AVOIDING THE ELEPHANT: THE NETAND NEARLY ZERO ENERGY BUILDING TARGET IN BELGIUM

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ABSTRACT

The recast of the European Performance of Buildings Directive (EPBD) requires all new buildings to be "nearly zero energy' buildings (nZEB) by 2020, including existing buildings undergoing major renovations. Belgium was even first to set a definition for a 'net zero energy house' (NZEB) in 2009. The revised Energy Performance in Buildings Directive calls governments to meet the nearly zero energy targets by 2020. Governments must adopt and publish regulations and procedures for the other requirements mainly the cost optimal calculation by July 2012. There are many elements of the recast Directive that pertain to new buildings. Unfortunately, the recast does not set targets for improving existing buildings and non-legislative measures will be needed to address how to achieve a greater share of renovation. Therefore, this paper aims to identify the share of the newly constructed buildings by 2020 in Belgium. The objective is to put the nearly zero energy targets in a wider perspective in relation to the existing building stock. The paper investigates some future scenarios for the national buildings stock growth rate, coupled with demographic growth by 2050. The study's final results indicate that newly constructed building will be less than 7% by 2020 and less than 15% by 2050 in Belgium. Thus by not addressing the potential for energy renovations in the building sector the EPBD is avoiding the elephant.

1. INTRODUCTION

The definitions of NZEBs are discussed and proposed at the international level. The International Energy Agency (IEA) is compiling and discussing the definitions within Task 40: Towards Net Zero Energy Buildings comprising almost 20 countries [1]. The USA is discussing the definitions within the Energy Independence and Security Act of 2007 and the European Union is discussing the definitions within the recast of the Directive on Energy Performance of Buildings (EPBD) adopted in May 2010 [2-4]. The recast of the EPBD requires the uptake of a definition of so called 'nearly zero energy' buildings (nZEB) [5]. All Member States, including Belgium, have to engage in a more widespread deployment of such buildings by 2020. In addition, the Member States shall draw up national plans for increasing the number of nZEBs. These national plans can include differentiated targets according to the category of building. Currently procedures are being developed in the energy administrations of the Belgian regions to respond to the European requirements.

In 2009, Belgian definitions for the low-energy house, the passive house and the zero-energy house have been introduced in federal income tax legislation [6], thus providing first guidance in the residential sector. For dwelling owners and leaseholders only, an income tax reduction can be obtained during 10 years. In 2010, the Royal Decree [7] defined the renewable energy types and their calculation method for net zero energy buildings (NZEBs). In 2011, the Royal Decree [8] defined the minimum requirements for nZEBs for Brussels Capital Region starting from 2015. Thus the nearly and net zero target is seriously addressed and Belgium is one of the leading member states to adopt EPBD recast. However, the zero targets are too short-sighted to deal with the urgent need for energy reduction questions to the climate change challenge and are underestimating the potential for energy renovations in the building sector in Belgium. The EPBD insists that the zero targets should be adopted for new buildings, which is not a long term effective way of reaching a certain energy efficiency target which sufficiently contributes to the fight on climate change. Energy reduction for the existing building stock based on net and nearly zero energy targets does not provide a sound basis.

Therefore, this paper reviews the existing energy regulation landscape and its impact on the existing building stock. The paper analyses existing Belgian definitions and projects future scenarios of building stock growth. The paper thus provides a critical review on the EPBD recast impact and highlights the benefits of building energy renovations. This paper can be useful for policy makers, NGOs, municipalities, governments, industry associations, project developers, building experts and researchers.

2. ENERGY REGULATION LANDSCAPE IN BELGIUM

Since January 2006, Belgium installed the EPBD regulation in its three regional administrations (Flanders, Wallonia and Brussels Region) as shown in Figure 1. The E-Level is required as part of the construction permit for any new residence, office or school. The requirements became more stringent (from E100 to E80) in all three regions in 2010 [9]. Prior to the introduction of the EPBD, the voluntary passive house requirements and PHPP software were introduced in 2003 by the non-profit organization Passiefhuis-Platform. PHPP is currently not accepted as an EPBD calculation and both calculations have to be performed. This situation created a partially conflicting situation [10]. Further, in 2009 Belgium introduced three definitions on the federal level: the low-energy house, the passive house and the zero-energy house [9].

