1. Introduction

The implementation of the Energy Performance of Buildings Directive (EPBD) in Belgium is a regional responsibility. In the Brussels Capital Region, the EPBD is under the combined responsibility of the regional Minister of Energy and the regional Minister of Environment.

The first EPB ordinance\(^1\) dates from June 2007; some minor changes were introduced in May 2009 and in February 2011. In May 2013, this ordinance was replaced by the ordinance on the Brussels Air, Climate and Energy Code (COBRACE), which reorganises and integrates Brussels' legislation in the areas of air, climate and energy, and fully transposes the 2010/31/EU Directive. COBRACE revises the established procedures to facilitate the work of professionals in the sector of building energy efficiency, defines the concept of Nearly Zero-Energy Buildings (NZEBs), highlights the exemplary role of the public authority buildings and extends the use of Energy Performance Certificates (EPCs). COBRACE also integrates the energy performance of buildings into a broader legal, environmental and energy framework. Indeed, going beyond the EPBD, COBRACE expresses the intention to reduce the energy and environmental impact of the building sector as a whole.

2. Current status of implementation of the EPBD

I. ENERGY PERFORMANCE REQUIREMENTS

I.i. Progress and current status

The energy performance requirements have been mandatory for buildings for which a building permit has been requested since July 2008. The applicable energy performance requirements are on primary energy consumption, insulation level, ventilation rate, overheating, technical installation, etc., and are different for new buildings, major or simple retrofits, and existing buildings.

Only the new units\(^2\) or units assimilated to new-builds\(^3\) which are designated as individual housing units (houses and apartments), offices and service buildings, or educational buildings have to respect all the energy performance requirements. These 3 types of units constitute the greater part of the building sector in the region, with a very significant share accounting for housing. Units similar to new buildings are governed by the same requirements as new units, but have 20% more flexibility on some requirements.

AUTHORS

Michael Govaert,
Geoffroy Knipping,
Yves Mortehan,
Jean-Henri Rouard,
Marianne Squilbin,
Brussels Environment (IBGE)

NATIONAL WEBSITES
www.environnement.brussels
guidebatimentdurable.bruxellesenvironnement.be

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\(^1\) Moniteur Belge: Ordonnance de la Région de Bruxelles-Capitale du 7 juin 2007 relative à la performance énergétique et au climat intérieur des bâtiments.

\(^2\) "Unit" = a set of adjacent rooms in one and the same building that can be sold or let independently and whose use comes within the scope of application of the EPBD.

\(^3\) "Unit assimilated to a new-build" = a unit that had more than 75% of its sources of heat loss renovated and also had all its technical installations replaced.
These requirements concern public buildings, as well as private.

The energy performance requirements have varied over time:

Prior to EPB regulation (July 2008), the only requirement was an overall insulation level of K 55\(^4\). In 2008, all EPB requirements came into effect, except for the one on energy performance. In 2009, the E90 requirement level\(^5\) came into effect for new housing units, offices and schools. After these requirements came into effect, a 17% reduction in energy consumption in comparison with buildings not subject to EPB (before 2008) was observed.

In 2011, the E-requirement level was tightened and became E70 for housing and E75 for offices and schools; moreover, a requirement on thermal bridges was introduced. After these 2011 requirements came into effect, a new reduction of 25% in energy consumption in comparison with buildings subject to the 2008-2011 requirements was observed.

As of 1 January 2014, the U-value requirement was tightened. Table 1 summarises the U-value requirement before and after 2014.

As of 1 January 2015, the E and K requirement levels are replaced by two new requirements, referred to as ‘very high performance’ requirements, one concerning the total primary energy consumption, and the other concerning net heating, for all new construction permit requests. The requirements set for 2015 should reduce primary energy consumption of buildings constructed between 2011 and 2014 by another 60%.

\(^4\) K-level is a function of the average U-value of the building envelope weighted by areas and correlated with compactness.

\(^5\) For a definition of the E-level, please see the chapter Belgium – Flemish Region in this book.

\(^6\) For primary energy consumption calculation purposes \(C\) is equal to the value of the compactness of the unit and cannot exceed 4.
The requirements by types of units are presented in Table 2. The Annexes referenced in Table 2 determine the requirements that must be met and can be found at the Brussels Environment (IBGE) website\(^7\). Units considered new (over 75% change in the envelope and replacement of the technical installations) are subject to the same requirements as new units, aside from a 20% loosening of the net heating and net cooling energy requirement, as well as the primary energy consumption (idem for airtightness as of 1 January 2018). This loosening of requirements has been established to encourage renovations, as opposed to demolitions. The net heating energy requirement has also been loosened (alternative formula with the X factor) for projects that, in the Brussels urban context, do not have sufficient solar heat gain to ensure the very-high-performance nature of the building (a very-high-performance building is a building insulated to the extent that all the heating could be provided by ventilation air). The net heating energy requirement goes in this case from 15 kWh/m\(^2\).year to X (variable, > 15 kWh/m\(^2\).year). The ‘X’ is an alternative requirement that has been designed for EPB units whose poor orientation or compactness makes it unfeasible to enforce compliance with a net heating energy requirement of 15 kWh/m\(^2\).year (for instance because the insulation that would have to be put in place would be far too thick). In that case, the EPB software will display a new threshold (X) that needs to be respected, calculated on the basis of different assumptions (e.g., minimum U-values for walls, etc.). Table 3 summarises the average performance of new units built in Brussels since 2008.

