

Towards passive homes

Mechanisms to support the development of the passive house market



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The Passive way to saving



A choice for the future

We are in an age dominated by concerns of energy supplies, global warming, competitiveness and employment. However we are as a society turning our back on probably the single most important remedy to these problems by collectively failing to transform the building sector to low and zero energy buildings. The building sector accounts for more than 40% of the total energy consumption, yet with estimated economic saving potentials of 28%, which represent a massive 11% of total EU final energy use (EC Action Plan for Energy Efficiency "*Realising the potential*", Oct. 2006).

The European Energy Performance of Buildings Directive and its transposition into national contexts has provided a tremendous opportunity to stimulate debate, to understand economical and ecological stakes, to assess behavioural impacts, and to design policies and programmes. The introduction of certificates for building energy performance provides the potential to challenge the market paradigm of low quality, high consumption (and often low comfort) buildings which has persisted over the last decades. Certainly certificates separate good from bad. However perhaps more importantly in the long term certificates provide a vehicle for introducing new and radical ideas to an ill informed public. The concept of passive zero energy homes and energy producing homes become a concrete possibility.

Passive homes – a big step in the right direction

Each year roughly 2,5 millions new homes are built in the EU. Though ensuring homes meet new regulations and the highest class on the energy certificates can slow the growth of CO₂ emissions, more radical steps are required if we are to stop emissions' growth and hopefully one day actually start reducing CO₂ emissions as required by international agreements. Low energy and in particular passive homes offer a radical but feasible step to reducing and eventually curtailing emissions.

The Passive-On project has looked at how to promote passive homes and bring its contribution to the debate in the form of a series of mechanisms supporting the market development of passive homes. We have concentrated on new individual passive homes, in the generic sense of comfortable and very low energy homes built at a reasonable cost, a house for which we believe there is a potential market that needs to be supported in its early development.

Passive systems, passive design and passive homes

A word on definitions

A passive home or a passive house generally indicates a house in which passive systems are used as the main means to provide light, heat, cold and ventilation.

A passive system uses and controls the natural energy flows which surround a building, such as solar radiation and wind. There exists an extended range of passive systems and measures; for example painting external walls white helps cool a building in summer, windows will provide daylight and stacks can drive ventilation.

Passive architecture and vernacular architecture were linked for centuries. More recently, Passive design has come to indicate buildings which integrate low energy active components such as pumps and fans with or along side passive systems - in many cases the energy demand of the active system is so low that it can be met economically and feasibly by a renewable energy source such as a photovoltaic panel.

In 1991 researchers from Darmstadt applied passive design to a house with the objective of providing a show case low energy home at reasonable cost for the German climate. By 1995, based on the experience from this and other early developments, this specific passive design was codified into the Passivhaus standard, which fundamentally consists of an energy limit (net useful energy demand for heating of 15 kWh/m²/year and a total primary energy consumption of 120 kWh/m²/year). This energy requirement can be met cost effectively thanks to a set of preferred passive systems including compact form and good insulation, good orientation and shade considerations, energy efficiency window glazing and frames, airtight building envelopes, passive pre-heating of incoming air and high efficient heat recovery from outgoing air, using an air-to-air heat exchanger, hot water supply using regenerative energy sources.

The Passivhaus standard has been recently revised to make it relevant and pertinent to passive design in the Mediterranean. In particular, the energy demand has been extended to cover summer cooling and the requirement on the building envelope permeability has been relaxed.

However to professionals in other areas of Europe where the Passivhaus standard has only recently been introduced, the term "passive house" maintains its generic meaning of a house constructed in line with passive design.

In this document, we have looked at *mechanisms* which support very low energy design – independently of the specific passive system involved or the technical solution chosen. We therefore use the terms "passive homes" and "passive houses" indifferently and do not refer to a given standard, unless specified when getting into the details of supportive mechanisms e.g. for "Passivhaus" in Germany, Minergie® houses in Switzerland or CasaClima houses in Italy.

As we note above, passive design may include the use of active components such as pumps and fans. These passive homes do consume some energy for heating and cooling; they are not necessarily zero consumption homes. Based on the Passivhaus standard and other experience we consider homes to be passive when the combined heating and cooling demand is lower than 15 to 20 kWh/m²/year.

On the building's energy certificate, as Class A thresholds vary from country to country, it may be that in some cases passive homes equates with the Class A. In other countries however, a class A home may still fall short of the requirements of a passive home. Therefore we recommend that supportive mechanisms target homes:

- providing optimal comfort conditions – since temperatures are to raise in the coming years, indoor air quality and temperature is a key issue in order to avoid the uncontrollable development of inefficient air conditioning systems
- whilst presenting the lowest possible energy needs.

[For technical information, see another output of the Passive-On project: "The Passivhaus Standard in European Warm Climates – Design guidance", www.passive-on.org]

The mechanisms proposed in the document were developed considering the feedback from more than 70 interviews with building professionals (architects, engineers, developers) industry, local and national government officials, performed by the Passive-On project partners in France, Germany, Italy, Portugal, Spain and United-Kingdom. The Passive-On project focuses on new built individual homes. Though there are obvious advantages to looking at medium density developments with apartment blocks and the renovation market, Passive-On looks at single dwellings in that:

- concentrating on a well defined object allows to get our message across – whereas the building sector is so vast - and receive targeted feed back from specific actors on specific technical solutions and supportive mechanisms (actors, solutions and mechanisms are often different in the case of individual homes and large apartment blocks);
- new constructions are easier to work on from a technical point of view and are often a good entry to start changing cultural approaches in the building sector (first change the constructions methods, then think of renovation practices);
- clients – households buying individual houses – are the ones with enough purchasing power to pull this new market – at least in its early stage;
- it is of crucial importance that at least the hundred thousands of individual homes

built each year are passive or zero energy homes;

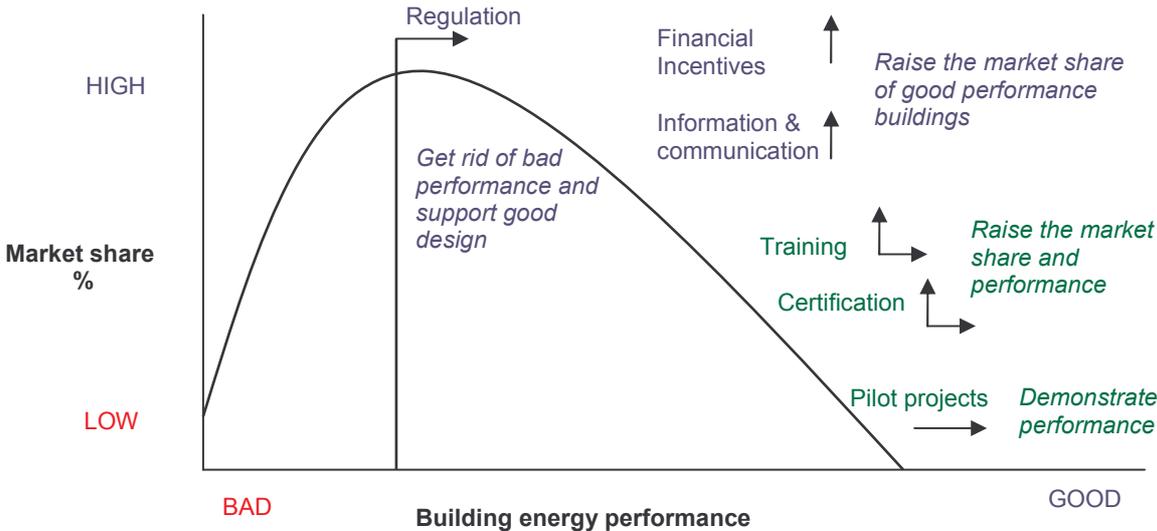
- finally, as for any research, the field to study must be delimited – other projects are and will look at larger developments and / or at social housing where the passive technical solutions and supportive market mechanisms will most probably be different.

Supportive mechanisms for passive homes

In order to prepare this document, partners of the Passive-On project have first undertaken interviews at the national level of building professionals and government officials (over 70 interviews in total), aiming at assessing national situations regarding passive constructions: the knowledge about passive homes, their development, blocking and supportive factors to their large scale dissemination, etc.

In a second phase, these interviews have been compiled, extracting mechanisms that can support the market development of new individual passive homes. The information is gathered around a set of separate thematic “Action Sheets”.

These mechanisms have different impact on the market, some of them mainly aiming at shifting the market shares and others aiming at pulling the markets towards greater energy performance



Market transformation: schematic effects of supportive mechanisms for low energy buildings

In total 6 Action Sheets addressing six major themes have been developed. Each Action Sheet provides the context and describes the existing advantages and barriers regarding a particular theme and then makes specific recommendations which we believe could speed up the development of passive houses. Each Action Sheet is to a certain extent self standing, but they may also complement each other.

The six Action Sheets focus on:

- 1) Undertaking pilot projects
- 2) Certification issues

- 3) Developing training
- 4) Developing financial mechanisms
- 5) Boosting communication and information activities
- 6) Supporting passive design in regulations

All actors involved in the construction sector are concerned by these recommendations, be it as actor setting up a supportive mechanism or as a target.

Each action sheet addresses a number of themes which are listed in the following table

Pilot projects	Certification	Training
<ul style="list-style-type: none"> ▪ Partnerships and calls for proposals ▪ Building design and construction phase ▪ Monitoring ▪ Risks ▪ Communication 	<ul style="list-style-type: none"> ▪ Advantages of certification schemes ▪ Careful planning ▪ Risks ▪ Certified passive homes: quality marks and success factors ▪ Certified professionals ▪ Certified products 	<ul style="list-style-type: none"> ▪ Long term training programme ▪ Recognition for training activities ▪ Passive architecture integrated in curricula and continuous professional training: enhancing the building's sector attractiveness for future professionals, building-up continuous training ▪ Empowering professionals: best practice dissemination, networking, multidisciplinary teams
Financial incentives	Information & Communication	Regulation
<ul style="list-style-type: none"> ▪ A less costly land for passive homes: taxes, prices, plot ratios ▪ Professionals encouraged to deliver passive solutions: subsidies, fees' structure, taxes ▪ Money less expensive to build and buy passive homes: banking products, governments support 	<ul style="list-style-type: none"> ▪ Core and background information ▪ Challenges and benefits for communities and authorities, clients, building sector's operators, banks ▪ Coordination: passive house umbrella structure, passive house days, internet portal, competition 	<ul style="list-style-type: none"> ▪ Accompanying existing regulation: controls, calculation tools, new technical solution, communication ▪ Going beyond regulation ▪ Checking conflicting issues

The development of passive houses outside of central Europe is still very limited so existing programmes for promoting this type of home are still very few. Many of the recommendations recalled in the Actions Sheets are therefore mainly based on existing procedures used to promote general low energy homes which we feel could be readily adapted to the specific requirements of passive houses. However we also identify a number of what we feel are novel concepts to promote passive homes. Although concrete examples

are given whenever possible, the proposed mechanisms are of general applicability and would of course need to be adapted to specific contexts.

Buildings are at the heart of society; architects are at the heart of buildings; local dynamics drive the building market on the supply- and on the demand side. With this work, we do not aim at challenging this fundamental vision but to explore one of the many boundary conditions facing contemporary architecture.

Objectives

The Passive-On project has explored ways to take the Passive House concept forward, in terms of climate and scale especially in Southern Europe. In these regions the problem of household energy use is one not only of providing warm houses in winter but also, and in some cases more importantly, of providing cool houses in summer while reducing energy requirements to a minimum.

The project has proposed a number of changes to the current German Passivhaus standard to make it relevant to warmer climates. The aim is to allow designers in Southern Europe to adopt passive design appropriate to the region whilst ensuring that these provide guaranteed results in terms of energy and indoor comfort quality. The principle changes aimed to make the Passivhaus standard relevant to the Mediterranean are:

- Removing the need for active air ventilation and heat exchange units. However, if they prove to be necessary, the limit on the air tightness of the building envelope has been relaxed to $n_{50} \leq 1 \text{ h}^{-1}$;
- The introduction of an explicit limit for summer cooling energy demand (15 kWh/m²/year). However, active systems should be used only when absolutely necessary, otherwise, it is advised to use passive systems;
- Acceptable indoor comfort conditions in warm climates: minimum requirements for summer comfort; indoor summer temperatures are not to exceed the Adaptive Comfort temperature as defined in the EN 15251 standard. Using the Adaptive Comfort model ensures comfortable temperatures compatible with Passive Design.

Outputs

- Design guidelines: The Passivhaus Standard in European Warm Climates – Design guidance.
- Revised definition of the Passivhaus standard integrating cooling loads and cooling solutions and updated Passivhaus House Planning Package (PHPP) software
- Strategy report on Mechanisms to support the development of the passive house market

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PILOT PROJECTS



Passive house development is still in its beginning. Though research and demonstration projects (concentrated in a few EU countries) have shown the feasibility, the positive effects and have developed constructive solutions which are simple and adapted to current building market, knowledge about building envelopes, efficient technologies and their effects is quite restricted among designers and building companies, and the possible performance of the combination of these technologies is not well-known. Before the market can widely develop and in order to prepare such development, many other demonstrative and successful passive constructions must be built in different countries, under specific conditions, benefiting from a lot of attention from institutions, designers, builders, financiers and communicators.

