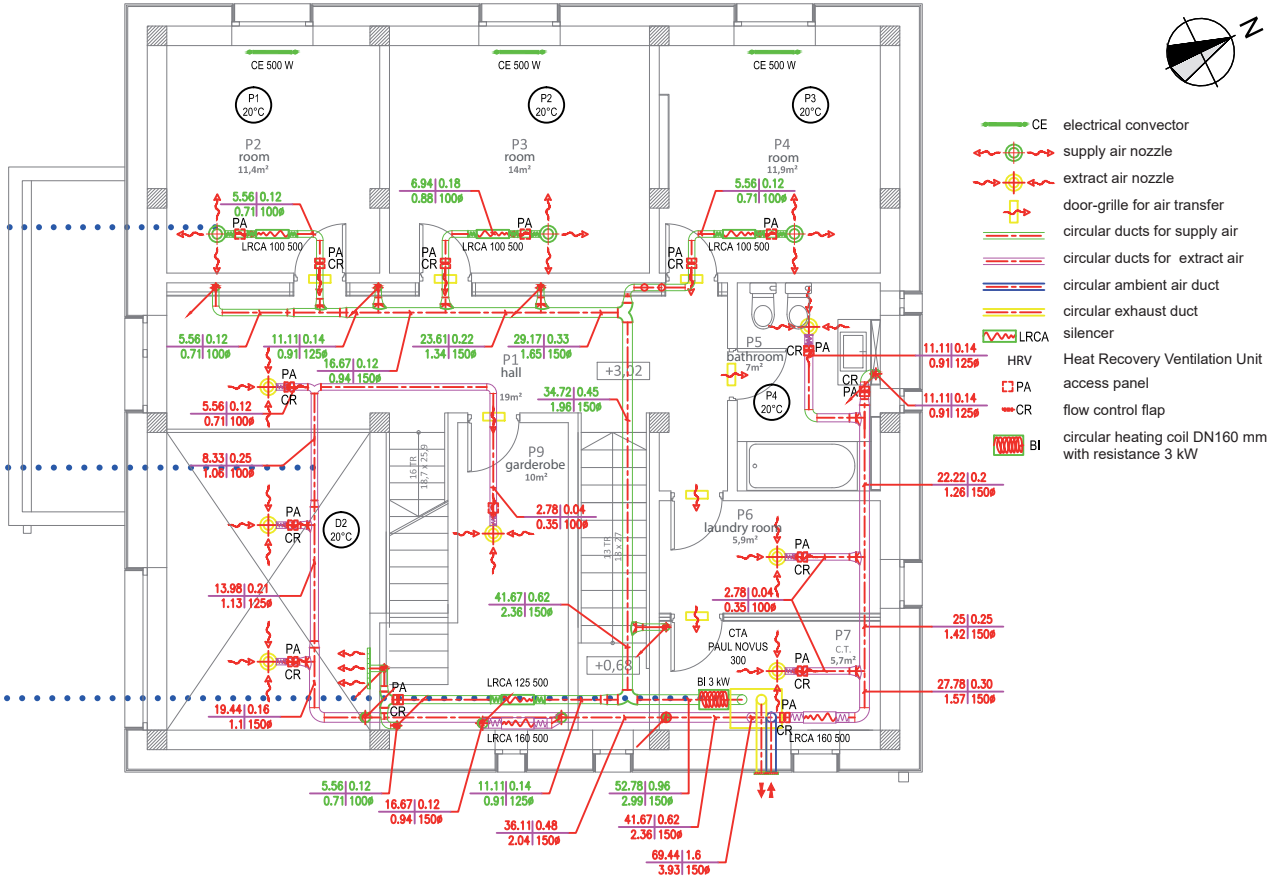
SCHEME OF VENTILATION SYSTEM

ventilation plan for each floor

correct representation of air supply and extract

correct representation of air ducts - meassure of ducts lenghts, diameter and insulation

location and type of ventilation unit(s) and other devices (ex. silencer, filter, flaps, earth tubes, control and etc.)



