Passive House Projects in Belgium

Erwin Mlecnik, Karen Verhaeghe

Passiefhuis-Platform vzw, Berchem, Belgium
Phone: +32 3 235 02 81 Fax: +32 3 271 03 59, e-mail: info@passiefhuisplatform.be
www.passivehouse.be; www.maisonpassive.be; www.passiefhuisplatform.be

ABSTRACT: A passive house platform was established in 2002 to introduce the passive house concept in the Flanders Region. Just four years later, demonstration projects and novel technologies are already available for the Benelux market, which swing the local market development by a factor four. This paper illustrates experiences with several projects.
A few passive houses are already inhabited and the universities of Gent and Leuven have performed measurements and monitoring. About a dozen new passive buildings are under construction and a lot more in planning. Amongst those are also large-scale projects including passive house office buildings in Gent, Aarschot and Verviers, and passive house educational buildings in Beernem, Gent and Nijvel.
Several certified passive houses are illustrated. Further the need for cost effective (European) quality assurance procedures for passive buildings is discussed.

Keywords: energy, passive house, urban environment, certification, case studies

1. INTRODUCTION

Previous papers have explained the creation of a passive house platform in 2002 and the development of its networking and initiatives for building passive houses during the first years [1, 2]. Its start was mainly dedicated to making people aware of the existence of the passive house 'standard'. The increase in comfort proved itself as a major sales argument, for buildings, and for passive house technology. The platform proved itself a successful example of how to create the preconditions for such broad market introduction of cost-efficient passive buildings [3, 4]. Available knowledge is now rigorously selected, analysed, structured and made accessible for future builders, architects and the general public. Networking events in themselves lead again to new building teams and collaborations. Today we see that in Belgium in the field of passive houses, a predefined goal of 100% market growth is reached.

2. CURRENT STRATEGY OF KNOWLEDGE TRANSFER OF PASSIVE BUILDINGS

2.1 Communication

From the beginning the mission of the platform was to make people aware of the existence of passive houses. Now that people become interested to build passive buildings, communication activities have shifted towards the provision of more technical information. Communication is mainly web-based and includes a web site and electronic newsletters to more than 2500 building contacts. A standard programme of requirements is available for building teams, as well as general information for the general public. A calculation package for passive houses has been translated and adapted for the Benelux climate. This package now serves as a quality assurance package for certification of new building projects. Future activities include the introduction of a project and a technology database on the web site.

2.2 Events

Every year a Benelux symposium on passive houses is organised, covering the evolution in the market. This is combined with a yearly passive house technology fair and visits to demonstration buildings.

Also assembly SME participation of innovative companies at major building fairs is stimulated. In this way small and medium enterprises get a chance to participate at important building fairs and to show and introduce innovative technologies.

Study trips to Germany are very popular and provide excellent networking for the planning of new projects. But also on site demonstrations of Flemish projects are regularly organised. The platform itself has become a popular candidate for contributions at seminars, courses on sustainable building development, open company days, and so on. Recently also the organisation of workshops cover ed more experienced topics like fenestration, ventilation, quality assurance and calculation procedures.

2.3 Technology transfer

Where as the communication and events stimulate the demand side, networking through the platform realises that the production side is stimulated as well. From the beginning a strategy was established to help small and medium enterprises to provide products, systems and services for a passive house market. SME's and building teams are contacted in a pro-active way to introduce the passive house concept. Motivated companies are guided in

the way to inquire for Flemish innovation grants and to attract participation of knowledge institutes. The strategy further also includes the establishment of contacts with foreign companies and institutes and a technology, grant and legislation watch for companies and building teams.

The strategy proved to be a success. Commercial production of Flemish passive house building systems is now planned by at least three system builders. Five types of passive house fenestration are now available on the Flemish market, as well three types of high efficiency residential heat exchangers. An alternative for triple glazing is being developed.

2.4 Consultancy and research

On demand consultancy services are provided focussed on the labelling and quality assurance of passive houses. The task of the consulting engineer is thus not replaced but completed with commissioning. Also for local governments aid is provided in the definition of grants, assistance on building fairs, the follow-up of energy research, communication, etc. Recently a European project 'PEP: Promotion of European Passive Houses', under the framework of Intelligent Energy Europe introduced a European passive house definition and regional certification methodology, which use is stimulated by the platform. In October 2005 the platform launched the Belgian 'certificates' for passive houses (habitats) based on the results of this project. Seven first projects were thus granted a quality assurance by the State Secretary of Sustainable Development and Social Economy. Projects with quality assurance are promoted as good examples for reproduction in the general market.

