Feedback from Passive House Institute

On the revision of the Energy Performance of Buildings Directive

Last updated 26.04.2022 by Jan Steiger

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957175. The presented contents are the author's sole responsibility and do not necessarily reflect the views of the European Union. Neither the CINEA nor the European Commission are responsible for any use that may be made of the information contained therein.

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ABSTRACT

The Passive House Institute (PHI) welcomes the European Union's efforts to reduce greenhouse gas emissions. PHI recognises the recent attempt to introduce more clearly defined Zero Emission Buildings and minimum performance standards in building renovation to improve the building stock of the EU Member States towards climate neutrality. However, we fear that, particularly in building retrofits [LM1], the minimum requirements for the Member States will not be sufficient to reduce the energy demand of buildings to such an extent that they can be met with renewable sources only. We recommend further specifications and more ambitious requirements, specifically in building renovation.

To make the energy supply of buildings completely renewable, we must account for all energy flows, including household appliances or office equipment and expected losses in seasonal energy storage. Buildings can then be planned and evaluated for a renewably supplied energy future and optimised accordingly. If implemented consistently, we can achieve more flexibility in expanding renewables, a lower grid load and greater independence from energy supplies from non-European countries. Thus a secure and sustainable supply can be achieved.

Thousands of Passive House projects and EnerPHit retrofits worldwide have been proving for 30 years that this is possible and can be carried out economically.

PRELIMINARY REMARK

The Passive House Institute welcomes the updated Energy Performance of Buildings Directive (EPBD).

The Passive House Institute (PHI) is an independent research institution working for over 25 years on energy-efficient building and renovation to provide robust solutions for climate protection in the building sector. The PHI translates its scientific findings into application-oriented concepts and methods, puts them into practice and makes them available to all users. From our many years of experience and current research results, we give the following feedback on the Commission's proposal for the recast of the EPBD[1]:

[1] Suggested on 15.12.2021

ZERO EMISSION BUILDINGS (ZEB)

In addition to the "nearly Zero Energy Building" (nZEB), the "Zero Emission Building" (ZEB) will be introduced as a new standard. All new buildings must comply from 1 January 2030 with the "Zero Emission Building" (ZEB) standard [2]. ZEB buildings are defined as buildings with a "very high energy performance", in which renewable energy sources can primarily cover the low residual energy demand. The EU Member States again set the requirements for ZEBs.

After the nZEB definition led to very different standards in the Member States, and "nearly zero" was interpreted quite generously in some cases, the Commission is now providing a more transparent framework of the requirements for ZEB buildings. There are specified upper limits for all Member States, at least for residential and office buildings, which, depending on the climatic region, are set at approx. 60-90 kWh/(m²a) primary energy (PE) demand (Annex III). This specification refers to the usable space, including non-renewable and renewable PE. The upper limit introduced by the Commission is independent of the size and compactness of the buildings [3].

ZEBs are generally not zero-energy buildings; they continue to consume (a little bit of) energy. The recast directive provides a binding framework for supplying "ZEBs". The ZEB must not cause any CO2 emissions from fossil fuels at its location [4]. In addition to renewable energies or waste heat, district heating and district cooling can also be used. They do not exclusively use renewable energies. Regarding Article 24 of the Energy Efficiency Directive (EED), there is a timetable that allows the required "efficient district heating and district cooling systems" to use up to 50% non-renewable energy [5] sources. Only for new sources, fossil energy sources are excluded - except for fossil natural gas (!), which may continue to be used in this case.

In addition, relevant energy flows of buildings continue to be disregarded, such as household appliances and electronics. The term "zero" emission should therefore be reconsidered. It would be better to demand complete independence from fossil energy sources for the ZEB and to initiate a corresponding, realistically implementable transformation to a renewable future. The more efficient the building is, the less energy it consumes in the critical, low-solar season, and the easier and faster the renewable supply infrastructure will be sufficient for the building. These principles are followed by the concept of the Passive House, which is also referred to by the Commission [6]. The Passive House standard meets the ZEB's sustainability and economic performance objectives - many years of measurement results and experience have proven this [7].