### I.ii. Format of national transposition and implementation of existing regulations

In 2013, COBRACE replaced the 2007 EPB ordinance and transposed Directive 2010/31/EC. Several decrees (available on the Brussels Environment website\(^8\)) describe the procedures to be followed, the calculation method and the requirements to be met. A set of resources are available to construction sector professionals, e.g., a handbook, info-sheets, FAQ, available on the Brussels Environment website\(^9\).

The calculation procedure is defined in an execution order that was adopted on 21 February 2013. The method is similar to those established in the Flemish and the Walloon Regions. The calculation method for primary energy already includes the input of Renewable Energy Sources (RES), e.g., solar energy (thermal and photovoltaic), biomass heating, geothermal heating and heat pump systems, as well as passive cooling techniques.

Professionals responsible for monitoring new buildings and major renovation projects must be accredited. To become accredited, they must have an architecture or engineering degree and must have followed 5-day training sessions, as well as retraining every two years. Monitoring and support for EPB advisors are provided by Brussels Environment.

An independent organisation performed an inspection of the quality of the work of 30 EPB advisors in 2012. This first inspection did not aim at imposing penalties, but solely at collecting information on the quality of work of the EPB advisors in the market. The results were quite positive and to date, no EPB advisor has been suspended.

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**Table 3:**

<table>
<thead>
<tr>
<th>EPB Units</th>
<th>Type of unit</th>
<th>Number of units</th>
<th>kWh/m(^2).year</th>
<th>Average index</th>
<th>Level E</th>
<th>Level K</th>
<th>Total m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices and services</td>
<td>Offices</td>
<td>28</td>
<td>91.55</td>
<td>B+</td>
<td>67</td>
<td>30</td>
<td>44,989</td>
</tr>
<tr>
<td>(buildings and building units)</td>
<td>Schools</td>
<td>16</td>
<td>187.32</td>
<td>C</td>
<td>74</td>
<td>34</td>
<td>9,942</td>
</tr>
<tr>
<td>Individual housing units</td>
<td>Apartments</td>
<td>2303</td>
<td>82.45</td>
<td>B-</td>
<td>51</td>
<td>29</td>
<td>228,421</td>
</tr>
<tr>
<td></td>
<td>Houses</td>
<td>133</td>
<td>109.34</td>
<td>C+</td>
<td>64</td>
<td>32</td>
<td>33,565</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>2480</td>
<td>87.29</td>
<td>52</td>
<td>29</td>
<td></td>
<td>316,917</td>
</tr>
</tbody>
</table>

\(^7\) IBGE stands for Institut Bruxellois pour la Gestion de l’Environnement (Brussels Institution for Environment Management) and is commonly referred to in Belgium as “Brussels Environment”


I.iii. Cost-optimal procedure for setting energy performance requirements

The cost-optimal study for the Brussels Capital Region, concluded in June 2013, was concerned with the requirements applicable in 2012 and those valid from 1 January 2015 to several types of buildings (Table 4). The results are presented in Table 5. The study thus showed that the 2012 requirements were insufficient to fulfil the cost-optimal obligation. On the other hand, the requirements planned for application as of 2015 completely meet the cost-optimal requirements, and, therefore, no amendment to existing legislation has been deemed necessary (see Table 1).

I.iv. Action plan for progression towards Nearly Zero-Energy Buildings (NZEBs)

National application of the NZEB definition

In the Brussels Capital Region, the NZEB obligation arising from Article 9 of Directive 2010/31/EU has been integrated in COBRACE and will make NZEBs obligatory by 2021 (2019 for public buildings). COBRACE was adopted on 2 May 2013 and the NZEB definition it adopted is based on the definition given by the EPBD.

In the meantime, the Brussels Capital Region has set up ambitious energy standards for new constructions to be applied starting in 2015. These standards, inspired by the ‘passive standard’ and targeting ‘nearly zero or very low energy consumption’ and achieved through high energy performance, are assimilated to the NZEB requirements. These standards are presented in Table 2. The 2015 EPB requirements are very ambitious for an urban context, and fulfil the nearly zero-emission objective. The requirements are in fact reduced to their minimum (from a cost-optimal perspective) and compensation by renewable energy is drastically reduced by the high number of low built area available in the city. Recourse to renewable energy is implied by the necessity to fulfil the maximum primary energy consumption requirement (45 kWh/m².year), however the RES share is not quantified.


