IRH-MED

Guidelines for Innovative Responsible Housing

Innovative Residential Housing for the Mediterranean

L'Europe en Méditerranée
Europe in the Mediterranean

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1 THE IRH-MED EXPERIENCE : A GENERAL OUTLOOK

Most of the MED construction market is related to the residential sector, including new and retrofitting actions. Therefore, the development of a methodology to support and to rate sustainable residential buildings is clearly a priority in the MED space.

Thus, the main objective of the Innovative Residential Housing in the Mediterranean project (hereafter, IRH-Med), during the last two years (2010-2012), has been designing the basis for the future development of an innovative Housing Sustainability Assessment model (HSA), suitable for the MED traditions, climate and society. The results of the IRH-Med project may affect approximately 16 million dwellings, and more than 28 million inhabitants.

The final project output proposes a **common framework for residential buildings sustainability assessment in MED areas** that can be used as a basis for the implementation of future regional initiatives.

This introductory chapter briefly depicts the whole IRH-Med experience, from objectives and target groups, to results and deliverables, and to dissemination and collaboration with other EU projects addressing similar issues.

1.1. Partnership and methodological framework

1.1.1. A fruitful partnership

The IRH-Med project has facilitated an open debate and positive work between MED experts, regional public authorities and trade support agencies around the definition and implementation of HSA in the MED space.

It has been led by the Catalonia Competitiveness Agency — ACC1Ó — and the Secretariat for Housing and Urban Improvement (Ministry of Town and Country Planning and Sustainability - Government of Catalonia).

Partners were public and private institutions from France, Italy, Greece and Croatia, more specifically :

- France : Association Bâtiments Durables Méditerranéens, PRIDES BDM ; Chambre de Commerce et d'Industrie Marseille-Provence ;
- Italy : Provincia de Ravenna ; Consorzio Nazionale Casaqualita ; Regione Sicilia ;
- Greece : Centre for Renewable Energy Sources and Saving ; Municipality of Rhodes ;
- Croatia : Energy Institute Hrvoje-Pozar, EIHP.

1.1.2. General objectives and methodology

Three main objectives were initially considered :

1- to design and test a common Med approach to assess housing sustainability in coherence with existing similar initiatives ;
2- to create a Transnational Guide for Sustainable Housing in the Mediterranean ;
3- to promote the public and private stakeholders participation in sustainable housing initiatives.

The methodology that has been adopted is summarized in figure.1. It is based on R&D work (analysis of the current situation, development of an assessment tool, pilot tests of the tool) the results of which have been constantly submitted to group discussions :

- four joint working group meetings ;
- four scientific group meetings ;
- three seminars along with other EU projects with similar objectives.

These group discussions have allowed the generation of progressive outputs and can be considered as a multi filter system to progress towards the construction of the common approach.

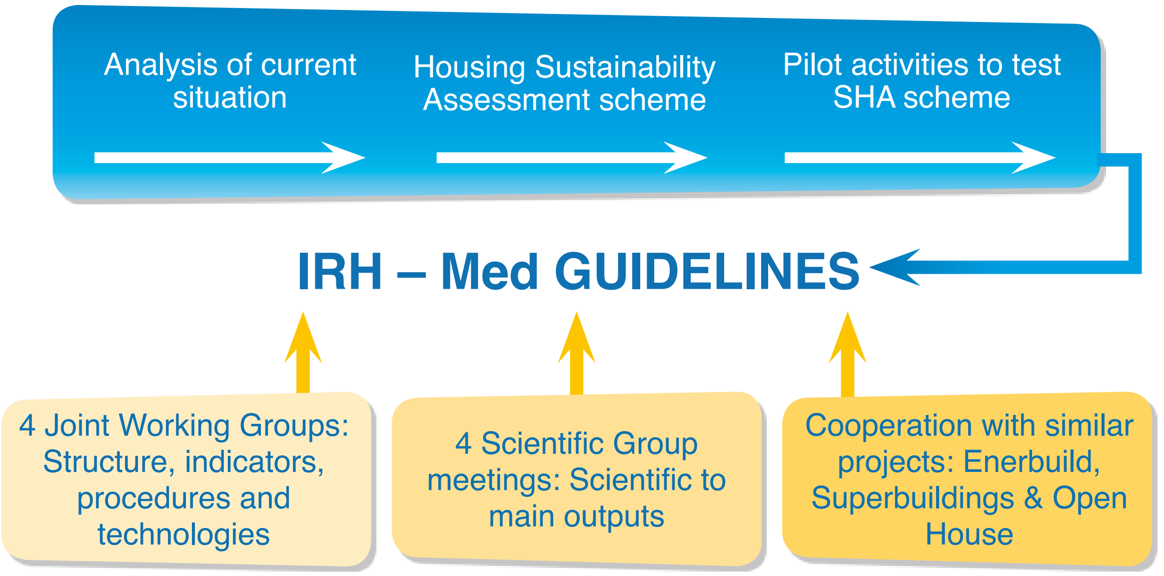


Fig. 1 – Main IRH–Med outputs and methodology

The first methodological step has been the analysis of the HSA current international situation :

- what are the concepts used in HSA ?
- what kind of policy instruments exist ?
- what are the existing HSA systems, labels and certifications ?

During a second step, a Housing Sustainability Assessment scheme has been developed, especially tailored to the MED space. It was then tested in eighteen residential buildings. The final step has been the writing of the present document — IRH-Med Guidelines —, which gathers and summarizes the project findings and aims at facilitating an efficient use and a fruitful implementation of the results obtained.

1.2. Local authorities as main target group

Different target groups could make good use of the present IRH-Med Guidelines as an interactive document facilitating the discussion and the implementation of HSA in Mediterranean regions and countries. Regional and Cities decision makers are the main target group. These IRH-Med Guidelines have been especially designed for them.

Up to now, Housing Sustainability has not been a clearly defined and implemented concept throughout Med Regions and Cities. This definition and implementation process will presumably be long and complex, especially considering that it is a multi-step process that includes :

1- detailed formulation of the HSA,
2- discussion and acceptance by all stakeholders involved, including home owners and users ;
3- operational implementation.

The IRH-Med contribution gives local authorities a preliminary HSA model agreed by several experts, regional authorities, technical institutes, development agencies ; it also benefits from international approval (see part 1.4.1.).

Therefore, it should be used as a sound and solid basis for starting the detailed formulation phase to which housing promoters, designers and managers should be associated in order to reach regional agreement. Chapter 4 of the present guidelines will detail governance recommendations to help design the necessary development and implementation process.

Other target groups (housing promoters, designers…) can also benefit from these guidelines, and the complementary detailed project deliverables, to better understand what is at stake when speaking about housing buildings' sustainability and what objectives and measures can be undertaken to reach it.

1.3. Main results and deliverables

The IRH-Med project has led to several reference documents, analysing the current international situation regarding HSA.

It was also able to deliver a detailed framework for HSA ; its experimentation on pilot projects gives it practical illustrations and shows its feasibility.

This result was achieved through wide partnership and expertise agreement, which emphasizes the strategic output of the project ; it gives Med Regions and Cities a sound and widely agreed upon basis to support their own adaptation and implementation of sustainable building assessment.

1.3.1. Analysis of the current international situation

The analysis of the current situation regarding HSA focused on four main fields: policy instruments, existing labels, technologies and certification. The information that was gathered will not be further discussed here, although it obviously will contribute to enriching the next chapters. It is organized in the three following deliverables :

1- Integrated Transnational Benchmark Study (ITBS)
The ITBS has described, analysed and compared the different instruments used to define, establish and guarantee housing sustainability. It mainly showed that present instruments and policies are largely focused on energy and environment and that the Med specificities are seldom taken into account.

2- Transnational Inventory of Technologies
The Inventory of Technologies presents a range of specific building technologies and materials, which can be used to significantly reduce the environmental impact of new and existing Mediterranean residential buildings whilst improving health and comfort of the occupants

3- Certification Legal Framework Study
The Certification Legal Framework Study central questions were :

- understanding the legal foundations of concepts such as standards, labels and certification and clarifying how they complement each other ;
- describing the operational mechanisms of the main established certification schemes ;
- developing scenarios regarding the implementation of the IRH-Med HSA scheme.

