Deliverable 2.6

Tender document for reliable, fast, and cost-effective renovation (Task 2.5)

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1. INTRODUCTION

The building industry plays a crucial role in the EU's energy policy and achieving its objectives, such as reducing greenhouse gas emissions and increasing the use of renewable energy sources. Key legislation such as the Energy Efficiency Directive (EED) and Energy Performance of Buildings Directive (EPBD) guide EU member states to implement measures that will help reach these goals. With the building sector accounting for around 40% of energy consumption in the EU, it has the greatest potential for cost-effective energy savings. Additionally, reducing fuel poverty, decreasing dependency on external energy sources and increasing energy security make the case for lower energy consumption and higher energy efficiency in the building stock even stronger.

To address this, EU has set the goal of all new buildings being nearly zero-energy buildings (NZEB) by 2020, which is a significant step in reducing carbon emissions and promoting the use of renewable energy sources. However, this goal depends on the commitment of individual member states, which are required to create ambitious plans for increasing the number of NZEBs, including policies and measures for retrofitting existing buildings. The average efficiency of the building stock is still poor, and in order to meet climate protection goals, there is a need for cost-effective and fast-installation deep renovation concepts that can achieve a considerable reduction of CO2 emissions. This, of course, can be done through the use of cutting-edge technologies such as smart building systems, advanced insulation materials, and high-efficiency heating and cooling systems.

However, not enough attention is dedicated to an essential part of the whole renovation value chain which is the construction tendering process. Currently, many construction tendering processes and practices involve a significant amount of manual labour, such as paper-based document submissions, in-person meetings, and in most cases lack specific clauses that characterise a deep energy retrofit. This can lead to inefficiencies and a lack of transparency, as well as increased costs for both the owner and the contractors. Taking these barriers into consideration, this document aims to develop a standardised set of criteria which can be included in any tender documents for deep renovation projects. They are intended for building owners and investors wishing to undertake these renovations which in turn will play a key role in ensuring that the goal of NZEBs is achieved. By utilizing the dependable principles of Passive House renovation, the developed criteria will offer guaranteed energy performance and consumer services to building owners or inhabitants, thereby creating a new business model that combines physical building upgrades with long-term energy supply services.

2. SAMPLE CRITERIA FOR RENOVATION OF BUILDINGS

Energy renovation of existing buildings is a process that can be divided into several stages and the quality of the final product depends on compliance with certain requirements of each of them. The award of the individual stages together or separately is most often done by tendering for a contractor. Through these procedures, the contracting authority should select the most economically advantageous tender, but also ensure a high quality of the final product. To this end, along with the technical specification, practice provides for the setting of minimum selection/eligibility criteria and evaluation criteria for tenders. It is essential that each participant in the investment process is informed as early as possible of the Employer's wish to certify its building. In order to ensure the quality of the design and implementation process, it is best that this is specified and explicitly written down when the energy audit is commissioned.

The technical specification is an integral part of the tender documentation for the building renovation, and at the design stage it also has the function of a design brief. In this section of the tender documents, the contracting authority should specify what it wants to achieve in the performance of the contract, define the subject matter, the object of intervention, the maximum or minimum time limit for performance, specific requirements to be taken into account by potential contractors, the location of the site, the estimated cost, and other specific requirements, for example: energy efficiency class, standard to be achieved, technical parameters (specific energy consumption for heating, air tightness, U value, etc.). Once a contract is concluded, the technical specification becomes an integral part of the contract for implementation and the requirements/conditions become clauses of the contract.

The selection/eligibility criteria should be as open as possible, allowing participation by the widest possible range of potential contractors. In this respect, when the contracting authority formulates these criteria, it should be guided solely by the specific characteristics of the procedure. The minimum selection criteria are those which are required by law for the exercise of a given activity, such as certificates, legal capacity, etc., and are directly related to the subject of the contract, i.e. if the contract is for the selection of a contractor for the design of a building, the tenderers should have a minimum specific experience and have designed at least 1 building with similar parameters to the one of the contract.

The criteria for evaluating tenders should be clear, measurable where possible, and provide information to potential tenderers on what conditions their tender will be evaluated more highly. Together with the technical specification, they are the main tool for the contracting authority to set the quality criteria for the final product. Some of these criteria may be greater experience of the designers or builders than minimally required, may include specific requirements for the final product such as energy consumption to be achieved, quality of the microclimate, operating conditions, life cycle costs, etc. When defining the quality criteria, it is advisable that the contracting authority defines a tiered scoring, so that the tenders which result in the highest quality on the defined indicators are scored the highest.

3. STAGE 1 – ENERGY EFFICIENCY AUDIT

Energy efficiency audits play a crucial role in the process of building renovation. They provide a comprehensive assessment of a building's energy performance and identify potential measures that can be implemented to achieve substantial energy savings. In the context of achieving the EnerPHit certification criteria, the first stage of the renovation process begins with the commissioning of an energy efficiency audit. This stage sets the foundation for the entire renovation project, as the findings and recommendations from the audit will serve as the basis for developing the investment project. By explicitly requiring the consideration of EnerPHit criteria in the energy audit, the employer ensures a standardized and rigorous approach to achieving energy efficiency goals. In order to avoid any suspicion of unequal treatment of bidders, the EnerPHit Standard should be provided as part of the technical specification to the tender/award.

It is important that the proposed measures in the audit are communicated at the earliest stage to all stakeholders, as these will be the basis for the development of the investment project, and this can also be included as a condition in the technical specification and consequently embedded in the future contract.

In terms of criteria, it is possible to award additional points if the contractor:

- has trained its experts in the principles of deep energy renovation and step-by-step renovation;
- the proposed staff has a higher professional competence - specific experience with auditing and prescribing measures that lead to deep renovation or reaching the parameters of the EnerPHit standard.

It is important that the conditions for awarding additional points are tailored to the local context in terms of available experience and capacity. The fulfilment of the conditions for additional points shall be evidenced by the provision of relevant training certificates and contracts, acceptance reports or certificates of works carried out.

4. STAGE 2 – DESIGN

After the energy audit, the investment projects for the implementation of the energy renovation of the building are commissioned and prepared. The design is a process that is regulated in the legislation, both in terms of the qualifications of the designers and the scope and content of the investment projects. In addition to the regulatory requirements is the design brief, which should set the working framework of the Employer's requirements to be met by the investment project, the phase of the investment project within the meaning of each country's specific Spatial development Acts (e.g. for Bulgaria that is: Art. 139, para. 1 of the Spatial development Act), as well as to clearly indicate what are the indicators for the final product, as a minimum it should define:

- the purpose of the intervention (renovation, construction, conversion, etc.);
- the purpose of the building;
- volumetric and spatial characteristics and functions;
- heating, cooling and ventilation systems;
- use of photovoltaic or solar installations
- specific requirements to achieve a certain energy class, energy consumption, comfort requirements, noise levels, etc.

The design brief may include a requirement for the building to be certified and refer to specific requirements for materials, testing and documentation described in the **EnerPHit** and **EnerPHit+i** certification criteria as described in Annex 1 in this document.

In addition to the eligibility criteria, which are based on the regulatory requirements, the following evaluation criteria could be set at this stage to give preference to participants (bonus points) that would ensure a higher quality final product:

- Applicants proposing a design team in which the expert in the Energy Efficiency and/or HVAC part has been involved in the design of at least one building (new or renovated) that is certified as Passive House;
- Bidder has proposed in his design team, designers who have been trained in the design of low energy buildings and/or deep energy renovation;
- A Bidder that can demonstrate/provide measured energy performance data for m^2 of completed projects, including heating, cooling, lighting, hot water, and ancillary equipment.

The fulfilment of the conditions for additional points shall be verified by the provision of relevant certificates of training and contracts, acceptance reports or certificates of works carried out. In addition, a list of the designed objects may be requested from the contractor or from each designer separately, indicating for each building minimum information such as the presence of an EE certificate, energy efficiency class, specific indicators such as energy performance per m^2.

5. STAGE 3 – EXECUTION/CONSTRUCTION WORKS

The implementation of energy renovation measures is crucial for the quality of the final product. Statistically, this is the stage where most mistakes are made that compromise the functioning of the building.

