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# Long - Term Renovation Strategies, Energy Voluntary Certification Scheme and Building Renovation Passport: an overview on Energy Performance Certification tools for the European Building stock

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**Abstract.** The revised Energy Performance of Buildings Directive (EU) 2018/844 has huge potential for efficiency gains in the EU building sector, including measures that should accelerate the rate of building renovation towards more energy efficient systems. Under the 2010 EPBD, all EU countries have established independent energy performance certification systems supported by independent mechanisms of control and verification. However, current practices and tools of energy performance assessment and certification applied across Europe face several challenges. The paper presents an overview on researches and tools for the European building stock renovation process with the goal to highlight barriers, limits and benefits to increase the energy renovation rate. The main focus is to clarify the energy performance assessment and process for the certification and the introduction of the Building Renovation Passport, considering the novelty introduced by latest regulations and standards.

## 1. Introduction

According to the Paris agreement, Europe needs to reach net-zero by 2050 at latest in all sectors, and with buildings as a cornerstone to any realistic plan. To stay on track, a net-zero scenario with efforts shared across sectors requires ramping up the renovation rate to at least 3%/year with an average energy efficiency improvement of 75%, both reached at latest by 2030 [1].

The stock of buildings in the EU is relatively old, with more than 40% of it built before 1960 and 90% before 1990. Older buildings typically use more energy than new buildings. The current rate at which new buildings either replace this old stock, or expand the total stock, is low with only about 1-2% of the building stock renovated each year, although it is estimated that renovation accounts for 57% of all construction activity. Most of these renovations do not utilize the full potential energy savings that could be achieved. This paper assesses various certification approaches and their potential for boosting the energy efficient renovation of buildings in Europe. The paper begins by describing the implementation of the mandatory energy performance certificate and its renovation potential across Europe in Section 2. The overview then focuses on the voluntary certification schemes providing a summary of the most currently used and diffused in Europe and introducing also the common EU



framework developed by JRC of Levels (Section 3). In Section 4 the novelties introduced by the implementation of the amended Energy Performance of Buildings Directive (EPBD) 2018 are presented and analyzed to complete the overview on the topic. A special focus is dedicated to the H2020 project ALDREN (Alliance for Deep Renovation in buildings) which aims to develop both the ALDREN EVC complementary to the ALDREN Building Renovation Passport (Section 5). The conclusions provide a critical analysis of the whole schemes and tools presented in the previous sections, point out the key benefits and the potential barriers that could slowing their take up.

## 2. Energy Performance Certificate (EPC)

The Energy Performance Certificates (EPC) was introduced at European level in the EPBD 2002 [2] as an important instrument that should contribute to the enhancement of the energy performance of buildings. EPCs play a central role in the context of the Article 20 (2) EPBD, which asks Member States to provide information: on the energy performance certificates and the inspection reports, on the cost-effective ways and, where appropriate, on the available financial instruments to improve the energy performance of the building to the owners or tenants of the buildings.

The main aim of the EPC is to serve as an information tool for building owners, occupiers and real estate actors and, as remarked by Arcipowska et al. [3], EPCs can be a powerful market tool to create demand for energy efficiency in buildings by targeting such improvements as a decision-making criterion in real-estate transactions, and by providing recommendations for the upgrading of the energy performance.

As stated on the Energy Performance Building Directive (EPBD) [2], an EPC is needed whenever a building is constructed, or in the case of existing buildings, before it is marketed for sale or rent. The certificate includes the overall energy performance of the building and reference values such as the minimum energy performance requirements, allowing the comparison with another building of the same type. With the EPBD recast 2010/31/EU [4] the certification scheme for existing buildings was strengthened by including a mandatory recommendation report, listing measures to improve the energy performance of the building, known as list Recommendations Measures (RMs) for the cost-optimal or cost-effective improvements of the energy performance of a building or building unit. This element on the EPC, to provide energy recommendations for retrofitting building in mass, represents an attractive solution to improve the existing residential building stock, which is the main source of CO<sub>2</sub> emissions in the building sector [5]. To date, however, renovation rates in the EU are low and renovating the existing building stock to make it more energy efficient remains a challenge, even more so when considering the ambitious levels set by the EPBD which includes aims for nearly zero-energy buildings (nZEBs) 0. Increasing the renovation rate is not an easy task, many barriers have been individuated by the study for the ITRE Committee on 2016 [6]. In Annex C the key barriers to renovate the existing building stock are outlined and grouped into 5 main families: financial, technical, process, regulatory and awareness. In this context [7], EPC has been considered as a reaction to the “information deficit” that belongs to the framework of the barriers to renovation in the EU and referring to building owners’ lack of awareness and knowledge of actions to take in order to enhance the energy performance of their building [6]. Moreover, it has been demonstrated by different researches, that the EPC is become a valuable instrument to support market transformation providing energy related building information (i.e. publication of energy performance indicator in commercial media advertisements) [8][9][10] and in parallel affecting the price of buildings and/or the time of sale [11][12].