Context

In the 1990's in Germany, many people, including from the scientific community, were sceptical about the possibility to achieve extremely low energy consumption, and put forward many technical and non technical barriers: technical limits in achieving very high thermal insulation levels, very airtight buildings and efficient heat recovery ventilation systems; difficulty in dealing with users habits such as opening the windows in wintertime, or their acceptance of living in very airtight and mechanically ventilated homes; too high investment cost of such buildings, etc.

Today, and after several pilot projects, the passive house concept is widely accepted in Germany, but some people still need to be convinced in Europe – "the passive house

concept may work in Germany, but not at our place: we have totally different conditions here" –everybody can still learn from experiences.

Many energy-saving, ecological, environmentally friendly and innovative building concepts are being proposed by different actors, each of them claiming that his specific solution is the most advantageous. For non-experts, it is difficult to judge which of these concepts perform well and which do not work at all. On the other hand, for most clients it is of vital economic importance that their homes work properly from the start. Therefore, the only way to make clients build passive houses is to provide proofs about the performance of these buildings, from the energy and comfort points of view. Theoretical considerations will not be sufficient.

Pilot projects can be supported with several main scopes:

- Demonstrate exemplarity, generally for a public institution ordering a passive construction.
- Demonstrate the feasibility of the passive house approach in the specific region where it is built.
- Demonstrate the feasibility of the passive house approach for large scale homebuilding projects.

Objectives

Pilot projects must clearly show, for various respective climatic and cultural conditions, that:

- passive houses really achieve the small energy consumption they promise,
- Additional investment cost can be reduced to such a level that, over the lifetime of the

building, economic advantages can be achieved (this need not be the case in a first pilot project, but it should at least appear possible within some years),

- There is a potential market for passive houses, and not only a “niche”,
- Thermal comfort is higher than in conventional houses both in winter and in summer,
- Inhabitants are satisfied with the performance of their homes.

European pilot projects is acknowledged by many professionals.

- The crucial role of local governments, launching new developments on their territory.

Pilot projects are particularly interesting in the sense that they rely on a concerted approach and effort – developers, designer/architects/engineers, industry, builders, banks, clients, working together

Actors involved

Mechanisms ' Designers	<ul style="list-style-type: none"> ▪ European programmes ▪ National and local governments setting a scheme to regularly undertake pilot projects ▪ Any of the actor mentioned below (particularly motivated)
Target groups	<p>Successful pilot projects need several cooperating actors, each of which needs to be willing to make the project a success. At least:</p> <ul style="list-style-type: none"> ▪ Financial supporters, e.g. a governmental body or banks ▪ Industrial firms involved in energy efficient solutions, energy suppliers ▪ Clients willing to build a modern home, or builders interested in selling modern houses ▪ Architects willing to get involved in the respective questions ▪ Experienced energy advisors, building physicists ▪ An institution capable of monitoring the building and evaluating the data

Special notes should be made regarding actors involved in the development of pilot projects:

- The crucial role of the European Commission programmes supporting

Possible means of action

Launching passive house demonstrative projects: partnerships and calls for proposals

Passive houses will meet success if they are designed and built by teams, where architects, heat engineers, builders, owners, and the building industrial sector companies join up and carry out demonstrative projects together. Such new projects, requesting more time and money than business as usual solutions, will need financial and institutional support to be carried out, the final results to be published and the whole initiative to be publicised.

One of the most efficient ways to achieve this action is, for local and national authorities and for energy efficiency institutional agencies, to build up periodical calls for demonstrative projects, which they will have to strongly support, on which they will communicate, etc... Call for tenders should specify that multidisciplinary teams – including the building owner – will have to be constituted in order to be supported. Professional representative organisations could be associated, as partners for the calls, which would help professionals to feel involved, and facilitate publicity for the calls.

Example - CEPHEUS demonstration project

The THERMIE Programme of the European Commission, Directorate-General Transport and Energy has co-funded between 1998 and 2001 the CEPHEUS project, one of the most well known and successful large scale demonstration projects targeting passive constructions in Europe. Around 250 housing units were built to the Passivhaus standard in 5 European countries with in-process scientific back-up and evaluation of building operation through systematic measurement programmes and inhabitants' satisfaction.
<http://www.cepheus.de/eng/index.html>

Building design and construction phase

Building a passive house for the first time requires more time and learning by the designers. This can result in additional

planning cost: professional assistance from experienced persons needs to be sought, suitable components must be identified, several design alternatives have to be considered in the energy balance, craftsmen

need special instructions and supervision, one or two blower door tests become necessary, for large projects there might a need to overcome the resistance of technical services which tend to ignore new materials because using them would imply dedicating more time and investing in studies to find the good dimensions, etc.

It is crucial to invest sufficient time on these issues in order to make the project successful. In the framework of pilot projects, this additional effort can financially be supported; training, consulting and availability of design tools are typical elements which can be supported to encourage clients and designers, in addition to their own investment.

Additional investment costs on the building-itself should not necessarily be subsidised, with the possible exception of very few first projects: such a support might result in increases of the various costs. However, quality insurance should be provided (also to stimulate the use of better solutions).

Monitoring

After the realisation of the building, a monitoring phase of at least two years is required in order to prove the success. Announced performance should be controlled. All relevant data have to be recorded and evaluated, including mistakes that have been made, as well as possible remedies. This work needs to be financed too, possibly through an independent evaluation project.

Risks

If major mistakes are made in the first pilot project(s), a second try will become a lot more difficult. This risk will be even more pronounced if the reasons for the failure are not clearly identified (which is probable because e.g. the designers will not want to have design errors reported). The public as well as possible financial supporters will then tend to refer to the first project and it will become very hard to convince them that the first implementation was wrong, not the basic principle.

For a client, a passive house must be a pleasant house before being passive – clients can of course be motivated by environmental concerns but they seek first of all, even in the framework of pilot operations, an architectural project, value for money and a comfortable life for a long period of time. Therefore passive houses should be designed as normal houses – with typical local selling items (such as a

cellar, an integrated kitchen, etc.) – and not cumulate too many innovations.

As for any construction, the whole building should benefit from a peculiar attention – not only the energy aspects: if the rest of the building is neglected and something goes wrong, the pilot project will, with reason, be considered as a counter reference even if the energy part is a success.

Communication

Communication is needed before and in the early phase of the pilot project, in order to convince all actors to participate, as this is a key issue for a successful implementation of passive constructions.

- The various operators need to get to know each other and their respective jobs, learn to develop a common culture and work together.
- Some actors will feel threatened by the development of passive houses, e.g. energy suppliers. They need to be informed to plan for an evolution of their business. For example, electricity suppliers could favour solutions with conventional buildings heated with electric resistance heating; but there are chances that given the high primary energy consumption they generate, it will become practically impossible due to pressure from environmentalists. However, they may support passive constructions because electricity can be used to cover their small energy demand for heating (e.g. through a compact heat pump unit), because these houses contribute to reduce peak load (no air conditioning), their consumption is fairly predictable and the installation will stay unchanged for many years. Where Demand Side Management schemes are in place (e.g. white certificate, specific tariffs), the framework might allow energy companies to promote these low energy houses (along with other energy saving measures).

Communication is also needed at the end of the project, on the results, including on the satisfaction of users and their behaviour, and the technical and financial means that were used. Publications should be widely disseminated in different media in order to convince a large number of people to initiate new projects - on the demand side (clients), on the supply side (the whole building sector) and on the policy side (national, regional and local institutions which can integrate these results in their activities targeting the housing sector).

Example: First demonstration project in Germany

The first passive house demonstration project was built in 1991 in Darmstadt-Kranichstein. The design, construction and monitoring phases were carried out very carefully. Possible performance problems were identified and eliminated as soon as possible, during the design and construction phase as well as during the first years of use, for example:

- *The heat recovery on the ventilation system had an initial efficiency of 65%. Only after some home-made improvements was it possible to raise this figure to more than 80%.*
- *Mineral wool was crammed into any gaps of the exterior thermal insulation compound system in order to eliminate air circulation and reduce heat losses.*
- *All thermal bridges were optimised by multi-dimensional heat flow calculations.*
- *All household appliances were carefully chosen to be the most energy-efficient ones on the market. Some of the appliances had to be imported from other countries.*

The project actually used so little energy that some scientists refused to believe the results. All information about the building and its performance was made publicly available (in those days mainly through printed reports, articles in magazines and oral presentations).

<http://www.passiv.de/>

CERTIFICATION



Framework elements

We present in this chapter three types of certifications schemes: for the building, the professionals involved in the construction process (builders and designers) and for products and construction elements. Certification provides quality guarantees useful to overcome customer scepticism and doubt in immature markets.

National and regional governments have a crucial role to play in awarding recognition, through various activities which extend from a pragmatic support to positive initiatives to development of frames of reference and the creation of full scale certification schemes. Certification schemes can also be developed by private institutions: among the most well known schemes in Europe, Passivhaus in Germany and MINERGIE® in Switzerland have both started as private initiatives, growing on with support from various public and private institutions.

In this document we discuss schemes awarding recognition and certification schemes, referring to top runner certification and endorsement labels (as opposed to informative labels covering the whole market). We do not refer to the general building energy certification schemes currently set up in the EU Member States within the context of the Energy Performance Building Directive – though these schemes, thanks to the development new regulations and software tools to calculate energy consumption, may pave the way to Top runner certifications.

Focusing on top runners, the idea should not be to exclude professionals or constructions that would not fit into a possibly rigid, complex or costly system, but rather to provide landmarks for clients, information to professionals (such as studies on products and their performances) and competitive advantages for professionals engaging in a still new approach.

Recognition and Certification schemes: advantages

The Passivhaus and MINERGIE® standards and activities in Germany and Switzerland have been instrumental in the strong development of low energy homes in those two countries over the last ten years. Certification provides quality guarantees in immature markets, in particular:

- They render the relatively complex issue of building energy performance and comfort understandable to the home owner,
- They allow builders and developers to market low energy solutions such as higher insulation levels and heat recovery units and increase the value of their product,
- They are often interpreted as a global mark of building quality increasing the value of the building, the work or the product,
- They provide the essential basis for public and private incentive mechanisms for low and very low energy homes. In particular the certification provides on the one hand

the benchmark at which subsidies, loans and tax credits are offered and on the other hand a quality guarantee to the incentive awarding agency that the goods (building and building components) are worthy of support.

- They provide a tool for increasing our understanding of passive and low energy buildings in that they provide a common basis for *ex post* analysis; for example through analysis of building energy performance, construction and running costs.

Key for success: a careful plan

The success of certification schemes depends very much on their design and the management resources.

A sound scientific basis

The scientific basis of the certification scheme must be sound. The required performance benchmarks need to be demanding but at the same time achievable at reasonable cost. This requires knowledge of best practice from different countries and / or building simulations if necessary in different climates.

Allow for evolutions

Ideally a certification scheme should be structured to allow for the evolution of the housing market which in part will occur through the introduction of the scheme (for example it can plan increments to performance requirements in time - a x% improvement after n years). This allows schemes to be introduced quickly based on current building standards and pragmatic approach whilst providing an impulse for builders and designers to begin to mature experience with new solution sets in light of programmed improvements to performance requirements. For example, the Passivhaus standard has evolved to cover warmer climates of Europe and their specific cooling needs. Likewise, the MINERGIE® scheme promoting low energy housing was first introduced in Switzerland in 1998; The stricter Minergie "P" standard for homes conforming to the Passivhaus standard was introduced in 2003 and most recently in 2006 – the Minergie "ECO" standard certifies buildings of overall low environmental impact. Today, the three certifications are available.

Stakeholders' involvement

If the scheme is organised by a public institution, in order to increase public acceptance and adoption by market operators, a public consultation process in the design phase should seek to include as many stakeholders as possible. Imposing a certification scheme, even voluntary, without consultation can lead to alienation and rejection by professionals and building industry.

Developing local Top Runner labels offers regional authorities to promote specific building techniques or fuel sources which may be particularly advantages to the local economy.

As the building market is essentially a regional and local market, large countries should be cautious in developing Top Runner certification schemes and energy efficient building standards. On the one hand, regional building techniques, aesthetics, lifestyles and climates should be respected. On the other hand, regional specific Top Runner certification risks fragmenting an already (at least in the near term) niche market. Developing cross-regional Top Runner certification provides the market with a unified and understandable framework. For example, the French Effinergie approach has set a level of performance adaptable according to climates and regions (www.effinergie.org).

A comprehensive control system

Much of the success of the Passivhaus and MINERGIE® building certification schemes lie in the use of a comprehensive control system which has provided the schemes with credibility. The worse situation would be that clients are disappointed or feel they have been fooled by an official scheme. In theory, building energy performance controls can take place in any or all of the planning, building and commissioning phases of the building construction process. Standard control procedures, completed within the context of building regulation minimum performance requirements enforced in all Member State are usually paper based checks of declared calculations with, in the best case, sample on-site checking during the construction and commissioning phases. However Top Runner certification schemes such as Passivhaus and MINERGIE® usually provide for guaranteed on-site checking of all new developments. Though this increases the costs of control process, it ensures that certified homes

conform to the strict performance requirements of the scheme.

