Defining the Nearly Zero Energy Building

Municipalities lead the way

Contents

Foreword

The Minister will say, Evelyn Huytenbrook aus Brüssel

stem por **1.100 characters with spaces | portrait photo**.
xxxxxxxxxxxxxxx **1.400 characters with spaces | no photo**.

Minister Foreword fehlt noch!!!

Foreword

The PassREg project is accelerating the future of construction in Europe. With the Passive House Standard as a basis complemented by renewables, participating regions are delivering a blueprint for Nearly Zero-Energy Buildings. As of 2020, this will become the standard throughout the EU – a step that will drastically reduce energy consumption in the building sector.

The pioneering regions in the PassREg project are already able to draw on valuable experience and offer guidance for other communities. The step towards Nearly Zero-Energy Buildings is long overdue, as over a third of the total energy consumption in Europe results from building operation. Up to 90% of this energy can be saved with Passive House.

Local authority officials are especially important in this regard. They can create a framework for energy efficient construction with their innovative ideas, whether by means of financial incentives, pilot projects, or land-use planning. This brochure provides guidance and highlights innovative examples.

Professor Dr. Wolfgang Feist

[1]

The Nearly Zero Energy Building NZEB

Defining the NZEB

The building sector has a key role to play in implementing the EU energy efficiency objectives: around 40% of the energy consumption and a third of CO_2 emissions are attributable to buildings. With the adoption of Nearly Zero Energy Buildings throughout the EU from 2020 onwards, these figures will be reduced in a perceptible and sustainable way.

Most buildings across Europe have not yet been modernised to improve their energy efficiency, therefore a considerable potential for savings exists. This will be addressed by the provisions of the European Energy Performance of Buildings Directive. The Nearly Zero-Energy Building, as defined in the Directive, is to consume very little energy. The small residual demand will be largely met by renewable energy generated onsite or nearby.

This definition prioritises energy efficiency for good reason. Energy from renewable sources is not unlimited and is not available to the same extent in every locale. The available area for wind or solar powered systems is usually very limited, especially in cities. Energy from biomass is also only a reasonable and sustainable solution in some cases – if too many buildings use wood pellets for heating, the raw material required will not be able to re-grow fast enough. If you reduce building energy demand by 90%, though, the situation will begin to look very different.

The Energy Performance of Buildings Directive aims to improve the overall efficiency of buildings, taking into consideration local conditions, indoor climate and cost effectiveness. In various studies carried out by the Passive House Institute, it has been shown that an optimum is achieved when it is possible to heat a building solely via the hygienically necessary supply air from a heat recovery ventilation system. For typical floor areas, this is the case with a heating load of 10 W/m² or an annual heating demand of around 15 kWh/(m²a). These values also happen to be critical for compliance with the Passive House Standard. A concept that has been proven successful for more than 20 years, Passive House is an ideal basis for the definition of the Nearly Zero Energy Building.

There are already numerous examples of buildings throughout Europe that, through a combination of Passive House Standard with renewable energy sources, can be regarded as Nearly Zero Energy Buildings. Some of these were built between 2012 and 2015 in the Beacon Regions of the PassREg project; others were awarded with the 2014 Passive House Award – information is available at **www.passivehouse-award.org**. These buildings demonstrate that architecturally ambitious designs can be combined with the Passive House Standard with outstanding results. An overview of these Nearly Zero Energy Buildings, along with numerous pictures, technical details, project descriptions and other material, can be found at **www.passreg.eu**.

Passive House – the perfect NZEB

Since the ratification of the Energy Performance of Buildings Directive, the 28 member states have been working to develop their own definitions of Nearly Zero Energy Buildings, which will be required as of 2020. The Passive House Standard already offers a highly efficient and economically viable solution that can be effectively combined with renewable energy.

In the current debate about the introduction of so-called Nearly Zero Energy Buildings, reference is made to a range of energy efficient construction concepts: Passive Houses, green buildings, solar houses or sustainable buildings, to name just a few. All these concepts are fundamentally convincing in their own way, as proven by the large number of exemplary projects around the world. With its clearly defined standard and general applicability, Passive House stands out from other concepts.

Based on consistent compliance with several performance related criteria, the Passive House Standard has proved itself in practice in building types ranging from houses to schools, supermarkets, offices and apartment buildings. In addition to its high efficiency requirements, this standard is also impressive with regard to its excellent cost-benefit ratios when taking into account the lower overall energy costs. The potential use of renewable energy further reduces the already low CO_2 emissions.

Photo: Villa Lucia | Passiefhuis Bergenbos | Netherlands | © BERGENBOS

Photos: Villa Pernstich | Michael Tribus Architecture | Italy
© Michael Tribus Architecture

Passive House thus fulfils the requirements of the EU Energy Performance of Buildings Directive in every possible respect, thereby forming the ideal basis for Nearly Zero Energy Buildings.

An overall energy performance standard, the Passive House Standard is not limited to any specific construction design or building type. Any experienced architect can design a Passive House building in line with his or her own creativity. What matters is the quality of the details. As a result, the building owner will have an energy efficient building that is both cost-effective and comfortable.

Heat that is not lost in the first place does not have to be actively supplied. This is the key principle of the Passive House Standard and is mainly achieved by means of a well-insulated building envelope. Passive sources such as the sun shining through the windows, as well as internal heat sources such as heat from people and appliances, suffice to heat the indoor space. Added to this is a ventilation system in which heat is recovered from the extracted air.

In this way, a Passive House consumes about 90% less heating energy than a conventional building and more than 75% in comparison to an average European new build. This standard thus makes a significant contribution to the energy revolution and to climate protection. A Passive House is also an attractive investment for building owners: extra costs incurred in the construction phase are amortised after a few years due to saved energy costs. Even after this time, heating and cooling bills will be a tenth of what they are in normal buildings. Passive

be mastered in the case of a supermarket with energy-intensive refrigeration systems are completely different to those of a conference building that is only used occasionally, but that is full when in use. A home in Northern Scandinavia must be planned differently to a home in the Mediterranean. The fundamental principles of the standard, however, remain the same regardless of whether these are applied to new builds or energy efficient retro-fits in accordance with the so-called EnerPHit Standard.

House occupants are thus less dependent on future energy price developments.

The first Passive House was built in 1990 in Darmstadt (Germany). Systematic measurement of this pilot building's consumption data provided evidence that the previously calculated energy savings were achieved in practice. Different types of buildings based on the Passive House principle where then built in the framework of further research projects, ranging from schools and offices to swimming pools and supermarkets, all built to the Passive House Standard. The following years also showed that this standard is not only applicable and successful in Central Europe, but also in all other climate zones throughout the world.