Despite the EPC potentialities, González Caceres [13] in his work underlined that the different implementation process across the Europe and the weakness of LR, limited their influence and impact on the renovation process, suggesting changes to improve the quality and impact of this EPC feature. More in depth, Geissler and Altmann [14] pointed out constraints on the role of the RMs within the EPC specifying advantages and disadvantages of the RMs and they proposed to include into the EPC two categories of recommendations: standard and tailor-made. The standard recommendations should show the improvement potential of the renovation measures such as providing the minimum U-value of the building elements, the upgrading or the possible change of heating, AC and domestic hot water systems into more energy efficient alternatives according to the building type and age. These recommendations

are cheaper and are kept general providing a basic potential overview of the building components, but in this case, the building owner might not be motivated enough to carry out improvements.

The tailor-made EPC recommendations should not only demonstrate the energy efficiency potential of the building, but also propose detailed renovation measures, such as the thickness and quality of the insulation according to the calculated needed U-value, the quality of the windows, the appropriate heating and domestic hot water system or variations according to the condition and situation of the building. In order to obtain a reliable EPC and tailor-made recommendations. Those other recommendations would significantly increase the price of the EPC but provide more specific information. The detailed or tailor-made EPC recommendations give the building owner a proper support in what needs to be done in relation to the energy efficiency of the building [14].

This fact is moreover confirmed in the latest update of the EPBD, since the current directive 2018/844/EU [15] has not modified the articles related to issuing and displaying of the energy performance certificate (Articles 11, 12 and 13). Basically, the Directive requires the Member States to lay down the necessary measures to establish a system of certification of the energy performance of buildings, including a methodology for the calculation of the energy performance of buildings which shall be transparent and open to innovation. Several studies have addressed the EU implementation of energy labeling buildings empirically. Eichholtz et al. [16] investigating the commercial office segment, found that US office buildings with a “green rating” are sold for about 16% higher prices. Brounen and Kok [17] performed a hedonic regression analysis on housing sector and they provided a first evidence of the economic impact of EPC implementation for residential dwellings confirming that there is a price premium for houses labeled as more energy efficient. Similarly, the Bio Intelligence Service [18] report - prepared for the European Commission - stated that EPCs have a significant impact on transaction prices and rents in selected EU countries thanks to a literature review on 22 studies to examine whether the EPCs affect property values. The main recommendations suggested within the conclusion of this study were: (i) to strength the role of EPCs; (ii) to implement them faster, (iii) to anticipate the publishing phase within the transaction process (e.g., at the time of advertising) and (iv) to make them more visible and comprehensible (e.g., with a more eye-catching front page or by improving the layout and using common language). Coupled with those recommendations, Arcipowska et al. [3] in their study, based on the EPC implementation across Europe, underlined also the following needs: introduction of further quality assurance measures especially during the early stages of the certification process; guidance in development of the centralized EPCs databases and digitalization of the EPC process and promotion of the effective use of the EPC data.

### **3. Voluntary certification scheme**

The field of building voluntary environmental assessment and labelling has matured remarkably quickly over the past decade and many countries currently have systems in place. The push toward sustainable design increased in the 1990s with the creation of Building Research Establishment's Environmental Assessment Method (BREEAM), the first green building rating system in the U.K. In 2000, the U.S. Green Building Council (USGBC) followed suit and developed and released criteria also aimed at improving the environmental performance of buildings through its Leadership in Energy and Environmental Design (LEED) rating system for new construction. Since that first release, LEED has continued to grow in prominence and to include rating systems for existing buildings and entire neighborhoods. Additional rating systems have been developed that were influenced by these early programs, but are tailored to their own national priorities and requirements or seek to go beyond the limits of current policy and building practices to address broader issues of sustainability or evolving concepts such as net zero energy and living and restorative building concepts that improve the natural environment.

