



CONCERTED ACTION ENERGY PERFORMANCE OF BUILDINGS

EPBD implementation in Hungary

Status in December 2016

AUTHORS

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NATIONAL WEBSITES

www.unideb.hu, www.e-epites.hu, www.miniszterelnokseg.hu

1. Introduction

In Hungary, most of the articles of the EPBD (Directive 2010/31/EU) were implemented between 2012 and 2015. For buildings that receive public funding, the energy performance requirements were upgraded to the cost-optimal level at the beginning of 2015. The cost-optimal requirements will be introduced as mandatory requirements in 2018, whereas NZEB requirements will come into force in 2019 for buildings used by authorities, and in 2021 for all new buildings, respectively.

Due to a change in administration, the EPBD transposition became the responsibility of the Prime Minister's Office. The office updated the national rulebook in 2015 introducing significant changes. The new version is in force since the beginning of 2016. It has introduced new category bands of labelling and, thus, all existing EPCs have been reclassified. Further, it gives an exact definition of the NZEB requirements with an impact on the EPCs issued since 2016.

The National Building Energy Strategy adopted in 2015 envisages very ambitious renovation goals until 2020 and, in particular, an exemplary role for public buildings. Hungary has adopted alternative measures for inspection of heating and AC systems. Support programmes have rather focused on public buildings, except for the non-refundable funds of the "Warmth of Home Programme" focusing on reconstruction of residential buildings (approximately 10 billion HUF per year since 2015 by the Ministry of National Development. In the near future (mid 2017) the "GINOP¹ 8" programme shall provide refundable funds for the retrofit of the residential stock with a budget of more than 100 billion HUF provided by the Ministry of National Development². Information campaigns have been carried out with special attention to cost-optimal renovation solutions.

2. Current Status of Implementation of the EPBD

2.1. Energy performance requirements: NEW BUILDINGS

2.1.i. Progress and current status of new buildings

The first ministerial order to transpose Directive 2002/91/EC (7/2006. (V. 24) Decree about Determination of Energy Efficiency of Buildings) was issued in May 2006 and has been in force since 1 September 2006, although the decree has been modified several times. New cost-optimal requirements had to be applied from the beginning of 2015 for buildings supported by public funds and for any construction projects financed by the state budget. The same requirements will be generally introduced for all new buildings (with exceptions allowed by the EPBD) and those undergoing major renovations with a commissioning date of 2018 (or later). The fulfilment of the cost-optimal level requirements is the precondition of any subsidy.

Requirements of NZEB, defined by the rulebook since 2016, are to be widely introduced in 2019 for public buildings and in 2021 for all new buildings. The NZEB threshold of the specific primary energy consumption for residential buildings is 100 kWh/m².year; in case of installed air-conditioning it rises to 110 kWh/m².year.

2.1.ii. Format of national transposition and implementation of existing regulations

The requirement system has three facets, as far as new buildings and major renovations are concerned. Maximum permitted U-values are set for elements, as well as the specific heat loss coefficient (W/m³.K) that is a function of the surface to volume ratio. The losses from thermal bridges (using either the simplified or the detailed procedure), passive solar gains and the effects of shading devices are also considered. Finally, the specific yearly primary energy must not exceed the set limit depending on the type and use of the building. In Table 1 maximum permitted values are given for a few typical uses (residential, school, office), whilst in the case of mixed use, comparison with a reference building is to be used³. The requirement of the specific yearly primary energy need for NZEB will not depend on the surface to volume ratio any more, only on the building function.

Function of the building	Ep, Specific yearly primary energy need (kWh/m ² .year)
Residential (without lighting)	100
Office (including lighting)	90*
Educational (including lighting)	85

* If mechanical cooling is applied, additional 10 kWh/m².year can be counted.

Table 1. The maximum values of the yearly Ep's as function of the building.

The primary energy needs include: heating, domestic hot water, cooling, ventilation, and for non-residential buildings also lighting needs. Airtightness measurements are not required, but the quality of

windows is examined visually by experts on-site and the estimated infiltration is taken into account in the calculation. For new buildings and major renovations, thermal comfort and minimum requirements on fresh air supply are set, but these values are not included in the calculation procedure for certification. The calculation procedure refers to several European standards. NZEB level requirements are presented below in detail and the method of calculations is the following:

- At least 25% of the energy need of the building should be covered from RES, that is, compared to the calculated value of the specific yearly primary energy need. The “renewable share” is defined as the quotient of renewable/non-renewable energy. During the calculation of the value of the energy need, the renewable primary energy need is not taken into account. Even if the specific primary energy consumption is less (e.g., half) than the threshold value, the building is not approved as NZEB unless the above 25% is fulfilled, which leads to extra measures in order to further decrease the non-renewable energy consumption; the utilised passive solar gain is to be taken into account while calculating the “renewable share” (this can lead to double counting).
- Regarding the primary energy factors, some cases are defined on national level for district heating. If the level of co-generation is at least 50% and the source of heat is gas, coal, oil, nuclear, other renewable, non-biomass waste, then $e=0.83$; under 50% co-generation $e=1.26$.
- If the level of co-generation is at least 50% but the source of heat is biomass, wood pellets, agricultural pellets, biogas, other renewable, landfill gas or sewage sludge, then the primary energy factor is $e=0.5$, under 50% co-generation $e=0.76$. For off-peak grid electricity the primary energy factor is $e=1.8$. In case of heat pumps, the primary energy conversion factor of electric energy is excluded from the calculation of the renewable energy share. Unless it is based exclusively on biomass, the energy from district heating is not counted as renewable unless: a) there are other renewable sources, too, and b) the systems are typically bivalent, combining renewable and non-renewable sources (the precise data of most of the Hungarian systems are available, e.g., for 13 systems only in Budapest); for the calculation of the renewable share the following RES factors should be used: $e_{RES}=0.1$ if the national electric grid is used; moreover $e_{RES}=1$ if firewood, biomass, biogas, pellets or agripellets as well as solar, wind, water, geothermal, hydrothermal energies are used (Table 2).

For NZEB, detailed calculation or dynamic simulation is compulsory – these match the already available CEN standards.

The most detailed and comprehensive technical guidance document for energy experts is the book “*Building Energetics*”⁴. This book is a step-by-step guide for professionals including legislative background, the calculation process of the asset method, the certification process and an analysis of existing buildings. A new up-to-date version of the book will be published in early 2017. In addition, the Prime Minister’s Office publishes technical guidance documents⁵ (Figure 1).

Mains gas	LPG	Oil - general	Diesel or heating oil	Fuel oil	Coal - general	Biomass - general	Wood - general	Wood pellets	Grid Electricity	District heating - general
1		1	1	1	1	0.6	0.6	0.6	2.5	1.26

Table 2. The primary energy factors in Hungary.



Figure 1. Cover of the book “Building Energetics” (Zöld, A. and others, ISBN: 978-963-7298-31-8).

2.1.iii. Action plan for progression to NZEB for new buildings

Since 2016, new energy labels have been introduced in the certification scheme: “BB” means NZEB, and there are three even more ambitious levels. The NZEB requirements will become obligatory after 2018 and 2019 as prescribed by the EPBD.

The national plan on NZEB was adopted in 2015 by the Prime Minister’s Office. It contains the NZEB requirements that were later transposed by the national rulebook on the energy efficiency of buildings (Decree 7/2006). It envisages initiatives on the improvement of energy efficiency of the existing building stock, but also on renewable energy systems that can be applied in new buildings. Since 1 January 2017, a new support system for the use of renewables is valid in Hungary, which is called “Renewable support system” (METÁR⁶). It is a new support system for the produced electricity in Hungary. By using this system, Hungary should fulfil the previously undertaken 14,65%⁷ renewable share. The possible applications of the use of renewables will be supported by public funds, and new subsidy programmes will be available.

There are no reliable statistics available on the number of existing NZEB. According to the Hungarian Passive House Association, there are approximately 100 to 300 existing NZEB. Most of them are single-family houses or public buildings, which have been renovated with the support of the Environmental and Energy Efficiency Operative Programme. As an example, a new NZEB kindergarten is presented, called “Fabulous Passive House Kindergarten” (“Mesékert Passzív ház óvoda”)⁸, located in Budapest.

In the framework of the Environmental and Energy Operative Programme of the Hungarian Government and the European Union, a NZEB was built in the Kassai Campus of the University of Debrecen⁹ (Figure 2). This building, with a 300 m² floor area, was built in 2013, both for education purposes and for demonstration of the use of RES. The total (overall) cost was 35,000 €. The design U-values are 0.16, 1.1, 0.15 and 0.22 W/m².K for walls, doors and windows, roofs and ceilings, respectively. Heat is delivered by a combination of district heating, a heat pump and solar collectors. In summer, unused solar energy is supplied back to the district heating network. The performance goes beyond the NZEB requirements (it is AA++) and about 30% of RES use was measured.



Figure 2. Sustainable Building Energy Information Centre, University of Debrecen.