The technical specification for the award of works is based on the energy audit and the investment projects. However, it is the tool for setting certain types of requirements for the civil engineering contractor to ensure the quality of the final product. These may be purely technical requirements, organisational requirements or those related to specific tests, studies and/or training prior to handover of the building. If the Employer wants to certify its building after renovation, it is also necessary to include this as a condition in the technical specification or as a clause of the contract, which is also part of the tender documentation, referring to the specific material, testing and documentation requirements described in the **EnerPHit** and **EnerPHit+i** certification criteria attached to this document. These may be:

- Require the Contractor to complete and submit all documents necessary to certify the building to the **EnerPHit** and **EnerPHit+i** Certification Criteria;
- Obligation of the Contractor to prove the compliance of the materials used with the set requirements by submitting the necessary documents;
- Require the Contractor to provide training to the Employer's staff operating the building;
- Requirement to carry out systematic monitoring for a period of min. 1 year after commissioning of the building and fine-tuning of the operating parameters of the individual systems to ensure optimum efficiency;
- Linking contract payments to the achievement of certain key performance indicators in the energy renovation, with the final payment (e.g. 10%) being made after certification of the building.

The selection/eligibility criteria should be as open as possible, allowing participation by the widest possible range of potential contractors. In this respect, when the contracting authority formulates these criteria, it should be guided solely by the specific characteristics of the procedure. For example:

- Builders must be registered in the relevant public professional registers for the category corresponding to the category of the works.
- The requirement for specific experience should be limited to the execution of at least 1 site/activity similar to the subject of the contract and may be supplemented by indicators of scope (floor area, function of the building if this implies any specificities, etc.). Experience of more than 1 activity/site should not be requested here as it could be interpreted as a limiting condition.

More stringent requirements could be applied in the evaluation criteria. There, for example, additional points can be given if the participant has more than 1 site, e.g., between 2 and 5, and more points if more than 5. The important thing is to put a reasonable limit on the extra points so that they are justified, and whether it is applicable. In Bulgaria for example nearly zero energy buildings are no more than 10. In this case it would not be relevant to set a minimum experience requirement of 5 sites per contractor.

In the evaluation criteria, it is appropriate to set minimum requirements for which a number of points (x) should be determined and, accordingly, building requirements, the fulfilment of

which will bring a higher number of points (x+) to a particular participant in the overall ranking.

№	**Minimal requirements** ***National Standards***	**Enhanced requirements** ***EnerPHit Standards***
1	Execution of at least 1 site/activity similar to the subject of the contract, which may be supplemented with scope indicators (floor area, building function if this implies any specifics, etc.). **Indicative mark:** X points **Means of proof:** Documents certifying the fulfilment of the condition according to national practices - it can be a recommendation, contract, handover protocol.	*Completed between 2 and 4 sites/activities similar to the subject of the contract, and may be supplemented with scope indicators (GFA, building function if this implies any specifics, etc.). **Indicative mark:** X + 5 points *Completion of 5 or more sites/activities similar to the subject of the contract, which may be supplemented by indicators of scope (floor area, function of the building if this implies any specific features, etc.). **Indicative mark:** X + 10 points
2	The designated project manager has coordinated the building renovation activities of at least 1 similar site. **Indicative mark:** X points **Method of proof:** Documents certifying the fulfilment of the condition according to national practices - it can be a recommendation, contract, handover protocol (*should be described according to local practices*).	*The designated project manager has coordinated the building renovation activities on 2 or more similar sites. **Indicative mark:** X+5 points *Has undergone deep energy renovation training. **Example score:** X +10 points
3	Training of the Employer's employees in the use and maintenance of the building systems on site. **Sample score:** X points	Training of the Employer's employees in the use and maintenance of the building systems and simultaneous monitoring and fine-tuning of the settings in a period of min. 1 year after commissioning. **Sample score:** X +10 points

When an effective reconstruction of an existing building is implemented according to the **EnterPHit** certification criteria from the construction stage, i.e. the initial project does not comply with these criteria - individual or all construction components do not meet the **EnterPHit** criteria, the Contracting Authority may award additional points for bidding construction components meeting the criteria.

№	**Minimal requirements** ***National Standards***	**Enhanced requirements** ***EnerPHit Standards***
1	Opaque building envelope - External insulation according to design **Sample score:** X points **Method of Proof:** - Internal insulation according to design **Sample score:** X points **Method of Proof:**	*External insulation in accordance with the requirements of the EnerPHit standard *Provided certificates, performance declarations, test results, etc. **Sample mark:** X+5 points *Internal insulation according to the requirements of the EnerPHit standard *Provided certificates, performance declarations, test results, etc. **Sample mark:** X+5 points
2	Window W (window) meeting the requirements of the project. **Sample score:** X points **Method of Proof:**	*According to the requirements of the EnerPHit standard *Provided certificates, performance declarations, test results, etc. **Sample mark:** X+5 points
3	Ventilation with heat recovery meeting the requirements of the project. **Sample score:** X points **Method of Proof:**	*According to the requirements of the EnerPHit standard (at least 75% Heat Recovery) *Provided certificates, performance declarations, test results, etc. **Sample mark:** X+5 points
4	Airtightness of the building meeting the requirements of the project. **Sample score:** X points	*According to the requirements of the EnerPHit standard (n smaller than 0.6 of the total house volume per hour) *Provided certificates, performance

	Method of Proof:	declarations, test results, etc. **Sample mark:** X+5 points
5	Thermal bridges of the building meeting the requirements of the project. **Sample score:** X points **Method of Proof:**	*According to the requirements of the EnerPHit standard (the most amount of thermal bridges avoided or minimised) *Provided certificates, calculations, test results (thermographic images), etc. **Sample mark:** X+5 points

It is also possible to take a more global approach - by presenting the certification criteria, the contracting authority specifies through a clause in the contract the possibility of a reward for the certification of the building.

Article X. The contractor shall be entitled to receive a reward of (may be fixed as an exact amount independent of the winning bidder's offer or as a percentage - 15% of the contract value) in case he certifies the building according to the attached certification criteria upon completion of the works. For the certification criteria for the EnerPHit standard see Appendix A.

6. SAMPLE STRUCTURE AND SPECIFIC REQUIREMENTS IN AN ENGINEERING PROCUREEMENT

6.1. TECHNICAL SPECIFICATION

This section, which forms part of the overall engineering procurement documentation, is a detailed technical specification to be applied in the implementation of the subject matter of the contract.

DESCRIPTION OF THE SUBJECT OF THE ORDER:

The subject-matter of this tender is the execution of ……

Scope of the order:

The subject-matter of this procurement shall include the execution of the following three activities:

Activity 1: design
Preparation of an investment project, technical/working design phase, for construction: ……
……

Activity 2: Author's supervision
Exercise of author's supervision during execution of construction works:
……

Activity 3: construction / execution of works
Execution of construction works on the realisation of the construction:
……

Place of execution:

……

6.2. DEADLINES

6.2.1. Deadline for completion

At least three deadlines should be foreseen - a deadline for design (possibly for approval of the investment project in the detailed design phase); a deadline for execution of the works; a deadline for author's control; If certification is foreseen or a subsequent deadline for confirmation of the achieved energy efficiency class and/or certification should also be foreseen.

6.2.2. Warranty periods

They are defined as a period of time during which the contractor is obliged, on his own behalf and at his own expense, during the operation of the building, to remove any defects/defects/errors that may arise as a result of the performance of the subject matter of the engineering contract. The warranty periods shall be in accordance with those specified and defined in each country's specific national legislation, e.g. for Bulgaria this is Ordinance No. 2 of 31.07.2003 on the commissioning of construction works in the Republic of Bulgaria and the minimum warranty periods for the completed construction and installation works, facilities and construction objects and shall commence from the date of issue, in accordance with the due statutory procedure, of the Certificate of Commissioning.

This report does not envision the warranty periods to be part of the methodology, as they are common practice and not related to the certification criteria. However, the requirements should be in line with the minimum ones and be realistic.

6.3. BACKGROUND DATA

The background data and information necessary for the performance of the contract is listed below:

Sample Requirements:

- For room types and their functionality;
- For the construction of the building and preservation/compliance with architectural features;
- Requirements for replacement of building installation;
- Other according to the needs of the Customer.

6.4. REQUIREMENTS FOR EPC OR ENERPHIT CERTIFICATION

This section lists the requirements for achieving an energy efficiency class or applying EnerPHit certification standards. The subsequent requirements, methodology and clauses in the contract will evolve around these requirements.

1. When developing the technical/working design, the Contractor shall provide for measures, activities and materials that will result in the building achieving energy efficiency class "X" according to the building energy efficiency audit or higher.

