

PassREg

FINAL REPORT

Passive House Regions with Renewable Energies



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1 Foreword

Passive House regions show what the sustainable future of building construction will look like: energy efficient and cost-effective. With the Passive House standard as a basis, complemented with regional renewable energy sources, participating cities and partners are delivering a blueprint for the Nearly Zero Energy Building, the introduction of which in the European Performance of Buildings Directive's revision in 2010 was a major step towards achieving the energy and carbon reduction goals. The PassREg project has been instrumental initially in establishing what nearly zero looks like, and later in demonstrating how entire regions can move towards a comprehensive and sustainable definition and successful implementation of NZEBs. Proper performance is essential for success: therefore, PassREg consistently builds upon proven design tools (PHPP) and certification procedures, thus strengthening the quality assurance infrastructure in the partner countries.



The landscape today, three years after the start of the PassREg project, looks very different. Passive House beacons, with renewables produced on-site or nearby in the regions, were built not just in the participating regions, but are now to be found across the EU. PassREg has pushed us to understand the impact and potential of integrating NZEBs at the regional level. This was accompanied by the introduction of the innovative Passive House classes relating to renewable energy supply: Passive House Plus and Premium.

Both the front runner regions and aspiring regions in PassREg have now created a blueprint for Nearly Zero Energy Buildings. They have shown us the way, and it is now time for other municipalities to follow. We invite all regions to join the network established by PassREg¹ and the iPHA² and thus become Passive House regions.

Dr. Wolfgang Feist
Director, Passive House Institute
Professor, Innsbruck University

¹ www.passreg.eu

² www.passivehouse-international.org

2 Executive Summary

The PassReg project aimed at introducing the Passive House concept with its superior energy efficiency combined with the energy supply from renewable sources on a regional level. This makes municipalities and regions capable of taking responsibility and acting as front runners today, years before it becomes mandatory with the Energy Performance of Buildings Directive (EPBD), recast of 2010, and as a consequence motivating them to assist the national authorities in the definition of the NZEB, which the EU has left to the individual member states. The cities and regions act as shining examples in their countries and pave the way towards NZEB implementation.

The PassREg project investigated front runner regions which have successfully implemented Nearly Zero Energy concepts using Passive House supplied as much as possible by renewable energies as the foundation. The lessons learned and the solutions applied in these regions serve as a basis for adaptation and implementation in other regions across Europe. The project, co-funded by the EU within the framework of the IEE and with participating regions from 10 European countries thus supports the implementation of the European Buildings Directive (EPBD), recast 2010 and makes an important contribution to the achievement of the EU's efficiency goals for 2020.

The deadline of 2018 for public buildings and 2020 for all new builds meant that Member States would not only need to define and implement these new requirements as policy but also work to shift entire markets and move an entire industry towards something new. This was the starting point of PassREg.

The methodology for convincing local politicians and stakeholders was to choose three front runner regions: Brussels, Hanover and Tyrol, closely connected with the PassREg partner organisations PMP (Brussels), proKlima (Hanover) and IG Passivhaus Tyrol (Innsbruck). The cities of Heidelberg and Frankfurt acted as supporting associated regions. The front runners opened their doors and allowed other regions to have a look behind the curtain, explaining their successful model structures. As outcomes, detailed descriptions of their successful structure were worked out and are available on the PassREg website www.passREg.eu. Eight cities and regions that were not familiar with the Passive House approach but were willing to learn joined the project. These were the City of Antwerp in Belgium which was connected to PassREg via the partnering organisation PHP, the City of Burgas in Bulgaria, the City of Zagreb in Croatia, and the City of Cesena in Italy. In the Netherlands the region around Arnhem-Nijmegen joined through the partner DNA in de bouw, Carmarthenshire in Wales through the partner BRE, Aquitaine in France through Nobatek, the City of Gabrovo in Bulgaria via the partner EnEffect, and the regions Latgale and Vidzeme in Latvia through the partner LEIF. In Italy, eERG from the University of Milano worked together with several cities and regions in Italy. The Passive House Institute coordinated the project and played a supporting role for all the partners in this process. The so-called aspiring regions were encouraged to understand and to learn from the front runners and from each other, to establish contact, and the cities and regions should ultimately develop their own new success models. Because the situation in each country is different, the process was not to simply copy other models, but for new ones to be adapted to the specific needs of the region.

Many success stories have been reported. While the already existing front runners have grown and the Passive House became more and more standard (e.g. standard in Brussels since 1 Jan 2015, 30%



of all new builds in Hanover, 21 % Passive House share in Tyrol (2014)³), many local successes could be achieved in the regions which are striving to become front runners: e.g. integration into the regulatory framework (SEAPs, sustainable development plans (Burgas, Cesena, Zagreb), first certified Passive House kindergarten in Gabrovo (Bulgaria), further development of the Nieuw Zuid quarter in Antwerp, a public building with the lowest energy demand in Latvia, Passive House regulations in several cities in Italy, one in Portugal. Sustainable training frameworks were established in all partnering countries (e.g. in Aquitaine, the training institution KERN in the Netherlands).

All the information has been distilled into a Success Guide which helps politicians, municipal staff and other stakeholders to learn how to proceed on the path of change towards NZEBs using Passive House + Renewables.

As stated by Matthias Wohlfahrt from the front runner proKlima/Hanover: “High quality beacons are the first and probably most important step in the beginning. They form the basis to demonstrate what is possible.” PassREg supported 48 beacons in all partner regions, old and new, small and large-scale - even entire districts (Heidelberg-Bahnstadt, Antwerp Nieuw Zuid) were among them. This was achieved simply through disseminating information at info sessions, more targeted training and even by providing calculation and monitoring support with the PHPP. The most important specifics and enabling factors have been compiled in a report⁴ about the beacon specifics.

On their way towards NZEBs, all stakeholders need information about excellent and proven solutions. In order to fulfil the needs of designers, producers, politicians, trainers, investors, certifiers, builders and owners, wiki-based tools were further developed and newly set up. While Passipedia⁵ is the continuously growing and quality-assured online resource on energy efficiency in building, the PassREg – Solutions Open Source⁶ provides an open platform relating to policy, the business case and financing, communication, construction, design and consultancy, and quality assurance and monitoring of NZEBs based on Passive House. It is primarily in English, but many articles are also already available in Dutch. It has been extended to include the French, Bulgarian, Croatian, Latvian and German languages. Other important pieces of the puzzle include the training of architects and tradespeople. Since relevant training for architects and engineers are already widely available, the training material for tradespeople was translated within the framework of the PassREg project. In addition to German, it is now also available in English, Dutch, French, Italian, Croatian, Bulgarian and Latvian, and sustainable training delivery structures have also been implemented. , Additional modules on the integration of renewables, energy efficient cooling, integrated design and training of certifiers have been developed for designers. A new interactive map helps beginners to find suitable components for their first Passive

³ In 2013 the share was 41%. It was extraordinary high because of the finalization of the O3 complex with more than 600 living units.

⁴ Beacon specifics, experiences and lessons learnt http://www.passreg.eu/index.php?page_id=374

⁵ www.passipedia.org

⁶ http://passregsos.passiv.de/wiki/PassREg-Solutions_Open_Source



Houses. Monitoring has shown the reliability of the Passive House approach and PHPP calculation: efficiency without performance gaps.

The method described in the integrated design module was also described in a booklet available on the PassREg website and in the SOS. In the Dutch section, this method is promoted as a new culture in the building sector and is being used very successfully. Originally used in IT development, it is called “agile project management” with “scrum teams”.

PassREg helped the Passive House Institute to develop the new Passive House categories Passive House Classic, Passive House Plus and Passive House Premium which – through the integration of renewable energy produced nearby in the certification scheme – relates very clearly to the NZEB development. For this purpose, the PHI proposes consistent assessment in a renewable energy scenario in a sustainable future. This is based on PER (renewable primary energy) factors.

PassReg also supported a variety of communication activities. In addition to the Passive House Conference, where results of PassREg were presented in different sessions, the beacons also opened their doors to provide information about Passive House technology. A special highlight is the PassREg brochure which describes the PassREg approach as a blueprint for the NZEB definition. It is available in all partner languages and is ready to be translated into other languages. An additional highlight was the Passive House Award 2014 with its category ‘Regions’ which was awarded to the Bahnstadt-Heidelberg in Germany; this is the world’s largest carbon-neutral Passive House city district which is supplied by a wood-chip power plant.

The PassREg consortium came to the conclusion that the lessons learnt can be summed up as follows:

- Political actors need to know that Passive House + renewable energy sources can be used to fulfil the European Buildings Directive.
- Architects and tradespeople require expertise to implement Passive House + renewable energy sources.
- Investors need the right financial incentives so that a decision in favour of Passive House + renewable energy sources is easier to make.
- Good beacons in the region are the first and probably the most important step in the beginning
- Active communication campaigns at EU, national and local level are needed to provoke those political and market actions which are required for a sustainable uptake of NZEB and Passive House + renewables as its proven and cost efficient solution throughout the EU.

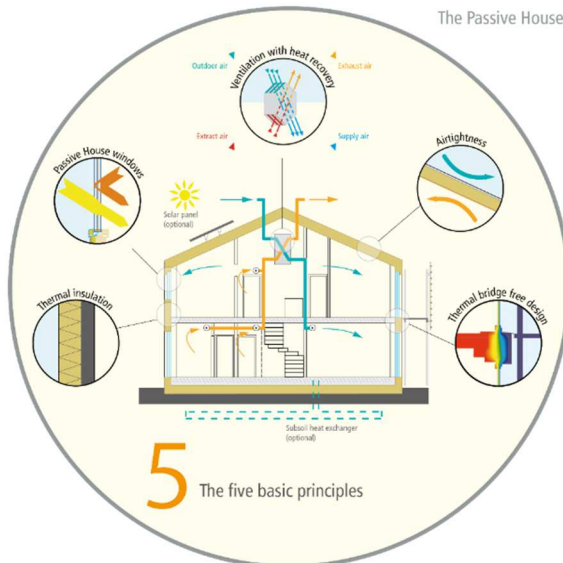
However, the processes that member states go through towards implementing the recast 2010 of the Energy Performance of Buildings Directive in national law are very complex. A political consensus has to be found, capacities built, new laws drawn up, and stakeholder acceptance attained. These are all processes that take time and require commitment, continuity, and knowledge. PassREg has provided the most interesting and helpful features towards a NZEB culture with Passive House + Renewables.

3 The PassREg project and concept

Passive House leads to NZEB

The Passive House Standard is well-known and has proved successful for over 20 years. Thanks to their extremely low energy use, regionally based renewable energy sources can easily play a substantial role in the supply of Passive Houses: a proper match, and a perfect prototype for the NZEB. In the PassREg project, this message was disseminated and multiplied all throughout Europe. With Passive House as

the basis, energy efficiency is prioritised. This creates a more sustainable development as energy that does not need to be used in the first place also means it does not need to be created. Using the Passive House principles reduces the energy demand by up to 90% of an average conventional European building. This means there is a very low amount of energy that still needs to be met and this can easily be done through renewables. A key component of the NZEB requirements is also cost-optimality, which is achieved through the Passive House Standard as the requirement for the choice of components has been set at a well-proven cost-optimal point.



©PHI, the five Passive House principles

The Passive House Standard is defined by five basic principles: an airtight building envelope, an adequate ventilation strategy, appropriate windows, a thermal-bridge free design and proper insulation.



©PHI, Passive House, a highly energy efficient building, coupled with on-site or nearby renewables is the perfect match for the NZEB.

Passive House is a concept that is climate-independent and applicable for all building typologies. This means that any building can be a Passive House and can be built anywhere. To date, there are actually Passive Houses built in every single Member State of the EU and there are many Passive Houses beyond the European borders, making it the most widespread approach in meeting NZEB requirements. The Passive House Standard has an annual heating energy requirement of less than 15 kWh/m², leaving very little energy demand to be covered by renewables.

The PassREg concept

The PassREg project aimed to offer a direct and efficient way towards the execution of the overall European goal – the introduction of Nearly Zero-Energy Buildings (NZEBs) as standard design and construction practice by 2020 based on the Passive House Standard supplied by renewable energies. The concept was to provide a framework which encourages municipalities and regions to take on the role of front runners which the European Commission already expects from them today, years before the deadline set by the EPBD, and to motivate them to assist EU Member States in finding their definition for NZEBs. The overall concept of the PassREg project is based on the firm conviction that the Passive House Standard is the ideal basis for the NZEB supplemented by renewables generated on-site or nearby, limiting the annual energy demand of new buildings to 15 kWh/m², both for heating and cooling. The concept used so-called Front Runner Regions (FRR) that were extremely successful in implementing the Passive House Standard with additional supply from renewable sources in their municipalities and regions, as models for Aspiring Regions (AR). The concept was to analyse the experiences of these FRRs and using the best practices and momentum of these to transfer the lessons learned to the ARs. Aspiring Regions would then implement Passive House practices through beacon projects to illustrate their implementation and the potential of ‘Passive House + renewables’ in achieving energy policy goals and incoming national requirements. Through this process, municipalities would act as leaders in defining what a ‘nearly zero’ building really is and how it could be most effectively put into practice on a broad scale. Lessons learned at the municipal or regional level could then also be transformed into national definitions or requirements for the NZEBs, showing the success and applicability of this concept. In the PassREg concept, the implementation of new models in the so-called Aspiring Regions were supplemented by supporting beacon projects through training, info sessions, PHPP support and monitoring, and has provided a wide range of solutions a) in the form of a tool, called PassREg Solution Open Source and b) through training courses and additional solutions in the field of quality assurance and c) extensive dissemination work.

3.1 Brief summary of the PassREg results

PassREg can report many results on different levels. While the already existing front runners became much stronger in the implementation of Passive House + renewables as a blueprint for NZEBs during the life-time of the project (Passive House is now standard in Brussels, 30% of the new build rate in Hanover are Passive Houses, in Tyrol the Passive House rate has increased to 41 % (2013), a variety of new model structures have been developed and implemented in the aspiring regions. The highlights have been compiled in a Success Guide. In several cities, Passive House + renewables has been/will be implemented in the SEAPs or City development plans (Burgas, Cesena, Antwerp), and specific Passive House regulations have been decided in several cities of Italy and in Portugal in the municipality of Agueda. A variety of beacons have been supported in all regions ranging from single-family houses, kindergartens and schools to entire urban settlements (e.g. Nieuw Zuid in Antwerp, Bahnstadt-Heidelberg in Germany). The city of Gabrovo in Bulgaria has achieved the first certified Passive House building in Bulgaria, the Sun Kindergarten, and LEIF (Latvia) is proud to have the public building with the lowest energy demand in Latvia: the Ērgļi school which was renovated using Passive House



components. Other Passive House kindergartens are in the procurement process in the cities of Burgas and Varna (BG). Some regions have a longer way to go (e.g. Zagreb and Aquitaine report on the raised capacities of the municipal staff and on a pilot project which has almost reached the Passive House Standard and which has been constructed using timber from local sources) than others (e.g. Antwerp, where some structures and a determined political will were already in place). A more business-oriented approach has been pursued in the region Arnhem-Nijmegen (NL). Morphological design and BIM support an innovative project design and delivery process with so-called 'scrum teams'. Originating in IT development and now transferred to construction, it provides a new approach for NZEB renovation based on Passive House + Renewables. For supporting the transition to NZEB construction culture, an open source database of solutions has been created. It is called PassREg Solutions Open Source (SOS). It provides an addition to the Passive House Institute's Passipedia where all kinds of information is provided relating to Passive House construction and the integration of renewables. Because training is an important key factor, training materials for craftsmen are now available in all partner languages and sustainable training structures have been created in all the regions (either through cooperation with existing organisations or by initiating a training institution KERN in the Netherlands).

The Passive House Institute has developed/updated the criteria for transparent and opaque components and preliminary criteria for testing of units for cooling and frost protection. In addition, the PHI laid the foundation for the PER (renewable primary energy) factors which directly lead to the new Passive House classes in the PassREg project. With regard to NZEB, the integration of renewables in the Passive House concept which follows the energy efficiency first approach is particularly interesting. Monitoring results are available from the Ērgļi project (simplified monitoring) and from the Marche and Sicily beacon project in Italy and also from the Bahnstadt in Heidelberg/Germany.

In addition to the more political and technical results, PassREg has produced a variety of PR material. This includes the PassREg brochure "Defining the Nearly Zero Energy Building: Municipalities lead the way". It is available in German, English, Dutch, French, Latvian, Italian, Bulgarian and Croatian. A special outcome was the Passive House Award 2014 for regions, which was given to the Bahnstadt-Heidelberg as the world's largest climate-neutral Passive House settlement which is supplied by a wood-chip power plant.

3.2 Who are the partners? Short introduction



The Passive House Institute (PHI) is an independent research institute lead by Dr. Wolfgang Feist and located in Darmstadt, Germany. It has a growing interdisciplinary team of employees focused on the research, development and implementation of energy efficient buildings around the world. PHI has played an especially crucial role in the development of the Passive House concept, including the first pilot project 25 years ago. It is also responsible for the development of criteria for the certification of buildings, components and construction professionals, in addition to providing energy balance planning tools to assist in the development of energy efficient buildings. Within the framework of



PassREg, PHI has acted as the project coordinator and work package leader for quality assurance and capacity building as well as communication.

bre BRE is an independent and impartial research-based consultancy, testing and training organisation, offering expertise in every aspect of the built environment and associated industries. BRE helps clients create better, safer and more sustainable products, buildings, communities and businesses - and we support the innovation needed to achieve this. BRE represents Wales (UK) within the PassREg project and is responsible for project dissemination activities for the region. BRE has worked with Local Authorities to establish Passive House Beacon projects and has also established Passive House training and certification providers in the UK.



Burgas is the fourth largest city in Bulgaria and the most important economic, logistic and touristic municipality in South-Eastern Bulgaria. With more than 210 000 inhabitants, Burgas is a fast developing city with increasing potential and needs, which is why ensuring sustainable development is of paramount importance. Commitment to sustainable urban policy has been demonstrated since 2008 when Burgas became one of the first cities to join the Covenant of Mayors. In fulfilment of its commitments under the Covenant of Mayors, in 2011 the Municipality developed and adopted the "Sustainable Energy Strategy of Burgas Municipality 2011 - 2020". In 2014, Burgas officially joined the initiative Mayors Adapt. In 2015 the city became one of the first in South East Europe to sign the Green Digital Charter.



The City of Zagreb is the capital and the largest city of the Republic of Croatia. It is a unit of local administration and at the same time of regional administration at county level. By a decision of the City of Zagreb Assembly dated October 30 2008, the City of Zagreb joined the Covenant of Mayors as one of the first European capitals and became a Supporting Structure to the Covenant of Mayors on April 27 2009. As part of its regular activities, the City office for Energy, Environment and Sustainable Development is authorised to undertake activities in the field of energy as well as climate and environment protection.



Comune di Cesena

Cesena is situated in Northern Italy in the Emilia-Romagna Region; together with Forlì, it is the capital of the Forlì-Cesena district. Cesena has a population of about 96 935. The municipality signed the Covenant of Mayors in November 2009 and in 2011 approved a Sustainable Energy Action Plan (SEAP) that focuses on energy efficiency in public and private buildings and in public spaces. In the same year, the city established an in-house company Energie per la Città Ltd which deals with all the energy related issues of municipal buildings (energy management, facility management etc.). Cesena has also implemented important EU projects relating to energy efficiency strategies.





The Centre for Energy Efficiency EnEffect is the oldest Bulgarian NGO in the field of energy efficiency and RES, founded in 1992 in Sofia with the mission of supporting the sustainable energy development of the Bulgarian public authorities and the private sector. Through its specialised business subsidiaries EnEffect Consult and EnEffect Design, it performs energy audits of buildings and industrial systems and provides integrated design of low energy and Passive House buildings. EnEffect also acts as the Secretariat of the Municipal Energy Efficiency Network EcoEnergy (a Covenant of Mayors supporter). As part of the EEE international consortium, EnEffect manages the Bulgarian Energy Efficiency and Renewable Sources Fund. It is coordinator of the EU-financed projects BUS Bulgaria, BUS EnerPro and Train-to-NZEB.



Recapitulating the initial experiences gained recently with large-scale construction based on Passive House principles (Mitterweg and Lohbach, both social housing with 60+298 apartments, about a dozen single-family houses), the need for capacity building in the planning and construction of highly energy efficient thermal envelopes based on the Passive House principles was felt by the involved planners and constructors. This was the starting point of the regional NGO network IG Passivhaus Tyrol, which was founded in 2002/2003 as a private initiative to spread specific knowledge and raise awareness and make the Passive House Standard perceptible to the public and to communicate the long-term benefits to politicians, decision makers and other essential stakeholders in Tyrol. 95 members now represent competence in planning, engineering and construction of nearly zero energy buildings, the network regularly organises information and dissemination events, and provides guided tours to construction sites and buildings that are now inhabited.



The Latvian Environmental Investment Fund ("the Fund") was established on 28 April 1997. The Ministry of Environmental Protection and Regional Development of Latvia owns 100% of the Fund's shares. The mission of the Fund is to reduce environmental pollution, promote the implementation of environmental protection projects and also to increase the capacity of municipalities and commercial organisations for the preparation and implementation of qualitative and effective projects from initial conception to realisation. Our activities are directed towards achieving maximal improvement of the environment, and investing financial resources in the implementation of environmental infrastructure development projects. For over 18 years, the Fund has supported commercial activities in the public and private sector, providing financial incentives for the realisation of projects for the development of environmental and business infrastructure. Starting in the year 2010, the Fund has supervised the implementation and post-implementation monitoring of projects co-financed by the 'Green' financial instrument (green investment scheme co-financing approximately 220 million EUR).





Nobatek is private non-profit technological research centre in France, working to promote and contribute to innovation in sustainable development and energy efficiency in building technology, architecture and urban planning. Nobatek carries out both R&D activities and short term assistance for private and public customers, working both on projects focusing on local specificities, and on international R&D projects aimed at collaboration in innovation and dissemination of best practices. For private and public building owners and architects, Nobatek provides services for the design and assessment of sustainable buildings and neighbourhoods, with more than 100 sustainable building projects completed since 2005.



Passiefhuis-Platform vzw (PHP) www.passiefhuisplatform.be is a Belgian non-profit organisation founded in 2002, currently with over 300 members consisting of leading actors from the construction industry: contractors, developers, architects, energy advisors, engineers, product producers and suppliers. Also, members include science centres, institutes and universities. All of them are committed to energy efficiency and sustainable development in the built environment.

The goal of Passiefhuis-Platform vzw is to stimulate the construction of new buildings and renovation of existing buildings with minimum energy requirements (based on the Passive House Standard), use of renewable energy and minimisation of environmental impact with high quality for the building users. A specific focus of PHP activities is the support of SMEs and local authorities.



The Belgian Plate-forme Maison Passive asbl, called pmp, regularly participates in the selection and the realisation of exemplary buildings, providing support during the implementation phase, and for the appointment of experts, and even for dissemination of information or organisation of colloquiums about the obtained results. Aware that energy is not everything in sustainable construction, pmp is also involved in the definition of the new Belgian sustainable standards.

Expertise of pmp - pmp is the Belgian reference expert regarding highly energy efficient constructions based on the Passive House concept and actively contributes to the establishment of standards relating to energy efficiency in buildings. It prepares expert reports and analyses and leads research in various fields: thermal bridges, building services, analysis of the life cycle, etc. To fulfil its mission of dissemination, the platform conceives and prepares publications for advanced training of craftsmen, architects and engineering consultancy firms.

Free access software - pmp has also developed free access software (BeGlobal, ConnecTools) to help designers with their calculations, and in particular statistical tools allowing a comparative analysis of the data provided by the PHPP design tool (software specific to Passive House buildings).



The climate protection fund proKlima was established in 1998. It operates on the basis of a partnership contract, in which the City of Hanover and the local energy supplier Stadtwerke Hannover AG play a key role together with five neighbouring municipalities. proKlima provides 4.4 M EUR yearly, thus supporting the energy efficient renovation of buildings, introduction of the Passive House Standard, and introduction of energy efficient technologies in households as well as renewable energy. proKlima aims to promote local climate protection measures with financial incentives for energy saving investments, energy consulting and quality assurance. Since the fund was established, the local CO₂-emissions could be reduced by more than 1 Mt CO₂ / year. proKlima does not only support ecological targets through its financial incentives, its funding model also influences economic benefits indirectly: every Euro of proKlima financial support generates 12.7 EUR in local investments.