Focusing only on the NZEB requirements, the structure of the regulation is the following:

1. Elements. The maximum U values of walls, windows, etc. are defined. In addition, there are requirements on balancing, control, pumps, airtightness of ventilation ducts, but these requirements are not ambitious. Directive 2009/125/EC on EcoDesign requirements for energy-related products (ErP directive)¹⁰ has a more significant impact on technical building systems.
2. Building envelope. Maximum limits for the specific heating output ($\text{W}/\text{m}^3\cdot\text{K}$) are set, depending on the surface to volume ratio. This output takes into account the transmission losses, the passive solar gains (through which indirectly the effect of thermal mass), thus data depending only on the building itself. For heavy buildings, the NZEB requirement is the same as the cost-optimal level, for light buildings, NZEB is more ambitious.
3. Thresholds for the specific yearly primary energy consumption are set (Table 3, Figures 3 & 4).
4. Minimum of “renewable share” is set to 25%.

Building element	2016 general requirement	foreseen requirements in 2015, 2018, 2019, 2021
Exposed wall	0.45	0.24
Flat roof	0.25	0.17
Attic floor slab	0.30	0.17
Floor slab over basement	0.50	0.26
Window, non-metal frame	1.60	1.15
Window, metal frame	2.00	1.40
Entrance door	3.00	1.45
Glazing	-	1.00

Table 3. Maximum U values (W/m².K) of building elements of 2016, cost-optimal and NZEB levels.

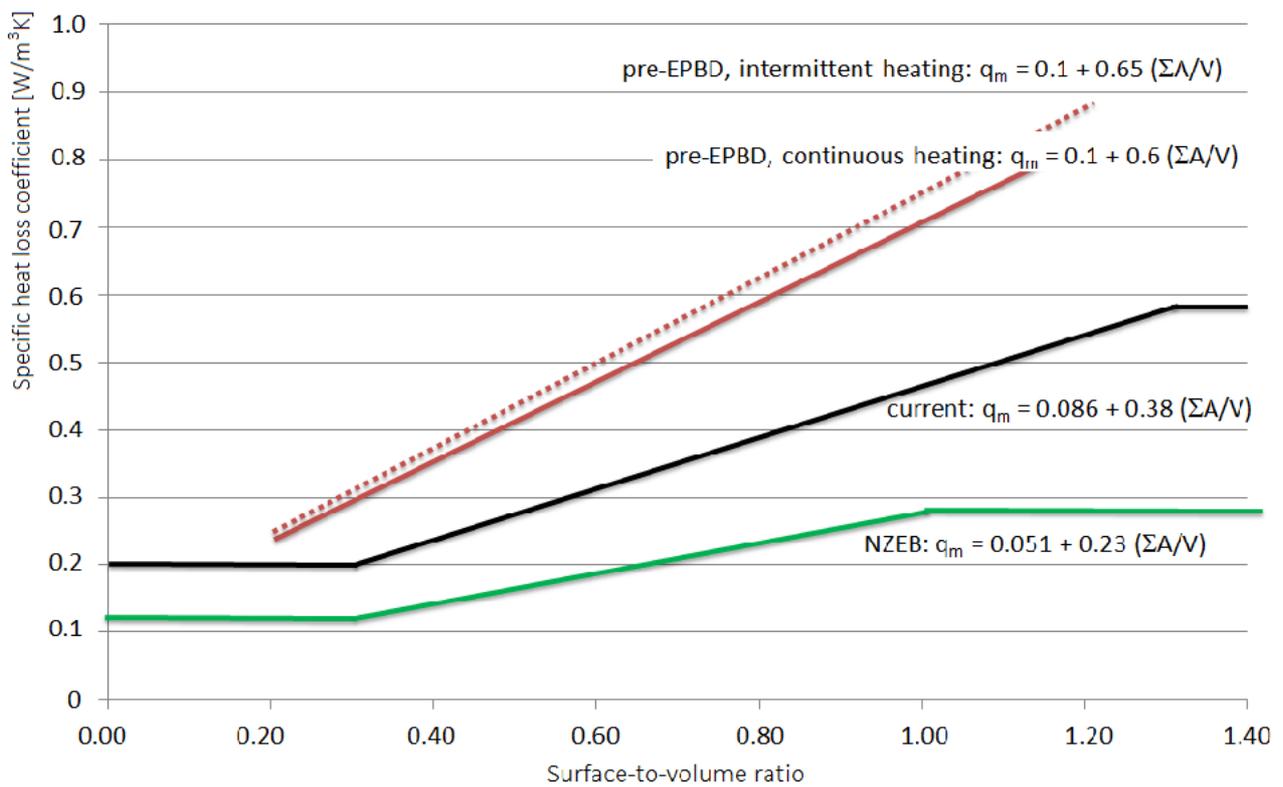


Figure 3. The specific heat loss coefficient [W/m³.K] before (pre-EPBD) and after 2006 (in force until the end of 2017) and the cost-optimal requirements that were introduced in 2015 for buildings receiving public funding. It will apply to all buildings in 2018. The foreseen NZEB requirements for the specific heat loss coefficient is identical to the cost-optimal requirement except for light buildings.