1.1. To establish the energy efficiency class, the Contracting Authority will commission a certified auditor to carry out an audit. The audit shall be carried out within three months after the expiry of one calendar year from the commissioning of the building. *(The time limits may be different, these are reasonable time limits in view of any withholding of payment or guarantees by the Contractor.)*

2. The Contractor shall comply with all EnerPHit, building components, and other specific building certification requirements described in the certification criteria when developing the technical/work design.

2.1. After completion of the works, the Employer will proceed with the certification of the building, and the contractor is responsible until the completion of the procedure. (the process should take approximately 2-6 months)

6.5. REQUIREMENTS AND CONDITIONS FOR THE PERFORMANCE OF THE ACTIVITIES COVERED BY THE ENGINEERING CONTRACT

6.5.1. Design

Describe the requirements of the Employer to the project. These may repeat the requirement for certification or achieving energy efficiency class. Indicate the obligations to provide designers in accordance with the requirements (if set as selection criteria or as an element of the evaluation of the offer, it is mandatory to set a requirement to use exactly the specified persons), describe the regulatory requirements for the project. If there are requirements for explanatory notes, method of presentation of information, drawings, formats and scales, such as the Contractor to describe technical solutions, activities envisaged, techno-economic indicators, specification of construction products (materials, products, kits and systems) envisaged to be used with their technical requirements in accordance with current norms and standards and EnerPHit performance technology and certification criteria. Other requirements of the Employer for the project shall be described - accessible environment, consideration of architectural-historical or cultural features, adjacent buildings, etc. Requirements for the BoQ, etc.

The contractor shall develop and submit an investment project, technical design phase, in scope and in all applicable/required parts,

The contracting authority shall specify the required parts and their respective requirements.

Designer supervision is not examined in this report.

6.5.2. Construction

It describes the scope of construction, albeit with reference to the approved investment project, the responsibility for compliance with legal requirements of the builder, as well as responsibility to third parties, communication with consultants and investor control. If there are specific technical requirements for materials, processes, supplies, allocation of responsibilities in coordination procedures, etc.

Requirements can be set for work processes and technologies, including "green" and social criteria, such as the use of machinery with low levels of harmful emissions, including background noise, the use of recycled building materials - recycled concrete, building ceramics, recycled plywood, etc., the employment of permanently unemployed persons, etc.

The supply of all products, materials and equipment necessary for the execution of the construction and installation works shall be the responsibility of the Contractor, and all materials, equipment, machinery, finished products and others to be incorporated and/or used in the construction and installation works on the Sites shall comply with each country's local legislation e.g. in Bulgaria that is the BDS EN standards (current at the date of application, from the Bulgarian Institute for Standardization) or equivalent, as well as the requirements of EnerPHit certification standards provided by Passive House Institute.

Supplied materials and equipment must be accompanied by the relevant certificates of quality and origin, declarations of performance and other documents in accordance with the

requirements of the local Law on Technical Requirements for Products and other regulations governing this matter.

The Contractor shall perform and provide all documents necessary to certify the building according to **EnerPHit** and **EnerPHit+i** Certification Criteria.

The Contractor undertakes to provide training to the Employer's staff who will operate the building.

The contractor shall appoint an expert to participate in a monitoring of the building within up to eight working days (two days each season) within one year of the building being commissioned to fine-tune the parameters of the individual systems to achieve optimum efficiency. On-site visits (if necessary) shall be carried out by prior arrangement, at the initiative of the Employer, at least 20 days before the visit.

EnerPHit certification criteria are an integral part of the technical specification and are binding for the contractor!

7. INDICATIVE SPECIFIC REQUIREMENTS FOR SELECTION CRITERIA

Selection criteria relating to the suitability/capacity to exercise a professional activity of the participants:

- **NO SPECIFIC**

Selection criteria including minimum requirements for the economic and financial situation of the tenderers:

- **NO SPECIFIC**

Selection criteria including minimum technical and professional ability requirements:

- The Bidder shall have a design team in which the Energy Efficiency and/or HVAC expert has been involved in the design of at least one building (new or renovated) that has been certified as Passive or certified to the **EnerPHit** standardization criteria or (On the Light Form) Has a designer/design team that has been trained to design low energy buildings or deep energy retrofits.

The minimum requirement shall be indicated/declared in accordance with the European Single Procurement Document (ESPD). According to the Law on Public Procurement/Public Procurement Act, the tenderer shall submit a list of persons who will participate in the performance of the contract, indicating the course/training undertaken and brief information about it.

- During the last five years from the date of submission of the tender, the tenderer shall have performed at least one activity with a subject and scope identical or similar to the subject of the contract i.e. one building certified as Passive House or according to **EnerPHit** certification criteria or another standard covering the same requirements.

A subject identical or similar to the subject of the contract shall be deemed to be the performance of a building certified as Passive House or certified according to the **EnerPHit certification criteria or another standard covering the same requirements. The Employer shall also accept a non-certified building, subject to the Contractor's submission of m^2 energy performance data from a completed project, including heating, cooling, lighting, hot water and auxiliary equipment, as determined by measurement by an independent organisation/laboratory.*

**A scope identical or similar to the subject-matter of the contract shall be deemed to be the execution of at least a site, with no requirement for an Area.*

In order to prove the requirement the bidder shall fill in Part IV, point "C", of the ESPD - a list of construction works identical or similar to the subject and scope of the contract.

At the stage of conclusion of the contract, the participant selected as contractor shall submit: a list of works identical or similar to the subject and scope of the contract, accompanied by a certificate(s) of good performance, which shall contain the value, the date on which the performance was completed, the location, type and volume, as well as whether it was performed in accordance with the regulatory requirements, as well as the necessary certificates, measurements or other documents certifying compliance with the set criteria.

Where the participant is an alliance which is not a legal entity, compliance with the selection criteria shall be demonstrated by the participant alliance and not by each of the persons included in it, with the exception of appropriate registration, presentation of a certificate or other condition necessary for the performance of the contract, in accordance with the requirements of a normative or administrative act and in accordance with the distribution of the participation of the persons in the performance of the activities provided for in the contract establishing the alliance.

It is a mandatory condition for the eligibility of a participant in the procedure that it (participating individually as a natural or legal person or as an association of natural and/or legal persons) fully meets the minimum requirements set out above relating to the economic and financial standing of the participants and to the technical and professional capabilities of the participants.

8. SAMPLE METHODOLOGY

In this section, a methodology for determining the complex evaluation and ranking the tenders of the tenderers for the performance of a public procurement contract with the subject is developed and presented.

The composite score (**Kc** = 100 points) is calculated according to the following formula:

$$\mathbf{Kc} = \mathbf{Kp} \times 0{,}45 + \mathbf{Kt} \times 0{,}55$$

where:

Kp is the criterion "price".

"Price for the design and supervision and execution of the activities under 2.1 of the draft contract, including commissioning" are evaluated.

Maximum number of points: 100. Relative weight **45**.

Kt is the criterion "technical parameters".

Maximum points: 100. Relative weight **55.**

The method of assessment for each indicator is shown below:

The value of criterion **Kp** is determined by the formula:

$$\mathbf{Kp} = \frac{\text{lowest price for the performance of the subject of the contract}}{\text{the price for performance proposed in the evaluated tender}} \times 45$$

The value of criterion **Kt** shall be determined as follows:

$$\mathbf{Kt} = \mathbf{Kt_1} + \mathbf{Kt_2}$$

where:

Kt_1 assesses the professional competence of staff as follows:

Kt_1 professional competence of staff:	**Maximum points 20**
The Bidder has proposed a design team that covers the minimum requirements of the contracting authority but without experience or training of the experts in the Energy Efficiency and/or HVAC parts in the redesign of low-energy buildings or deep energy renovation according	**1**

to the requirements below.	
The Bidder has proposed a design team in which the Energy Efficiency and/or HVAC expert has undergone training for the design of low energy buildings or deep energy renovation.	**5**
The Bidder has proposed a design team in which the Energy Efficiency and/or HVAC expert has participated in the design of at least one building (new or renovated) that is certified as a Passive House or under or certified to the **EnerPHit** standardization criteria.	**15**
The Bidder has proposed a design team in which the Energy Efficiency and/or HVAC expert has participated in the design of more than one building (new or renovated) that is certified as a **Passive House** or under or certified to the **EnerPHit** standardization criteria.	**20**

Kt_2 the organisational competence of staff is assessed as follows:

Kt_2 qualification of the design team:	**Maximum points**
Bidder has proposed a project/site technical manager who covers the minimum requirements of the contracting authority but has not been involved in the building renovation or new construction of a building certified as a **Passive House** or under **EnerPHit** certification criteria.	**1**
Bidder has proposed a technical project/site manager who has coordinated a building renovation or new construction of a building certified as a **Passive House** or under **EnerPHit** certification criteria.	**5**

As the maximum sum of Kp and Kt is 70, the remaining 30 points can be supplemented with other important technical parameters for the contracting authority, such as the deadline for execution, guarantees for the types of work, input materials (material parameters higher than required), use of ecological heavy construction equipment, or social criteria, such as hiring the permanently unemployed, retraining of low-skilled employees, etc. Any other site-specific conditions that are normally evaluated, such as time, warranties, etc., may be included, reweighting the specific parameters according to the Employer's understanding.