POLITECNICO DI MILANO



Within the Energy Department of Politecnico di Milano, the end use Efficiency Research Group (www.eerg.it - eERG-PoliMI), is dedicated to research, technology transfer and education about the efficient use of energy in buildings, particularly in the areas of zero energy buildings, passive cooling techniques, efficient lighting, and technical and economic analysis of energy-using products. Besides several other studies and projects, eERG has coordinated a European research project on the adaptation of the Passive House concept to the Mediterranean climates (www.passive-on.org). eERG also took part in the consortium which developed the study 'Towards nearly zero-energy buildings - Definition of common principles under the EPBD' for the EU Commission.



DNA in de bouw is a regional association of small-scale building professionals such as architects, contractors and engineers. By actively participating in DNA, small and medium-sized organisations with a big vision can make a difference. DNA has the ambition to facilitate the transition towards a sustainable society by developing and applying sustainable building techniques and by fostering cooperation in a multidisciplinary and integrated manner considering the complete lifecycle of a project. DNA optimises well-known methods like lean, scrum and morphological design for the building sector. "DNA" stands for De Nieuwe Aanpak, which means "the new approach".



3.3 General lessons learnt

The PassREg consortium came to the conclusion and Elena Giovanini from partner Cesena summed up the lessons learnt quite well:

- Political actors need to know that Passive House in combination with renewable energy can be used to fulfil the Buildings Directive.
- Architects and tradespeople require expertise to implement Passive House + renewable energy sources.
- Investors need the right financial incentives so that a decision for Passive House along with renewable energy is easier to make.

The processes that member states go through towards implementing the Buildings Directive in national law are very complex. A political consensus has to be found, capacities built, new laws drawn up, and stakeholder acceptance attained. These are all processes that take time and require commitment, continuity, and knowledge.

Political will is decisive. Without specialised information about Passive House + renewable energy sources, this is not possible. Political decision-makers generally do not know that Passive House in combination with renewables is a sound, inexpensive, and easily applicable approach for nearly zero-energy buildings. Municipalities that opt for Passive House in combination with renewables will have an easier time acting as pioneers, as expected by the EU. The solution is ready to be applied. Local authorities can play a particularly important role in driving change because they can decide the local framework more quickly than changing national regulations.

The PassREg team believes that **Passive House projects** must **first** be **built as beacons in the regions**, with convincing architecture, building quality, affordability, user-friendliness, etc. Good information material on the projects will help to disseminate the knowledge and to answer additional questions.

The Latvian PassREg partner LEIF reports: “Our reference project, Ergli in Vidzeme, is an example of an optimal procedure. The boarding school was retrofitted with Passive House components. A rundown old building from the Soviet days now has an impressive new look. In addition it has the lowest demand for heating energy of all public buildings in Latvia. We are able to demonstrate that a Passive House retrofit in combination with renewables is possible under the climate conditions in Latvia, that it is affordable, and that the planning targets were met. A before/after comparison shows that we used to need 154.8 kWh/m² to keep the building at 18 degrees Celsius. After the retrofit, we only need 9.8 kWh/m² for 20 degrees Celsius.”

Awareness-raising, information and **targeted/tailored training for architects and tradespeople relating to Passive House + renewables has to be available locally**, maybe more bite-sized. Raising capacity through training courses, tours, event activities are all important for gaining confidence in executing high quality nearly zero energy buildings using the Passive House Standard and renewable technologies. Architects need to know how to plan Passive House buildings and how renewables can be properly used. Craftsmen must also have the expertise for avoiding thermal bridges and ensuring airtightness, for instance. Another form of quality assurance is Passive House certification. Experience shows that certification makes communication with the public more effective.

Financial incentives help encourage decisions for more beacon buildings more quickly. Incentives are important as a helping hand for the beacon/example projects, which in turn help develop supply chains and gain support across the industry and stakeholders by demonstrating their success. This is clearly demonstrated by the progress made in the front runner regions Hanover (ref. CB13 proKlima), Tyrol and Brussels.

In Germany, a 2011 study⁷ calculated the added value that funding from the proKlima climate protection fund brought about. It found that every Euro of incentives from proKlima in 2010 led to 12.70 euros in investments. Translated to the transition that the construction sector will undergo in the next few years, this ratio means that incentive programs can effectively speed up further development.

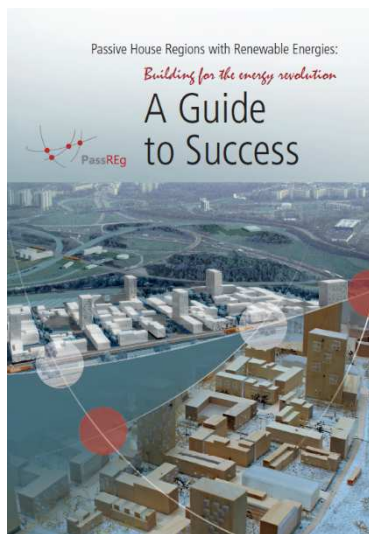
In conclusion, these factors are important: information, beacons, training and incentives. In the next few years, they will remain crucial for supporting Passive House + renewables as a solution for nearly zero-energy, zero-energy, and even Plus Energy buildings.

It might be added that local language is very important for communication. While communication at the EU project level is mostly completed in English, the translated communication and working documents of the project were found to be most successful. The 'localisation' of project results was one of the success factors.

The words of the front runner pmp may remind the future front runner not to rest on the successes: "Nothing can ever be taken for granted.... That is the lesson learnt by pmp from the long lobbying and support crusade in the sector. The inertia of the construction world and its aversion to change is forcing certain players to drag progress down, thereby constantly jeopardising the advancements. Nevertheless, the law has been adopted and applied since 1 January of this year, so there is no risk to report."

⁷ http://www.proklima-hannover.de/downloads/proKlima/4_proKlima_Evaluation_Bericht.pdf

4 Success stories are showcasing the pathway (Success Guide)



The PassREg Success Guide is the product of an extraordinary collective effort of a group of enthusiastic building experts from 14 European organisations, supported by numerous cities and regions from 11 European countries. Inspired by the desire to shorten the path to the buildings of the future decades, these experts joined forces in the project “Passive House Regions with Renewable Energies” (PassREg) with the invaluable support of the Intelligent Energy Europe program of the European Commission.

PassREg experts studied the experiences of three European “front runner” regions with undoubted success in Passive House and NZEB design – Hanover, Brussels and Tyrol. The personal involvement, hands-on experience and examples of the applied solutions encouraged other “aspiring” regions - regions with the ambition of becoming front runners themselves - to follow. Thus, through the established PassREg network, policy makers and building experts exchanged ideas and practical knowledge, shared solutions and approaches, assessed the achievements and planned the next steps together.

While some of the aspiring regions made their first steps towards ‘passive’ and ‘nearly zero-energy’ buildings, other used the project to accelerate their movement forward. At the same time, front runners extended their ambitions to cover larger urban areas. Starting from the design of individual Passive House buildings, local and regional authorities moved through carbon-neutral neighbourhoods and even started to design and build entire cities consisting of Passive House buildings. The Passive House Standard was confirmed as a solid foundation for the long-term energy and building strategies and development plans of a number of European cities and regions.

In the PassREg Success Guide⁸, the interested reader will find a wide range of policies and specific actions that can inspire new followers. It offers links to other valuable sources of knowledge and information necessary on the road to the ‘nearly zero-energy’ building – and beyond. It is available in print and electronic version, and is accessible at www.passreg.eu.

4.1 The beacon projects: window into Passive House regions

The beacon projects represent outstanding best practice examples of Nearly Zero Energy Buildings (nZEB) implemented in the European “Passive House regions” – both front runners and aspiring – which make exemplary use of the PassREg strategy: Passive House principles plus renewables to cover the remaining energy demand, achieving optimal profitability and significantly saving GHG emissions.

⁸ Success Guide: http://www.passreg.eu/index.php?page_id=289

The PassREG beacon projects are either new builds or renovations, ranging from larger individual buildings to entire urban settlements. As case studies, the beacons provide valuable information about tested and effective solutions for the implementation of ambitious building projects in various conditions.



Studio Associato Secchi Vignato | Combined flat/office | Nieuw Zuid | Antwerp | Belgium | © Studio Associato Secchi Vignato



Studio Associato Secchi Vignato | Combined flat/office | Nieuw Zuid | Antwerp | Belgium | © Studio Associato Secchi Vignato

> Beacon: Belgium

Nieuw Zuid urban development

In immediate vicinity to the historic city center of Antwerp, an old railway yard will be converted into a highly energy-efficient Passive House district by the name of Nieuw Zuid – or 'New South'. Covering an area of 70 hectares, the district will feature a total of 2,000 residential dwellings, office buildings, public facilities, a large park and other amenities. As part of the "Covenant of Mayors", the city of Antwerp is committed to achieve a CO₂-neutral city by 2050, in order to comply with the European Union's climate targets.

The developments of Nieuw Zuid employ a variety of renewable energy sources: Solar panels were installed on the roof tops of several buildings and each building unit is equipped with smart digital meters as well as a heat exchanger to connect it to the district heating network.

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The partners from 11 European countries have developed and delivered their own beacons and for some of the less advanced regions, successful beacon projects proved to be the best possible driver for the energy revolution in the building sector. It is no exaggeration to state that, in some cases, PassReg beacons lead the way towards the development of functional regional models of success, aimed at achieving, and in fact exceeding, the EU 2020 goals in the area of climate protection and energy. There are more details about these beacons in the

beacons brochure and in the report on experience with and effectiveness of specific instruments as well as in the beacons section of the PassReg webpage⁹.

4.2 Frontrunners

The selection of FRRs is based on the remarkable results achieved in the area of Passive House buildings, but also reveals a variety of approaches and solutions created under different national and local conditions. Born in Germany, the PH concept is implemented in a consistent national framework and energy policy that is constantly updated. Hanover is one of the pioneering regions in Germany where the promotion of the Passive House Standard and the use of renewable energy in buildings began in the mid-80s. In contrast, the regional authorities in the Brussels Capital region formally committed to the PH standard in as recently as 2009. As a result, Brussels quickly established itself as a leader in this area, and all new buildings and major renovations carried out since 2015 comply with this standard. Tyrol represents the country with the highest density of Passive House buildings worldwide - the result of years of deliberate national, regional and local policies and incentives.

4.2.1 Region of Hanover, Germany

The region of Hanover is located in the mid-north of Germany. The region consists of 21 municipalities and 1.1 million inhabitants with over 520 000 inhabitants living in the City of Hanover alone (2014).

⁹ http://www.passreg.eu/index.php?page_id=70

Success story Passive House development



Hanover-Kronsberg, Photo © PHI

The regional development of Passive Houses was initiated in the 1980s when the City Council of Hanover took a decision in favour of rational energy use and wide scale introduction of renewable energy sources on the territory of the city. The long political process was reinforced by several activities during the EXPO 2000 which took place in Hanover. In the context of the EXPO, an ecological urban neighbourhood,

Kronsberg, was built with renewable energy systems (solar, district heating, PV, wind power). This could also be considered as the starting point of the Passive House process in Hanover and demonstrates orientation towards NZEBs. In the Kronsberg district, a project consisting of 30 terraced houses built to the Passive House Standard was realised in 1998. Since this Passive House development, proKlima has supported more than 98 000 m² of new Passive House residential space in the area covered by proKlima, as well as Hanover and five surrounding municipalities. In 2014 one out of three new residential housing units in the City of Hanover was a Passive House.¹⁰

Development of new Passive House living space proKlima supported cities*

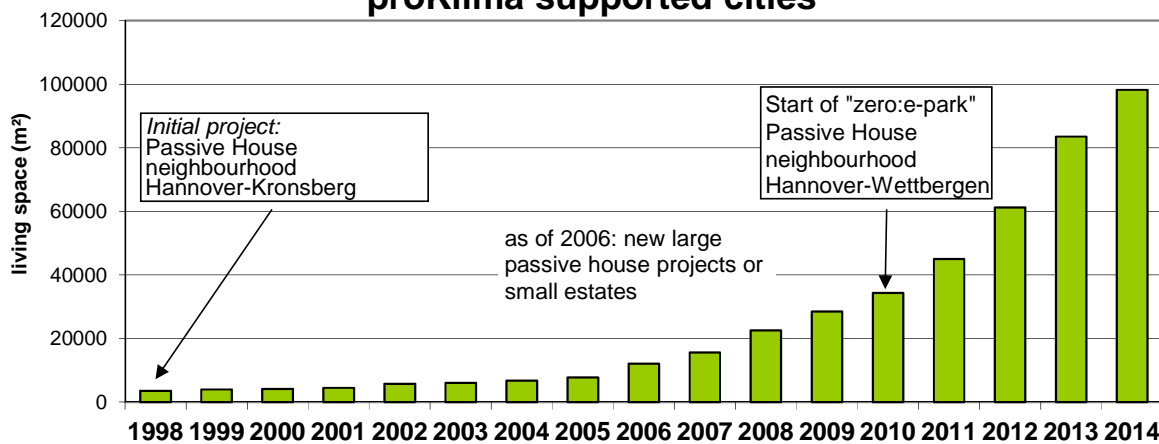


Fig.: proKlima funding statistics 2014 (* Hanover, Hemmingen, Laatzen, Langenhagen, Ronnenberg, Seelze)

¹⁰ More Information about Passive Houses in Hanover: www.passivhaus-plattform.de

Success story zero:e-park

With experience and results of the first Passive House settlement, the City of Hanover started another development of a new urban district with more than 300 Passive House units using renewable energy sources. In 2002 the City Council decided to develop this new neighbourhood with the use of renewable energy sources only in order to achieve its zero-emission-targets (CO₂-neutral). But sceptics who predicted that this decision and project, with stricter ecological standards than those enforced nationwide, would fail, were proved wrong. They thought that high investments costs and new technical appliances would deter potential owners, therefore the City developed a long term strategy. The plan was to sell all plots in the urban development by 2021 over a period of ten years. The first construction site was set up in 2010. However, after four years, in the summer of 2014, all single plots were successfully sold out.



Strong partnership in climate protection – Local partners at zero:e-park, 11/2013:

Prof. Dr. Axel Priebes, Director of Environmental Affairs Region of Hanover, Sabine Tegtmeyer-Dette, Director of Economic and Environmental Affairs City of Hanover, Udo Sahling, CEO Climate Protection Agency Region of Hanover, Harald Halfpaap, director of proKlima. Photo © CPAH/ F.Arp

The energy concept for the zero:e-park was initially based on the reduction of the heating demand to a minimum by applying the Passive House concept. Combined with the use of renewable energies (mainly solar energy: solar thermal and/or PV), only a small energy demand remained, therefore the urban planning concept determined a limiting envelope for each building within which it had to be constructed in order to avoid shading by the neighbouring building and to guarantee that every building achieved the solar gains needed. Despite the fact that every housing unit was a Passive House supplied additionally by renewable energies, a remaining energy demand for heating and domestic electricity still remained. An accompanying study showed that an energy demand of more than 1300 MWh/year in total still remained for the whole settlement. To cover this residual energy demand, the city planned to reactivate a regional hydroelectric power plant in order to achieve the zero-emissions target.

The fact that some new houses use even more renewable energy appliances than stipulated originally (e.g. wood pellet stoves) is remarkable. In this way a zero-emissions concept or even plus-energy concept is directly supported. Monitoring results of some houses show that a grid-connected plus-energy concept is feasible in combination with the Passive House Standard.

proKlima participated in this development with a special framework, financial incentives and supporting studies. Besides supporting the owners with subsidies for the Passive House design (e.g. 5000 EUR/single Passive House), an accompanying quality assurance program was developed to improve the quality of construction work. The quality assurance program aims for the double effect of helping and supporting the owners and construction companies with special know-how, and also forcing the companies to deliver high quality work. The quality assurance therefore serves as a prerequisite for proKlima incentives. The quality assurance is carried out by local planners and experts suggested by proKlima.

Key elements of the zero:e-park:

- Passive House Design
- Reduction of the residual energy demand by use of solar thermal energy, PV or other RES
- Use of energy-efficient household appliances
- Balancing residual CO₂-emissions via a renewable power plant

Source: www.zero-e-park.de

To provide special know-how, input and information to potential owners, the Climate Protection Unit of the City of Hanover¹¹ developed a neighbourhood project called “LeNa”¹² running from 2010 until 2015. The LeNa project (living, vibrant neighbourhood) regularly provided information with the support of proKlima and local experts in different evening events. Furthermore, the events brought together new and current owners from neighbouring districts in order to stimulate their communication and exchange of experience. A special LeNa planning team (architect and designer) provided individual advice. LeNa was accompanied by a voluntary monitoring program to analyse energy consumption. This program was managed by proKlima.

The Hanover process shows how important beacons are to convince potential investors and owners. While the Passive House construction at zero:e-park started hesitantly at first and was mostly realised by “ecologically motivated owners”, the potential investors of the following group were especially convinced by their neighbours along the lines of: “Why shouldn’t I build a Passive House like the neighbour has done?”

With the experience of Hanover’s Passive House development, the PassREg group was encouraged and motivated to build beacons. In general, the approach with the Kronsberg neighbourhood and zero:e-park shows how important beacon effects are.

¹¹<http://www.hannover.de/Leben-in-der-Region-Hannover/Umwelt/Klimaschutz-Energie/Akteure-und-Netzwerke/Die-Klimaschutzleitstelle-der-Landeshauptstadt-Hannover>

¹² <http://www.zero-e-park.de/en/beratung/lena-bausteine>



zero:e-park September 2011 and November 2014, Photos © proKlima

Since the City of Hanover started its new building offensive (over the last years the annual new build rate was under 0.1 % with approx. 250 units per year), more housing projects have been built to the Passive House Standard. As of 2014, a € 50 million building complex has been constructed in the city centre with 100 housing units, 4500m² office space, one day care centre and 1150m² commercial area. proKlima supported this project with more than € 400 000 in order to further the development with studies, quality assurance and to balance the additional costs of the investment in part. But it also showed that financial incentives are still necessary to encourage investment in a high energy standard, particularly in the social housing sector. New rental models would overcome the barriers of limited investment decisions and pay back challenges. "Warm" rental models are not usual in Germany, although examples do exist in Hanover. Normally "cold" rents (heating costs are not included in the rent) are limited to a maximum, while the local social authorities don't really pay attention to energy costs. Only a nationwide reform of social housing grants and rent subsidies and cold rent limitation would greatly solve the problem, a prospect for further projects.

Success story Passive Houses with special type of use

Until 2014, proKlima supported more than 40 non-residential buildings built to the Passive House Standard and subsidies were allocated for more than 30 projects. The realised projects cover a wide range of building uses e.g. fire stations, day care centres, schools, office buildings, care homes, a museum, supermarkets etc.

To enable contact with the local beacons, proKlima organised three study tours to current projects. The first study tour in May 2012 was mainly organised to inform the PassREg group during the kick-off meeting in Hanover. The second and third sessions successfully focused on the implementation of the Passive House concept in non-residential buildings and their technical solutions. More than 100 participants, local planners, architects, investors, members of municipalities and politicians were informed and projects were presented as follows:

- REWE Passive House Supermarket, zero:e-park Hanover (06/2013)
- Housing development at zero:e-park Hanover (06/2013)
- Office building of the waste management facility Hanover Region, Hanover (06/2013)
- New construction and retrofit of the Memorial Ahlem, Hanover-Ahlem (07/2014)
- Day care centre Im Wiesengrunde Hannover – Bothfeld (05/2012)

- Day care centre at Ahlemer Holz, Hanover-Ahlem (07/2014)
- Day care centre in Otto-Reinhold-Weg, Hanover – Vahrenwald (07/2014)
- Primary school In der Steinbreite, Hannover-Davenstedt (05/2012)



Left: Open 1st certified Passive House Supermarket in Germany, zero:e-Park End of 2012. Photo © proKlima / O. Mahlstedt
 Right: PassREg info session at zero:e-Park May 2013 – local group visiting the new Passive House supermarket, Photo © proKlima

The study tours equipped the participants with expert knowledge of the development of architecture, building technologies and requirements of the owners and investors. Several renewable energy systems were presented:

- Heat pumps and chillers connecting with heat recovery (supermarkets)
- District heating and absorption chillers
- PV and solar heating systems

The projects “8 day care centres” (tour 2014) and primary school In der Steinbreite (tour 2012) highlighted a special financial model “Public-Private-Partnership” (PPP).



PassREg Info session 07/2014 - local group visiting new Passive house day care centre in Hanover, Photo © proKlima

Particularly the Passive House concept for the supermarket evoked common interest during the tour 2013. The technical solutions were presented together with explanation of the energy concept. The Passive House supermarket concept reduces the electrical energy demand by more than 50% compared to the normal standard. In cooperation with the Passive House Institute, proKlima has undertaken much efforts to develop the Passive House Standard for this special type of use. New innovative technologies for foodstuff cooling combined with heat recovery and a well-insulated building envelope make this standard possible. Subsequent new projects opened successfully at the

end of 2014: the world's largest certified Passive House supermarket (more than 3100 m² sales floor) is now located in Hanover. In addition, the tours allowed investors, users, planners and architects to share their personal experiences and led to detailed discussions among the participants. A major purpose of proKlima was thus fulfilled: an exchange of experiences and practical solutions (e.g. planning indicators, summer comfort and user strategies) took place. The study tours also conveyed an important message: architectural quality did not fail with the Passive House Standard and renewables.

Successful beacon effect

The REWE Passive House supermarket needed extra support by proKlima and the climate protection unit of the City of Hanover to convince potential investors. However, new projects are guided by the regional supermarket beacon and need less support. The REWE supermarket shows that reduction of energy is profitable. So if one of the players like REWE can realise such a concept, other competing companies will also try this. As a result of the beacon processes, two new supermarkets opened at the end of 2014 in Hanover, the first Passive House discounter (company NETTO) and the world's largest Passive House supermarket (EDEKA).



Netto Supermarket – Opening of 1st Passive House Discounter in Hanover, December 2014, Photos © NETTO



E-Center Supermarket April 2015 - presentation of proKlima and Passive House Certificate, Photo © enercity/ proKlima

Ulf-U. Plath, Executive President EDEKA Minden-Hannover, Sabine Tegtmeier-Dette, Director of Economic and Environmental Affairs City of Hanover, Matthias Wohlfahrt program manager enercity-Fonds proKlima

What is coming next?

Though Hanover's new build activity is increasing again, refurbishment of existing buildings plays a key role. Influenced by proKlima's activities, the local investments in modernisation of the existing building stock in Hanover (50 000 buildings erected before 1978) is increasing compared to nationwide trends. However an increase up to 2% in the local annual refurbishment rate of full renovations is needed to



meet the local zero-emission objectives. With the "Master plan 100% for Climate Protection"¹³ the Hanover Region and the City of Hanover is looking at a CO₂-reduction of over 95% and more than 50% reduction in energy consumption by 2050. While the annual refurbishment rate of 1.7 % in the sector of single/ two-family houses is remarkable, a rate of 1.3% for multi-family houses is improvable.

Old buildings are a challenge – retrofit to NZEB, background: newly modernised with Passive House components, foreground: standard neighbourhood built in the 1950s and 60s, Hanover, Photo © proKlima, 2015

In spite of the regional targets, Hanover counteracts the nationwide annual refurbishment rate of less than 1%. It is possible that proKlima incentives of the "existing building program" with about € 1.3 million per year has encouraged owners to invest in efficiency measures. NZEB renovation concepts are needed to look at long term strategies. A PassREg study about *Zero-emissions strategy for a neighbourhood built in the 50s and 60s*¹⁴ initiated by proKlima showed that zero-emission is technically feasible (Passive House components with RES), but still challenging in terms of costs.

¹³ <http://www.hannover.de/Leben-in-der-Region-Hannover/Umwelt/Klimaschutz-Energie/Klimaschutzregion-Hannover/Masterplan-100-für-den-Klimaschutz>

¹⁴ Wohlfahrt, M., Harhausen, G. *Zero-emissions strategy for a neighborhood built in the 50s and 60s*, 19th International Passive House Conference. Leipzig, 04/2015.

(Paper DE: http://www.passivhaus-plattform.de/downloads/eu_projekt_passreg/2015-01-12_IPHT2015_Wohlfahrt_Harhausen_final.pdf)

(Presentation DE: http://www.passivhaus-plattform.de/downloads/eu_projekt_passreg/19PHT_AG14_IPHTLeipzig_Wohlfahrt.pdf)

(Related Study DE: http://www.passivhaus-plattform.de/downloads/eu_projekt_passreg/2014_PassREg_NZEB-Studie_Quellengrund.pdf)

4.2.2 Brussels Capital Region, Belgium

Up till 2007, not a single building in the Brussels Capital Region complied with the Passive House Standard. However, today the Region is a leading Passive House region, having anticipated by 6 years the EU directives for low energy construction.