The general applicability of the Passive House Standard has led to a huge increase in its dissemination internationally in recent years. Of course, the exact implementation details depend greatly on the respective project and location. The technical challenges that must

Photos: Casa EntreEncinas | DUQUEYZAMORA_ ARQUITECTOS | Villanueva de Pría | Spain © DUQUEYZAMORA ARQUITECTOS

Photo: First Estonian Passive House | Architekturbüro Reinberg ZT GmbH | Estonia © Architekturbüro Reinberg ZT GmbH

The five key factors for consideration in all cases are:

1) An optimal level of thermal insulation. This provides for excellent thermal protection of the building envelope and is essential to achieve high levels of energy efficiency, as most of the heat in conventional buildings is lost through the exterior walls, roof and floor. This principle is reversed in the summer and in warmer climatic zones: alongside external shading elements and energy efficient household appliances, thermal insulation ensures that heat remains outside, keeping the inside pleasantly cool.

2) Thermally insulated window frames with high quality glazing. Such windows, typically with triple-glazing, "trap" the sun's heat during the cold winter months. South-facing windows in particular direct more solar energy into the house than the heat they release towards the outside. During the warmer months, the sun is positioned higher in the sky so that less heat is trapped. Still, external shading is important to prevent any overheating.

3) Thermal bridge free construction. Heat will travel from a heated space towards the cooler outside, following the path of least resistance. Thermal bridges are weak points in a structure that allow more energy to pass through than might be expected. Avoiding thermal bridges in building design is thus a great way to avoid unnecessary heat loss. Careful planning, especially for connections between building components, intermediate ceilings, and foundations, is essential.

4) An airtight building envelope. An airtight envelope that encloses the whole interior space prevents energy loss, moisture-related structural damage, and draughts. To achieve this,

Passive Houses are designed with an uninterrupted and continuous airtight layer; special attention must be paid to junctions and connection details.

5) Ventilation with heat recovery. Heat recovery ventilation ensures a plentiful and consistent supply of fresh, clean, dust and pollen free air while reducing energy losses. Up to 90% of the heat from the extracted air can be recovered via heat exchange. These systems are usually very quiet and easy to operate. Passive House is not just an energy-saving standard; a central component of the concept is the high level of thermal comfort. Throughout the building, indoor temperatures remain constant and comfortable year-round, even without floor heating or radiators near the windows.

While the concept behind the Passive House Standard may be straightforward, great care must be taken during design and construction to achieve the desired results. Each Passive House project should be guided by an experienced expert right from the design phase. The Passive House Planning Package (PHPP), long internationally established as the premier design tool for Passive Houses and other energy efficient buildings, enables designers to accurately predict the effects of design changes on annual heating demand and other important characteristic values. Passive House certification further ensures both high quality and that the designed energy performance is delivered in practice. Certification is either carried out by the Passive House Institute itself, or by an internationally accredited Building Certifier. Through certification you can be sure that the delivered energy performance and quality is as promised.

Photo: Office building | Stadtwerke Lemgo | h.s.d. architekten | Germany
© Christian Eblenkamp

[2]

Highlights

Some regions and municipalities are promoting the use of Passive House low energy principles and renewables and achieving these standards on a wide scale thanks to targeted policies, legislation, incentives, and support. Despite their very different social and political contexts, Hannover, Brussels, Heidelberg, Frankfurt and Tyrol provide excellent examples.

> City of Hanover

Hanover's success story began as early as 1998 with the completion of a row of terraced Passive Houses in Hanover's new Kronsberg district, built for the EXPO 2000. At around the same time, the regional climate protection fund, proKlima, was established via the municipal energy supplier, enercity Stadtwerke Hannover AG, and the Hanover City Council. The fund channels over €3 million annually in direct subsidies, consulting, and quality assurance for Passive House new builds and retrofits with the provision of renewable energies. This innovative funding mechanism is fed by Hanover and select neighbouring cities, a 0.05 cent per kilowatt-hour tax levied on consumer gas bills, and enercity Stadtwerke, which transfers a portion of its profits to the fund. The effect of this fund on the local economy has been remarkable: for every euro spent in subsidies, an estimated €12.70 flows back into the region.

> City of Hanover

Photo: zero e:park Hanover | Supermarket | Spengler & Wiescholek Architektur und Stadtplanung | Germany © Olaf Mahlstedt, enercity-Fonds proKlima

The zero e:park, the development of which was supported by the fund, stands as a particular highlight. This almost carbon-neutral district in Hanover-Wettbergen comprises 300 Passive House residential units, complemented by the use of solar-thermal energy. The use of hydro power is also planned. A hugely successful concept, future home owners may buy land in this area on the condition that they build to the Passive House Standard.

Photo on the left: Kronsberg district | Hanover | Germany
© Passive House Institute

Photos: Multi family dwelling | Eco-district Haren | A2M | Brussels | Belgium
© and the copyright (photographer)

> The Brussels Capital Region

In contrast to Hanover's long-running history with energy efficiency and Passive House, the Brussels Capital Region underwent rapid change, going from zero to front-runner in less than ten years. As of 2014, over one million square meters of passive buildings had been built or retrofitted in Belgium, particularly in Brussels Capital Region, including single-family homes, apartment buildings, offices, kindergartens and schools. Thousands of building professionals, occupants and users throughout Belgium have now been directly influenced by Passive House.

In Brussels, the Exemplary Building Programme, known as BATEX, popularised the Passive House Standard as the preferred low energy building solution. The programme granted subsidies through a series of Passive House design competitions for residential buildings and a wide variety of both public and commercial buildings. BATEX, which ran from 2007 to 2014, was complemented via additional training, support and widespread stakeholder engagement, all of which quickly brought Passive House into the mainstream. In January 2015, Passive House became part of the official construction regulation, making it the reference standard for all new builds and deep retrofits. The adoption of Passive House by the Brussels Capital Region has already inspired many other regions and municipalities throughout Europe and the Americas.

Photo: Bahnstadt Heidelberg | Germany © City of Heidelberg | Photo Steffen Diemer

Photo: Bahnstadt Heidelberg | Germany © City of Heidelberg | Photo Kay Sommer

> Heidelberg's Bahnstadt

Another striking example of forward-thinking planning is Heidelberg Germany's new city district, the Bahnstadt. The Bahnstadt is rapidly becoming a well respected model for the implementation of high sustainability standards in urban development and was honoured with the 2014 Passive House Award in the "Passive House Regions" category. Established on the site of a former freight yard, the area will eventually provide housing for 5,500 people as well as office space for 7,000.

The City of Heidelberg made the Passive House Standard mandatory for the entire Bahnstadt development, making it one of the largest Passive House sites in the world. The 116 hectare district includes a student campus, offices, industry, retail, leisure, housing and associated services, demonstrating the flexibility with which the standard can be applied. It is supplied by a district heating network based on woodchip-fed combined heat and power. As such, the area is net zero in terms of annual carbon emissions – all heating and electricity needs are supplied entirely via renewable sources.