Whenever the Employer has envisioned an evaluation of the personnel - designer(s) and/or supervisor, a requirement should be made in the template for the Proposal for execution to indicate the information required for the evaluation.

According to the mentioned model, the requirements for the construction works separate from the design, in which the EnerPHit requirements are not included, the requirements for the materials according to the model described in the text part should be set - complying with the investment design X, and complying with the Standard with X+.

9. SAMPLE SPECIFIC CONTRACT CLAUSES

Here, there are several examples of contractor's responsibilities (to be set out in the contract in accordance with its structure - in the Contractor's obligations, warranties or other sections):

- The contractor undertakes to execute the contract with the experts (technical manager/designers) proposed in the tender (as they are subject to evaluation);
- Contractor shall incorporate materials that meet **EnerPHit** certification criteria and submit all certificates, technical and performance declarations;
- The Contractor undertakes to participate in the certification of the building to the **Passive House / EnerPHit** standard, which the Employer will commence after one year from commissioning of the building;
- The contractor shall maintain a performance bond in the amount of 4% of the contract value (*as the PPA requires maintenance bonds to be part of the performance bond*) until completion of the certification process - 15 months after the building is placed in service. (*The release and drawdown are no different than standard bonds*);
- The Contractor undertakes to coordinate the replacement of an expert to be evaluated or named in the Bid, and the new expert shall meet all the same criteria as the replaced employee;
- The contractor is liable for a penalty of 20% (as it is subject to evaluation it is appropriate to take into account the relative weight of the criterion so that there is no abuse on the part of the participants) in the case of performance of the contract with an expert other than the one to be evaluated;
- The Contractor shall be liable for a penalty of 5 % for replacing an expert with an expert who meets the criteria of the expert being replaced, subject to evaluation, without having first agreed the new expert.

There clauses are relevant for construction works contract without a design meeting the certification criteria, but can also be used for full engineering contracts and they aim to commit the Contractor's participation after the building is commissioned. The Contractor is eligible to receive an award/additional payment of 2 to 5% upon certification of the building to **Passive House** or **EnerPHit** certification criteria.

10. INNOVATIVE TRENDS IN CONSTRUCTION TENDERING

The construction industry is increasingly adopting digital technologies to improve efficiency, reduce costs, and enhance collaboration. Online-based contracting systems are among the most promising digital innovations in the field, as they facilitate the sharing, management, and tracking of documents, bids and invoices electronically, which can greatly improve the tendering process. This chapter aims to analyse the trend of online-based contracting systems and to explore how these systems can be applied to the construction tendering process.

10.1. OVERVIEW OF ONLINE-BASED CONTRACTING SYSTEMS

An online-based contracting system is a set of digital tools and platforms that enable the management and sharing of information related to contracts, tenders, and project management. These systems include electronic document management systems (EDMS), electronic bidding systems (EBS), electronic invoicing and online collaboration platforms (OCP).

EDMS are used for the storage, sharing, and tracking of documents electronically, reducing the need for paper-based systems and making it easier to share and access documents remotely. This can greatly improve efficiency by enabling real-time access to documents, reducing the need for physical document storage, and making it easier to share and collaborate on documents with stakeholders. Additionally, EDMS often include version control and tracking features that allow for the tracking of document history, who has accessed it, and what changes have been made.

EBS enable the submission and evaluation of bids electronically, reducing the need for manual processes and making it easier to share and access bid information remotely. This can greatly increase the speed of the bidding process and make it more efficient, as well as increasing transparency by providing a central location for all bid-related information. Additionally, EBS often include tools for evaluating and ranking bids, which can improve the quality of the bids received.

Electronic invoicing systems enable the electronic submission and processing of invoices, reducing the need for paper-based systems and streamlining the invoice process. This can greatly improve efficiency by reducing the time and effort required to process invoices, as well as increasing transparency by providing a central location for all invoice-related information.

Online collaboration platforms (OCPs) allow for the seamless collaboration and communication between stakeholders, regardless of location. This can greatly improve the efficiency of the tendering process by enabling real-time sharing and commenting on documents and providing a central location for all project-related information.

The use of these online-based contracting systems has been growing in many industries such as construction, finance, healthcare, and transportation and becoming standard practice for many companies. These systems help to increase efficiency, reduce costs, and improve collaboration between stakeholders, as well as enabling better monitoring and tracking of the project process. They are widely adopted by many industries and adopted by many construction companies and general contractors.

10.1.1. ELECTRONIC DOCUMENT MANAGEMENT SYSTEMS (EDMS)

Electronic Document Management Systems (EDMS) are software solutions designed for the storage, management, and distribution of electronic documents. They provide a central location for all project-related documents, making them easily accessible and shareable for all stakeholders.

EDMS typically include a range of features such as document storage and organization, version control, access controls, and search capabilities. These features allow for the efficient and secure management of a wide range of documents, such as contracts, drawings, specifications, and reports.

In terms of function, EDMS allows for the storage, sharing, and tracking of documents electronically, reducing the need for paper-based systems and making it easier to share and access documents remotely. It also enables real-time access to documents, reducing the need for physical document storage, and making it easier to share and collaborate on documents with stakeholders. Additionally, EDMS include version control and tracking features that allow for the tracking of document history, who has accessed it, and what changes have been made.

One of the major components of EDMS is document storage. It provides a central repository for all project documents, where they can be stored, organized, and easily accessed by all stakeholders. The second component is version control, which allows for the tracking of document changes and version history. The third component is access controls, which enable users to set different levels of access and permissions for different stakeholders. And the last component is search capabilities that allow stakeholders to quickly search for and find specific documents.

Examples of EDMS used in the construction industry include Aconex, Procore, and Buildxact. These solutions are widely used by construction companies and general contractors to manage and share construction-related documents, such as contracts, drawings, and specifications. The benefits of using EDMS in construction industry is significant as it allows for better collaboration between stakeholders and can greatly improve the efficiency of the tendering process. Construction companies and general contractors can use EDMS to improve the accuracy and timeliness of document sharing, tracking, and approvals. Additionally, these systems can also enhance project tracking and reporting, which can assist companies in staying within budget and timeline. It can also reduce the cost associated with paper document storage and distribution.

10.1.2. ELECTRONIC BIDDING SYSTEMS (EBS)

Electronic Bidding Systems (EBS) are digital platforms that enable the submission and evaluation of bids electronically. They provide a streamlined and efficient process for construction companies to submit and evaluate bids, reducing the need for manual processes and enabling remote access to bid information.

EBS typically include features such as online bid forms, the ability to upload supporting documentation, and real-time notifications and updates. These systems can also facilitate communication between the company issuing the tender and the bidders, allowing for clarification questions and answers to be handled electronically.

One example of an EBS that is used in the construction industry is the Construction Industry Institute's (CII) e-bid system. This system is used by construction companies, owners, and architects to manage the bid process for construction projects. It allows for the easy submission and evaluation of bids and provides real-time access to bid information.

Other benefits of EBS include the ability to automate the bid process, which can help to reduce human errors and increase efficiency. Additionally, the use of EBS can also provide greater transparency in the bid process, making it easier for companies to track the status of their bids and providing a centralized location for all bid-related information.

In summary, Electronic Bidding Systems (EBS) can help construction companies to streamline the tendering process, reduce the time required to evaluate bids, enhance the transparency and accessibility to bid information, and automate the bid process to minimize human errors. This in turn improve the chances of getting a qualified and competitive proposal, and reduce the time required to evaluate them.

10.1.3. ELECTRONIC INVOICING

Electronic invoicing, also known as e-invoicing, is the digital process of creating, transmitting and receiving invoices between businesses and organizations. Electronic invoicing systems automate the invoice process, allowing for the electronic submission, tracking and payment of invoices. This process reduces the need for paper-based invoicing and streamlines the invoice process.