scale:
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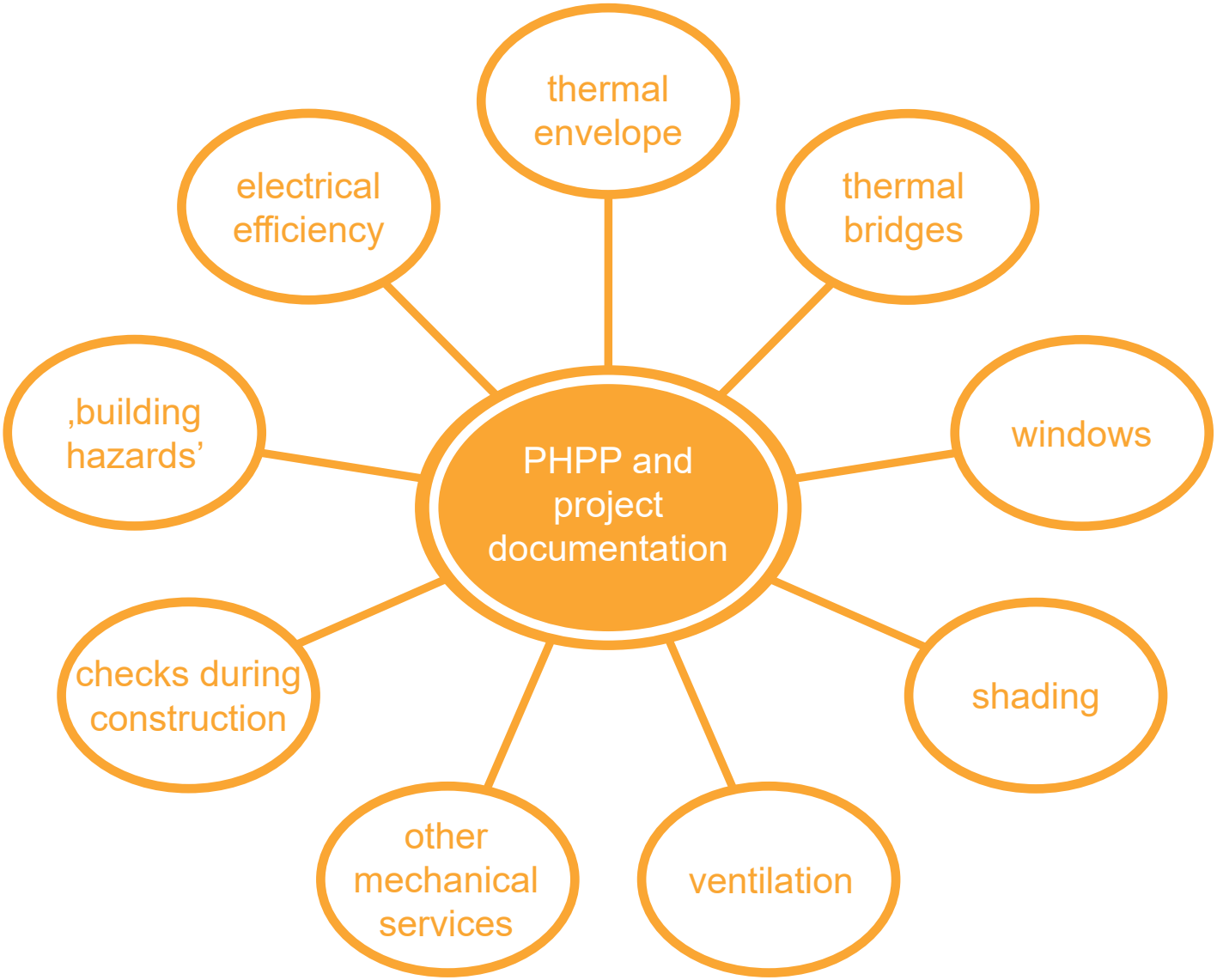
or
1:100

CHAPTER 3
Project documentation

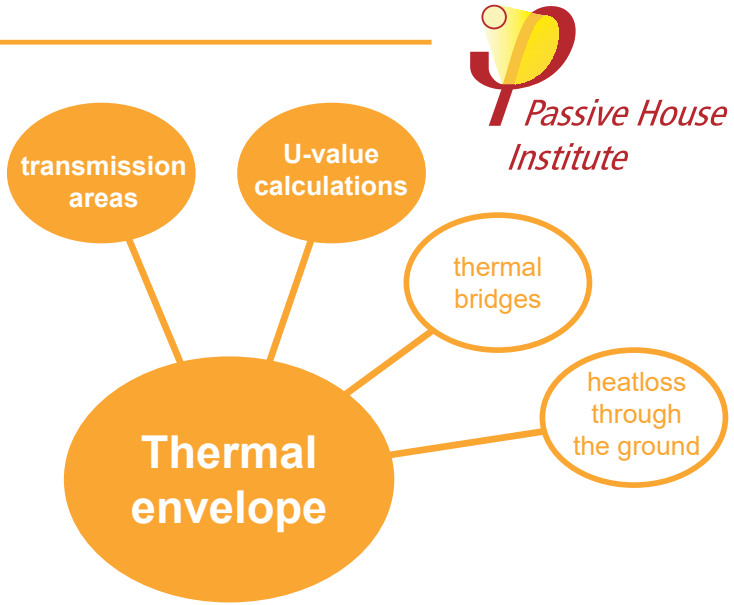


The PHPP is an easy to use planning tool for energy efficiency for the use of architects and planning experts. The reliability of the calculation results and ease of use of this planning tool has already been experienced by several thousand users.

The advantages of the Passive House Planning Package:

- Energy balance calculation in the common Excel format
- Easy and direct data input, in a flexible way where required
- Validated result accuracy
- Continually being further developed
- Verification for Passive House buildings and EnerPHit retrofits
- Detailed manual with tips for energy efficiency
- Interface for import/export of data from/into other programmes
- Can be combined with the 3D tool designPH (plugin for SketchUP)

PHPP Areas and U-values



The building envelope consists of all components that separate the interior from the exterior. The interior of the building allows prevailing comfortable climate, whereas the outside is determined by the weather. In order to maintain comfortable indoor conditions in Passive Houses, the entire building envelope needs to be perfectly insulated and prevented from air leakages.

The values may vary depending on the different climate zones and with the help of the PHPP you can precisely calculate the optimal solution for your project.

Transmission areas

- All dimensions/surfaces entered in the PHPP (Areas worksheet) should be also noted on the technical drawings, (heights/widths/lengths/areas);
- Name the transmission areas the same way in PHPP and on the plans;

PHPP TIP

- Document the calculation of the Treated Floor Area (TFA).

U-value calculations

- Make shure all entered layer thicknesses are correct and correspond to the detail drawings;
- Write the product names of the used insulating materials in PHPP;
- Check and enter the heat conductivies of all materials used;
- Take into account potential mixed layers (wooden/metal frame work);
- In the hot climates, the direction of the heat flow is different from the colder climates. The PHPP can automatically asess the direction of the heat flow, taking in consideration the chosen climate data.