At present, the Brussels authorities have initiated large-scale experiments to determine the ability of businesses, public services and citizens to realise highly energy efficient projects: behaviour change (Energy Challenge), PLAGÉ program, call for exemplary buildings. Without such high level political commitment, the existing potential for embracing the highly energy efficient solutions may have gone unnoticed. Thus, the sustained engagement of the Brussels authorities at the initial stages of the process is a key factor in the Brussels model.

The Region officially committed to the Passive House Standard only after having experimented with the first three Calls for Proposals for Exemplary Buildings. The success of the Exemplary Buildings program showed that Passive House standards are affordable, and do not increase renovation and construction costs to unacceptable levels.

Based on three rounds of successful trials with Exemplary Buildings (in 2007, 2008 and 2009), in July 2010 the Brussels government passed an order stipulating the Passive House Standard for all regional new public buildings by 2010, and on 3 May 2011 it adopted new energy target regulations for all new constructions (housing, offices and schools) from 1 Jan 2015 onwards (there are some exceptions for buildings with a poor orientation and/or capacity).

Economy and financing

The “**Exemplary Buildings**” program (Bâtiments Exemplaires, or BatEx) is the main financial incentive instrument of the Brussels regional government to encourage demand for extremely energy efficient and environmentally efficient construction based on an annual call for proposals since 2007 (except in 2010). The planned duration of the program was May 2007 to December 2014, with a total budget of 45 million Euros.

To be eligible for BatEx funds, projects had to be located within the Brussels Capital Region, and had to consist of a new building, renovation, or a combination of the two. Most importantly, projects had to fall within one of the following categories: single-family or collective housing unit, collective facility (e.g. school, hospital, or nursery), office, commercial or industrial facility. To be approved, a proposal had to adhere to the following four specific criteria:

1. all new construction and renovation must be implemented according to Passive House Standard guidelines (it must strive to be a zero-emission building);
2. the project must prioritise the use of eco-friendly construction materials, and must consider natural cycles and biodiversity;
3. the project must demonstrate a high quality and attractive architectural design, good level of public perception/ good visibility, and a satisfactory level of integration into existing stock;
4. rather than a “high tech solution,” the project must be simple and feasible in technical and financial terms, with reasonable payback timelines.



Approved projects were awarded a subsidy of € 100/m², which was divided between the contracting authority (€ 90/m²) and the developer (€ 10/m²).¹ Moreover, winners received technical assistance and publicity for their initiatives.

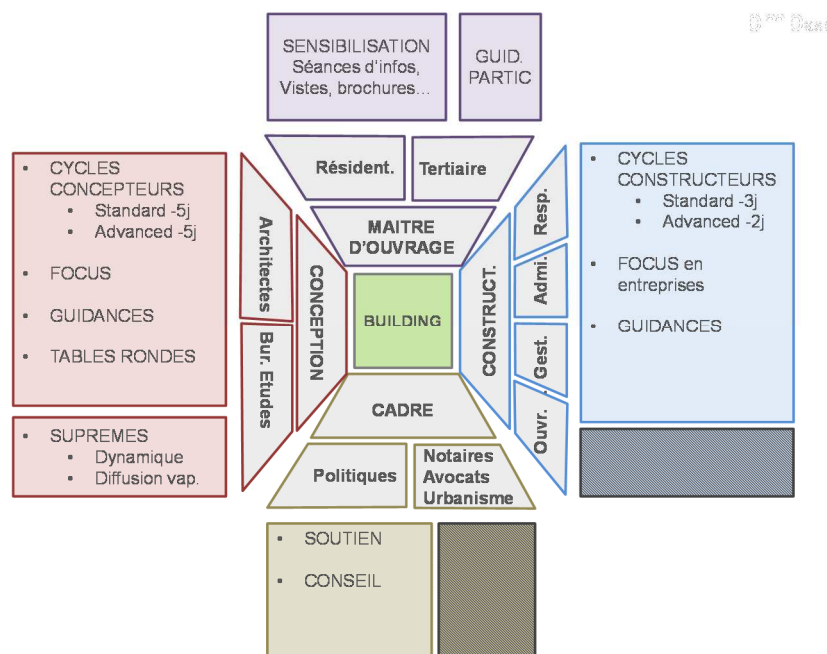
Another key financial incentive, introduced in 2004 within the policy framework of the Brussels Capital Region was the system of **energy subsidies**. These subsidies aim to cover part of the excess costs necessary for high energy efficiency investments in buildings. 80% of the beneficiaries are individuals, but groups and businesses that wished to renovate buildings in order to reduce energy consumption and CO₂ emissions were also eligible. The following were included in the types of activities covered by the subsidies: insulation, energy audits, ventilation and the installation of high-performance boilers and super-insulating glazing,¹ which can also apply to Passive House buildings (€ 100/m²) and for low (€ 100/m²), very low (€ 130/m²) and renovation to Passive House Standard (€ 160/m²).

The increase in energy subsidies (2013) aimed at avoiding a crisis in Passive House construction, once again illustrates one of the key success factors in the Brussels model: a high level of commitment of the regional government. Today (2015), energy subsidies have been reduced and resulted in reduced certification requests (but not of Passive House constructions).

Also part of the 2004 policy framework package, the green social loan (prêt vert social) is a zero-interest loan provided to individuals who wish to insulate their homes, thereby reducing energy consumption in line with the Passive House Standard criteria.

In 2009, the Federal Government offered tax breaks for efficient buildings. Thus, a € 420/ m² tax reduction was offered for a building defined as “low-energy”, a € 850 /m² tax reduction was offered for a Passive House building and a € 1700/ m² tax reduction was offered for a zero-energy building. The tax reductions were valid for a period of 10 years, and were renewable annually, provided that the building continued to adhere to Passive House construction guidelines. However, in November 2011 the Federal Government eliminated federal tax breaks relating to low energy buildings.

Training



Since the Passive House Standard became a compulsory norm in the Brussels Capital Region, there arose a need to train building sector professionals via universities, vocational schools, and various training centres. Given the lack of quality sustainable building training in Belgium, in 2009 Brussels Environment decided to develop a professional training program for designers, engineers, architects, and contracting authorities. A core premise of the training is excellent building design. Thus, in 2005 PMP introduced training for designers in the Brussels Capital Region, and in 2007 for construction project developers. Today, the training program involves the entire sector (developers, investors and promoters, building managers, property managers, notaries, maintenance companies, etc.) relating to energy, material, water management, biodiversity, land use, and indoor comfort, among others.¹ PMP’s training program enables contractors to talk with/train other contractors, investors to talk with/train investors, etc.



For designers and builders, the specific added value of the training lies in the opportunity to apply the learned concepts in practice. During the last day of training, participants spent a day together, collaborating on a project to build a typical “Passive House” construction.

Visibility and public support

To raise awareness of energy-efficient construction, Brussels Environment featured the Exemplary Building winners in articles, project files, seminars, the ‘Green Brussels, Inspiring Architecture’ book, and other publications. Visits were organised for the public during or after the completion of the project.¹ Below are some other activities that the Brussels Capital Region organised in order to encourage low-energy construction.

Created in 1999, the **Ecodynamic Company Label** is an initiative of Brussels Environment. Its goal is to encourage companies and organisations to actively commit to improving their environmental performance (especially energy consumption, waste management, and the efficient use of raw materials). The target groups are all enterprises and organisations (large and small, private and public, regardless of their area of expertise).



Since November 2009, PMP and PHP have been issuing “Be Passive,” a quarterly magazine dedicated entirely to low-energy building, and the Passive House Standard in particular. The target audience includes: architects, public authorities, building societies, regional development agencies, engineers, construction manufacturers, real estate actors and all others involved in construction. The magazine aims to serve as a “one-stop shopping” centre for all that relates to energy-efficient construction. The goal is to present the information in a clear, concise, and jargon-free way so as to be comprehensible to individuals without technical training. The website (free details and free issues) has more than 20 000 downloads so far. The magazine is distributed to all target audiences without exception (approximately 15 000).



In 2015, a ‘be passive’ **book** called “architecture passive” was created. This was translated into Dutch and English and consists of 300 pages, discussing the status quo of knowledge about Passive House construction in the year when the Passive House Standard became law in Brussels.

Passiefhuis-Platform (PHP) and *Plateforme Maison Passive* (PMP) jointly organised an **annual Passive House Fair**: a building technology forum that showcased the latest developments in energy-efficient construction. The Fair addressed construction professionals and the general public alike. The event included activities such as open houses, free readings, information and planning advice, and meetings with the professional members of PMP/ PHP.



Photos © pmp

4.2.3 Region Tyrol, Austria

Tyrol is one of Europe’s regions with the highest density of nearly zero energy buildings, one of Europe’s most “developed” regions in terms of energy efficient constructions in large-scale residential and non-residential buildings. This outstanding position is due not only to legal framework and stimulating incentives such as a very attractive federal housing subsidy, but also to committed local players such as the federal government, social housing companies, the federal energy saving agency “Energie Tirol”, private contractors and initiatives like the IG Passivhaus Tirol.

This development started in the mid 90s, when the biggest Tyrolean Social Housing company NHT, focusing on low rents, energy and running costs of their building stock, tried to implement the principles of nearly zero energy standards in their new apartment buildings “Mitterweg” and “Lohbach”. This first attempt was quite successful, the “Lohbach” apartments achieved a measured heat demand of 17 kWh/m²a, and the Passive House Standard seemed to be within range.

Many lessons were learnt from the initial experiences: most components such as windows and ventilation systems were self-defined and were not widely available on the market at that time, and were therefore expensive. A great lack of knowledge of planning and construction of high quality thermal envelopes was apparent, there was a low level of awareness of major criteria such as

airtightness and minimised thermal bridges. Capacity building had to be implemented in order to improve the planning and construction process, a new market had to be created for components of nearly zero energy buildings. They had to become affordable and prices had to be competitive.



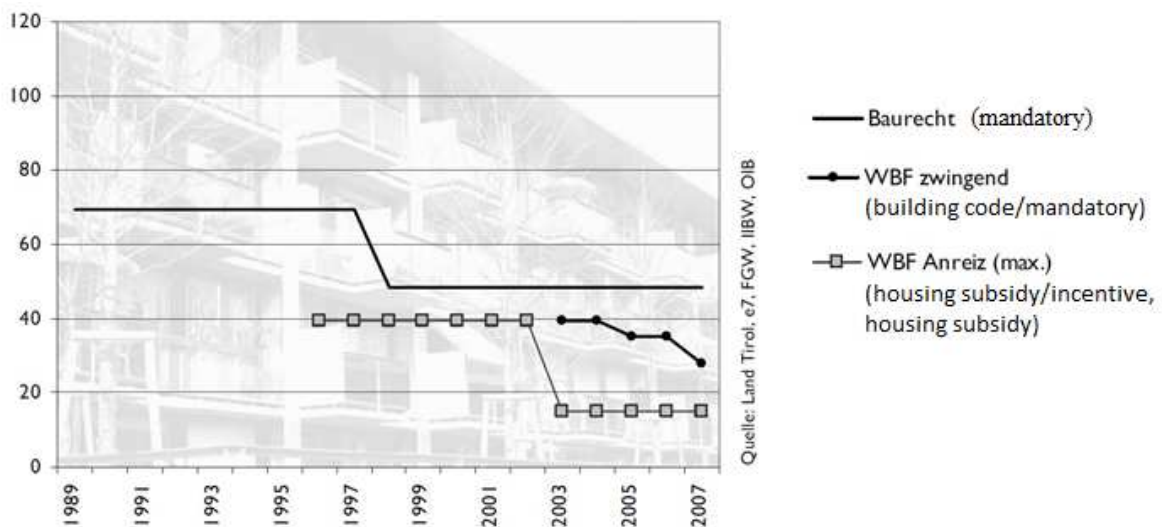
Some examples of NZEB activities and thermal refurbishment within the city of Innsbruck, Photo G.Gaigg © IG Passivhaus Tirol

It was the merit of all players involved in the first step that the latter could be achieved: experienced planners, engaged contractors, motivated social housing companies and – most importantly – a new housing subsidy in 2007, which covered most of the additional costs of the nearly zero energy standard and was due to the federal government of Tyrol. PassREg was one of the next steps, making the Tyrolean examples visible not only to decision makers from other Austrian regions but also for those from other European regions through study tours and dissemination events.

Methods and strategies, which led to this status quo, were an essential point of interest within the PassREg project; why and how these energy-relevant improvements of new builds as well as retrofits were possible, which of these references could be applied and implemented elsewhere.

This development was mainly driven by the federal housing subsidy office of Tyrol. To maintain the funds, the mandatory energy-relevant standards for new builds and retrofits were stricter than the obligatory levels of the Austrian national building codes (OIB guideline 6, “energy economy and heat retention”). If the heating demand came down to a level equal to or less than 10 kWh/m²a, additional grants were given.

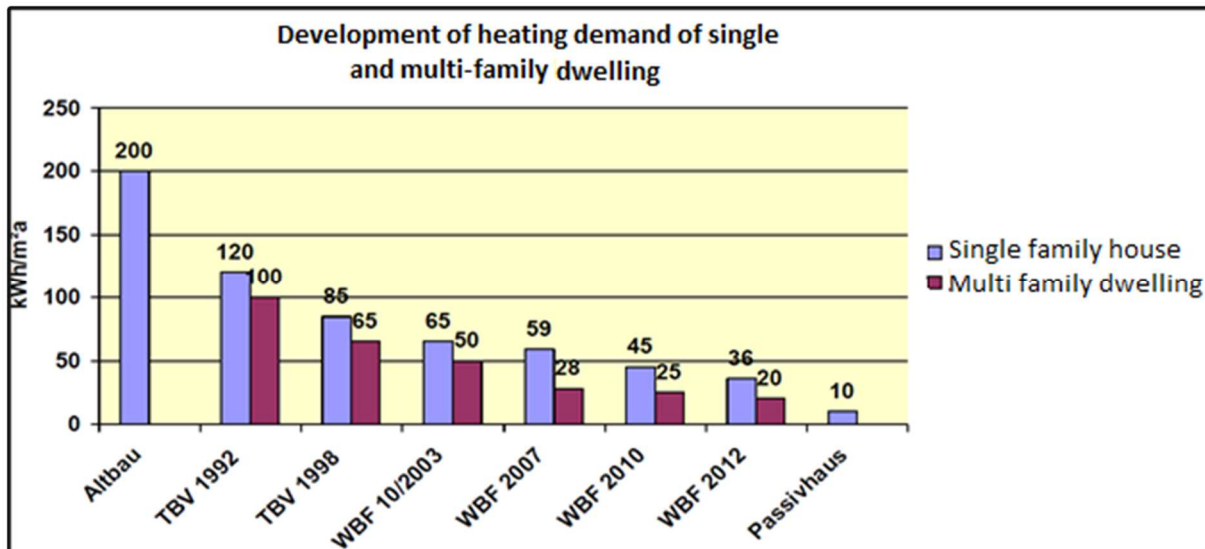
Starting at the end of the 1990s, Tyrol’s policy has favoured incentives for achieving greater efficiency and lower energy consumption in buildings.



Source: K. Lugger, W. Amann, Ecologising housing subsidies in multi-storey residential buildings

Since 2007, the heating demand of single-family houses and apartment buildings could be reduced a further 30 percent. Additional construction costs for the better level of energy efficiency were mostly covered by subsidies and grants; in January 2015, additional grants for nearly zero energy buildings were increased by an additional 25%.

This success was achieved through persuasion and awareness raising of important stakeholders as well as the general public and capacity building in those involved in planning and construction. Architects, planners, executive companies and their employees had to be brought to a high level of knowledge and expertise, which now allowed cost-efficient and reliable implementation and maintenance of nearly zero energy constructions.



Source: Land Tirol, Wohnbauförderung, R. Kapferer 2012

Achievements

The number of subsidised Passive House homes in Tyrol has nearly doubled from 18.1% in 2012 to 21% in 2014 and is still rising in 2015 due to extended housing subsidies for NZEB’s. In 2013 the share was 41%. It was extraordinary high because the O3 complex with more than 600 living units was completed.

Visits from European and international delegations, study tours and information events within PassREg



also helped to increase interest in Tyrol, providing new contacts and new markets for local manufacturers of Passive House components as well as architects, planners and engineers. Local Politicians and decision makers were encouraged that the path taken by them was the right one for improving the energy efficiency of the building stock.

WA Vögelebichl © NHT

Within the PassREg Project, the local focus in planning and construction moved more and more from residential to non-residential buildings; besides the beacons, which were mostly residential buildings, it was possible to realise new schools, kindergartens, office buildings and even supermarkets and – very important for Tyrol’s tourism – also hotels, leisure and recreational buildings to the Passive House Standard using renewable energies as well. One of the most interesting projects in accordance with the PassREg objectives was a medium-sized residential estate in the west of Innsbruck, consisting of two buildings with 24 apartments and 1930 m² effective floor area. Constructed between 2013 and 2015, the unique feature of this project is its positive energy conception: based on the Passive House

Standard combining renewables, all necessary heating energy and hot water is supplied through renewable energy sources, produced on-site. The surplus electricity is used for the lighting of the underground parking.

Explorer Hotel Neustift:



In 2011 the Explorer Hotel in Gaschurn/was constructed as the first Passive House Standard Hotel in Austria; in 2016 it will be followed by a second one in Neustift in the Stubai Valley. The guests are benefiting from the sustainable and comfortable design and the mountain view and recreational areas. The residual heating demand is ensured via a wood pellet central heating system and solar panels on the roof with an area of 70 m².

ID 2341, photo © Herz & Lang GmbH

M-Preis supermarket in Natters:



Very positive experiences were gained with the first Passive House supermarket which was completed in 2012. The management of M-Preis decided to construct other supermarkets in the same way, Natters was a subsequent example in 2014.

The cooling equipment covers the heating demand, no fossil energies are used. Compared with conventional supermarkets, 10 000 litres of oil or 32.5 tons of CO₂ are saved annually.

ID 4220, Photo © Passive House Institute, Innsbruck

Thermal refurbishment "Civil engineering faculty" Innsbruck University:



ID 4200, Photo © Passive House Institute, Innsbruck

The campus of the technical faculty, planned by architect Hubert Prachensky and constructed in the 1960s, was refurbished in 2012 and 2014. The "Civil engineering faculty" building was refurbished based on EnerPHit principles using Passive House components. This example is proof that EnerPHit refurbishment can be implemented with comparable costs while offering better thermal comfort and cost effectiveness in the long term.

4.2.4 Heidelberg-Bahnstadt, Germany

The urban district Bahnstadt in Heidelberg is a conversion of former railway premises into one of the largest Passive House estates in Europe which is supplied with renewable energy. The aim is to achieve a zero-emission housing estate.

The new urban district covering an area of 116 ha aims to provide accommodation for about 12 000 occupants and 7000 workplaces, built according to the Passive House Standard (offices and university-related services such as laboratories, retail (food and non-food), restaurants, hotels and cafés). This district is supplied by a biomass cogeneration plant (woodchips). The official opening took place on 16 April 2014.

The project team consists of the City of Heidelberg, and the principal developer EGH (Entwicklungsgesellschaft Heidelberg (Heidelberg Development Association)).

An innovative feature of this large-scale Passive House development of an urban district for commercial and residential use is that it has zero-emissions (or is CO₂-neutral). The PH Standard had to be verified using the PHPP (Passive House Planning Package). Building approval was not granted without the PHPP.

Prior to this, free consultation was offered relating to energy-efficiency. The energy-efficiency concept also included the topic of "saving electricity", which also constituted a part of the consultation. Information was made publicly available by means of the Bahnstadt-Heidelberg internet website.

The PHPP is a requirement for energetic design and quality control, airtightness concept and concepts for prevention of thermal bridges. Documentation of flow rate adjustment of ventilation systems and

airtightness tests are compulsory. The PHPP calculation had to be accepted by the City and inspection of the building site was carried out with regard to e.g. thickness of insulation, examination of main components, final acceptance, testing of the building components and technical inspection.

In addition, the Bahnstadt has good local public transport connections including trams and buses, new cycle routes, a separate network of cycle routes to the university and additional routes on bridges over the railway tracks. Useful space was freed up by means of underground car parking under buildings.

Other environmental factors are the fact that green roofs are compulsory and other rainwater retention systems have been foreseen. 50% of the amount of rainwater percolates into the soil on the premises. In addition, land use is reduced because this is converted land use and there is a higher ratio of free land due to the compactness of the development. A minimum amount of soil was moved away from the area, excavated earth was kept in the Bahnstadt area as far as possible.

Political decision-making for the Bahnstadt project

The political decision in favour of the Bahnstadt Project within the urban development context was made by the municipal council of the City of Heidelberg in Autumn 2007 (Appendix 2 of this material: 0393/2007/BV). See the link below regarding urban planning (Städtebauliche Rahmenplanung) “Bahnstadt 2007”, in which the various aspects of the Bahnstadt development are set out.)

In 2008, the municipal council of the City of Heidelberg added a binding commitment for the urban development concept for energy and heat supply (see link below) (Appendix I of this material: 0080/2008/BV), and an urban development contract was made with the EGH (Heidelberg Development Association) for creating the infrastructure and a requirement for investors to build Passive Houses on a large scale.

A recommendation was made to the public utilities company of the City of Heidelberg (public services), which led to voluntary adoption of the energy concept with reference to the district heat connection and biomass cogeneration plant within the context of business principles.

According to the German development law for communities, the City of Heidelberg has the right to initiate long-term urban development. Since buildings already exist in a part of the new quarter, the City of Heidelberg will apply this law to the extent that existing buildings which need to be reconstructed are built to the Passive House Standard.





ID 3879, Bahnstadt, Heidelberg, Photos © PHI

4.3 Future front runners

For all those involved in PassREg, it is evident that the empowering of local and regional authorities is crucial for the actual introduction of the NZEB concept (based on PH Standard with RES) in building practice across Europe. In order to promote replication of FRRs' success, the active involvement of policy makers and building experts was specifically targeted in the PassREg Aspiring Regions of the City of Antwerp (Belgium), Aquitaine (France), Arnhem-Nijmegen (Netherlands), Burgas (Bulgaria), Cesena (Italy), Latgale and Vidzeme (Latvia), Wales (UK) and Zagreb (Croatia), and in associated cities in Italy and Bulgaria. This approach has already led to tangible results, clearly visible in the PassREg Success guide, Solutions Open Source and all publications at www.passreg.eu.

4.3.1 City of Antwerp/Belgium

At the start of the PassREg project, the City of Antwerp had already signed in to the Covenant of Mayors. The objective was to become a CO₂-neutral city by 2050. As the city is confronted with a large historic building stock, it is important to be as ambitious as possible in the case of new developments in order to be able to achieve this goal.

The residential area of the city of Antwerp is 5462 hectares or 204.5km². Almost half of all buildings are apartments, 45% are single-family houses, mostly terraced houses. Compared to the overall Flemish level, the number of apartments is significantly higher in the City of Antwerp (49% compared to 20%), there are also significantly fewer detached single-family houses (1% compared to 34%).

Prior to the PassREg project, the local policy decided that in newly built private developments, a collective heat production unit must be installed (no separate production units for each housing unit) and easy connection to a district heating network would be enabled in the future. It also requires the Passive House Standard for new buildings, renewable energy and a sustainable approach to urbanisation. This policy was implemented for the first time during the PassREg project, in the development "Nieuw Zuid" (New South), which is also a Beacon Project.

The main barriers at the start of the PassREg project were the high initial costs, life cycle costs were not always taken into account, quality assurance and quality control mechanisms were not common practice, there were problems with realising a high quality of design, installation and maintenance of ventilation systems.

During the PassREg project, the market for new build Passive House buildings developed even further and included large residential developments, different types of non-residential buildings and a market for deep energy retrofits based on Passive House principles began to emerge.



Studio Associato Secchi Vigano. Nieuw Zuid, Antwerp, Belgium. © Studio Associato Secchi Vigano.

The trend towards Passive House buildings and use of renewables increased due to local policy decisions of the city. These included the following:

- All new school buildings were to be built to the Passive House Standard
- Ambitious Nieuw Zuid development of 40 000m² (PassREg Beacon project) was built to the Passive House Standard with renewable technologies (PV) and biomass based district heating system.
- Mandatory regulation for green roof construction for all new flat roof constructions (or in major renovations).
- New legislation that all new houses, schools and offices built in Flanders must include a minimum share of renewable energy (solar thermal, solar PV and/or heat pump technology).
- In accordance with the European Directive for Renewable Energy, Flanders has developed a programme for certification of installers of solar thermal, PV and heat pumps.
- Subsidies for investment in renewable energy technology in buildings and some local subsidies for “green” technologies. ESCO is used for financing renewable installations (for example utilities) for non-residential buildings
- Energy-efficient retrofitting activities are on the increase, supporting city policy is undergoing development, and programmes for demonstration buildings are emerging.