1.3.2. IRH-Med Housing Sustainability Assessment Scheme

The IRH-Med Assessment Scheme has been designed through a progressive development process based on contributions from project partners and their consultants, which have been thoroughly discussed during four Joint Working Groups meetings and four Scientific Group meetings.

This resulted in an expert and partnership agreement on a general scheme that includes **seven thematic areas** (Territory & site, Materials, Energy, Water, Health & comfort, Social aspects, Economy & Management). These seven areas are further subdivided in **thirty-six criteria** and **one hundred and twenty eight indicators**.

The agreement also includes recommendations regarding the evaluation weightings attributed to the different thematic areas ; the recommended balance is :

- 50% of the assessment value should be allocated to resources (materials, energy and water)
- whilst the other 50% should be allocated to the remaining four areas.

Chapter 3 gives a detailed description of the assessment scheme and its weighting system.

1.3.3 Pilot Activities

The IRH-Med **pilot activities** have been designed to test and evaluate the usefulness and the operability of the HSA scheme under development.

Housing is apparently a clear concept. Nevertheless, there are several typologies and sub-typologies of housing ; for example, three typologies and twenty sub-typologies have been described within the EU Joint Research Centre scientific and technical report in 2008. The partners decided to use a much simpler four-category-typology, distinguishing :

- new built and retrofitted buildings ;
- individual homes and collective buildings.

Therefore, sixteen housing projects have been selected so as to test the HSA tool on those typologies.

	Provence-Alpes-Côte d'Azur	Catalonia	Italy	Greece	Croatia
New housing building	1 collective 1 individual	2 collective	3 collective	1 collective 3 individual	1 collective
Retrofitted housing building	1 collective 1 individual	1 collective	1 collective 1 individual		

The pilots had to address a series of common questions :

- availability of documentation for calculation or assessment of each indicator ;
- feasibility of calculation and assessment ;
- result of the assessment ;
- importance of each indicator regarding the global area requirements ;
- proposed changes of indicator definition ;
- feasibility of the indicator in case of renovation.

The pilot activities main results are reported in six videos and eighteen leaflets[1].

1.4. Communication strategy, capitalization and cooperation

Communication and transparency have been two main concerns during the IRH-Med project implementation[2]. Capitalization efforts have been concentrated towards two main directions :

1- looking for synergies with on-going EU funded projects/initiatives related to Building Sustainability Assessment.
2- generating actual commitments of decision makers, within IRH-Med partners decision bodies.

1.4.1 Cooperation with on-going European projects and initiatives

A fruitful cooperation with on-going projects, programs and organizations has been established during the IRH-Med project life, not only to avoid duplication of work but also to look for a converging agreement about the building sustainability concept and assessment approach.

This cooperation reached a climax during the first semester of 2012 and will certainly extend the life span of the IRH-Med project, well after it is officially closed. A common statement has been written and will serve as a basis for future collaborations and projects.

As will be developed in Chapter 3, the following projects' partners, together with the IRH-Med partners, have had several working sessions which resulted in a common agreement on a general framework for building sustainability assessment[3] :

- **ENERBUILD,** INTERREG Alpine Space project (Energy Efficiency and renewable energies in the buildings 2009-2012) http://www.enerbuild.eu the cooperation has been established in several aspects but especially in a common diagnostic (Alpine and Med spaces).
- **SUPERBUILDINGS**, VII FP T. 6 (2010-2013) http://cic.vtt.fi/superbuildings/. The key results are related to Sustainability and Performance Assessment and Benchmarking of Buildings with special interest in methodological aspects.
- **OPEN HOUSE**, VII FP ENV (2010-2013), http://www.openhouse-fp7.eu Benchmarking and mainstreaming building sustainability in the EU with special focus on office buildings.
- **CONSTRUMAT21**, IEE (2011-2013), http://www.construction21.eu Platform for Sustainable building practitioners.

[1] See : http://www.irh-med.eu/formulation-med-label-principles.php
[2] The communication strategy is available on the IRH-Med web site.

The following other projects have also been informed of or inspired by the IRH-Med results :

- **EU ECOLABEL**, JRC, EU Commission
- **eSESH (2010-2012)**, Saving energy in social housing, ICT PSP VII program project (2010-2012), http://www.esesh.eu ; linked with energy, sustainability and focused on housing users' behaviour improvement.
- **ICE-Wish** (2011-2014), http://www.ice-wish.eu, (Energy and Water wastage reduction in European Social Housing using intelligent control) will develop IRH-Med criterion : "Information and participation of users".
- **MARIE**, strategic MED project (2011-2014) focused on the promotion of energy renovation of buildings in the Mediterranean, www.marie-medstrategic.eu, opens the discussion that energy conservation in buildings is a sustainable area that can provide economic benefits. Could energy savings help finance IRH-Med Housing Sustainability Assessment ?
- **ECOHABITAT**, INTERREG SUDOE project (2011-2013), http://www.ecohabitat-sudoe.eu, can strongly benefit from the use of the HSA concept formulation and contribute to the development of further networking.

Additionally, the work of the following initiatives has been analysed:

- ISO TC59/SC 17 committee and the CEN TC 350 working group,
- the Sustainable Buildings Alliance (SB Alliance),
- the UNEP Sustainable Buildings and Climate Initiative (SBCI),
- the European research project LEnSE (Methodology Development towards a Label for Environmental, Social and Economic Buildings),
- and the European Coordination Action for Performance Indicators for Health, Comfort and Safety of the Indoor Environment (Perfection).

1.4.2. Impact and actual implementation

The impact of the IRH-Med project on public and private stakeholders has been important and could be even more significant in the future.

For instance, in Region Catalonia, the Government has opened a process to include the results obtained in the IRH-Med project within its own legal framework. It is preparing the criteria and indicators to regulate a public label for Sustainable Housing.

In Region Provence-Alpes-Côte d'Azur, during the process of the IRH-Med project and thanks to it, the Association Bâtiments Durables Méditerranéens was able to have its own assessment tool evolving from 5 to 7 areas and enriching its approach especially regarding the Economic and Social issues. It is also presently improving the assessment tool addressing individual homes renovation, making it as simple and straightforward as possible, so as to be comprehensible by individual owners whilst keeping a high level of soundness and accuracy. This improved assessment tool will be tested during the pilot activities of the Med strategic project Marie.

In Italy, and through Federabitazione, the IRH-Med Assessment Scheme will be used as reference scheme for the recast of the "Qualità e Sostenibilità dell'abitare" label. This label is aimed to evaluate the quality and sustainability contents of a new social housing project from the programming phase to operation phase. In particular, CasaQualità is improving the Economic and Social issues proposed on the IRH scheme. A number Social Housing Coops that are operating in Southern Area of Italy (Lazio, Basilicata, Puglia, Campania and Sicily), have asked to use the IRH-MED results to assess their new housing projects to highlight to local public decision makers the MED sustainability quality of their Housing projects proposals.

The following chapters will gradually detail the main results of the project. Chapter 2 will concentrate on the main deliverables, the content of which at the same time fed and was fed by the work undertaken during group sessions. Chapter 3 will thoroughly detail and illustrate the HSA scheme that the IRH-Med project concentrated upon. Chapter 4 will bring recommendations helpful for any public or private body wishing to implement HSA and include it in its strategy or policies.

[3] Refer to : http://irh-med.eu/deliverables.php

2 A THOROUGH CONTEXT ANALYSIS WHICH BROUGHT SHARED INSIGHTS AMONG PARTNERSHIP

An analysis of the current situation in terms of conceptual framework, regulations, labels, certifications procedures and technologies has been developed background and foreground for the main IRH-Med project outcomes. This analysis has facilitated the comprehension and knowledge of the existing framework regarding HSA, and helped take into account the different approaches and status between the countries and regions involved in the project.

2.1. Housing Sustainability Assessment (HSA) : a definition

The IRH-Med partnership brought the unique opportunity to capitalize on the experience of existing sustainability assessment systems, especially those that are suitable in Mediterranean countries:

- Protocol SBC-ITACA, widely used at the regional level in Italy because of its possibilities for regional adaptation of the assessment criteria to better cover regional specificities and priorities; Knowledge exchange with IRH-Med has been established thanks to the participation of an ITACA expert on the IRH-Med expertise group ;
- BDM is presently being developed in Provence-Alpes-Côte d'Azur and is one of the partners of the project.