Thermal envelope - required documentation concerning walls, roofs and slabs

Passive House Institute

	Documentation (pdf format)
wood framework	Provide technical data sheets detailing the materials used in the wood framework components. Define adjoining components on both interior and exterior sides.
concrete beams / metallic framework	Provide a technical assessment of the beams/framework which makes possible the calculation of the wall's global U-value. Otherwise, a thermal bridge calculation must be made on the basis of a detail drawing showing the sections andmaterials of the components. If combined with insulating components, state precisely the expected technology and the prescribed final U-value in W/(m²K).
insulation	Provide technical data sheets containing the following information: • conductivity [W/(mK)] in conformance with the European Norm (eg EN13162 - EN13171); • density [kg/m3]; • thickness [mm, application methods for insulating each opaque exterior surface, For insulating materials whose thermal properties depend largely on application (eg. cellulose fills) a technical sheet or technical assessment must be provided detailing the application mode, the settling and density parameters. The technical sheets of mechanical fastenings for insulating materials (wall plugs, screws, ...) must be provided and the relevant values for the project highlighted in the documents.
concrete / masonry	Provide technical data sheets describing the resistance class (eg. C16/C25); If applicable, provide information on the reinforcement degree and the volume density.

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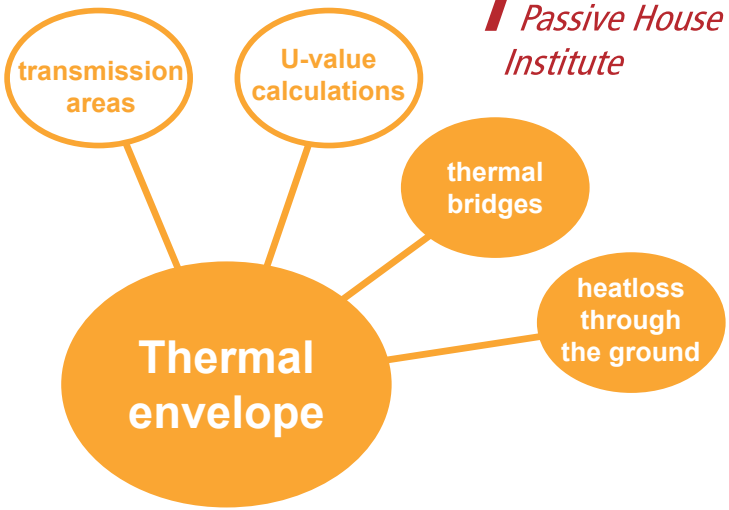
Thermal bridges

They are speciffic areas of the thermal envelope where the heat flow is increased compared to the adjacent surfaces.



- Illustrate the position and lengths of all relevant thermal bridges;
- Include thermal bridge calculations of the relevant details or make a reference to a thermal bridge catalogue;

Heat loss through the ground

- If a geotechnical report was made make shure to enter the results in the Ground Worksheet. If not, you can use the standard PHPP values;
- Enter the ground slab perimeter;
- Make sure to choose the apropriate connection type of the building with the ground in PHPP (Ground worksheet).
- If you used ground perimeter insulation in your project you can either enter it here.

Thermal properties of the soil

Soil type	Thermal conductivity W/(mK)	Heat capacity MJ/(m³K)
Slit/clay	1,5	3
Peat	0,4	3
Dry sand/gravel	1,5	1,5
Wet sand/gravel/moist clay	2	2
Saturated clay	3	3
Rock	3,5	2

Types of thermal bridges	Thermal bridges towards exterior ambient **|** Thermal bridges towards the ground **|** Perimeter thermal bridges
Documents (pdf format)	• Simplified evaluation report of coefficients for thermal bridges or make refference to a thermal bridge catalogue that contains the same detail description and materials as given in your project; • Numerical simulation report of coefficients for linear thermal bridges • Numerical simulation report of coefficients for punctual thermal bridges

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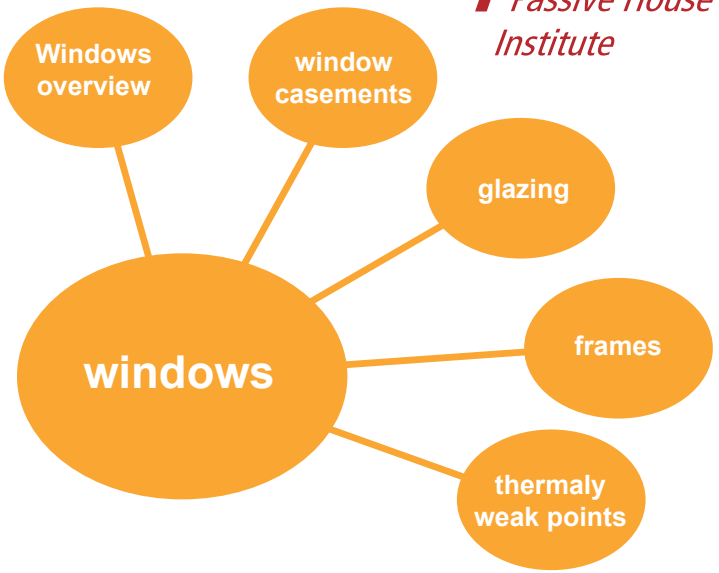

Windows overview

Windows have a considerable influence on the total energy balance. Therefore it is important to take into consideration the following aspects:

 In PHPP every glazing surface together with it's perimetral frames is considered as one window casement. Because of different orientations, shading situations, glazing and frame properties, every window casement should be entered separately, in a new row, in PHPP.
 For an easy recognition, every window casement should have the same Code name noted both on the architectural drawings (plans/facades) and in the PHPP/Windows Worksheet.

Glazing

 The g-value measures the solar heat energy alowed to pass through the chosen glass type. The values are given as percentage and must be entered with 2 decimals, e.g. g-value=0,55.

 The U_g-value measures the heat loss through the glass and the values are given in W/m²K with 2 decimals, e.g. U_g=0,62 W/m²K.
The glass manufacturer should provide this technical information.
If certified components are used, you can choose them from the list available in the PHPP/Components Worksheet.