Throughout the PassREg project, the Nieuw Zuid development in Antwerp served as a beacon project. The 70 ha large area, comprises housing, local shops, public facilities and offices and a park with a surface area of over 15 ha. It is a private market development initiative in close collaboration with the City of Antwerp.

Sustainability is a key element in the development. The focus on water, energy and waste management and implementation of a district heating system based on renewable energy sources demonstrates an ambition to develop Nieuw Zuid as a best practice example of sustainable urbanisation.

The significance of this beacon is derived from the fact that it is the first large-scale development in Antwerp which has adopted the Passive House energy efficiency standard and also that it is the first implementation of a district heating network in Antwerp, as the first step in developing a city-wide network in the long term. The implementation of this project under the direction of the City of Antwerp is exemplary for a cooperation with private developers (on building and site level) and third parties (on site level).



Studio Associato Secchi Vigano. Combined flat/office. Nieuw Zuid, Antwerp, Belgium. © Studio Associato Secchi Vigano. The significance of PassREg through this beacon project was also in enabling a process of capacity building for different levels and groups:

- capacity building of the private developer of Nieuw Zuid. In the long term, a private development pilot project such as Nieuw Zuid serves as an exemplary model for other private developers
- capacity building within the City of Antwerp: gaining knowledge on how to overcome hindrances and implement a district heating system, and this from several aspects (technical, legal, cooperation models, financial models)
- capacity building of third parties such as investment companies, construction companies, heat production and distribution companies
- capacity building of the end users of the buildings, using info sessions to instruct end consumers on the use of the technologies involved and steering their behaviour regarding energy consumption

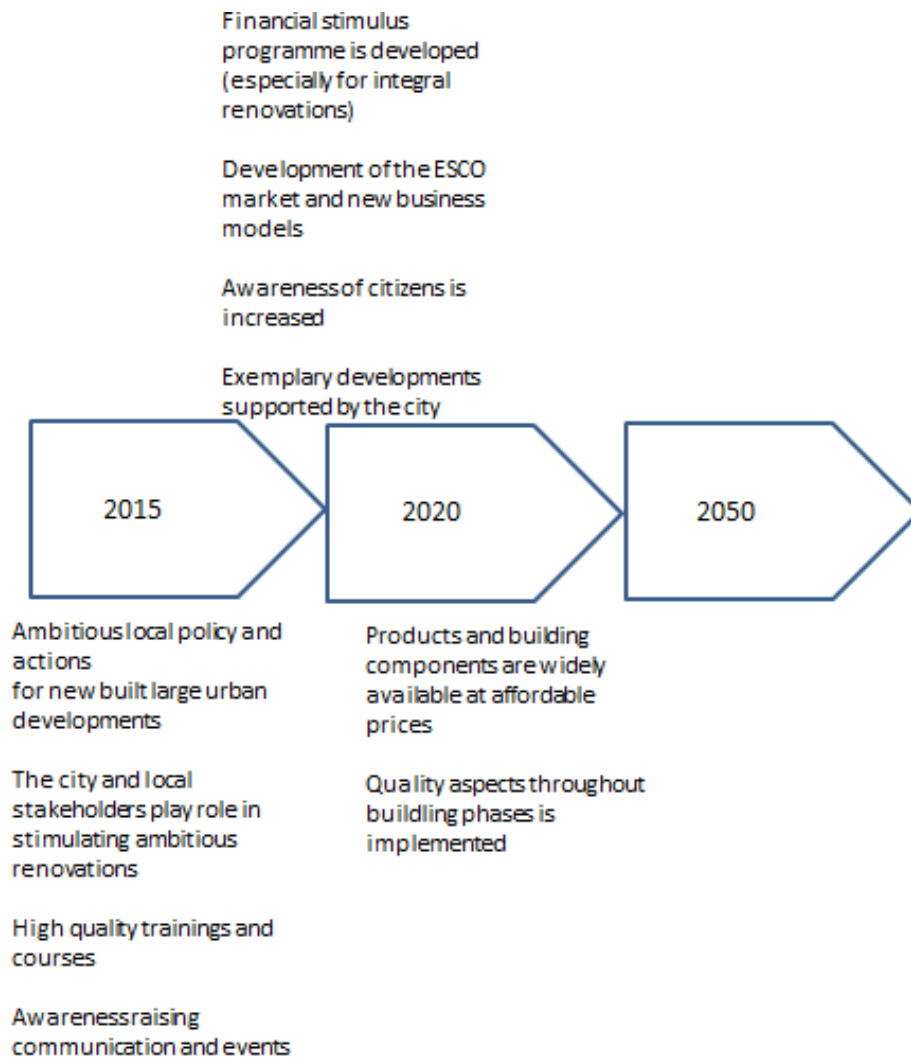
The key lessons learnt from this beacon are that the local policy decisions are a strong enabling factor for the uptake of Passive House buildings and application of renewables. Financial incentives help and encourage decisions. Incentives are important as a helping hand for the beacon/model projects, which in turn help gain support across industry and stakeholders by demonstrating their success. Raising awareness and increasing capacity with training, visits, events and activities are important to gain confidence in executing high quality nearly zero energy buildings using the Passive House Standard and renewable technologies.

The success model for the city of Antwerp is forward looking for achieving the 2050 objectives.

With reference to funding, the City explored opportunities for financing retrofits, such as through the revolving fund that was created for cheap loans - it could be promoted more - and through group actions which could be developed to reduce the investment necessary for energy saving measures. Novel business models were developed where ESCO formulas are applied to the residential sector (new build or renovation). Also, innovative financing models were created to finance ambitious retrofits, especially at the group/neighbourhood level.

Capacity building continued through specific training for employees of the city administration according to their needs (focus on single-family houses, multi-family houses and non-residential buildings). Companies and product manufacturers and suppliers continue to offer products suitable for PH and integration of renewables onto the market. As it is expected that the NZEB market for newly built and energy efficient ambitious renovation will grow, the City of Antwerp has assumed an exemplary role through the implementation of its own municipal buildings as well as the urban development projects. The renovation market in Antwerp is increasing, due to which obstacles such as lack of funding and knowledge amongst architects, builders as well as clients demanding full refurbishments are reduced or eliminated. To this end, demonstration projects played an important role in further establishing successful practices in the renovation market in the City of Antwerp.

More variety and target-oriented actions to reach specific homeowner segments should be further developed. Certain target groups were addressed with tailored communication, such as building stock owners, property developers, home sales agents and syndics.



4.3.2 City of Burgas/Bulgaria

Burgas Municipality joined the PassREg project led by a strong political will for change. We knew where we stood and where we wanted to go in terms of energy policy in the municipality, but we did not know which road to take for this.

In 2012, the Passive House Standard was almost unknown in the municipality; there was a lack of basic information and purely practical application of the standard, and there was no awareness of the social and economic potential of its introduction as a common building practice. While looking for the right solution for the problems faced by the municipality in achieving the EU 2020 targets, we became aware of the PassREg project.

Through this project we were able to study successful models of leading European regions in the field of low energy buildings, we managed to raise public awareness and to provide a large amount of information that so far had not been available. With the popularisation of the concept of passive buildings, it was possible to involve stakeholders which helped Burgas to outline its roadmap towards nearly zero energy buildings.



The city of Burgas, Photos ©Burgas

The Art Gallery of Burgas will be the first building constructed in accordance with the concept PH + RES = NZEB as a pilot project. The choice of a public building was not accidental, because the best example in the municipality was crucial for the successful implementation of energy policies in the region.

"By its decision to design and build this building in accordance with the Passive House Standard, the municipality initiated a new policy at the local level, namely the introduction of the highest energy standards in the construction of new municipal buildings, which undoubtedly motivated owners and developers to follow the good example of the local authorities."



Eng. Chanka Koralska / Director of Construction / Burgas Municipality

The Burgas Art Gallery building is located in the centre of the city, diagonally opposite the Town Hall. The project was undertaken by local architects who supported the city of Burgas on its way to nearly zero energy buildings right from the beginning.

"Since this was a building of great public importance for us, it was essential to meet the required level of energy performance, but the building also had to have remarkable architectural characteristics. Another challenge was the location of the building, because it was in close proximity to cultural monuments and located in a very narrow plot. Exactly for these reasons, the building is an extremely valuable model for our city, and because it breaks some of the popular myths about Passive Houses, namely that they have no architectural value, that they are not applicable in strongly built-up urban areas, and that they are only suitable for housing. "

M.Arch. Kiril Kirilov / BUDA architects / Burgas

Developed within the project, the municipality's success model is based on a detailed analysis of the existing situation; challenges had to be faced and opportunities had to be taken to overcome the existing barriers. This included adapting solutions from leading regions that were applicable for Burgas.

For us, it was important that the success model and the roadmap should be developed to last. For this reason, we decided to integrate the success model in the second update of the sustainable energy development plan of Burgas. The envisaged measures and their implementation thus became an official part of the energy policy of the municipality.

The roadmap of Burgas includes three main components to upgrade the results achieved:

- Wide publicity of results to keep the public, policy makers and media interested
- Providing demonstration buildings with different functions: social, cultural, etc.
- Financial mechanisms and economic levers

To ensure public support on a broad scale, the municipality plans to continue the set tradition to mark the international days of Passive House buildings and regularly organised information sessions on planned activities in the field of low energy building. Because our pilot project for the Burgas Art Gallery is superbly located in terms of public traffic, after the completion of the construction, a panel will be mounted on the facade that will show the monthly consumption of the building and compare this with the consumption of a conventional building of a similar purpose and the scale of payback of the initial investment. This is envisaged for all buildings belonging to the municipality and those in which highly effective measures for saving energy have been implemented. Thus, the public will become acquainted with the real economic impact of low energy buildings.



Art Gallery Burgas, Photos © Burgas

Ensuring excellent demonstration buildings is of utmost importance for the future development of energy policies in the municipality. The approach chosen is to construct buildings for various uses in order to disprove the claims of sceptics that Passive House buildings have limited functionality – i.e. can only be implemented as single-family or two-family houses. After the Burgas Art Gallery, the municipality will build a brand new kindergarten in one of the largest and fastest growing residential complexes.

Apart from providing savings as an example of the benefits of low energy buildings, these buildings also have another very important function: that of providing training/knowhow. Their implementation increases the capacity of designers, builders, local government and educational institutions in the city.

As existing building stock in the municipality accounts for a large percentage of buildings, local authorities are not limited to the construction of new buildings, but also address the refurbishment of existing buildings which can be studied for their potential energy savings since optimal use results in a favourable ratio of invested funds and achieved results.

Ensuring the necessary funding for implementation of the projects is one of the most difficult tasks for the municipality. To make possible the effective utilisation of all public funds, the municipality could benefit from participation in various projects financed by the current programmes in Burgas and other European programs for which an analysis of the obstacles has been carried out. As a result of this analysis, we identified opportunities for the municipality to take advantage of grant schemes, by providing the required amounts of the municipality's own resources for the application of higher energy standards. This was the case with both buildings, the Burgas Art Gallery and kindergarten in Meden Rudnik. Both projects are included in the investment program of the municipality and will be eligible for financing under the current program Regions in Growth 2014-2020.

To stimulate the private sector, we developed a model for providing technical and administrative support, including consultations with local experts, search support for funding sources and simpler procedures for coordination and issuing of building permits by the municipality.

4.3.3 City of Cesena, Italy

“The participation of Cesena in the PassREg project provided a significant opportunity for our city for coming into contact with other partners all around Europe and being exposed to such good examples and practices.” Francesca Lucchi, Cesena Councillor for Environmental Sustainability and Europe.

For a long time, the Municipality of Cesena has been committed to energy saving and territorial safety issues, one example of this policy is its commitment to the PassREg project.

Cesena has a lot of experience in the field of energy efficiency and RES due to several projects both at the European and municipal level, and due to the activities of Energie per la città, the in-house company and energy manager of the Municipality of Cesena.



Photos © Municipality of Cesena and Michele Buda

At the beginning of the project, the municipality wasn't aware of Passive House activities in their region. The situation was surprising: there were 4 certified projects within the Emilia Romagna region, none of them was in the province of Forlì-Cesena. The first step was therefore the establishment of several contacts with all the stakeholders involved in NZEB construction and promotion. After that a network was implemented with stakeholders outside the region and with more campaigns and activities organised together (courses, info sessions, PH days, collaborations, etc.) Therefore, putting together what the region was offering in relation to PH, the municipality of Cesena started to push the process forward through training courses, events, open houses, visits, conferences, forums, etc.

After 2 years of the project, many cities showed interest and appreciation in what Cesena was doing and expressed the willingness to learn from its experience. "Thus, from aspiring regions we became front runner regions at least in our country." Elena Giovannini, Cesena Project Officer.

Cesena, with the expertise of Energie per la città, learned from the front runner regions what tools and policies they had available to support PH and NZEB, thanks to the success models and to the transnational workshops and study tours and many other means of exchange and learning. Cesena chose and implemented 3 solutions from Front Runner Regions, adapting them at the local conditions. Furthermore, according to project activities the municipality organised all the events, info sessions and training courses in order to promote PH at the local and European level.

One of the main objectives of PassREg was the promotion of the beacon projects, the outstanding examples of Passive Houses that existed in the region. Cesena has two beacon projects: the Fiorita Multiresidence and the Case Finali Social Housing.





Photos © Archevice associate and Studio Piraccini

The Fiorita Multiresidence project foresees the demolition of an old private building with a high level of energy consumption, and the realisation of a new Passive House building. The building will be optimised in terms of the number of flats and energy efficiency. According to the PH Database, it will be the first certified wooden multi-storey residential building and it will contribute to the fulfilment of the Cesena SEAP that considers the energy retrofitting of existing buildings as a priority activity for achieving the Europe 2020 Directive. This project is the pilot example of the Urban Regeneration Protocol promoted by the National Craftsmen's Association of SMEs (CNA) of Forlì-Cesena Province. The project foresees greater application of RES to fulfil the energy demand. A PV plant will be installed on the roof supplying 10 kW of energy. A heat pump will provide hot water. The space heating energy demand is currently around 11 kWh/m²/year. The project will be certified to the PH Standard by Zephir.

The Case Finali Social Housing is a multi-storey building with 25 apartments set in the city of Cesena. Designed by Archevice studio and owned by the Forlì-Cesena Savings Bank Foundation (Cassa dei Risparmi di Forlì-Cesena), the building features a roofed gallery structure with revisited ballatoio¹⁵ typology. The project is the first Passive House designed in the Cesena city and it contributes to the fulfilment of the Cesena SEAP that considers the construction according to energy class A, a priority action for achieving the Europe 2020 Directive. The Case Finali Social Housing benefited from reduced urbanisation costs from a municipal policy regulation which has now been replaced by the regional environmental law 156/2008. The ballatoio typology helps minimise the surface/volume ratio, which reduces heat losses. The building will be highly insulated and will have a high integration of RES: 25 kW

¹⁵ Ballatoio typology: typical architectural elements with stairs and stair landings

of PV modules, 50 m² of solar collectors for hot domestic water. The building achieved PH certification. The objective of the building is to actually take into account social performance, in addition to environmental and financial performance (triple bottom line of sustainability).

The success model of the municipality of Cesena is therefore the integration of several activities addressing different issues relating to energy efficiency. Starting from the overall strategy addressed within the Sustainable Energy Action Plan approved in December 2011, under the framework of the Covenant of Mayors, as mentioned before, the City of Cesena established the in-house company *Energie per la città*, energy manager of all the public building systems. This company is 100% public and is in charge of all the monitoring and maintenance of public buildings. The company also runs a municipal project called “Schools of the sun” that foresees the installation of PV modules in each primary and secondary municipal school. These systems are operating with on-site electrical power exchange mode, providing renewable energy directly to the school and meeting 100% of the energy demand in some cases. The planning of measures started with the consideration that the construction of the plants coplanar to the roofs of school buildings does not involve the use of greenery area. The systems and the energy production are constantly monitored by *Energie per la città S.p.a.*

Furthermore the strategy of the municipality is also supported by several European projects funded under VII FP or Interreg IV C addressing sustainability policies promoting energy efficiency and sustainability.

The future steps of the municipal strategy are focused on education and capacity building of citizens, students and companies, in order to promote communication campaigns, training courses, pilot actions to change their behaviour and increase their awareness.

The municipality has furthermore become a driver for sustainability, promoting more and more binding regulation and driving local changes in behaviours and habits.

The new Cesena’s Municipal Structural Plan can be an opportunity for change, as a new planning tool that will promote the discipline of urban regeneration to facilitate retrofitting and in some cases, reconstruction of existing private and public buildings, with incentives for those who choose to pursue a high level of excellence in construction with reference to energy efficiency and seismic safety.

All these strategies will definitely benefit from the experiences with the PassREg project and will continue to follow the same objectives and overall goals.

Through the PassREg project, Cesena has learned about the activities taking place throughout Europe to promote NZEB with RES and the importance of providing support to each region. Being in contact with many shining examples and seeing well-designed completed buildings with good energy performance showed the municipality a new approach that will definitely have an impact on upcoming decisions and political strategies. The project helped the city of Cesena to understand that Passive House is the way to achieve the objectives of the European Directive coming into effect in 2020, and that training and awareness are fundamental for attaining the knowhow for making this possible, and that support through financial incentives is necessary for actually realising PH projects.

4.3.4 City of Gabrovo, Bulgaria

The city of Gabrovo, in the heart of the Balkan mountains, has been known for centuries for the frugality and economic thinking of its residents. No wonder then that this is the home of the first certified Passive House in Bulgaria. But in the last two decades Gabrovo has also become a model of sustainable energy policies, so its recent success is hardly due to its thriftiness alone...



City of Gabrovo, Photos © EnEffect

The example set by Gabrovo in energy efficiency policies and projects is really contagious. Gabrovo is a founder and longtime member of the Municipal Energy Efficiency Network EcoEnergy. With the support of the Centre for Energy Efficiency EnEffect, the municipality participated in numerous demonstration projects supported by the GEF/UNDP, the European Commission and other international organisations. Some of the most famous and successful initiatives included the projects "Building Local Capacity for Promoting Energy Efficiency in Private and Public Buildings", through which a municipal EE Info Centre was established back in 2008; "Towards Class A Buildings" in the European campaign "Display", which provides information about the energy performance of public buildings; "MODEL: Energy management in municipalities" in which Gabrovo was awarded in two categories as "Best pilot municipality for 2008" in competition with 30 municipalities from 7 countries.

In 2013, Gabrovo joined the Covenant of Mayors - the most successful European initiative to support local sustainable energy development. Through this act, which reaffirmed the municipality's determination to work towards the European 2020 objectives, the city developed its Sustainable Energy Action Plan (SEAP) in which the construction sector occupies a major position. The development of SEAP was supported by two European projects (NET-COM and Covenant CapaCITY), implemented in cooperation with EcoEnergy; Gabrovo also joined the project EuroPHit, through which the school "St. Cyril and Methodius" will be renovated to the EnerPHit standard. Now Gabrovo is a partner in the SPP Regions project, supporting sustainable public procurement practices in the building sector.

Today Gabrovo municipality continues to implement a number of projects in the field of energy efficiency, demonstrating its commitment to an active policy in this area. Like all partners in PassREg, municipal leaders and experts are convinced that the concept and principles of the Passive House Standard must form the basis for the implementation of the Energy Performance of Buildings Directive and the national definition for Nearly Zero-Energy Building (NZEB). Modern construction standards and economic conditions impose new standards and challenges, which are reflected in concrete initiatives of local authorities to improve energy efficiency in all areas, with special emphasis on the construction sector, not only because of the energy savings that this approach can achieve; expected social benefits in terms of improved public services and quality of living are perhaps even more important for them.



City of Gabrovo, Photos © EnEffect

With the implementation of the PassREg Success Model, these efforts will be complemented by strengthening of the role and capacity of the energy management unit in the municipality, active work with all stakeholders and public campaigns to raise awareness and to promote the effective application of market solutions based on the Passive House Standard with RES: the most effective and feasible way to the NZEB.

The experience gained from PassREg in Gabrovo shows that such potential exists even now, and that the example set by the local authorities will be followed by private investors. The main suppliers of products and technologies are already on the market and the construction sector will follow immediately when it sniffs demand. What is needed now are more actual examples of Passive House buildings and raising awareness of the end users. That is the direction in which the relevant national and local authorities can and should begin to work hand in hand. This is also the main contribution of the PassREg beacon – the "Sun" kindergarten. A good piece of news is that this was followed by the project for the "St. Cyril and Methodius" school using the EuroPHit Standard, as well as by new projects for Passive House kindergartens in the cities of Burgas and Varna. We believe that this is just the beginning.

"Sun" kindergarten: the First Certified Passive House building in Bulgaria



Architect: SolAir Int. Ltd (www.solair-bg.eu), "Sun" kindergarten, ID 2996, Photos © EnEffect

The “Sun” kindergarten is the first certified Passive House building in Bulgaria and the first and only public building designed and constructed to the Passive House Standard. The project was initiated by the municipality of Gabrovo and the Centre for Energy Efficiency EnEffect, and technical support was also received by the EcoEnergy Municipal Energy Efficiency Network.

The execution of this undertaking is a part of the project “DIRECTIONS – Provision of social and educational consulting and integration in the communities” under grant agreement with the Ministry of Labour and Social Policy through a loan from the European Bank for Reconstruction and Development. It is the flagship project of the municipality in the area of energy efficiency, celebrating Gabrovo's participation in the EU initiative Covenant of Mayors in 2013.

The concept of the project is to cover Energy Class “A” for net energy demand according to the Bulgarian standards and at the same time to follow and comply with the concept of the Passive House Standard. According to the PHPP calculation, the building has a space heating demand of 15.47 kWh/m²a. Thermal comfort is ensured through floor heating and highly efficient ventilation with heat recuperation. Solar panels with selective collectors are used for hot water.

As the very first of its kind – and not only in the region of Gabrovo – the “Sun” day care centre is drawing the attention of many professionals in the building sector in Bulgaria. The construction work was performed in close contact with the designers in order to avoid major mistakes in the execution. The process was followed closely by the municipal experts concerned with construction, engineering, architecture and city planning. Trainers from the Technical University of Gabrovo and the local Vocational College of Architecture and Construction took part in the train the trainer course conducted by the Passive House Institute within the framework of the PassREg project. A number of regional building forums, training courses and study visits were conducted along with other capacity building events related to energy efficiency in buildings. The “Sun” kindergarten was and is being presented at the major national conferences and events with the participation of EnEffect and the Municipal Energy Efficiency Network EcoEnergy.

Mayor of Gabrovo Tanya Hristova on local energy efficiency policy



Tanya Hristova, photo © EnEffect

Policies are successful when they are quickly, efficiently and effectively applied in our communities. Municipalities are the natural partners in this process. In the new program period, which has already started and will be under the focus of the EU 2020 strategy, there are extremely important commitments related to both energy efficiency and responsible use of resources, as well as commitments to include growth, sustainable development and employment. In the area of

energy efficiency, we are particularly looking for optimal use of

EU funding opportunities, as we continue with our efforts to position Gabrovo as a pilot municipality and a model for success.

Our new low-energy day care centre "Sun" has already been certified by the Passive House Institute, making it the first public building in Bulgaria, designed and implemented to the Passive House

Standard. It is not only a good living space for children, but is also a model that demonstrates the latest solutions in the field of energy efficiency. I hope that after it is commissioned in the coming month, we will be able to report excellent results proving the effectiveness and sustainability of this decision. When we take into account the benefits that this approach will bring over time, we will certainly try to use it again in all similar projects in the future - and of course we will take into account all lessons learned so that we are able to achieve even better results in the next steps we take.

4.3.5 City of Zagreb, Croatia

The City of Zagreb was one of the Aspiring Regions of the PassREg project during the last 3 years. As the project partner, the City of Zagreb participated in planned activities. The main role of the City of Zagreb was to adopt and implement front runner region models, enhance capacity by increasing the number of building entities, offering quality training for construction professionals in the project region, the dissemination of key facts in info sessions and training courses, participation in partner meetings and study tours and development of a success model which will increase accessibility and stimulate exchange and successful application of solutions, and also highlight the importance of the Passive House Standard through outstanding beacon examples.