An electronic invoicing system typically includes features such as online invoice forms, the ability to upload supporting documentation, and real-time notifications and updates. These systems can also facilitate communication between the company issuing the invoice and the recipient, allowing for clarification questions and answers to be handled electronically.

One example of an electronic invoicing system that is used in the construction industry is the Coupa e-invoicing platform. This platform allows construction companies to electronically send and receive invoices, track their status and make payments. It also includes features such as spend analytics and financial reporting.

The use of electronic invoicing systems can also improve data accuracy and transparency and provide greater visibility into the invoice process. This can help businesses to better track their finances and make more informed decisions about their spending. Additionally, as e-invoicing systems are widely adopted, it can help to simplify communication and transactions between different companies, which can be beneficial for construction companies that work on large scale projects.

In summary, Electronic invoicing (E-invoicing) is a digital process of creating, transmitting and receiving invoices between businesses, which eliminates the need for paper-based invoicing and streamlines the invoice process, reduces errors and increases data accuracy, transparency, and visibility. This process can be implemented through various platforms like Coupa and others.

10.1.4. ONLINE COLLABORATION PLATFORMS (OCP)

Online Collaboration Platforms (OCP) are digital tools and platforms that enable the seamless communication and collaboration between stakeholders, regardless of their

location. OCPs allow stakeholders to share, comment on and edit documents, as well as track progress and monitor project-related information in real-time.

The key components of an OCP include a central platform that can be accessed remotely, document storage and sharing capabilities, and real-time communication and collaboration tools. Some OCPs may also include project management tools and task tracking capabilities, making it easier to manage and coordinate project-related activities.

One of the main benefits of OCPs is the ability to improve collaboration between stakeholders, regardless of their location. This can greatly improve the efficiency of the tendering process, as it enables real-time sharing and commenting on documents, and provides a central location for all project-related information. Additionally, OCPs can improve accessibility as they can be accessed remotely, which can be particularly beneficial for stakeholders who are not physically present at the project site.

Examples of OCPs used in the construction industry include Procore, Asana, and Autodesk BIM 360. These platforms have been adopted by many construction companies to improve collaboration and coordination between stakeholders, reduce the need for paper-based systems, and increase transparency and accessibility to project-related information. For example, Procore's platform allows construction teams to access and update project information in real-time, improving the speed and efficiency of communication and collaboration. Autodesk BIM 360 also improves collaboration between stakeholders by providing a centralized location for all project-related information, making it easy to access, share, and track information.

Overall, OCPs offer many benefits for the construction industry in terms of improved collaboration, increased transparency, and enhanced accessibility to project-related information. By implementing OCPs, the construction industry can improve the tendering process and help to increase the renovation rate throughout Europe.

10.2. IMPACT OF ONLINE-BASED CONTRACTING SYSTEMS ON CONSTRUCTION TENDERING

The current state of construction tendering is characterized by a high level of complexity and a need for speed, transparency, and accessibility. The tendering process typically involves multiple stakeholders, such as architects, engineers, contractors, and clients, who need to share and manage a large amount of information related to the project. This information includes contracts, tenders, and project management documents, among others. The traditional methods for managing and sharing this information, such as paper-based systems and face-to-face meetings, are time-consuming, inefficient, and can lead to errors and misunderstandings.

Online-based contracting systems have the potential to significantly improve the efficiency and effectiveness of the construction tendering process. These systems provide digital tools and platforms that enable the management and sharing of information electronically, reducing the need for paper-based systems and face-to-face meetings. This can help to speed up the tendering process, increase transparency, and improve accessibility for stakeholders.

The implementation of online-based contracting systems in construction tendering can bring a number of potential benefits. One of the main benefits is increased transparency. Online-

based contracting systems provide a centralized location for all project-related information, making it easy to access, share, and track information. This can help to increase the transparency of the tendering process, as all stakeholders can have real-time access to the same information. Another potential benefit is increased accessibility. Online-based contracting systems can be accessed remotely, which can be particularly beneficial for stakeholders who are not physically present at the project site. This can help to improve collaboration and communication between stakeholders, regardless of location. Additionally, online-based contracting systems can improve the speed of the tendering process, as the sharing, management, and tracking of information can be done electronically, which can help to reduce the time required by various stakeholders to evaluate the tenders.

The implementation of online-based contracting systems in the construction industry is not without its challenges. One major concern is the issue of data security. As construction tendering processes involve sensitive information, such as bid prices and project details, it is crucial that the systems used to manage this information are secure and can protect against unauthorized access or breaches. This requires a robust system of security protocols, including encryption, firewalls, and regular software updates.

Another challenge is ensuring compliance with regulations. As construction tendering is subject to a variety of laws and regulations, it is important to ensure that the systems used comply with all relevant legislation. This includes ensuring that the systems used meet data privacy standards, such as the General Data Protection Regulation (GDPR) and are able to meet the requirements of public procurement laws and regulations.

Resistance to change is another potential obstacle to the adoption of online-based contracting systems. Some stakeholders in the construction industry may be resistant to using new digital tools, as they may be unfamiliar with the technology or may prefer traditional methods. To overcome this resistance, it is important to provide training and support to stakeholders and to demonstrate the clear benefits that online-based contracting systems can bring.

To implement online-based contracting systems in the construction industry, it is important to start by conducting a thorough analysis of the current process, identifying areas where improvement is needed. This should be followed by selecting the appropriate systems and tools, such as EDMS, EBS, electronic invoicing and OCP, that can meet the specific needs of the organization and are in compliance with all relevant regulations. Once the systems are in place, it is important to provide training and support to stakeholders, as well as to monitor and evaluate the effectiveness of the implementation over time.

Finally, the adoption of EDMS, EBS, electronic invoicing and OCP should be done in a phased approach, allowing stakeholders to adapt to the change. This may include identifying the specific systems and software to be used, outlining the roles and responsibilities of stakeholders, and establishing a timeline for implementation. It's also important to have continuous monitoring and evaluating of the system, to ensure it's working effectively and efficiently.

To conclude, online-based contracting systems offer numerous benefits for the construction tendering process, such as increased efficiency, transparency, and accessibility. However, it is essential to consider the potential challenges and risks and to have a thorough plan in

place for implementation. By taking the necessary steps to ensure data security, regulatory compliance, and effective communication and training, construction industry stakeholders can successfully adopt online-based contracting systems and realize the many benefits they offer.

11. CONCLUSION

In conclusion, including a clear and comprehensive set of evaluation criteria for the bids, as well as the evaluation process and scoring method in the invitation to construction tender documents for deep energy retrofit projects would be a significant improvement. It would help stakeholders to better evaluate the bids, select the best contractor for the project, and ensure that the project meets the technical, financial and sustainability objectives. Additionally, it would increase the transparency and accountability of the tendering process, increase public trust and confidence, and promote fair competition among the bidders.

In the near future, online-based contracting systems have the potential to greatly improve the efficiency, transparency, and accessibility of the construction tendering process. This chapter has provided an overview of the different types of online based contracting systems, including electronic document management systems (EDMS), electronic bidding systems (EBS), electronic invoicing, and online collaboration platforms (OCP). We have also examined the potential benefits and challenges of implementing these systems in the construction industry.

This report suggests that the use of online-based contracting systems can streamline the tendering process by reducing the time and effort required by stakeholders to evaluate proposals, increase transparency by providing a centralized location for all project-related information, and improve accessibility by allowing for remote access to information. However, implementing these systems also brings its own set of challenges and risks such as data security and regulatory compliance that need to be considered.

To overcome these challenges, it is recommended to develop a comprehensive implementation plan that addresses data security, regulatory compliance and resistance to change. Furthermore, it is crucial to provide training and support to ensure the successful adoption of these systems.

Overall, the adoption of online-based contracting systems in the construction industry holds great promise for improving the tendering process and enabling deeper energy retrofitting. This study serves as a foundation for further research on how to best implement these systems in the construction industry to maximize their potential benefits.

12. APPENDIXES

12.1. APPENDIX A

EnerPHit and EnerPHit+i

Certification criteria for energy efficient reconstruction with elements of Passive House

If the energy-efficient reconstruction of an existing building reaches the criteria for Passive House (for new construction), it can also be certified as a certified Passive House.

However, reaching the Passive Building Standard in old buildings is quite often a difficult task, for many different reasons. The use of Passive Buildings technology for the relevant elements in these buildings will still lead to significant improvements in terms of thermal comfort, increasing the life of the building structure, cost efficiency over the life cycle of the building and energy use.