Frames

 The U_f-value measures the heat loss through the frame and the values are given in W/m²K with 2 decimals, e.g. U_f=0,75 W/m²K.
The frame manufacturer should provide this technical information.
If certified components are used, you can choose them from the list available in the PHPP/Components Worksheet.

Thermally weak points

 The thermally weak points of a window are found:

- at the intersection between the glass and the frame ($\Psi_{glazing\ edge}$). The value of the $\Psi_{glazing\ edge}$ must be provided by the window manufacturer. If certified components are used, you can choose them from the list available in the PHPP/Components Worksheet; Standard values can also be found here.
- at the intersection between the frame and the building ($\Psi_{installation}$). The $\Psi_{installation}$ values must be assessed for every project, following the technical drawings. The window frames certified by the Passive House Institute offer calculated $\Psi_{installation}$ values for tipical window install situations.

 Don't forget to enter any additional heat and smoke vents, skylights etc. in the PHPP/Windows Worksheet.

Required documentation concerning windows

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	drawings (pdf/dwg format)	technical data sheets or tender documents
frame	• type of casement: fixed / sided-hung / top-hung, inwards/ outwards openings • frame overall dimensions in [m] • name of manufacturer • name of product • frame witdth a left / right jambs, sill and lintel	• manufacturers technical data sheets according to current standards: EN 10077-1 (4) and EN 10077-2 (5) for U_f and g, U_d; EN 673 (6) for U_g; EN 410 (7) for g in the following format: 0,xx W/(m2K) and g=0,xx or g=xx% • Tender Call Documents for Windows and Doors, written by the design team for the building aiming at Certification
glazing	• name of manufacturer • name of product	• decription of the materials used for the frame and spacer for sliding openings and exterior doors • state the prescribed g, U-Value installed
solar protection	• name of manufacturer • name of product	• state the composition of layers used in glazings as well as expected U-values, g-values and transparency index

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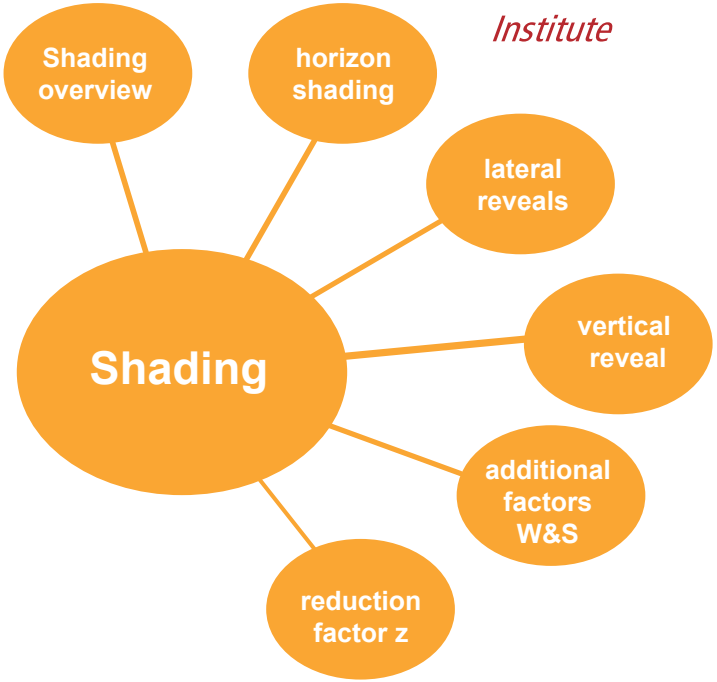
In order to precisely calculate the energy balance of a building it is important to take into consideration the shading situation resulted from neighbouring buildings, surounding vegetation, site's geography and building orientation.
The PHPP can assess the influence of the shading situation on the overall energy balance, in the form of a total reduction factor (r_S).
Please read the PHPP manual for more information on shading and step by step data input.
Make shure to take into consideration the following shading parameters:

Horizon shading (***h_{Hori}*** and ***d_{Hori} [m]***)
 Elements positioned in front of the glazing (when tracing an imaginary perpendicular line from the glazing surface to the elements), such as buildings, neighbouring landscape, hills/mountains etc.

Lateral reveals (o_{Reveal} and d_{Reveal} [m])
 Lateral distance from the glazing edge to the edge of the shading facade. This could be the distance to the same window reveal or to a protruding wall, etc.

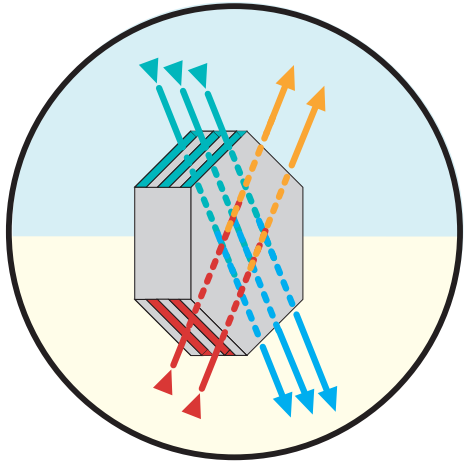
Vertical reveal (o_{Over} and d_{Over} [m])
 Vertical distance from the glazing edge to the edge of the overhang/balcony/roof overhang etc.

Additional reduction factors for winter and summer ($r_{other,w}$ and $r_{other,s}$ [%])
 Here you take into account elements such as balcony railings, trees etc. If the trees are decidous, the shading reduction factor for the winter time will be different from the one in the summer.



Reduction factor z for temporary sun protection [%]
 If additional shading devices are used, such as window shutters, they must be entered in this section following the calculation algorithm presented in the PHPP manual.
If the shading system is operated manually, remember that you must calculate as if it was closed only 70% of the time.

