PHI Certificate – Building Certification Guide

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Last Recommendation J draft amendments concerning the policy of data gathering and processing on the real estate market include PHI certificate provision. Banks will be obliged to collect information on buildings being certified. According to the reference, it will have a crucial impact on property value. This certificate validates that all passive building standards are achieved.

Passive buildings come under sustainable buildings, which make a distinction between energy-efficient buildings, passive buildings, and zero-energy buildings. These building types vary in terms of energy demand (zero-energy buildings are completely self-sufficient), the minimal thickness of thermal insulation, type of ventilation, and heat source. In buildings that have to meet the highest requirements – passive and zero-energy buildings – mechanical ventilation with heating recovery is used. The most important feature of these buildings is that their heat mainly stays inside and does not have to be provided actively. For instance, the passive residential building needs 1/8 energy for heating in comparison to the average house. This value equals no more than 15 kWh/sqm per year. Energy is obtained from renewable sources mostly. Passive building constantly maintains an optimal temperature because of good thermal insulation. Only to a minimal extent, it loses heat that is generated from solar energy and heat produced inside the building by people, animals, and installed household appliances and electronics, etc. In cold locations during the winter season, simple heating systems are suitable to provide comfortable conditions. As stated by the Passive House Institute, annual heating fuel consumption in a passive house of average space located in Poland equals to about three full refuellings of an average car. Passive building standards are achievable in almost every climate condition. However, too much shade in conjunction with a cold environment that does not allow to draw solar power can be the biggest barrier.

PHI CERTIFICATE – PASSIVE HOUSE, ENERPHIT AND PHI LOW ENERGY BUILDING

PHI certificate is a document confirming an investment's compliance with passive building principles. Certification criteria are developed by The Passive House Institute (PHI) in Darmstadt (Germany). PHI appoints in other countries accreditation units, that are authorised to grant the certificate in accordance with the procedure based on criteria. In Poland, the only established unit is Polski Instytut Budownictwa Pasywnego i Energii Odnawialnej im. Güntera Schlagowskiego (PIBPiEO).

PHI certification includes residential buildings as well as non-residential buildings. Not only houses, but also sports halls, schools, office buildings and industrial properties often achieve passive building requirements.

Receiving a certificate can also be possible after modernization of the existing buildings. Nevertheless, it is more difficult than constructing a passive building from the ground up, when the investor has influence for all materials and technologies applied and possible mistakes can be removed at the design stage by specialised certificatory.

There are three basic requirements that the building has to meet to gain the Passive House Certificate. The first one relates to the annual energy demand indicator for heating, which may not exceed 15kWh/sqm or heating power equivalent to a maximum of 10 W/sqm. Moreover, the annual primary energy demand indicator may not exceed 120 kWh/ sqm for all the energy needs. Another demand concerns air infiltration by leaks of building envelopes, so-called uncontrolled air leakage. In a passive building, the air infiltration has to be less than 0.6 h-1 of the whole building volume per hour, which means that for the pressure difference equal to 50 Pa the infiltration has to be lower than 0.6 volume of the building per hour.

Other quality requirements are, among others, appropriate ventilation efficiency providing air quality compatible with standard DIN 1946, which guarantees consistent draught in every room and does not allow the temperature to drop below 17 degrees. The noise level within the ventilation system has to be below 25 dBA. Every room should have an opening that allows the inflow of air from the outside to get additional cooling during hot days.

PHI Certification concerning newly built passive constructions is a Passive House Certificate. It is worth underlining that this certificate is designed for all types of building, not only for house buildings. There is also a possibility to get so-called EnerPHit Certificate designed for modernised existing buildings. During certification, a building is classified as a class 'Classic', 'Plus' or 'Premium'. The class is based on building's renewable energy generation. Besides, highly energy-efficient buildings that do not qualify for the achievement of passive building standard, may obtain PHI Low Energy Building certificate.

Detailed criteria for Passive House, EnerPHit i PHI Low Energy Building are available on the PHI website (passiv.de), under Certification\Buildings\Energy Standards Criteria.

The Passive House Institute verifies meeting the standards using the Passive House Planning Package (PHPP). At the moment this tool is available in over 20 language versions and used by architects, designers, and verifiers in many parts of the world.

CONSTRUCTION METHODS, MATERIALS AND TECHNOLOGIES

The passive building should have a simple, compact structure with possibly minimal number of architectural forms protruding from the facade (bay windows, balconies etc.). The aspect ratio A/V that determines the ratio of the area of partitions to the volume of the building should be in the range of 0.75 - 1.2.

The passive building should be characterized by appropriate building materials that provide good thermal insulation. Walls and roofs are insulated with the material of the highest thermal parameters. Very good insulation applied across the entire building shell protects against both cold and overheating in the summer. In the spring and summer season, additional sun protection is required, such as external blinds.