3. CERTIFIED PASSIVE BUILDINGS IN BELGIUM IN 2005

The following tables show the buildings that have been realised in the Flanders Region since the creation of a passive house platform and that have received a passive house quality assurance document. The quality assurance guarantees that the energy use for heating is limited to 15 kWh per m2 net conditioned surface and that an air tightness level is achieved of n50 below 0,6 h^{-1}. The specific performance criteria for passive houses, design guidelines and regional programmes of requirements are available from the web site http://www.europeanpassivehouses.org. The passive house standard is purely an energy performance standard that allows architects otherwise to develop their projects in total freedom. A Dutch database of all passive house projects in Belgium is available on http://www.passiefhuisplatform.be. In some countries, like Belgium, certification as a passive house is coupled to regional grants. The owners are very enthusiastic about the ventilation, light, thermal and acoustical comfort and the attention from outsiders.

3.1 Heusden-Destelbergen

This wooden row house with two exterior facades by architect Bart Cobbaert was the first example of a cost-efficient passive house in Flanders. It is located in a dense urban area. Construction costs were limited to 800 EUR per m2 thanks to extensive collaboration in a building team. A double wood skeleton frame was used for the outside walls wooden trusses for floors and walls to integrate ventilation conduits. The following table shows some of the details of this project.

Table 1: Urban passive house in Heusden-Destelbergen (architecture & calculation: denc!-studio; contractor: lab15; consultancy: Cenergie cvba; blower-door test: isoproC)

Construction			
	Insulation	Thickness [mm]	U-value [W/m²K]
Floor	EPS	160	0.194
Wall – outdoors	mineral wool + air gap	329+38	0.110
Wall – outdoors	mineral wool + vermiculite	178+150	0.139
Roof	mineral wool	350+80	0.094
Windows	triple glazing with low-e coating		0.790

Technical information	
Earth-air heat exchanger	length: 40 m, depth 1.5 m, Ø 110 mm
Heat recovery from exhaust air	counter–flow heat exchanger
Supply water heating	solar collectors + gas boiler
Solar collectors	yes
PV panels	yes
Air tightness	n50 = 0.57 h-1

Figure 1: Urban passive house in Heusden-Destelbergen (arch. Bart Cobbaert)

3.2 Heusden-Zolder

This freestanding house by architect Eric Ubachs was the first Benelux example of the implementation of a building system for the construction of a passive house. The project is constructed in a wood platform building method. OSB panels provide a good air tightness level. All details have further been documented and perfected in the framework of an innovation study of a merchant of FJI-studs. Both previous examples are well documented in the Belgian national brochure of passive houses, available for download and for free on www.europeanpassivehouses.org

Table 2: Passive house in Heusden-Zolder (architecture: Eric Ubachs; contractor: Vanhout NV; materials: isoproC, Hanssens Houtconstructies, ecom@; Ecobouw; technical installation: IZEN, esco+; consultancy: Cenergie cvba)

Construction			
	Insulation	Thickness [mm]	U-value [W/m^{2}K]
Floor	EPS	250	0.127
Wall	2×mineral wool + air gap	45+280+100	0.121
Roof	mineral wool	350	0.104
Windows	triple glazing with low-e coating		0.790

Technical information	
Earth-air heat exchanger	length: 40 m, depth 2 m, Ø 173-200 mm
Heat recovery from exhaust air	counter–flow heat exchanger
Supply water heating	solar collectors + gas boiler
Solar collectors	yes
PV panels	no
Air tightness	n50 = 0.20 h-1

Figure 2: Passive house in Heusden-Zolder (arch. Eric Ubachs)

3.3 Ename

This house was constructed by a person working in the health sector as a (passive) house using ecological materials with a main goal of living healthy and economically. The house is now open for courses on 'how to live and cook in a passive house'. More information on www.passiefhuisplatform.be

Table 3: Passive house in Ename (architecture: Christophe De Brabander; materials: isoproC, ecom@, De Noordboom, Hanssens Houtconstructies; technical installation: Stroomop; blower-door test: @home)

Construction			
	Insulation	Thickness [mm]	U-value [W/m^{2}K]
Floor	EPS + cellulose	150 + 190	0.114
Wall	cellulose + feather (air gap)	422 + 40	0.151
Roof	Cellulose + air gap	350	0.099
Windows	Wood/PUR joinery + triple glazing with low-e coating		0.780

Technical information	
Earth-air heat exchanger	length: 35 m, depth 1.8 m, Ø 200 mm
Heat recovery from exhaust air	counter–flow heat exchanger
Supply water heating	solar collectors + pellet stove
Solar collectors	yes
PV panels	no
Air tightness	n50 = 0.47 h-1

Figure 3: Passive house in Ename (arch. C. De Brabander)

3.4 Wijtschate

This house is constructed with FJI studs as a carrier beam for the wall and the roof, a construction system developed mainly for passive houses. The habitat serves a family of five and a doctor's practice. There are three different temperature areas: the practice 24 °C, the parent bedroom and the other rooms.