Regional Market Definitions

Like in many countries definitions are also subject to different market interpretations. 'Zero energy' is generally interpreted as 'net zero energy': i.e. balance between the consumed and produced energy on site. Due to the lack of policy definition for (very) low energy buildings, initially different definitions were introduced by business networks and mixed business/ policy networks. Table 1 summarizes the definitions introduced for market creation in Belgium. It highlights the multitude of definitions that exist, which all have an impact on the construction market. Table I show that there is no consensus in the market, especially considering low-energy definitions. Further, there are large differences according to the Region. In the Flemish Region these definitions can differ according to the initiating body (NGO's or government). In the Walloon Region, there are only very limited energy restrictions. Most advances towards the passive house definition appear to be in the Brussels Capital Region with its implementation of limitations for space heating demand and primary energy use [9].

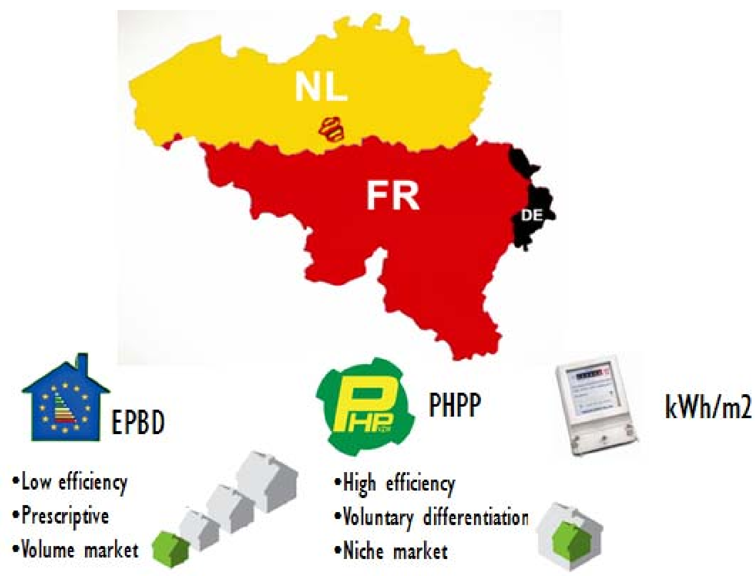

Figure 1, the three Belgian regional federations and the energy regulation landscape

Legal Belgian Definitions

Next to the previous definitions listed in Table 1, in Belgium definitions for dwellings (for the low-energy house, the passive house and the zero-energy house) have been introduced in federal income tax legislation [6] as shown in Table II. For dwelling owners and leaseholders only, an income tax reduction[1] can be obtained during 10 years.

A recent Royal Decree [7] defines that the renewable energy should be produced by:
1° a system of water heating using solar energy[2]
2° solar panels for the conversion of solar energy into electrical energy

3° heat pumps that use energy stored in the form of heat: (- in the surrounding air, - under the soil surface, - in surface water)

According to the Royal Decree, the number of kWh generated renewable energy has to be calculated with the regional energy performance calculation method in the framework of the Directive CE/2006/32 applicable on the building, unless this method does not provide an evaluation of the production between input and output of the systems and equipment for renewable energy has to be valued by means of a European/International procedure[3].

TABLE 1: MARKETING DEFINITIONS FOR LOW ENERGY HOUSES IN BELGIUM.