**Table 1.** Comparison of Voluntary Certification labelling and certification schemes.

| <i>Certification system name</i> | <i>Developer</i>                         | <i>Labelling type</i> | <i>Assessment Method</i>   | <i>Rating scale</i>   | <i>Areas of focus</i>   |
|----------------------------------|--|-----------------------|--|---|---|
| <b>LEED</b>                      | US Building Council                      | Green Comparative     | Modelled (ASHRAE ref.) – Energy Performance Ratio (EPR)                    | Certified, Silver, Gold, Platinum according to points (40<points<80)                      | Each LEED rating groups that address the unique needs of different building and project types.  |
| <b>BREEAM</b>                    | Building Research Establishment (BRE) UK | Comparative           | Modelled for new, measured for “in use” version                            | Star system (1star – 30% to 5 stars – 85%)  | BREEAM measures sustainable value in a series of categories, ranging from energy to ecology.  |
| <b>DGNB</b>                      | Germany                                  | Comparative           | LCE modelling and measured in reference to a mandatory national baseline   | Bronze (>50%)<br>Silver (>65%)<br>Gold (>80%)   | Due to its flexibility it can be tailored precisely to various uses of a building and even to meet country-specific requirements.   |
| <b>PassivHaus</b>                | Germany                                  | Endorsement label     | Modelled – Energy performance calculation                                  | As designed   | The certification system focuses only on the energy topic areas include: health and comfort; energy balance in practice.  |
| <b>HQE</b>                       | France                                   | Comparative           | Measured and estimated – Energy reduction through dynamic simulation model | 14 requirements - over 4 themes (energy, comfort, environment, health)                    | - Assessment of the building's impact<br>- Taking suitable measures to reduce the building's impact looking at: eco-construction, eco-management, comfort, health.  |
| <b>MINERGIE</b>                  | Switzerland                              | Endorsement label     | Energy performance calculation according Swiss standard                    | Different products are offered within the MINERGIE framework: Standard: P; A; ECO and SQ. | Minergie offers three construction standards that can be combined with the ECO complement, which stands for healthy and ecological construction.  |
| <b>Casaclima</b>                 | Italy                                    | Endorsement label     | Calculated   | Class B $\leq$ 50 kWh/m <sup>2</sup> y<br>Gold $\leq$ 10 kWh/m <sup>2</sup> y             | Assessment criteria include: overall energy efficiency, environmental impact of construction materials, efficient use of water resources; high indoor air and light quality and low emission materials, acoustic comfort. |

In the 21st century, when growing concerns over global warming and resource depletion became more prominent and supported by research, the number and type of green products and a proliferation of standards, rating, and certification programs in the marketplace to help guide, demonstrate, and document efforts to deliver sustainable, high-performance buildings. Many green building rating programs in fact are in use around the world and they vary in their approach with some outlining prerequisites and optional credits, while others take a prescriptive approach, and still others suggest performance-based requirements that can be met in different ways for different building types. As a result, it can be challenging and time consuming determining which standards, certifications, and rating programs are most credible and applicable to a particular project. Across Europe for example over 20 schemes for voluntary building certification are currently in use and they are also well-established. Table 1 provides an overview of the most diffuse certification scheme for selected criteria. These assessment methods can be used on different types of buildings (new or existing; residential or non-residential; etc.); cover different stages (design, construction, upon completion or operation); and address different criteria (energy only vs. sustainability schemes). The main differences belong to the environmental and energy issues included or not in the assessment method, making the benchmarking or comparisons between the schemes difficult as their baselines, scopes and indicators differ. The market for voluntary building certification schemes is mainly developed and used for commercial buildings: public and private users rely primarily on the mandatory EPCs. In the absence of financial incentives, the take up of a voluntary building certification scheme depends on the benefits perceived by the client in terms of marketing advantage and/or enhancements to building performance with a label demonstrating the sustainability of the building and the credibility of the energy assessment. In December 2014, the European Commission received a market study on the voluntary common EU certification scheme for non-residential buildings, in accordance with EPBD Article 11(9). The report gives an overview of existing voluntary schemes, analyzing the demand for a European wide voluntary scheme. Rademaekers [19] stated that the voluntary EU scheme should build on CEN standards, take a modular approach for energy performance only, and be applied both for public & private buildings, as well as new & existing buildings. The key findings of this study were: (i) the market for voluntary building certification schemes in the EU is young, and there are differences between Member States in their uptake of such schemes; (ii) key factors when choosing a certification scheme include reliability, cost and international acceptance; (iii) the most significant added value of a voluntary common EU scheme is that it allows for a consistent comparison between buildings across Member States, while simultaneously offering high-quality assessment and international acceptance; (iv) a majority of interviewed scheme users were in favor of integrating the EU common voluntary scheme within existing mandatory or voluntary schemes.