The topic related to building sustainability assessment gained wide recognition on the last years, yet partners have recognized that it is still an evolving topic, seeking a mainstreamed understanding and wide acceptance both in the academia and in practice. Therefore, a stable common consensus still remains to be reached about its definition and its implementation.

Along project development, the IRH-Med consortium worked to share a common definition of sustainability assessment:

> *"The purpose of sustainability assessment is to gather and report information for decision-making of all stakeholders involved during different phases of the design, construction use and maintenance of a whole building. The sustainability score or profile, based on indicators, results from a process in which the relevant actions are identified, analyzed, and valued."*

In order to achieve this, a HSA tool should be based on three key elements :

1. An assessment model (global framework, set of criteria, set of indicators, normalisation and aggregation methods) ;
2. A calculation methodology for all selected indicators ;
3. Indicative levels of performance (weighting and reference system).

2.2. Few and diverging regulations regarding building sustainability

The introductory work undertaken by the IRH-Med consortium was to identify, collect and analyse the existing state of art and trends related to Building sustainability regulations and existing sustainability building assessment tools that are available and widely used on the MED construction market and applicable in the residential sector.

From this analysis, it is clearly evidenced a highly disintegrated status quo with a lack of common understanding and approach towards the sustainability in building sector and its assessment. A variety of building sustainability policies and rating systems has been developed worldwide in the last years but none of them have a common definition and framework, as they use a diversity and complexity of indicators, different levels of usability and of building stakeholders.

Furthermore, it is not certain sustainability assessment of building is necessary to increase the diffusion of sustainable buildings or, vice-versa, if the diffusion of sustainable buildings contributes to increase of the sustainability assessment of building.

It is important to note that construction building is still permeable with performance measurements, and although many assessment systems already exist, their diffusion is still low in absolute terms. However, sustainability measurements in the building sector are receiving significant attention worldwide, rapidly moving from theory to practice. The diffusion of sustainability assessment of buildings has reached visionaries, but still needs to conquer the "pragmatists" vision. The above mentioned lack of a common reference framework, the myriad of existing and emerging sustainability assessment tools, and the too high complexity perceived are all factors that are confusing building stakeholders (above all design team, general contractors and suppliers) to adopt both building sustainability practices and assessment tools.

In particular, its complexity and adaptability to local context are increasingly pointed out as limits for the diffusion of sustainable rating systems. A balance between completeness in coverage and simplicity of use appears from the building stakeholders' point of view a sine qua non condition to widespread the use of sustainability building assessment systems.

Another key statement emerging from the IRH-Med analysis is that the existing and forthcoming generation of building assessment tools is becoming multi-criteria so as to measure the continuous growing sustainability complexity. However, these multi-criteria systems seem still unbalanced towards environmental criteria and, particularly, energy-related criteria.

In fact, the review of building assessment tools reveals a high weight and rating given the Energy criteria. This is straightforward looking at the evolution of the building regulation in recent years: Energy Efficiency is considered as the top priority of the building sector and all decision-makers agendas; in particular within the EU, the Energy Performance of Buildings Directive (EPBD) and EPBD recast directives are noticeably aimed at strengthening the energy performance in the whole building sector[1].

[1] Refer to : http://www.academia.edu/1035576/Comparison_of_sustainability_rating_systems_for_buildings_and_evaluation_of_trends_........._read_more_at_http_onlinelibrary.wiley.com_doi_10.1002_sd.532_abstract

Regrettably, this effort to harmonize the Energy-related approach in the building sector has neither been done for the Sustainability as a whole nor key areas such as water.

Specific EU directives related to sustainability or water management in the Building sector do not exist to define a common framework and harmonize the myriad of current initiatives.
One of the first conclusions could then be that the lack of an EU Directive related to building sustainability contributes to the lack of a HSA legal framework in Med countries. The efforts made by IRH-Med, and the other projects listed in 1.4.1, could be a useful basis for a specific EU Directive that would aim at clarifying, harmonizing and developing HSA in European countries.

It is interesting to note that in recent years a number of international harmonisation and standardization activities, i.e. CEN TC 350, ISO TC59 SC17, Sustainable Building Alliance (SBA), UNEP SBCI, amongst others, have been developed to harmonize (existing) sustainability indicators and assessment methods.

Moreover, the European Commission is progressively giving more attention to the need for a harmonized approach and to strengthen this, it has co-financed numerous research projects such as OPEN House, SuperBuildings and LENSE.

For further details related to the MED space regulations framework related to HSA, consult ITBS[2].

2.3. Analysis of existing sustainability assessment labels

Even if an important effort is still needed to define a harmonized framework, there are numerous operative building sustainability assessment systems available in the Building market, mainly developed by non-governmental organisations. The majority remain based on a voluntary approach of the stakeholders, although progressively more governmental regulations are adopting part of these assessment schemes and enforcing the building sustainability assessment as a mandatory step to be granted financial incentives.

As we said previously, the ITBS has also reviewed a number of building sustainability assessment tools operating within the IRH-Med countries and studied specific key issues of relevance for the IRH-Med project goals, namely : LEED, Verde, Protocollo Itaca, BDM, Minergie and Klimahaus.

A first conclusion drawn from this analysis is that all these building assessment tools are fully applicable at the residential sector. So, despite the lack of public initiative to regulate HAS, building stakeholders can find sustainability assessment tools to assess new housing estates. It is interesting to note that these tools are more often useable for new construction rather than for the retrofitting of homes. Furthermore, due to the above mentioned lack of supporting regulations, the assessment of "sustainability performance" is not yet a mandatory obligation but a voluntary approach.

Building stakeholders are bewildered by the multiplicity of sustainability assessment tools and are intimidated by the complexity and up-front costs that have to face to conduct an assessment of "sustainability performance". So, even if the market proposes a myriad of sustainability assessment tools, the number of "certified or assessed" buildings is limited.

The second conclusion is that important differences have been detected in the assessment methodologies used :
- diversity in the general structure and variety of issues, criteria, indicators and weighting factors ;
- diverging assessing methods : some relying on yes/no questions concerning prescriptive criteria (i.e., the existence of a certain service – car sharing, separate waste management facilities, etc.), while others only consider performance values calculated with varying degrees of complexity.

The third conclusion is that energy efficiency among reviewed assessment systems is considered the most important category (weight average 25%) followed by Indoor Environmental Quality (IEQ), waste and pollution, sustainable site and material and resources. It should be remembered that evaluation criteria and the weighting system are important comparison for rating systems: i.e. Fowler and Rauch compared the assessment tools for other properties (applicability, usability, and communicability).

It clearly appears that environmental aspects receive greater attention than economic and social ones. This highlights clearly another common critical issue of the existing assessment tools : the majority are still focused on technological performance measurement while issues such as affordability continue to be neglected.

The fourth conclusion is that all the reviewed assessment systems are adjustable to local conditions through selective criteria, correction factors and weighting systems. The IRH-Med position is that local characteristics must be taken into consideration and building assessment tools should be tailored to local needs and expectations.

2.4. Understanding the certification process

In order to complement the ITBS analysis, an additional evaluation of the legal framework applied to certificates and labels has been undertaken and developed by a selected team of international experts.

The key questions were :

- understanding the legal foundations of concepts such as standards, labels and certification and clarifying how they complement each other ;
- describing the operational mechanisms of the main established certification schemes ;
- explore the current situation in Med countries ;
- developing scenario regarding the implementation of the IRH-Med HSA scheme ;
- make recommendations regarding the operational model for the bodies which will undertake/be involved in the implementation of an assessment tool based on the IRH-Med project outputs.

The basic conclusions of the expert evaluation indicate that each national or regional official scheme will need specialized adaptation in order to integrate the sustainability assessment system. The analysis of the implementation conditions and the possible market acceptance of building sustainability schemes revealed diffe-

[2] Refer to: http://www.irh-med.eu/pdf/integrated-transnational-benchmark-study.pdf

rent maturity levels, multi-faceted approaches and trends among the reviewed countries. Unique convergent issue was the approach related to the Energy thanks to the on-going harmonization process generated by the EPBD Directives implementation (even if works are still under development within the Concerted Action EPBD initiative launched by the European Commission).

Accreditation seems to be the only path to convey formal demonstration of the competence of a body that provides certification services. It serves as an official proof of its credibility, minimizing the risk of providing unreliable results and services.

When designing the system for the verification, assessment and certification of a building with regards to its compliance with the sustainability criteria, the basic principles for a certification body will have to be taken into consideration: credibility, independence and integrity[3].