Category[4]	Energy criteria for homes	Reference
Low-energy house	under no specified calculation model: The total energy demand for space heating should be limited to 60 kWh/m^2 gross floor area.	Flemish charter 2003 [10]
(Low-energy house)	under the conditions in the Flemish EPB calculation model: The E-level should be limited to 60.	Label for Flemish architects [11]
(Low-energy house)	under the conditions in the Flemish EPB calculation model: The E-level should be limited to 60.	Flemish grants from energy providers [12]
Low-energy house	under the conditions in the Walloon EPB calculation model: $E_w \leq 80$.	Baseline for subsidies[5] in the Walloon Region [13]
Low-energy house	under the conditions in the Walloon EPB calculation model: $E_w \leq 70$; $E_{spec} \leq 120 kWh/m^2.a$.	Label for construction companies & architects [14]
Low-energy renovation	under the conditions in the PHPP 2007 calculation model: The total energy demand for space heating is limited to 60 kWh/m² of conditioned floor area.	Project listing for Brussels Capital Region [15]
(Very low-energy house)	under the conditions in the Flemish EPB calculation model: The E-level should be limited to 40.	Flemish grants from energy providers [12]
Very low-energy renovation	under the conditions in the PHPP 2007 calculation model: The total energy demand for space heating is limited to 30 kWh/m² of conditioned floor area.	Project listing for Brussels Capital Region [15]
Passive house	under the conditions in the PHPP 2007 calculation model: - The total energy demand for space heating is limited to 15 kWh/m² of conditioned floor area. - The total primary energy use is limited to 45 kWh/m²year for heating, domestic hot water and auxiliary equipment (fans, pumps), excluding lighting and appliances	Exemplary projects Brussels Capital Region [15-16]
Passive house (also non-residential)	under the conditions in the PHPP calculation model: - The total energy demand for space heating and cooling is limited to 15 kWh/m² of conditioned floor area; - The total primary energy use for all appliances, domestic hot water, and space heating and cooling is limited to a compactness formula: {90 – 2.5 x Compactness kWh/m²} where the compactness [compactness=V/A] is a ratio between the building volume (V) and the envelope surface area (A)	Definition promoted by Belgian business and research networks: PHP, PMP, BBRI,..

In Belgium, the legal "zero energy" definition is thus defined on the federal level requiring compliance with the passive house requirements and the compensation of heating and cooling demand on site by renewable energy. Biomass was rejected as an option because on site production could not be guaranteed. However, the application and calculation is different on the regional level. For example, in the case of Wallonia, the calculation method is based only on the PHPP calculation method and is communicated in kWh/m^2. The general policy trend among the local governments is to reduce the demand as low as possible before considering renewable systems [9]. However, most the previous mentioned initiatives, regulations, and policies and are mainly addressing new constructed buildings.

3. ANALYSIS OF BUILDING STOCK IN BELGIUM

Before introducing the scenarios for building stock growth in Belgium it is very important to identify the growth characteristics of the Belgian building stock. In fact this step is essential to put the 2020 objective in perspective. However, the research field of basic building stock analysis is still developing in all European countries. The documentation and analysis work was not done in the in a systematic way and knowledge of the building stock varies widely between professionals and between countries. [11]. the building stock's energy analysis models categorize buildings based on age represented by typical buildings identifying annual energy consumption per m^2.

In Belgium, the building stock comprises almost 4.400.000 building, where more than 40% of the building stock was built before 1945. Figure 2 shows the building concentration in the large Belgian cities and their agglomerations. The study by Vanneste et al. in 2007 [12] shows different the different housing types and urban agglomerations.