Certifying building components and products requires in the first instance defining the required performance characteristics which the components could meet. This in turn might require identifying performance levels as determined by existing standards or in the worse case actually defining new test cycles and standards. Actual compliance to the standard might be achieved by manufacturer self declarations or by sample testing of components in approved laboratories. Either way, component certification requires a good understanding by the certification authority of how performance of single components relates to the performance of the entire building; component and building certification needs to be coherent. To avoid unduly large schemes which can prove difficult to manage, component certification should be limited to those components which are critical to building energy performance and which experience has shown have been difficult to implement in building development (for example highly air tight triple glazed windows).

For professionals, certification is usually provided on the basis of participation in recognised professional training courses. This requires defining, usually with the support of higher education establishments, the course curriculum. The scheme should encourage continuous training, for example requiring professionals to complete regular update courses.

A strong communication plan involving regional and local authorities

Voluntary certificates have value in so far as they are recognised and understood by the public and professionals. Though recognition can come through “word of mouth” over time, certification schemes can benefit from targeted communication activities. In general certification authorities, working with limited budgets must clearly identify their target audiences and objectives. Developers, builders, architects, engineers, installers, manufacturers, institutions, banks, insurances and clients should be made aware of these schemes and incited to ask for and promote them. This is a mid- and long term activity implying the development of various communication supports: from leaflet and public meetings in villages for the general public to more or less technical guidelines for

architects, application forms for manufacturers, etc.

In the case of building component certification it might be advantageous (in terms of required resources) to only target professionals (designers and builders) in that home owners are likely more interested in the outcomes (i.e. low heating requirements) than means (the choice of windows or heat exchangers).

House certification needs to be understood by both sides of the supply and demand chain in order for the certificate to “lever” the purchase or investment decision. Even so professionals might still represent the most cost efficient means to communicate Top Runner Certification to the general public; Top Runner certification can represent a valuable tool in the marketing strategy of housing developers.

Top Runner and energy certification in general does provide an interesting basis for developing communication “events”. Inherent in most house certification is a scale of energy performance and the comfort performance. Such indexes can serve as the basis for competitions rewarding the most efficient or comfortable home. For example, the Provincia di Bolzano in North Italy has since 2002 held an annual competition for the Best CasaClima.

Risks

Building certification is a theme currently acutely discussed, some experts underlying that the very idea of a certification maintains low energy constructions at the high end of the market instead of contributing to their generalisation, that non governmental systems will have difficulties being consistent with current regulations (obliging people to use different calculation tools, superposing top runner labels with the energy certificates issued from the European regulation, etc.), that governmental systems will be bureaucratic and limit the innovation on the builders' side, not to mention the cost of certification.

The issue of certification and awarding recognition as presented with examples in this document covers a wide range of activities, from defining a list of products conforming to certain specifications, to designing a training course or developing a full scale certification scheme involving a certification agency, upstream studies, controls, labels, etc. The risks are not the same when designing and implementing these various activities; however, the design phase should in any case assess them carefully, especially regarding the procedure and cost issues. All aspects of

certification cost. Certification schemes can seek to be self financing by those seeking certification (building owners, professionals or component manufacturers) in order to cover the costs of managing the scheme through the fees paid for certification. However given the public utility of low energy homes in terms of reduced local and global pollution there would be political justification to part finance schemes through local or national budget (for example the house certification in the Provincia di Bolzano, in Northern Italy, is completely free to the home owner).

Developing local Top Runner schemes also risks fragmenting an already small market for low energy efficient homes, making it even more difficult for suppliers of advanced products and services (for example window manufacturers and design studios) to market the goods across regional boundaries. Therefore, it seems essential to get as much as possible inspiration from existing schemes - as far as they can fit the needs of the local construction market.

1. Certified passive homes

Certifications or labels for passive homes provide quality guarantees, especially in starting and immature markets. Clients understand what the future home will provide: high thermal comfort, low maintenance cost and extremely low energy consumption. Architects and planners know the level of performance they should achieve. Public institutions can support the dissemination of a well defined concept. Banks can estimate the added value and formulate a specific loan policy.

- the Passivhaus scheme in Germany created and developed by the Passivhaus Institute
- the MINERGIE® scheme in Switzerland, developed at national level by an association supported by the government
- the CasaClima scheme in Italy, developed by the regional government of Bolzano's Province.

Objectives

Simplify the assessment of passive homes
 Simplify the understanding for clients
 Simplify the work for builders
 Provide a differentiation tool for market operators

Actors involved

Mechanisms ' Designers	<ul style="list-style-type: none"> ▪ National and regional governments ▪ Associations and Institutes with enough power to be heard by professionals and clients ▪ Banks
Target groups	<ul style="list-style-type: none"> ▪ Clients ▪ Architects / Engineers developing the house ▪ Promoters and Developers ▪ Banks

Quality marks for passive houses

Definitions, frames of reference conditioning subsidies or certification schemes exist for passive homes in various countries. We briefly present below three illustrations of such approaches and then synthesise how they have supported the market development for low energy homes. (The other sections of this document may develop specific topics regarding these quality marks, e.g. in the training and the financial mechanisms' sections):

[See also "Comparaison Internationale Bâtiment et Energie", PREBAT, ADEME, CSTB, PUCA, Intermediate report, Dec 2006, <http://www.prebat.net/> (executive summary in English).]

Example - Passivhaus in Germany

In 1991 Wolfgang Feist and Bo Adamson applied passive design to a house in Darmstadt, with the objective of providing a show case low energy home at reasonable cost for the German climate. The design proved successful both in terms of energy consumption and comfort such that the same passive systems were applied again in a second construction in 1995 in Groß-Umstadt. Based on the experience from the first developments, Feist has codified the passive Design of the Darmstadt and Groß-Umstadt homes, into the "Passivhaus standard" (1995). The standard fundamentally consists of three elements: an energy limit (15 kWh/m²/year for heating purposes and no more than primary energy 120 kWh/m²/year for the whole energy consumption), a quality requirement, a defined set of preferred passive systems which allow the energy limit and quality requirement to be met cost effectively

In total more than 8 000 houses have now been built in Germany and elsewhere in central Europe (for example Austria, Belgium, Switzerland, Sweden) which conform to the Passivhaus standard. To most professionals in Germany and to many in the general public a passive house now equates firmly with the Passivhaus standard and set of technical solutions. The Passivhaus also certifies the performance level of certain products.

Homes achieving the standard can be self certified by the owner or builder or certified by a third party. The Passivhaus Institut and more recently Passivhaus platforms provide independent certification services. The Passivhaus Instiut estimates that roughly only 1 000 of the 8 000 homes achieving the Passivhaus standard have been certified by an external auditor.

Passivhaus constructions benefit from a subsidy scheme from the German KfW ("Kreditanstalt für Wiederaufbau" - bank for reconstruction).



**PASSIV
HAUS
INSTITUT**

Dr. Wolfgang Feist

The Passive-On project has worked to render the existing Passivhaus standard pertinent and suitable for use in Mediterranean climates, principally by relaxing the building envelope air tightness requirements and introducing limits on summer cooling demand. Hopefully the development of a modified Passivhaus standard will allow passive house development to lift off in South as it has in Central Europe. www.passiv.de

Example – MINERGIE® in Switzerland

MINERGIE® is a certification scheme which was created by regional energy offices in Switzerland, before being managed by a national association, today supported by the Federal Government. The objectives are to certify buildings providing a high level of comfort, an attractive economic cost and very low energy consumption (a maximum of 42 kWh/m² in new constructions and 80 kWh/m² in renovations for the production of heat and hot water), and to encourage owners, architects and builders to build in line with sustainable development.

The procedure is quite simple: the owner prepares a file with required energy calculations, plans for the execution phase and a description of the technical solutions; his request for the MINERGIE® label is analysed by a Certification Office (generally hosted at the Regional authorities' energy department) which controls the conformity of the calculation and make random visits on sites before delivering the label at the end of the construction.

MINERGIE® also works on product certification, and labelled buildings benefit from interesting banking products (the more stringent the label, the more interesting the rebate on the loan).

MINERGIE®

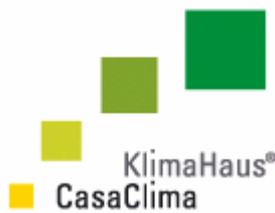
Mehr Lebensqualität, tiefer Energieverbrauch
Meilleure qualité de vie, faible consommation d'énergie

After 15 years of operation – and the introduction of a stricter Minergie "P" (for Passive) standard for homes in 2003 and the Minergie "ECO" standard certifying buildings of overall low environmental impact in 2006 – the market share for MINERGIE® new constructions can be as high as 25% depending on the Regions.

Regional and local authorities play a crucial role in MINERGIE®: they decide on the label's delivery, promote the certification scheme and have the responsibility to inform professionals and the general public. www.minergie.ch

Example – CasaClima in Italy

CasaClima in the Province of Bolzano, Italy. The north Italian Province of Bolzano introduced a voluntary CasaClima (Klimahaus) labelling scheme for homes in 2002 which has enjoyed wide scale application.



After three years the Provincial Administration felt sufficiently confident to make the labelling compulsory. In 2005 labelling became obligatory for all new homes, which were required to achieve a minimum standard of Class C (equivalent to a heat demand of less than 70 kWh/m²/year).

A CasaClima building is characterized by high insulation and compact construction. In its shape and orientation, it makes use of the sun and its energy: with the aid of thermal protection windows, light enters the building and scarcely any warmth leaves. Thermal bridges must be avoided wherever possible. CasaClima buildings exhibit optimized construction methods, careful execution and a high level of comfort. There are three possible levels: CasaClima d'Oro (Golden CasaClima – 10 kWh/m²/year for heating purposes), CasaClima A (30 kWh) and CasaClima B (50 kWh). <http://www.agenziacasaclima.it>

The above described quality marks are different in their organisation and specifications but have all been decisive in enhancing the market for low and very low energy buildings. **The success of these approaches rests on number of factors** (some of them are also mentioned in the framework elements' section).

A well defined product

A standard codifies precisely energy, quality and comfort requirements for new homes and provides a relatively standard set of solutions (e.g. passive systems) by which these requirements can be met. In consequence a Passivhaus, a MINERGIE® house and CasaClima are a well defined product, understood by the developer, architect and owner; everyone involved in the process knows what they are getting. This is a fundamental basis for governments and banks to offer specific loans and incentives.

In contrast, though the general concept of the passive design might be understood, the exact outcome of the design process will depend on the skill of the architect. Though there are undoubtedly a large number of well designed passive homes, there are also a number with problems; in particular the large use of glazing on the south facade typical of many solar homes, though reducing winter energy demand, leads to overheating in summer.

However, even if the product is well defined, the architect is still in charge of defining the architectural concept as no solution is imposed.

Service first

The focus is put on the service provided by the new home: a guaranteed conformable home at an affordable price. The solutions are in deed

relatively cheap; e.g. a house built to the Passivhaus standard at most costs 10% more than a standard house though they can be built for the same price. In practice, experience shows that on average a Passivhaus costs just 4-6% more to build than the standard alternative, same figures are available for MINERGIE® – to be compared to low running costs for many decades and the additional value given to the house (easier to rent and to sell at a better price).

A locally anchored concept

The institution supporting the quality mark is also well known and trusted by the general public. In particular in the case of MINERGIE®, the approach is dually carried by regional energy offices (close to the fields and building owners) and the federal government (institutional guaranty and coordination with national policies and norms), and involves all operators: professionals from the building sector, the environment sector, the finance sector, representatives from national bodies, local authorities and the general public.

For the house itself, solutions can be integrated into homes which have the same aesthetics as current standard developments; local materials can be used for insulation,

A simple procedure

Tools are made available for free or at very low price to assist in the design of the passive house and determine the building energy consumption. Administrative paper work is limited. Controls upstream and on site visits ensure the quality of the whole approach.

In the case of CasaClima and MINERGIE® the situation is very favourable as in Italy, Provinces define the rules for the energy certificates (according to the European

framework) so there is no risk of dual certification, and in Switzerland the implication of public authorities guarantees the compatibility with the national regulation. (The progressive introduction of CasaClima is also to be underlined, as it started as a voluntary certification scheme for some years (pulling the market) before imposing a minimum level of performance for all new buildings (eliminating the worst part of the market). Passivhaus and MINERGIE® further simplify the work for architects and engineers by certifying the performance of certain products, such as windows.

A strong image

The three types of building are well identified, so are their names and image – which use is protected.

Information documents are designed according to their target:

- for professionals: a consistent package of documentation / training / visits;
- for individuals: designed graphical label easily understood by families (CasaClima), simple presentation documents underlining comfort and quality (before environmental aspects).

Example – Code for sustainable homes in the UK.