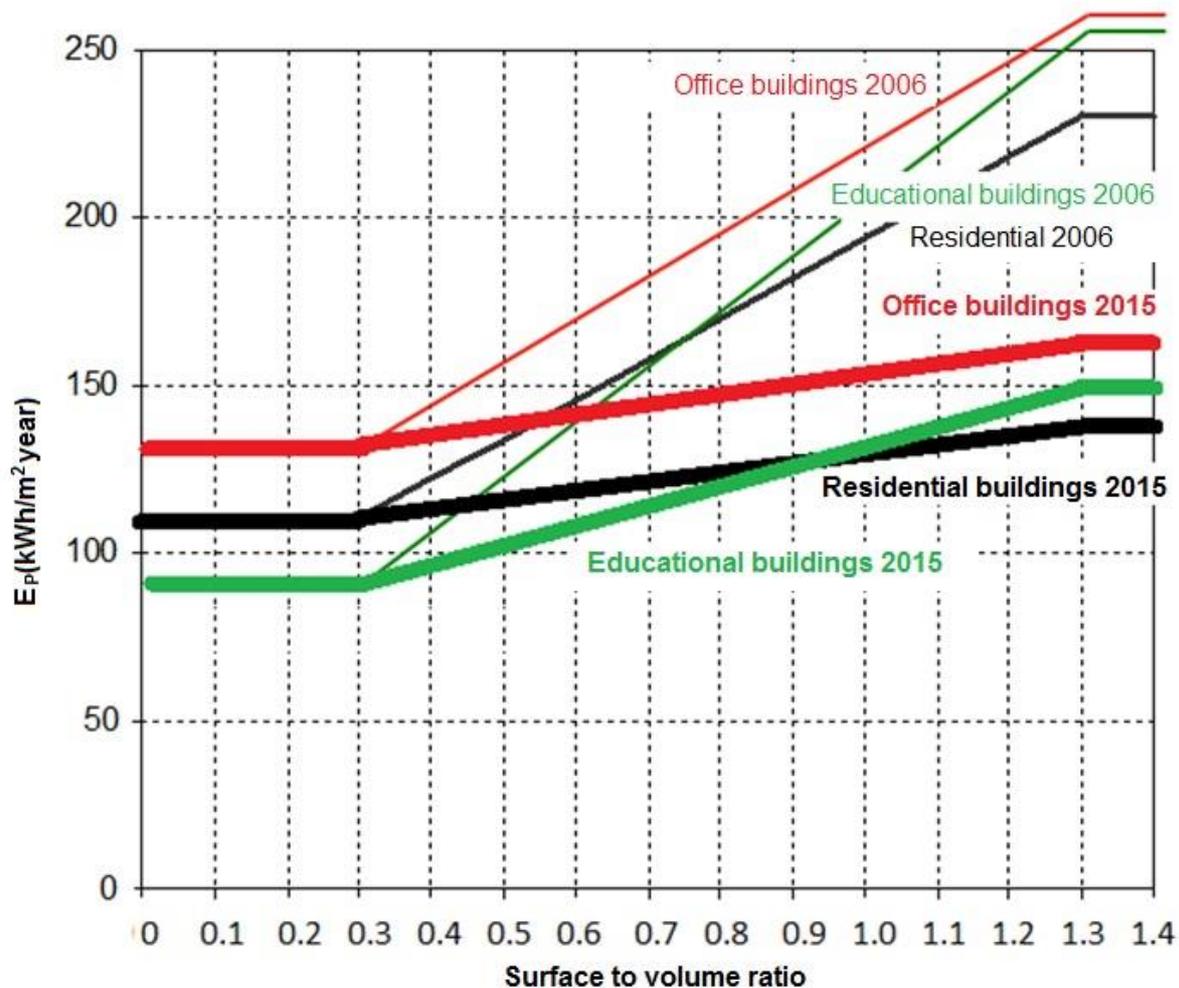


Figure 4. The 2006-2014 and 2018 (in some cases 2015) cost-optimal requirements for the specific yearly primary energy need. The NZEB requirements will be 100 kWh/m².year for residential, 90 kWh/m².year for office and 85 kWh/m².year for educational buildings (not indicated on the diagram).

2.II. Energy performance requirements: EXISTING BUILDINGS

2.II.i. Progress and current status of existing buildings

Since 2006, major renovations have to follow the same requirements as for new buildings. Other renovations are regulated since 2013 and only requirements for individual elements have to be fulfilled (both envelope and technical building elements). From 2016, major building extensions are considered as new buildings and all requirements are relevant, but in case of minor extensions only requirements for individual elements are defined. After 2018, cost-optimal requirements shall be obligatory for both renovations and extensions. NZEB requirements are not planned to become mandatory for retrofits.