The development has been so well received, the second phase of construction was accelerated by two years. Public and private investment through 2022 has been estimated at €2 billion.
The City of Heidelberg also offers subsidies to aid the ultra-low energy development of the region, for example, by providing €50 per square metre for residential Passive House buildings – up to a maximum of €5,000 per unit.

> The City of Frankfurt am Main
Germany

The City of Frankfurt has shown its commitment to climate protection through its integration of the Passive House Standard and renewables in its planning activities. It is currently developing a master plan to reduce greenhouse gas emissions by 95% by the year 2050, leading the way to climate neutrality. The plan includes the use of the Passive House Standard in the building sector and stipulates that the city be fully supplied by renewable energy sources by 2050.

Initiated as early as 1991, current building policy consists of two main pillars: the Climate Protection Concept and the Passive House Act.

The Climate Protection Concept covers a wide range of proposed measures for reducing CO_2 emissions, including an integral communication concept relating to climate protection, a quality standard for energy-efficient renovations, capacity building campaigns, and financial support through 'Frankfurt's Passive House Loan'.

The second pillar is the Passive House Act. In 2007, the City Council of Frankfurt decided that all municipal buildings, as well as all buildings belonging to the city's own housing associations must be built to the Passive House Standard. It also stipulates the use of renewables. As of 2014, more than 100,000 m² of Passive House floor area have been built in Frankfurt. The municipal housing association, AGB Holding Frankfurt, proudly calls themselves "The Passive House builders" – a tagline that stands as a testimony to the city's dedication.

Photos: Riedberg Secondary School | Frankfurt am Am Main | Architects Ackermann+Raff | Germany © Thomas Herrmann

> The Region of Tyrol
Austria

Today in Austria one can find the highest density of Passive Houses per km², more than in Germany and Switzerland. Tyrol's success story begins when in 1999 the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) launched a research and technology programme "sustainable management" (Nachhaltig Wirtschaften) with a subprogramme "Building of tomorrow" (Haus der Zukunft). Starting from the low-energy solar building approach and the passive building concept, new designs with great promise for the future have been developed and implemented both for new construction and for renovations.

Photo: Nursing home | retreat home | Tyrol | Artec Architekten | Passive House Consultant Herz&Lang GmbH | Austria © Herz&Lang GmbH

Photo: The Lodenareal in Innsbruck | architekturwerkstatt din a4, team k2 architekten | Austria © Passive House Institute

Today the energy policy is based on the "Tyrolian Energy Strategy 2020". Tyrol cemented Passive House and renewables into their strategy for climate protection via attractive housing subsidies and Passive House promotion. Beside energy efficiency in buildings the policy also strengthens hydropower, solar energy and energy from biomass in order to achieve energy autonomy for Tyrol within one generation.
Largescale Passive House projects are also playing a particularly important role. Neue Heimat Tirol, the biggest regional social housing company, has been instrumental in this with exemplary projects that provide quality passive housing to low-income citizens. The Lodenareal in Innsbruck, for example, comprises 354 flats built to the Passive House Standard complemented with renewables in the form of solar collectors and a wood pellet boiler.

> The Region of Antwerp
Belgium

The city of Antwerp, located in northern Belgium, has committed itself to sustainable development, looking to the Passive House Standard and supported by renewables through its growth. Following its signing into the European Covenant of Mayors in 2009, the city of Antwerp began to develop policies and financial mechanisms to stimulate the energy efficient construction market in the region.

Passive building is one method the city is using to achieve its goals of carbon emissions reductions by 2020 and obtaining carbon neutrality by 2050.

In this Flemish region of Belgium, the large urban development of Cadix required all residential buildings to be built to the Passive House Standard, including the incorporation of renewable energy technologies.

The first example of such a policy initiative was in 2008 with the city of Antwerp decreeing that all public schools would be built to the Passive House Standard. Since that time, Antwerp has recognized the important role of the built environment in achieving its sustainability goals. The city is looking to increasing awareness of its citizens and capacity building of the industry's architects and engineers.