### 3.1. Levels

A focus has been dedicated to Level(s) to present the voluntary reporting framework, developed by the European Commission in close co-operation with industry stakeholders, to improve the sustainability of buildings. Buildings sector is a key target in the EU Commission's policy for circular economy; a regenerative economic system in which resource and energy consumption are minimized: Level(s) is the answer to this need being a sustainability framework of the circular economy and offers a tiered approach to life cycle assessment. Developed as a common EU framework of core indicators for the sustainability of office and residential buildings, Level(s) provides a set of indicators and common metrics for measuring the performance of buildings along their life cycle defining in this way a general language of sustainability for buildings. In addition, the Level(s) framework aims to promote life cycle thinking guiding users from an initial focus on individual aspects of building performance towards a more holistic perspective, with the aim of wider European use of Life Cycle Assessment (LCA) and Life Cycle Cost Assessment (LCCA). Using existing standards, Level(s) provides a common EU approach to the assessment of environmental performance in the built environment, with a common language that can make a clear contribution to broader European environmental policy objectives enabling actions to be taken at building level. Within the framework, each indicator is designed to link the individual building's impact with the following priorities for sustainability at the European level:

greenhouse gas emissions throughout the building's life cycle; resource efficient and circular material life cycles, efficient use of water resources, healthy and comfortable spaces. adaptation and resilience to climate change and life cycle cost and value. Each indicator within Level(s) can be used for different types of performance assessment, from a basic level through to a full Life Cycle Assessment (LCA). The entry point to Level(s) is through the common performance metrics: the simplest and most accessible use of each indicator. Level(s) sets out common units of measurement and basic calculation methodologies, which can be used by building professionals, building assessment schemes, investor reporting tools and public sector initiatives. For each indicator, a 'graduated' approach is possible, enabling users to move from simple through to more complex and precise calculation methods and extended reporting. Level(s) shows how to reduce environmental impact and can prepare users for more challenging performance assessment schemes and tools.

#### **4. EPBD 844/2018**

The Amending Directive (2018/844/EU) took place on the 19th June 2018, it came into force on the 9th July 2018, but the end of the transposition period will fall on the 10th March 2020. EuroACE [20] within a dedicated guidance, investigated in detail the amended EPBD to highlight the key changes and to also emphasize the need for robust implementation in all Member States of the EU. The main points underlined in the guide are the following: (i) the move of the national Long-Term Renovation Strategies (LTRS) from Article 4 of the Energy Efficiency Directive to the Article 2A of the EPBD, with this provision being considerably strengthened; (ii) the option for Member States to develop the use of Building Renovation Passports (BRP) and the requirement for the European Commission to undertake, before 2020, a feasibility study on the possibilities and timeline for the introduction of BRPs as an option; (iii) a better accessibility to financing as well as links between financial measures and improved performance after renovation works; (iv) the introduction of a Smart Readiness Indicator and (v) the revision of Annex I on the methodology to describe the energy performance of buildings (increased transparency, and incentive to use EU standards). In order to complete and set the scene within the certification and process of building performance assessment, specific focuses on the novelties introduced by the recast are presented in the following subsections.