2.II.ii. Plans to improve the existing building stock

Renovation targets are set in the National Building Energy Strategy for the period 2015-2020 with an outlook to 2030. In total, a target on 49 PJ/year primary energy savings is set for 2020; from that, 40 PJ/year comes from the residential, 4 PJ/year from the public and 5 PJ/year from the tertiary sector. By 2030, the target is set to 111 PJ/year.

Current policies focus mostly on cost-optimal levels rather than on NZEB. Although NZEB requirements shall apply only to new buildings, the support of the use of RES is prioritised in practice.

The implementation of the EED Articles 4 and 5 are laid down in Law 2015/LVII on energy efficiency. Three percent (3%) of the total floor area of heated and/or cooled buildings owned and occupied by the central government are to be renovated each year.

Approximately 15,000 m² of floor area have to be retrofitted annually, which is equivalent to 3-5 buildings according to cost-optimal requirements. The list of the selected buildings is published on the website of the Ministry of National Development and the necessary budget is already allocated by a governmental decree.

2.II.iii. Regulation of system performance, distinct from whole building performance

The regulations include requirements on technical building systems elements (e.g., on balancing, control, pumps, airtightness of ventilation ducts). The rulebook does not set any direct system performance requirements; only the upper threshold of the total primary energy consumption of the building is defined.

The requirements of the ErP directive on gas boilers, water tanks, heat pumps, pumps, ventilations systems, etc., have a much more significant impact on the construction sector than element requirements set in the rulebook.

2.II.iv. Encouragement of intelligent metering

In the frame of a demonstration project¹¹, more than 60,000 smart meters are being installed in Budapest and 5 other cities in Hungary. This is carried out by the *KOM Központi Okos Mérés Ltd*¹² project company in cooperation with several energy service provider companies. Within the project, software and mobile apps shall be developed so that end users can monitor their water, gas, heat and electricity consumption. The project budget is 21 million € and is financed from the CO₂ quota incomes.

2.II.v. Financial instruments and incentives for existing buildings

In Hungary, there are different subsidy programmes for supporting the energy efficient refurbishment of buildings. The *KEHOP*¹³ programme focuses on public buildings mostly, with 100% subsidy of costs. The *GINOP*¹⁴/*VEKOP*¹⁵ programme supports energy efficiency and renewable energy systems of buildings used by SMEs (the budget is approximately 300 million €). A residential retrofit programme is under preparation providing loans with 0% interest rate with a budget of approximately 400 million €. A bottleneck is that programmes are mainly ad-hoc, often restructured, and funds run out quickly.

2.II.vi. Information campaigns / complementary policies

The Ministry for National Development has adopted the *Action Plan to Improve Awareness for Energy Efficiency and Climate Protection in 2015*. It sets communication and education actions as well as monitoring mechanisms to control the implementation of the action plan. The plan envisages several opportunities to submit applications for the implementation of awareness-raising programmes to be co-financed by the EU, which are also able to contribute to numerous programmes to encourage the reduction of energy consumption.

To mention an example, within the frame of a *TÁMOP*¹⁶ research project (*Sustainable Energy with Optimal Integration of the Renewable Sources*) the University of Debrecen was supported with approximately 1.6 million € from EU funds (Figure 5). As a result of the project, more than 100 articles and notes have been published on different fields related to RES (e.g., energy efficiency in buildings, environmental, climatic and legal aspects, cost-optimality).

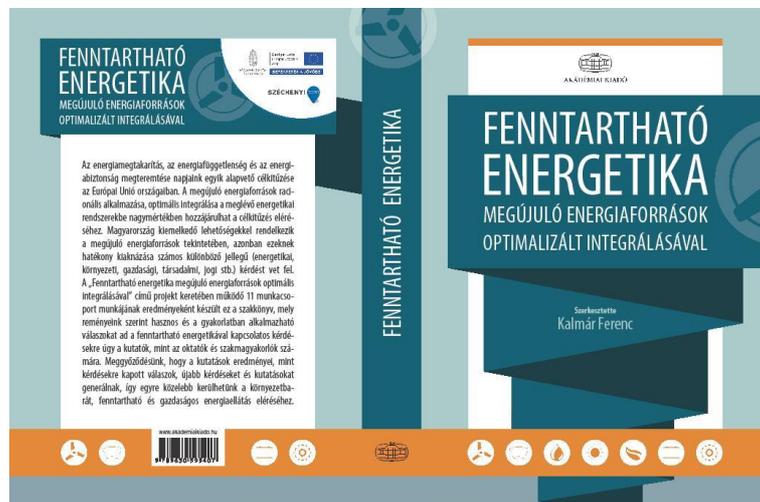


Figure 5. The book cover of the *TÁMOP* project: *Sustainable Energy by Optimal Integration of Renewable Energy Sources*.

