European Common Voluntary Certification Scheme and energy ratings

JANA BENDŽALOVÁ
ENBEE s.r.o., Bratislava, Slovakia
e-mail: bendzalova@enbee.eu

The ALDREN European Common Voluntary certificate (EVC) for non-residential buildings aims to trigger the renovation rate by providing a reliable tool for high quality buildings recognition by the market, professionals and policy makers. This article describes the ALDREN approach related to the energy performance assessment and rating especially for high performing buildings and Deep Renovation identified as a priority under the European Green Deal.

The ALDREN energy performance rating and the associated reporting certificate, aims to provide a reliable, consistent and transparent instrument for benchmarking, prediction and assessment of high performing buildings and improvement achieved by energy renovation.

Keywords: European Common Certificate, European standards, energy performance of building, energy rating, scale, energy performance indicators, deep renovation, NZEB

The Renovation Wave initiative announced in the European Green Deal and the Commission recovery package are discussed today at the highest political levels. The announced financial support aims to increase the renovation rate of existing buildings and their transformation into highly efficient buildings.

A reliable, advanced tool and common metrics are needed which are able to benchmark such buildings, predict and prove that their required and actual performance have been achieved.

A comparable ambition level for renovation targets across the EU is crucial to achieve the EU climate targets.

The ALDREN European Common Voluntary Certificate (EVC) is a part of the ALDREN common framework that aims to provide a harmonised instrument for benchmarking, prediction and assessment of high energy efficient buildings and improvements achieved by renovation to avoid a suboptimal renovation with the potential long-term lock-in effect.

The energy performance certificates (EPCs) represent a crucial instrument for public policies and their role has been strengthened in the amendment of the EPBD [1]. The Member States are asked to improve the quality of energy performance certificates and to potentially verify the eligibility of the financial support by comparing energy performance certificates issued before and after renovation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 754159. The sole responsibility for the content of this paper lies with the authors. It does not necessarily reflect the opinion of the European Commission (EC). The EC is not responsible for any use that may be made of the information it contains.

Today there is a clear lack of comparability and no common quality benchmark as the calculations, indicators and the ambition levels of the national mandatory certificates differ per country or even per region [11]. ALDREN tries to close this gap.

The ALDREN proposal follows the previous developments for the EVC scheme presented to stakeholders in the frame of the study "Enabling the European Common Voluntary Certification scheme for non-residential buildings" [9] and the recommendations in market study for uptake of the EVCS [10].

The ALDREN European Common Voluntary Certificate rating & targets

The ALDREN energy rating and targets aim to provide in the ALDREN European common certificate (ALDREN EVC) a transparent and comparable metric and more accurate results closer to the actual energy consumption. The ALDREN EVC is compatible with the EPBD requirements on the energy performance certificate. The reliability of the ALDREN approach is based on the following key components:

1. Harmonized and transparent calculation methodology based on the new European standards developed under the Commission Mandate M/480, that provides the results closer to the actual consumption using the hourly calculation step, the climate conditions of building location, the real performance of systems and envelope. The national standard use and occupancy schedule, assumed as conditions for calculation, represent the average building exploitation during a longer period (e.g. 15-20 years) considered for global cost and discounted cash flow (DCF) calculation for renovation options;

2. **Two main common indicators** for the benchmark on the **common scale** based on the non-renewable primary energy use either (a) with only the self-used PV electricity produced on-site taken into account or (b) including also the export to the grid (the main energy performance indicator);

3. The additional numerical indicators including a "**hurdle race**" towards the Nearly Zero Energy Building (NZEB) for the "**green**" ALDREN certificate because to achieve an energy class "A" is not sufficient for ALDREN NZEB level. The indicators were aligned with the existing schemes (BREEAM, DGNB, HQE, IVE-BES) and with the recommendations in Level(s) [7];

4. Link of reported energy performance with **the thermal comfort score** based on the operative temperature obtained from the hourly energy simulation;

5. Possibility for calibration of calculation model using the measured energy (actual and calculated heating power based on EN 15378-3[6]);

6. A **common content** and **template** of European certificate reporting all indicators together with the **recommendations for improvement** of energy performance towards the NZEB with the link to more detailed ALDREN **Building Renovation Passport** (BRP).