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[2] Public buildings 3 years earlier

[3] The requirements will be defined by the member states, thereby may vary, as long as the PE demands fall below the above mentioned limits.

[4] Annex III

[5] Annex III

[6] Impact Assessment report 3 on the revision of the EPBD

[7] S. z.B. Johnston et al. https://rdcu.be/b26VA;
https://passipedia.org/operation/operation_and_experience/measurement_results/energy_use_measurement_results
Durability of building fabric components and ventilation systems in passive houses:
https://link.springer.com/article/10.1007/s12053-019-09781-3

MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS)[8] AND MINIMUM PERFORMANCE REQUIREMENTS [9]

Implementing maximum energy efficiency in building renovation is crucial to achieving a climate-neutral building sector. Therefore, the new version of the EPBD also sets out appropriate steps for achieving climate neutrality in the building sector. The envisaged focus on buildings with inferior energy performance that do not achieve the MEPS (according to Article 9) in line with national building renovation plans [10] is a sensible approach. On the one hand, it will quickly reduce energy consumption and emissions, and on the other hand, it will decrease dependence on fossil fuels.

It is a good idea to consider these successively necessary retrofits in the existing stock and for "major renovations" to be taken into account for achieving the minimum requirements (according to Article 5) for buildings to be renovated. They should also consider the affected building parts and, depending on the measure, building components to avoid unnecessary lock-in effects. However, the Member States have to define these "minimum performance requirements", as well as the requirements for new buildings, including the nZEB [11] standards already introduced, based on national economic considerations of the economic optimum [12]. This is now to be explicitly determined, considering official investment cost assumptions and costs for greenhouse gas emission certificates. Nevertheless, similar to the definitions of the national nZEB standards, there could once again be a dilution of requirements and standards and a significantly under-ambitious implementation by the Member States. The ZEB standard does not have to be achieved until 2050. The upper limits are also binding for the Commission's new building standard [13] (see above).

Given the importance of retrofitting the existing building stock to achieve climate neutrality, it is more important to immediately strive for the highest possible level of energy efficiency with every measure. For decades to come, there will be few opportunities to make further necessary improvements to these buildings or parts of buildings that also make sense economically. Suppose all measures taken on energy-relevant parts of buildings or facilities are used to reach high levels of energy efficiency, as shown by a study recently carried out as part of the EU-funded "outPHit" project for the German building stock [14]. This can be implemented economically, and the low energy consumption would also result in greater independence from fossil energy imports and lower network loads. The full implementation of the renewable energy expansion plan would significantly accelerate the energy transition, provided that the building sector's energy demand is low.

Experiences with high-efficiency retrofits using Passive House components show that energy-efficient deep retrofits lead to low energy consumption. The retrofits are well planned and implemented carefully and with quality assurance. These extensive retrofits allow flexibility in future supply systems

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[8] Article 9.
[9] Original: Minimum performance requirements Article 5
[10] Original: National building renovation plans (for the building stock of the member states), Article 3
[11] Nearly Zero Energy Building according to EPBD 2010ff, obligatory for new buildings as of 2020
[12] „cost optimal level“. The efficiency requirements oft he MS must at least achieve the cost optimum level.
[13] According to Annex III for residential and office buildings
[14] outPHit: https://outphit.eu/media/filer_public/c4/62/c46248f3-4b2e-45e6-adf3-3520b9d7579f/outphit_klimaneutralergebaudebestand_en_final.pdf

and lead to greater independence from energy imports. The EnerPHit standard is an ideal and proven way to achieve such a high level of efficiency for existing buildings - and to do so is also highly attractive in economic terms and associated with other positive effects.