The third Energy Efficiency Action Plan (EEAP-3) for the Brussels Capital Region was sent to the EC in May 2014. It provides an overview of the measures implemented to improve energy efficiency in the region. The EEAP-3 targets not just final energy consumption but the entire energy chain, in line with the intentions of the Energy Efficiency Directive (Directive 2012/27/EU – EED). The EEAP-3 establishes the roadmap to a strategy for building renovations (Article 4 of the EED) which includes an overview of the building stock, identification of profitable approaches to renovation, policies and measures aiming to stimulate major renovation, future orientations, and estimates on energy savings.

In the meantime, the Brussels Capital Region has set up ambitious energy standards for new constructions to be applied starting in 2015. These standards, inspired by the ‘passive standard’ and targeting ‘nearly zero or very low energy consumption’ and achieved through high energy performance, are assimilated to the NZEB requirements. These standards are presented in Table 2. The 2015 EPB requirements are very ambitious for an urban context, and fulfil the nearly zero-emission objective. The requirements are in fact reduced to their minimum (from a cost-optimal perspective) and compensation by renewable energy is drastically reduced by the high number of low built area available in the city. Recourse to renewable energy is implied by the necessity to fulfil the maximum primary energy consumption requirement (45 kWh/m².year), however the RES share is not quantified.

The implementation of Article 5 of the EED was detailed in a plan sent to the EC in compliance with the EED in December 2013. The mechanism used to implement this article is the local energy management action plan.

Implementation of Article 5 of the EED is feasible due to the alternative proposed by Article 5.6 EED. In order to reach an amount of energy savings equivalent to the one that would be obtained by refurbishing 3% per year of the total floor area of central government buildings, the region has adopted, as part of
COBRACE[10], the implementation of a local action plan for energy management (known as PLAGE). The methodology to set up PLAGE is founded on a coherent and coordinated set of measures, which aim at identifying the potential for energy savings and priorities for action. The methodology is planned over a period of 4 years, the first of which is dedicated to setting up an energy accounting, developing an action plan, and defining a target, while the following 3 years to carrying out the action plan, making an assessment report, and verifying the results. PLAGE first (starting in 2005) was voluntary, but became compulsory through COBRACE. Experience so far has shown a reduction potential of 10% in energy consumption without major investments (measures such as isolating energy pipes, setting reflectors behind heaters, etc.).

I.vi. Other relevant plans
The draft regional Air-Climate-Energy Plan (PACE draft) has its legal foundation in COBRACE. This plan provides for more or less 130 measures that are distributed over ten areas oriented towards the sectors of energy consumers and emitters of greenhouse gases and air pollutants (buildings, transport, and all other types of energy consumption). It was adopted on first reading on 26 September 2013. This plan has been submitted to a study of environmental impact and should soon be adopted by the government in 2016. Afterwards, the plan will be submitted to public scrutiny.

II. REQUIREMENTS FOR TECHNICAL BUILDING SYSTEMS (TBS)

II.i. Coverage of heating, domestic hot water, air-conditioning and large ventilation systems
Heating systems - all the components necessary for heating the air and/or water in a building - with boilers of an effective rated output for space heating purposes of more than 20 kW, and air-conditioning (AC) systems - the combination of all the components necessary to ensure a type of treatment of the air in a building - of an effective rated output of more than 12 kW, are subject to energy requirements (Table 6). These limitations will soon be rendered redundant, extending the requirements to every heating and AC system, but even with the current limits in place, this requirement already covers the great majority of heating and cooling systems in the Brussels region.

The extent to which the systems involved comply with the requirements is monitored by accredited professionals during the various inspections provided (acceptance, periodic inspections - see section IV).

These requirements are detailed in documents drafted by Brussels Environment and are available at the Brussels Environment website.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Type of system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comblustion efficiency and emissions of boilers in operation</td>
<td>heating</td>
</tr>
<tr>
<td>Modulation of power of boiler burners</td>
<td>cooling</td>
</tr>
<tr>
<td>Chimney draft</td>
<td></td>
</tr>
<tr>
<td>Ventilation of boiler room</td>
<td></td>
</tr>
<tr>
<td>Tightness of exhaust gas and combustion air supply ducts</td>
<td></td>
</tr>
<tr>
<td>Insulation of pipes and accessories</td>
<td></td>
</tr>
<tr>
<td>Partitioning of water and air distribution</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Logbook</td>
<td></td>
</tr>
<tr>
<td>Energy metering</td>
<td></td>
</tr>
<tr>
<td>Heat recovery on exhaust air</td>
<td></td>
</tr>
<tr>
<td>Variation of the flow of fresh air by actual occupation (for spaces with variable occupation)</td>
<td></td>
</tr>
<tr>
<td>Energy accounting (measure, analyse and report the energy consumption)</td>
<td></td>
</tr>
<tr>
<td>Sizing</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Requirements for heating and cooling systems.