Passive houses can be constructed in various technologies, e.g. brick, reinforced concrete, wooden, prefabricated, and mixed construction technologies. However, the thermal properties of structural elements are very important. Heat transfer coefficient (U) is used to describe these properties. U-coefficient determines the amount of heat per sqm at a temperature difference of 1 Kelvin which passes through the structural component. The smaller the value of this coefficient, the lower the heat loss of the element. In a passive house, the U-coefficient should be close to 0.1 W / (sqmK). Precisely, the U-coefficient of a non-transparent building shell has to be below 0.15 W / (sqmK), and the U-coefficient of windows and other transparent elements has to be below 0.8 W / (sqmK).

The construction project should take into account of the problem associated with shading. Since the passive building is characterized by the possibility of passive solar energy use, the side of the building with the southern orientation should acquire as much heat as possible from the sun in the heating season.

Nevertheless, it would be impossible to construct a passive house without using modern technologies. One of the advanced building methods used in passive construction is recuperation. It is mechanical ventilation with heating recovery from exhaust air. Recuperation ensures supplying the home with fresh air with higher

oxygenation, preventing heat loss at the same time. Because of this ventilation system, frequent opening of windows is unnecessary.

Another technology used in passive buildings is a heat pump. This device is very energy-efficient because it does not produce heat energy, but transfers thermal energy from the outside using a refrigeration cycle. Warm water is prepared by using a heat pump or solar collectors.

Interesting issue is possibility of ventilation of the building without any significant heat loss. The tubular ground heat exchanger (tube GHE) is used to supply fresh air in passive buildings. By exchanging heat with the ground, the exchanger pre-heats the fresh air to a temperature above 5 degrees. The air heats up to this temperature even in the winter season. In the next step, using an air-to-air heat exchanger, it occurs an effective recovery of heat from exhaust air. Most of the heat in the removed air is mixed with the incoming fresh air, so that the heat recovery efficiency in passive buildings is above 80%.

It is worth knowing that it is relatively easy to find out whether a given building material or other product can be used in the construction of a passive property because The Passive House Institute in Darmstadt also certifies components.

Another element, which should be characterized by a passive building, is energy-efficient equipment. Equipment such as a ventilation unit with a power consumption of less than 0.45 W/m3 is required. In addition, household appliances must have the highest possible energy class (preferably A to A++ class).

CERTIFICATION PROCESS

There are several steps in the procedure for certification of passive buildings according to PHI standards. The first step is to verify the architectural design. The investor provides documentation to the authorized institution (in Poland it is the PIBPiEO), which confirms the completeness of the documents and the correctness of the calculations performed. If at this stage it is detected that the building does not meet all the standards, it is still possible to change the design. After adjusting the design to the requirements the investor can start construction works.

The second step is to conduct two leakproof tests, so-called Blower Door Test. The tests have to be performed in accordance with the standard PN-EN 13829. The PIBPiEO or any other entity can conduct them, provided that it is not involved with the investor or contractor. The first test is conducted in raw state. After finishing work the second test is conducted.

The final stage of the certification takes place after the successful completion of the Blower Door Test. The investor is bound to deliver, among others, construction design, installation diagrams, Blower Door Test data, and documentation of construction works to the PIBPiEO. If the final verification is completed, the certificate is issued.

BENEFITS OF THE PROPERTY WITH PHI CERTIFICATE

The PHI certificate gives the investor a guarantee that the building was designed and made by passive building standards. Although passive buildings are average 5-10% more expensive in construction, it is affordable to build them, due to maximally low operating costs. As long as the building is operated, it is economized for so long.

In addition to the economic value, the health benefits of staying in a passive building are important. The passive house provides residents with high thermal comfort and good indoor air quality all year round.

It should also be pointed out the invaluable environmental benefit. At this era of the energy crisis and times when buildings are responsible for about 1/3 of the total energy consumption in the world, passive construction becomes an attractive alternative.

DEVELOPMENT OF THE IDEA OF PASSIVE CONSTRUCTION

The idea of passive construction is the most popular mainly in Germany, Austria, France, and the United Kingdom. In Poland, there are currently 12 buildings with PHI certificates. In our country, the first certificated building is a detached house built in 2007 in Smolec nearby Wroclaw. The first non-residential certified building is a sports hall (Lesser Poland Voivodeship) built in 2011.

Current data on passive buildings is published in the database of the Institute of Passive Construction in Darmstadt, at the Internet address: passivehouse-database.org. In addition, open data related to all PHI-certified buildings in the world are presented in the map, available on the Institute's website (passiv.de), under Certification\Buildings\World map of certified buildings. You can also find the map at database.passivehouse.com/pl/buildings/map/.

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