Buildings that are reconstructed with components for Passive Buildings and to a large extent and with installed external insulation can meet the **EnerPHit** certification criteria as proof of the quality of the construction and the achievement of specific energy values. **EnerPHit+i** name is used when more than 25 % of the surface of opaque exterior walls have internal insulation.

The certification criteria for both standards are described below.

1. CHOOSING A CERTIFICATION PROTOCOL

Certification may be carried out on the basis of the heat demand requirement (Section 1.1) or on the basis of requirements for individual building components (Section 1.2). Compliance with the general requirements set out in Section 2 is mandatory in both cases.

1.1 CERTIFICATION BASED ON THE REQUIREMENT OF THERMAL NEED

Specific energy consumption for heating: QH 25 kWh/(m2a) (calculated by PHPP)

1.2 CERTIFICATION BASED ON REQUIREMENTS FOR INDIVIDUAL BUILDING COMPONENTS (AS AN ALTERNATIVE TO 1.1)

Evidence shall be provided that all relevant energy-efficient building components for which PHI has determined the certification criteria for a Passive House Certified Component shall be provided. The building components criteria, which are published on

www.passivehouse.com, apply, unless otherwise specified in the **EnerPHit** criteria described here. For products not certified by PHI, the applicant for certification must provide evidence that the specific criteria for the components are met. It is the claimant's responsibility to provide a declaration of compliance in writing, certified by a legally binding signature.

The required limit values shall not be exceeded on average for the whole building. A higher value is only allowed in certain zones when the absolute upper limit as given in Section 2 is not exceeded.

If the heat transfer resistance (R-value) of existing building components is taken into account in the improvement of the heat transfer factor (U-value) of the renovated building components, this shall be demonstrated in accordance with the adopted technical standards. It is sufficient to accept a conservative approximation of the thermal conductivity of the building materials concerned from appropriate reference tables. If the layers of building components of existing buildings are not clearly identifiable, standardised estimates, according to the year of construction, may be used and taken from the appropriate catalogues for components2.

Note:

Where average values are used for insulation layers of building components, the weighted U-value shall be applied rather than the average insulation thickness. Thermal bridges shall be taken into account when calculating the average if they are part of the standard structure of the building component. For the use of multiple ventilation systems, a weighted average of volumetric flow shall be used.

1.2.1 REQUIREMENTS

In the following section, the important requirements for Certified Passive Components will be repeated for greater ease. Nevertheless, they are subject to the existing criteria, which are set out on the PKI website (www.passivehouse.com) under the heading 'Certification'.

Additional requirements for EnerPHit certification will also be mentioned.

1.2.1.1 Opaque building envelope

For external insulation: $\mathbf{f_t \bullet U \leq 0.15\ W/(m^2K)}$

For internal insulation: $\mathbf{f_t \bullet U \leq 0.35\ W/(m^2K)}$

With a temperature factor $\mathbf{f_t}$:

In contact with the outside air: $\mathbf{f_t = 1}$

In contact with the ground: 'Land Reduction Factor' from the Ground Sheet in PHPP

The use of internal insulation is recommended only when the use of external insulation is

constructively impossible, legally unauthorised or economically unprofitable in terms of life cycle.

When refurbishing existing buildings, it is not always possible to completely eliminate the thermal effect (t + 0.01 W/(mK)) with justified efforts as needed in newly built Passive Buildings. However, the effects of thermal bridges must always be avoided as much as possible or minimised, while ensuring cost-effectiveness (see 3.3; however, the requirements set out in Section 2.7, 'Protection from moisture', must always be fulfilled).

Thermal bridges, which are part of the standard structure of the building components, shall be taken into account when assessing the heat transfer coefficient.

1.2.1.2 Window W (window)

For the window as a whole (see EN 10077): $U_{W,installed} \leq 0.85$ W/(m²K)

For g and U_g-value of the glazed part: $g \bullet 1.6$ W/(m²K) ≥ U_g

1.2.1.3 Exterior doors D (door)

$f_t \bullet U_{D,mounted} \leq 0.80$ W/(m²K)

with a temperature factor f_t:

in contact with the outside air: $f_t = 1$

in contact with the unheated basement: f_t = "Land Reduction Factor" from the Ground sheet in PHPP

1.2.1.4 Ventilation

$\eta_{HR, eff} \geq 75$ %

Specific electrical consumption of the whole system based on the average volumetric flow flow rate (electric efficiency): 0.45 Wh/m³

All rooms in the thermal volume of the building shall be connected to the fresh or exhaust air system with thermal recuperation or be part of the transfer zones. Compliance with $\eta_{HR, eff}$ for the whole ventilation system – in accordance with the criterion of Passive House Certified Component, heat losses from hot ducts in cold zones or cold ducts in warm zones should also be included.

Notes:
These are only the minimum requirements! Enhanced thermal protection often leads to further reduction of environmental impact and even greater independence from energy price fluctuations with the same cost-effectiveness.

Determination of the layers of internally insulated building components for component requirements:

- *It contains at least one hard layer (with A > 0.2 W/(mK) and thickness*

100 mm and at least one layer of insulation (with A < 0.1 W/(mK) and thickness of 10 mm).

- *The insulation layer is located inside and there are no additional insulation layers (with A < 0.1 W/(mK) and thickness 10 mm) on the outside of the innermost rigid layer.*
- *Only the part of the layer with the largest part of the surface (e.g. filling panels, not wood, in a partial wooden structure) is taken into account.*

1.2.2 EXCEPTIONS

The limit values given in Section 1.2.1 for heat transfer factors of external building envelope components may be exceeded if strictly necessary for one or more of the following justified reasons:

- If required by the authorities in relation to the preservation of the original values
- If the economic profitability (see 3.3) of the measure concerned cannot be ensured due to exceptional circumstances or additional requirements
- If there are specific legislative requirements
- If the application of the required thermal insulation standard would lead to an unacceptable restriction in the use of the building or adjacent outdoor areas.
- If there are special, additional requirements (e.g. fire safety) and there are no suitable components on the market to meet both, the additional requirements and the **EnerPHit** criterion
- If there are other significant reasons related to construction

For thermal transfer coefficients > 0.35 W/(m^2K), the maximum possible thickness shall be used using materials having a thermal conductivity of approximately 0.025 W/(mK). In the case of slabs or ceilings of basements, it is advisable to install insulation if possible along the whole perimeter.

If the standard requirements are exceeded, on the basis of an exception, there must be clear evidence that the conditions for this exception are met, supported by the appropriate documents signed by the responsible person.

The moisture protection requirements of Section 2.7 and the thermal comfort according to Section 2.8 shall be met in all cases.

If no significant reduction of heat needs can be achieved as a result of widespread application of the exceptions rules, a document may be issued in place of the **EnerPHit** certificate by the Certification Body confirming the values achieved in writing.

2. OTHER ESSENTIAL REQUIREMENTS

For certification, apply and take precedence over the calculation methodology described in the PHPP manual, which must be applied secondarily. The valid Certification Criteria are available at www.passivehouse.com.

Due to the large number of refurbishment requirements for existing buildings, it is possible that some absolutely precise requirements for some individual energy measures are not included in the certification criteria. In this case, the measure must be implemented in such a way as to improve energy efficiency as much as possible, provided that the measure is cost-effective on the basis of its life cycle (see Section 3.3). The required heat protection standard for building components is then determined on a case-by-case basis by the Certification Body (in cooperation with PHI for critical, exemplary cases).

2.1 ENERGY BALANCE

The energy balance of the renovation must be checked using the latest version of the Passive House Planning Package (PHPP). This also applies to certification based on the building component method (Section 1.2). However, there is no need to transfer data to a newer version of the PHPP when the project is already underway. The monthly or annual method should be used to calculate the specific energy demand for heating. If the differences between the two methods are too large, a message appears in Sheets "Verification" and "Annual Heat Need" of the PHPP. In this case, use the monthly method.

The reference value is total heated area (TFA) calculated in accordance with the requirements of this PHPP guide.

The entire building envelope, for example a number of row houses or apartment block, can be taken into account when calculating specific values. A general calculation can be used to verify this. If all zones have the same temperature, then the weighted average of single PHPP calculations on individual premises to the heated area can also be used. The combination of thermally separated buildings is not allowed. Buildings bordering other buildings (e.g. in densely populated urban areas) must have at least one external wall, one roof surface and a basement slab or ceiling to be self-certified.

2.2 CERTIFICATION TIME

When issuing the certificate, all requirements must be met. Currently, certificates can not be issued in advance for renovations, which are carried out in several stages.