2.III. Energy Performance Certificate requirements

Starting from January 2012, all existing residential and non-residential buildings need to be certified when sold. The owner must present a valid EPC to the buyer, when the sale contract is agreed upon. For rentals, the EPC is obligatory only since 2015.

In 2016, the energy performance classes were rescaled. The new labels are marked by double letters to differentiate them from the old labelling system. The reference value of the scale is the NZEB requirement on total primary energy performance. Building units meeting the NZEB requirements can get label “BB” or better. EPCs issued before 2016 have been automatically rescaled, but unfortunately owners are not automatically informed about the change because of technical barriers of the database.

EPCs are valid for 10 years unless the building undergoes a major renovation, in which case a new EPC is required.

The EPCs are issued by independent experts who have passed the necessary exam at the Hungarian Chamber of Engineers or at the Hungarian Chamber of Architects.

2.III.i. Progress and current status on sale or rental of buildings and EPCs

Since January 2013, EPCs are registered in a central database operated by the *Lechner* Non-Profit Organisation. The database is partly public. In the public part, a building's energy performance class can be searched by using its address. Statistical information from the database is also publicly available, but only a limited number of searching criteria are allowed. Detailed statistical analysis is only for internal use. The licences for the certified experts are issued by the Hungarian Chamber of Engineers and the Chamber of Architects. The Chamber of Engineers runs the control system of the EPCs.

The EPC assigns an energy performance label to residential and non-residential buildings or building units, and it lists cost-effective measures for improving their energy performance. The energy label classifies the buildings on an efficiency scale ranging from AA++ (high energy efficiency) to HH (poor efficiency). The classification is based on the specific yearly primary energy need. The labels of the new EPC's are presented in Figure 6.

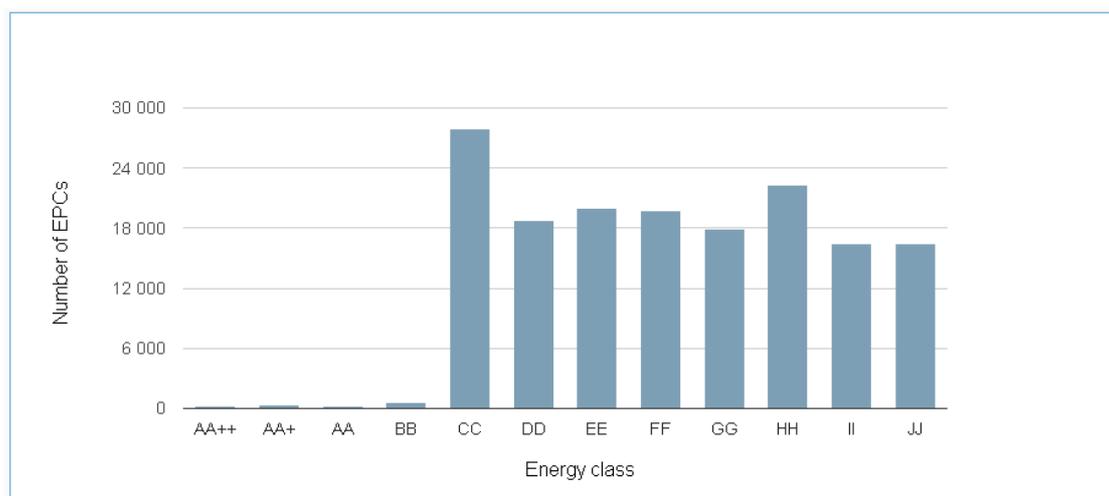


Figure 6. Number of EPCs in function of energy class registered in the electronic system in 2016.

The cost of a certificate¹⁷ for an apartment unit is set by law (40 € + VAT per unit). The same price applies for single-family houses. This cost has often been criticised by experts as unrealistically low and it thus has a strong negative impact on the quality of the certificate. For non-residential buildings, there is no legally defined amount of the cost of an EPC.

2.III.ii. Quality Assurance of EPCs

An EPC electronic registration system has been in operation since 2013. An EPC is only valid after upload into the online system. Roughly, 150,000 EPCs are issued annually.

The online system also serves as a first level of quality control: first, it automatically checks the permit of the energy expert. Following this step, the system checks for unrealistic figures.

The second and third control levels are performed by the Hungarian Chamber of Engineers. Randomly selected, 2.5% of the EPCs are verified by an office check and 0.5% (20% of the 2.5%) are verified on-site. Both controls are carried out by independent experts and all control results are registered in an electronic database. From the beginning of 2017, targeted controls are also possible.

If the quality control detects a miscalculation leading to a difference of more than two energy classes, the expert loses his licence for 3 years. Since 2017, further sanctions can be applied, including fines and penalties.