2.5. Transnational Inventory of technologies

The general objective of the Transnational Inventory of Technologies (IT) is to briefly present a range of technologies and materials which, if applied, can reduce significantly the environmental impact of new and existing Mediterranean residential buildings. The principles for many of these technologies can also be applied to a wide range of building types. The technologies presented are adaptable to the natural resources available in the Med region and can create comfortable and healthy environments for the occupants.

The Inventory is structured based on the 7 thematic areas of the IRH-Med rating grid:

- Territory and Site
- Materials
- Energy
- Water
- Health and Comfort
- Social
- Economy and Management

The materials and technologies presented in the IT were selected on the basis of a range of criteria, so as to establish a balance between low impact on the environment and practical / financial viability. These criteria include:

- adaptability to the Mediterranean climate characteristics ;
- reduction of a buildings greenhouse emissions during its life cycle (construction phase, operation phase and end of life) ;
- origin of components from sustainable sources ;
- possibility to recycle components ;
- availability of local know-how on application / installation ;
- local production of components/ materials ;
- impact on the health & comfort of occupants ;
- low need for maintenance.

For each technology or material presented, a short technical description is included explaining the basic principles and components. Information is also given on the function and application of each technology, its benefits and potential restrictions (if any), and the environmental indicators of the IRH-Med system which the use of the technology addresses.

As such inventory can be neither exhaustive nor final, and because discrepancies between countries and partners could be witnessed while developing it, the transnational inventory of technologies should mainly be understood as one example among many others, showing what kind of accompanying tools should be developed locally to raise awareness and skills of the building sector[4].

2.6. Conclusive shared views

The implementation of the IRH-Med project has facilitated the understanding and diagnosis of the current variegated situation in MED countries, related to HSA.

This helped the IRH-Med partners go beyond this diversity and reach an agreement based on the four following lines of work for the development of HSA :

- **need for a common, clear and practical conceptualization of HSA** : the procedures for developing this necessary detailed definition must be very democratic in order to obtain a widely shared acceptance of the concept ;
- **need for a strong common methodological approach balanced by enough flexibility for good adaptation to local conditions** : homogenization of indicators and calculation methodologies — including regulatory ones — must contribute to the common approach while the weighting system and/or the selection of the requirements enable adaptation to local conditions ;
- **seek strong and sustainable agreement from all stakeholders, either public or private** : housing sustainability is a complex multifold concept ; its actual implementation requires decision making and the involvement of many actors with competing agendas ;
- **need for renovated, flexible and compatible models of building sustainability in each country, region and city** : this need for more convergence about the legal framework, evaluation units and methods and certification processes might require a EU Directive related to sustainable building.

Beyond this specific agreement between the IRH-Med partners, the cooperation with other EU funded similar projects (refer to section 1.4.1.) helped go one step further on the way to converging building sustainability assessment.

Chapter 3 will provide more details about the IRH-Med HSA scheme, introducing firstly the general framework that was agreed upon by the partners of these converging EU projects. It will then detail two major topics — Energy demand for heating and cooling and water management — and show how they are addressed when considering Housing Sustainability implementation and assessment.

[3] For further details related to these issues consult the ITBS: http://www.irh-med.eu/pdf/integrated-transnational-benchmark-study.pdf
[4] For further details related to these issues refer to : http://irh-med.eu/pdf/Transnational%20Inventory%20of%20Technologies.pdf

3 THE IRH MED HOUSING SUSTAINABILITY ASSESSMENT SYSTEM

The main output of the IRH-Med project consists in the development of an assessment scheme, tailored for the MED context. This assessment scheme, while organized in seven specific areas, further works in a systemic way, many criteria being closely linked.

3.1. Housing sustainability : a complex and holistic concept

3.1.1. What are we talking about ?

Talking about *sustainable building* rather than about *green building* — or even more, rather than concentrating only on energy —implies that environmental issues should be addressed bearing in mind that social and economic issues must as well be taken into consideration, so as to ensure the viability and the equity of the housing project, as illustrated in *figure 3*.

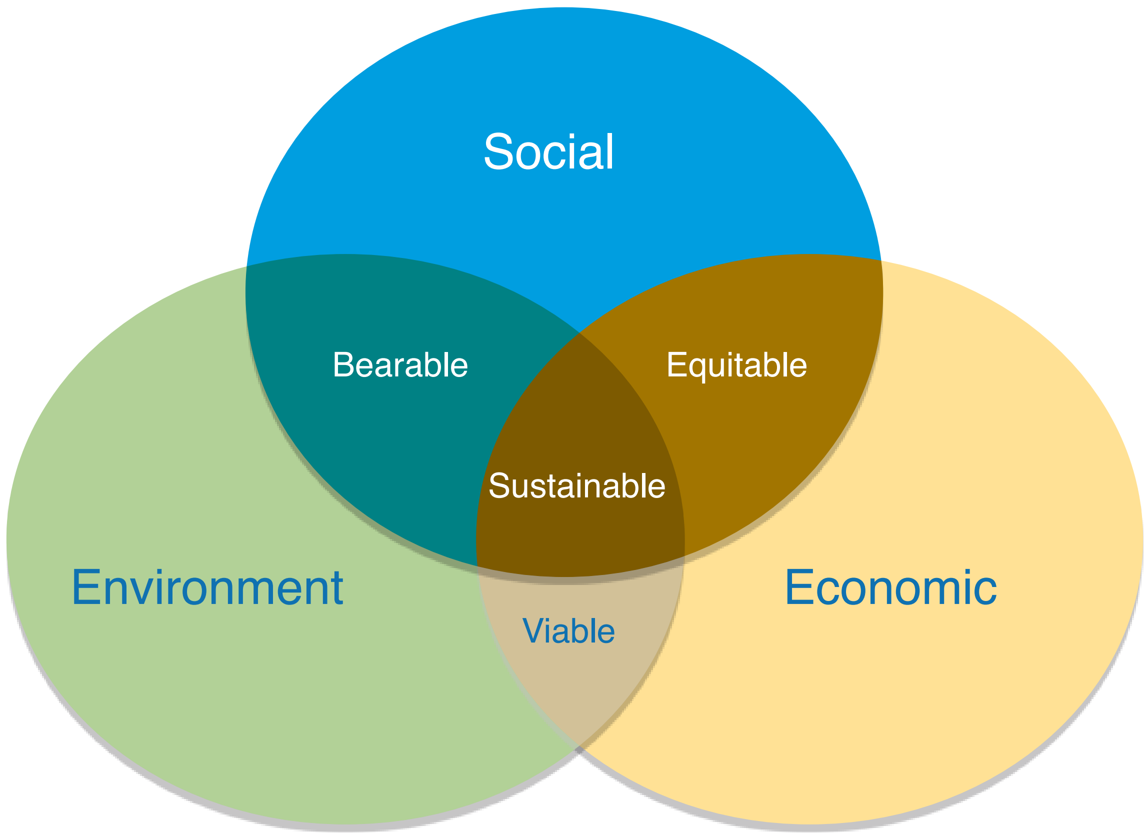


Fig. 3 : Pillars of sustainability

3.1.2. A shared approach

The IRH-Med approach has additionally been supported by the partners of six other European funded projects, whom agreed on a common approach for Sustainable Building Assessment (*see figure 4*) that includes data from the European Norm CEN TC-350.

