

Promotion of Passive Houses: from estimating the energy saving potential to the implementation of financial stimuli

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1 Summary

In the framework of the SAVE Intelligent Energy Europe project 'Promotion of European Passive Houses', the energy saving potential of the Passive House concept has been calculated for the Belgian situation. The study shows significant CO₂ and financial savings potential compared to buildings that oblige to the national regulation in several scenarios. The paper discusses some of the differences between the Belgian national Energy Performance of Buildings (EPB) and Passive House Planning Package (PHPP). Further, a perspective is given for linking the Passive House certification with the national EPB Directive, barriers are identified and a transition path is projected.

2 Calculating the energy saving potential of Passive Houses

In Belgium about 26340 new residential buildings per year have been built during the last period (1999-2004), which is about 44869 living units. The number of renovations is increasing rapidly (add 28311 renovations per year for the period 2003-2004). An estimate of October 2001 provides 4.398.070 living units in total.

The mean use of gas of a family in a new dwelling is about 22000 kWh/a for space heating and about 2000 kWh/a for hot water and cooking. For residents using household fuel in old buildings the fuel consumption is about 2800 litres per year for heating and hot water production. Average electricity consumption is about 3500 kWh/a (8750 kWh/a primary energy). These figures can be compared to measured results of a Passive House in Belgium: about 4600 kWh/a for space heating, hot water production and cooking and about 1500 kWh/a electricity consumption. So every new built Passive House saves about 2000 kWh/a electricity and 19718 kWh/a gas consumption. Every renovation towards the Passive House standard saves about 27590 kWh/a gas per household.

Taking into account the (regional) emission factors for gas and electricity every Passive House saves 5,56 ton CO₂ compared to standard construction (2005) and every renovation towards the Passive House standard saves about 7,13 ton CO₂. Take into account a building lifespan of 100 years and an emission cost of 25 EUR per ton CO₂ that is produced too much, and you can calculate the benefits for the regional government. What the government saves, can logically also be spent, either in the form a grants, tax reductions, financial aid.



In the Flanders Region, the use of fuel and electricity in the residential sector is estimated to be respectively 211 PJ/a and about 10 TWh/a. Financially this means a total energy bill of all Flemish households of about 3,5 billion EUR. This means that if all residents would live in Passive Houses the buying potential of households could increase by two billion EUR. Some regional companies working solely on Passive Houses have also demonstrated a 100 % growth of their employment.

3 Current situation in Belgium

In 2005 about 40 Passive House projects were under construction, mainly in the Flanders Region due to the existence of a Passive House network (PHP). In October 2005 seven projects received their first quality assurance certificate. In January 2006 grants for Passive Houses were launched by energy distribution net manager GeDIS and by the city of Turnhout (both in the Flanders Region). Meanwhile dozens of new Passive House projects appear, including office buildings, schools, day care centres, educational facilities, sports halls, etc. The situation in the Flanders Region is therefore typical for a starting Passive House market, with a promise for a quick growth of projects and governmental interest. In Belgium most legislative matters and building normalisation are reserved for the federal Government. However, building regulations on rational use of energy are dealt with separately within the three administrations: Flanders Region, Walloon Region and the Brussels Capital Region. As of January 1, 2006, only the Flanders Region met the criteria set forward by the European Commission concerning the implementation of the EPBD. The Walloon and Brussels Region still have to implement the EPBD. As a part of building regulation compliance assessment new-built dwellings in the Flanders Region must be supplied with energy performance certificates. These certificates are based on the Government's "Energy performance regulation" (software edition EPB v1.0 released in March 2006) calculation methodology. This methodology is used for new buildings throughout Flanders, and thus a degree of harmonization is achieved. For existing dwellings another software has been developed, EAP.

Main features of EPB 2006:

- EPB v1.0 makes buildings comparable;
- EPB v1.0 has two conditions: the K-45 (insulation on the building level expressed as a factor of a medium U-value and taking into account compactness of the building) and E-100 (an overall energy efficiency degree). Both are maximum;
- EPB v1.0 and the E-value take into account insulation, space heating, water heating, ventilation, overheating in the summer, lighting for schools and offices, energy generating technologies

The following table compares EPB and PHPP¹.

¹ PHPP, Passivhaus Projektierungs Paket (available in English version PHPP 2004 and Dutch version PHPP 2003 Benelux) is a tool to help design and certify passive houses, see www.passiv.de and www.passiefhuisplatform.be.



	EPB (Flemish Region)	PHPP
Goal	Making buildings comparable	Certification: limiting the energy demand for space heating to < 15 kWh/m ² a
Financial benefits	Grants for E 70-75	Grants for Passive Houses in the distribution territory of GeDIS (Flemish distribution chain manager) and in the city of Turnhout.
Filing	First calculation with concept	First calculation with the concept
	Obligatory part of the file for the building permit	Sustains the making of a project with a low energy demand, several calculations are possible
	Second calculation six months after using the building, with the real input	Second calculation after realising the air tightness, before finishing the project. So there is still the possibility for adjustments.
	Penalty if you don't stay under K-45 and E-100	No certification if you don't reach the goal
Demands	K-45 and E-100	<15 kWh/m ² jr and n50 < 0.6 h ⁻¹
	K-45 has also demands for the U-values	Demands for U-values, ventilation,...
Use	You see only your input and have no survey of what happens with the information	Based on a Excel sheet, background calculations are visible
	Very hierarchical input	Always possible to work in the sheet you need
	Works with a library, some data are exchangeable within projects	For one project