Table 4: Passive house in Wijtschate (architecture & calculation: denc!-studio; contractor: lab15; materials: MB Benelux, Artiklima, isoproC, Hanssens Houtconstructies; blower-door test: isoproC)

Construction			
	Insulation	Thickness [mm]	U-value [W/m²K]
Floor	EPS + EPS	160 + 100	0.117
Wall	3 x mineral wool + mineral wool (air gap)	38 + 224 + 38 + 38	0.110
Roof	3 x mineral wool + air gap	38 + 324 + 38 + 22	0.093
Windows	Wood/cork joinery + triple glazing with low-e coating		0.740

Technical information	
Earth-air heat exchanger	length: 40 m, depth 2 m, Ø 200 mm
Heat recovery from exhaust air	counter–flow heat exchanger
Supply water heating	solar collectors + gas boiler
Solar collectors	yes
PV panels	no
Air tightness	n50 = 0.35 h-1

Figure 4: Passive house in Wijtschate (arch. denc!-studio)

3.5 Torhout

This house has a wooden skeleton structure filled with mineral wool and an outside brick facade. The construction costs are 1250€ per m². The owner got so enthusiastic about his project that he convinced a major regional company in the neighbourhood to deliver suitable passive house technology. The project also uses a collector of rainwater 15000 l for the toilet, shower, laundry and garden.

Table 5: Passive house in Torhout (contractor: De Noordboom; materials: isoproC, Deceuninck; blower-door test: isoproC)

Construction			
	Insulation	Thickness [mm]	U-value [W/m²K]
Floor	EPS	300	0.112
Wall	3 x mineral wool + mineral wool (air gap)	320 + 90	0.115
Roof	3 x mineral wool	168 + 210 + 90	0.093
Windows	PVC/PUR joinery + triple glazing with low-e coating		0.76

Technical information	
Earth-air heat exchanger	length: 40 m, depth 2 m, Ø 200 mm
Heat recovery from exhaust air	counter–flow heat exchanger
Supply water heating	solar collectors + pellet stove
Solar collectors	yes
PV panels	no
Air tightness	n50 = 0.40 h-1

Figure 5: Passive house in Torhout (arch. G. Sabbe)

3.6 Willebroek

This house is a semi-detached construction and the first passive house built for sales to a different owner by a contractor.
The collaboration of the building team led to a good handling of different grants and a social loan.

Table 6: Passive house in Willebroek (contractor: Vanhout NV; calculation: denc!-studio; materials: MB Benelux, isoproC, Hanssens Houtconstructies; technical installation: Artiklima bvba; blower-door test: isoproC)

Construction			
	Insulation	Thickness [mm]	U-value [W/m^{2}K]
Floor	EPS	220	0.150
Wall	cellulose)	38+224+38	0.132
Roof	cellulose	38+324+38	0.110
Windows	wooden joinery + triple glazing with low-e coating		0.74
Technical information			
Earth-air heat exchanger	length: 50 m, depth 2 m, Ø 200 mm		
Heat recovery from exhaust air	direct current heat exchanger		
Supply water heating	heat pump		
Solar collectors	no		
PV panels	no		
Air tightness	n50 = 0.60 h-1		

Figure 6: Passive house in Willebroek (arch. FDA)

3.7 Bocholt

This wooden house is designed as a square oriented to the sun. There's also an office included.

Table 7: Passive house in Bocholt (calculation: denc!-studio; materials: MB Benelux, isoproC, Hanssens Houtconstructies)

Construction			
	Insulation	Thickness [mm]	U-value [W/m^{2}K]
Floor	PUR	150	0.168
Wall	cellulose + mineral wool (air gap)	350+53	0.100
Roof	Cellulose + air gap	36+400 +22	0.093
Windows	Al/wood/cork joinery + triple glazing with low-e coating		0.750
Technical information			
Earth-air heat exchanger	length: 40 m, depth 2.3 m, Ø 200 mm		
Heat recovery from exhaust air	counter–flow heat exchanger		
Supply water heating	solar collectors + gas boiler		
Solar collectors	yes		
PV panels	no		
Air tightness	n50 = 0.34 h-1		

Figure 7: Passive house in Bocholt (M. Cuyvers)