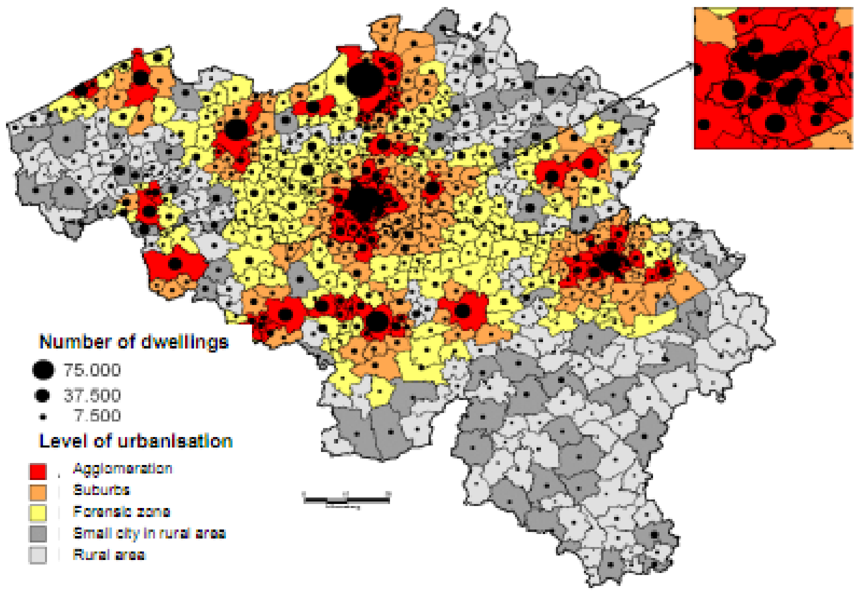

Figure 2: Pattern of inhabited private residences, in relationship to the level of urbanisation [12] p. 38

Table 2. Building age in percentages and absolute numbers according to the data [11]

Building Period	%	Number
Before 1919	9,6%	477,089
1919 – 1945	10,6%	525,282
1946 – 1970	18,7%	924,261
1971 – 1980	9,8%	485,735
1981 – 1990	5,8%	286,778
1991 – 2000	8,0%	398,019
Age unknown	19,9%	986,827
Unknown, but >20 years	15,9%	788,210
Unknown, but <20 years	1,5%	74,486
Total	4.946.687	

The Belgian building stock in those cities and urban agglomerations can be divided into eight vintages as shown in Table 2. According to [12] the share of buildings before 1919 is 9.6 percent building and the share of 1919-1945 is 10.5 percent. The largest share of buildings is 18.5 percent for the 1946-1970 constructed buildings which was constructed before the energy crisis in 1973. The share of the stock between 1981 and 1990 is 6 percent and the share between 1991 and 2001 is 8 percent. Information on the rest of the stock, which represents 47% of the buildings, is unknown.

4. RECOGNISE THE POTENTIAL OF RENOVATION

Up to 30% of the total energy consumption in Belgium is due to the buildings in cities and urban agglomeration, most of which are residential buildings. The renovation of those existing buildings can contribute to a great saving in energy. Example renovation projects indicate that consumption can be reduced up to three to five times while improving living indoor quality simultaneously. According to [13] work Table 3 shows the energy consumption values according to the building vintage for residential buildings. 61% of all Belgian houses are constructed before 1980 and were not retrofitted. These houses consume almost 75 percent of the total energy consumption. These building were built before the energy crisis and do not have any kind of insulation, tight envelopes, high performing glazing or efficient heating systems. Another major problem of those buildings is the poor thermal comfort conditions. For the building stock built after 1980 there are some dispersed renovation efforts. For example, 10 percent of the Walloon and Brussels building stock having been renovated in the period 1981-1990. While during the period 1991-2000 Flanders seems to catch up with 9,8 percent of houses having been renovated, compared to 6,4 percent in 1991 [11]. A report by Hilderson et al. [14] on the potential of low energy housing retrofit.

Table 02: Total energy demand for residential buildings in Belgium according to [13]

	Energy demand per dwelling		Number of dwellings	Total energy demand	
Construction Year	GJ	kWh		TJ	%
<1945	118	32800	1011714	119400	30,4%
1946-1970	107	29700	1022032	109400	27,8%
1971-1980	96	26700	580922	55800	14,2%
1981-1990	79	21900	537400	42500	10,8%
1991-1995	60	16700	422953	25400	6,5%
1996-2000	60	16700	417723	25100	6,4%
2001-2005	56	15600	275346	15400	3,9%