##### *4.1. Long term renovation strategies*

A key change in the amended EPBD is the request to each Member State to prepare an LTRS like a roadmap with an action plan on how to transform their building stock to a highly energy efficient and decarbonized building stock by 2050 with specific milestone in 2030 and 2040. This provision offers a great tool to Member States for transforming the overall building stock to nZEB performance levels as a complement to the requirements that apply to new buildings. The LTRS must be supported by measurable progress indicators and must explain how they contribute to the achievement of the overall 32.5% energy efficiency target set by the EU for 2030 (in the Energy Efficiency Directive). The LTRS must include policies and actions to target the worst-performing segments of the national building stock and all public buildings and to set out actions to alleviate energy poverty. The implementation of the LTRS should lead to a real mobilization for energy renovation across the whole of the EU. EuroACE [20] noted that Member States that have set up a single, clearly mandated and well-staffed entity that is charged with the responsibility of overseeing the preparation, implementation, review, assessment and revision of its LTRS, are the ones that reap the most benefits for their citizens.

##### *4.2. Building Passport*

In Europe, the introduction of Building Passports has been discussed for decades with the objective to provide information to a potential purchaser, investors, renter or user of the building. Tackling the issue of increasing the renovations in existing buildings, the concept of BP and its current applications, in some Member States (i.e. Germany, Belgium – Flanders region and France) mainly on residential buildings, they are demonstrating to be a possible way to achieve higher (and deeper) renovation rates. In Article 2a.1(c), the possibility for Member States to introduce an optional scheme for individual building renovation passports (BRP) is included for the first time in the context of the requirement that

Member States prepare an LTRS for their building stock. The references to the possible use of a BRP in conjunction with the LTRS and, possibly the EPC, reflects the need for better guidance and support for owners throughout their energy renovation journey. The inclusion of the BRP as a complementary tool to the EPC, it is a recognition that well-planned step-by-step energy renovations are the most effective way to ensure the compatibility of short-term measures with the long-term goals set for the building stock. Sesana and Salvalai [21], with an overview on the BP concept evolution and the critical review of the running initiative, identified some important recommendations and needs to define a powerful BP for Renovation: (i) long-term perspective needed; (ii) timing and sequencing of actions developed; (iii) customer engagement and consideration of the individual renovation context; (iv) attractiveness and motivation; (v) automation and dynamism of the process instead of static tool. In addition, Fabbri [22] remarked the importance of engaging users and considering their needs and habits to ensure a tailor-made roadmap with a long-term perspective and right timing and sequencing of renovation actions.

## 5. The ALDREN project

In the context outlined in the previous two sections, the ALDREN (Alliance for Deep Renovation in Buildings) project is the further and extended development and the implementation of a common European Voluntary Certification Scheme (EVCS) for non-residential buildings based on the EPBD Art. 11 (9) and CEN and ISO standards. The main goal of ALDREN is to motivate the construction sector value chain stakeholders to undertake deep renovation projects on their properties. According to an EU Survey run by BPIE in 2012 on buildings sent out to EU countries, non-residential buildings account approximately for 25% of the floor area distribution in Europe and can be drivers of this energy transition that Europe is looking for. To match the ambitious EU commitments several complementary actions have been made at the same time, with different actors and coordinated: the development of tools (CEN standards, ALDREN), capacity building (CEN-CE), provided a consultancy support (EPB Center). The revised EPBD provide the chance to contribute all together at EU level.

The table 2 hereafter is showing how the ALDREN outcomes could help to fulfil the new requirements of the amended EPBD. The adoption of the ALDREN procedures and outcomes, it could facilitate on one hand the transposition of the revised EPBD and on the other to be in line with the suggested European harmonization. ALDREN intends to encourage investment and accelerate the movement towards a nearly zero energy non-residential building stock across the EU, as targeted by 2050 to meet Paris Agreement commitments. The back-bone of ALDREN is the European common Voluntary Certification Scheme (ALDREN VCS) which will be used to track the deep renovation process.

For office buildings and hotels – as for the overall building stock – deep renovation (ambitioning 60% primary energy savings through building retrofit), or even the move to NZEB level, will not be triggered for the only sake of energy performance and related direct financial benefits over buildings lifespan. The development of holistic procedures, assessing the overall benefits from building deep renovation – regarding energy performance, confidence in the savings, high quality indoor environments, financial valuation – are needed to engage property owners and stakeholders on deep renovation pathways.