The common calculation methodology ensures the harmonisation at the EU level and the level playing field for products and innovative solutions. It will also enable a common EU market for software and training of experts that started already within the CEN-CE project [13]. High level professionals, able to work with new CEN standards, are needed to run the ALDREN scheme.

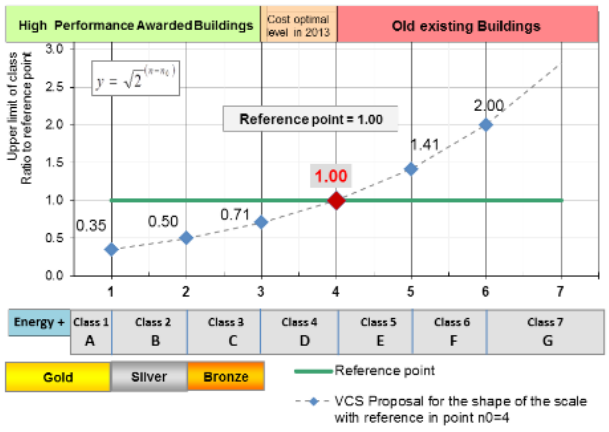
Big differences in national energy performance certificates do not allow comparability because of different consideration of innovative solutions such as the production of renewable energy, for example. The monthly calculation step is used in most of countries while the hourly calculation is crucial for some systems assessment (heat pumps, cooling, PV electricity self-consumption and export) and for evaluation of indoor thermal environment.

The amended EPBD [1] requires Member States to describe their national calculation methodologies following the national annexes of the overarching standards. The "Annex A" of the overarching standard EN ISO 52000-1 [3] has been developed for the ALDREN EVC. This will ensure the consideration of technical systems, especially producing the renewable energy, in a transparent and harmonised way and facilitate the easier implementation of the ALDREN approach into national or EU certification schemes.

ALDREN introduces a harmonized European energy performance scale, with classes from A to G. Energy performance is reported in relative values to a reference point. The national energy performance scales are mostly based on EN ISO 52003-1:2017 [4] with two reference points. The ALDREN scale is a non-linear

scale based on one reference point [4] located on the upper limit of energy class "D" (**Figure 1**). The reference value is based approximately on the cost optimal level of minimum requirements calculated by the Member States in 2013 that are based on a comparable approach required by the EPBD [1]. Energy Class "A", representing 35% of reference value, is required for ALDREN NZEB.

The reference values are based on calculation of several typical buildings and are set for offices and hotels for

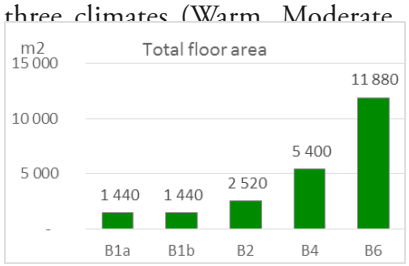


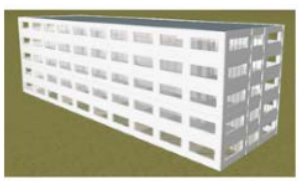
Ref = energy class D

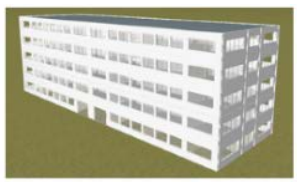
Class	Energy classes
A+	EP< 0
A	0 < EP ≤ 0.35 Ref
B	0.35 Ref < EP ≤ 0.50 Ref
C	0.50 Ref < EP ≤ 0.71 Ref
D	0.71 Ref < EP ≤ 1.00 Ref
E	1.00 Ref < EP ≤ 1.41 Ref
F	1.41 Ref < EP ≤ 2.00 Ref
G	2.00 Ref < EP

Figure 1. The ALDREN EVC scale with one reference point.

three climates (Warm, Moderate, Cold) (**Figure 2**).







Offices

Climate zone	ALDREN REF	ALDREN NZEB
Warm	**70**	**25**
Moderate	**130**	**46**
Cold	**170**	**60**

Hotels

Climate zone	ALDREN REF	ALDREN NZEB
Warm	**200**	**70**
Moderate	**270**	**95**
Cold	**310**	**109**

Figure 2. The Reference Values (REF) for ALDREN scale expressed in kWh/(m^2.a) of non-renewable primary energy and an example of a typical building for setting the scale.

The Commission Recommendation (EU) 2016/1318 on guidelines for the promotion of nearly zero-energy buildings [2] has been taken as the main reference for ALDREN NZEB definition.