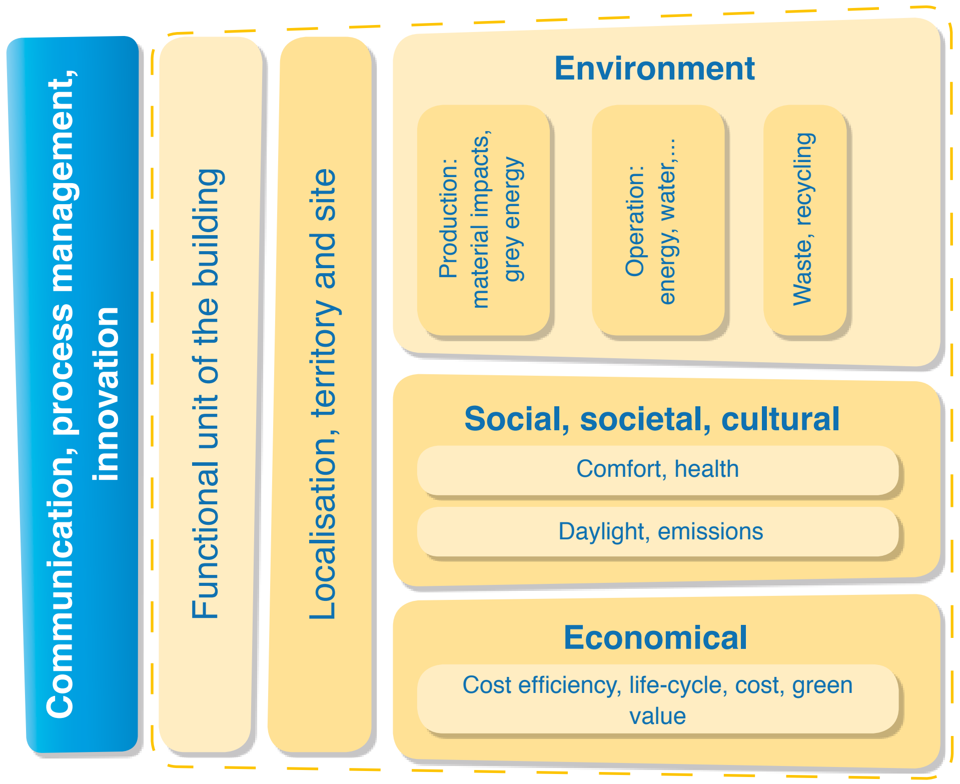


Fig. 4: Common European Sustainable Building Assessment (CESBA)

The CESBA framework:

- is constructed as a system, which includes transversal variables ;
- includes sub-chapters and their associated indicators to allow for flexible adaptation to unique regional characteristics ;
- provides for flexibility in future analysis : (1) by allowing for variations in the impact of assessment criteria, (2) by permitting the inclusion or omission of various assessment indicators or (3) by variation of the time of implementation of the assessment criteria ;
- distinguishes the notion of “signature”, which can be based a set of available scientifically based indicators calculated on the raw data of a building, from its use in a market-related labelling.

The CESBA further calls for associated tools that could help provide easy comparison and communication of buildings sustainability. Definitions to be introduced include:

- sensible functional units indicative of the future use of the buildings ;
- a core-set of criteria and indicators defined by their measurement methods ;
- a common communication structure that defines the target groups and their involvement. This common structure will include impact indicators and performance based indicators.

3.1.3. Breaking the concept down into an operational tool

To overcome the conceptual complexity of housing sustainability assessment and to make it feasible, it is necessary at the same time to go into further details and yet to keep a general organizing framework.

The IRH-Med partners, considering the proposal of the Scientific Groups Members, finally agreed on a general HSA scheme based on 7 areas, 23 sub-areas and 36 criteria as can be seen in *figure 5*.

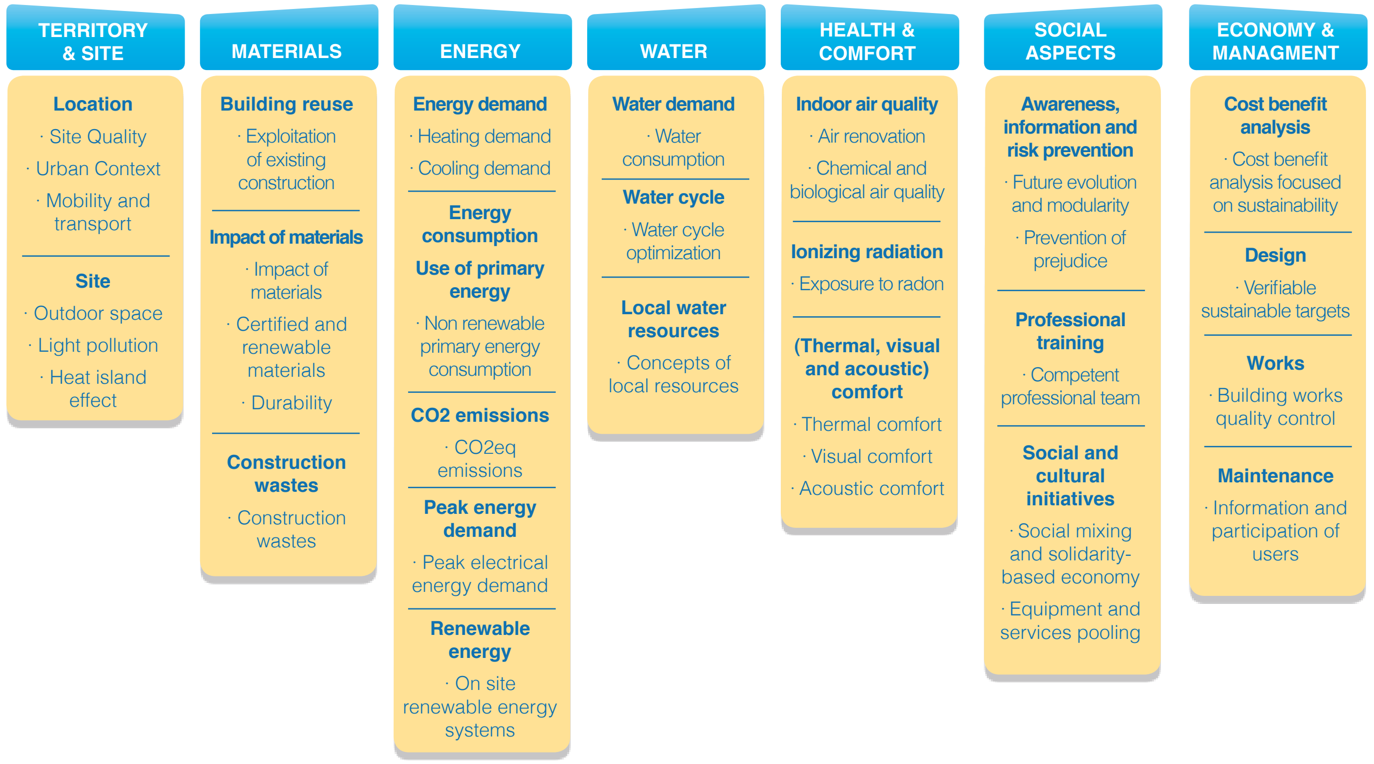


Figure 5 – Areas of the HSA scheme

The scheme addresses the need for necessary structure and organization, avoiding rigidity. It should also be understood as a systemic tool in which most of the criteria are interrelated. Moreover, as future insights may be expected thanks to the progress of the housing sector and feedback from the users, we can already predict changes of this HSA scheme.

3.2. More insights into the IRH-Med assessment scheme : understanding the areas and associated criteria

The seven assessment areas of the IRH-Med scheme, and their associated criteria, will be better defined below. One should bear in mind that two of these areas are transversal ones (management of the project and territory and site) whereas others are more specific on the building functionality : materials, energy, water, health & comfort, social & economic aspects.

Area nº 1

TERRITORY AND SITE :
Land is one of the most precious resources that we have. So, decision making about where to build or renovate is significantly decisive at many levels. The assessment goes both ways: the influence of the location qualities is as important as the impact of the project on the site. development. The area include 6 criterion

Site quality

The site of the housing building brings assets related to the users' health and comfort. The air quality, the ambient noise level, the existence of sources of pollution on the land (due for instance to past industrial uses), the electromagnetic fields (due to the presence of high-tension cables, buried cables, transformers) and the presence of radon (depending on the geologic nature of the land) are important parameters to assess the sustainability of the site.

Urban context

The urban characteristics of the site (density of inhabitants, proximity to the urban centre, level of equipment, infrastructures proximity and quality…) will model the behaviour of its inhabitants. Isolated situations, far from the equipments and services, are not sustainable for housing.

Mobility conditions and transport

The necessary mobility, linked to homes, constitutes an important source of air pollution, of CO_2eq emissions and of urban space occupation. A transportation model based on private cars traffic increases these negative effects. On the opposite, a transportation model based on the non-emissive mobility, with basic itineraries on foot or with bicycle, complemented by an efficient public transportation system and, occasionally, by infrastructures for electric vehicles will provide a higher level of sustainability.

Outdoor space treatment

If outdoor spaces are available, their treatment should be sustainable, either keeping their existing conditions or anticipating their improvement. This includes the treatment of soil and topography, the management of runoff and the maintenance or introduction of native plants or plants adapted to the local climate.