II.ii. Regulation of system performance, distinct from product or whole building performance

The energy performance of heating and AC systems is included into the calculation of the energy performance of new buildings. The various requirements that apply to heating and AC systems (thermal insulation, partitioning, regulation, heat recovery, etc.) set a minimum performance for these systems, including replacement and upgrade, even for renovations not needing a building permit. Administrative follow-up of facilities not compliant with the provisions of the regulations is provided by Brussels Environment.

II.iii. Applicability to new, replacement and upgraded systems in existing buildings

The requirements apply to all heating and AC systems that fall within the scope of the regulations, whether the buildings pre-exist, are under renovation, or new, regardless of whether there is an urban planning permit requested. Table 7 lists the factors that trigger the application of each individual requirement.

II.iv. Provisions for installation, dimensioning, adjustment and control

New cooling or heat installations must undergo a dimensioning calculation, the principal steps and results of which must be listed in a design calculation.

The following systems must be inspected by an accredited professional:
> heating systems with a new boiler (gas or fuel);
> heating systems with a new boiler body or a new burner;
> heating systems when the boiler (gas or fuel) is moved;
> new AC systems;
> upgraded AC systems when the effective rated output of the added or replaced part is 50% or more of the effective rated output of the AC system after works.

This inspection includes verification of certain operating parameters and features, e.g., adjustment of the settings for heating or AC systems, airtightness of the ducts for air intake or evacuation of the combustion gases, compatibility of the boiler and the ducts for evacuation of the combustion gases, etc.

II.v. Encouragement of intelligent metering

Up to now, there is no specific encouragement of intelligent metering but the installation of meters that can be read remotely is mandatory.

II.vi. Encouragement of active energy-saving control (automation, control and monitoring)

The EPB heating and AC regulations require establishment of energy monitoring and control.

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Table 7: Factors triggering the requirements for heating and cooling systems.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Triggering factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustion efficiency and emissions of boilers in operation</td>
<td></td>
</tr>
<tr>
<td>Modulation of power of boiler burners</td>
<td>New boiler</td>
</tr>
<tr>
<td>Chimney draft</td>
<td></td>
</tr>
<tr>
<td>Ventilation of boiler room</td>
<td>New boiler / work on the walls of an existing boiler room</td>
</tr>
<tr>
<td>Tightness of exhaust gas and combustion air supply ducts</td>
<td></td>
</tr>
<tr>
<td>Insulation of pipes and accessories</td>
<td>New boiler or new cooling installation / New pipes or new accessories</td>
</tr>
<tr>
<td>Partitioning of water and air distribution</td>
<td>New heating or air conditioning system / new distribution network</td>
</tr>
<tr>
<td>Control</td>
<td>New boiler</td>
</tr>
<tr>
<td>Logbook</td>
<td></td>
</tr>
<tr>
<td>Energy metering</td>
<td>No triggering factor except for electrical metering on cooling towers and air coolers, for which the requirement applies only to newly installed equipment</td>
</tr>
<tr>
<td>Heat recovery on exhaust air</td>
<td>New ventilation system</td>
</tr>
<tr>
<td>Variation of the flow of fresh air by actual occupation (for spaces with variable occupation)</td>
<td>New ventilation system</td>
</tr>
<tr>
<td>Energy accounting (measure, analyse and report the energy consumption)</td>
<td></td>
</tr>
<tr>
<td>Sizing</td>
<td>New boiler or new cooling installation</td>
</tr>
</tbody>
</table>
III. ENERGY PERFORMANCE CERTIFICATES (EPCs) REQUIREMENTS

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

Overview and administration system

EPB certification began in May 2011 for sales of residential houses and apartments, as well as office spaces larger than 500 m², and has been mandatory since November 2011 for rental of similar properties. EPCs are only issued by accredited experts. The validity of the EPC is 10 years, unless updated due to renovation, or revoked due to error(s) in its preparation.

Brussels Environment, the administration in charge for the Brussels Capital Region, oversees the whole scheme for the government and provides all needed materials for the issuance of EPCs, including the software.

The mandatory software to be used for issuing EPCs for single-family houses and apartments operates in combination with a central registry. This software has various graphical user interfaces, and allows the expert to input specific elements, e.g., special windows or complex skylights, with ease. The software also includes automatic controls for a comprehensive list of possible discrepancies, thus avoiding many possible mistakes.

How flats are certified in apartment buildings

Each apartment must have its own certificate; an apartment building cannot be certified as a whole. The certifier has a simple copy-paste function in the software to reduce costs in the event of multiple certifications required for similar apartments. On the contrary, office buildings can be certified either as a whole, or by floor or group of floors; the choice is on the owner.