AVOIDING LOCK-IN EFFECTS THROUGH RENOVATION ROADMAPS

The highest possible level of energy efficiency must be achieved from the very beginning. For complete retrofits or individual retrofitting measures, mediocre standards result in adverse lock-in effects. This is especially true in the case of step-by-step processes, where a retrofit project is carried out partially to take a building to the highest level of energy efficiency from the outset. Hence it is necessary for involved building owners, investors or building managers to agree to achieve, i.e., a zero-emission building or better.

The European Commission has recognized the necessity of building-specific retrofit plans and calls for retrofit passports with a "retrofit roadmap" in the revised EPBD (Article 10). These are to be mandatory from 2025 onwards to show building operators the consumption reductions that can be achieved in the long term and ensure that retrofits started can lead to a ZEB. In 2016, the PHI developed a building-specific retrofit plan using the Passive House Project Planning Package (PHPP) and expressly welcomes this approach. This step-by-step guide is called the EnerPHit Retrofit Plan (ERP) and was part of the EU-funded EuroPHit [15] project.

FUTURE-PROOF EVALUATION STANDARD BASED ON PRIMARY ENERGY

The primary assessment standard for buildings is the "energy performance", measured by the primary energy per floor area. These clarifications need to be emphasized:

- As a measure of efficiency, under primary energy, the total, both non-renewable as well as renewable, primary energy is calculated

- The reference area should be the usable floor area of the building, making it much easier to compare the standards.

However, primary energy does not include all energy flows into the building; only buildings and building services are included. For example, household appliances and office equipment continue to be disregarded. It should be clarified that in the concept of primary energy, both non-renewable and renewable PE sources are associated with resource use. On the other hand, they are not comparable in their effects and should be reported separately.

It remains unclear whether the calculated energy demand considers additional losses for conversion and storage in the renewable portion of primary energy, especially during the seasonal storage for the "winter peak". It is also not apparent whether the requirement for the Member States has been clarified in a sufficiently binding manner. This question becomes even more important when the en-

[15] www.EuroPHit.eu

tire energy supply is renewable. The Passive House Institute has developed the Primary Energy Renewable (PER) rating system, enabling a sustainable building assessment [16].

The PER demand is the energy demand, including distribution and storage losses in the targeted energy system made up entirely of renewables, which needs to become a reality in Europe in just a few decades, around 2050. Buildings being constructed or retrofitted today should also be evaluated against this future renewable energy supply to support this transition, as they will soon have to be supplied accordingly. The Passive House Institute offers further information on the renewable primary energy demand in the knowledge database Passipedia **Fehler! Textmarke nicht definiert.** or in the protocol volume 56 "Energy efficiency and renewable energies: Conflicting Goals or Synergy? " [17] of the Working Group on Cost-effective Passive Houses.

THE CALCULATION METHODOLOGY FOR ENERGY DEMAND

The energy demand calculation provides a solid basis for the building evaluation and verification procedures. The calculation method is determined by the Member States [18] based on a framework set out in Annex I of the revision of the EPBD. An hourly calculation method for determining energy demand is now required. This is to ensure the validity of the calculation (using high-resolution measurement data) and to maximise the use of renewable energy on-site [19].

Various theoretical and practical aspects that argue against such a requirement as the sole calculation methodology can be cited. First, it is true that with an input of data as detailed as possible, one can achieve correspondingly detailed results. However, the input data is not yet available in the planning phase to the level of detail required for a valid hourly based resolution. This applies to time-sensitive usage profiles, load profiles and the use of shading devices and windows that open. A large number of input data for an hour-by-hour calculation increases the error rate and can easily lead to calculations becoming intransparent and no longer verifiable and, thus, no longer close to reality. The determination and input of very detailed input data packages are also time-consuming and challenging for a fast and uncomplicated planning process.

The advantage of monthly calculations compared to hourly methods is a more comprehensive energy balance in conjunction with negligibly short calculation times and the more reliable relevant input data. This facilitates optimisation in the planning process since the relevance of various heat gains and losses are immediately visible. At the same time, incorrect inputs are easier to detect.