A new promising scheme has been introduced in the UK. The Code for Sustainable Homes is a new national standard for sustainable design and construction of new homes. It was launched at the end of 2006 after a public consultation carried out by the government. By integrating elements of this voluntary Code into new homes and obtaining assessments against the Code, developers will be able to obtain a 'star rating' for any new home which will demonstrate its environmental performance. It will provide valuable information to home buyers, and offer builders a tool with which to differentiate themselves in sustainability terms. The Code for Sustainable Homes was launched as part of a package of measures towards zero carbon development, including an overarching consultation: 'Building A Greener Future' on the shift to zero carbon; and a consultation on the draft of a new 'Planning Policy Statement: Planning and Climate Change'.

<http://www.planningportal.gov.uk/england/professionals/en/1115314116927.html>

2. Certified professionals

Context

Professional certification is usually linked to recognised training. Certification provides architects, engineers, builders and contractors a tool to market acquired skills in low energy design and construction. It also provides some form of quality guarantee to customers in an immature market place.

An important issue is to establish whether professional certification should be achieved through simple course participation or through some form of controlled verification (for example by exams). The former solution increases accessibility, the second increase the quality of the certification process.

Objectives

Simplify the understanding for clients and provide quality guarantees

Reinforce training schemes

Encourage quality of construction

Provide a competitive advantage to certified professionals

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National and Regional governments ▪ Professional and technical associations ▪ Architectural and technical schools
Target groups	<ul style="list-style-type: none"> ▪ Architects and designers ▪ Builders and SME ▪ Clients (indirectly)

Possible means of action

Professional Certification schemes can be initiated by public institutions or private associations (including those known from the general public such as ministries, regional administrations, NGOs, etc.). Professional and technical associations should be involved in certification schemes as they are the usual interlocutors of the different professions benefiting from a certification scheme. They have the task to set the rules of the game:

- Specifications needed to obtain the certification (training involved, exams, signature of a quality charter, regular activity reports, etc.),
- Control and possibly sanction policy in case of misuse of the certification,
- Communication means dedicated to promote the certification.

Professionals will be interested if they can show to their clients:

- An institutional guarantee, possibly under the form of a logo, where an official institution certifies that this professional is recommended (e.g. trained to install domestic solar water heaters)
- Publicity in which their competencies are acknowledged: list of certified studios and SMEs on the internet, in brochures, guides, at fairs for the general public, etc.

Example – MINERGIE® certified training in Switzerland

The MINERGIE® association has developed a specific training course for professionals. If the course is successfully passed, or if professionals can justify for the building of at least two MINERGIE® constructions, they can become "Official Partners". The benefits are to be allowed to use the MINERGIE® logo, to be listed on the website as professional partners, to be able to publicize their work on the website, to be recommended when the public asks for information, being priority partners in case of event organised by MINERGIE®

http://www.minergie.ch/fr/download/Fachpartner_Reglement.pdf

Example – CasaClima certified training in Italy

In the framework of the CasaClima training course described in the training part of this report, certified professional receive either a Certificate of Participation or a CasaClima Expert diploma depending on the course they have followed. Participants in the specialist course obtain the right to apply the label "CasaClima Specialised Company" (Azienda specializzata CasaClima) - provided a high level manager attends the course. Both Experts and Specialist Companies are listed on the CasaClima web site <http://www.agenziacasaclima.it>

3. Certified Products

Context

Product certification represents:

- A valuable gain of time for professionals as scientific and market studies are undertaken by one institution analysing and comparing products, and then publishing the results – ready to use;
- A powerful incentive for manufacturers to market and develop complying products.

Objectives

Simplify the work for architects and builders
Encourage product development

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National and regional governments ▪ Institutes and research laboratories
Target groups	<ul style="list-style-type: none"> ▪ Architects and builders (as prescriptors) ▪ Manufacturers

Possible means of action

As for the certification of professionals, credible institutions have the task to set the rules of the game:

- Choice between the development of endorsement labels - voluntary schemes - and information labels - aimed at informing on performance levels for all products put on the market.
- Specifications needed to obtain the certification (required performance for each type of product, testing policy, self declarations from manufacturers, etc.).
- Control and possibly sanction policy.
- Communication means dedicated to promote the certification.

Example – Product certification in Germany

The Passivhaus Insitut (PHI) issues a "component certificate" for a number of components suitable for passive houses: glazing, window frames, building systems and junctions without thermal bridges, entrance doors and ventilation units. Window frames are a good example: If an architect needs windows for his passive house project, he would have to source high-performance frames on the market and find out about their thermal quality, because he needs reliable data on the thermal properties of the frame in order to properly design the building. Having to do this for an individual building project implies a tremendous amount of work, therefore architects generally rest on the list of certified components and their manufacturers on the PHI website.

<http://www.passiv.de/>

EDUCATION, TRAINING, EMPOWERMENT



Framework elements

The building sector is faced with a number of difficulties; one of them is its fragmentation in many different trades. Information and practices are complex to share across the spectrum of the various professions involved in the building sector - including those regarding passive solutions.

Very often, researchers are insufficiently informed of the needs of homeowners and builders. It proves difficult for architects, designers, builders and contractors to keep up to date with regards new products, materials and systems. Often professionals rely on the training and information provided by the component and product manufacturers and access to independent assessment is limited or unavailable. It can prove difficult to both procure innovative products/solutions and identify trades people able to ensure their correct installation.

At the end of the chain, consumers and homeowners have insufficient structured information or informal reference points (e.g. the experience of friends or family) to enable them to evaluate low energy designs. Consequently passive homes remain an unknown and demand fails to grow.

All studies and assessments on the building sector integrating sustainable development insist on the need to bring education and training to all operators in the construction chain, from the fields of R&D, product manufacturing, design / architecture / engineering to builders (whether public or

private) and contractors, consumers, homeowners and real estate.

Though often repeated, this requires that action be taken in several directions in order to promote passive architecture.

Designing a long-term training programme at national and local levels

Such a large scale programme goes beyond the scope of this report¹ and includes defining short- mid- and long-term targets based on the ultimate national objectives for the development of the passive home market over the same period. Many professionals underline the fact that passive architecture should not be a specialisation but rather a theme to be incorporated in the general thinking on training and curricula, as other elements.

Developing such training programme includes establishing working groups involving industry, government and universities to identify those professions requiring improved labour skills and develop together with the corresponding trade associations suitable strategies by which this training could be provided. It also requires improvements to relevant courses at higher education institutions, at universities and technical colleges.

Education and training programmes need to be tailored to the different target audiences, considering existing skills levels and factors

¹ See "Building Envelope Technology Roadmap – A 20 years Industry Plan for Building Envelope", Department of Energy, 2001, http://www.eere.energy.gov/buildings/info/documents/pdfs/envelope_roadmap.pdf

motivating current working practices. Consistent budgets and means should be devoted to this long term training programme.

Recognition for training activities

Both existing and future professionals (students) need to be encouraged to take action, develop an understanding of passive architecture and techniques, and integrate these into their standard design practice; they must see the relevance of training courses to current or likely future business opportunities.

Though in the immediate future passive house design will likely represent a minor segment of the housing market, experience from Germany and Switzerland shows this niche can quickly develop. The demand for low energy and passive designs will receive an important stimulus from the introduction of building energy labelling. It should be stressed to professionals that the theme of sustainable construction is developing, that more and more local governments are taking action - they should not miss this potential market because of scarce knowledge or training. At the other end of the chain, home owners need to be reassured that the professionals charged with designing their passive or low energy home are suitably qualified and prepared. For both these aspects, national and local policies can be of great support, provided the administration itself is trained to the concept and results of passive homes (their costs, impact on family budget in a context of rising energy prices, on air pollution, etc.).

Quality guarantees and certified training schemes have proven to be an effective means of both reaching out to professionals as

well as reassuring market operators and in particular clients. Public approved schemes are particularly effective. However public approved schemes require significant commitment from national and local governments to launch and/or support. The public and institutional guarantee, provided it is correctly designed, implemented and controlled, attracts participants in training courses and insures a certain level of quality for passive homes.

Risks

If there are risks connected to introducing the theme of passive architecture in education and training, they lie in the "business as usual" attitude of education and training institutions. In reality there is no time to waste.

In this framework, "Working together" could be a motto to boost training and practices around passive design.

- Schools need to incorporate passive design and solutions in their curricula
- Curricula should encourage architects and heat engineers to be trained together on many issues, including the ones of passive design and building physics. Architects and engineers need to learn to speak and listen to each other, especially in countries where the two professions are rather separated.
- National and local governments should support this development, invest time and money in order to help develop high quality and cross-disciplinary education courses and training programmes.

1. Passive Architecture integrated in curricula and continuous professional training

Context

Architects are generally insufficiently prepared to design passive buildings because they lack a sufficient understanding of building physics and the general notions of passive design, namely the use of natural energy sources, their flow, storage and modulation within the building envelope. The lack of understanding stems from a scarce preparation at university and the problem is generally recognised even by architectural schools.

Constructing passive homes can require attention to detail which in ways might be alien to the current construction sector paradigm. Indeed builders and the trades (carpenters, joiners, bricklayers, plumbers, etc.) find it increasingly difficult to attract sufficiently able and motivated students. Work in the construction industry is seen as hard, both for the type of work and the environment (outdoors). The building trades are often only viewed as solutions for the less academically skilled teenagers.

Building low energy and passive homes can also require different on and off site skills. For example triple glazed windows are heavier and bulkier than double glazed alternatives requiring different construction procedures in the joiner's workshop, ensuring building envelopes are air-tight requires windows to be correctly taped when installed on site.

In addition, many of these solutions are still unknown to technical college teaching staff. If the passive market is to develop, all operators must be taught, from the very beginning of their normal curriculum, and regularly during their professional life, about passive architecture and its related materials, systems and installations.

Given the importance of such a contemporary issue as climate change, it is terrible to think that the great majority of teenagers undergoing training in the building trades today will most probably not even hear about sustainable architecture and passive buildings.

If the market for passive homes is to develop, passive and low energy designs need to be integrated in all relevant curricula and not be left as a specialist choice for the interested

few. Initial college education and training should be followed up by on-going professional training courses, in consideration of the fact that low energy design is a rapidly evolving subject and solutions are likely to mature quickly over the next few years as experience grows.

Objectives

Integrate the passive house concept and low energy design solutions in the normal curricula for higher education establishments, technical schools and professional training programmes. Attract more able and motivated students into the building trades.

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ Universities and professional schools ▪ National and local governments overseeing students curricula ▪ Professional and Trade Associations ▪ Chambers of Commerce ▪ Component Manufacturers
Target groups	<ul style="list-style-type: none"> ▪ Students ▪ Professional and Trade Associations ▪ Architects / Designers / Builders

Possible means of action

Enhancing the building's sector attractiveness for future professionals

Developing passive homes requires that:

- architects and heat engineers are able to integrate sustainable design concepts in the very upstream phase of their designs
- trades and craftsmen are able to correctly implement the sustainable measure when working on-site

For all non residential and for much residential developments the architect represents the ultimate reference point: his/her ideas and plans give the project its form and his/her management define its effectiveness. Any attempt to move sustainable development from a niche market to the mainstream is obliged to begin with changes to the curricula of the

architectural schools. Two issues need to be addressed:

i) More priority needs to be given to basic building physics. This is essential to understand the simple and more advanced notions of sustainable design. It will also facilitate the sometimes difficult communication between architects and engineers. Far too many graduate architects have only the most qualitative understanding of basic building physics. However, there are differences across European Member States: in Germany, architects are also engineers (architects have basic knowledge of technical aspects

and mechanical systems, and specialised engineers take care of the details). At the initiative of certain schools, this "dual training" is starting to develop in countries where this is not a common practice, such as France or Italy.

ii) Much wider coverage needs to be given to sustainable design and passive concepts, both in the terms of number of schools where it is offered and to the time allocated within school curricula. In most cases, students cover sustainable design concepts as an optional course towards the end of their studies.

Example – The International Union of Architects promoting sustainable architecture

The International Union of Architects (UIA) is promoting training on sustainable architecture through a number of activities. One of its Commissions is called "Architectural education" with a thematic group dedicated to Environmental awareness and sustainable development. One of the UIA's working programmes is also dedicated to sustainable architecture with the objectives, among others, to facilitate access to information and continuing education on sustainability; to create effective research tools that will get the educational community involved in this area; to establish an on-line platform on "sustainable building materials" and "powerhouse-energy efficient technologies and methods".

<http://www.uia-architectes.org>

Example – France. Nancy's school of architecture

In order to speed-up the integration of sustainable architecture in curricula, an appeal has been launched by the architecture school of Nancy and several French personalities to encourage professionals dealing with architects' education to implement six propositions:

1- Sustainable and fair development principles must be integrated within the theoretical and practical education in the fields of architecture, urbanism and landscape.

2 - Environmental quality issues must be addressed in all cycles of initial and continuous training.

3 - Students must carry out at least one project integrating the environmental approach per training cycle.

4 - Specific courses must be available to get into detail of specific issues: passive architecture, sustainable urbanism, eco-techniques, building's sanitary impacts, etc.

5 - Research on this issue must be strengthened in order to develop knowledge and build new competencies

6 - Bridging scientific, technical and cultural knowledge should serve as a basis for a new ethic, guiding pedagogy in line with sustainable and fair development's objectives.