The hotels are buildings with many different potential use scenarios depending on the operation (annual, seasonal), category, climate and the geographical area (urban, rural, coastal, mountain) and activities (business, Spa, B&B). The categorisation of hotels and the recommendations from the neZEH initiative [8] have been taken into account but the scale has to be still adapted based on the experience from pilot hotel buildings.

The thermal comfort score is reported in the ALDREN EVC together with the energy performance. The estimation of the score for each season (summer, winter, fall/spring) and the overall score is based on the hours during occupancy when the operative temperature is outside the assumed intervals for IEQ categories I – IV defined in EN 16798-1 [5]. The operative temperature is obtained by the hourly simulation of the building energy performance for standard use and behaviour of technical systems and for the Typical Meteorological Year (TMY). It reflects the indoor environment assumed for energy calculation only and not the real comfort in the specific rooms. Reporting this indicator together with the energy performance is important for comparison of solutions as the better energy performance due to a missing system (e.g. no cooling) is penalised by worse thermal comfort score. The link with the building resilience to climate change is also investigated. The example of the thermal comfort score reported in the ALDREN EVC and the hourly indoor operative temperature from simulation for TMY is shown in **Figure 3**.

The ambition level of ALDREN energy targets

The current financial instruments often refer to the best practices (achieved levels) in the existing commercial environmental schemes (e.g. BREEAM, LEED, DGNB, Passive house) because the requirements of these schemes go beyond the legal minimum requirements. This is also the ambition of ALDREN EVC energy performance rating.

The main target of ALDREN renovation strategies is the ALDREN NZEB level. It is not sufficient to achieve the energy class "A" but the "hurdle race" is required to be fulfilled in line with the recommendations in EN ISO 52000-1 [3]. The criteria for ALDREN NZEB for which the threshold values have still to be tested on pilot buildings are:

- Energy class "A" for the non-renewable primary energy use;
- A maximum level of energy needs (heating, cooling, lighting);
- A maximum expenditure factor for final energy;
- the overall thermal environment score below required level.

To provide a direct support for green investment the high performing buildings that achieved ALDREN NZEB level are highlighted by a "Green ALDREN Certificate" as shown in **Figure** 4.

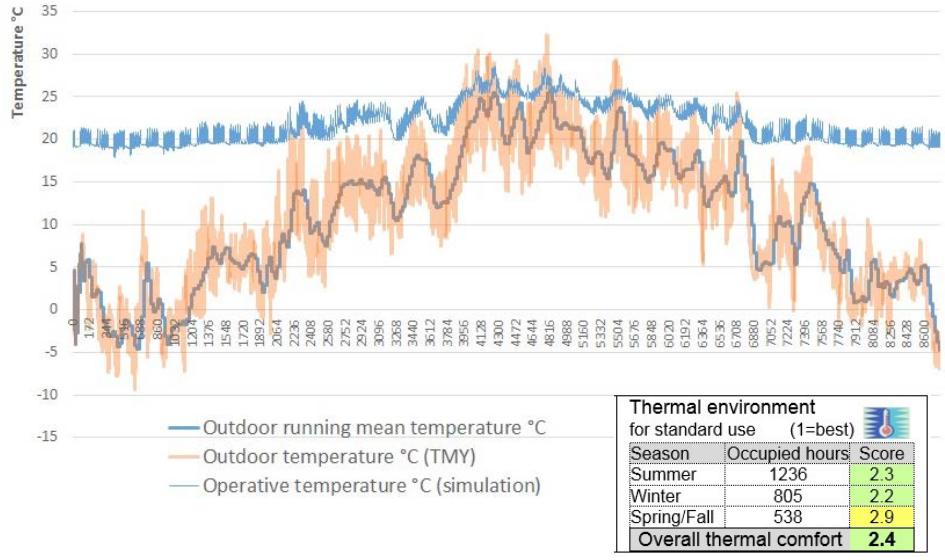


Figure 3. Example of the thermal comfort score reported in the ALDREN EVC for hourly indoor operative temperature obtained from simulation.