2.3 RESTRICTIONS ON EXISTING BUILDINGS

Only buildings renovated according to the Passive House Standard, of which it is economically unsuitable (see 3.3) or impracticable due to the peculiarities of the existing building or the composition of the building will be certified. In principle, an **EnerPHit** certificate cannot be issued for new buildings.

2.4 LOCATION OF THE BUILDING

Currently, only buildings in a cold, temperate climate (e.g. Central Europe) can be

certified.

2.5 PRIMARY ENERGY CONSUMPTION

Q_P 120 kWh/m^2a + ((Q_H- 15 kWh/(m^2a)) • 1.2)

Primary energy consumption includes all necessary applications of energy for heating, DHW, additional electricity, lighting and other types of electrical consumption. The limit value applies to residential buildings, office buildings, schools and the like, as well as to other cases, as a preliminary criterion to be verified in specific cases. In individual cases, where very high levels of energy consumption are required, this limit may be exceeded subject to the agreement of PHI. For this purpose, proof of the efficient use of electricity is required, except where improving energy efficiency through modernisation or renovation will prove economically unfavourable throughout the life cycle (see 3.3).

2.6 AIRTHIGHTNESS

Limit value: $n_{50} \leq 1.0\ h^{-1}$
Desired value: $n_{50} \leq 0.6\ h^{-1}$

If the value of 0.6 h^{-1} is exceeded, complete detection of all leakages within the controlled pressure test, during which all individual leaks are sealed, which may cause damage to the building or cause disturbance of comfort. This must be confirmed in writing and signed by the person responsible in accordance with Section 6.1.

2.7 MOISTURE PROTECTION

All standard incisions and details for connections, without exception, must be designed and executed so that the accumulation of excessive moisture on the inner surface or in the building is excluded.

If there are any fluctuations, evidence of moisture protection must be provided in accordance with the adopted technical standards. To calculate the temperature of the inner surfaces, an increased heat transfer resistance of R_{si} = 0.25 m^2K/W (due to furniture, curtains, etc.) is used, and location-specific outdoor design temperature (Heat Load “Time 1” in the PHPP dataset, if any)

For building components with internal insulation, proof of precise design must be provided that would prevent indoor air currents behind the insulation layer.

For internal insulation, proof of suitability in terms of moisture protection in the particular case must be provided. Certificates issued by PHI for Passive House Certified Components can be used for this purpose. Otherwise, an expert report certifying this quality may be issued on the basis of accepted test procedures (e.g. hygrothermal simulation), in which case the expert must assume full legal responsibility for the issued report. The PHI certification criteria for internal insulation components (publication

expected in mid-2012) contain comments on the requirements to be met.

2.8 TEMPERATURE COMFORT

If the minimum standard recommended by PHI for the components of adjacent housing areas of the building envelope is not respected (see Section 1.2.1), the minimum absolute thermal comfort requirements will apply. Alternatively, they will be considered covered if proof of available comfort conditions is provided in accordance with EN ISO 7730.

2.8.1 External wall

$f_t \bullet U \leq 0.85$ W/(m^{2}K)

With a temperature factor ft:
In contact with the outside air: $f_t = 1$
In contact with the ground: 'Land Reduction Factor' from the Ground sheet of PHPP

2.8.2 Roof/Upper ceiling

U ≤ 0.35 W/(m2K)

2.8.3 Floor

The internal surface temperature of the floor shall be at least 17 °C as a result of the design conditions (PHPP: sheet Ground, design terrain temperature for sheet "Heating load" or, if used, design outdoor air temperature, indoor temperature 20 °C)

2.8.4 Windows/External doors

Desired value: $U_{W/D,installed} \leq 0.85$ W/(m^{2}K)

Exceeding the target value is permissible if heating surfaces are used for windows and doors where thermal comfort is suspected as a result of lower indoor surface temperatures (according to ISO7730).

3 DOCUMENTS NEEDED FOR CERTIFICATION

3.1 SIGNED PHPP WITH AT LEAST THE FOLLOWING CALCULATIONS

PHPP Sheets

(Please also attach the Excel File)

- Summary of the property and verification of the criteria for the implementation of the project……**Verification**
- Summary of areas with corresponding U-values, radiation balance data and TM……**Areas**
- U-values of standard building elements……**U-values**

- List of building elements used……**Components**
- Calculation of U-values of windows……**Windows**
- List of used window and glazing frames……**Windows**
- Land reduction factors, if used……**Ground**
- Shading Factors……**Shading**
- Calculation of flow rate, HR efficiency and test results with controlled pressure…**Ventilation**
- Sizing of ventilation systems with multiple vent. units (if used)……**Additional Ventilation**
- Specific heat demand according to the annual PHPP method……**Annual Heating**
- Specific heat demand according to the monthly PHPP method if selected in a table "Verification"……**Monthly Method**

- Heat Load according to PHPP……**Heating Load**
- Frequency of overheating……**Summer**
- Shading Factors in Summer……**Shading**
- Summer ventilation, if used……**SummerVent**

- Calculation of the need for DHW and heat losses in the distribution of heating and hot water……**DHW+Distribution**
- Part of the need for DHW, covered by solar energy, if a solar collector is used
- Annual heat generator recovery factor**……Compact, HP, Boiler, District Heating**
- Calculation of electric consumption……**Electricity**
- Calculation of additional electric consumption……**Aux Electricity**
- Calculation of the value of primary energy……**PER**
- Selection of climate data……**Climate**
- Useful refrigeration if active cooling is used……**Cooling**
- Refrigerated Load if used for active cooling……**Cooling Load**
- Calculations for cooling units if active cooling is used……**Cooling Units**

3.2 PLANNING DOCUMENTS FOR DESIGN, CONSTRUCTION AND BUILDING SYSTEMS

- Plan of the site, including the orientation of the building, the adjacent structures (location and height), large trees or similar landscaping and possible horizontal shading from terrain levels, with pictures of the plot and surroundings. The shading situation needs to be clear.
- Projects (floor plans, cuts, heights) with comprehensible sizing for calculation of all areas (room sizes, areas of the building envelope, masonry dimensions of windows).
- Separate plans of the facades and windows, as well as of the thermal bridges, if any, to clearly define the areas or the thermal bridges calculated in PHPP.
- Detailed drawings of all connections of the building envelope, e.g. external and internal walls to a basement or slab ceiling, exterior wall to roof and ceiling, roof ridge, eaves, window installation (side, top and bottom), suspension of balconies, etc. Details must be given in size and information on the materials used and their thermal conductivity. The airtight layer must be indicated in all details, together with details of how it should be placed and protected during construction.
- Evidence of moisture protection

- Ventilation system projects: presentation and sizing of ventilation units, volume flows (Sheet “Ventilation”, see PHPP), noise protection, filters, inlet and outlet air valves, transfer air openings, outdoor air inlet and outlet, duct sizing and insulation, subsoil heat exchanger (if any), adjustment, etc.
- Projects for the heating system and plumbing: presentation of heat generators, boiler and thermal distribution (pipes, heating coils, heating surfaces, pumps, regulation), distribution of DHW (circulation, single pipes, pumps, regulation), aerated drainage pipes, including diameters and thickness of insulation.
- Building system projects for part electricity (if used): description and lighting power (as well as daylight usage concepts and simulations, if used), lifts, kitchen equipment, computers, telecommunications systems and other specific electricity consumption (e.g. ovens).
- Air conditioning projects (if used): description and sizing of cooling and dehumidification systems.

3.3 SUPPORTING DOCUMENTS AND TECHNICAL INFORMATION, DOCUMENTATION WITH TECHNICAL CHARACTERISTICS, IF ANY

- Details of the specific conditions of the project described in point 4.
- A comprehensible specification of the calculation for the heated area calculated by the method described in PHPP.
- Manufacturer, type and documentation with technical characteristics, especially for insulating materials with very low thermal conductivity(A.R < 0.032 W/(mK)).
- Information on the windows and doors to be installed: manufacturer, model, Uw value, WMounted, WGlass edge and graphical representation of all intended fittings on the exterior walls. The calculations shall be performed mathematically in accordance with EN 10077-2. This data is available for products that are certified by the Passive House Institute.
- Information on the glass to be installed: manufacturer, model, structure, Ug value according to EN 673 (to the second decimal place) g value according to EN 410, type of spacer.
- Evidence on the thermal loss factors used in PHPP based on EN ISO 10211. Alternatively, they may be referred to similar documented thermal bridges (e.g. in construction systems certified for Passive Buildings, PHI publications, Passive House thermal bridge catalogues).
- A brief description of the planned building systems with schematic sketches, if used.
- Manufacturer, type, technical documentation and verification of electrical consumption of building systems: ventilation system, heat generator for heating and DHW, storage, insulation of air ducts and pipes, anti-ice protection, pumps, elevators, lighting, etc.
- Efficiency of thermal recuperation and electrical consumption of the ventilation system according to the Passive House method. Systems with heat recovery from exhaust air (e.g. fireplaces, etc.) must be included.
- Information on the subsoil heat exchanger (if any): length, depth and type of installation, soil quality, size and type of material and verification of heat recovery efficiency (e.g. with PHLuft). For underground heat exchangers: adjusting, temperature limits and checking the efficiency of heat recuperation.
- Information on the length, dimensions and insulation levels of the inlet pipes (DHW and heating), as well as the air ducts between the recuperator and the thermal building envelope.