Format and content of the EPC

The certificate consists of several pages. The first page (Figure 1) presents the energy performance index, directly based on the theoretical specific primary energy consumption, the total consumption, the floor area, the CO₂ emissions and three recommendations.

The second page of the certificate (Figure 2) provides explanations of the data listed on the first page and briefly explains the assumptions in the calculation.

The next pages contain the complete list of recommendations for improvement of the energy performance specific to the residential sector, as well as a one-page list of actions and advice for achieving daily savings.

For existing housing, the reference values determining the energy label are the same as those for new housing (Tables 8 and 9, and Figure 3).
EPC activity levels

The number of EPCs issued as of 31 December 2014 is shown in Figure 4, whereas Figure 5 shows the office area for which a valid EPC is available, and Figure 6 the office area for which EPCs were issued each month from March 2011 to December 2014.

Typical EPC costs

The government has not set a fee for drawing up EPCs, but has ensured that an adequate number of certifiers are active in the market to satisfy the demand. Prices are thus set by the market depending on the accepted hourly rate for this type of activity and the average time needed to draw up an EPC.

The approximate average prices are as follows:

- > 250 € including VAT for an apartment;
- > 375 € including VAT for a single-family house.

The lowest prices found on the market are 100 € for a studio and 175 € for a house.

For offices, there is always a fixed part and a variable part, depending on the floor area. Average market prices are:

- > 1,200 € including VAT for an area of 1,000 m²;
- > 3,500 € including VAT for an area of 5,000 m²;
- > 7,000 € including VAT for an area of 20,000 m².

### Table 8: Energy labels for houses – subclasses and consumption.

<table>
<thead>
<tr>
<th>Energy class</th>
<th>kWh/m².year</th>
<th>kWh/m².year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A⁺⁺</td>
<td>&lt; 0</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>from 0 to 15</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>from 16 to 30</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>from 31 to 45</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>from 46 to 62</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>from 63 to 78</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>from 79 to 95</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 96 to 113</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 114 to 132</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 133 to 150</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 151 to 170</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 171 to 190</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 191 to 210</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>from 211 to 232</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>from 233 to 253</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>from 254 to 275</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>from 276 to 345</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>≥ 346</td>
<td></td>
</tr>
</tbody>
</table>

### Table 9: Energy labels for offices – subclasses and consumption.

<table>
<thead>
<tr>
<th>Energy class</th>
<th>kWh/m²/year</th>
<th>kWh/m²/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A⁺⁺</td>
<td>&lt; 0</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>from 1 to 31</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>from 32 to 61</td>
<td></td>
</tr>
<tr>
<td>B⁺⁺</td>
<td>from 62 to 93</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>from 94 to 124</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>from 125 to 155</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 156 to 186</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 187 to 217</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>from 218 to 248</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 249 to 279</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 280 to 310</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>from 311 to 341</td>
<td></td>
</tr>
<tr>
<td>E⁺⁺</td>
<td>from 342 to 372</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>from 373 to 403</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>from 404 to 434</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>from 435 to 527</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>&gt; 527</td>
<td></td>
</tr>
</tbody>
</table>
Assessor corps

All Qualified Experts (QEs) (no minimum requirements) have to follow a specific training programme (course and exam) to obtain a certificate of competency, and to request accreditation from the Brussels Environment. The training is conducted by private training centres according to the regulation rules. At the end of 2014, 7 centres have been accredited, and there are about 1,500 registered QEs for residential, non-residential, and public buildings, whose information can be found on the Brussels Environment website.

Three years after the start in May 2011, the government decided to amend the law to improve the quality level of the certifiers. The new legislation requires certifiers to be engineers, architects, or other professionals familiar with EPB. This is nowadays the case for 1,300 certifiers already accredited. The new legislation also specifies that when there are major changes in the certification system (regulations, calculation method, software or working protocol), certifiers must be retrained and take an examination anew.

Compliance levels by sector

To ensure enforcement of the legislation, the administration has agreed with the notary association on the obligation to report every real estate transaction for which a valid EPC is not available. For sales of houses and apartments, the regulations are followed for virtually 100% of the cases.

Beyond advertising, there is also an obligation to provide a copy of the EPC at the time that the building (residential or non-residential) is sold or rented.

The office building market has also responded very favourably, with almost 100% of transactions accompanied by an EPC so that no penalties have been necessary as yet.

Figure 5: Cumulative area of offices for which a valid EPC is available.

Figure 6: Area of offices for which EPCs were issued each month.
Enforcement with building owners and real estate actors

The administration has focused its inspections on the presence of EPC results in sale and rental notices. Due to the tight market for housing, no complaint has been received, in three years, related to an event in which a prospective tenant wanted to obtain an EPC and it was unavailable. Some cases were reported where the buyer and the seller mutually agreed on a settlement without an EPC, which is prohibited and in such cases the sellers incur a fine. A small number of fines have been imposed till the end of 2014, but many others are in the pipeline (fines require a long procedure).