Tipp
 Each factor indicates the percentage of solar radiation reaching the glazing surface as reduced by the respective shading element. A shading factor of 100% means the window is unshaded; a shading factor of o% means the window is completely shaded.



The heat recovery principle of a MVHR
© Passive House Institute

For occupants, the most important planning aspects are health and comfort. Excellent air quality is especially essential and can only be achieved if “used” air is regularly replaced by fresh air. In this respect, opening windows twice a day is not enough. Comfort ventilation based on the requirements for fresh air is therefore indispensable in every Passive House.

The main interest here is the health of the building’s occupants, not necesarily energy efficiency; Indoor Air Quality (IAQ) has a much higher priority than energy conservation - but it turns out that there is no conflict at all, if a mechanical ventilation system with heat recovery is used (MVHR).

The evaluation of laboratory measurements shows that there are important differences between unit parameters determined based on measurements and theoretical design data based on the properties of individual components.

We therefore recommend that, whenever possible, energy parameters based on measurements be used to determine a building’s energy balance.

The number of certified Passive House ventilation units is constantly growing. You can find the certified components database with all the needed energy specifications here.

If only design data are available, then these should be used with caution and appropriate margins of error.

If the chosen component is not certified by the Passive House Institute please provide technical documentation regarding the heat recovery rate (the plant test report) and the electricity consumption (SEL) at the expected volume air flows and pressure losses.

Documents and information needed for asessing the ventilation concept

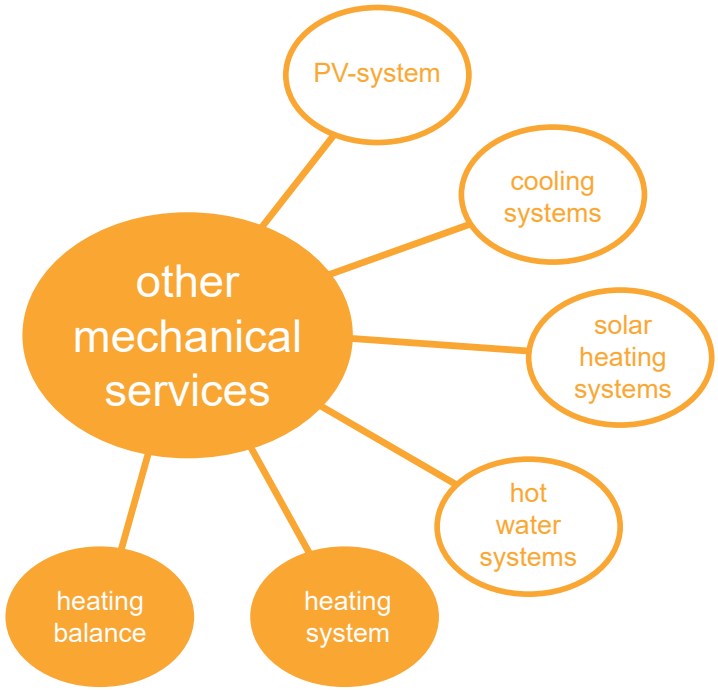
Passive House Institute

	ventilation plans (pdf/dwg format)	airflow design sheet	ventilation technical sheets or tender call documents
outside air, exhaust air	• specify duct type, diameter, length in m between the exchanger unit and thermal envelope (if exchanger inside envelope) • ducts insulating material, thickness in mm and lambda in x.xxx W/m.K • specify location and type of inlet and outlet air vents • specify the type of filter on the outside air vent	The outside and exhaust air flows must be balanced	Provide technical sheet for: • ducts, associated junctions and fastening joints • insulation used and associated temperature range
supply air/ extract air	• specify interiour duct type, diameter in mm and (if aplicable) insulation thickness in mm together with the lambda value in x.xxx W/m.K • specify location and type of inlet and outlet air vents	Specify the designed airflows for each room	Provide technical sheet for: • ducts, associated junctions and fastening joints • insulation used and associated temperature range input and return air vents. • In the tender call, please state the prescribed overall pressure loss for both supply and extract sides. Describe also the insulation level.
transfer flows	Show transfer openings according to EN 13779.	Define transfer flow rates and specify types of openings.	Note in the tender docs number and products for transfer airflows.

Documents and information needed for asessing the ventilation concept

Passive House Institute

	ventilation plans	airflow design sheet	ventilation technical sheets or tender call documents
ground heat exchangers (air or brine)	Draw the circuit. On drawing, show: • length in m and average depth in m, • declivity in % where applicable • material and diameter in mm • fluid type for brine heat exchanger • where applicable, condensates disposal area • hydraulic module and exchange battery, where applicable	Specify the designed airflows for each room	If no (air or brine) ground heat exchanger is present, please provide: • technical sheet of defrosting coil, which must indicate its rated value. If a ground heat exchanger is used, provide: • technical sheet of pipes • technical sheet of condensate liftpump where applicable • technical sheet of circulation pump, where applicable • In the tender call docs, describe required properties for defrost battery or ground heat exchanger. Do not forget key features such as declivity, brine type, circulation pump, depth, number of tubes and length.
silencers	On drawing show: • manufacturer, product • dimensions		Provide technical sheets of the different types of silencers, precise number and technology.
MVHR units	Locate on plan and specify the Product Manufacturer In the case of location inside the thermal envelope, specify the sound insulation planned for the walls of equipment room / false ceiling. In the case of location outside the thermal envelope specify the composition of the walls of the room and show access ways.	Specify the type of filters planned	For units not certified as “Passive House component”, provide a calculation of heat recovery efficiency according to the Passive House Institute measurement protocol, or alternatively following EN 13141-7 (9) with calculations based on the exhaust air.