- Concept of efficient electricity recovery (e.g. specific appliances, instructions and preferences for the owner). If the efficiency of the electric consumption has not been verified, average values for appliances available on the market (standard PHPP values) shall be used.
- A demonstration of summer comfort. The PHPP procedure for determining summer overheating only shows an average for the whole building, however overheating in individual parts can occur. If suspected, make a detailed analysis (e.g. with temporary simulations).

3.4 VERIFICATION OF THE AIRTIGHTNESS OF THE BUILDING ENVELOPE

The airtightness measurement shall be carried out in accordance with EN 13829 or ISO 9972. In case of differences or uncertainties, the standard EN 13829 should be used. A series of measurements with overpressure and subpressure are required. The controlled pressure test should only be done for the heated building volume (basement, verandas, winter gardens, etc., which are not in the building's heat envelope, should not be included in the test). It is recommended that the test be carried out when the airtight layer is still available, so that it can be more easily repaired. The controlled pressure test shall also document the calculation of indoor air volume.

In general, the controlled pressure test must be performed by an institution or an independent person other than the customer or builder. If the controlled pressure test is performed by the customer, it will only be accepted if the test results are signed by someone who assumes personal responsibility for the correctness of the information provided.

3.5 REPORT ON COMMISSIONING OF RECUPERATION VENTILATION

The results must include as a minimum: description of ownership, location/address of the building, name or address of the tester, adjustment time, ventilation system manufacturer and type of unit, controlled flow rate in normal mode, mass flow/flow balance for external and exhaust air (maximum imbalance of 10 %).

3.6 DECLARATION BY THE HEAD OF CONSTRUCTION WORKS

The implementation under the reviewed PHPP projects must be documented and confirmed by a declaration by the construction manager. Any deviations in implementation must be mentioned, and if any of the products used deviate from those included in the project planning, evidence of compliance with the criteria must be provided.

3.7 PHOTOS

It is necessary to provide photographs, supporting the construction process. Digital photos are preferable.

It may be necessary to provide additional reports or data on the components used. If the values are more favorable than the standard ones in the PHPP, they must be supported by the necessary evidence.

4 TEST PROCEDURE

An informal certificate application can be made with the selected Building Certifier accredited by the Passive Houses Institute. The required documents must be completed in full and signed by the certifier. Certification documents must be checked at least once. Depending on the procedure, additional checks may be carried out.

Note: If possible, the verification of the relevant documents of compliance with the Passive House Standard should be carried out during the planning phase so that the necessary adjustments or suggestions for improvements can be taken into account at an early stage.

After assessment, the client will receive the results with corrected calculations and suggestions for improvements, if any. Construction inspection does not automatically fall within the scope of certification. However, evidence of the airtightness of the building must be provided, the report on commissioning of the ventilation system with recuperation, a declaration by the manager is the construction and at least one photo. If

the accuracy of the documentation required for certification is confirmed and the above criteria are met, the following certificate will be issued:
The award of an **EnerPHit** certificate certifies the correctness of the submitted documents for compliance with the Passive House Standard as determined at the time of certification. The evaluation does not concern either the monitoring of the works or the supervision of consumer behavior. The responsibility for the design remains with the competent designers, and the responsibility for implementation lies with the construction supervision. The **EnerPHit** mark may only be used in relation to the certificate issued.

The additional quality assurance of the construction works by the certification body is especially useful if the construction supervision has no previous experience with reconstructions, where components for Passive House are used.

We reserve the right to adapt the calculation criteria and procedures to reflect technical progress and development.

5 CALCULATION METHODS, CONDITIONS, STANDARD REFERENCES

The following cut-off conditions or calculations shall be used in the PHPP:

- **Climate data**: a set of regional data (suitable for location, elevation deviations with temperature correction of -0.6 °C for 100 m altitude increase).
- **Individual climate data**: their applicability must be agreed in advance with the relevant certifier. If the climate data for the location is already present in the PHPP, then they must be used.
- **Design internal temperature**:

  Residential buildings: 20 °C excluding the night period.

  Non-residential buildings: Design internal temperature: standard indoor temperatures based on EN 12831 shall apply. For unspecified use or deviating requirements, the internal temperature must be determined on the basis of the specificity of the project. For break-off heating (night mode), the internal temperature can be reduced after checking.

- **Internal Heat Gains**: PHPP contains standard values for internal heat gains: apartments (2.1 W/m^2), offices (3.5 W/m^2), schools/kindergarten/high schools (2.8 W/m^2) and nursing homes (4.1 W/m^2). These values should be used unless PHI has specified other national values. The use of individually calculated internal heat gains is allowed only if it can be demonstrated that the actual consumption differs significantly from the standard values.
- **Usage**:
  Residential buildings: 35 m^2/person; deviating values are acceptable if the reason is indicated (updated habitability or correct parameters) in the range 20-50 m^2/person.
  Non-residential buildings: Employment and periods of employment must be determined on the basis of the specificity of the project and coordinated with the intended purpose.
- **DHW Consumption**:
  Residential buildings: 25 litres per person per day at 60 °C, provided that no other national PHI values are defined.
  Non-residential buildings: The consumption in litres at 60 °C per person and day should be determined for each specific project.
- **Average values for ventilation flow**:
  Residential buildings: 20-30m^3/h per person in the household, but not less air exchange rate than 0.30 relative to the heated area multiplied by 2.5 m height of the premises.
  Non-residential buildings: The average air exchange rate shall be determined for each specific project based on the need for fresh air of 15-30 m^3/h per person (or according to the legal provisions, if applicable). The different operating settings and operating hours of the ventilation system should be taken into account. When switching off the ventilation system, the operating time for pre-ventilation and post ventilation shall be taken into account. Mass flows shall comply with the actual corrected values.
- **The Electric Consumption**:
  Residential buildings: standard values according to the SPPK, deviating values only if they are personally verified by the customer or are the result of the concept of household electricity.

Non-residential buildings: The electrical consumption should be determined on the basis of the specifics of the project in accordance with PHPP. A profile of the purpose of the building with employment and reoccurrence should be drawn up. Without lighting design or details for other electrical consumption, the standard PHPP values should be used.

- **Surface of the heat envelope**: Relative to external dimensions without exception.
- **U-values of non-transparent building components**: PHPP procedure based on EN 6946 with conductivity values according to national standards or construction regulations.
- **U-values of windows and doors**: PHPP procedure with completed U-value of frame (U_f) and glass edge thermal bridge (W_g) according to EN 10077, or $W_{Install}$ according to EN ISO 10211.
- **Glazing**: Calculated U-value (U_g; to two decimal places) in accordance with EN 673 and g-value in accordance with EN 410.
- **Thermal recuperation efficiency**: testing method in accordance with PHI (see www.passivehouse.com); if applied, additional test results according to the DIBt method(or equivalent) with a deduction of 12 % after consultation with the certifier.
- **Energy performance indicators of the heat generator**: PHPP method or separate verification.
- **Primary energy factors**: PHPP dataset.

6 APPLICATION

6.1 CONFIRMATION OF DETECTION AND SEALING OF LEAKS DURING A CONTROLLED PRESSURE TEST

(Only required if 0.6 h^{-1} < n_{50} 5 1.0 h^{-1})

Standard text:

It is now confirmed that the search for leaks was made during the controlled pressure test. All rooms in the airtight envelope were accessible for this purpose. All potential vulnerabilities have been checked for leaks. This also applies to areas that were difficult to access (e.g. rooms of high height). All the larger leaks with a relative share of the total leak flow that were found were sealed.

The following information is required:

- Name, address, company of the signatory
- Date and signature
- Description and address of the construction site
- Controlled pressure test: date and name of the person who took the test