Quality Assurance (QA) of EPCs

The government has set up a Quality Assurance (QA) scheme. A private body has been hired in order to monitor QEs issuing EPCs for houses and apartments, and to improve the scheme. In 2013, 38 QEs and 156 EPCs were controlled, and in 2014 this concerned 59 QEs and 236 EPCs. For 15% of the controlled EPCs, the body in charge of quality control visits the house, makes a new EPC and then compares the two EPCs.

Most experts and most of their EPCs are chosen randomly by Brussels Environment, but approximately 20% of them are targeted by Brussels Environment due to complaints concerning the QE. A list of frequently made mistakes was drawn up based on the first annual report of the quality control body wherein mistakes with the most significant impact on the quality of the EPC were sent to the QEs.

Due to the lower number of issued EPCs for office buildings, their QA has been managed so far by Brussels Environment itself, often with the support of the issuing QE, before or during the issuance of the EPC.

Penalties may be imposed on the QE if relevant errors are discovered and confirmed. The number and significance of the errors determine whether the EPC should be revoked. If the certifier has several certificates revoked over a short period, and/or if he does not fulfil his administrative obligations, his license may be suspended for a maximum period of 120 days. Whenever a second suspension is required, Brussels Environment can request withdrawal of the accreditation. Fines for QEs are not applicable yet but will start to be in 2015.

Approximately 60 certifiers have already had their accreditation temporarily suspended. The first withdrawals of accreditation are planned for the near future.

III.ii. Progress and current status on public and large buildings visited by the public

Overview

Since 1 July 2012, any public body building that occupies more than 1,000 m² floor area must display an EPC on the front door or in the main lobby of the building. As of 2015, the threshold drops to 250 m². The certificate is to be issued by a QE using the relevant web app, and applying the protocol provided by Brussels Environment. The public building EPC is based on the actual consumption data and the areas occupied.

If a public building is owned by a public institution, it is required to install a meter for each energy source and for each building individually within 24 months from the date on which the executive order came into force.

Format and content of the EPC

The certificate displays the index of CO₂ emissions, as well as other information, e.g., financial data, information on on-site production systems, recommendations selected from a list of typical cost-effective measures, and a histogram of the consumption over the last three years (fully completed after three years - see Figure 7).
The EPC reflects the energy performance level of the public building, and places it in one of 14 label categories, e.g., town halls, parliaments, judicial buildings, crèches, high schools and university buildings, hospitals, health centres, swimming pools, etc. The mean energy performance level for the building categories in the Brussels Capital Region is illustrated as a dotted line in the scale. The certificate is based on consumption data for electricity and fossil fuels used for all purposes, based on meters or invoices and, where applicable, on data on the on-site production of electricity. Measurement of the data may commence the earliest 24 months from the date of the certificate issuance, and must cover a continuous period of 11 to 13 months. The energy performance indicator is calculated on the basis of the occupied floor area.

The scales are specific to each category of public building, and the consumptions are greater there than those of buildings subject to transaction, as they also include the consumption of the electronic apparatus: computers, coffee machines, microwave ovens, medical machinery, etc.

Frequency of updating
The energy performance certificate for public buildings is valid for a one-year period and must be updated within this timeframe.

Activity levels
Already 450 public buildings have a certificate, updated every year.

Not each public body makes every endeavour for their buildings to comply with the obligation to display an EPC. More control, support, and penalties have to be implemented by the administration.

Costs
EPCs for public buildings can be drawn up by employees of the public body, or by private certifiers.

The size and complexity of the building do not actually increase the price of the certificate, as it is based on the operational rating. The cost for an EPC drawn up by a private firm is approximately 1,300 €, VAT included.

Assessor corps
There are no minimum requirements for QE qualifications. The training is conducted by private training centres, according to the regulation rules. At the end of 2014, 3 centres were accredited. The length of training varies from 25 to 45 hours depending on the academic and/or professional background of the applicant.

It is also provided that when there are major changes in the certification system (regulations, calculation method, software or working protocol), the certifiers must be retrained and take an examination again.

Quality Assurance (QA) of EPCs
Before the web application became available (in June 2013), the quality of the EPC was checked preventively by the administration prior to its issuance, and a report was provided to the certifier. Since the web tool came into use in June 2013, the potential for entry errors became much more limited and checks are sporadic.

The information regarding all public buildings to be certified was collected in 2013 (address, area, contacts and whereabouts, meters, etc.), and Brussels Environment then performed a control to 145 public buildings EPCs, to confirm the validity of their inputs.