Heating balance

 The PHPP heating demand calculation method generally follows the **EN ISO 13790.** There are two Worksheets in PHPP that offer extensive informations regarding the Heating Demand:

 The Heating Worksheet

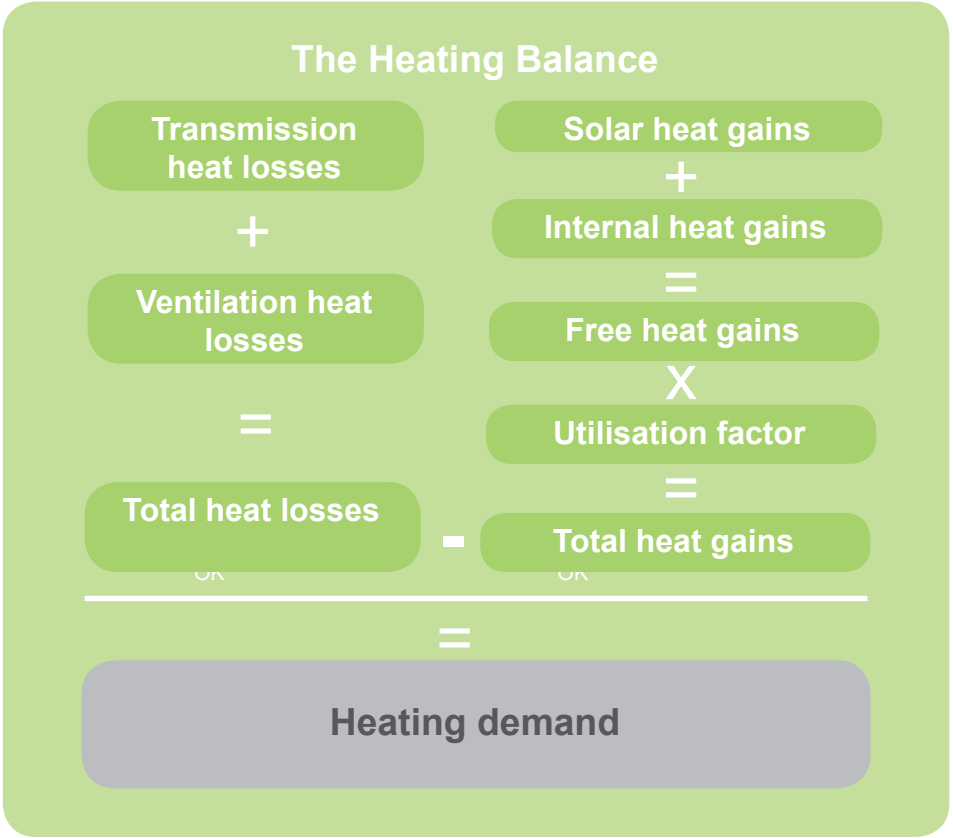
- Calculates according to the monthly climate data and determines the sum of the monthly balances during the heating period;
- The thermal storage capacity (calculated in the Verification Worksheet), is taken into account

 The Annual Heating Worksheet

- Calculates the energy balance using as reference, the annual climate data of the entire heating period.

Heating system

 Make sure to add a comprehensive written description of the heating generation and distribution concept. The description should include information regarding the heating system, heating source (ex: natural gas, heat pump, district heating, etc) and distribution (air heating, radiators, under floor heating, wall heating etc.).



The energy balance diagram
© Passive House Institute

Documents and information needed for asessing the heating generation and distribution

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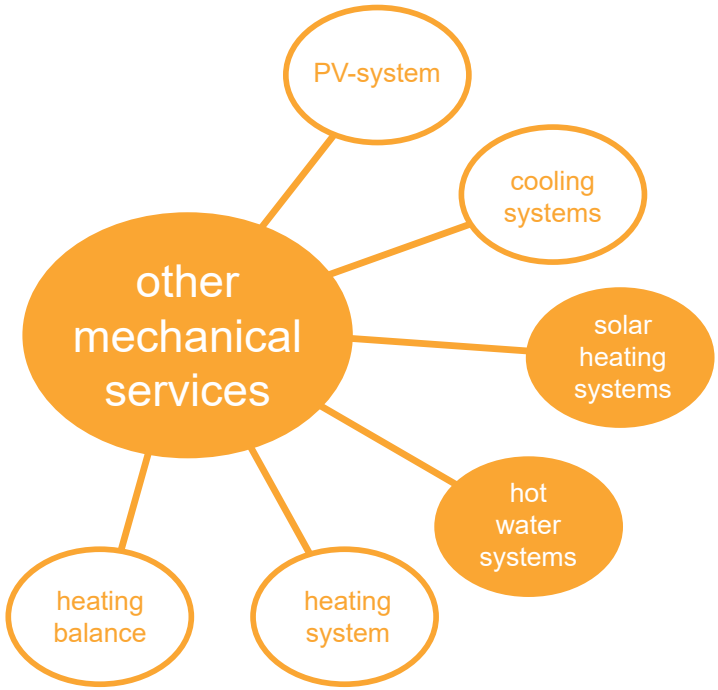
	technical drawings	written description of the heating concept	heating technical sheets
type of expected document	1:100 scaled floor plans describing the heating system and specifying: • heat generation type (direct electric, heat pump, logs, pellets, gas, fuel,etc.) • manufacturer / product • rated power in W / kW • where applicable description of hydraulic network	Description of the heating concept written by the design team.	Manufacturer's technical data sheets; Technical evaluation document or equivalent.
heating with supply air	Show the rated power of each source in W / kW. Specify the type of insulation of supply air ducts.	Precisely state the target heating load with hygienic air flow (PHPP calculation, should be close to 10 W/m²). Describe the heat supply system : nominal power, regulation, insulation of distribution system	Technical sheet of heat sources
heat pump heating	• Drawing of the heat pump/s on floor plan/s • Insulation material, lambda and thickness in mm for ducts and storage where applicable	Precisely state the heat source, prescribed annual COP according to relevant European Norm, expected storage volume and specific losses	• heat pump, including evaluation of its annual COP or failing that, COP evaluation accordingto EN14511-2 (10) and EN14511-3 (11) • storage where applicable • different types of insulation
heating with wood, gas, fuel	• drawing of the boiler on floor plan • insulation material, lambda and thickness in mm for ducts and storage where applicable • manufacturer / Product	Precisely state the heat source, prescribed nominal power and efficiency, expected storage volume and specific losses, insulation level of distribution system, properties of circulation pump where applicable.	• boiler, refer to PHPP tab for required entry data • storage where applicable • different types of insulating materials