Ligth pollution reduction

Darkness is being increasingly replaced by artificial light. Though this brings safety improvements in many places, it also makes clear observation of the night sky impossible and the habitats of nocturnal animals are adversely affected. Furthermore, negative effects on the circadian and endocrine systems of man and animals alike has been reported, the human senses to the visual qualities of the naturally intact nocturnal landscape are dulled and energy is wasted due to light spill.

Minimization of heat island effect

Urban areas cause overheating around themselves due to the dissipation of internal loads, transportation and less presence of vegetation. Part of this "heat island" can be limited by increasing the reflectivity of the surfaces exposed to the ground, vertical and horizontal — especially roofs and paved public spaces —, by shading and using vegetation.

Area nº 2

MATERIALS:
Construction is the sector most material intensive in our lives. The selection of the materials that daily surrounds us should be accurately done. The impact of materials should be considered along the whole life cycle.

Optimize new and existing construction

New housing construction requires an important quantity of materials. Promoting housing renovation can reduce the quantity of materials needed.

Minimize the impact of materials

The Life Cycle Analysis (LCA) allows knowing the complete impact of materials along the life of the building. Minimizing these impacts can be done using renewable, low impact and recycled materials.

Use of certified wood and other renewable materials

The use of certified renewable materials ensures the biodiversity impact minimisation.

Durability

Using durable materials minimize costs of extraction, treatment, maintenance and renovation ; it is an important factor to make sustainable housing.

Recycle construction wastes

Minimizing the amount of waste off the site by encouraging the development of a construction waste management program with recycling measures.

Area nº 3

ENERGY:
Energy is definitely the most explored of the seven areas defined for sustainable housing.
Nevertheless, the implementation of existing knowledge in that area is poor, despite the challenge of the EU Directive 2010/31 that stipulates the standards of nearly zero energy buildings for all new construction in Europe, before 2020.

Heating demand reduction

The reduction of the heating demand through architectural design measures opens opportunities to reduce the housing energy consumption.

Cooling demand reduction

The reduction of the cooling demand through architectural design measures opens opportunities to reduce the housing energy consumption.

Non renewable primary energy consumption reduction

The reduction of non-renewable primary energy consumption integrates the outcomes of several measures acting over the electric and thermal real consumption of residential buildings.

C02 emissions

Implementation of several architectural, engineering and management measures to reduceC02eq emissions.

Peak electrical energy demand reduction

The reduction of the electrical peak demand for building operations contributes to a more efficient electricity network management.

Provision of on-site renewable energy systems

Increase the amount of renewable energy produced on site for thermal and electricity uses

Area nº 4

WATER:
A water consumption level that exceeds the resources is a worrying characteristic of the Mediterranean.
The future deal of water must be based on retracing the natural cycle of water by reducing the demand, recycling water and a long-term strategy striving for the autarky of buildings.

Reduction of water consumption

The scarcity of water in the majority of Med regions requires the reduction of its consumption. This objective can be achieved by using several mechanisms and systems.

Water cycle optimization

The design of the global cycle of water with use of recycled or waste water permits minimizing the consumption of water resources.

Use of local resources

Increasing the amount of local resources will minimize the catchment of natural water.

Area nº 5

HEALTH AND COMFORT :
Interior space conditions, especially the air quality, are often worse than outdoor environment.
Avoiding toxic substances in materials, design that guaranties thermal, visual and acoustic comfort and an adequate ventilation may manage to create healthy living spaces.

Indoor air quality

Ensure high indoor air quality by providing adequate ventilation.

Chemical and biological quality improvement

Use indoor material with low intensity of VOC emissions and other toxic or pollutant substances.

Exposure to radon

Control and prevent the exposure to natural radon emissions (in specific areas).

Thermal comfort improvement in summer

Ensure acceptable summer temperatures and humidity levels using preferably passive cooling techniques. The acoustic comfort (see below) must be achieved ensuring adequate ventilation and comfort in summer.

Visual comfort

Ensure an adequate level of visual comfort through daylight, high quality of artificial lighting; favour good external views.

Acoustic comfort

Limit indoor noise impact through adequate envelop insulation and noise attenuation between dwellings.

Area nº 6 and 7

SOCIAL - ECONOMY AND MANAGEMENT:
The sustainable building process implies the involvement of many stakeholders, all of which are concerned by the social and economic issues, at some point or another. Identifying them and considering how to bring proper social and economic answers to their concerns is a key element of sustainable building, as opposed to solely green building. This may be accomplished by integrating these concerns as early as the planning phase and by implementing a sustainable costs-benefits analysis.

Identifying who should be taken into consideration when addressing the questions linked to social, economy and management aspects is important. The following table may bring some insight into the way this can be achieved.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood	●	●		●	●
Designing team			●	●	
Construction crew				●	
Owner/investor	●	●	●	●	●
Final users		●	●		●
Maintenance and Operation staff		●	●		●

The IRH-Med assessment scheme development has followed this multi-stakeholders logic to design the details of the Social and Economic areas. Using the table above might help assessment tools designers enrich the guidelines suggested by IRH-Med and consider how adaptation to local context can be taken into consideration.

As it might appear bellow, these two dimensions of sustainable building are intricately intertwined thus making it sometimes difficult to decide which of the social or economic aspect prevails.

The following classification could thus be further discussed at length. It emphasizes the fact that, up to now, the main focus of most assessment tools, has been mostly environmental due to their green building origins. This certainly supports a call for more research on these two dimensions as applied to building.

SOCIAL ASPECTS DETAILS

Facilitate future evolution and modularity

Dwellings and facilities should be adaptable to other future needs, either because individual needs evolve (size of family, age and ability, etc.) or because part or all of the building can be devoted to other functions. By anticipating the future needs, the necessary evolutions can be made with minimal extra works (and extra environmental and economic costs).

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood					●
Designing team			●		
Construction crew					
Owner/investor		●	●		●
Final users		●	●		●
Maintenance and Operation staff					●

Anticipate and compensate prejudice

All potential prejudices along the building life must be identified and corrected through a preliminary audit, an appropriate follow-up and careful dialogue with stakeholders' neighbourhood, design team and building crew, owner and users.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood	●	●	●	●	●
Designing team			●	●	
Construction crew			●	●	
Owner/investor	●	●	●	●	●
Final users		●	●		●
Maintenance and Operation staff		●	●		●

Built a competent professional team and raise their skills

All the participants in the different stages of the project (including monitoring and maintenance) must have assessed know-how in sustainable building. This can be replaced or corrected by proper training through the project process. At this stage of the development of the sustainable building market, training the designing, building and maintenance teams during the whole building process seems quite crucial to help develop and raise the awareness and know-how of the sustainable building industry.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood					
Designing team			●		
Construction crew				●	
Owner/investor		●	●	●	●
Final users	●	●		●	●
Maintenance and Operation staff		●			●

Promote social mixing and solidarity-based economy

Claiming sustainability further means that, at all stages, the project must contribute to promoting social mixing and equal opportunities for all (unemployed, genders, disabled…).