Three years ago, the various administrative bodies as well as the residents of the City of Zagreb had very little knowledge about the Passive House concept. There were only a few events for increasing knowledge about PH and there was very little awareness of the importance of increasing the number of educated experts and certified PH designers or craftsmen.

During the last three years, the main activities of the City of Zagreb were based on the organisation and execution of the Passive House Days and Zagreb Energy Week via Info Sessions and Regional Building Forums. The significance of study tours was to show decision makers from the City of Zagreb the benefits of Passive House buildings. The main lessons learned related to the importance of local authorities which is crucial because of their impact in driving changes - it is important that they be introduced to PassREg as a project and the positive effect of Passive House buildings on climate change. The PassREg project was an opportunity for the City of Zagreb to learn how to promote NZEB and show the effect of the support between partners. We shouldn't forget the importance of trained individuals in the process of developing Passive House buildings, which was presented through a good local example (*beacon*). Study Tours, provided by the FRRs, were the most important because the participants attained practical knowledge which they later disseminated. Their role was to show the benefits of PH. The most important element is to increase the number of educated architects, construction managers and tradespeople not only with regard to Passive House principles, but also the use of renewable energy and building specifics as the first step to raise the number of PH.

A success story of the PassREg project related to raising awareness and knowledge about Passive House buildings, primarily at the local level, but also at the regional level. The dissemination that took place throughout the duration of the project resulted in increased interest in Passive House buildings not only in the investors' circles, but also in other cities in the region. Over 236 people were trained during the project. The biggest success refers to the organised training courses on Passive House technology where 36 people took part. This was a major success of the beacon project which is a first-

hand demonstration of the advantages of the Passive House Standard. The increased perception of the beacons make investors realise that energy and cost savings can be achieved in the present time and not only in the future.

Altogether, the City Department for Energy, Environment and Sustainable Development of the City of Zagreb found that the PassREg project was successful in achieving the objectives as set out at the beginning of the project. At the start of the project, the City of Zagreb was regarded as a learning partner, somewhere in the middle compared to other partners in the consortium. In that position the City had a lot to learn, but also had fresh experiences to share with other partners. The process of stakeholder mapping, stakeholder and citizen involvement in development of the Passive House activities that Zagreb had successfully completed just prior to the PassREg project launch, allowed us to learn many important lessons and we believe those were successfully transferred to partner cities. The City of Zagreb estimates its performance differently in individual tasks. As concerns the dissemination obligations and activities according to communication processes, the goal was to target different types of stakeholders (architects, civil engineers, contractors, investors) and start with the dissemination of the Passive House principles through organisation of info sessions, Regional Group Forums, Zagreb Energy Week and Passive House Days as the monitoring and identifying beacon project.



Detached single-family house, Croatia photo © Dubravko Martinic

During the PassREg project implementation period, the City of Zagreb staff received first-hand information from other project partners through mentoring and work shadowing activities of the good examples and possible strategies for effective implementation of a wide range of passive principles of building, measures and activities. Various models of investment in RES and subsidy schemes, different approaches to sustainable building models, PHPP models are just some examples of activities that are crucial for the City of Zagreb strategy and were already implemented in other partnering cities. One of the main reasons why the City of Zagreb greatly supported the establishment of the Passive House Consortium Croatia was the lasting effect of the action after the end of the project.

The Passive House Consortium Croatia strategy plan is to unite all the associations and achieve progress by linking experts who will ensure competitive and professional institutions, products and satisfied users of Passive House buildings. The plan for increasing NZEB at the national level was made during 2014; it contains and defines NZEB and Passive Houses and states that all the public buildings have to be NZEB by 31.12.2018. The knowledge shared in the consortium resulted in raising awareness

of all those included in the dissemination process. The office staff assigned to energy issues learned a lot during the PassREg project, and knowledge, awareness and capacity were increased.

The City of Zagreb will continue to work on dissemination of the Passive House Principles in the upcoming projects and events.

4.3.6 Region Arnhem-Nijmegen, Netherlands

Thanks to PassREg, the Dutch principle of Trias Energetica has become virtual: the accuracy of the Passive House approach and the fine-tuned combination with renewable energy supply is now commonly seen as a practical and forward-looking way of building NZEB. Starting from scratch with no evidence of any special aspirations in this field, the region Arnhem Nijmegen now plays a leading role in the implementation and up-scaling of NZEB in the Netherlands. This is the result of the activities of the vital regional network platform of stakeholders for sustainable building: DNA in de bouw.

“This transition becomes tangible in our beacon projects including the retrofit of the apartments in Presikhaaf in Arnhem and the construction of GWLO in Nijmegen. But it revolves around the knowhow that is disseminated by DNA via its network and via the new knowledge institute KERN. Cooperation and coherence are the keys to success for energy neutral construction and renovation”, acknowledged the councillors for sustainability Harriet Tiemens for the municipality of Nijmegen and Henk Kok for the municipality of Arnhem.



Henk Kok



Harriet Tiemens

Cooperation and coherence will result naturally from the integral building method that DNA in de bouw developed in the so-called ‘scrum-teams’. During the PassREg project, DNA experimented with alternative forms of collaboration and project management. Its main goals were to increase customer satisfaction, shorten delivery times, reduce investment costs and reduce the risk of mistakes and miscommunication in the NZEB projects. This makes NZEB and NZE retrofits more competitive in the market and supports the building partners in the face of the challenges of implementing high energy standards. DNA in de bouw promotes a combination of techniques from the agile-scrum movement, systems engineering and morphological design. The so-called scrum-team approach has been implemented in several (beacon) projects and is adopted by several members of DNA in de bouw in their daily practice.



Left: Lean-planning at GWLO; right: DNA-Scrum team-session, photos © DNA

Inspired by the success model of Brussels and other FR's, DNA in de bouw proposes to make the expertise and training courses that have been developed and fine-tuned through PassREg available in the national educational programs of a number of the standard national training institutions. The training institution KERN (Kennisinstituut voor Energetische Renovatie en Nieuwbouw) was founded in order to meet the high demand for capacity building,.



KERN has taken over all training activities from DNA in de bouw. Complementing, and in cooperation with, conventional training institutions, KERN is establishing itself as a point of focus for innovative and integral training courses for craftsmen in the energy neutral building sector in the Netherlands.

To enable interregional sharing of knowledge, the Solution Open Source (SOS) database was developed during the PassREg project. Upgraded with the latest functionalities, it has become a Wikipedia-style library of PassREg innovations and developments of (inter-) regional significance.

Screenshot SOS © DNA

Preliminary results of the networking activities of DNA in de bouw are promising at all policy levels. The notion that the integral approach to construction and the Passive House methodology are likely to become the building standard for new buildings and retrofitting in the years to come has reached national level due to, in part, the convincing media appearance of DNA in de bouw. This affects the lobby around the national promotion of high energy awareness in the context of the national adoption of EPBD-guidelines. The development of regulations in accordance with the so-called 'Private Quality Assurance' is on-going. As guaranteed energy performance becomes obligatory for the suppliers of buildings and construction components, the call for a nationally accepted calculation tool is getting stronger. To encourage the use of PHPP, the calculation tool adhering to Passive House principles, this tool and manual recently have been translated for nationwide implementation. The Dutch NZEB tool based on PHPP is the most important outcome of the PassREg project in the Netherlands. It will be introduced as the new design tool for NZEBs by



the middle of 2015 and is expected to play a key role in the further transition.

Excursion with stakeholders during Trilogie 2013, © DNA

Residential care centre Vroomshoop

In Vroomshoop the 'Mijande Wonen' housing corporation built a Passive House project with 22 apartments for residents with reduced physical or mental abilities and shared facilities such as living rooms and guest rooms. With its high level of comfort and low flat rate utility bills (€9 per apartment per month) this beacon project is of national relevance.

Mijande wrote a tender for the most sustainable project for a fixed construction budget. The building was planned via the morphologically design method and was proposed as a traditional comfortable building without complicated machinery. In the subsequent interactive design process, called 'scrumming', a self-governing team of professionals cooperated with the client in elaborating the plan, constantly looking for better solutions.

The complex was erected in traditional masonry with a cavity wall based on a thick layer of glass granulate. A single small gas heater, usually fit for a standard home, suffices to heat the entire project. For extra ventilation in hot summer nights, the corridors are equipped with hatches. The integral design method together with Building Information Modelling (BIM) clarified the advantages of the Passive House approach. Moreover, they kept the project within budget - the additional costs of a Passive House home are no longer significant.



Treated floor area: 1800 m²
Heating demand: 11 kWh/(m²a)
Heating load: 9 W/m²
Primary energy demand: 116 kWh/(m²a)
Airtightness: 0.224 h⁻¹
Costs (€/m²): € 1031/m²
Planning and design: BouwNext

Residential care centre Vroomshoop © Bouwnext

Generatiewooncomplex Landgoed Oosterhout



Treated floor area: 213 m²
Heating demand: 14 kWh/(m²a)
Heating load: 10 W/m²
Primary energy demand: 60 kWh/(m²a)
Airtightness: 0.47 h⁻¹
Costs: € 1100,-/m²
Passive House design: Azimut Bouwbureau

GWLO © Bouwnext

GWLO is an ensemble of three single-family Passive Houses and three clustered low energy houses for families of different ages/generations living together. The houses are designed to be luxurious and self-supporting energy-wise with wood chips from the property and a central furnace. This lifecycle accommodation project is one of the first NZEBs based on Passive House design in this region. The team of professionals used the LEAN method, obtaining quick and high quality results with the least (long-term) costs for the client. This led to a very energy-efficient design with sustainable and healthy construction materials that proved feasible for a market price similar to that of non-passive homes. Triple glazed windows, an airtight wooden beam construction with 40 cm cellulose insulation, balanced ventilation and automatic exterior sunscreens achieve a comfortable interior climate around the year. The CO₂-neutral shared wood chip furnace using forestry scrap from the wooded estate supplies heating and hot water. The cost of heating and hot water is only €8 per housing unit per month.

Renovation of a terraced house in Orduyненstraat

This 1960 home in the city of Den Bosch is the first Dutch owner-occupied terraced house renovated to zero energy standard (zero added on the electricity and/or gas meters over a year as a whole). Initially desiring an extension of their kitchen, the owners eventually aspired to a better energy performance of the whole house. Supported by the regional “coalition energy zero ‘73”, the national programme for energy transition “Energiesprong” and a committed scrum/renovation team, just about all sustainable interventions suitable to this type of home were applied. Added were an airtight insulating envelope on the outside, insulation under the ground floor and an extension with a wooden frame and highly insulating panels. The renewed insulating roof features solar panels that supply all required energy (more in summer, less in winter, the excess being at least as large as the shortage). It became an all-electric home with a heat recovery ventilation system. This way, homeowners can pay for the transition with money they would spend on energy bills otherwise. Because this project demonstrates how the housing sector can become energy neutral and fossil fuel free, the Dutch government now promotes the Passive House approach through an acceleration programme for the private sector called ‘Stroomversnelling Koop’.

Treated floor area: 125 m²
Heating demand: 17 kWh/(m²a)
Heating load: 14 W/m²
Primary energy demand: 70 kWh/(m²a)
Renovation costs: € 880,-/m²
Airtightness: 0.246 h⁻¹
Passive House design: BouwNext



Passive House retrofit project Orduyненstraat © Bouwnext

Nearby future plans

Thanks to PassREg, DNA in de bouw made considerable progress in the transition of the Dutch building sector. DNA has identified the success factors that work well in our region and beyond. From the lessons of the front runner regions in PassREg and from DNA’s own experiences, the enormous complexity of the playing field and the importance of a cooperative, integral and client-centred approach of the entire supply chain is apparent.

Yet, many challenges lie ahead of us. In the public opinion there are still many misconceptions about NZEB methods, and the advantages of the Passive House methodology are unknown to many professionals. For long-term success in the mainstream market, the public must embrace the Passive House approach for meeting their needs and for a competitive alternative to traditional and other modern concepts. The political climate in the Netherlands is favourable because of the European demand to recast national standards to EPBD levels. Also, sustainability has become fashionable in general: a climate neutral lifestyle could benefit from this if we succeed in improving the image of Passive House technology. The independent organisation DNA in de bouw at the regional level and KERN at the national level can play important roles in the Netherlands for informing the general public about energy conserving construction and renovation.

A challenge that will be addressed by DNA in de bouw and KERN is the traditionally fragmented construction culture. Integrated multidisciplinary design, construction and installation are not common and suppliers often have very little theoretical and practical knowledge of Passive House technology. Adoption of the Passive House concept on the supplier side is crucial to meet the growing demand. DNA provides a platform for building professionals for sharing knowledge on Passive House technology and integral construction methods. Through PassREg, several persuasive beacon projects have been realised which already serve as a basis for inspiration and education in the region. Representing local small and medium-sized enterprises, the DNA platform also serves as an independent sparring partner for the government. KERN will develop solid educational opportunities for the suppliers of construction components and support the dissemination and promotion of integral NZEB construction practices among designers and builders.

Overcoming the financial barriers of higher initial investment costs for high quality NZEBs will be the subject of further exploration, for example in the form of Energy Service Companies (ESCO) and by furthering lifecycle cost analyses. With the strategic insights and experiences gained from the PassReg project, the members of DNA are well equipped for the years to come in order to build on the results achieved so far and to eventually reach the mainstream market with the Passive House concept.

4.3.7 Region Aquitaine, France

“The Aquitaine Region has been involved for a long time in environmental quality and energy performance. This has been demonstrated through several initiatives: organisation of the 1st symposium about HQE (French standard for High Environmental Quality) in 2001, implementation of the local Plan Climat Energie (local roadmap for the realisation of measures that are both energy efficient and have low impact on the climate), active participation in the realisation of the Plan de Rénovation Energétique de l’Habitat (large-scale retrofitting program for energy efficient residential buildings), the creation in 2006 of the Pôle CREAHD (cluster for Construction, Resources, Environment, urban Development, and Sustainable Homes) to move forward in a collective approach, and more recently the kick-off of INEF4, National Institute for the Energy Transition.

In 2014, a regional BBC Effinergie (French standard for energy efficiency) observatory was launched, which will include operations that will achieve the Passive House Standard.”

Alain Denat, Président of Pôle CREAHD, Pessac, Aquitaine, France



A Passive House Region in construction

As one of the 27 French administrative regions, Aquitaine is a Passive House Region in construction. Located on the south-western part of the metropolitan French territory, the region has a strong connection with both the Atlantic coast and the Iberian Peninsula. With more than 3 300 000



Nobatek/INEF4 headquarters © Nicolas Laisn

inhabitants over a 41 300 km² territory, Aquitaine offers more than 1 650 000 dwelling units, and 55% of these were built before 1974.

The Aquitaine region possesses the political ambition to develop a sustainable economy that is more respectful of the environment, and which integrates the energy efficiency of buildings as one of its main objectives.

As a first step towards this goal, the PassREg project highlighted some outstanding examples of nearly zero energy buildings in Aquitaine. Two examples are presented here.

Zac Euratlantique Office Building

Due to the national interest in urban renewal, the Bordeaux Euratlantique, PICHET Group are building a seven-storey wood-frame office building in the heart of Bordeaux. The building is designed to be a Nearly Zero Energy Building. With a floor area of 4500 m², the high-performance envelope is designed to be very close to the Passive House Standard. Renewables have been integrated and locally sourced organic insulating materials will be used.



Office/administration building | Zac Euratlantique | Nicolas Laisné Associés | Bordeaux | France © Nicolas Laisné

This project is part of a comprehensive approach in Aquitaine that aims to develop and strengthen engineering expertise in the field of energy-efficiency and timber frame construction, using local timber resources such as maritime pine and bio-based insulation.

A Passive House in the French Basque Country

In 2012, Carbone 64 and idea (thermal engineering and construction company of the CIB Habitat group) realised the first certified Passive House in Aquitaine in Arcangues (French Basque Country). Didier Rospide is the owner of this 210m² house and is convinced by the Passive House concept. For him, the best means of promoting the concept was to prove that the result could agree with the expectations. “About 6 years ago, when we decided to get involved in specialisation in the field of energy efficiency, we chose the Passive House concept and label, as it seemed to be the most



interesting one.” Didier Rospide – Manager of Group CIB habitat and Passive House Designer. In 2013, a study of the energy consumptions showed that the measured consumptions were in good agreement with the PHPP calculations (i.e. less than 76 kWh/m²a in terms of primary energy, all uses included).

Exterior | Poly Rythmic - ideA - Carbone 64 | Maison passive labellise | Arcangues | France, ID 2699 © Le groupe CIB Habitat

The interest in Passive House construction is growing in the region. The house has received a great number of visitors and professional stakeholders since its completion. “Didier Rospide wanted to prove that it was possible to build a Passive House and at the same time to respect the local architecture and the constraints due to modern life styles, and to allow complete freedom with reference to the indoor design.” Xabi Brave – Business Manager /idea/Passive House Designer. Indeed, as concerns the exterior, the architecture is very similar to traditional houses of the Basque Country: double pitched roof, red shutters, etc. During winter there is maximum sunlight and during summer the solar gains are regulated through shading elements.

Challenges and opportunities

Many opportunities are still to be exploited in order to obtain very low energy building stock. Since 2012, the PassREg project has allowed access to reference buildings and outstanding examples at the European level, and to solutions for developing such buildings, and identifying sources of inspiration to define the key to success for the Aquitaine region.

For the progress of sustainable development issues, many buildings with low energy consumption were built in Aquitaine over the last few years (including one certified Passive House). These projects



Photo © Nobatek

aimed at reducing the energy demand in winter and at the same time maintain optimal comfort conditions during summer. Indeed, one of the most crucial aspects in the local context is to achieve efficient management of summer comfort, in a way that is adapted to the local climate (South Atlantic temperate, and thus relatively humid and mild). The monitoring activities carried out by Nobatek/INEF4 generally provided very positive results, for winter as well as for summer.

These projects even revealed three main topics of interest for further developments: professional capacity building, detailed dynamic studies, integration of the role of the user.

The French regulations for thermal behaviour of buildings (RT2012) currently do not foresee the implementation of the Passive House Standard. The French context thus has its own standards, which could even aim for plus energy buildings in the near future (with production higher than consumption) by the year 2020. However, the Passive House sector is still poorly developed in France, and there are many difficulties which have to be overcome by private owners. Nonetheless, one of the main barriers to the progress of the Passive House Standard in France is the prior existence of a detailed regulation framework (RT2012) and of various labels and construction approaches (BEPOS, Effinergie+, HQE). These pose limitations to the visibility of the Passive House Standard in the French construction market. The RT2012 framework is still quite different from the Passive House Standard, but it could be an interesting option to combine the computation methods and the criteria of the Passive House approach to those of the regulations. This would then mean checking that there is no incompatibility, by integrating a stricter approach for each component.

Today in France, the cost of Passive House construction is still slightly higher than the cost of buildings built according to RT2012. This is still one of the most important obstacles for the Passive House



approach. However, in some European regions, the Passive House approach has progressed greatly, and has resulted in construction costs similar to “conventional” construction. This is the case in Belgium for example, and it has been widely presented during the PassREg project. In France, the objective of very low energy buildings, together with the future RT2020, will most probably correspond with the

requirements for Passive House construction, thus in a relatively short term. The best way to combine Passive House and RT2020 would probably be to adopt a roadmap that would include the common points of the two certifications and to unify and make homogeneous the future methods for calculation and design.

Photo © Nobatek

4.3.8 Regions of Italy

In Italy some regions started the process to become Passive House regions with renewable energy, aspiring to implement examples, solutions and models developed in the PassReg project. This could be



relevant for the whole Mediterranean area, with its specific features and opportunities. In addition to the city of Cesena, which is a direct partner in the PassReg project, the following other regions are involved with the *End-use Efficiency Research Group* guide of Politecnico di Milano:

- Catania district and Sicily region
- Lonato municipality and Lombardia region
- Aglientu municipality in Sardinia region
- San Giovanni Lupatoto municipality (Verona)
- Pesaro e Urbino district
- Foggia district
- Cesena municipality - PassREg Partner

The Catania district, in Sicily, shows important developments. In the Sicily beacon the target of zero energy was achieved by adopting the Passive House Standard and integrated renewable energy systems. It functions as a shining example. This residential building drew the attention of many people in the building sector and policy makers. They saw an affordable solution for realising a zero energy building with a pleasant architectural appearance. Many people have taken part in events and open-door events demonstrating this. The building is being monitored for energy and comfort performance by the eERG research group. The quantitative results demonstrated a large multiplier potential for Passive House + RES as the building has already gained the interest of industry and local governments.

This has increased awareness and knowledge both in common users as well as designers and builders, and **requests for potential Passive House** projects for new buildings and renovations are being made.



(Progetto Botticelli | Mascalucia, Sicily, Italy | © SAPIENZA & PARTNERS)

Building sector operators can take this **market opportunity** for a high level of comfort and quality buildings with very low energy costs, with more stable and successful projects despite the recent economic crisis. At the beginning of the year 2015, the design phase and the construction work has started for **another Passive House building** in the Region. This additional residential building, located in the town of Lentini, represents yet another step forward for the development of the Passive House plus renewables in the region.

All the meetings and technical activities conducted by eERG-PoliMI on the ground, in particular for the beacon in Sicily, resulted in the development of a **team of experts** with practical experience in the field of Passive House buildings with RES supply. They will provide in-depth important knowledge for the development of NZEBs in the Mediterranean context as well, particularly with regard to solar shading and controlled ventilation, and the construction and commissioning of Passive House buildings with RES supply. In addition, further training activities are starting particularly for new Passive House designers with a relevant **post-graduate Master degree** which is being developed in Catania, to provide a high level of knowledge relating to ecological and zero-energy buildings with an overall approach.

In the north of Italy, eERG-PoliMI organised and conducted a **training course** to build the capacity of craftsmen and construction managers. The course was attended by a good number of interested participants, who assessed this training activity positively. In general, in Italy the training activities in the training courses and during the info sessions will be continued in order to have a positive impact on the construction sector.



Info-session and technical meeting at Progetto Botticelli | Mascalucia, Sicily, Italy, Photo © Ing. Marco Pietrobon)

The same progress can be seen in the **Lombardia region**, particularly in Lonato del Garda, a small town where two different buildings were recently built according to the Passive House Standard with renewables, representing important examples of a zero energy single-family house and an apartment block for **social housing** respectively, particularly relevant for providing low-cost apartments for low-income families.

Many official visits were organised to directly present these beacon projects to **building users, designers** and other stakeholders. Many sessions were held in the single-family house in Lonato particularly for **young students** who showed great interest in Passive House solutions. The building was also publicised by the local media and television programmes.

The beacon projects constituted a very relevant element of the project, in order to demonstrate actual and successful examples for convincing policy makers, building owners, designers, etc. of the quality



and opportunities associated with the PassREg solutions. For this reason, we described and communicated intensively regarding these projects, and offered strong technical support to the designers, builders and owners of the beacons, and in particular the two monitored beacons in Italy and the other beacons for which we performed energy calculation using the PHPP software during the design phase.

Villa del Sole Passive House | Lonato del Garda, Brescia, Italy, ID 2939 | © ENERGIA CASA SRL

In other regions, new beacon projects are under development, as in the municipality of Aglientu where a Passive House building is presently in the design phase, and will be built in the pleasant landscape of a strategic tourist area in the north of **Sardinia**. The PassREg project provided technical support and energy calculation using the PHPP software in the design phase of this building.



In all Italian PassREg aspiring regions, starting from the project study tours, outcomes and analyses, involved policy makers are considering the inclusion of Passive House features in their **local building regulations** and in **potential tenders** for new buildings and renovations in the public sector. This has already happened for example in San Giovanni Lupatoto, a small town near Verona and Lonato, where the municipality is building a **public school** according to the Passive House Standard.

Mediterranean Passive House project | Porto Bello di Gallura, Aglientu, Sardegna, Italy, Photo © Arch. Patrizia Attanasi

In Italy, the PassREg project also showed that Passive House targets in local policy decisions are now affordable and feasible keeping in mind the fact that intermediate steps may still be necessary towards this coherent long-term vision. Some decision makers and experts from Italian regions also participated in the organised study tours and the project analysis demonstrated that it is now possible to include the Passive House requirements in local building codes, public tenders and policy decisions, as is happening in other regions and municipalities in Europe, such as Hanover (Germany), Brussels Capital



Region (Belgium), and Tyrol (Austria). But it's also possible to adopt Passive House requirements in regulations and tenders in smaller and intermediate steps with less strict, therefore intermediate quantitative requirements, or initially involving only some building types following coherent and effective medium and long-term strategies to reach complete Passive House solutions.