<http://www.nancy.archi.fr/appe/>

At the other end of the production line, good design can fail if trades people (carpenters, joiners, bricklayers, plumbers) do not know or fail to implement passive solutions correctly on-site. passive houses can require builders to employ special attention in performing standard tasks; for example in relation to rendering building envelopes air tight (the notion should be understood), working with skilled plasterers (not only using gypsum boards) or correctly installing insulation bricks.

Both current and future trades' people need to be provided with the relevant skills. However achieving the required and hoped for large-scaled shift toward sustainable development in the coming years, requires that sustainable construction techniques be taught and presented to students today without delay.

To integrate sustainable building methods into Technical and Professional School curricula requires work to first collect and collate the different procedures and techniques. Current literature on sustainable architecture considers

design concepts and tends to address architects and engineers. Little or no literature is available aimed specifically at trades' people and how sustainable concepts impact on-site building procedures.

Certainly manufacturers of relevant building materials (for example insulation, sealant tape, plaster with phase change materials, heat exchangers) can assist in this work, either

working directly with Technical Schools to explain specific solutions, or working in association to develop a more complete global understanding.

As with designers, future trades people should be made aware of the likely trends in the construction industry and the business opportunities for those sufficiently prepared.

Example – Italy. The province of Venice

The province of Venice has been funding for several years a network of centres specialising in environmental education. Some of these centres present the themes of energy savings and renewable energies to groups of students from 6 to 18 years old (contents are adapted to the age of the audience). They present the rationales of saving energy and using renewable energy sources but also show the systems (small hydro, solar thermal energy and photovoltaic, heat pumps) and their correct installations in cooperation with local SMEs.

http://www.itislevi.it/mappa/Lab_permanenti/edu_ambiente.htm

Building up continuous training

Changes to school curricula can prepare students of today for the enlarged market of tomorrow. However the market and solutions are evolving rapidly and continuous training for current and future trades' people has and will have a crucial role to play.

National and regional government can develop training courses, but should also think about providing incentives (financials incentives,

institutional guarantee, communication) to the trades regularly training their staff on sustainable practices and thermal regulations (most often, these are not perceived as a key issue compared to security or health issues to which time and resources are dedicated).

Professional organisations can also organise courses and make sure that their own structural organisation is encouraging professionals to invest in training.

Example – Italy. CasaClima in the Province of Bolzano

In the Province of Bolzano, northern Italy, the Provincial Office (Ufficio Aria e Rumore) in charge of establishing and monitoring the labelling scheme CasaClima understood from the very beginning, the importance of training architects and trades people in low energy design and building. The office runs both basic and specialist courses for architects and trades people:

- a 20 hour basic course leads to a simple Certificate of Participation,
- a 40 hour course leads to the "CasaClima Expert" diploma.

Participants in the specialist course obtain the right to apply the label "CasaClima Specialised Company" (Azienda specializzata CasaClima) - provided a high level manager attends the course. Both Experts and Specialist Companies are listed on the CasaClima web site
<http://www.agenziacasaclima.it>

Mid 2006, in total 183 companies and 346 designers (architects, technicians, engineers) had completed the respective specialist courses. The courses are so highly appreciated that more participants to the specialist course for designers now come from outside the Province of Bolzano than from the Province itself. Indeed nearly half of the designers (172 as compared to 174) registered in the CasaClima website come from regions other than Bolzano, some from as far away as Sicily and Sardinia.

The local government has also sought partnerships with other professional bodies and trade institutes to spread participation in the courses, for example with L'Associazione BioediliziaItalia

Example – Germany. Credit points for professionals

Professional federation of architects require their members to acquire a minimum of training courses credit points each year: some passive house seminars are included in training courses delivering points.

Example – Italy. Industry investing in training

BASF has developed a project called “E6 sestaenergia”: training courses on energy efficiency in buildings and a dedicated software, “E6 Energy Analysis”, enabling planners and certifiers to carry out simplified calculations for the energy analysis of different types of buildings according to Italian rules. The first series of courses has gathered up to 500 trainees across the territory. The Italian Architects and Engineers associations have recognised the participation certificate delivered at the end of the course and the Association of technical experts (including thermal experts) has gone further in delivering training credit points to the experts following the course.

<http://www.sestaenergia.it/>

2. Empowering professionals

Context

A change of culture in the building sector is needed if passive homes are to become the standard new house. For this, beyond training and education, action should be taken to motivate, accompany and empower all building sector's operators.

Professionals need to be supported through the creation of networks where to exchange experiences within given professions, but also between professions as passive solutions rely on the good operation of interdisciplinary teams from the very early stage of the design phase. If a collaboration with a heat engineer is engaged after the sketch's design, essential opportunities regarding elements for passive constructions, such as the building's orientation, its compactness, etc. may be lost. For many European countries where the professions of architects and engineers are quite separated and to a large extent ignore each other, learning to work together is a revolution in itself.

As for the education and training activities, participation in some of the actions described below can lead to professional recognition (through certificates, institutional guarantee, publicity, etc.). This is a way to both encourage the first professionals engaging such actions – they are changing their habits – but also to facilitate the meeting of supply and demand.

Objectives

- Putting operators on the concrete tracks of passive constructions
- Sharing knowledge and competencies
- Learning to work together

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National and local governments ▪ Professional unions and associations ▪ Clients ▪ Architects experienced in passive architecture ▪ Industrial firms
Target groups	<ul style="list-style-type: none"> ▪ Architects ▪ Designers ▪ Builders, contractors and trades ▪ Promoters and Developers

Possible means of action

Editing and disseminating best practice guides on passive solutions

The construction sector gathers very heterogeneous actors, all of them needing information on passive solutions, on different subjects, with different degree of details. Some operators will need to be introduced to the subject with orders of magnitude, some will prefer very detailed and technical guides on very specific subjects and case studies, some will care for drawings, others for equations, some will favour ready made solutions where others will prefer a fully developed simulation tool. The content of these guides and publications can cover many subjects: building codes and standards, information on the passive architecture and engineering concepts, information on materials, installing techniques, costs, energy saving stakes, financial mechanisms, etc. The dissemination strategy of these guidelines on passive construction should be well designed and target appropriate audiences.

As experiencing, seeing and touching is always convincing and motivating, **organising visits** for architects, engineers, developers and builders but also for local governments to discover or go into detail of passive constructions has proven to be successful. These visits can be organised in different countries but also within a country in different regions – in this case proving to visitors with the same administrative context that taking action in favour of passive construction is possible. It is also a chance to speak with inhabitants, experience climate differences, etc.

Example – Energie Cité

Many institutions organise tours and visits for architects, engineers and decision makers. The association Energie Cité gathering 150 members (city councils) from 24 countries for the promotion of local sustainable energy policies, proposes a series of city tours in 14 European towns. The programme includes low energy buildings and can be adapted to the needs of the participants.
<http://www.energie-cites.org/-Study-Tours>

In several countries, local government and chambers of commerce have set up **clusters / professional networks** to gather and support small and medium size enterprises willing to work on low energy and/or sustainable constructions.

Cluster can bring several types of support to their members:

- Creation and accompaniment of a network to share information and experiences.
- Development of partnerships.
- Organisation of working groups and technical monitoring.
- Organisation of didactical construction sites, in order to discover and learn how to implement specific techniques. For example, ensuring a building is air tight requires both knowledge on the products available on the market and know how on these materials' proper use. Experience shows the blower door test (the method used to test air tightness in new homes) must be completed on average 3 or 4 times before the builders actually correctly apply the solutions. Testing new material is also a way to assess the economic viability of new solutions: some products may be more expensive but allow a gain in the installation time - builders need to be convinced.
- Gathering of funds in order to help SMEs invest in specific machinery and equipment, may be organising internal leasing schemes so that the equipment can serve several members of the cluster, organising and subsidising the transportation of the machine from one company to another.
- Organisation of workshops and training courses.
- Organisation of publicity: publication of leaflet for the general public, representation on fairs, etc.

Example – Belgium. The Eco-Construction Cluster

The Region Wallonie is supporting several clusters, including the Eco-Construction Cluster. Underlining that the cluster will be successful if SMEs are really motivated and active in the process, the Regional government finances the cluster's management for the first three years at a rate of 100%, provided it is done by a senior expert coming from the cluster's field of intervention. This financing rate is digressive after 3 years because, as the objective of the cluster is to create added value for each of its members on the long run, it should tend towards self-financing.

http://clusters.wallonie.be/xml/index_ecoconstruction_fr.html

Forming multidisciplinary teams

In most European countries, architects and heat engineers are not used **to working together**² – due to the structure of the different curricula. However, passive solutions rely on interdisciplinary teams.

- Often, small architect studios do not have enough means to employ specialised

engineers. The constitution of a team is project-based according to the client's demand. Usually, architects studios buy services from heat engineers after the project is designed, in order to check the thermal regulation. One solution could be to **share resources** – e.g. two or three studios employing a thermal engineer or a specialist of a given simulation software tool, in order to integrate this work in the design.

- Learning to work together is also achieved by **setting up a team gathering various competencies**. Depending on countries, as this sometimes new practice is not easy

² See "Logements à faibles besoins en énergie - Guide de recommandations et d'aide à la conception", Cabinet Olivier Sidler for ADEME, Région Rhône Alpes, Conseil Général de Savoie, ODH 26 <http://sidler.club.fr/index.html>

to implement, a few recommendations can be made:

- The client should strongly encourage this dialogue, if not impose it from the very beginning of the design phase.
- Both the architect and the thermal engineer should be committed to dedicate time to this dialogue.
- The team should speak the same language. It is useful to make written minutes of every meeting to avoid ambiguity between different professions and understandings. Likewise, the team could use the same guides and publications (depending on the level of knowledge of the various parties, neither too technical nor too simple).
- Plans, sketches and pictures should be used to enable both architect and the engineer to express their respective analysis of the building: What are the various justifications to a specific building's orientation from the points of view of the architecture, urbanisms, technique, thermal

behaviour? What are the advantages and drawbacks? What about the volumetry? How could natural lighting fit in it? Etc. Confronting these various points of view at every stage of the project contribute to develop a "common culture".

- The team goes beyond the architect/engineer couple and should include, if possible, a construction economist to have up-to-date information on current cost of different materials and techniques, and oversee the project as a whole. Studying local operations already implemented is also a very good source of information regarding construction costs. One can see the regional aspects affecting construction costs (that are difficult to assess such as the local preference for specific materials and construction techniques, the competition between SMEs at local level, geographical aspects affecting the work – distance of supply centres, altitude...).

FINANCIAL MECHANISMS / INCENTIVES



Framework elements

Financial mechanisms and incentives can help the development of passive homes market. In the following pages, we present mechanisms aiming at reducing, in the case of passive homes, the cost of:

- land,
- design and technical solutions,
- capital (i.e. money).

Most often, the presented mechanisms are inspired from measures aimed at encouraging the retrofit of houses which could be adapted to the construction of passive homes.

National versus local action

When designing financial mechanisms, decision makers should keep in mind that passive homes' builders and buyers make trade-offs, just as anybody else: before investing in the place they will live in for the next 10 to 50 years, buyers take into account elements that have nothing to do with the house itself: the area, available transport solutions, school for their children, shops and parks, etc. Regarding these very contextual issues, financial mechanisms have little influence, as the alternative is not investing in a heat recovery system compared to a traditional heating system, or not even choosing between the heat recovery system and a built-in kitchen – which also plays a role – but choosing between the heat recovery system and paying transportation to go to work. Local governments working on a

consistent territorial policy have more chances to see financial mechanisms succeed as it is the general housing offer that matters.

However, these mechanisms do make a difference once fundamental issues are settled, pulling beneficiaries and public funds, and hopefully the whole market, towards intelligent solutions.

Some of the presented mechanisms may prove very difficult to put in place depending on the country's institutional organisation (e.g. it may take ages to modify a VAT rate) but most of them show in contrast that local governments have an important and concrete role to play – with the support of the national level. A lot can be done by linking the work undertaken on zoning, land settlement, city planning, urbanism rules... with financial incentives.

Frame and guide rails

Financial mechanisms and incentives should be well framed in order to yield investment stimulating the passive house market:

- Constructions benefiting from these mechanisms should be well defined and conform to certain specifications.
- Beneficiaries must be carefully targeted according to the aim of the mechanism. For example, mechanisms' design should be quite different if the target group is young first time buyers needing very long

term loans or seniors investing their capital in a new house.

- Communication should be framed so that targeted beneficiaries are aware that such incentives exist and, if necessary, are helped to apply for them. These mechanisms should not be perceived as too complex to apply to. Experience shows that certain socio-professional groups do not have the curiosity to look for funding solutions or do not want to get involved in the administrative work. For example, if low income families are targeted, the mechanism could be presented at or distributed through the social services' offices rather than through a bank.
- Management should also be framed correctly.
 - On the economical side, general and individual budgets should of course be studied carefully, using simulations, etc. A follow up at micro and macro economic levels should be put in place to assess how the passive home market is affected. However, it seems important to also have a pragmatic approach when designing such mechanisms:
 - The extra cost of a passive home is not an easy notion – especially in countries where this type of construction is relatively new and the building sector does not have enough hindsight. The definition of this notion is complex – as situations vary so much – and should not hamper the development of these mechanisms which can be based on broad averages since they will not apply to single cases but to a number

of houses which will show a certain spread of features.