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood	●	●			●
Designing team			●	●	
Construction crew				●	
Owner/investor	●	●		●	●
Final users		●			●
Maintenance and Operation staff		●			●

Promote equipment and services pooling

Natural resources conservation additionally implies promoting an economy based on a functionality and services approach, rather than on individual ownership of goods. Thus housing projects should include collective equipment, rooms or services (laundry, sports, restaurant, composting, hospitality rooms, etc.). Moreover, these shared equipment help promote better citizenship and friendlier communities.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood	●	●			●
Designing team			●		
Construction crew					
Owner/investor	●	●	●		●
Final users		●			●
Maintenance and Operation staff					●

ECONOMY AND MANAGEMENT DETAILS

Cost/benefit analysis focused on sustainability

Economic sustainability of the measures implemented is essential in order to ensure the feasibility of housing sustainability concept. The project must be designated so as to minimize the costs due to the implementation of the sustainable measures. A cost/benefit analysis tool, including in-use and externalities costs, may help put into perspective and mitigate the allegedly “extra” costs that are often emphasized.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood	●	●	●		●
Designing team			●	●	
Construction crew			●	●	
Owner/investor	●	●	●	●	●
Final users		●	●		●
Maintenance and Operation staff		●	●		●

Formulation and monitoring of verifiable sustainable targets

From the start, the project design formulates and determines sustainable targets for each criterion. This includes using advanced calculation/optimization tools for those subject to actual measurements (energy, water…). It further implies that the monitoring tools and equipment necessary for measuring and controlling the main sustainability criteria are installed.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood					
Designing team			●	●	
Construction crew				●	
Owner/investor	●	●	●	●	●
Final users		●	●		●
Maintenance and Operation staff		●	●		●

Building works quality control

In order to ensure the actual and correct implementation of sustainable measures and criteria, the constructor must adopt measurement and documentation systems for quality control. It includes good monitoring of the construction stage itself (minimizing water and energy consumption, optimizing material use, reducing and recycling waste). In addition, it includes fair wages and safe working conditions for construction crews.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood					
Designing team			●	●	
Construction crew			●	●	
Owner/investor					
Final users					
Maintenance and Operation staff			●		

Information and participation of users

Sustainability further depends on the final users' behaviour, so they should be involved as early as the initial design stage (as was shown above). The monitoring system must provide useful data for managing sustainability through the operative life of the building. Therefore, it is further used to inform building users and help them adjust their behaviour and control the operating costs.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage	When the building is in use
Neighbours and neighbourhood					
Designing team			●		
Construction crew					
Owner/investor		●	●		●
Final users		●	●		●
Maintenance and Operation staff		●	●		●

3.3. Housing Sustainability Assessment : making it Med and locally adapted

Focusing on two main issues, energy and water, we are now going to illustrate how different areas and criteria are closely intertwined and contribute to the overall approach of sustainability.

3.3.1. Energy demand reduction

The reason for promoting the reduction of energy consumption is not only political (to reduce dependence to oil), but also environmental (reducing CO^2 emissions, fighting against global warming), and finally economical (to save money and create jobs).

This last reason is most important in the residential sector, especially for the many that do not have proper heating or cooling in their dwellings. It is now common knowledge that energy poverty in the residential sector, and more so in low income housing estates, has been growing steadily in the past years.

Buildings use about 40% of all the energy consumed (and count for 36% of the greenhouse gas emissions) ; space heating and cooling currently account for 70% of this energy demand. This is the adverse consequence of the way we design, build and use homes. Thus, the potential for improvement is undeniable.

As stated above, the EC is urging state members to act by re-thinking the way we build homes and the way we live in them.

In this matter, one of the key statements made by the IRH-Med project, is to stress the geo-climatic characteristics of the European territory, which have often been neglected in the past years. Basically, from the energy demand point of view, the European territory can be divided into two main climatic zones : the South is dominated by a hot, maritime climate, the North by a temperate to cold one. Up North, the heating demand is the most important concern for homes builders ; down South, it is the need for cooling. Because of these differences, the IRH-Med project considers that a unique building standard cannot be imposed on all European latitudes. *"One Size Does Not Fit All"* Southern and Northern European countries !

Because of these climatic characteristics, heating and cooling are both at stake in Southern areas ; cooling loads may even be the most important issue.

For example, Italy is generally considered as a country that enjoys Mediterranean climate. However, Italy has a varying typology of mountains and lowland stretching 1.500 km from North to South and is subject to considerable climate variations.

The national territory of Italy is subdivided in 6 climate zones (A -F) depending on the heating degrees days (HDD). The Italian legislation on energy in buildings is undergoing revision, recently revised in the framework of the national implementation of the EPDB and EPDB recast, gave new maximum legal values of energy need for space heating and cooling referred to the climate and the aspect ratio S/V (surface vs. volume) indicator.

Building aspect ratio S/V	Climate Zone A	Climate Zone B		Climate Zone C		Climate Zone D		Climate Zone E		Climate Zone F
	≤ 600 HDD	601 HDD	900 HDD	901 HDD	1400 HDD	1401 HDD	2100 HDD	2101 HDD	3000 HDD	> 3000 HDD
≤ 0,2	8,5	8,5	12,8	12,8	21,3	21,3	34	34	36,8	46,8
≥ 0,9	36	36	48	48	68	68	88	88	116	116

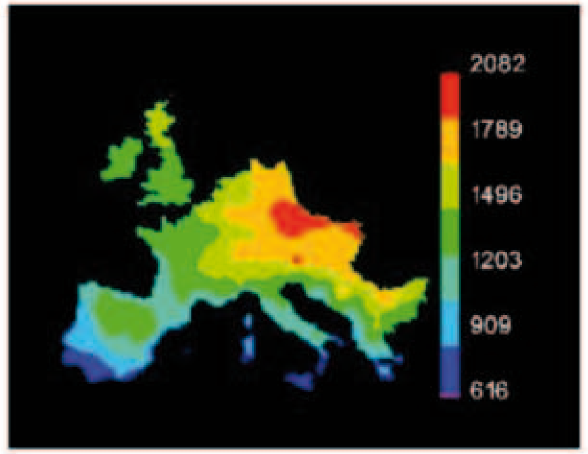
Figure 6a. Maximum legal values of energy need for heating for residential buildings

Building Type	Climate Zone A - B	Climate Zone C - F
	< 900 HDD	> 901 HDD
Residential building	40 kWh / m²	30 kWh / m²

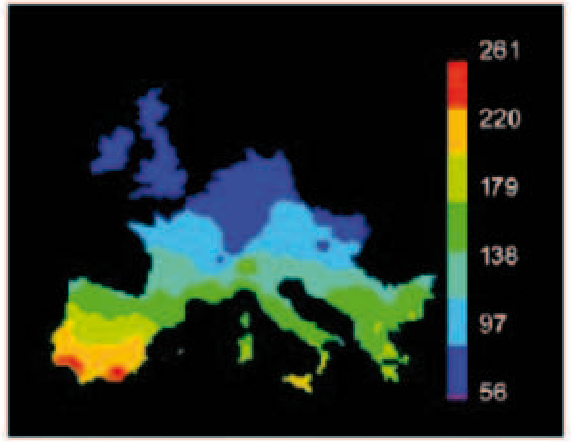
Figure 6b. Maximum legal values of energy need for cooling for residential buildings

As was stated above, in the warm climates of Southern Europe, heating is less of a problem than in Central or Northern European climates. However, homes in MED areas have to be kept comfortable all year round, without neglecting either heating or cooling loads. Heating and cooling requirements need to be considered conjointly when defining the home design specifications in Southern Europe.

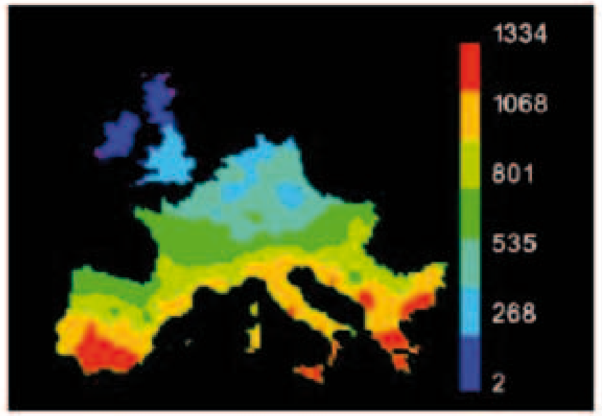
Both Heating degree days and Cooling degree days should be carefully evaluated, without neglecting the impact of solar radiation. In fact, even if temperatures are fairly low, solar radiation is so high in some regions that houses can be easily heated without further energy. A desirable effect in some countries, too much of a good thing in others. Naturally, there is more solar radiation in Southern Europe than up North. That is why this issue must be carefully addressed when designing Southern homes, so as to favour cooling as well.