III.iii. Implementation of mandatory advertising requirement
The EPC aims at informing the potential buyer or tenant of the energy performance level of a building, and thus must be issued and be readily available prior to any advertising or real estate transaction. Therefore, since 2011, the law states that the reference values shall appear clearly on all advertisements. These reference values are currently the energy class, the energy performance (kWh/m²·year) and the CO₂ emissions.

Contacts with major and minor real estate agencies, as well as with owner unions, made compliance with the requirements possible in about 50% of the advertising. Some real estate agencies fully observe the requirement to display the results of the EPC in their notices. However, despite the progress made, an equally large proportion of agencies still do not fully observe the requirement to display EPCs in their advertisements.

At first, for greater efficiency, the certificates check is being focused more on professionals who put properties up for sale and rental, that is, real estate agencies. An administrative fine that can go up to 625 € per notice in violation can be levied on real estate agencies that do not observe the rules for display at the time the property is put on the market, or do not provide a copy of the EPC to prospective buyers and tenants.
Over one hundred agencies have been checked at random from September 2013 to September 2014 on the basis of notices in their window displays or on internet websites, and several formal reports have been drafted that will result in administrative fines. At the end of 2014, a real estate agency received the first fine. In addition to new random checks, the next checks will in particular target agencies that have repeatedly published advertisements that do not post the results of the EPC.

**III.iv. Information campaigns**

In order to encourage the mandatory drafting of EPCs and heating system inspections, advertising campaigns have been realised in 2011 and 2012 on the radio, the press, and in public transport, as well as with banners on the administration website (see example in Figure 8). In addition, professionals are continuously informed through newsletters and specific seminars, in collaboration with professional associations. A significant amount of information has since been available on the Brussels Environment website. A new campaign is planned in 2015 on websites publishing notices and on the radio to improve compliance with legislation.

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**Table 10: Number of EPCs issued by type of residential unit.**

<table>
<thead>
<tr>
<th>Type of Residential Unit</th>
<th>Number of EPCs</th>
<th>% Certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-family houses</td>
<td>17,736</td>
<td>8.19%</td>
</tr>
<tr>
<td>Apartments</td>
<td>111,095</td>
<td>37.87%</td>
</tr>
</tbody>
</table>

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**[11]** Solid fuel boilers represent only a small part of the boilers in the Brussels Capital Region. They are covered by an old law that will probably be revised soon.
Arrangements for assurance, registration and promotion of competent persons

Accreditation of QEs by the Brussels Environment is subject to certain conditions, including attainment of a certificate of competency after training, including an examination about the regulations and the techniques (depending on the type of accreditation), compliance with certain obligations (e.g., keeping a copy of the reports, accepting the quality control, using the methodologies and tools supplied by Brussels Environment, etc.) and follow-up refresher training. The accreditation is valid for 5 years and may be extended for 5 year periods.

Accredited professionals are listed on lists available on the Brussels Environment website. At the end of 2013, there were nearly 1,200 professionals who can periodically inspect boilers and over 400 to accept new or upgraded heating systems.

Promotional activities

A guide for owners of heating systems (Figure 9) has been drafted and is available online on the Brussels Environment website or in print format in the municipalities, some associations, etc.

A helpdesk[12] (Figure 10) intended for accredited professionals has been set up to answer their questions and support them in carrying out regulatory activities.

Enforcement and penalties (activity level and statistics on penalties already levied)

If the procedures specified in the regulations are not performed, the owner of a facility is subject to criminal penalties. For the moment, the focus is on high-powered facilities with environmental permits (≥100 kW), together with the verification whether the correct environmental regulation has been applied. The Brussels Environment is in charge of those inspections in case of permit renewal, complaints or regular control.

Penalties are also imposed if a non-compliant installation is not brought into compliance within the deadline provided. To date, no penalty has been levied.

Quality control of inspection reports

Brussels Environment receives and analyses all the attestations of acceptance and attestations of periodic inspection in the event of non-compliance of a boiler, or if it is brought into compliance. For high-powered facilities, an on-site inspection is performed by the administration in some cases (182 inspections done in 2013).

For other installations, a certain number of attestations will be inspected at random on-site by an independent quality control organisation (39 inspection reports controlled in 2013).

Inspection activity figures

On the basis of the attestations of acceptances and periodic inspection received, it is estimated that less than 10% of new boilers (~14,000 new boilers each year) undergo acceptance (~2,000 acceptance reports received in 2013) and less than 1% of the Brussels stock of boilers (~350,000 boilers) has already undergone a

periodic inspection (~250 inspection reports received in 2013[13]).

**Impact assessment**

The current impact of inspections has not yet been evaluated precisely. However, it is noted that a certain number of periodic inspections lead to replacement of the boiler. Moreover, it is estimated that full implementation of the regulations on heating facilities should reduce CO$_2$ emissions related to Brussels buildings by 6%.

**Costs and benefits**

For private individuals, the cost of an inspection generally varies between 100 € and 200 €. This cost includes maintenance of the boiler, which represents the major part of the cost.