Table 1: Comparison of PHPP with Flemish EPB

Linking the Passive House standard with Flemish energy performance regulation:

The following solutions were considered including:

- Extending the Passive House Planning Package (PHPP) to include a EPB rating output
- Produce a generic banding/EPB rating for a Passive House
- Incorporate the features of PHPP into EPB v1.0
- Produce separate 'quality assured' certificate for a Passive House dwelling which incorporates an energy performance rating

These solutions are not workable in the Belgian situation, so it is unlikely that an EPBD certification scheme of the Passive House dwellings will be successful in Belgium. This causes a number of potential barriers to the adoption of the standard.

4 Defining the barriers to eliminate in 2006-2010

The Passive House concept has only been introduced in 2002 in the Flemish Region. PHP was then established as an independent organisation to stimulate market and demand for Passive Houses. In the beginning the main barrier was to inform people about the existence of Passive Houses. This could only efficiently be addressed by building demonstration buildings so that people could believe that buildings 'without heating' are feasible in Belgium. Today the following barriers are detected:



- Governmental barriers:

A faster implementation of the EPB as a tool to reduce energy consumption is highly recommended, e.g. research on standard construction in other PEP-countries shows U-values that are even lower than what is promoted as energy efficient in the Flanders Region (K45). Sticks and carrots are currently missing to go beyond current standards. For regions starting with Passive Houses special adapted financial and promotional impulse programmes by the government are recommended.

- Language barrier:

Passive Houses are still mainly built in the Flemish Region because of available information in the Dutch language and because of the existence of a regional multidisciplinary network to support potential clients (PHP).

- Financial barriers:

Passive Houses introduce innovative technologies and, in a starting market, still cost more than standard construction. It makes a lot of sense to provide better grants and loan conditions for constructions reaching better energy efficiency. A voluntary and independent Passive House quality assurance certificate can provide for necessary grant assurance in a starting market. In a short term the obligation of including financial analyses of energy and maintenance costs in the evaluation of public offers is highly recommended.

- Education and research:

Although the Passive House concept has been introduced, efforts are still required to bring the concept to the main public (especially architects and building professionals, VSE's). Media should be used in full to change consumer mentality. Research is still needed in the field of (phased) renovation in urban environment and the exact definition of a Passive House renovation and service building. Providing details of building systems to building professionals can stimulate the market.

- Quality assurance issues:

The energy labelling of buildings should include a reasonable interpretation of the consumption of low energy buildings and Passive Houses. If EPB is to be used for grants and tax benefits, the Passive House concept cannot be excluded. However, the definition of a Passive House requires an exact interpretation of EPB regulation in the framework of providing heating only by means of the ventilation system, without dimensioning the ventilation system for heating. EPB reporters need to be trained to interpret the Passive House concept. The blower-door test is recommended as an essential feature in the quality assurance of any building with a mechanical or natural ventilation system. Contractual issues like working with building teams and performance-based design should be clarified.

5 Transition path 2006-2010

Apart from tackling barriers on a project basis and linking EPBD with PHPP, there are a variety of other routes to increase to market penetration of Passive Houses:

- Passive House professionals accreditation scheme

There is a sizable knowledge deficit in the construction industry with regards to non-repeating thermal bridging, correctly utilizing solar gains and air tightness. A training course and associated accreditation scheme could work well. Also listing of professionals implied in Passive House projects (by PHP membership and the listing of project files) provides a useful tool for initially broadening the market development.

- PHP voluntary quality assurance for Passive Houses

Criteria set forward by PHP are currently accepted as the basis for the Passive House standard and grant schemes for Passive Houses in the Flanders Region. Building regulations usually follow the market, so at some point in time it is likely that the housing industry and building regulations will have evolved sufficiently to allow correct assessment and design of Passive House dwellings as a matter course.

- Codes for sustainable home

A voluntary code for energy efficient homes is currently in use in the Walloon Region (Construire avec l'énergie) – the code is a government initiative to encourage wider sustainable development and motivate the industry towards the realisation of more energy efficient buildings. As a part of this voluntary code there are some benefits that can be achieved, like listing of the professionals. It is anticipated that this voluntary scheme will relate directly to the EPBD implementation in the Walloon region, and hence Passive House development. Also, in the Flemish Region, the Government is sponsoring transition management to develop codes for sustainable homes.

6 Conclusion

This investigation indicates that a quality assurance procedure on a project basis has a good chance of success in Belgium, especially in the initial phase of market development, since a fixed quality assurance procedure provides a firm basis for grant schemes and financial incentives to stimulate the market.

In the future a special accreditation scheme of professionals can be recommended, especially for energy auditors in the framework of the EPB in the Flemish Region and for the partners in the code for sustainable homes in the Walloon Region.

Whilst linking Passive House accreditation directly to EPBD certificates is unviable in Belgium, we should, however, consider undertaking work to simplify the PHPP assessment procedure; this should ease the burden of having to carry out two calculations.

As a part of our further work we should also aim to integrate the Passive House standard within initiatives such as the development of new codes for sustainable homes and regional energy efficiency standards (initiatives like lowering the E value in the Flemish Region). This is likely to prove popular with professionals.



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