Info-session and training activities at Villa del Sole Passive House | Lonato del Garda, Brescia, Italy, Photo © ENERGIA CASA SRL, P.I. R. Vincenzi, Arch. G. Cabini

Some municipalities in Italy are already doing this, for example by adopting the Passive House principles in the local building codes (*Regolamento Edilizio*) as quantitative requirements required for achieving financial subsidies. This has recently been done for example in the Municipality of Muzzano (Biella) and the Municipality of Botticino (Brescia) in Italy.

All the solutions described and developed in the documents and analyses of the PassREg project throughout Europe can also be relevant for the **renovation of urban areas** previously occupied by old industrial structures which are no longer in use anymore. This is the case of many urban areas in Italy, called *aree dismesse*, that means that new buildings can be built on some of these areas. Interesting examples of Passive House solutions adopted on a large scale in this kind of area can be seen in Antwerp.



The beacon projects selected and analysed during the project by eERG-PoliMI have shown that Passive House + RES strategy is feasible and successful in a **wide range of different project typologies**: for small and large buildings, new and existing ones. For instance, we could consider the beacon in the town of Chiasso, located on the border between Italy and Switzerland, which is very close to the construction market of the Lombardia region and to the ones in the north of Italy.

This successful refurbishment of an existing multi-storey building achieved the “plus” energy building standard based on Passive House certification. The building comprising 19 apartments is a typical example of an apartment block built in 1965. Passive House principles were applied in this refurbishment that was carried out with renewable energy systems such as solar thermal panels on the roof and photovoltaic modules installed

Gasser Gruppe | Multi-storey building, ID 2923 www.passivehouse-database.org | Chiasso, Switzerland, Photo © Gasser Baumaterialien AG

on vertical surfaces of the facades and the south-facing balconies and on the roof. The integration of RES components led to an attractive architectural aspect. Thanks to Passive House + RES solutions, the renovated building will produce more energy than it consumes. This beacon and its features may thus represent a successful example for the whole of Europe.

The relevant **instruments are already available for** implementing local policy plans and regulations at the regional, district or municipal level. Many of these instruments are mandatory and required by national and regional laws. In addition, their structures and typologies are already well-known to policy makers and consultants. These instruments are various and cover strategic planning, regulations and codes for building construction, urban planning, and guidelines for public tenders and procurements, etc. Developing and communicating on the **Set of Solutions** (WP 4) and the **Success Model** (WP 2) in the Italian regions, we analysed and showed that all these instruments are suitable for easy integration into general Passive House requirements.

They can be expressed as **energy performances** (energy need for heating and cooling, total primary energy demand, etc.) and as **comfort requirements for building and system components** (thermal transmittance of the envelope, characteristics of glazed surfaces, level of airtightness, efficiency ratio of heat recovery, etc.). Also, the Passive House **calculation method** (PHPP) and the **quality assurance procedures** can be stipulated in the policy instruments.



Multi family dwelling and certified Passive Houses | Lonato del Garda, Italy | Studio Ing. Ziletti, and Arch. A. Imperadori, ID 2416, Photo © Arch. Angiolino Imperadori

4.3.9 Region of Latgale, Latvia

The Latgale Region borders with the Russian Federation in the east, the Republic of Belarus in the southeast, and the Republic of Lithuania in the south. According to the current administrative division, the Latgale Region incorporates 19 counties – including Rēzeknes county and two republican cities (Rēzekne and Daugavpils) that have the same administrative status as the districts. The territory of the region is 14 547 square kilometres, which is 22.52% of the entire territory of Latvia.

Energy efficiency is not directly determined as a priority in the development programme for the Municipality of Rēzekne. The cost-efficiency is one of the main decision-making arguments which determines the distribution of investments in the region. Investment decisions are based mainly on economic objectives, the only case of application of green procurement is the tender of projects financed by CCFI as it was one of the financing provisions. The municipality is looking for well-substantiated arguments why green procurement is advisable. The municipality of Rēzekne aims to use on-site renewable sources for heating energy supply as much as possible, and has chosen ground-source heat pumps for school and hostel buildings. The other main on-site source is wood. However, as the decisions for energy procurement are made in a decentralised way by local governments, a common policy has not been implemented and the main motive in favour of the decision is the low cost. Professional consultation for the project was provided by certified Passive House Designers and energy efficiency and building physics experts in Latvia.



Tiskadi Secondary school (left) ID4450 and Tiskadi special Boarding Elementary school hostel (right) ID 4451
Photos © Eduards Grišuļonoks

Knowledge in this field is growing slowly in the region because specific courses (Passive House designer and Tradesperson courses) were mostly provided only outside the Latgale Region due to insufficient numbers of interested professionals. The PassREg project provided the opportunity to organise on-site training sessions in beacon projects. To educate the public and experts about the Passive House concept, the PassREg project team developed a Latvian Passive House platform, where international solutions across Europe can be found on different topics, as well as practical examples, a Passive House database with constructed buildings in Latvia, information about the next planned Passive House Designer and Tradesperson course and much more.

In the Latgale region, the project had a great impact on the development of the Rēzekne region by improving the educational infrastructure, and is an example of low energy design and construction processes in the region.

Through the PassREg project, many initiatives have been started, and various informative info sessions and Passive House open-door days were organised which were very successful, because Passive House owners opened the doors of their homes for visitors in Latvia for the first time. This event was a great opportunity for all people in Latvia who were interested in Passive House buildings.

The objective of the project is the implementation of refurbishments as pilot projects in compliance with the goals defined by the European Union for the construction of buildings with an energy consumption close to zero as from the year 2020.



A multiplication factor is the fact that both buildings are typical products of the Soviet era, and there are numerous similar schools in the area. The insulation work in some buildings had already been carried out prior to the PassREg project, but the beacon projects of PassREg will demonstrate this comprehensive low energy approach of Passive House Standard for the first time in the local area.

Photos ©: Jānis Mickevičs

4.3.10 *Region of Vidzeme, Latvia*

The Vidzeme Planning Region (VPR) lies in the North East of Latvia and borders on the Latgale Planning Region in the South East, Zemgale Planning Region in the South and Riga Planning Region in the West. Vidzeme Planning Region is the biggest of the planning regions with regard to its area. There are 25 local municipalities (novads) and one city - Valmiera. The population in the region is around 240 thousand. The Ērgļi Region takes pride in its picturesque nature, rich history, highly enterprising people and their achievements. The common goal of the residents of the Ērgļi Region is to make it an economically advanced area by creating favourable conditions for business, bringing order to infrastructure and improving the environment, offering quality youth education opportunities, developing accessible health care and welfare system, leading a healthy lifestyle and having a creative approach to life. The student hostel project, which is one of the beacon projects in PassREg, serves as an excellent example of affordable Passive House refurbishments with renewable energy sources.

The student hostel project in Ergli serves as an excellent example to advocate affordable Passive House refurbishments with renewable energy sources.

This building is one of the most visited Passive Houses in Latvia and serves as an inspiration for multi-storey building refurbishments. The energy efficient renovation of the hostel with Passive House components achieved a specific space heating demand of 9.8 kWh/m² in a year. The advantage is a reduction in the CO₂ emissions of 169.2 t per year or 90.2 %. The calculated energy demand for space heating was reduced by 94% from 154.8 kWh/m² per year, and CO₂/LVL emission effectiveness index is 0.35 kg/LVL per year. The purpose of this project was to practically demonstrate energy efficient as well as environmentally friendly solutions for improving the living environment. This project will have a great impact on the development of the Ērgļi Vocational Secondary School and the whole Ērgļi Region by improving the educational infrastructure. In general, this project is the initiation of the Eco Construction recourse centre, based in Ērgļi Vocational Secondary School.

The main goals of energy efficiency and utilisation of renewable energy in the municipality have been determined in the regional policy document "Development Programme for Ērgļi Municipality2.

The Development Programme for Ērgļi Municipality predicts long term investments in the area of energy efficiency. All municipal residential buildings in Ērgļi have now been insulated and refurbished. The next step is refurbishment of public buildings such as social day care centres and kindergartens, and the reconstruction of the municipal heating system. It is envisaged that these investments will result in energy and cost savings. The municipality aims to use on-site renewable sources as much as possible for heating energy supply. The main on-site sources are wood, some raw materials and also hydropower.

The Ērgļi Vocational Secondary School as part of the Priekuļi Competence centre is becoming the competence centre of the entire Vidzeme Region and is one of the strongest bodies for vocational education in Latvia. Since the year 2010, the internal training courses for sustainable construction have been taking place regularly in the school.





Ergli Vocational Secondary School hostel ID 2913, Photos © Ansis Starks, Guntars Veicis (down right)

The school brings together experts and professionals from other regions. It works towards strengthening and developing its educational programs in energy efficient construction, including wood buildings, use of renewable sources etc.

The Ērgļi vocational Secondary School hostel is the most striking example in Latvia of successful refurbishment of buildings using Passive House components. The derelict Soviet-era building now has a modern look as well as the lowest level of energy consumption among all existing public buildings in Latvia. Heat consumption in conventional non-refurbished residential buildings in Latvia is 15-20 times higher. An informative seminar and discussion on "Establishment of cost effective low-energy buildings" was led by the Minister of Environmental Protection and Regional Development - Einārs Cilinskis in the Ērgļi beacon as the best practice example in Latvia.

4.3.11 Carmarthenshire, Wales (UK)

Carmarthenshire County Council is looking to lead their region to become a sustainable, low carbon community. Hence they want to explore the real world challenges of delivering the future nearly zero energy targets for construction, the impact on supply chains and the potential to create new industries and jobs. Sustainability is a core principle of everything the Welsh Government and subsequently its Local Authorities implement, hence Carmarthenshire Council are keen to deliver high environmental standards across all construction activities in the region.

The Council wants to set an example for the region as well as ensuring their own running costs are manageable now and into the future. There is a considerable programme of new school building due over the coming years across the County and they are keen to follow the Passive House Standard supported with renewable energy sources wherever feasible.

Before the PassREg project, there were very few examples of low energy Passive House buildings in Wales; there were a small number of houses built – usually as one-off demonstrations – and an office building. Inspired by the completion of new Passive House schools in England, Carmarthenshire Council decided to trial the concept on a new primary school development in the small coastal village of Burry Port. This is now the first Passive House school in Wales and is due to be completed in time for the next school term.



Photo on the left side © Jez Hewitt Photography; photo on the right side, Burry Port Marina © Carmarthenshire County Council

The challenges faced by Carmarthenshire Council when developing their low energy school will be relevant UK-wide. A particular issue in the short term was the ability to cost effectively source appropriate Passive House components. While the Council endeavours to support the local economy and manufacturers, product availability is currently limited locally and they have had to use some imported products. Such issues will obviously influence competition, value and cost in the short term. However, if large clients become confident enough to regularly set such low energy standards on future developments this should prompt the local market to supply appropriate products, which will have benefit in the long term.

The Burry Port School beacon project

The development unites the town's infant and junior schools, accommodating 210 pupils and a nursery class holding up to 30 children. In addition to low running costs, the aim was for the classrooms to offer a comfortable, healthy, well-daylight environment to enhance the learning experience of the students.



Burry Port school, Photo left © Architype; photo right © BRE

The school takes a ‘fabric first’ approach to energy efficiency via the Passive House Standard, with quality assurance built in to guarantee performance. The design will maximise ‘free’ energy from the sun during winter months but also offer shade and night time cooling to avoid any need for air conditioning in summer. Although the building is constructed to eliminate leakage and prevent heat from escaping, there is no risk of the classrooms becoming ‘stuffy’, since fresh air will be provided throughout the building by a heat-recovering ventilation system. The project uses Welsh timber throughout the structure and cladding, thus supporting local supply chains. It demonstrates the feasibility of building to this standard in a rural setting, thus proving the viability of Passive House in almost any location. In more urban situations, wider supply chains should offer increased value for money.

Quotes:

“The pupils, staff and governors are absolutely delighted at the improvements being made to our school and at the prospect of being part of the first Passive House School in Wales.”

Alison Williams | Head Teacher, Burry Port CP School | Carmarthenshire County Council Wales

“The new Burry Port CP School design hinges on a ‘fabric-first’ approach to energy efficiency, meaning the building does the work, rather than relying on bolt-on energy devices.”

Andrew Tidy | Architect & Projects Team Leader, Property Services | Carmarthenshire County Council Wales

Carmarthenshire Council justified piloting the Passive House Standard on Burry Port school by considering capital investment and lifecycle costs to determine the overall ‘cost optimal’ solution; the school will offer manageable and predictable running costs for the Local Authority, which will more than compensate for any increased capital costs in the short term. Capital costs and ongoing running and maintenance costs are usually managed by separate departments within Local Authorities, so it is not necessarily a simple process to facilitate this ‘joined up approach’ of lifecycle costing as a means of enabling low energy projects. Traditionally in the UK (and elsewhere in Europe) buildings do not perform as forecast at the design stage and energy bills are often much higher than planned, creating a ‘performance gap’. With this track record, a lot of trust is required by the various budget holders that the low energy Passive House designed school would live up to expectations and meet its running

cost targets. Evidence provided through the PassREg project about existing Passive House buildings and their actual in-use performance helped provide confidence in the lifecycle cost proposals. Lifecycle costing was an important mechanism to finance this project since there are no grants or subsidies available in the UK to help instigate Passive House developments like there have been in the Front Runner Regions.

Early engagement with designers and consultants was also valuable to determine the viability of the project and to give realistic visions of the building layout and costs prior to the scheme being tendered. This involved testing outline designs using the Passive House Planning Package (PHPP) design tools and discussions with supplier networks about potential construction options. This also contributed to the financial case for the build and allowed the Council to include specific details in their tender documentation relating to the energy standards and specifications they required.

Following the beacon school project, Carmarthenshire Council are now looking to implement the Passive House standard as their approach towards NZEB on two further planned new school developments. Each one will provide new challenges, as they are successively larger buildings with additional facilities not encountered in Burry Port (for example, kitchen/ dining facilities were not required in the Burry Port school as it was an extension and these facilities were already present in the existing part of the school). Alternative tendering and contracting arrangements will be used on these future projects with more of an emphasis on value, quality and shared risk rather than simply lowest price, with the aim of encouraging more suppliers to take on such projects and to develop strong relationships for the delivery of Passive House.

A key lesson that has become apparent from the PassREg Front Runners that is certainly true in Carmarthenshire is that Local Authorities can play an important role in driving change more quickly at a local level than is possible when trying to change National Regulations – strong political support for Passive House plus renewable energy as a solution for NZEB locally or nationally is very important to instigate new projects.

4.3.12 *Águeda/Portugal*



One major success can be reported from beyond the PassREg project. Observing the activities of the project the municipality of Águeda in the Aveiro region became convinced that the PassREg approach is also a viable pathway for them. On the 30th of September 2014, the first Passive House Municipality in Portugal was established. The first step was the training of 17 members of the municipal technical staff in order to lead and develop Passive House projects. Furthermore, funding schemes will be developed to motivate building owners to retrofit. Águeda is committed to leading by example, retrofitting the city hall building and their own social housing. The integration of the ten-point plan for the building sector, which were developed in PassREg and published on 13 March 2014, into the new municipal regulations of Águeda is also ongoing. The 10-point plan can be downloaded from the PassREg website. The next step in Portugal which is a currently ongoing task is to create the first Passive House Region in Portugal, the Region of Aveiro, with eleven municipalities and a total population of 370 0000 people. The picture below shows the Mayor of Águeda (l.) with the certificate stating that



the official decision for becoming a Passive House Municipality was taken by the municipal council on 2 February 2015.



Climate protection at the municipal level – a ten-point programme for the building sector 

Darmstadt, 13.03.2014

Climate protection at municipal level: ten-point plan for the building sector

Position paper of the Passive House Institute regarding the use of Passive House technology as a contribution to climate protection in the building sector for cities and communities.

Climate change affects us all. In order to effectively tackle climate change, we must reduce our energy consumption significantly in the long term. This means efficient use of available energy and placing maximum priority on saving energy. Cities and local authorities are important actors when it comes to climate protection – at the local level, with every individual, every community, in every region.

5 Solution open source (SOS) – the tool for NZEB implementation

Introduction

The collective knowledge from a variety of European regions on (nearly) zero energy construction can now be found on www.passregsos.passiv.de. This database contains inspiring examples and relevant solutions on topics regarding the regional dissemination of this new emphasis in construction. The information addresses all those concerned in construction, designers, contractors, educators, suppliers and politicians: everyone can find a number of inspiring articles. The database is structured like Wikipedia and is expected to keep growing. Professionals from the construction sector can enter supplementary information or entirely new articles on experiences that may further the transition to a low-emission society.

Open source wiki in 7 languages

Thanks to the open source nature of the database, every user can contribute new information in the field of energy neutral construction and retrofit. The website is multi-lingual in order to make the information applicable to all regions. Currently it contains German, Croatian, Bulgarian, French, Dutch and Latvian articles next to the English versions.

The creators of 'PassREg-SOS' hope that it won't be necessary to re-invent the wheel time and again when it comes to energy-neutral buildings. All the knowledge required for making healthy, affordable and energy-neutral indoor space everywhere in Europe is already available.

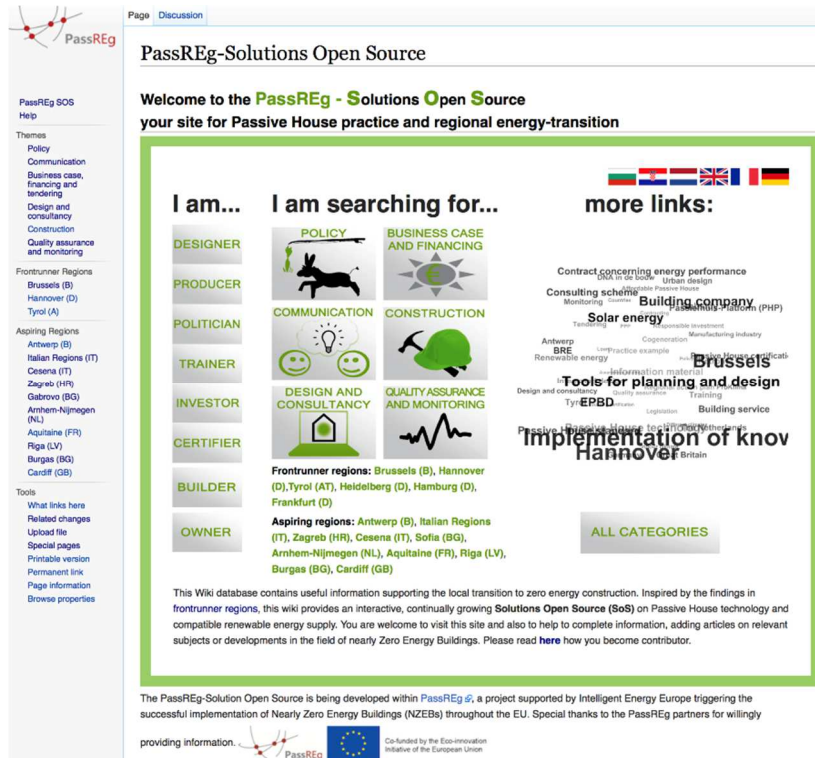


Figure: PassREG-SOS homepage, just head on over to www.passreg.sos.passiv.de

In the following some example articles will be shown:

Cesena

Project in schools for the dissemination of energy saving and renewable energy

Sensitizing youth through meetings in schools is important in raising awareness about energy saving and renewable energy. The project focused on visits to retrofitted buildings and to the municipal plant monitoring process. The visits and school meetings were informal in nature, yet education projects are a complementary and essential activity to make the most of retrofiting. In addition to sustainable energy plants, **eco-friendly attitudes** are indeed fundamental to further energy conservation.

The informal education projects organised by the Municipality of Cesena addressed the whole citizenship. The educational activities were tailored to **all categories of the public**, encouraged active involvement and assured a pleasant engagement.

- **Students** participated in workshops and study visits to buildings where retrofiting was completed. Thanks to the contribution of "Energie per la Città", a subsidiary company of the city, the Municipality of Cesena already retrofitted 83 public buildings and 19 schools. The schools have been provided with solar panels. All of these structures are located within the Cesena district. All the retrofitted buildings are continuously observed by the Municipality through monitoring. Students have also been involved in the production of publicity material. These activities involved 250 pupils in 12 classes.
- **Children and families** were addressed by day-time events and recreational activities organized in squares and parks in the city.
- **Adults and aged citizens** were invited to attend evening meetings, held in public places in each of the administrative wards of the district.



More information:

<http://www.comune.cesena.fc.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/14789/UT/> (IT)

Belgium and the Netherlands

Innovation development for highly energy-efficient housing

General

Research of Delft Centre for Sustainable Urban Areas by Erwin Miecnik. He defines the opportunities and challenges related to the adoption of Passive Houses that takes into account the supply side, the demand side and the policy side. It reveals important features of innovation-adoption strategies in the building sector for the adaptation of highly energy-efficient housing concept, particularly that of the Passive House. He clearly defines barriers and drivers in the process of adaptation of innovative technology such as Passive House design. Based on research in Flanders, The Netherlands and throughout Europe he reflects on

- innovation actors;
- the interdependence of the adaptation by endusers, businesses and policymakers;
- aspects in the decision making process of the end users;
- solutions to overcome the gap between early adopters/early majority to the late majority in dependence of the three major actors.

Conclusions

The two main-recommendations of Miecnik's research:

Makers of Innovation and energy policy should support specific change agents:

- Energy policy and innovation policy should be integrated for the construction sector.
- Enterprise collaboration and multi-player networking should be stimulated.
- Funded innovation agents should guide committed SMEs and suppliers.
- Funded change agents should guide potential adopters in each step of their innovation-decision processes.
- In some cases, these change agents could also combine their communication activities with positions as enterprise-innovation agents.

Quality-assurance schemes for highly energy-efficient housing should be introduced or revised:

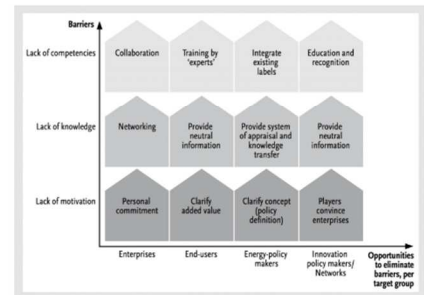
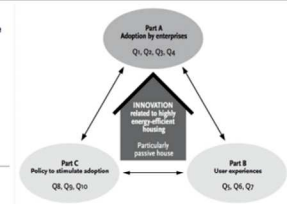
- Benefits that are not related to energy should be used to persuade potential adopters.
- The quality of demonstration projects should be assured.
- A pool of experienced actors should be developed.
- End users should be provided with detailed information.
- Indoor comfort and the adequate performance of building services should be guaranteed.
- A system of appraisal for nearly zero-energy housing should be defined, using available passive house labels or related experiences.
- An educational programme should be developed, particularly for highly energy-efficient housing renovation.

Read more:

Free download of the book via TU Delft:



Categories: Regional action plan | Communication strategy | Cogeneration | Integrated design | Passive House standard | Implementation of knowledge | Information material | The Netherlands



Germany/proKlima

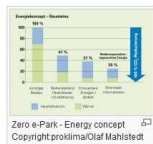
Zero:e park, Hannover

Inhaltsverzeichnis [Verbergen]

- 1 The first European settlement with passive houses and zero emission standard
- 2 Certified Passive supermarket
- 3 Downloads
- 4 More information

The first European settlement with passive houses and zero emission standard

By building nothing but Passive Houses in the ZERO E park in Hirtenbach in southwestern Hanover, the City faces the challenge of building a new residential area with 330 single family homes as a zero-emissions neighborhood. The plan is based on an innovative concept which ecological objectives are derived from the Kronsberg neighborhood, which was built more than ten years ago for Expo 2000. Overall, the new neighborhood will not emit any carbon from heat supply and household electricity. The ZERO E park in Hirtenbach, based on the Kronsberg neighborhood (1999), is thus another milestone for Hanover's climate protection objectives. The basic principle of the energy concept is to bring the houses' heat demand to a minimum thanks to energy efficient construction with passive and active use of solar energy, taking the use of renewables into consideration, only a small amount should need to be compensated for outside of the neighborhood. For heat supply, average residual carbon emissions were calculated to be 900 kg/year per house. Compared to a neighborhood built only to the current legal standard (EnEV 2009), consistent application of the Passive House Standard reduces greenhouse gas emissions from heating by 65 to 87%. Costs for heat supply are important aspects of the ZERO E park include: • constructing all buildings as Passive Houses • using solar thermal energy to reduce residual energy demand • using household appliances that consume electricity efficiently • compensating for remaining carbon emissions from heat and household electricity demand with renewable energy production facilities For the entire neighborhood to achieve climate neutrality, compensation for heating and household power was calculated to be an average of 1,300 MWh, this amount is to be covered with electricity from a reactivated hydro powerplant.