For decades, Passive House planers have been using the energy balancing tool Passive House Planning Package (PHPP) to plan Passive House new builds and EnerPHit renovations with monthly calculations. The program provides very accurate results, proven repeatedly [20]. Already in EN ISO 13790 [21], it was laid out that the monthly calculation method does not differ more from the hourly calculation

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[16] https://www.passipedia.org/basics/energy_and_ecology/primary_energy_renewable_PER
[17] https://passipedia.org/phi_publications#research_group_for_cost-effective_passive_houses_proceedings
[18] Article 4
[19] Recital (12) of the EPBD Revision
[20] https://europhit.eu/sites/europhit.eu/files/EuroPHit_T2.4.2_Report_PHPPForOldBuildings.compressed.pdf
[21] EN 13790, DIN EN ISO 13790: Thermal performance of buildings — Calculation of energy use for space heating. English version EN ISO 13790:2004

method than the various hourly calculation methods. This method has proven successful in practice on a large scale. Tens of thousands of reliably performing Passive Houses were designed on the basis of a monthly balance sheet. This remarkably effective method must remain in place.

ENDING THE PROMOTION OF MEDIOCRE QUALITY

We must not continue promoting average and insufficient qualitative products for the reasons mentioned so far. The Commission estimates that a further approx. €150 billion per year needs to be invested in retrofitting buildings [22]. The "EU Sustainable Finance Taxonomy" set up as a delegated act could help ensure that these funds are used where clear and ambitious energy efficiency targets are being pursued. However, here, for example, savings of 30% are already generally considered "sustainable," which is precisely the risk that the financial flows will be channelled into suboptimal solutions that will create severe problems in the medium term. This must be prevented at all costs.

Article 15 requires the Member States to establish a financial and organisational framework and provide instruments to facilitate the transformation of the building stock. Explicitly, incentives are to be set for "deep renovations" [23] - this refers to renovations that achieve the respective national nZEB standard and the ZEB standard from 2030 [24]. On the other hand, "extensive programs" are also to be promoted, targeting many buildings without having to prescribe targets that go beyond the minimum requirements. Incentives for heating with fossil fuels will be eliminated, but not until 2027. Moreover, there are exceptions, depending on which fund the incentives come from, even for this exclusion. It only applies to direct heating systems and not, for example, to the supply from fossil-generated district heating.

Since mediocre-quality and non-future-ready sites create lock-in effects and jeopardise the development towards climate neutrality, it would be the proper signal to promote only highly efficient immediately and future-proof building parts, components, and systems. Individual retrofit projects should only be granted if a renovation plan demonstrates that an efficiency improvement to ZEB or better is possible if the renovation steps are continued.

ACCEPTANCE OF PROVEN AND TARGET-ORIENTED METHODS

However, this signal should also be accompanied by further steps that are not only linked to the promotion of great quality solutions but also simplify the practical day-to-day work of planning and implementing them. Looking at the current need to reduce the energy demand of buildings as soon as possible to ensure the independence of the European Member States from non-European energy imports. It becomes clear that existing building energy efficiency concepts, which meet the objectives of the EPBD and its new version, have to be recognised and accepted by the Member States. This will enable proven concepts such as the Passive House standard for new buildings and the EnerPHit standard for renovation can be implemented quickly and easily without the additional expense of duplicating the verification.

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[22] Preferred Option HIGH1 of the impact assessment
[23] Definition according to Article 2.19
[24] Article 15 (11)

The proven calculation methodology for highly energy-efficient buildings, the Passive House Project Planning Package (PHPP), should be accepted as an alternative to the national verification methods. The reliability of the calculation, based on monthly procedures, has been proven over 25 years in tens of thousands of Passive House projects worldwide and has been verified both metrologically and through validation with dynamic, hourly calculation methods.

Energy efficiency planners and Passive House stakeholders who use proven concepts to create highly efficient, reliably functioning buildings and retrofits, especially ZEBs, can and want to realise highly efficient and reliable buildings and renovations in the future. Looking at the urgency of these tasks, ZEBs would no longer be up to date.

Passive House Institute, March 2022