The ALDREN procedure consolidates an approach to deep renovation assessment, integrating:

- a European harmonized energy performance rating, offering comparability across the EU;
- an energy Performance verification protocol to enhance confidence and management tools;
- a health and well-being assessment framework offering the integration of indoor air quality, comfort and health in the scope of deep energy renovation;
- the financial valuation of both energy and non-energy benefits (such as increased productivity in office buildings);
- a Building Renovation Passport (BRP).



**Table 2.** Comparative reading of selected articles of the (EU) 2018/844 with ALDREN issues.

| 2018/844 articles                        | Common language  | ALDREN VCS  | Measured energy | Wellbeing evaluation   | Financial evaluation  | ALDREN BRP   | Training and dissemination   |
|--|--|---|-----------------|--|---|--|--|
| Article 2a Long-term renovation strategy | highly energy efficient and decarbonized build stock by 2050 |   |                 |  |   |  |  |
|  |  |   |                 |  | (b) cost-effective approaches considering potential relevant trigger points | (c) introducing an optional scheme for building renovation passports;                                    | (f)... skills and education in construction and energy efficiency sectors; |
|  |  | (g) evidence of expected energy savings and related to health, and air quality. |                 |  |   |  |  |
|  | 3. Mobilization of investments into the renovation needed    |   |                 |  |   | (a) aggregation of projects to enable access as well as packaged solution                                |  |
|  |  |   |                 | (b) the reduction of the perceived risk  |   | (e) accessible and transparent advisory tools on energy efficiency renovations and financing instruments |  |
| 4. collect                               |  |   |                 |  | on successful public/private financing schemes                              | and disseminate best practices   |  |
| Article 7 existing buildings             |  |   |                 | high-efficiency alternative systems and shall address healthy indoor climate’. |   |  |  |
| Article 8                                |  | ‘1 overall energy performance 9. the complete altered system, is assessed.      |                 |  |   | The results shall be documented  |  |

| 2018/844 articles | Common language  | ALDREN VCS   | Measured energy | Wellbeing evaluation  | Financial evaluation  |
|-------------------|--|--|-----------------|---|---|
| Article 10        | (c) comparing EPC's issued   |  |                 |   | '6. link their financial measures to the targeted or achieved energy savings                                  |
|                   |  |  |                 |   | 6a. Databases for energy performance certificates shall allow data to be gathered before and after renovation |
| Article 11        | ..adopt a voluntary European certification scheme for non-residential buildings. |  |                 |   |   |
| Article 19a       | Feasibility study  |  |                 |   | ... building renovation passport<br>...to provide LTRS and step-by-step renovation                            |
| Annex I           |  | a1 Member States shall describe their national calculation methodology           |                 |   |   |
|                   |  | optimal energy performance of the building envelope                              |                 | b2. calculated in order to optimize health, indoor air quality and comfort levels |   |
|                   |  | d4 The positive influence of the following aspects shall be taken into account.' |                 |   |   |

The ALDREN procedures are designed to be adopted either as a standalone standard or as a set of individual methodological pieces that may be taken up in already existing voluntary environmental certification schemes across the EU (i.e. BREEAM, HQE, DGNB, IVE).

ALDREN is not only the superimposition of these individual methodological pieces but also their overall integration, exploiting the interactions in between. For example, a given energy retrofit action will contribute to the improvement of the predicted energy performance (rating) but also to the assessment of refined actual energy targets, to the enhancement of thermal comfort, indoor environments, to increased well-being and productivity. Last, the ALDREN procedure is designed in the perspective of a European library for building components, systems and equipment description, according to the EU Eco-design directive implemented into Industry standards. The soundness of the ALDREN concept is based on three components: 1) quality of the individual pieces; 2) commitment of different stakeholders and 3) a backbone plan to build the holistic ALDREN procedure and it is well reflected into the WP structure of the whole project activities:

WP1 - related to coordination and stakeholders exchange;

WP2 - technical to work on the different components and the overall integration in the assessment procedure of buildings and in the building passport;

WP3 is dedicated to dissemination / communication and market uptake.