5. SCENARIOS FOR BUILDING STOCK IN BELGIUM

In fact over the last 60 years the growth rate of Belgian building stock has been around 1 percent. As shown in Figure 3a, the post Second World War building boom has been increasing from approximately 1 percent to 1.5 percent. However, since the 1980 the growth rate has been almost stable ranging around 0.6 percent annually. According to Figure 3b, if we project the same growth rate until 2050, the share of the newly constructed buildings will not exceed 20 percent of the current building stock. Even if we assume a strong growth rate of the Belgian building stock during the coming years, assuming a growth rate of 1 percent, which contradict with the demographic forecasts, the newly built stock will not exceed 50%. In fact, in 2050 it is expected that Belgium (currently 10.3 million) will reach 9.3 million. This confirms that by 2050, almost three quarter of the building stock currently exists. On the other hand, the renovation rate of existing buildings in Belgium is very low and almost negligible. The most realistic scenario for newly constructed building will be less than 7% by 2020 and less than 15 by 2050 in Belgium.

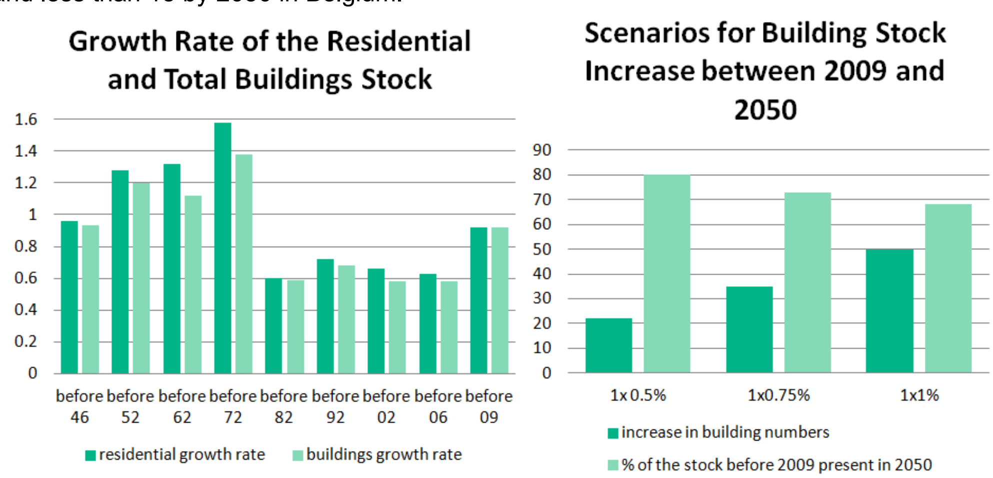

Figure 3a, Growth rate of Belgian building stock, 3b, future scenarios (adapted from [14])

6. DISCUSSION AND CONCLUSION

At this stage Belgium should focus on renovation of the building stock. The efforts for renovations are insufficient and there are no incentives for renovations to be carried out. Currently most of the focus is towards net and nearly zero an energy building, which is creating an unbalanced and distorted situation. Based on the figures on existing building stock in Belgium the real challenge is existing buildings. By focusing only on new building is like chasing a mosquito and avoiding the elephant. Such distortion in focus needs to be eliminated from a balanced building stock analysis methodology in order to balance the direct the energy reduction efforts. Subsidies are needed for residential and commercial buildings calculated from a building stock analysis perspective can lead to more ambitious energy renovations than net and zero energy target aiming on a narrow energy reduction perspective.

Urban renewal, on a large-scale could be an opportunity for sustainable renovation, at least if decisions on asset management were related to the technical quality of the buildings, which is mostly not the case. Here, too, specific organisational and financial solutions are needed. More renovation schemes should also be provided in order to help building owners to invest and by doing so getting a pay back in both economical terms and improved living conditions.

The same consideration should be discussed for all countries of the EU27 where the renovation rate of existing buildings is very low. The EPBD should be revised to enforce renovation to be part of a greater policy framework which includes near and net energy for both newly and existing building. It is closely linked to Europe's climate change policy which, itself, is considered from a building stock analysis perspective. Thus, the revised EPBD cannot make its full and effective contribution if it is not also considered to face the elephant.

7. ACKNOWLEDGMENTS

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