- For mechanism involving public funds, political justifications have a role to play. Given the climate and the energy crisis, national and local governments can straightforwardly justify investing tax payers' money in solutions directed to single individuals since those solutions help the community as a whole to fight against climate change, local pollutions, energy shortages, etc. (Those individuals will receive benefits - a low consumption house - but will also have to do a lot of personal effort to undergo the process of pioneering in a new area)
 - On the implementation side, the distribution and promotion networks must be planned carefully. If commercial banks are obliged to distribute products which they have not developed themselves and for which they have no commercial advantage, the whole programme is jeopardized as the mechanisms will not be promoted and potential users will be encouraged to go for more traditional financing and building solutions. For example, banks distributing loans softened by public funds should be invited through demanding tenders – the most interesting offer from the point of view of the community being selected; manufacturers which products benefit from a tax credit should be invited to actively promote their products

1. A less costly land for passive homes

Context

Within the European Union, there are many organisational differences in the housing situation, e.g. France dramatically lacks new homes whereas Portugal is on the contrary not showing a deficit. However, in most countries the price of the land has been steadily and impressively rising since the mid nineties. Within a given and most often limited budget, the share of the land is raising, pushing clients to make a balance and buy relatively low investment constructions.

Objectives

Make the price of the land lower for buyers investing in a passive home, in order to release funds for the construction itself.

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National governments and bodies in charge of general policies in the fields of: taxes, land use planning, urbanism, architecture ▪ Regional government and bodies in charge of local taxes, land use planning, owning land or able to impose zoning ▪ Public actors owning land ▪ Developers
Target groups	<ul style="list-style-type: none"> ▪ Governments at national and local levels in charge of land use planning, owning land or able to impose zoning ▪ Developers ▪ Builders ▪ Buyers

Possible means of action

In exchange of a commitment to build passive homes, several offers can be made regarding the land – its price and its use.

- **Taxes on property and/or on occupation** of a house can be reduced if the house is a passive house

Example – Variation of property tax in France

Since September 2005, new buildings respecting environmental criteria can be exempted of property tax for 15 years to 30 years (following their completion). Buildings should respect at least 4 of the 5 following criteria: 1) environmental conception and implementation of an environmental management system, 2) environmental nuisance and waste minimisation during the construction, 3) energy consumption for heating and hot water production and their noise levels inferior to the regulatory levels, 4) use of renewable materials and energy sources, 5) implementation of energy saving measures.

Décret n° 2005-1174 du 16 septembre 2005

<http://www.admi.net/jo/20050918/BUDF0520324D.html>

- Separation between **property of land** and **property of the house** can be made. Following the example of some countries (e.g. Finland), if local authorities are the owner of the land:
 - Emphyteutic leases can be put in place.
 - The land can be rented under an "ownership access" scheme, allowing spreading payments on the long term (30 to 40 years). The buyer starts the reimbursements of the land when he

has finished reimbursing the house. Such a system has been designed in France in order to help low income families becoming owners of their homes, but the principle could be adapted to the construction of low energy homes.

- The **land** can be **sold at a lower price** if the houses to be built are passive constructions. When local authorities and developers launch calls for tenders, they

can ask – or be encouraged to ask – builders for different estimates regarding construction costs and energy consumption on the long run: for an average house, a house performing 10% better than current level of the thermal regulation and for a passive house. The price of the land can be linked to the performances of the house. Guide rails should be put in place so that the house's performances are certified and so that buyers benefit from this land price difference. If the local legal framework does not allow for such schemes, a strong communication plan towards decision makers and the populations about developers respecting (or not) their commitments, may be a sufficient pressure. In The Netherlands, Municipalities owning lands can sell it to housing developers and cooperatives and make a lower price for social housing

developments. This kind of rebates could be extended to the type of constructions, with a lower price for low energy homes.

- The **plot ratio** can be higher in case of passive construction. It means that authorised maximum size of the house on a given piece of land can be bigger in the case of a passive house compared to an average house.
 - The bonus can be decided in per cent
 - Elements participating in the passive construction can be deducted from the calculation of the size of the house: insulation material, buffer zones, spaces used to evacuate hot air, etc. passive houses are actually penalised with respect to conventional buildings where elements linked to energy consuming devices are not counted in the volume of the house, e.g. cooling devices' condensers.

Example – Plot ratio modulation in France

Since May 2007, Municipal councils can grant larger floor area ratios (up to 20% more than normal) to new buildings achieving lower energy consumption compared to the thermal regulation or including renewable energy production means. New buildings should respect the specifications corresponding to various official labels (THPE, THPE EnR or BBC 2005).

Arrêté du 3 mai 2007, pour l'application de l'article R. 111-21 de code de la construction et de l'habitation relatif aux conditions à remplir pour bénéficier du dépassement de coefficient d'occupation des sols.

<http://www.admi.net/jo/20070515/SOCU0750659A.html>

2. Professionals encouraged to deliver passive solutions

Context

If the passive homes market is to develop, passive solutions – good design, good materials, good installation – should become normal solutions. But the building sector faces difficulties of various types which prevent passive solutions to be known, encouraged, developed and implemented.

Designers and architects need more time for their upstream studies; products are sometimes expensive because the demand is not high enough to mass-produce them; in consequence, these products are not promoted with the same strength as current and usual solutions; since the demand is low and the incentive to use traditional energies is high, installers do not invest in training on new practices and materials...

Objectives

Ensure framework conditions favourable to the choice of passive solutions by offering arguments to their providers.

Recognise the know-how involved in passive solutions' design and application.

Help markets for passive materials reach a critical size and lower the price of single products

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National government in charge of developing framework tax policy ▪ Local government in charge of local taxes ▪ Local government implementing a housing policy ▪ Component manufacturers ▪ Developers & Builders
Target groups	<ul style="list-style-type: none"> ▪ Designers and architects ▪ Component Manufacturers ▪ Developers & Builders ▪ Buyers

Possible means of action

Many national and local authorities propose **subsidies to builders**, be it in the framework of the normal funding procedures of social housing, to support builders in given areas or to support pilot projects.

The use of subsidies bound to the respect of energy requirements is developing. Subsidies can be granted only or in priority to builders:

- undertaking specific studies on the energy consumption of the planned house,
- undertaking specific studies on the best energy sources to be used by the planned house – including renewable sources
- complying to a given energy reference frame defined by the subsidy provider.

Designing a passive house is often considered to be more time intensive than designing a standard house - because a passive house needs to be contextualised. This has a cost which should be paid to designers and architects designing - and thus further incited to design passive houses.

The house **designers' and architects' fees** can be structured in such a way to reward them for designing houses that have a low operating and lifecycle costs. This reward can be more or less formalised, from the phase of the selection (through call for tenders) and/or can take the form of a bonus – for certified passive constructions

Example – Designer's fees in Germany

The law on honoraria for architects and engineers (HOAI) imposes maxima on the fees they may charge for their work, depending on the building cost and the difficulty of the task. In 1994, the government explicitly introduced the possibility to charge additional, case-dependent fees for checks on the possibility of active or passive energy savings or the use of renewable energy.

Example – Financing efficient design in Italy

The Italian 2007 Budget (Legge Finanziaria 2007) provides incentives for the development of low energy buildings greater than 10 000 m³ in which the calculated energy demand is at least half the maximum energy demand required by building regulations. The Budget established an annual fund of 15 000 000 Euro, for the three years (2007, 2008, 2009) to cover 55% of the extra construction and design costs of those buildings meeting the requirement.

The general tax policy orients house buyers towards given equipment and sources of energy. With this regards, the **value added tax** (VAT) applied to energy sources and the various energy saving and renewable energy equipment is critical.

Countries willing to promote passive houses can use the general tax system to do so, in

order to (at least) avoid pushing buyers in the wrong direction. For renewable energy and energy saving equipment, the VAT rate can be at least equal to if not lower than the one applied to energy sources and average energy consuming devices.

Example – VAT reduction in the UK

In April 2000, the UK government instituted a reduced VAT level - 5% instead of 17.5% - for a list of equipment favouring energy efficiency in the domestic sector (solar panels, control systems for central heating...).

Several countries have put in place **tax credit schemes**, in which the owner of a home buying an energy saving or a renewable energy equipment gets a refund on the income tax, or a money in compensation if the person does not pay an income tax. A list of specific

equipment and processes is issued and tells under which condition a certain percentage of the equipment cost can be credited.

Example – Tax credit schemes in France

The 2005 Finance law involves the following tax credits' levels: For efficient boilers, insulation and energy meters, 25% of the investment value; For efficient heat pumps or renewable appliances, 40% of the investment value. A limit of total amount per person per fiscal year is set at 8 000 Euros tax credit.

<http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=15971>

Other countries and regions give **subsidies** to specific solutions. Again, a list of specific equipment and processes is issued, for which a certain grant is given, under specific conditions.

Example – Subsidies in Germany

The use of renewable insulation materials is supported by the federal government with a grant of 25 or 35 €/m³, depending on the material category. Installation of solar thermal systems is also supported with 84 (DHW only) or 108 (DHW and heating) €/m². Another programme subsidises the use of biomass for heating.

Example – Subsidies in the UK

The Low Carbon Buildings Programme is an initiative to promote renewable microgeneration in residential buildings. The programme is sponsored by the Department of Trade and Industry. To be eligible to receive a low carbon buildings grant, the householder must ensure that their house's energy requirements are minimised. Grants are being released towards the capital cost of the installation for SME and homeowners alike. The funding from 2007 is being increased (up to more than 26 million Euros for home owners).

<http://www.lowcarbonbuildings.org.uk/how/householders/>

In order to promote specific products and solutions, specific **loans** could be granted with the opportunity to **deduce interest rates** totally or partly **from the income tax**. If the incentive is coupled to the amount of energy

saved – not to the cost of the measure – it would make the most cost-effective measures be realised, which in turn would produce the highest possible savings for the money spent on the programme.

3. Money less expensive to build and buy passive homes

Context

Borrowing money to build and/or buy a house is almost compulsory. This money has a cost – actions can be taken to reduce this cost for the borrower willing to build a passive house.

Objectives

Make money less expensive for investing in passive solutions.

Actors involved

Mechanisms ' Designers	<ul style="list-style-type: none"> ▪ National government and bodies in charge of fiscal incentives ▪ Local government and bodies investing in and implementing a housing policy ▪ Banks
Target groups	<ul style="list-style-type: none"> ▪ Banks ▪ Buyers ▪ Component manufacturers ▪ Developers & Builders

Possible means of action

Soft loans are meant to facilitate access to solutions for which the investment cost is high. With a soft loan, the buyer facing a higher initial investment than his own available capital can nevertheless buy the equipment - compared to subsidies where the investor still needs to spend a high amount of his own money, since the subsidy never covers the whole cost of an equipment.

Several **banks** have started to propose products to their clients willing to invest in energy efficiency and renewable energy solutions while retrofitting or buying a home. Interest rates can be softened by the bank itself, willing to attract new client and develop new "environmental friendly" financial products by reallocating parts of its benefits.

Example – Specific bank products in France

The bank Banque Populaire has developed a specific home loan to fund ecological equipments in new constructions. The interest rate is softened by the bank through ethical savings accounts and by the French Agency for Energy Management and Environment (ADEME), and the administration fees are offered.

http://www.banquepopulaire.fr/groupe/p745_FR.htm

ADEME has also recently developed a web-based tool to compare the various ecological home loans available: <http://www.ademe.fr/internet/ecoprets/>

However, to encourage banks further in this direction and/or to soften even more the loan (and reach e.g. 0% percent interest rates), **governments** can help – at all administrative levels.

Governments can cooperate with public and private banks, bringing money to take in charge part of the interest rates. The client benefits from a softened loan, the bank is making profit with a new product benefiting from institutional guarantee and communication, and the government is ensured to yield investments in energy savings solutions, renewable energy equipment and/or passive constructions.

These soft loans can be dedicated to cover:

- Specific solutions, with a list of accepted technologies and materials. The maximum loan is then relatively limited.
- The extra cost possibly induced by the construction, provided the performance is certified. Instead of a list of technologies, a percentage of the total cost of the passive house can benefit from a soft loan.
- A large part of the house, for certified constructions.

Example – Government support in Germany

The German KfW ("Kreditanstalt für Wiederaufbau" - bank for reconstruction) runs a scheme which subsidises passive houses and other dwellings with a primary energy demand below certain limits by mortgages with extremely low interest rates (for some time below 1 %, currently 1.7 to 2.1 %, fixed for 10 years, duration 30 years, up to 50 000 € per dwelling unit). These advantageous conditions are made possible thanks to federal subsidies.