2.III.iii. Progress and current status of EPCs on public and large buildings visited by the public

In Hungary, the definition of a public building includes every state-owned non-residential building. Initially, only the larger buildings (exceeding 1,000 m² floor area) were required to display their EPC, making it visible to the public. Since 2015, the EPC is obligatory for all public buildings and large buildings open to the public exceeding 250 m² floor area, and the EPC must be displayed in a visible place. For the display itself, there is no effective control and sanction system in operation.

The cost of an EPC for public buildings must be determined on the basis of real cost reports and is generally between 100 and 1,500 € depending on the size and complexity of the building.

2.III.iv. Implementation of mandatory advertising requirement - status

According to the Governmental Decree 176/2008 (VI. 30.), as of 9 January 2013, the energy categories must be displayed in all commercial advertisements for all buildings or building units, (including individual apartments in blocks of flats, single-family houses and non-residential buildings) when sold or rented, if the EPC is available. In most cases, the EPC is not available in the period of advertising, but only at the moment of sale or rental. As of January 2017, it is neither controlled nor sanctioned if the mandatory advertising requirement is obeyed or not.

2.IV Inspection requirements - heating systems, air conditioning

2.IV.i. Report on equivalence of model A and B for Heating Systems

Hungary has adopted alternative measures for inspection of heating systems and AC systems. This means that the inspection system will be replaced by other alternative actions, such as information campaigns on the replacement of obsolete or low-efficiency boilers, AC and heating systems. Such campaigns are integrated in the *Action Plan to Improve Awareness for Energy Efficiency and Climate Protection*^{18, 19}.

2.IV.ii. Progress and current status on heating systems

The government has initiated several programmes to subsidise the installation of new condensing boilers to replace obsolete low-efficiency boilers and water heaters. The *Environmental and Energy Efficiency Operation Programme* supported heating system modernisation actions and the integration of renewable energy systems for public buildings in recent years. The applicants can select from several renovation packages, including complex renovation and different combinations of 2 or 3 retrofit measures. No further results are available yet.

2.IV.iii. Progress and current status on AC systems

Only 3.8% of the EPCs reported existence of an AC system in buildings or building units. This means that AC systems are rarely used in Hungary, particularly not in the residential sector. In 2015, 270 TJ was the total used energy for cooling of the households, which was 0.1% of the total used end energy of the households.

The support of AC systems is therefore not a priority of the Hungarian energy policy actions. Instead of subsidising AC systems, the installation of shading devices is preferred. In the “*window exchange*” programme for single-family houses and small residential apartment buildings, the installation of shading devices was a priority²⁰. No further results are available yet.

2.IV.iv. Enforcement and impact assessment of inspections Enforcement and penalties

As mentioned above, Hungary has adopted alternative measures for the inspection of heating and AC systems. Therefore, the issue of enforcement and penalties is not relevant.

Three per cent (3%) of the 1.2 million boilers operating in Hungary have capacities below 20 kW, 80% have capacities between 20 and 30 kW, and 17% have capacities above 30 kW. Overall, 1,116 million boilers are affected by the EPBD requirement for on-site inspections. The share of household boilers is 90%, while the share of boilers in commercial and public institutions is 10%.

In 2013, the Ministry for National Development sent the report on relevance of equivalent measures to the European Commission. The evaluation of this report is still ongoing.

3. A success story in EPBD implementation

A success story is the energetic refurbishment of 20 educational buildings in Debrecen. Within the framework of the *New-Phoenix Plan*²¹, the technical building systems and the building elements of 20 educational (elementary and high school) buildings in Debrecen (Hungary) were refurbished with focus on improving energy efficiency. The project was financed by the Norwegian Fund (eea grants)²² and Debrecen obtained about 17 million € for the renovation activities. The windows and doors of all buildings were changed with plastic framed ones, the external walls of the buildings were insulated with 20 cm thick polystyrene insulation, the heating systems of the buildings were modernised, and thermostatic valves were installed. Eighty (80) panels of photovoltaic solar cells were used with 20 kWp electric power potential. For the operation and maintenance, a smart-building automation system was built-in as well.

From the design stage, for the *István Hatvani* elementary school, about 661 MWh/year energy savings are expected, and for the *Endre Ady* secondary grammar school, about 563 MWh/year energy savings are expected. Unfortunately, actual measured values are not available yet (Figures 7, 8, 9).



Figure 7. Refurbished educational buildings in Debrecen 1.



Figure 8. Refurbished educational buildings in Debrecen 2.



Figure 9. Refurbished educational buildings in Debrecen 3.