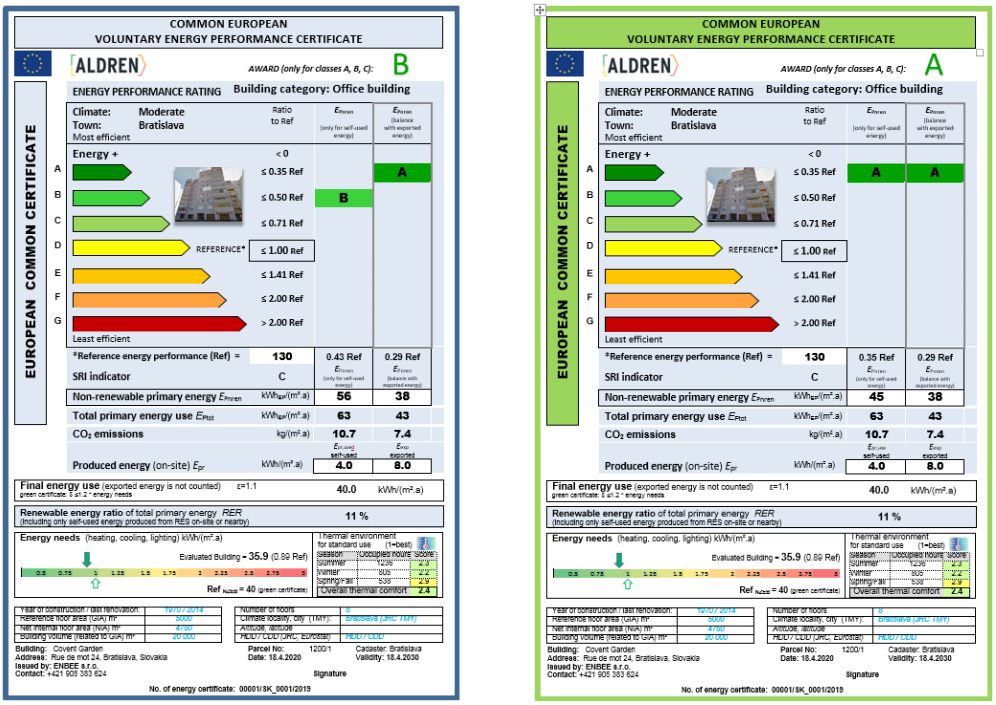


Figure 4. The template of the cover page of "standard" (a) and "green" (b) ALDREN certificate.

The energy classes achieved by one of ALDREN's pilot office buildings in Slovakia on the ALDREN scale and on the national scale for the mandatory energy performance certificate (EPC) are presented in **Figure 5**.

The comparison shows not only a much higher ambition level of ALDREN benchmark but also the ability of ALDREN scale to show the intermediate improvements by shifting from one class on the scale to the better energy class.

The position of ALDREN EVC

The ALDREN EVC is not to be considered as a competing instrument with the national mandatory EPCs. The two are complementary; both have an important role to play in the climate policy framework.

The national mandatory EPCs provide comparison of building energy performance against the national building stock and the cost optimality has to be taken into account. The price for issuing the mandatory energy performance certificate is also an important issue.

The position of the ALDREN EVC is different as it aims to trigger investment in deep renovation in non-residential buildings. Indeed, a higher ambition level is required for financial support and a more accurate prediction of energy performance is needed for building owner for his decision-making process towards the deep renovation. The ALDREN EVC may illustrate a potential pathway for national EPCs evolution towards reinforced performance request.

The ALDREN Common European voluntary certificate:

- Can stand alone or can be taken over at the EU, national or commercial level (e.g. by banks) for some purposes (e.g. for financial instruments);
- Can be integrated in other existing voluntary commercial certification schemes as an energy module (e.g. BREEAM, DGNB, IVE, HQE);
- Can complement the national EPCs for some cases (e.g. for subsidies).

Article 11 (9) of the EPBD requires that the Commission in consultation with relevant sectors, adopts a voluntary common European Union certification scheme for the energy performance of non-residential buildings. The ALDREN EVC could support Article 11(9) as a technical tool.

Implementation in pilot buildings - link with other ALDREN tasks

In the testing phase, the ALDREN protocol has been applied on several pilot buildings. The ALDREN EVC is only one piece in the ALDREN holistic approach. EVC also provides inputs to other ALDREN tasks and it is part of ALDREN's EVC+ that reports also the additional pages to describe the actual (measured) energy performance, IEQ and the financial impacts of proposed energy renovation actions. Energy cost savings, the non-energy benefits from improved indoor environment (renting rate, vacancy) are inputs in discounted cash-flow and balance with the investment for potential renovation options discussed with building managers.