Domestic hot water system

 The DHW+Distribution worksheet calculates the useful energy demand for hot water generation and the heat losses of the different distribution and storage systems for heating, hot water and cooling.

 The PHPP requires the input of different parmeters in order to calculate the following elements:

- Space heat distribution;
- DHW useful heat;
- DHW demand;
- Shower drain-water heat recovery (if aplicable);
- DHW distribution (with circulation pipes or individual ones);
- Storage heat losses;
- Cooling distribution.

 Write a comprehensive written description of the hot water generation and distribution concept. The description should include information regarding the hot water system, heating source (ex: natural gas, heat pump, district, etc), distribution (individual pipes or recirculating pipe system), storage and insulation.
 follow the instructions/recommendations available on the following two pages.

 Please **provide the technical data sheets of all the system's elements, together with technical drawings and pictures** showing the installed situation.

Solar heating system

 The solar contribution rate is calculated through an algorithm according to Duffie and Beckman [Duffie/Beckman]. Altough this method is giving a rough estimate, the accuracy is normally sufficient both to size a solar thermal system (collector area and storage tank volume) and to estimate the output of the system under the boundary conditions given by the climate and the construction site. In PHPP the user can choose default values for typical systems or configure his particular solution.

 In order to justify the output, please make sure to **provide the technical data sheets of all system elements together with drawings/pictures showing the installed position, number of modules, orientation and potential shading elements**.

Documents and information needed for domestic hot water

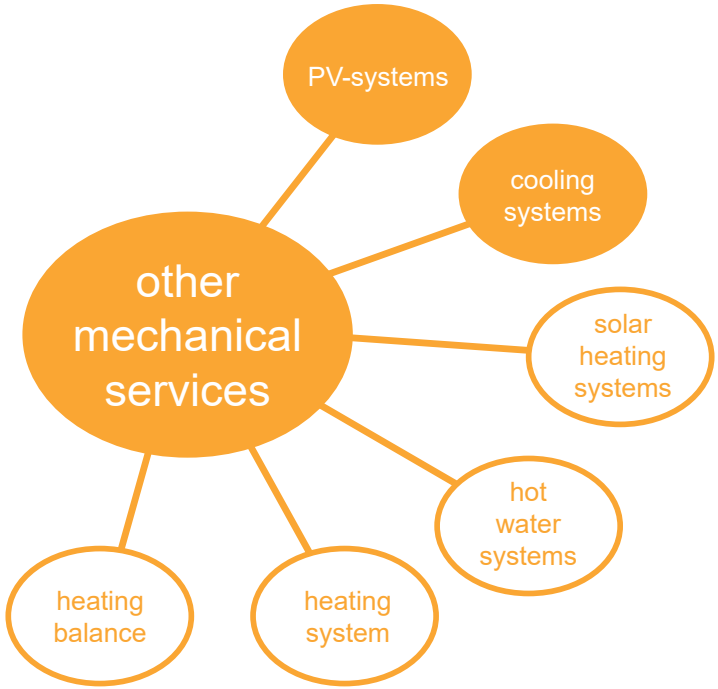
Passive House Institute

	DHW plans	DHW written description	DHW technical sheets
type of expected document	1:100 scale floor plans describing the heating system (centralized / decentralized) and specifying: • DHW generation type (direct electric, air/water, etc. heat pump, solar thermal, logs, pellets, gas, fuel, etc.) • manufacturer / product • rated power in W/kW • description of the water-heating system distinguishing loops and terminal links • description of the storage	Description of the heating concept written by the system design team.	Manufacturer's technical sheets, Technical evaluation document or equivalent for thermal solar panels or equivalent, SolarKeymark, CSTB, SPF technical specs or equivalent
DHW storage tank	Show on drawing: • manufacturer / product • volume in L • rated losses in W/K	Precisely state volume, stratification technology, specific rated losses in W/K, installation room. Define connections to any exterior generation system.	• Manufacturing technology • volume in L, material, insulation thickness in mm and lambda • rated losses in W/K
recirculating pipes	Show on drawing: • pipe material & diameter in mm, insulation thickness in mm and lambda • verifiable length of loop in ml • circulation pump manufacture or product	Precisely state minimum insulation level in terms of U-values for insulated pipes. Define operating hours and nominal temperature. Define required nominal power for circulation pumps.	Technical sheets for the different types of insulation used
individual pipes	• pipe material & diameter in mm, insulation thickness in mm and lambda where applicable • verifiable lengths of terminal links (drawing point >tank) in ml	State expected pipe material, total length of pipes with their diameter sizes.	