### 5.1. *ALDREN EVC*

As anticipated in section 2, the role of energy performance certificates (EPC) has been strengthened by the Directive 2018/844 by recommendation to be improvements achieved as a result of the renovation assessed by comparing energy performance certificates issued before and after the renovation. The Member States are asked to ensure that the national certificates are of good quality to provide reliable information. However, to manage large buildings stocks at European scale, the national EPCs do not provide yet direct comparability of energy performance ratings across the EU and do not consider in the same way the innovative solutions and all technical systems. EU targets of decarbonization, energy efficiency and primary energy savings, are of a societal and environmental importance, while the interest of private building owner is often determined by costs. European voluntary certificate could facilitate the adoption a voluntary European certification scheme for non-residential buildings according to EPBD Article 11 (9). The aim of ALDREN European Voluntary Certificate (EVC) is to provide transparent advisory tools for building owner, tenant, financial institutions and policy makers by energy ratings and targets comparable at European scale. ALDREN EVC provides also a possible link with financial valuation, asset valuation and financial strategies to facilitate energy efficiency renovations, setting the conditions for a consistent benchmark of energy performance at EU level, based on an EU comparable scale with one reference point reflecting approximately the cost optimal level of energy performance in 2013 as today only transparent and comparable value. Possible link with the existing voluntary certification schemes as presented in section 3 (i.e. HQE, DGNB) has been investigated to be EVC potentially used as a transparent energy module included in these wider voluntary European environmental schemes.

### 5.2. *ALDREN BRP for Non-Residential buildings*

As clarified in section 4, the BRP (Building Renovation Passport) has been introduced for the first time within Directive 2018/844/EU in the context of the LTRS preparation for the Member States. Article 19a sets out the concept of a novel tool that is “complementary to the energy performance certificates”. It is aimed at providing a long-term step-by-step renovation strategy which should be “based on quality criteria, following an energy audit”. The BRP that is currently being developed within the ALDREN project for office buildings and hotels seeks therefore to meet the objectives of Article 19a.

While initially analyzing the available knowledge on voluntary certification schemes and EPCs for Non-residential buildings, the ALDREN project was faced with a lack of data and connections between those instruments and the BRP. To overcome these barriers, the ALDREN approach for the BRP definition has been developed under the following important key points [23].

- The ALDREN BRP should not only provide detailed energy renovation strategies with all the relevant technical details (like lifespan of components and sequence of pose for each systems), but also include relevant indicators about the impacts of these strategies on the building’s health

quality and the well-being of its occupants. The improved energy and environmental quality of the foreseen improvements should also be translated into economic and financial criteria.

- Audience and target people of the ALDREN BRP should be various: from technical staff, designers, energy manager or building asset manager to the single building owners, in order to facilitate the decision-making process.
- There is a need to agree on a common language (“How can a thermal bridge talk to a banker?”) with all the target group belonging to the renovation process and to individuate a valuable source of data at European level such as the Building Stock Observatory. This allows to have a statistic reference value in case of absence of history knowledge of the building from different data point sets (i.e. geometrical, technological, constructive, certification, etc.)
- The ALDREN BRP should be linked and complementary to the existing voluntary certification schemes and the EPC. There is a strong case for cross-referencing data between these tools. Still, data provided within the BRP should be updated along the lifetime of the building rather than constitute a one-time overview of the building state at a specific time.

The current structure of the ALDREN BRP is based on all the data inputs and parameters collected throughout the application of the main methodologies developed within the project (WP 2) to a specific building. It is composed of two main elements:

- the ALDREN BuildLog (Logbook) keeps track of the most relevant calculated and measured energy, environmental and financial performance indicators for energy renovation decision-making to provide a picture of the building and all its component (envelope + system plants) at the current stage and through the time;
- the ALDREN RenoMap (Renovation Roadmap) is a decision support tool for building managers and auditors aimed at reaching deep renovation targets. Mid to long-term renovation objectives are set based of elementary renovation actions (ERA). This allows in turn to define a step-by-step energy renovation strategy by phasing the implementation of sets of renovation actions over the building lifetime. For doing so, decision-making criteria are evaluated with the help of suitable indicators from the BuildLog.

## 6. Conclusions

The paper provided an overview on energy performance assessment and voluntary certificate procedures highlighting barriers and limits to their take up, but also the potential benefits to increase the energy renovation rate according to the EU legislations. The ALDREN project and its outcomes are presented as one of the latest experiences of VCS and BRP development and applications for non-residential buildings with the goal to increase the building renovation rate over a longer-term horizon, thereby significantly contributing to the European Union climate and energy targets.

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