The Stage	Original (as constructed)	Current (partly renovated)	Deep renovation 1	Deep renovation 2 (DH)
Non-renewable PE (no PV)	174.3	164.6	59.2	71.4
Non-renewable PE (self-used PV only)	174.3	164.6	47.8	59.6
Non-renewable PE (- PV export)	*174.3*	*164.6*	*43.8*	*56.1*
Savings	-	5.6%	73.4%	65.9%

The Stage	Original (as constructed)	Current (partly renovated)	Deep renovation 1	Deep renovation 2 (DH)
ALDREN energy class (no PV)	E	E	B	C
ALDREN energy class (self-used PV only)	E	E	B	B
ALDREN energy class (- PV export)	E	E	A	B
		ALDREN NZEB (A):	46	
Official EPC class (2020) (no PV):	B	B	A0	A1
Official EPC class (2020) (self-used PV only)	B	B	A0	A0
Official EPC class (2020) (-PV export):	B	B	A0	A0
		Official EPC NZEB (A0):	61	

Figure 5. The comparison of energy classes achieved by the pilot building on the ALDREN EVC scale and on the scale for national mandatory EPC.

IAD Investments volunteered to implement the ALDREN protocols on their head office building Maly trh 2/A in Bratislava. One of their financial products "Prvý realitný fond" is the first and oldest real estate fund in Slovakia (28 years on the market) that invests in various types of real estate such as office and commercial buildings, logistic parks, hotels & wellness in several Central European countries. Its return is generated by lease and market valuation of real estate. The ALDREN EVC allows comparability and reliability around the EU and could help with the recognition of high-quality buildings or risk in the stage of new building acquisition.

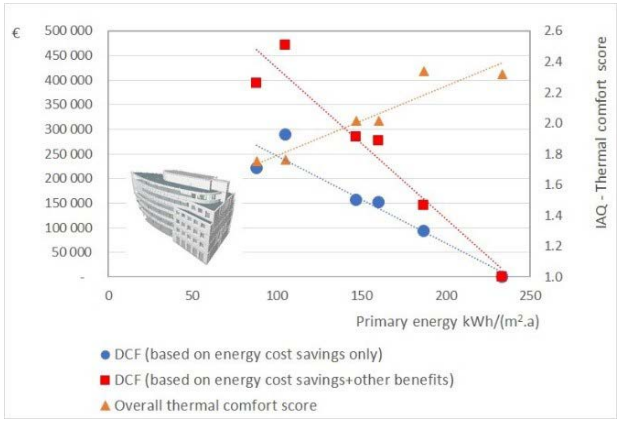
An example of renovation actions and individual steps implemented and planned (ALDREN RenoMap) for IAD pilot building and the link with other ALDREN tasks is presented in **Figure 6**.

It shows the connection of energy ratings with the thermal comfort and financial valuation (DCF) based on the energy and non-energy benefits.

A significant improvement has been already achieved for IAD building by the additional thermal insulation of the light weight façade. Future potential energy savings were identified together with the building manager (the facade joints sealing, technical possibility to change to triple glazing, the potential for PV installation) (**Figure** 7).

An important part of energy performance assessment remains in the link with the actual consumptions.

The example in **Figure 8** shows how close can be the results from hourly simulation for the ALDREN EVC rating to actual measured energy.



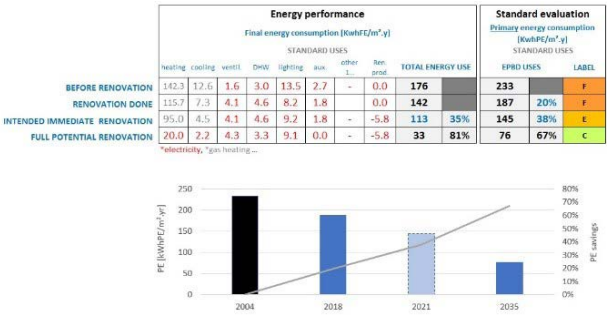


Figure 6. Example of connection of energy ratings with the RenoMap, thermal environment and financial valuation (pilot building Maly trh 2/A, Bratislava).

Figure 7. Pilot building Maly trh 2/A, Bratislava.