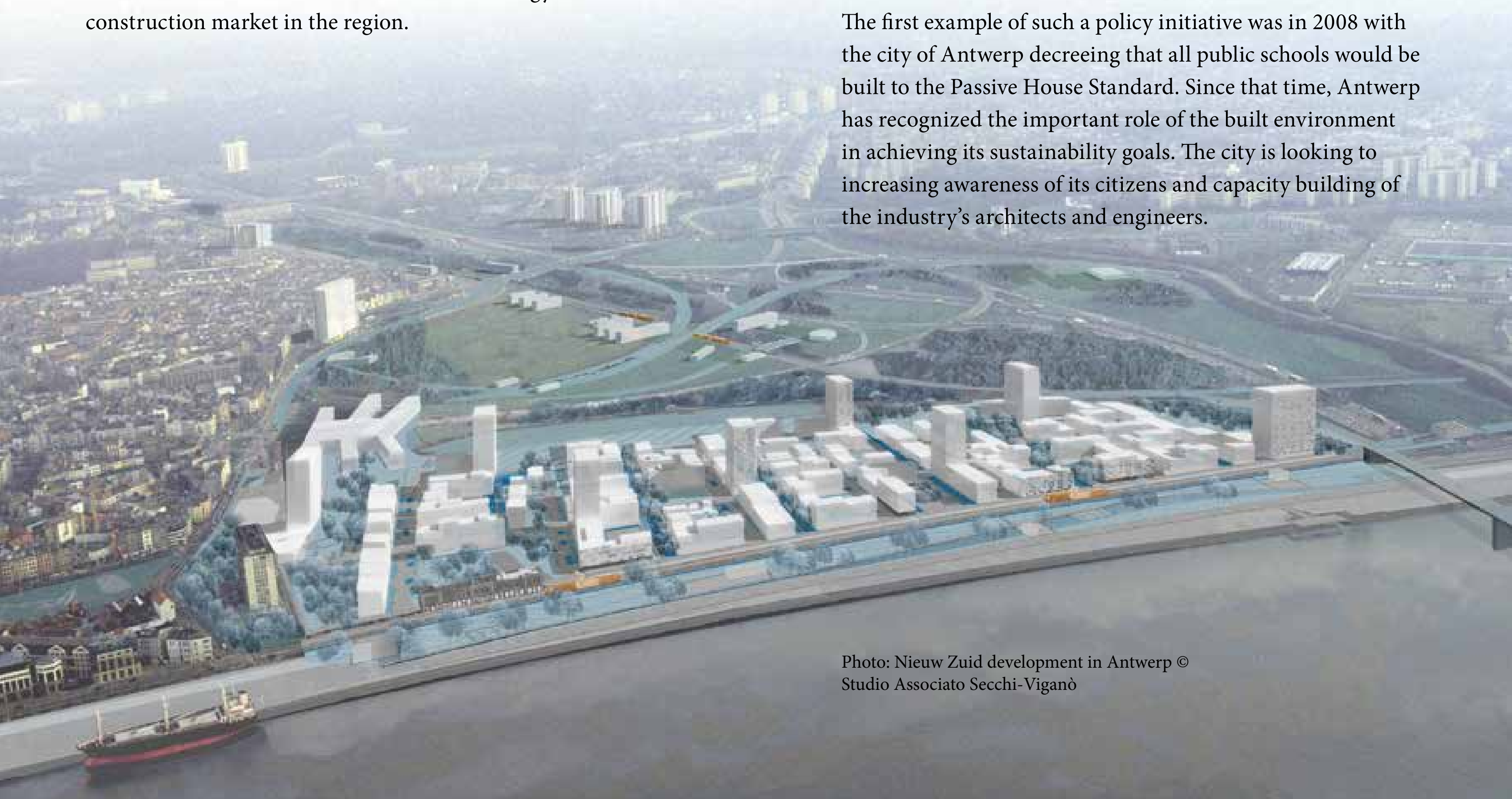


Photo: Nieuw Zuid development in Antwerp ©
Studio Associato Secchi-Viganò

[3]

A Passive House region in the making

10 reasons why the Passive House Standard is ideal as a basis for Nearly Zero-Energy Buildings

Low energy houses – or Nearly Zero-Energy Buildings – are characterised by extremely high energy efficiency as well as the use of renewable energy sources. Although promoted as the future Europe-wide standard, the exact definition of this low energy standard for buildings has been left to the 28 EU Member States. The following 10 reasons speak in favour of the Passive House Standard as a basis for Nearly Zero-Energy Buildings, due to its clearly specified criteria:

1. The Passive House Standard forms a comprehensive and advanced concept which views the building as a whole. Due to this overall approach, errors in planning are avoided right from the start and construction costs are reduced.

2. The Passive House Standard has proved successful in practice in many thousands of buildings for over 20 years. Compliance with the Standard is assured easily and reliably by means of the Passive House Planning Package (PHPP) and can be verified later on.

3. The Passive House Standard is available to everyone; it is a quality assurance and energy-relevant standard, and is not a protected brand.

"The Passive House Standard uses the efficiency first principle and can be applied to all building types, budgets and climates while still allowing for architectural expression. It therefore provides an optimal model for Nearly Zero-Energy Buildings."

Gernot Vallentin | Architektur Werkstatt Vallentin GmbH

Photo: Daycare facility for children Traunstein | Certified Passive House | Architektur-Werkstatt Vallentin GmbH | Germany © Photo Sven Ring

4. The Passive House concept is suitable for new buildings as well as energy-related refurbishments. All types of building materials may be used in Passive Houses.

5. The Passive House Standard can be combined with any architectural style and does not require a particular construction method. All types of buildings can be constructed to the Passive House Standard. Whether detached houses, apartment blocks, schools, offices, kindergartens, hospitals, production facilities, small buildings, or even tower blocks: the Passive House Standard is universally applicable.

6. With the Passive House Standard, the meticulous execution of details and use of high-quality components work together to provide an optimal level of energy efficiency. The quality of these components and that of the entire building can be verified through certification. A large number of reliable and comparable data for building components and construction systems are available because of these certifications.

7. Current research programmes are devoted to the continual advancement of the Passive House Standard. This has been described in detail in a comprehensible way in the available literature. Many training institutions throughout the world are dedicated to further training architects and craftsmen on Passive House.

8. In the long term, the overall costs of Passive Houses are lower than those of buildings built in accordance with the currently applicable energy standard due to their low energy costs.

9. Passive Houses consume very little energy on account of their optimal thermal insulation and their highly energy efficient technical building services. The low remaining energy demand can be met by using renewable energy sources on a long-term basis. All renewable energy sources – from district heating and cooling from regenerative sources to geothermal energy and solar panels – can be successfully integrated into a Passive House.

10. With the Passive House as a basis for energy-plus, zero-energy and low-energy buildings – the so-called Nearly Zero-Energy Buildings, the energy revolution is possible!

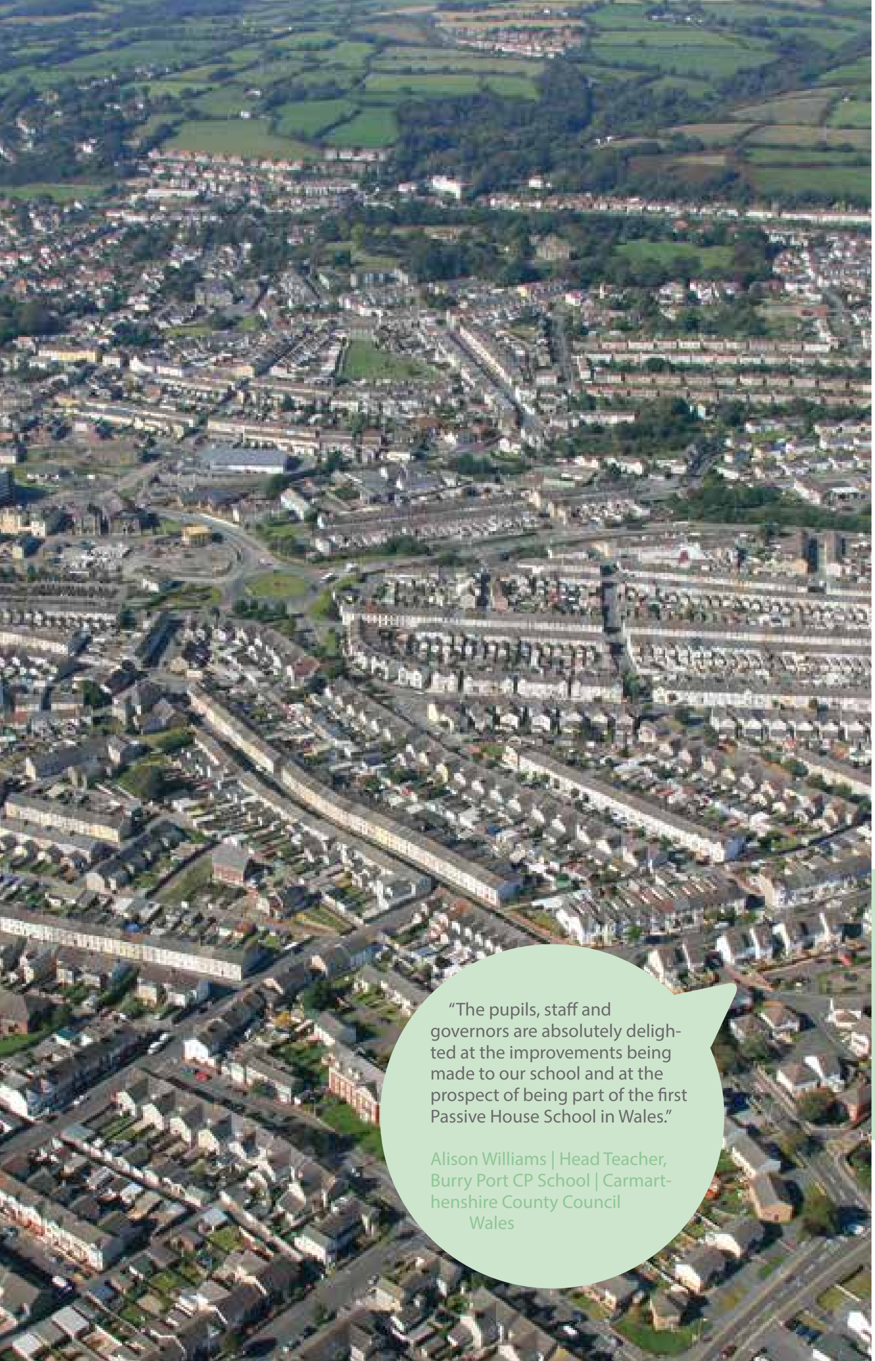
Photo: Office building | Eitting | Materials with patina - corten steel in combination with Photovoltaic panels | ArchitekturWerkstatt Vallentin GmbH | Germany © Photo: Jakob Kanzleiter