Latvia

KfW project in Aspiring region Latvia

KfW project in Latvia

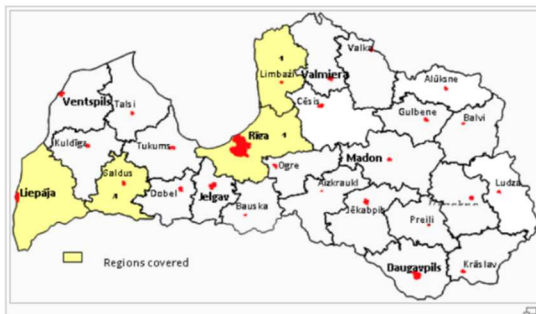
In the year 2004 realization of the project "Heat insulation of buildings for energy saving purposes" has been started. During this project municipalities and communities of apartment owners (cooperative communities of apartment owners, Ltd.) had an opportunity to obtain loan with favourable conditions for complex heat insulation of buildings. The project "Heat insulation of buildings for energy saving purposes" has been implemented in co-operation with German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, German Development Bank Kreditanstalt für Wiederaufbau (KfW), Ministry of Environment of the Republic of Latvia, Environmental Investment Fund and Mortgage Bank. In total 5 million euro has been allocated for realization of the project. In the beginning 127 applications for loans has been received and Mortgage Bank specialists have selected 47 projects to participate in the 2nd stage of competition. Unfortunately many of applicants refused from the idea of project implementation during the preparation process. Main reasons bothering successful realization of the project and loan obtaining were: Difficulties in receiving acceptance of 75% apartment owners to start the project, which is necessary, pretending for loans without mortgage. Due to different wealth level of apartment owners, it was difficult to organize common activities in loan obtaining. Within the project there was planned complex building renovation, which is technically fine, but at the same time is money consuming. Not all of the apartment owners were ready for loan liabilities, which are necessary for financing house renovation in accordance with the program conditions. Until year 2004 / 2005 heating season there have been completed 5 building renovation projects. And there also have been organized the evaluation of results obtained during the heating season. In 2005 renovation of two more houses has been finished: During the project complex renovation of building was done and as a result windows have been changed, external walls, ceilings of cellar and top floor have been heat insulated. Within the framework of the project Environmental Investment fund:

- Provided consultations to the representatives of municipalities about the possibilities of financing,
- Provided informative activities for project popularization,
- Supported municipalities during the project implementation, e.g. procurement process and process of reconstruction,
- Performed environmental improvement monitoring of the implemented project during the loan repayment period.
- Within the framework of the project "Heat insulation of buildings for energy saving purposes" the compact disc has been prepared, which summarises all necessary information about technical and economical aspects of house renovation and also includes all the informative materials, distributed during seminars. (1) http://www.lvif.gov.lv/?object_id=420

Introduction

Housing renovation projects have been implemented within the framework agreement between the Federal Ministry for the Environment, Nature Protection and Nuclear Safety of Germany and the Ministry of Environment of the Republic of Latvia. This monitoring report covers the first 5 renovation projects that were finished in 2004 and also 2 projects that were finished in 2005. The aim of this monitoring report is to analyze the achieved results and to provide information on energy saving potential in the housing sector based on concrete projects. The projects are located in 4 regions of Latvia – Riga, Saldus (Broceni), Liepaja and Limbazi (Salacgriva). The project owners in Riga and Salacgriva projects case are associations of apartment owners, but in case of Broceni and Liepaja – municipalities.

Figure 1 – Location of projects



The monitoring report was prepared by the Latvian Environmental investment fund in close cooperation with the project owners that provided information on results achieved and renovation activities carried out.

6 Training qualifies stakeholders and quality assurance is key for successful implementation

Introduction

Passive Houses do not look any different from other buildings. However, due to their clearly defined energy standard, they have a high level of thermal comfort and very small energy consumption. Good planning as well as careful execution of the details is essential, and designers and craftspeople need additional expertise.

Training materials

Training materials for architects and engineers had been available for many years; in PassREg the training material for crafts/trades has now been translated into all partner languages. The training material for craftsmen was made available in **Bulgarian, Croatian, Dutch, English, French, Italian and Latvian** including adaptations in the regional and cultural contexts. The course leads to the personal certificate “Certified Passive House Tradesperson”. For the designer courses, new modules were created to cover the topics of renewable energy integration, energy-efficient cooling and integrated design and a module for building certifiers was also elaborated.

Sustainable course infrastructure was established in all regions and Memoranda of Understandings were signed by participating universities, associations and independent training institutions. All future course providers of Tradesperson and Designer courses can take advantage of Train-the-trainer courses in English and

German which are offered

regularly by the Passive House Institute. Within the framework of PassREg, three Train-the-trainer courses were conducted in Cesena, Italy; Antwerp, Belgium; Sofia, Bulgaria.



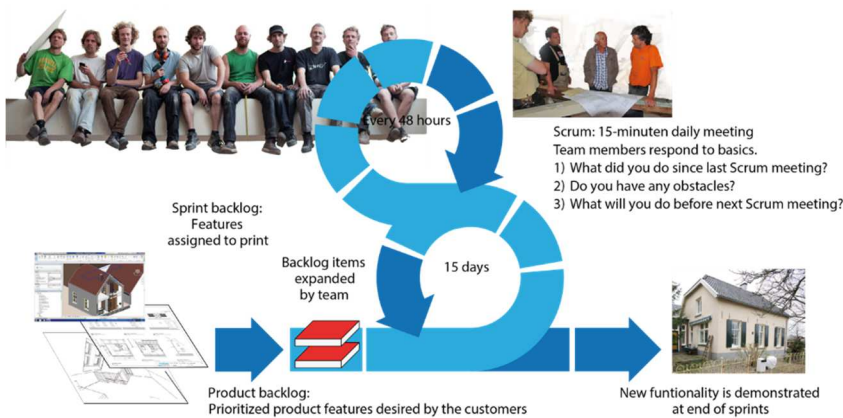
Train-the-trainer course, Cesena, Photo © Passive House Institute

Agile project management with scrum teams

DNA in de bouw actively promotes a new working culture in the building sector that is very different from the traditional way of working. New methods for collaborating, integral design and project management were developed, as well as practical tools such as calculation programmes. The main concepts that have been developed and put to use are working in scrum teams, the use of morphological design, and active use of BIM design and project management tools.

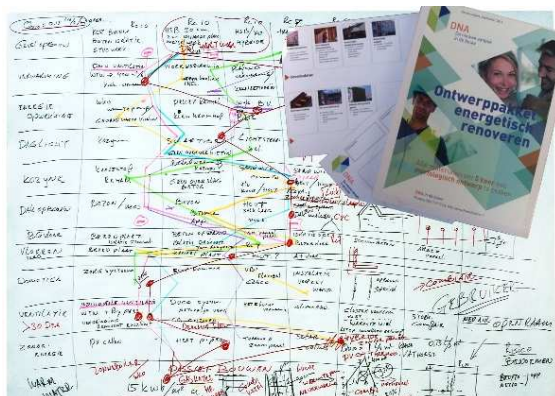
Scrum teams.

In the Dutch building sector, a practical tool for chain cooperation was missing. For more than 2 years now, the association DNA in de Bouw has been experimenting with so-called scrum teams for planning and developing NZEBs in the Netherlands. Lessons learned are carefully recorded and linked to scientific research in the fields of project development, community formation and innovation. A scrum team is a small self-steering team collaborating during the whole project. In short, intensive sprints, a clearly defined and usable product is completed each time. For sustainable building projects, integral chain cooperation from the start of a project is even more crucial than for traditional building projects. When the architect, contractor and installer regularly meet each other right from the start of a project, the costs for failures can be reduced drastically. Moreover, as a result of the special creative process that is developed in the interdisciplinary setting, sustainable building appears to become competitive pricewise compared with conventional building.



Sprint team, Photo ©DNA

Morphological design



DNA in de bouw also introduced the Ontwerppakket Energetisch Renoveren (Design tool for energy conscious retrofitting). This box contains easy-to-use tools for making a morphological design.

With the morphological design method, the client is involved in a neat and clear decision-making process. A broad range of options is discussed, and brought down to integral scenarios for deep retrofits

Morphological design, Photo ©DNA

BIM model

In addition, DNA in de Bouw promotes working with BIM models. Designers or design teams are encouraged to make use of this project system in an easy way: work on a project, together with the client, at the kitchen table, on a laptop. This was done with the owners of the Bake House. Measurements could be performed immediately and measurements from the model were checked. The BIM model makes it possible to analyse the impact of design changes on the spot.



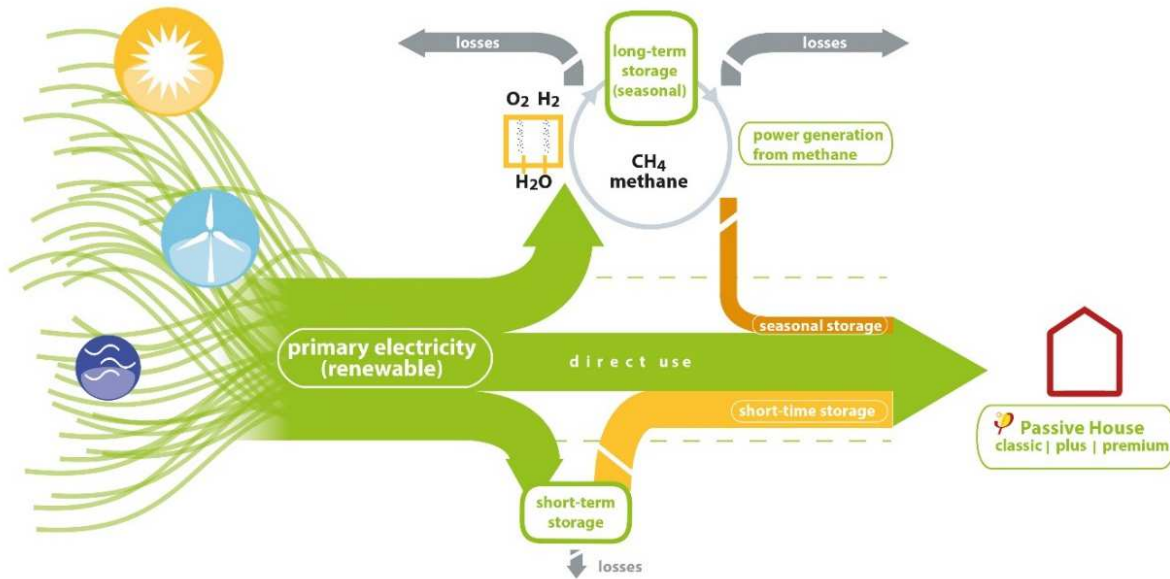
BIM model and bakehouse ready (Passive House), Photo ©DNA

The transition of the business culture

Trust the others and work together, this is the crux of the transition from the current contracting culture. Such a change in the traditional company culture cannot be achieved in a single day. DNA in de bouw actively promotes and demonstrates that collaborative teamwork in retrofit works.

PER factors - derived from a vision for a sustainable society

The Passive House institute developed the proposal for a new assessment of the energy mix used in buildings. The PassREg project has contributed to this development. Currently the energy mix used in buildings is assessed by the PE-factor (primary energy factor) which is focused on fuels. Energy from renewable sources has a very low PE-factor depending on the fuels used for its production. The new proposed PER factors (renewable primary energy) are derived from the vision of a society which is purely supplied by energy from renewable sources. It also covers the fact that in many regions of Europe, a huge amount of electricity can be produced in summer, while buildings need energy for heating in winter time. In the completely renewable scenario, the issue of storage has been taken into account, as gas heating will cover the total demand with the power-to-gas strategy as a method for long term storage. An overview of the idea behind the PER model is shown below.



© Passive House Institute

In the table below, PER-factors for some energy uses are compared with the (non-renewable) PE-factors used in the German EnEV 2016:

Appliance	Energy carrier	PER-factor*	PE-factor**
	Primary electricity	1.0	-
DHW	Electricity	1.3	1.8
Household	Electricity	1.4	1.8
Heating	Electricity	1.7	1.8
Heating	EE- Methane	1.8	1.1 (Gas/oil)
	Biomass	1.1	0.2

*Values vor central Europe ** not renewable, German EnEV (2016)

You can find more details in the Deliverable D.5.3.2 Adapted boundary conditions on the PassREg website.

New Passive House Classes

The PER approach directly led to the new Passive House categories .

Not new!!!

Efficiency first approach: Independently of the development of the energy supply structure, the efficient use of energy in buildings remains primarily important. From the beginning, this “efficiency first” approach was in the focus of the Passive House Standard, next to comfort and hygiene requirements.

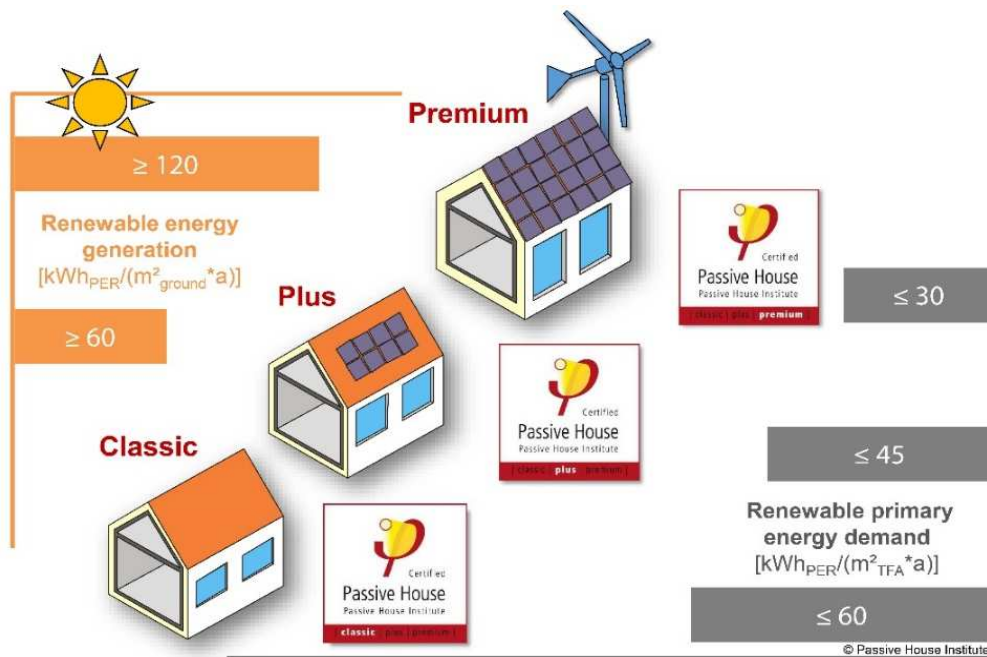
Space heating demand: As an example, a maximum annual space heating demand of 15 kWh/(m²a) is required, which is generally the economic optimum in Central Europe.

Primary energy demand: The space heating demand is not the dominant energy demand in highly efficient buildings. For example, in Passive House buildings it is in the same range as the domestic hot water demand. The demand for household electricity is generally much higher. Thus, there are efficiency potentials to be found in this area, also in combination with the chosen heating and DHW system.

Integration of renewable energies: Generation and use of renewable energy in buildings makes sense and is also required by the European Buildings Directive. Approaches which directly offset generation and demand in the annual balance will inevitably lead to incorrect optimisations because generation of solar electricity in summer cannot directly offset demand in winter. The reason is that there is a chain of transition, storage and transition again between generation and demand, and losses need to be taken into account.

New!!!

For verification and certification, the Passive House Institute introduced **Passive House classes** which are based on the **PER system** for evaluating buildings according to demand and generation which takes into account the issue of storage and the related reconversion.



©Passive House Institute

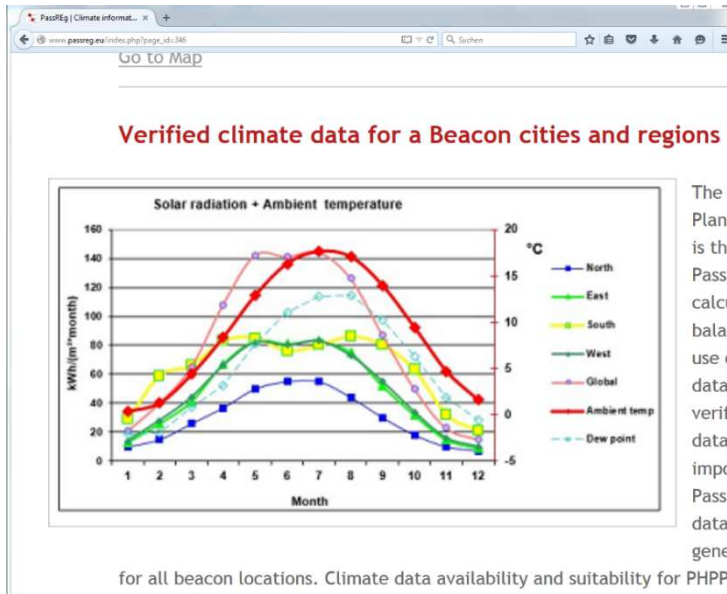
Passive House – Classic: is the approach which we have been used for over 20 years. (PHPP calculation, heating and cooling energy demand less than 15 kWh(m2/year), and what is new: the primary energy demand from renewable sources (PER) must be less than 60 kWh/(m²(treated floor area)/year) – previously the limit was 120 kWh(m²/year) annual primary energy demand from non-renewable sources (PE).

The **Passive House Plus** has the same heating and cooling demand as Passive House Classic, but energy is generated additionally, for example from photovoltaic modules. Such buildings produce more than

60 kWh/m² (ground area) energy from renewable sources and have a renewable primary energy demand of less than 45 kWh/m² (treated floor area).

The **Passive House Premium** class is designed for the avant-garde. These buildings are still Passive Houses in their basic construction, but produce more than 120 kWh/m² (ground area) energy annually from renewable sources and have a renewable primary energy demand of less than 30 kWh/m² (treated floor area). They are of a far more ambitious level than the other classes.

Verified climate data for beacon cities and regions

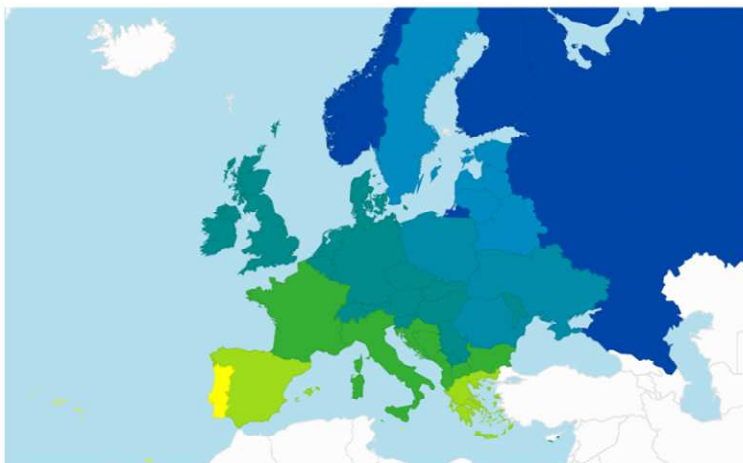


The Passive House Planning Package (PHPP) is the cornerstone of Passive House design. In calculating energy balances, the tool makes use of local climate data. As such, access to verified local climate data is extremely important. Within PassREg, new climate data sets have been generated and verified for all beacon locations. Climate data availability and suitability for PHPP calculations has now been documented for all countries represented within PassREg (Belgium, Bulgaria, Croatia, Germany, Italy, Latvia, Netherlands, and Wales).

General recommendations on how to access and treat climate data for energy calculations will act as helpful guidelines for PH designers.

An interactive map assists the beginners

Using the Passive House Standard and renewables as a basis, a clickable map provides guidelines for appropriate components for all European regions and climate zones, both for new builds and retrofits.



The displayed suitable building services solutions were supplemented with components of the building envelope, which are the exterior insulation, glazing, window frames and shading. This integral component guideline includes exemplary buildings in the different European climate zones and covers appropriate integration of renewables as well.

Typically intended for use by architects and engineers as a starting point for the integral PHPP energy balance calculation of NZEBs, it can also be used by non-technicians like politicians and investors.

Component guidelines for cost-optimal Passive Houses and EnerPHit retrofits										
Building envelope		Building services								
Climate zone	Regions	Building services								Example buildigs
		Heating installation	Cooling strategy	Ventilation concept	Domestic hot water system	Hydro	Wind	Solar	Other	
Cold temperate	Alsace, Aquitaine, Auvergne, Brittany, Burgundy, Centre, Champagne-Ardenne, Corsica, Franche-Comté	Supply air heating is possible	Night ventilation	With heat recovery and frost protection	Boiler or compact unit (ventilation, dhw boiler, heating/cooling in one unit)	Some hydropower.	Potential for wind power.	High potential for PV for electricity and solar thermal for hot water generation		Example project 2714
	Aquitaine, Auvergne									

Follow-up of beacons and monitoring in Italy and Heidelberg

Follow-up of the beacon in Latvia

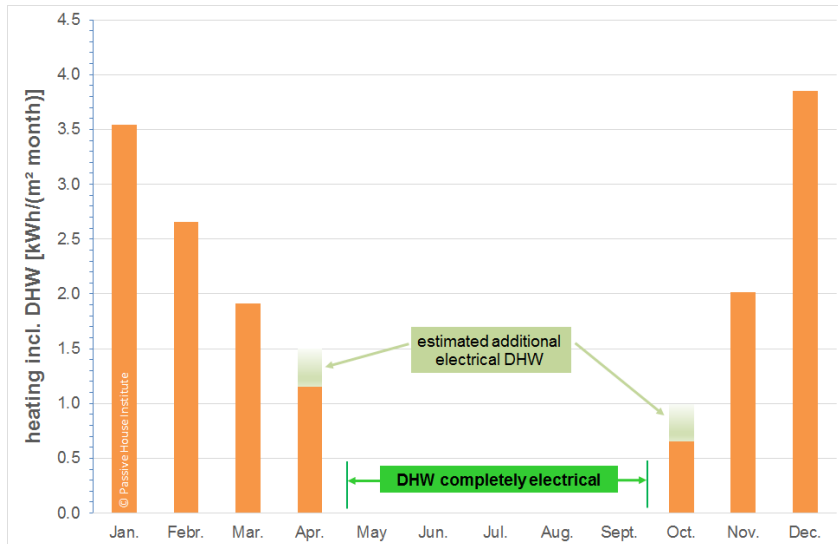
The performance of the PassREg beacon projects was followed up differently. Most of the buildings which were still in the planning and construction phase were designed with the energy balance tool PHPP in order to assess and verify their performance. Simplified monitoring and data evaluation was carried out at the Latvian project “Ērgļi Student Hostel retrofit” project. The building underwent monitoring using the templates developed by the Passive House Institute.

This project concept aimed for the implementation of the first large-scale EnerPHit renovation using



Passive House components in **Latvia** as well as in Northern Europe. It serves as an excellent example for advocating affordable Passive House refurbishments with renewable energy sources. This building is one of the most visited Passive Houses in Latvia and serves as an inspiration for multi-storey building refurbishments. The space heating demand was reduced from 154 kWh/(m²a) to 9.8 kWh/(m²a).