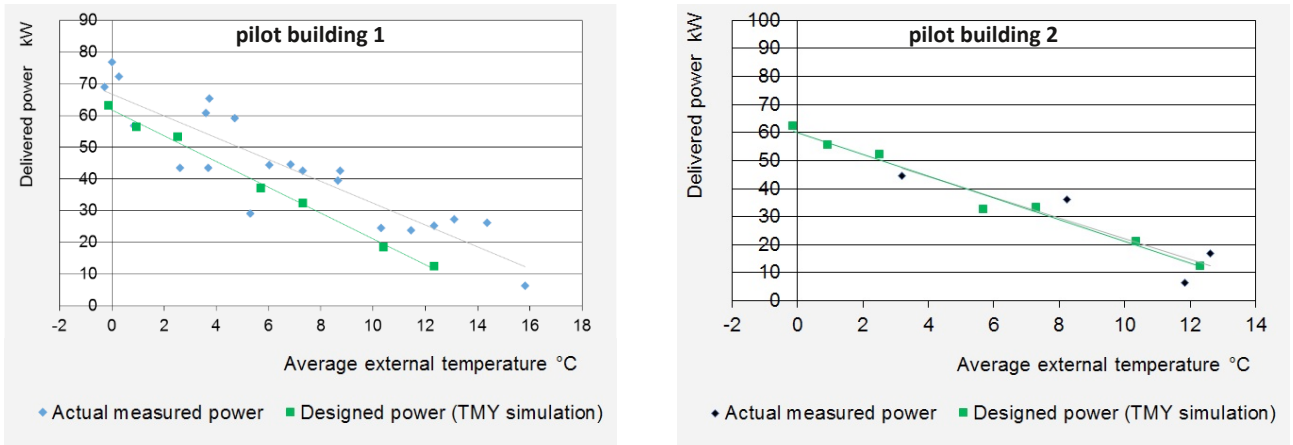


Figure 8. Comparison of energy signature from simulation (TMY) and from the actual monthly energy consumption (gas) for two different pilot buildings.

The energy signature developed for heating according to EN 15378-3 [6] from measured gas consumption was used to calibrate the calculation model for ALDREN EVC. The energy signature based on the simulation can be used by building manager in the future for checking the actual building operation.

The significant difference between both, the calculated delivered power for the climate conditions of the Typical Meteorological Year (TMY) and the actual power under the actual climate conditions, can inform about the malfunctions in building operation or can help to improve the calculation model.

Conclusion

The goal of ALDREN project is to align the market recognition for high quality energy retrofit with the enhanced building value based on the evidence and awareness rising of key stakeholders involved in the deep renovation process.

The ALDREN EVC aims to support the EU climate related policy by providing the harmonised common metrics based on the European standards. ■

References

[1] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, amended by Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.

[2] Commission Recommendation (EU) 2016/1318 of 29 July 2016 on guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy buildings.

[3] EN ISO 52000-1:2017 Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures.

[4] EN ISO 52003-1:2017 Energy performance of buildings — Indicators, requirements, ratings and certificates - Part 1: General aspects and application to the overall energy performance.

[5] EN 16798-1:2018 Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

[6] EN 15378-3:2017 - Energy performance of buildings - Heating and DHW systems in buildings - Part 3: Measured energy performance.

[7] JRC Science for policy report, Level(s) – A common EU framework of core sustainability indicators for office and residential buildings: Part 3, (Draft Beta v1.0), August 2017.

[8] neZEH initiative (Nearly Zero Energy hotels) http://www.nezeh.eu/home/index.html.

[9] Bendzalova J., "Specific criteria related to the label (display) and the content of energy performance certificate", Workshop – public consultation, "Enabling the European Common Voluntary Certification Scheme for non-residential buildings", ENER/C3/2015-545, 2016.

[10] Market study for a voluntary common European Union certification scheme for the energy performance of non-residential buildings, Final Report, Triple E Consulting, 2014 for DG Energy ENER/C3/2012-436.

[11] Zirngibl J., Bendzalova J. – "Technical assessment of national/regional calculation methodologies for the energy performance of buildings", Final report, 2015, ENER/C3/2013-425.

[12] ALDREN, Horizon 2020 project, (ALliance for Deep RENovation in buildings) https://aldren.eu/.

[13] CEN-CE, Horizon 2020 project, (CEN EPB standards certified experts), www.cen-ce.eu.