Photo: Terraced homes | Cerfified Passive House PLUS | Obermenzing | ArchitekturWerkstatt Vallentin GmbH | Germany © Photo Südhausbau München

[4]

BEACONS: Shining examples

Buildings that demonstrate innovation and future-proof performance show what can be practically achieved and offer encouragement to others aspiring to equivalent standards. By combining Passive House principles with renewable energy sources, these projects provide lessons learned and guidance to stimulate wider regional implementation.



> Beacon: Wales

Burry Port Primary CP School

Carmarthenshire Council justified piloting the Passive House Standard on a new school project in the small coastal village of Burry Port by considering capital investment and lifecycle costs to determine the overall 'cost optimal' solution. This first Passivhaus school in Wales provides manageable and predictable running costs for the Local Authority.

The project 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 offer increased value for money. The school serves as a very important example to assess the benefits of and barriers to energy efficient construction.

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-daylit environment to enhance the learning experience of the students.

"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

Photo: Llanelli Town Centre | Wales © Carmarthenshire County Council

> Beacon: Wales

Photo: Architype | Burry Port CP School | Wales © Architype

"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

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 nighttime cooling to avoid any need for air conditioning in summer. Although the building will be 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 will use Welsh timber throughout the structure and cladding, thus supporting local supply chains.

Photo: Burry Port | Wales © Jez Hewitt Photography

Usable floor area (TFA): 675m^2
Heating Demand (according to PHPP): 15 kWh/(m^{2}a)
Heating Load (according to PHPP): 12 W/m^2
Cooling Demand (according to PHPP): 0 kWh/(m^{2}a)
Cooling Load (according to PHPP): 0 W/m^2
Primary Energy Demand in kWh/(m^{2}a) (according to PHPP): TBC
Airtightness: n_{50} = 0.6/h (design)
Costs: £ 3.8 million (approx.)
Architect: Architype
Architect's website: www.architype.co.uk

> Beacon: Bulgaria

Sun Daycare Centre

The Sun Daycare Centre is the first certified Passive House building in Bulgaria and the country's only public building designed and constructed to the Standard. The project was initiated by the municipality of Gabrovo and the Centre for Energy Efficiency EnEffect. Technical support was also provided by the EcoEnergy Municipal Energy Efficiency Network.

The daycare was built as part of a project 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 energy efficiency project for the municipality, celebrating Gabrovo joining the EU initiative Covenant of Mayors in 2013.

The concept of this project was to achieve "Energy Class A" for net energy demand and comply with the Passive House Standard. High comfort levels were ensured through floor heating and highly efficient ventilation with heat recovery. Solar panels with selective collectors are used for hot water.

Photo: Mayor of Gabrovo Tanya Hrstova on local energy efficiency policy © Tanya Hrstova | Mayor of Gabrovo

Photo: Mayor of Gabrovo Tanya Hrstova on local energy efficiency policy © Tanya Hrstova | Mayor of Gabrovo

> Beacon: Bulgaria

As the very first of its kind, Sun Daycare Centre is drawing the attention of many in Bulgaria's building sector. Careful communication between the designers and site staff was required to ensure no major mistakes were made. The process was observed closely by municipal construction, engineering, architecture, and planning experts. Trainers from the Technical University Gabrovo and the local Vocational High School of Architecture and Construction took part in the Train the Trainer course conducted by the Passive House Institute. A number of regional building forums, training sessions and site visits were also conducted along with other capacity building events related to energy efficiency in construction.

Photo: Kindergarten sun | Town | with architect | Country and the © copy-right (photographer)

Usable floor area (TFA): 734 m^2
Heating Demand (according to PHPP): 15 kWh/(m^2a)
Heating Load (according to PHPP): 14 W/m^2
Cooling Demand (according to PHPP): 0 kWh/(m^2a)
Cooling Load (according to PHPP): 0 W/m^2
Primary Energy Demand (according to PHPP): 102 kWh/(m^2a) incl. heating | domestic hot water | household and auxiliary electricity
Airtightness: n_{50} = 0.55/h (design)
Passive House Database ID: 2996
Architect: SolAir Int. Ltd
Architect's website: http://solair-bg.eu/

Photos: Student housing | Ergli | Ervins Krauklis | Latvia © copyright Ansis Starks

> Beacon: Latvia

Vocational Student Dormitory

The Ergli Vocational Secondary School Student Dormitory in the Vidzeme region of Latvia, originally built in 1972, was retrofitted in 2012 with Passive House Components. The goal was to complete the first large scale EnerPHit renovation of this type in Latvia and Northern Europe.

The project was built with the support of Climate Change Financial Instrument (CCFI) for the retrofits of school buildings. This project is an excellent example of an affordable EnerPHit retrofit supplied with renewable energy. The total construction costs for all implemented energy efficiency measures were only €240 per m^2 of living space. The school serves as an inspiration for multi-family building retrofits in Latvia.

The space heating demand of the building was reduced from 154 kWh/(m^2a) to 9.8 kWh/(m^2a). Renewable energy was integrated by using the local district heating system, produced by biomass (wood-chips). An excellent airtightness result was achieved by wrapping the old building shell with an airtight membrane.