Documents and information needed for domestic hot water

Passive House Institute

	DHW plans	DHW written description	DHW technical sheets
Heat pump generation, other Renewable Energy Sources	Drawing of the heat pump on the floor plans: • Pipe and storage insulation material thickness in mm and lambda value • Manufacturer / Product	State the expected average efficiency of the generation system, as well as its minimal performance in winter (eg. X % coverage of DHW demand from November to February). Define all energy-related properties (seasonal performance, surfaces, volumes, thermal powers, electrical loads, …)	Technical sheets: • nominal thermal power, average efficiency • seasonal performance • storage where applicable NOTE: In the event of a compact unit not “Certified Passive House component”, refer to PHPP tab
Heater using combustible materials wood, gas, etc.	Drawing of the heater on the floor plan: • pipe and storage insulation material thickness in mm and lambda where • applicable	State the expected average efficiency of the generation system, as well as its minimal performance in winter (eg. X % coverage of DHW demand from November to February). Define all energy-related properties (seasonal performance, surfaces, volumes, thermal powers, electrical loads, …)	Technical sheets: • boiler, see required entry data in PHPP “Boiler” tab • storage where applicable • different types of insulation used
format	.pdf	.pdf	.pdf



Cooling systems

 In order to save energy, it is important to firstly concentrate on the **passive ways of cooling the building** such as:

- using exterior shading devices for the windows;
- propperly insulating the thermal envelope;
- using highly reflective coatings on external walls and roofs;
- enabling the night ventilation for cooling, by opening the windows (only in climates where the night temperature and humidity contribute to passive cooling).

 In case the above mentioned measures are not enough to satisfy the necessary cooling demand, an active cooling system should be installed. The **Cooling worksheet** calculates the useful cooling demand, which represents the amount of heat that must be extracted from the building during the year, in order to obain a confortable indoor climate.

 The **Cooling units worksheet calculates the final energy demand for (sensible) cooling and dehumidification** and enables the possibility to choose the active cooling strategy. Here you can also **predimension the cooling units**, in order to satisy the cooling demand and coose one of the following four different processes for cooling:

- **Supply air cooling;**
- **Recirculation cooling e.g. fan coils or split units;**
- **Surface cooling without dehumidification;**
- **Additional dehumidification without sensible cooling.**

 Electrical operation using a heat pump is assumed for each process; absorption chillers or similar devices cannot be represented. More information regarding the above mentioned active cooling strategies can be found in the **PHPP manual** and on **www.passipedia.org**

 Please write a **description of the active cooling concept and provide the technical data sheets of all system elements together with drawings/pictures showing the installed position, number of units and their alocated cooling areas.**.

PV-systems

 The PHPP enables the output calculation of up to five connected photovoltaic Systems. The output calculation is carried out using the following input parameters from the PV pannel's technical data sheet:

- Rated current (I_{MMP} **in A**) and rated voltage (U_{MMP} **in V**);
- Temperature coefficient of the short-circuit current (**α in %/K**);
- Temperature coefficient of the open-circuit voltage (**β in %/K**);
- Dimensions of the modules.

 In order to justify the output, please make sure to **provide the technical data sheets of all system elements together with drawings/pictures showing the installed position, number of modules, orientation and shading elements**.

Electrical efficiency

 The electricity demand in a Passive House should be reduced as significantly as possible. In this respect the efficiency of household appliances and building systems is crucial for reduction of future electrical demands.

 Efficiency is characterized by standardized energy usage estimates. The electricity demand is calculated from these estimates taking in consideration the conditions of use.

 There are different calculation algorithms and required documents for different usage patterns, as follows:

 Residential buildings: please provide **a list containing all the household electric appliances and their rated energy consumption**.

In this case PHPP calculates the energy demand using a standard usage pattern according to the number of occupants and the entered household electric appliances.

 Non-residential buildings: The **Electricity non-res worksheet** offers the possibility to choose from a big variety of **user patterns, according to the building use**. It is also possible to enter new data and configure a custom usage pattern.
Special attention must be given to rooms/devices which require a considerable amount of electricity such as **server rooms/devices, refrigerating rooms/devices, professional kitchens, elevators**, etc.
In this respect please provide **a detailed list of all electric appliances and their rated energy consumption**.

 Another important factor **is lighting**. In order to propperly assess the energy demand for lighting, please provide **the lighting technical plans/drawings containing the installed power of every element or alternatively the LENI values**.

In the A**ux. Electricity worksheet** make sure you check the following isues:

- activate/deactivate the electrical de-frosting of the MVHR;
- enter the extra electrical power for summer ventilation (if applicable);
- enter the power rating of additional pumps used for DHW and/or heating/cooling distribution (if applicable).

Photographs from the construction process

The progress of construction should be supported with photographs. It is not necessary to provide complete photographic documentation of all measures but some aspects are quite relevant.
Recommendations:

- Insulation around foundations
- Detail of window mounted in wall
- Photos of type of windows and glazing
- Photo of brand and type of ventilation unit
- Insulation of warm and cold ventilation ducts
- Insulation of warm and cold piping
- Any other noteworthy aspect/construction detail.

Airtightness test report

 Airtightness measurements in Passive House buildings are carried out in accordance with the EN 13829 standard. Supplementary information by the FLiB (specialists' association for airtightness in building construction) can be found in the supplementary sheet for this standard. The measurement can also be carried in accordance with ISO 9972, but with an adapted calculation of the volume.

 Make sure to enter the corresponding aitightness result in the PHPP/Ventilation;
 Adapt the wind protection and screening factors in accordance with the building's location.

Commissioning report for the ventilation system

 Provide a copy of the guideline and commisioning report to the technician who runs in the ventilation system;

Declaration of compliance

 Provide by post, the signed declaration of compliance which states that the built project corresponds to the documents supplied to the Certifier. The declaration must be signed by the site manager who was responsible for the construction.

Technical References

Project Acronym	EuroPHit
Project Title	Improving the energy performance of step-by-step refurbishments and integration of renewable energies
Project Coordinator	Jan Steiger Passive House Institute, Dr. Wolfgang Feist Rheinstrasse 44/46 D 64283 Darmstadt jan.steiger@passiv.de
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