**IV.ii. Progress and current status on AC systems**

**Overview, technical method and administration system**

As of 1 September 2012, AC systems of more than 12 kW must undergo a periodic inspection performed by an accredited professional according to a method and with a tool made available by Brussels Environment (Figure 11).

**Arrangements for assurance, registration and promotion of competent persons**

The accreditation procedures are the same as those provided for heating system inspections.

The penalty mechanisms are the same as those provided in the framework of the regulations on heating facilities.

There have not yet been any penalties.

**Promotional activities**

Various explanatory documents are available on the Brussels Environment website (Figure 12).

Several presentations intended for professionals in the sector have already been held and others will be organised in the coming months.

**Quality control of inspection reports**

No quality control is currently in place for the inspection reports, only support for the accredited professionals in performing their periodic inspections. Quality controls are planned for the long term.

**Inspection activity figures**

To date, only about 15 professionals are accredited to perform periodic inspections of AC systems.

The first periodic inspections began at the end of 2013.

**Impact assessment**

It is estimated that full implementation of these regulations (i.e., regular inspections and mandatory maintenance), should reduce consumption related to AC systems by 5 to 10%, provided the AC system maintenance is correct.

**Costs and benefits**

There is no relevant information available as yet.

[13] Brussels Environment only receives reports of non-compliant boilers. For the moment, there is not a good view of what is really done. Wider communication to heating system owners or users is foreseen in 2016.
3. A success story in EPBD implementation

In 2007, the Brussels Capital Region launched a call for projects, called “Exemplary Projects” (or BATEX - BATiment EXemplaire - Figure 13 and Box 1), with all market participants for very-high-performance buildings in the energy and environmental sectors. While no requirement was then imposed, the ‘Passive House’ standard appeared in the best projects selected. Over the course of the six calls for proposals (once a year), the ‘Passive House’ standard became progressively apparent as ‘the’ energy standard, with almost 350,000 m² of buildings selected. Thus, the participants in the region demonstrated their ability to build and renovate buildings of any kind and any size corresponding to very high energy standards. Over half meet the ‘Passive House’ standard (56%), equivalent to 350,000 m² of floor area. Those that do not yet meet it, fulfil the low or even very low energy criteria.

This call for projects has also created pressure on the real estate market and has led numerous private and public participants to undertake projects with very high energy performance. The latest inventory drawn up by Brussels Environment counted:

- >800,000 m² of passive buildings constructed, under construction or decided upon;
- >2,365 buildings with high energy performance;
- >216 buildings meeting the ‘Passive House’ standard;
- >2,144 (very) low energy buildings.

Based on the experience accumulated, the Brussels Capital Region decided to impose the ‘Passive House’ standard on the public sector for all new construction, and the low or even very low energy standard for renovations, as of 2011. In addition, in view of the technical and financial capacity of the market to offer so many passive buildings, the Brussels Capital Region opted in 2013[14] for the maximum energy standard in terms of insulation for its new constructions, ‘the passive ambition’, as a matter of regulation. This concept was adapted to the Brussels reality, and the resulting requirements were subject to negotiations with the construction sector in 2012.

With this choice, Brussels is avoiding the programmed obsolescence (by the successive increase in energy requirements) of its new buildings successively put on the market. A passive building will never be obsolete, inasmuch as it will no longer be necessary to change its envelope or technology to give it higher performance.

4. Conclusions, future plans

The 2015 EPB requirements are a necessary and essential step toward the mandatory European NZEB standard of 2019/2021, in terms of both timing and ambition.

In view of this NZEB standard in 2019/2021, the finality of very high performance has guided consideration of the passive level of requirements, especially as the Brussels building sector has devoted considerable effort to the subject and shown that these requirements are feasible on a large scale. The multitude of buildings built, under construction and planned in the Brussels Capital Region moreover confirm the theoretical cost-optimal approach. Very high performance can be profitable,

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provided that significant care is taken in the design, for any building. The construction sector is divided into two fronts, those who have already constructed very high performance buildings and are not opposed to it, and those who have not yet constructed such buildings and are wary. It is obvious in this regard that stepped-up support for professionals remains necessary. The region is now among the world leaders with regard to very high energy performance buildings and delegations come from afar to get the knowhow in Brussels.

The actions taken for new construction are an indicator of the trend that the Region shall follow for renovation, for which the stakes are enormous and the energy savings potential greater than for new construction. At present, renovated buildings are only subject to specific requirements related to minimum values of insulation of the walls (U and R values). As renovation processes are in essence gradual, it is completely possible to arrive, after successive renovations, at a cost and scope of works equivalent to that of a new construction, but with a distinctly lower energy efficiency, for lack of a central emphasis on obtaining a high-performance building at the end of the process. The new challenge is to delineate the renovation process to maximise energy improvement in the long term.

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