> "Wisely constructed Passive Houses are not more expensive than conventionally built houses and they are beneficial for everyone, starting from the client, designer and constructor and ending with the country, because they reduce dependency on imported resources, improve our quality of life and increase our professional pride in high quality, well-done work."
>
> Ervins Krauklis | Architect | Riga | Latvia

> Beacon: Latvia

This was the first example of a retrofit of a Soviet-era building in Latvia using Passive House Components. The project was a challenge for both the designers and the construction company. The project was important not only for the school, but was significant for the country as a whole. It clearly demonstrated that refurbishment of Soviet-period building stock with Passive House Components and renewable energy is feasible with local skills and expertise. The retrofit resulted in extremely low heating costs, unparalleled thermal comfort and high indoor air quality. The success of this project demonstrated that energy efficiency solutions can be replicated on a large scale in Latvia.

Usable floor area (TFA): 3521.3 m^2
Heating Demand (according to PHPP): 9.8 kWh/(m^2a)
Heating Load (according to PHPP): 13 W/m^2
Cooling Demand (according to PHPP): 0 kWh/(m^2a)
Cooling Load (according to PHPP): 0 W/m^2
Primary Energy Demand (according to PHPP): 98 kWh/(m^2a)
Airtightness: n_{50} = 0.58/h (design)
Passive House Database ID: 2913
Architect: Ervins Krauklis
Costs: €240/m^2 gross

Photo: Student housing | Ergli | Ervins Krauklis | Latvia © copyright Ansis Starks

Photo: Case Finali Social Housing | Cesena | Archefice Associati | Italy © Archefice Associati

Photo: Fiorita Multiresidence | Cesena Studio Piraccini | Italy © Studio Piraccini

> Beacon: Cesena

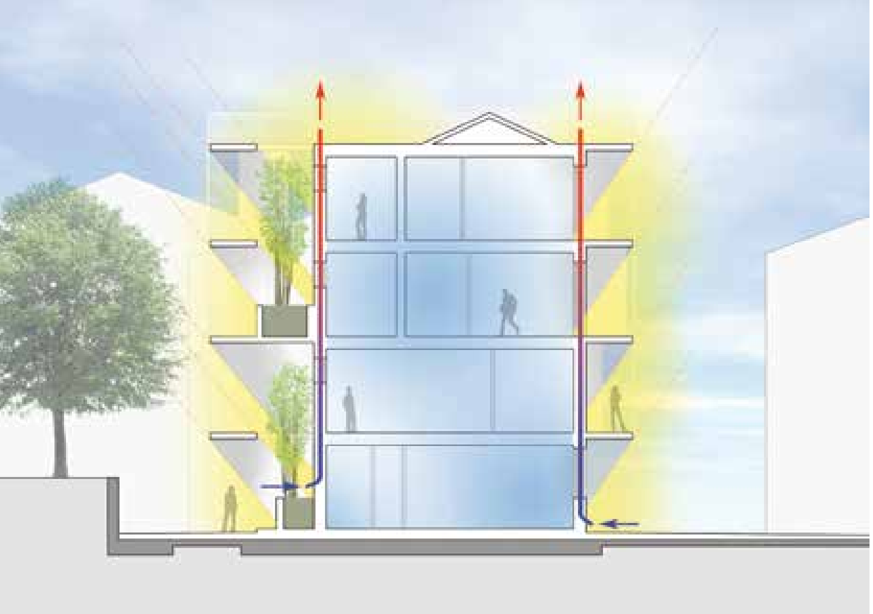
Fiorita Multiresidence

An old private building with high-energy consumption will be demolished in order for the Fiorita Multiresidence project to be developed. This new residential building is designed to meet the Passive House Standard. The building has been optimized to be highly energy efficient.

It will be the first wooden multi-unit residence certified to the Passive House Standard and it will contribute to the fulfilment of the Cesena Sustainable Energy Action Plan, which prioritizes retrofits of existing buildings in order to reach the EU 2020 Buildings Directive. The project is a pilot example for the Urban Regeneration Protocol promoted by the Artisans National Confederation of SMEs (CNA) of Forlì-Cesena Province.

The project will use renewables to fulfill the building's energy demand. A PV plant will be installed on the roof, supplying 10 kW of energy. A heat pump will be installed for domestic hot water. The annual heating demand will be around 11 kWh/m^2. The project will be certified to the Passive House Standard by Zephir.

> Beacon: Cesena

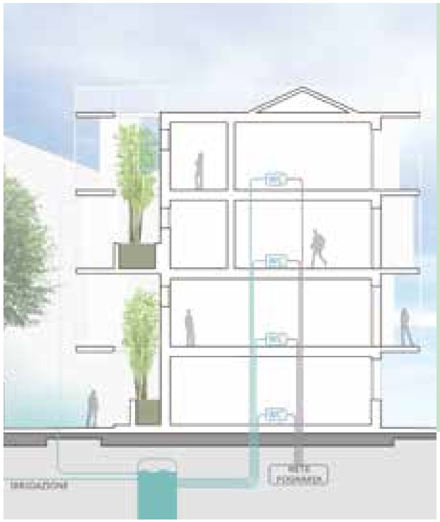


Fiorita Multiresidence solar scheme | Cesena | Italy © Studio Piraccini

The project involves the construction of eight residential buildings. Each building is designed to the Passive House Standard and will be certified once built. As the first multi-unit timber residence certified to the Passive House Standard, the Fiorita Multiresidence is an outstanding example. This project is significant not only in Italy, but also for the broader territory. The building is also a pilot project in the Urban Regeneration protocol, signed by cities, trade associations, architects, SMEs and public bodies to promote a more sustainable use of landscape and territory.

Fiorita Multiresidence RES scheme | Cesena | Italy © Studio Piraccini

Fiorita Multiresidence water scheme | Cesena | Italy © Studio Piraccini



Usable floor area (TFA): 318.7 m^2
Heating Demand (according to PHPP): 11 kWh/(m^2a)
Heating Load (according to PHPP): 8 W/m^2
Cooling Demand (according to PHPP): 9 kWh/(m^2a)
Cooling Load (according to PHPP): 9 W/m^2
Primary Energy Demand (according to PHPP): 95 kWh/(m^2a)
Airtightness: n_{50} = 0.58/h (design)
Passive House Database ID: 4086
Architect: Piraccini Stefano
Architect's website: http://ec2.it/stefanopiraccini
Costs: €1,5000/m^2

Photo: Garonne river quayside | Bordeaux | France © SAED RAJI

> Beacon: Bordeaux

Zac Euralantique Office Building

Through the national interest urban renewal operation, 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 4,500 m², the high-performance envelope is designed to be very close to Passive House standards. Renewables have been integrated and locally sourced organic insulating materials will be used. Natural ventilation is used in the building by using a "thermal chimney" system. This project is located in the heart of Bordeaux city, close to the railway station and the Garonne River.

Photo: Nicolas Laisné Associés | Office /administration office | Zac Euralantique | Bordeaux | France © Nicolas Laisné

The façades were designed to optimize homogeneous natural lighting throughout the building. The building's compactness ensures a balance between daylighting and energy performance. Renewables have also been taken into consideration including geothermal, adiabatic cooling, heat pumps and a photovoltaic generation system.