4. INTRODUCTION OF THE PASSIVE HOUSE STANDARD IN SERVICE BUILDINGS

In 2005 also a first service building in the passive house standard was realised in Belgium. This project is an office of the harbour company of Ghent with improved specifications of ventilation, overheating, …

Table 8: Passive house office building in Gent (sustainable building concept: Cenergie cvba)

Construction			
	Insulation	Thickness [mm]	U-value [W/m^{2}K]
Floor	Resol	140	0.14
Wall	Mineral wool + air gap	240 + 50	0.15
Roof	PIR	240	0.11
Windows	HDPU interrupted wood + triple glazing with low-e coating		0.8
Technical information			
Earth-air heat exchanger	2 x length: 40 m, Ø 800 mm		
Earth- air heat exchanger for the server room	Ø 300 mm		
Heat recovery from exhaust air	heat wheel with moisture recycling		
Supply water heating	2 x gas-fired condensation boiler 64 kW		
Overheating	automatic sunshade blinds		
Solar collectors	no		
PV panels	no		
Air tightness	n50 = 0.55 h-1		

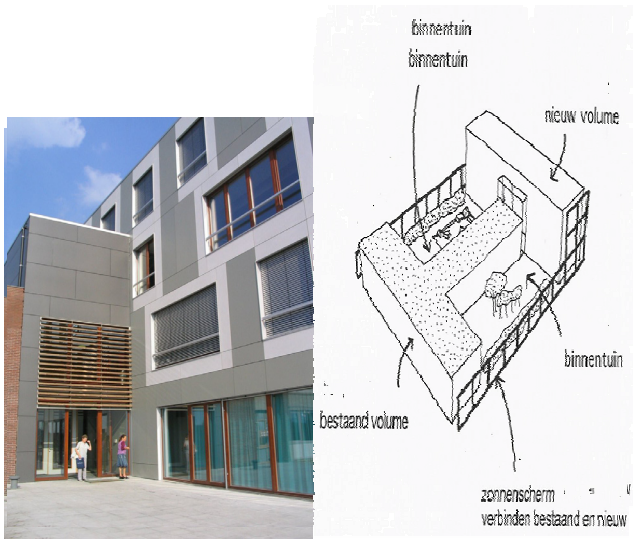

Figure 8: Passive house office building in Gent (arch. evr-architecten)

CONCLUSION

These examples show the variety of initiatives. About forty new passive buildings are under construction and a lot more in planning. Amongst those are also large-scale new passive house educational buildings in Beernem [4], Gent and Nivelles [4]. The universities of Gent and Leuven have monitored the passive houses in Heusden-Destelbergen and Heusden-Zolder and results are available from the proceedings of the Benelux symposia [4-6]. Required air tightness levels were reached, concerns about the ventilation equipment lead to improvements.

There is a definite need for a fast and cost efficient certification strategy and for cheap expert input of quality information during the design process, to assure the high standard set from the beginning. An international working group now takes the (German) PHPP software as a starting point for labelling initiatives, to obtain foolproof regional procedures. The PEP-project should provide for a fast answer to obtain a uniform European procedure, with adaptation towards local energy performance legislation and building codes, e.g. due to the introduction of the EC energy performance directive for buildings. Certification of passive house technology will be introduced shortly.

ACKNOWLEDGEMENT

This paper is a result of the participation of PHP in the project 'PEP: Promotion of European Passive Houses'. The PEP-project is partially supported by the European Commission under the IEE Programme EIE/04/030/S07.39990. PHP also wishes to thank IWT for funding the VIS-TIS project 'Passiefhuis-Platform' and the Nationale Loterij for their support to introduce the passive house concept on a federal level.

REFERENCES

[1] Mlecnik, E., PHP: towards radical energy reduction in Flemish buildings, 7e Internationale Passivhaustagung, Feb. 21-22, 2003 Hamburg, Germany, 271-274.
[2] Mlecnik, E., The success of the passive house in Belgium, 8e Europäische Passivhaustagung, Apr.16-18, 2004, Krems a.d. Donau, Austria, 585-589.
[3] Mlecnik, E., Demand and supply solutions for more passive buildings: implementation of PHP, 21th PLEA conference, Sep. 19-22, 2004, Eindhoven, NL.
[4] PHP, Proceedings of PHS 2004 2nd Benelux Passive House Symposium, Gent, Belgium, Oct. 22, 2004 (pp.300).
[5] PHP, Proceedings of PHS 2003 1st Benelux Passive House Symposium, Turnhout, Belgium, Oct. 24, 2003 (pp. 180).
[6] PHP, Proceedings of PHS 2005 Passive House Symposium, Aalst, Belgium, Oct. 21, 2005 (pp. 402).