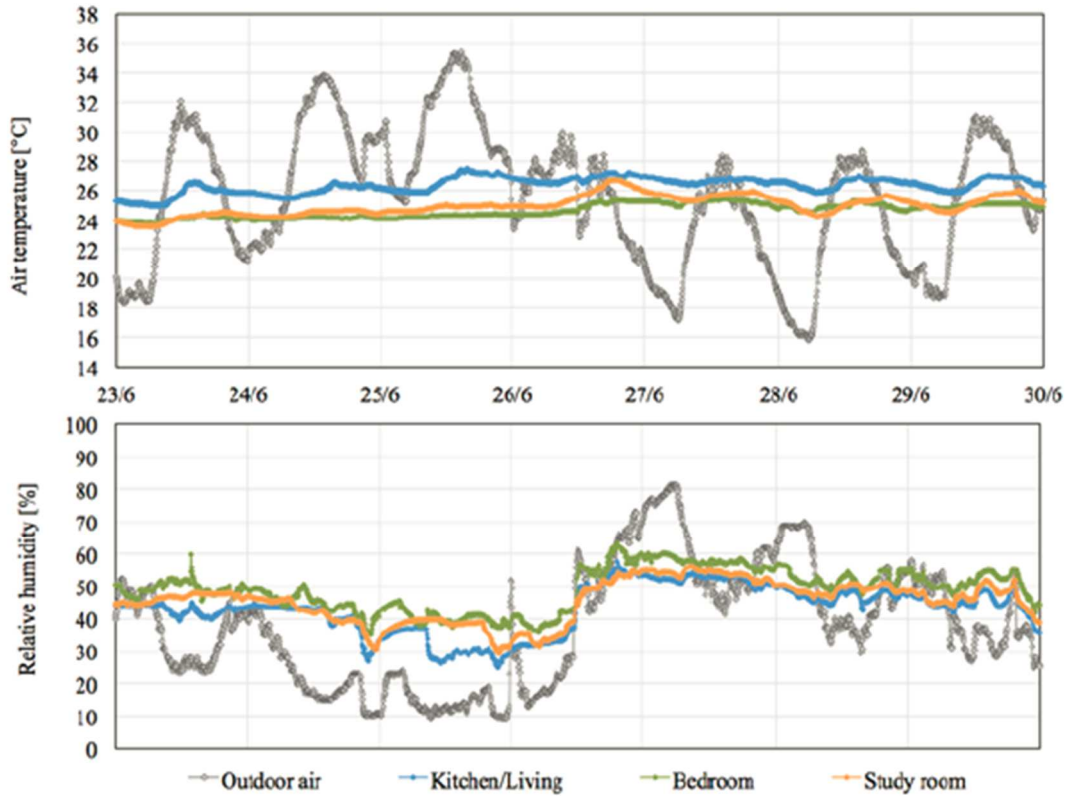
ID 2913, Photos © Ansis Starks



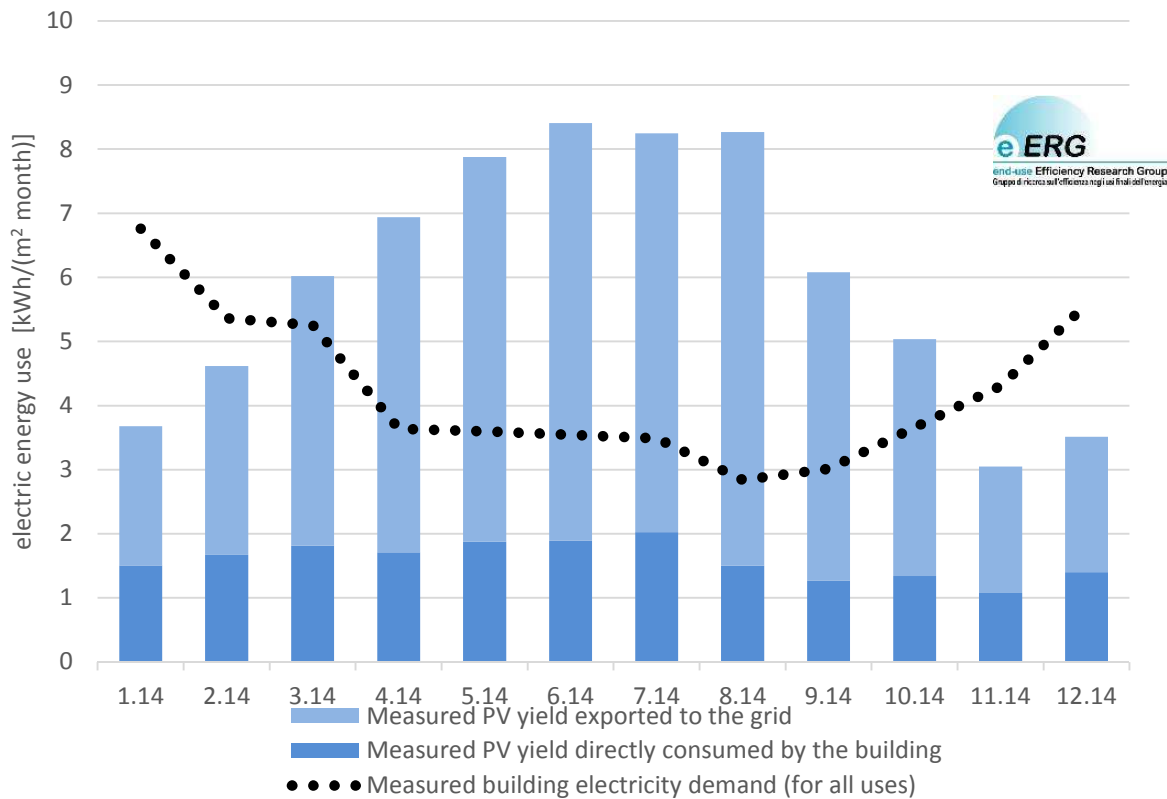
EnerPHit student hostel, Ergli, Latvia: Annual space heating consumption, including DHW, in 2014.

Italy

In **Italy**, eERG-PoliMI carried out detailed monitoring of energy and comfort related performance in two beacon projects, in the regions Marche and Sicily respectively, as relevant examples of cooling dominated climates. Monitoring results show good thermal values and indoor air quality and comfort conditions, with an interesting balance between energy demand and production from integrated renewable sources, suitable for nearly Zero Energy Building performance; some examples are presented below. The monitoring of energy and comfort related performance of the beacon projects in Sicily and in Marche will continue during the next few years, further measured data will be collected and analysed, with additional detailed analysis and studies in research activities in the field of zero energy buildings as well.



Progetto Boticelli Passive House - Sicily: temperature and relative humidity values recorded in the kitchen, bedroom and study room of the building in a warm week from 23rd to 30th June 2014



Progetto Boticelli Passive House - Sicily - monthly total electric energy use of the building vs. total electric energy generated by the PV system, in year 2014.

Heidelberg - Bahnstadt

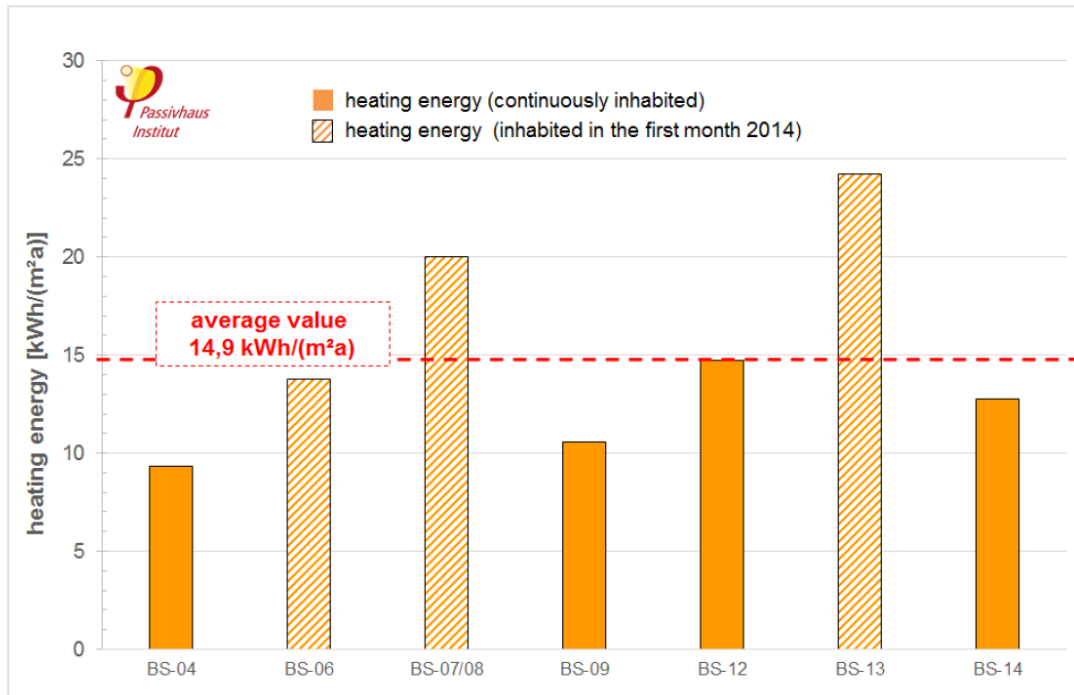


Aerial view of the Bahnstadt district, Heidelberg, ID 3879 and ID 3858 © City of Heidelberg | Photo: Kay Sommer

Currently the largest Passive House settlement in the world, the Bahnstadt district in Heidelberg, Germany, shows how monitoring can be performed successfully. The results demonstrate that the energy demand calculated with the PHPP correspond with the energy consumption monitored in the realised buildings. Moreover, the buildings currently still under construction were all calculated using the PHPP and can thus provide accurate design data in terms of energy performance and comfort.

The success monitoring was performed for the complete year 2014 but further monitoring is still ongoing. Monthly meter reading were analysed and a distinction was made between fully occupied buildings and those which were only inhabited for a shorter period. The results show that a potential for technical optimisation certainly exists in the Bahnstadt buildings, particularly with reference to storage and distribution losses. Furthermore, a few outliers can be clearly identified and thus examined more closely.

All in all, the evaluation of the consumption data shows conclusively that extensive efforts by the City of Heidelberg to design a city district to a high standard of energy efficiency through provisions and quality assurance have proved successful. More than 1200 living units have been monitored. An extremely good result has been achieved here with heating consumption values of 14.9 kWh/(m²a) on average, for measurements mainly in the first year of operation and including hostels.



Annual heating consumption values for residential utilisation (incl. hostels) according to development blocks in the Bahnstadt (ref. report D5.4.1).

7 Communication raises awareness of successes

Final workshop ‘Passive goes NZEB – Building regulations make the point’

During the Passive House Conference 2015 in Leipzig a final workshop ‘Passive goes NZEB – Building regulations make the point’ was organised. Philippe Mosely (project officer of the EU for the PassREg project) provided information about the latest development in EU politics, Ronald AA Schillemans



(Head of the Directorate for Housing and Construction, Ministry of Interior Affairs and Matters relating to the Kingdom of the Netherlands) presented the approach used in the Netherlands for developing the national definition of NZEBs: Let the market speak. Joke Dockx (Advisor to the Belgian organisation Environment Brussels) spoke about the Belgian approach.

In the subsequent lively discussion, participants from many different countries were able to exchange experiences and to

Photo@ DNA

take home new ideas and disseminate the PassREg message in their countries in order to support the process of choosing Passive House + Renewables as a solution for the national NZEB definition.

International Passive House Conference

Passive House Conferences held in 2013, 2014, 2015 all highlighted the PassREg project and further disseminated the goals of the project and ultimately the lessons learned and key takeaways which was



important in inspiring other regions, municipalities and stakeholders to implement Passive House + renewables and to consider this model as the method for defining and successfully achieving NZEBs. The Conference, which brings together over 1000 individuals from around the world, was used as a central event to include project presentations,

meetings, networking opportunities and booth space in the exhibition to raise awareness in the general public as well.

Wolfgang Feist, director of the Passive House Institute presenting final key results of the Passive House project at the plenary session of the 19th International Passive House Conference 2015 in Leipzig, Germany, Photo ©Passive House Institute

International Passive House Days

Every year in the autumn, the International Passive House Association promotes and organises the International Passive House Days, where building owners and residents open the doors of their Passive House buildings to the public and interested persons. Over the course of the PassREg project, this event was promoted by the project partners, and local events were held to showcase the Front Runner and Aspiring Regions and relevant projects. Certain PassREg partners found it particularly successful to



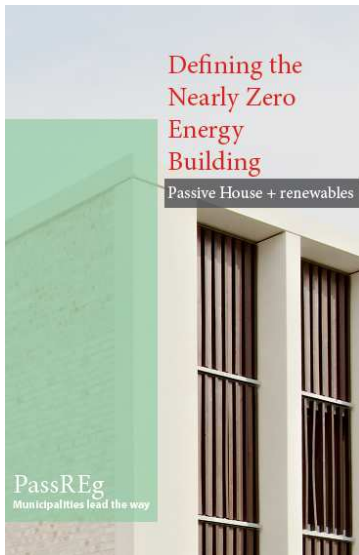
organise tours of beacons and further involve municipalities to gain a better understanding of the opportunities and importance of Passive House construction in order to meet policy goals. This activity also built a framework based on which partners and participating regions of the PassREg project will continue to present their existing and future Passive House projects with renewables integrated on-site or nearby.

Local politicians and actors in climate protection promotion the International Passive House Days at zero:e-park hanover, Germany, Photo proKlima/CPAH, 2013

PassREg brochure in all partner languages

A final deliverable of the PassREg project was the creation of a brochure, oriented towards policy makers and municipalities, to highlight both the models of front runner regions and the success of beacon projects in implementing Passive House buildings with integration of renewable energy sources. The brochure, titled 'Defining the Nearly Zero Energy Building, Passive House + renewables: *Municipalities lead the way*', was published in English as an international version of the brochure and then localised and translated by each project partner to serve as a more useful tool to communicate with local politicians and policy makers about NZEBs and the role municipalities can play. The brochure was launched at the 19th International Passive House Conference in 2015 in Leipzig and was so well-received by participants that many attendees from across the EU requested extra copies to distribute to local politicians in their home countries and cities. Beyond European borders, partners in North America saw great value in the 'politician-friendly' design and content of the brochure and an adapted North American version is planned to highlight the success of PassREg and implementation of NZEBs as a model for highly efficient buildings there.

Image of the International PassREg brochure and photos used within.



Photos: Villa Pernatich | Michael Tribus Architecture | Italy
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Photos: Casa Entre Encinas | DUQUEYAMORA ARQUITECTOS | Villanueva de Pría | Spain © DUQUEYAMORA ARQUITECTOS



Photos: Multi family dwelling | Eco-district Haren | A2M | Brussels | Belgium
© Filip Dujardin

Image of the International PassREg brochure and photos used within.

Passive House Award – regions category



In 2014, a Passive House Award was held to showcase the fact that world-class architecture and the Passive House Standard complement each other perfectly. An international jury made its selection from approximately a hundred submissions. The award recipients in a total of six categories were announced on 25 April in Aachen, Germany, at the 2014 International Passive House Conference. The six categories included single-family homes, apartment buildings, educational buildings, office and special-use buildings, retrofits and regions. PassREg was represented in the category of regions. A travelling exhibition of posters was also created for the finalists and winners of the award, available for partners and for lending to network members, showcasing the impressive results worldwide. The Bahnstadt, the city district built completely to the Passive House Standard was far and away the favourite in the "region" category. The official award plaque has now been affixed to a kindergarten in the district, thereby making the international recognition visible to passers-by within the cityscape itself.

PassREg Networks

As part of the communication and dissemination activities of the PassREg project, a network was created specifically for the project, with free registration for individuals to gain access to informative e-mails, project newsletters and publicity in our database of energy efficiency experts. Members joined from all over the world, especially from partner countries, highlighting the greatly diverse interest in the project, its findings and results. Members of the network also received access to benefits typically available exclusively to paying members of the International Passive House Association such as access to the iPHA Forum where one can ask questions and start discussions with Passive House experts as well as gain access to the members-only area of Passipedia. At the close of the project the network had close to 500 members.



8 Concluding statements

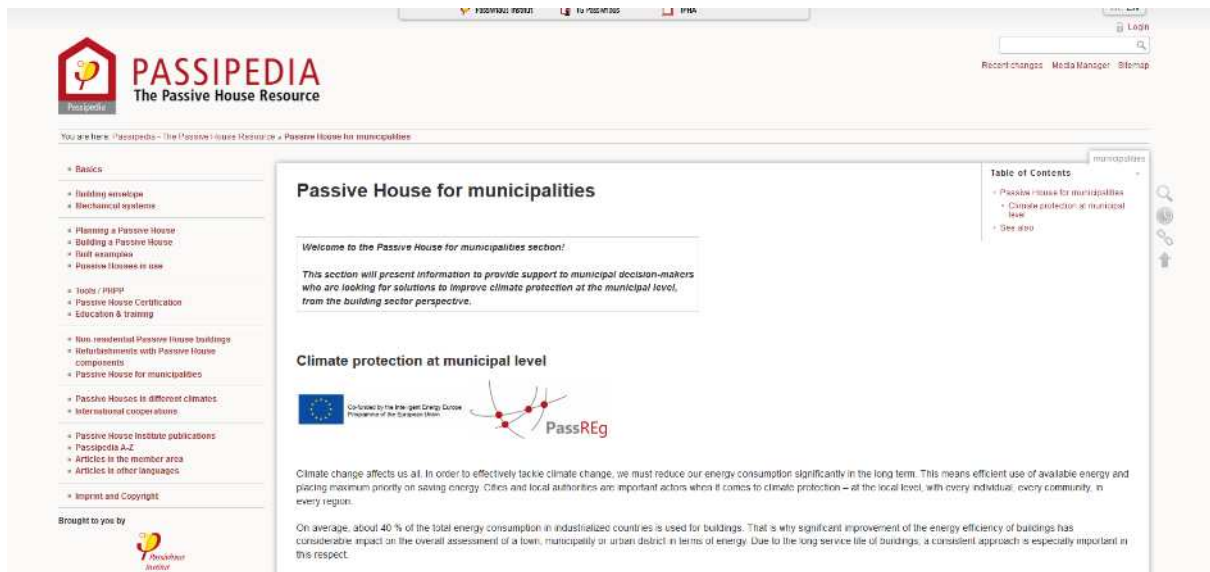
PassReg was a project which required a wide range of expertise and incorporated very different fields of activities. Starting with the technical knowledge of the Passive House Standard and renewable energies, it also included wide scale PR work, and in addition, political lobbying and empowerment of stakeholders such as manufacturers, investors and city developers. Although the starting point of the partner regions varied greatly, e.g. from almost zero in Bulgaria to a somewhat advanced level in Antwerp, all regions faced an equal challenge through the NZEB requirements coming into effect in 2019 for public buildings and in 2021 for all new buildings. The large variety of activities was excellent and necessary to meet the challenges which the cities, as well as the construction industry were and are still facing. After three years of training courses, info sessions and lobbying activities, it can now be observed that these efforts have borne fruit. The PassREg vision that Passive House + Renewables is the most suitable blueprint for NZEB or ZEB or even Plus-energy buildings is becoming more and more clear. Although several regions have already adapted the approach, there are still a huge number of regions which could benefit from programs such as PassReg in a profound and sustainable manner. The first steps have been taken, and many further steps are needed in order to change the construction and building sector throughout Europe. As mentioned at the beginning of the report, the PassReg project has very successfully showcased the path towards sustainable construction in the future. Some cities and regions have assumed the front runner role. Other cities, regions and national states may follow to help the important transition process currently facing the construction sector and to meet the climate protection goals of the European Union.



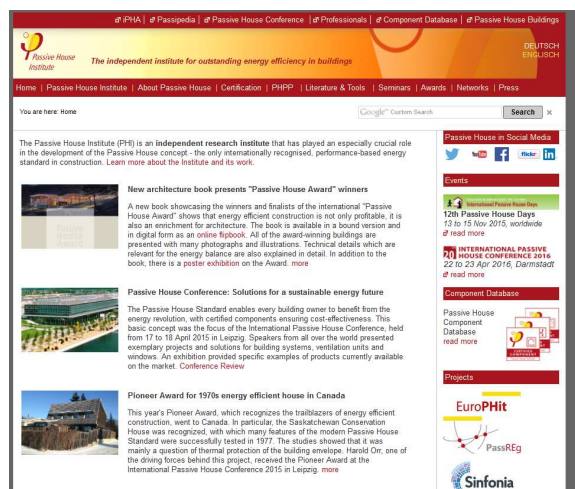
9 Resources

Passipedia

Passipedia is the online wiki-based resource for all Passive House information across a variety of subjects. There is a vast array of cutting edge, scientifically sound articles about the Passive House concept and related topics. On Passipedia, basic information and insights are available for all to see, whereas members of the International Passive House Association and the PassREg Network receive special access to more in-depth sections. This knowledge database is ever-expanding and comprises over two decades of research. There are also articles generated by the PassREg project, relevant to the implementation of Passive House + renewables in municipalities and regions.



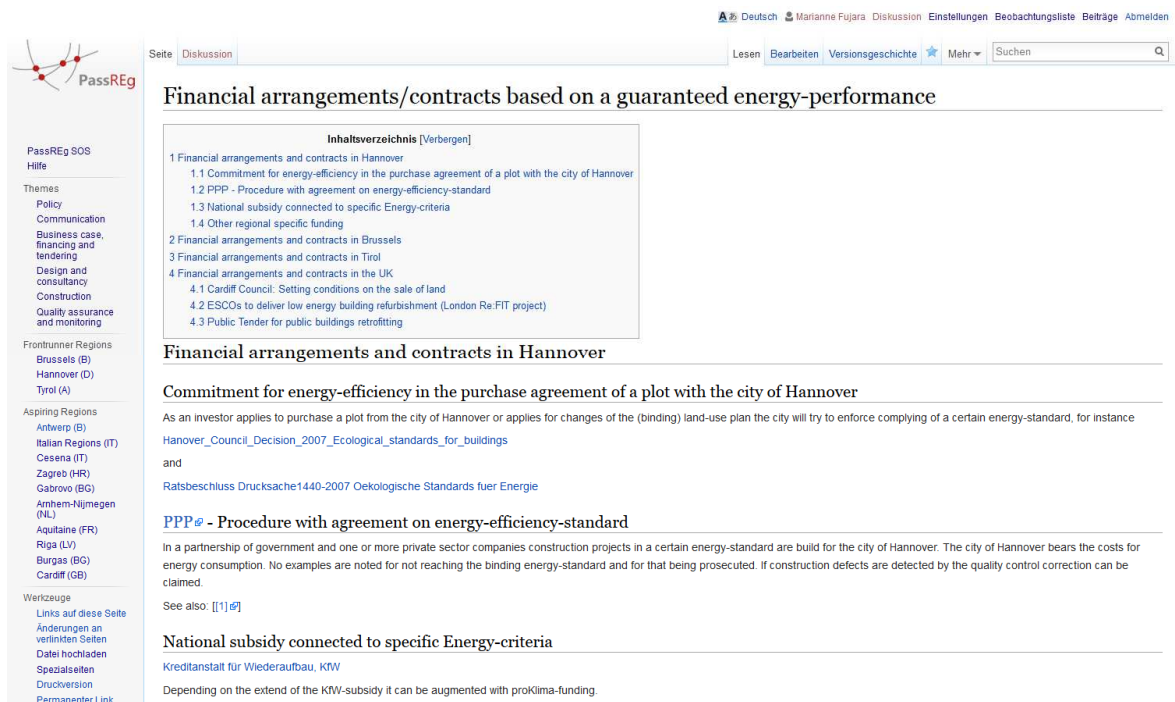
Passive House Institute www.passivehouse.com



The Passive House Institute is an independent research institute that has played an especially decisive role in the development of the PH concept – the only internationally recognised, performance-based energy standard for construction. In addition to its research activities, the Passive House Institute is also involved in the certification of buildings, building components and construction professionals.

PassReg Solution Open Source

The PassREg Solution Open Source is a wiki based tool which provides information which is helpful for the transition process towards a NZE building culture based on Passive House + renewables. It covers a large range of information from policy to quality assurance. It is available in 7 languages. http://passregsos.passiv.de/wiki/PassREg-Solutions_Open_Source



The screenshot shows a wiki page with a sidebar on the left containing navigation links for various regions and themes. The main content area is titled "Financial arrangements/contracts based on a guaranteed energy-performance" and includes a table of contents, a section for "Financial arrangements and contracts in Hannover", and a detailed section for "Commitment for energy-efficiency in the purchase agreement of a plot with the city of Hannover".

International Passive House Association (iPHA) www.passivehouse-international.org



The screenshot shows the iPHA website with a green header and navigation menu. The main content area features a section titled "International projects" which includes a sub-section for "PassREg" with a description of its role in supporting the growth of Passive House regions towards an EU energy revolution.

The International Passive House Association (iPHA) is a global network for Passive House knowledge working to promote the Passive House Standard and connect international stakeholders. Based on a network of over 2700 individual members and organisations and 18

affiliate countries, including 12 from EU Member States, iPHA acts as the central international network and platform for international exchange relating to the Passive House concept and energy efficiency.

Passive House Planning Package (PHPP)



The Passive House Planning Package (PHPP) is the key design tool used when planning a Passive House or any other low-energy building, including retrofits and historical buildings, making it the perfect tool for the planning and verification of NZEBs. It is the PHPP's high level of precision and accuracy in calculating energy balances that sets it apart. Based for the large part on European norms, the PHPP makes use of numerous

tested and approved calculations to yield the heating, cooling and primary energy demand of a building, as well as predicting its likelihood of overheating in warmer months.