<http://www.kfw.de/>

Example – Regional government support in France

The Nord-Pas de Calais and Picardie Regions have set up a mechanism to soften loans targeting home insulation works. The interest rate for the borrower is 0% provided the works are undertaken by building professionals. Both Regional governments have selected private banks through competitive call for tenders, and are communicating about the schemes. In Picardie, the Regional government has invested 1,8 million Euros over 5 years, expected to generate in total 100 million euros worth of works, and to yield 20 million Euros energy savings per year

<http://www.cr-picardie.fr/spip.php?article1129>

<http://www.nordpasdecals.fr/isolto/intro.asp>

Several countries have put in place financial mechanisms to encourage construction and access to ownership in general. These mechanisms can be framed so that incentives target in priority passive homes. For example:

- When interest rates may be partly deduced from the income tax, a larger share can be deduced in case of mortgage/loan to build a passive

house – this should be linked to a certification process.

- Fiscal advantages granted to people investing in the construction sector could be more or less important according to the standard of the construction – certified passive houses benefiting from the most advantageous case.

INFORMATION & COMMUNICATION



Framework elements

Context

Today the construction market for individual homes is generally dominated by companies promoting a house for which the price and the "traditional" aspects (design and construction materials according to regional specificities) are central. There is very little space for the passive home discourse to be heard, mainly because the general public does not know the passive home concept but also because the general background is not favourable: clients are not incited to think in terms of global cost (investment *and* operation of their future house), they encounter financial difficulties, the quality of the global environment is not a decisive issue, they do not have notions about indoor air quality, regulation of the ambient temperature, etc.

The passive homes' market will develop only if all stakeholders are informed about its concept, the benefits of such houses, the means and technical solutions for their construction and the concrete results: comfortable and satisfied inhabitants and owners - saving energy.

Developing an information and communication strategy for passive homes goes beyond the scope of this report, but some key points corresponding to passive constructions' specificities can nevertheless be underlined regarding the type of information to be presented and the challenges and benefits these houses represent.

Objectives

Stimulate demand for passive homes, notably through the media.

Stimulate interest and actions from professionals and decision makers.

Target groups

In situations where passive homes are a relatively new concept, it is advisable to concentrate communication efforts and resources on target groups potentially interested in the subject (it is no use trying to convince a harsh audience). The most motivated target groups will be actors that are or soon will be making part of their living from passive constructions: they need information and support and will relay this information towards their clients. The impact in terms of the quality of the outcome, for example of the information provided during a seminar, is much higher if this support is provided to those persons ready to act.

Passive homes: core and background information

As for any communication strategy, for each target, communication activities can focus on various aspects:

- The concept of passive homes (what)
- The benefits of passive homes - for the community, for the clients, for professionals (why)
- The existing schemes: training courses, technical information, certifications, regulations, partnerships with banks, etc. (how)
- The actors: presentation and contacts with lists of professionals, energy advisors, institutions, banks, etc. (who)

However, information and communication activities aiming at promoting passive constructions should also contribute to the debate on background issues, supporting

decisions in favour of passive homes. For example:

- The global cost of a house: help people take into consideration the expenses generated by the house beyond the investment costs. In France, for a period of 50 years, the cost distribution is estimated at 2% for the design, 3% for the assembly, 20% for the construction and 75% for the maintenance. In addition, on average, heating expenses represent 70% of households' energy expenses.
- Quality issues: help client understand comfort, air quality, or health issues, by informing on quality and long term positive effects (rather than focusing only on savings).
- Behaviour: one can always argue if the house should adapt to the client or the client to the house, but it is crucial that clients understand for which optimum their house has been designed. Inhabitants' behaviour can jeopardize the comfort and performances announced (for example if the house is built for an optimum at 19 °C, but people set the thermostat at 23 °C).
- Environmental issues: all decisions have an impact on the environment and stakeholders should be able to link their own decisions and these decisions' impacts on the environment (e.g. lowering the thermostat from 20 to 19°C for the ambient temperature allows saving 7% of energy). Energy and money savings can be underlined as positive actions rather than be associated to regulation, bans and renunciation.
- Local action: the choice of building and buying a house, how, at what price, etc. is always based on a local reality. Therefore, information and communication should be developed, among others, at local level in order to rely on community networks, integrate cultural background on energy and environment, local construction materials, etc.

Passive homes: Challenges and benefits

For the community, including local authorities

Many people have not yet fully understood the importance of energy efficiency. The idea of climate protection and more independence from oil is often reduced to the use of renewable energies, i.e. action focusing on the supply side. The fact that energy efficiency is a prerequisite for renewable energies to cover a significant fraction of the total energy demand

is not well understood. In addition, "saving" energy has a taste of poverty and renunciation, whereas renewable energy, especially solar energy, profits from positive connotations. In order to convince decision makers, there is a need for complementary and numerous arguments showing how passive constructions can positively contribute to the following issues:

- Improved comfort,
- Reduced energy costs to consumers,
- Quality of environment,
- Climate protection,
- Security of energy supply and independence from energy imports,
- End of oil crisis,
- Cheaper than investing in increased energy capacity,
- Lower green house gases emissions, i.e. a major contribution to climate change mitigation's strategies, helping to achieve the Kyoto Protocol targets,
- Sustainable development,
- Increased inland revenue,
- Local employment in the building sector.

Some actually argue that these general benefits can help justifying subsidies for passive constructions (at least for pilot projects) as a contribution to the improvement of a global situation concerning the quality of environment and the economic stakes regarding oil dependency.

Administrative institutions in charge of the housing policy (often regional governments) can find a number of advantages in promoting passive constructions: they provide high quality homes for their citizens, lower their maintenance costs when they are the owners, contribute to the achievement of their Kyoto Protocol's and Agenda 21's objectives, etc.

For the client

To the client, passive homes have to fulfil all the requirements of an ordinary home, such as being situated in the right place, having good access to transportation and schools, having a balcony, looking nice, having the right ground plans, being affordable, etc. Energy efficiency is often not an issue.

- Experience shows that the major reason for buying a passive home is actually comfort – which is the main selling argument – and other non energy benefits (such as internal air quality, security, low noise, etc.).
- Being relaxed about future energy prices' increases is an argument, but not decisive. Environmental issues are not popular

among the majority of people, though they are important for a few persons.

- Economic efficiency is very important as a sale's argument as clients like to believe their decisions are based on a rational basis, even though rationality is usually not the real motivation for any decision... However, lower energy expenses and additional patrimonial value in case of resale truly are additional positive arguments.

For the building sector

Architects, builders and SMEs can benefit from a positioning on the passive home market:

- They get a commercial advantage on a new market promised to a large development,
- They work on high value added missions,
- They contribute to improved building quality,
- They can attract employees on the ground of new practices.

For banks

Banks can benefit from a positioning on the passive home market:

- They can develop partnerships with national and regional institutions,
- They can develop new banking products specifically targeting passive constructions and / or renovations,
- They contribute to the CO₂ neutral policy of the company (if any).

Possible means of action

The objective of this chapter is not to list the many leaflets, brochures, handbooks, internet websites... successful in promoting and inform about passive homes, but rather to present a few means of actions gathering, structuring and reinforcing stakeholders. Individual initiatives are crucial (the passive home market is actually developed at the very local scale, by pioneers architects, builders and clients) but a certain coordination is needed if the global concept of passive homes is to develop.

An umbrella structure to promote passive houses

In a context where passive homes are still the exception, the people and organisations working in this field have a lot to win in the mutualisation of means, also in the field of communication. The structure can be more or less formalised and carry out a number of communication /information activities: design and edition of printed documents, management of a dedicated website with various sections according to the visitors (professionals looking for labelled products versus general public looking for general information of list of accredited professionals), organise conferences for professionals or the general public, consultation processes at the time of new regulations and labelling design, present the concept at fairs, etc. Especially in the case of individual homes, it is important to be present at fairs at the very local levels where homeowners can be met.

Example - The IG Passivhaus Deutschland

The IG Passivhaus Deutschland (Information Association Passive House Germany) is run by the Passivhaus Institut and the Passivhaus Dienstleistung GmbH and is financially supported by manufacturers of passive homes components, architects and similar professionals and institutions. The IG Passivhaus runs a website obviously informing about the Passivhaus standard, offers a protected site for its members e.g. for discussion or the exchange of promotional material, distributes a newsletter, organises the annual Passivhaus day, promotes Passivhaus constructions on building fairs, etc. Component and material manufacturers, blower door testing companies, environmental activists, housing associations, local government energy departments and electricity suppliers are examples for groups who support passive houses.

<http://www.ig-passivhaus.de>

Passive house Day

Dedicating a day to passive constructions allows focusing, on a given day, on many events carried out by a large variety of actors

in order to give them additional visibility and impact. It also allows motivating the various actors and attracting the general public.

Example – The Passive House day in Germany

Once a year, the IG Passivhaus organises a Passivhaus day, during which it is possible to visit existing Passivhaus and talk to their inhabitants. The aim of this event is to share the positive experience of the inhabitant, thus convince consumers about the advantages and give them the chance to find out the truth concerning their doubts. The Passivhaus day draws considerable interest as about 5000 persons visited the last Passivhaus day in Germany and Austria.

Internet portal to inform and network initiatives

The general public interest by the passive homes concept will most surely start by gathering information on the internet before thinking of getting engaged into a structured approach. Many websites exist, but it is rare to find a complete information on the subject, presenting the concept, the benefits, the costs, professionals involved, existing financial supports, etc. Public institutions (from the

national and local levels) can support this portal: for the general public, it is an important guarantee on the information's objectivity.

This communication mean is also flexible (the information can easily be updated) and not too costly to put in place – but it implies a first work of consultation before its establishment.

Example – The MINERGIE® website in Switzerland

The website developed by the MINERGIE® association is very complete. It presents the concept, its advantages, shows pictures, lists all the events (fairs, training courses, public meetings...), but also propose technical modules on specific subjects, the procedure to build or renovate a construction to the MINERGIE® standards, documentation on official partnerships and logo use, etc.
www.minergie.ch

Example – The pan European website of the PEP project

the objective of the European Project "Promotion of European Passive Houses" – sponsored by the European Commission – Intelligent Energy Europe – is to promote the potential of the European passive house concept in Europe by the development of information packages and designs tools for passive houses, the organisation of (inter)national workshops, symposia and conferences and the set up of an international passive house website.
<http://www.europeanpassivehouses.org/>

Passive house competition

Passive homes competitions can be organised: beyond stimulating passive constructions' projects and professionals, when the awards are publicly announced they generate communication about the projects,

the concept, the chosen solutions, results, etc. The awards can be organised at the regional level in order to reflect local specificities.

Example – The Carbon Challenge in the UK

'The Carbon Challenge' aims at driving forward the development of zero and near zero carbon communities. "English Partnerships", a national agency supporting high quality sustainable growth in England, has invited expressions of interest from private sector house builders and housing associations to deliver these new communities by 2008. The key objective is to raise the environmental performance of new communities while still delivering quality at an affordable price. Two sites have been identified, Hanham Hall in Bristol and Glebe Road in Peterborough, and developers will now bid to meet the ambitious development briefs that will deliver zero and near zero carbon communities.
<http://www.englishpartnerships.co.uk/carbonchallenge.htm>

REGULATION

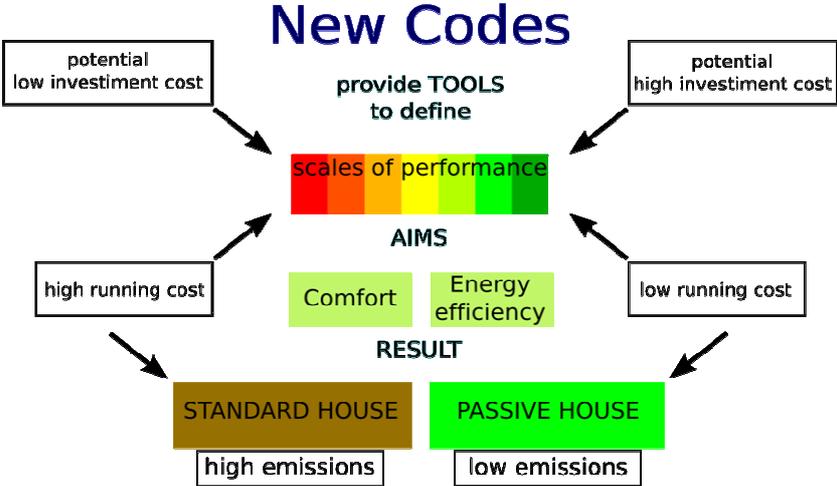


Context and Objectives

In the European Union, buildings account for 40 % of the final energy consumption. Motivated by the 70's oil crisis, Member States have introduced specific thermal regulation in order to reduce new buildings' energy consumption. The translation of the European Energy Performance of Buildings Directive in the various national legislative frameworks has provided Member States with the opportunity to modify national building thermal regulation generally strengthening performance requirements, to integrate renewable energy sources, develop calculation tools, design and implement training sessions and to disseminate information.

frameworks, and in particular the design and implementation of energy certificates for buildings has generated debates on whether to introduce explicitly the concept of low energy homes in the regulation (or not) and how. Members States have chosen different political options concerning methodologies and scales to classify buildings. For example, the UK energy performance certificate is based on running costs, in Spain a class A buildings should consume no more that 10,7 kWh/m²/year for heating purposes, or in France, a class A building should not consume more than 50 kWh/m²/year for heating, hot water and cooling purposes. These choices imply different regulations, understandings and strategies to promote passive design.