Photos: Nicolas Laisné Associés | Office /administration office | Zac Euralantique | Bordeaux | France © Nicolas Laisné

> Beacon: Bordeaux

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. It also aims to increase capacity for implementing multi-storey timber buildings. This will enable a strong positioning of actors on the regional housing and tertiary market. These are expected to be implemented in the coming years at an annual rate of 25000 dwellings and 159 000 m² of office floor area. This project is part of Bordeaux Euratlantique and the Bordeaux Metropolitan area (CUB) housing activity, which includes more than 9500 units per year.

Usable floor area (TFA): 4,475 m²
Heating Demand (according to PHPP): 20.2 kWh/(m²a)
Primary Energy Demand (according to PHPP): 51 kWh/(m²a)
Architect: Nicolas Laisné Associés
Architect’s website:
http://www.nlaparis.com/actualites.html,9,28,0,0,0

Photo: appartments for residents with reduced physical or mental abilities and one parent + child appartment | Vroomshoop | Carl-peter Goossen | Netherlands © Jacob Westra

Photo: The front of the building gets shade of deciduous trees | Vroomshoop | Carl-peter Goossen | Netherlands © Jacob Westra

> Beacon: Netherlands

Vroomshop Service-flats

The 'Mijande Wonen' housing corporation developed a project with 21 apartment buildings for residents with reduced physical or mental capacities in the village of Vroomshoop. The project includes one additional parent with child apartment and shared facilities, such as living rooms, a kitchen, an office and two guest rooms. Sand lime bricks and cavity walls were among the materials used for these Passive House buildings. Mijande published a tendering for the most sustainable project proposal. The apartment buildings in Vroomshoop thus stand as a testimony to the many advantages of Passive House: high living comfort and low utility bills with heating and hot water as low as EUR 6 per housing unit per month.

All apartments in traditional masonry construction are equipped with a cavity wall based on a thick layer of glass granulate. One small gas heater, suitable for a standard home, provides enough heat for the entire complex. The corridors use hatches for additional ventilation during hot summer nights.

Photo: The project features a solid Passive House design with common-place construction materials such as sand-lime bricks and cavity walls | Vroomshoop | Carl-peter Goossen | Netherlands © Jacob Westra

Photo: For extra ventilation in hot summer nights, the corridors are equiped with hatches | Vroomshoop | Carl-peter Goossen | Netherlands © Jacob Westra

> Beacon: Netherlands

From the beginning, the client was passionate about applying the Passive House concept on a more traditional building design without the use of complicated machinery. In the subsequent interactive design process called 'scrumming', an independent team of professionals cooperated with the client in developing the plan, constantly looking to improve the measures.

The innovative design combined with Building Information Modelling (BIM) demonstrated the numerous advantages of Passive House. The project was kept well within budget, thus rendering the higher initial costs of Passive House buildings negligible.

Usable floor area (TFA): 1 800m^2
Heating Demand (according to PHPP): 11 kWh/(m^2a)
Heating Load (according to PHPP): 9 W/m^2
Primary Energy Demand (according to PHPP): 116 kWh/(m^2a)
Airtightness: n50 = 0.2235/h-1 (design)
Costs: (€/m^2): € 1.031/m^2
Architect: Carl-peter Goossen
Architect's website: www.bouwquest.nl
Passive House Database ID: 3004

> Beacon: Italy | Sicily

Photo: Botticelli project | Mascalucia, Sicily | SAPIENZA & PARTNERS

Botticelli Housingproject

The Botticelli project is a Nearly Zero Energy Building (NZEB) built to the Passive House Standard within the village of Mascalucia, Sicily. It is the first NZEB adopting Passive House principles in a south Mediterranean climate. It is also the first Passive House building in Sicily and has become an "Active House" with a positive energy balance.

The adoption of local building technologies ensures a very high level of thermal insulation. Glazing surfaces are equipped with automatic external blinds for solar shading, when required.

This residential building is a certified Passive House building, meeting all requirements in terms of thermal performance, airtightness, and indoor air quality.

né Associés | Office/administration office |
ordeaux | France © Nicolas Laisné

The building's extremely low energy demand is covered by the on-site production of renewable energy through solar panels and an earth-to-air heat exchanger in the mechanical ventilation system. An automatically regulated thermal solar system is employed in conjunction with a highly efficient heat pump generator.

Photo: Botticelli project | Mascalucia, Sicily | SAPIENZA & PARTNERS | Italy
© ????????????????????

icolas Laisné Associés | Office/administration office |
antique | Bordeaux | France © Nicolas Laisné

> Beacon: Italy | Sicily

This highly advanced nearly zero-energy building was designed by Eng. Carmelo Sapienza of Sapienza & Partners technical firm, with the support of dynamic simulations and comfort optimization techniques provided by eERG-PoliMI – the end-use Efficiency Research Group of Politecnico di Milano. eERG-PoliMI will closely monitor energy and comfort performances of the building during the following years. The building's distinguishing features and the rising interest of local policy makers from Sicily as well as the national level make the Botticelli project a shining example not only for the region of Catania, but for the entire Mediterranean.

Usable floor area (TFA): 144m^2
Heating Demand (according to PHPP): 11 kWh/(m^{2}a)
Heating Load (according to PHPP): 7 W/m^2
Primary Energy Demand (according to PHPP): 88 kWh/(m^{2}a)
Airtightness: n50 = 0.6/h (design)
Architect: Eng. Carmelo Sapienza and
eERG Group - Politecnico di Milano
Architect's website:
www.sapienzaepartners.it | ww.eerg.it
Passive House Database ID: 2123

Photo: Ljubomir Miščević | Detached single family house M6 | Zagreb | Croa-
tia ©???????????????????

> Beacon: Croatia

M6 House

M6 is a single-detached Passive House building in the Zagreb County Area, designed by architect Ljubomir Miščević. Located in the Gornji Stupnik area, south-west to the city centre of Zagreb, it has a usable floor area (TFA) of 334 square metres. According to the most recent census figures, Gornji Stupnik is currently home to approximately 1800 citizens living in over 500 households. The Passive House building thus blends in perfectly with this environment, engaging directly with the beautiful landscapes surrounding the property. The spacious green area around the building is an integral part of the basic concept and identity of M6.

˝Project PassREg is extremely necessary and reasonable platform for the realization of the objectives for energy efficiency and sustainability according to the scenarios of the European Union for 2020 and 2030. Previous project crosslinking promoter of the passive house construction standards in the EU (PASS-NET), was successfully carried out with the University of Zagreb, Faculty of Architecture and City of Zagreb support.˝

Prof. Ljubomir Miscevic, B. Sc. ing architect. Head of the Passive House Consortium Croatia

Photo: Ljubomir Miščević | Detached single family house M6 | Zagreb | Croa-
tia ©???????????????????