4. Conclusions, future plans

The 2018 EPBD requirements for new buildings and major renovations will bring important energy savings in the near future and in the long term, although new and renovated buildings only represent a small share of the entire building stock in Hungary (around 4.4 million dwellings and single-family houses in total). To mention a positive trend, although between 2008 and 2012 the number of new apartments has decreased from 35,000/year to around 10,000/year, a boom has been experienced in 2016 due to the governmental support programme *CSOK*²³ on new residential buildings for families with children. The number of building permissions was 2.5 times higher than in the previous year, which is still only 0.6% of the existing households. In these projects, the cost-optimal requirements have to be applied. *CSOK* gives support to families for building or buying new houses or flats, with one, two and three children. Families with at least three children can get about 32,000 non-refundable financial support and can have a loan of the same value. For one and two children, the loan is not entitled and the support is significantly lower, too.

The National Building Energy Strategy envisages a significant reallocation of funds and support for the building sector for the period 2015-2020. In spite of the difficulties, the introduction of energy performance requirements on partial renovations since 2013 and the introduction of cost-optimal requirements in 2015 for buildings that obtain public funding can have a remarkable effect. According to current trends, savings will be expected mainly in the public sector. Hopefully, new subsidy programmes will appear in the future, the first one being the on-going *METÁR*.

In the medium term (after 2018), the introduction of the cost-optimal requirements for all kinds of buildings and the NZEB concept after 2019 and 2021 will become the factors determining the construction market. It is not easy to estimate the effect of a new or extended EPBD.

The defensive features of buildings (thermal insulation, airtightness, shading) are approaching the rational limits. Regarding biomass as renewable energy the problem of transport will override the exaggerated expectations. Perspectives in the fields of smart metering, electric cars, national grid, co-generation are more promising however these items are beyond the competence of the designers of individual buildings.

CEN standards can be applied in the final stage of the design. Nevertheless, before elaborating the final construction drawings, a building permit is to be issued on the basis of overview plans. In this stage, many details of the construction are not fully defined yet and, as a consequence of the lack of input data and due to the inevitable changes during the later stages of design and construction, the application of the CEN standards is put under question. From building permit until commissioning (which may take years), the market conditions, e.g., availability and cost of some elements, may change: this is why reliable but simplified calculation tools are and will be necessary in the early stage of design (application for building permit), when lack of input data does not facilitate the application of many standards.

Endnotes

1. *GINOP*: Economic development and innovations operative programme (www.palyazat.gov.hu)
2. www.palyazat.gov.hu/ginop-841-a-17-lakpletek-energiatkonysgnak-s-megjul-energia-felhasznlnak-nvelst-clz-hitel
3. Actual buildings need to have better performance than a reference building with the same shape and size following the prescriptive values for building elements and HVAC systems.
4. Zöld A. and others, *Building Energetics*, 2009. ISBN: 978-963-7298-31-8
5. www.e-epites.hu/e-tanusitas/kezikonyvek-utmutatok
6. *METÁR*: Support system for use of the renewable sources (www.metar.hu)
7. http://2010-2014.kormany.hu/download/2/b9/30000/Meg%3BAjul%3B3%20Energia_Magyarorsz%C3%A1g%20Meg%3BAjul%3B3%20Energia%20Hasznos%3ADt%3A1si%20Cselekv%C3%A9si%20terve%202010_2020%20kiadv%C3%A1ny.pdf
8. http://ovoda.bp13.hu/index.php?lang=hun&page=cms&spage=showpage&id=660&mikrohonlap_id=1494

9. <http://dem.eng.unideb.hu/>
10. Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products
11. Central Intelligent Network, www.komzrt.hu
12. www.komzrt.hu/web/kom/projekt, a subsidiary of the MAVIR Zrt (Hungarian electric energy transmission leader company)
13. KEHOP: Environmental and energy efficiency operative programme (www.palyazat.gov.hu)
14. See endnote 1
15. VEKOP: Competitive Central hungarian operative programme (www.palyazat.gov.hu)
16. TÁMOP: *Reformation of society operative programme* (now suspended)
17. <https://entan.e-epites.hu>
18. www.kormany.hu/download/1/25/80000/IIIINemzeti%20Energiacselekv%C3%A9si%20Terv_HU.PDF
19. www.kormany.hu/download/0/e4/80000/Energia-%20Kl%C3%A9matudatoss%C3%A1gi%20Szemleletform%C3%A1si%20Cselekv%C3%A9si%20Terv.pdf
20. ZFR-KAZ/2017 *Otthon Melege Program*, <http://futeskorszerusites2017.nfsi.hu/>
21. <http://uft.hu/>
22. <http://portal.debrecen.hu/varoshaza/hivatal/euprojektek/energiacselekv%C3%A9si%20Terv/energiacselekv%C3%A9si%20Terv%20Kl%C3%A9matudatoss%C3%A1gi%20Szemleletform%C3%A1si%20Cselekv%C3%A9si%20Terv.pdf>
23. CSOK: Reduced fare for building and buying family houses



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