The translation of the Energy Performance of Buildings Directive into national regulatory



Regulations may use to incentive the implementation of passive houses

Actors involved

Mechanisms' Designers	<ul style="list-style-type: none"> ▪ National and local governments in charge of regulation ▪ Lobbyist for passive homes ▪ Organisations in charge of developing norms
Target groups	<ul style="list-style-type: none"> ▪ National and local governments elaborating and enforcing regulation ▪ Professionals conforming to regulations ▪ Organisations in charge of developing norms

Controlling performances

Conforming to the Energy Performance of Buildings Directive, Member States have to introduce an energy certificate for building. Home owners and investors must trust this energy certificate. A prerequisite for a good implementation of regulation lies in its control. However control of building thermal performance is often weak, especially when, for example, compared to the control of health and safety regulations. Enacting control systems requires dedicating means, assigning and effectively communicating responsibilities to the different actors in the development process. This also applies to low and very low energy homes.

Accompanying existing regulation

Example – Controls in the new regulation in Portugal

The new regulation requires ex-ante, during and ex-post control of building code compliance, in order to release the building permit and the inhabitation permit. Building engineers and architects are held legally responsible for the veracity of any information they provide. A "Building officer" is appointed to assess compliance with the regulations and reports to the administration releasing the permits. Building officers will be trained on the basis of the new certification regulation, supervised by the Direction General for Geology and Energy (energy efficiency) and the Institute of the Environment (air quality). The Energy Agency, ADENE, manages the certification process, i.e. provides training for the building officers, maintains a database of issued certifications, undertakes quality control through a random check the Officers' activity (their work is expected to be audited at least once every five years). ADENE may also request an indoor air quality audit if there is a suspicion of danger for inhabitants or neighbours. Non compliance with the building codes (thermal, systems and certification) or failure to implement the proposed solutions can be fined or can, in the worst case, lead to building and or inhabitation permits being revoked.

Calculation tools

The thermal regulation procedures required to determine building energy performance are quite complex. Implementation can be assisted by calculation tools. However these can themselves be expensive to purchase and complicated to use - the project designer will generally seek the services of an external heat engineer. The calculations themselves are often therefore performed at the later stage of project design with the purpose of simply verifying that the design meets the minimum standards, i.e. they are not used as a tool to assist the design process. There is evidence that providing simple and free software increases the use by the designer in the early design stage when many of the important decisions regarding energy consumption are made.

In case of designing passive homes, it becomes more imperative to establish a precise building energy balance. Passive homes are not equipped with high powered heating or cooling systems which can make up for any short falls in the design process. If the calculations are wrong, the home owner risks being cold or hot. Thus the energy balance calculations become essential to the design process and must be included at an early stage. Building a home using rules of thumb based on past experience is not sufficient. Completing this precise energy analysis generally requires the use of more specialist tools than those used to calculate compliance with building codes.

This means that those developing passive homes generally need to complete two set of calculations: one set serves to actually

determine the energy consumption of the building and the comfort conditions and another set serves to show compliance of the building to current building regulations. This double calculation represents an unnecessary complication of the design process. Regulatory authorities could simplify the process by recognising, with due limits and controls, alternative calculation procedures to those developed by the official standards bodies.

Support for new technical solutions

In order to apply a regulation and dare to implement new technical solutions, professionals need to be ensured that these solutions perform correctly and are compatible with the regulation and to be able to trust this information. This is particularly crucial for passive constructions which sometimes rely on the correct implementation of new technical solutions. For example, the use of air tight envelopes and active conditioning units with heat exchangers common of passive homes solutions in Central Europe could raise doubts of their compliance with the regulatory codes of minimum air change rates in many countries.

Industry developing new products and systems generally invest a lot in R&D and product testing. It is important that governments also invest in R&D, notably on passive solutions which are not depending on products and do not necessarily interest private investors, such as natural ventilation or night ventilation simulations, but which are essential to bring high quality comfort in passive houses.

All products must pass the European Technical Approval (ETA) in order to get the CE mark. This control identifies when and where new products can be used; insurance companies base their judgement on the ETA before accepting or refusing insuring a new

product in a given location. For example, Monomur clay bricks are not very common in Spain because they are catalogued as "innovative product", which cannot be used in seismic zones like Granada. After a certain period of time of implementation without problems, "innovative products" may go on the list of "commonly used products". Insurance companies are more reticent when a product is on the "list of innovative product" which is clearly a barrier to their use.

Governments could for example encourage industry to demonstrate the feasibility of their solutions, try to accelerate procedures for getting the ETA and lead a dialogue with insurance companies to release the situation.

Communication

Improving professional understanding of the regulation, new materials, calculation tools, etc. by public sponsored communication activities also represents a useful step. Work should be first undertaken to identify what the perceived risks are and who are the target groups before undertaking campaigns.

Even if "ignorance of the law is no excuse", architects and builders are confronted to numerous regulations regarding various issues. They are obliged to keep up to date and dedicate time and significant resources to many regulatory requirements in relation to, for example, workers' safety, health and fire - issues are seen by many of higher priority than thermal regulation.

In order to properly implement new codes and regulations, several communication activities can be undertaken to alert professionals: set up a web portal, organise seminars and workshops, prepare technical publications presenting the codes, with commented versions article by article, software and case studies. Wider dissemination can be envisaged through radio and TV messages.

Example – Portugal. Informing professionals

The translation of the European Directive on Energy Performance of Buildings into the Portuguese law has been used as an opportunity to update the existing thermal and systems regulations and introduce methodologies and requisites that comply with the European standards and codes. These new regulations have been discussed and presented to professionals through a series of seminars. Specific training for the experts in charge of forming those who will apply and verify the compliance with the regulations has started.

Strengthening and going beyond existing regulation

The passive-On project has developed a "stock model" to determine the potential impact of

developing homes conforming to the Passivhaus standard on CO₂ emissions from the national housing stock in four partner countries: Italy, Germany, France and the UK. The stock model considers a number of

scenarios, including looking at how to return CO₂ emissions from the residential sector to 2005 levels by 2020. Though the details of each scenario differ, the important conclusion which emerges from the analysis is that just slowing the growth of residential CO₂ emissions requires the annual development of tens of thousands of new and refurbished Passivhauses. The development of 8 000 Passivhauses in central Europe provides a beacon for the way forward, but the situation now demands that the Passivhaus no longer be seen as the Formula 1 of the housing market available only to the chosen few, but needs to move to become a mass market commodity available to the majority.

Ensuring that all new homes achieve Passivhaus standard in the near future is an ambitious but feasible goal. The European Action Plan for Energy Efficiency* envisages proposing a minimum performance requirement (kWh/m²) to approach the levels of passive houses (without traditional heating systems and without active cooling) for all new homes from 2015. The Stern Report** commissioned by the UK Treasury and published in October 2006, with the conspicuous public support of the British Prime Minister Tony Blair and the Chancellor of the Exchequer, Gordon Brown, proposes that all

new homes in the UK meet the Passivhaus standard from 2012.

In order to reach these goals, most existing thermal regulations applying to new constructions and renovation operations will be strengthened. It would be counter productive to impose everywhere and as a minimum passive house solutions – this report shows the present needs in terms of training, funding, empowerment, etc. before regulations can fully integrate passive solutions. However, the ground can be prepared by taking strong political decisions showing the way to the building sector's operators. In particular, industry needs to know that the "writing is on the wall". Regional and local governments have a leading role to play in going beyond regulation by promoting low energy architecture through specific call for project, subsidies, energy labels, etc.

* Action Plan for Energy Efficiency: Realising the Potential COM(2006)545 final
http://ec.europa.eu/energy/action_plan_energy_efficiency/doc/com_2006_0545_en.pdf

** Stern Review on the economics of climate change, HM Treasury, UK, http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Example – Portugal

According to the new regulation, solar water heaters are compulsory in new buildings with in the measure of 1 m² per occupant up o maximum of 50 % of the roof area (except in specific cases: city centres, near by buildings of peculiar architectural and cultural interest, etc.)

Example – Switzerland

The introduction of air conditioning systems of greater than 10 kW thermal power is subject to authorisation. The building owner is obliged to first ensure the building achieves minimum thermal performance in terms of thermal mass, windows shading and reduction in internal and external loads (Technical Norm of the Société des Ingénieurs Architectes Suisses SIA 382/1, <http://www.sia.ch/f/index.cfm>)

Example – Spain

Regional governments can take initiatives to accompany or strengthen national regulations. Under the national framework, they can:

- *Decide on minimum regional requirements (possibly linking their application to subsidies),*
- *Develop complementary methodology to the official one (for a better use of their climatic and constructive peculiarities in the calculation procedures).*

Example – France

The Thermal regulation is updated every 5 years. This process is known by all actors of the building sector who know they should get prepared for the next edition. The new text is expected for 2010. In the meantime, a wide research and experimentation programme on energy in buildings, PERBAT, has been set up by national and regional authorities in order to improve energy efficiency in the building sector. There are two fields of research (technical and socio-economical) and of three major axes: modernising existing buildings, understanding tomorrow's buildings (through subsidised calls for projects to build "factor 4 buildings"), future zero CO₂ buildings or buildings producing energy.
<http://www.prebat.net/>

Checking potential conflicting issues

The introduction of the Energy Performance of Buildings Directive initiated a major process of revising current and introducing building standards and norms to provide the technical framework on which the requirements recalled in the Directive could be measured and implemented. The European standards body CEN was given a mandate to develop the standards and Member State national standards bodies have over the last two to three years been in a process of adopting or adapting these as part of the national body of standards. Though many standards have already been defined, others are still under definition and possibilities still exist to influence their development.

Regulations are up-dated, generally after debate with professionals and other interested actors. There is an issue to how well open and democratic these processes are. Though representatives of the general public might be present through Consumer or Environmental Associations, this is not always the case. The result is that building (and other regulations)

can be weighted towards favouring particular industries and positions. For example, regulations which define too strict summer comfort conditions might lead to the implicit requirement for air conditioning units in buildings.

National governments and the European Commission can work to improve democracy in the standard definition process. The standards institutes (for example CEN) should also work to ensure that all standards are in line with the general European Commission policy on issues such as climate change and local pollution. For example Comfort Standards whilst being based on sound analysis and science should however be sustainable.

Regulations updating periods can serve as occasions to chase blocking elements to a wider development of the passive home market. Potential conflicting issues can be found within the building and thermal regulations themselves or within other types of regulations targeting urbanism or health issues.

Example – The Netherlands

The new energy performance norm (EPN) of January 2006 is more rewarding high energy efficient active systems than building shell related measures such as insulation levels and envelope air tightness. The PassivHuis Holland estimates³ that this results in a decrease of air tightness causing an energy loss of 8% in a standard row house

³ See "Implementation of PH technology in the Netherlands: Experiences from the Past and New challenges", Erik Franke, Stichting PassiefHuis Holland, in the Conference Proceedings of the 10th International Passive house Conference, 19-20 May 2006 Honover.

Example – Germany

The Passivhaus Institut has found that the normal calculation procedures used in the German building codes (EnEV) underestimate considerably building energy demand when applied to Passivhauses. Basically some of the assumptions introduced to building codes (for example minimum air change rates, thermal bridge losses) do not hold true on very low energy homes. The standards, calculation procedures and corresponding software programmes used in the framework of the regulation are very well-known because the calculation must be performed for every new building. EnEV imposes certain maximum values on the primary energy demand of dwellings. But these norms are not suitable for designing or assessing very energy efficient houses. For example, the EnEV calculations assume that a building with a typical passive house supply air heating has so-called 'heat losses for the heat transfer within the room' which are of the same order of magnitude as the average measured total heating energy consumption of passive houses. A closer investigation of the other energy flows in the building shows that this is not possible. For solar thermal collectors standard solar fractions may be assumed, independent of the installed system. This procedure is used by most EnEV calculation programmes. Consequently, users of the respective programmes are lead to wrong conclusions about the energy efficiency of their designs.

Example – Portugal

Minimum and maximum air infiltration rates are defined for different uses and window classes. The minimum air change rate per hour (ACH) is 0.6. Depending on the air permeability of the window frames, the existence of shutters and class of exposition to the wind, this value may increase to a worse case scenario to 1.35 ACH which may increase heat losses. Therefore, complying with the Passivhaus requirements as defined for Mediterranean climates with a maximum of 1 ACH implies using better window frames, controlled admission units but may be also limiting the window areas/floor ratio and/or height above ground (source: RCCTE: Regulamento das Características de Comportamento Térmico em Edifícios, Decreto-Lei N. 80/06 de 4 de Abril).

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It has been compiled by ICE – International Consulting on Energy, Sophie Attali and eERG Andrew Pindar – based on studies and interviews from teams in the following participating countries.

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Spain: Asociación de Investigación y Cooperación Industrial de Andalucía (AICIA)

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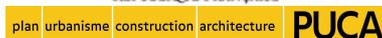
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