M6 was one of the first structures built with a reinforced concrete base plate to achieve very high standards of thermal insulation. The basement and ground level floors are made of reinforced concrete. The stairs and all remaining vertical wall constructions were made using layered wooden columns and beams.

> Beacon: Croatia

M6 can be separated into three levels: basement, ground-floor and first floor. The basement and main vertical staircase are made of concrete. The first floor as well as the attic are wooden constructions built by using state of the art construction techniques. The building envelope was conceived as a wooden door system ensuring integration and easy access to the central chambers. This Passive House building is an exemplary project as it demonstrates how well the plan and systems of a building can be adjusted to meet Passive House requirements. M6 already complies with the EU Directive on the Energy Performance of Buildings (EPBD), which will fully go into effect in 2020.

˝In a time of recession and crisis, rational use of energy, energy efficiency, the application of new green technologies and renewable energy sources is an imperative but also a challenge and impulse for economic development, opening new workplaces and a brighter perspective for our young generations.˝

Marijan Maras, M. Electrical Engineer
City of Zagreb, Head of Office for Energy, Environment and Sustainable

ssociés | Office/administration office |
aux | France © Nicolas Laisné

Usable floor area (TFA): 334 m^2
Heating Demand (according to PHPP): xxx kWh/(m^2a)
Primary Energy Demand (according to PHPP): xxx kWh/(m^2a)
Architect:
Architect's website:
http://www.

[6]

The power of cities – how to proceed

VORSICHT für INTERN. Broschüre ist dies Chapter 5 !!!!!

The power of cities

Climate protection begins at the local level and reducing energy use in buildings is one of the most important tasks. Many local authorities have therefore taken the initiative in recent years to promote the use of highly efficient Passive House technology.

The introduction of Nearly Zero Energy Buildings in European cities is one of the most important objectives of the PassREg project. Information exchange has taken place between partners from different countries in Europe to fast track learning and knowledge transfer. The aim has been to reduce greenhouse gas emissions and also help local authorities make significant savings, relieving the burden on municipal budgets.

When formulating local efficiency and climate protection objectives, local authorities should not just limit themselves to the fulfilment of national requirements. They can often draft their own, more ambitious, plans. Cities and communities have, in fact, played a leading role with regard to energy efficiency in recent years. Many regions such as Hanover, Heidelberg, and Frankfurt, are already realising Nearly Zero Energy Buildings on a large scale by adopting the Passive House Standard in combination with renewable energy.

In practice, the ten measures that follow have proven extremely helpful for improving energy efficiency in the building sector. Even though local framework conditions will obviously influence each individual case, these measures can provide guidance for municipalities that wish to reduce their energy consumption sustainably. Cities and communities can therefore not only make a valuable contribution to climate protection, they can also reduce their operating costs and protect themselves from future energy price increases at the same time.

10 measures for effective climate protection in the building sector

1) In order to reduce energy consumption in a sustainable manner, cities and communities can stipulate that new public buildings belonging to the city or local authority will only be built to the Passive House Standard. The additional use of renewable energy may also be required. This can be reinforced by carrying out retrofits with Passive House suitable components.

2) As part of their climate protection efforts, municipalities can decide that land belonging to the local authority will only be sold on the condition that construction will take place according to the Passive House Standard with the integration of renewable energy, or that refurbishment will be carried out using Passive House components. Suitable verification such as preliminary planning with the Passive House Planning Package (PHPP) is highly recommended.

3) For climate-adapted urban master-planning by local authorities, the topographic situation, orientation with relation to the sun, the prevailing wind direction, compactness and shading should be taken into consideration. These points can be supplemented with an appropriate provision of building services and energy supplies.

4) Social Housing companies can make a contribution towards better energy efficiency by constructing new buildings in accordance with the Passive House Standard and modernising their existing building stock using Passive House components, while moving towards the use of renewable energy.

5) Municipalities can encourage citizens to participate in climate protection efforts by initiating financial incentive programmes for energy efficient investments. In this way, private home owners will be motivated to build houses to the Passive House Standard or to retrofit with Passive House components. Incentives for the use of renewable energy should also be encouraged.

6) To ensure that the required standard is actually achieved, cities and local authorities can introduce quality assurance by means of milestone checks. These will ideally consist of approval planning, implementation planning, a first on-site meeting at the end of the shell construction phase, a second on-site meeting after completion of the airtight building envelope, an inspection upon completion and commissioning, and finally, independent Passive House certification.

7) To promote commitment to energy efficiency at a wider regional level, local authorities can develop, sponsor and implement climate-neutral urban districts as pilot projects based on the Passive House Standard with renewable energy.

8) Municipalities can help instigate wider support activities for stakeholders, including contractors, architects, manufacturers, local authority planning departments, building owners and occupants, etc. These may be in the form of informational events and training activities to help the industry acquire the necessary knowledge and skills to design, construct, build and use Passive House buildings. The city or municipality may additionally facilitate complementary advisory services for investors before issuing building approvals.

9) Cities and municipalities can reduce their energy consumption even further by developing information campaigns and/or financial incentives to encourage households to upgrade energy intensive equipment with modern, energy efficient appliances and building systems.

10) In order to increase the impact of all these efficiency measures in a targeted manner, it is also beneficial to include information about Passive House buildings and the use of renewable energy in municipal PR concepts. Case studies of buildings in which energy use has been monitored and published can be very motivating.

The PassREg project supported the implementation of such measures and, at the same time, offered participating partners a platform for the exchange of information. The main objective was to raise awareness of the growing significance of energy efficiency measures at the local level with key decision makers in local authorities and municipalities. It is hoped that the push provided by the PassREg project will make a lasting contribution to the reduction of energy consumption across the whole of Europe long beyond the project's end.

Imprint

Coordinator:

Passive House Institute

Publisher
Passive House Institute
Rheinstraße 44/46
64283 Darmstadt | Germany
mail@passiv.de
www.passivehouse.com
www.passreg.eu

Design and execution
Marlies Blücher | Passive House Institute

Photo credit
Coverphoto | xxxxxxxxxxxxxxxxx
©

xxxxxxxxxxx
xxxxxxxxxxxxxxx

Further information
www.passivehouse-international.org

With support from the EU:

Co-funded by the Intelligent Energy Europe Programme of the European Union

PassREg

Partner:

International PASSIVE HOUSE Association iPHA
www.passivehouse-international.org

IG Passivhaus Tirol
www.igpassivhaus-tirol.at

PHP
www.passiefhuisplatform.be

www.lvif.gov.lv

pmp
www.maisonpassive.be

Comune di Cesena
www.comune.cesena.fc.it

EnEffect
www.eneffect.bg

nobatek
www.nobatek.com

DNA
www.dnaindebouw.nl

bre
www.bre.co.uk

www.zagreb.hr

enercity
www.proklima-hannover.de

eERG
www.eerg.it

www.burgas.bg