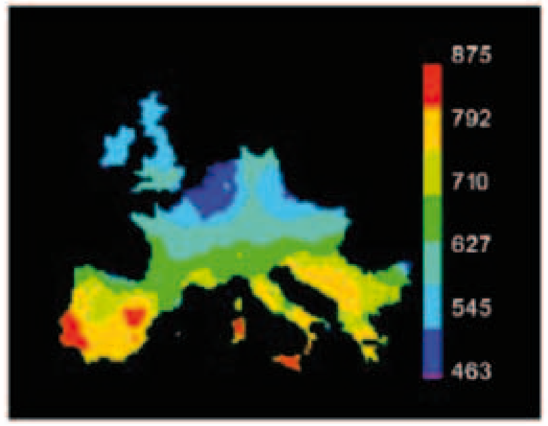
Winter degree days



Solar radiation over horizontal surface in winter (kW/m²)



Summer degree days



Solar radiation over horizontal surface in summer (kW/m²)

Fig. 7 – HDD /CDD and Solar Radiation in Europe. Source: European "Passive-on" project

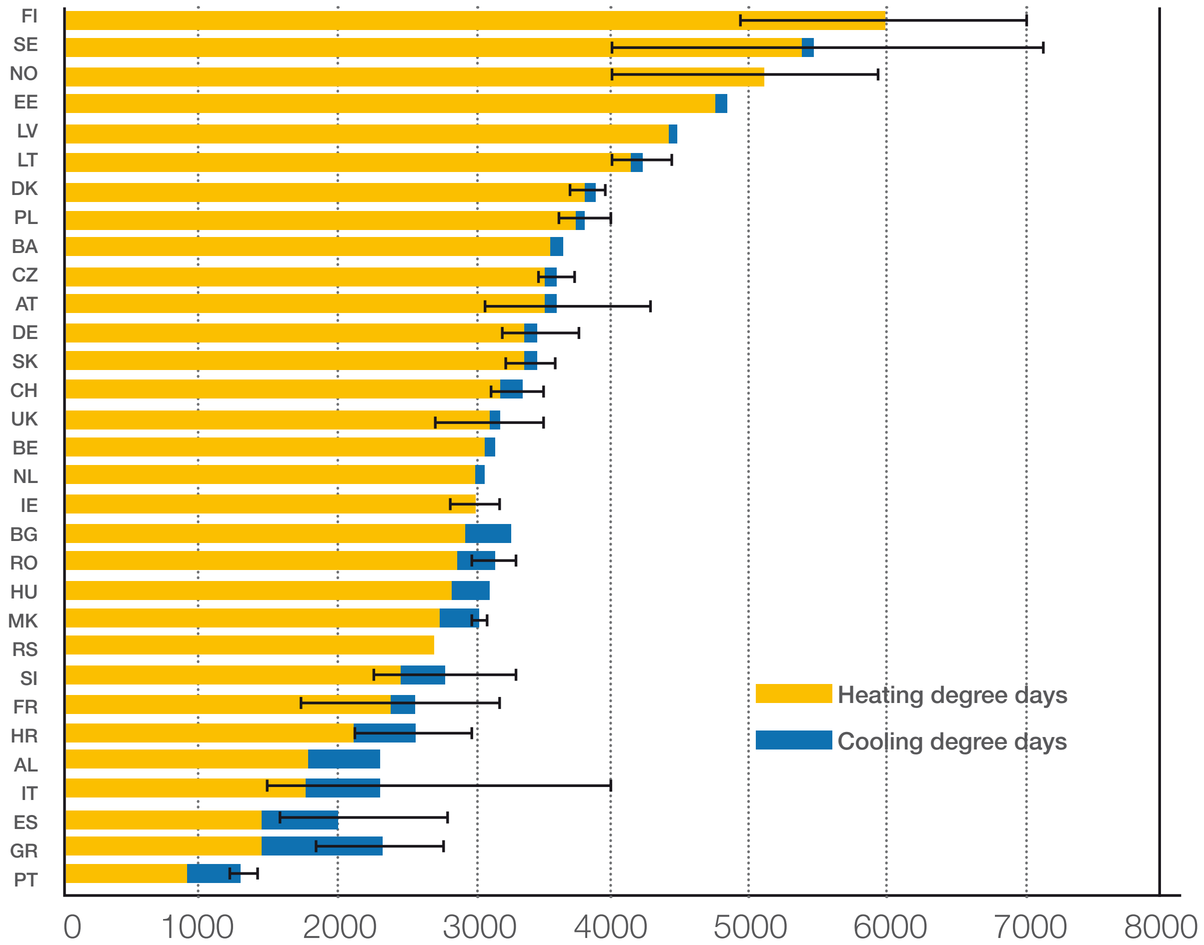


Fig. 8 – Heating degree days and cooling degree days for EU

European countries. The black lines indicate the city with the highest and lowest value respectively

3.3.1.1. Heating demand reduction

IRH-MED criteria: *The reduction of the heating demand through architectural design measures open opportunities to reduce the housing energy consumption.*

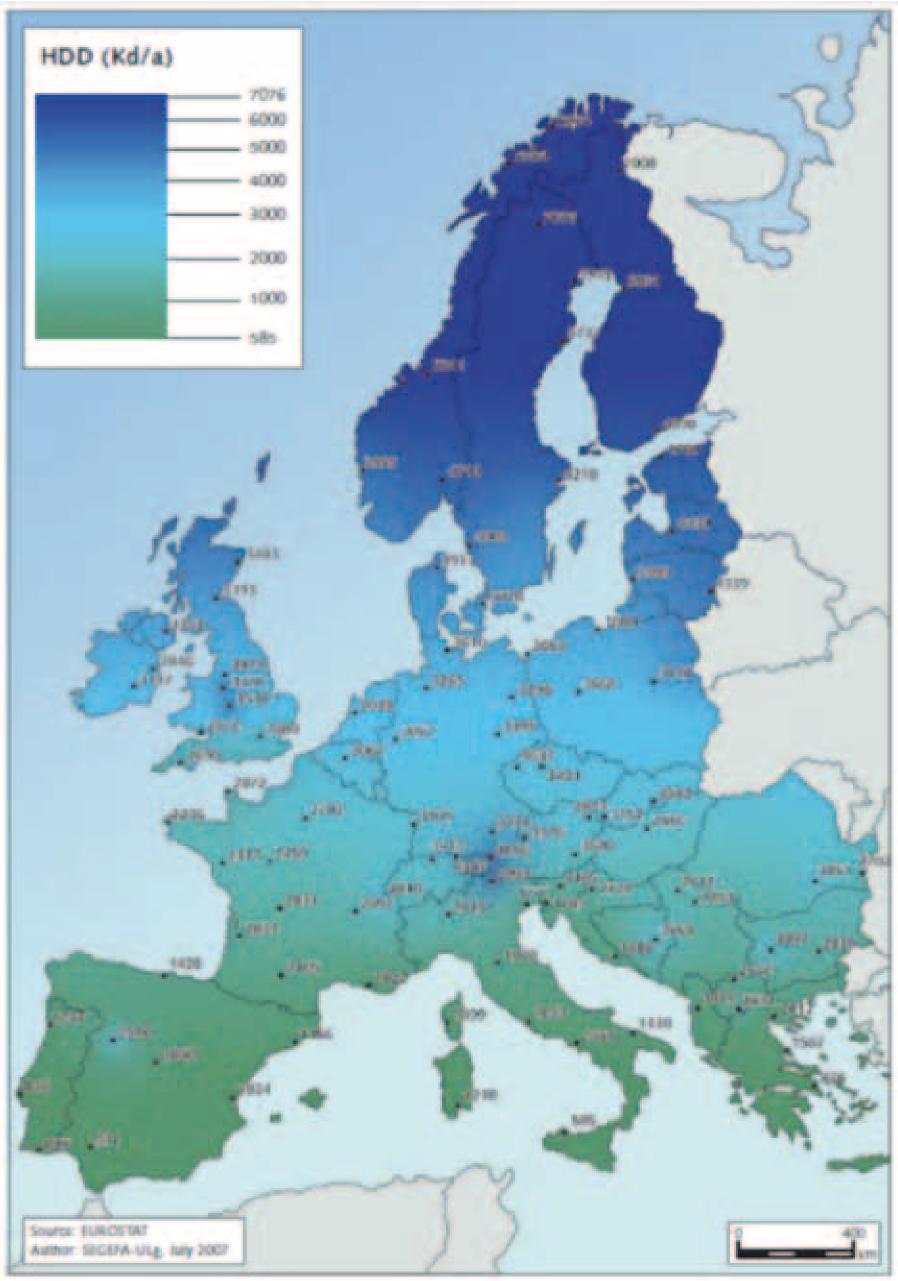


Fig. 9 – European heating degree days (Eurostad method)

The energy used in a “standard” 100 m2 dwelling (around, 20.000 kWh/y) can be drastically reduced to half that figure without undue difficulty and without compromising living conditions ; it can be reduced to even less with a little more thinking and trouble.

This needs to be rapidly done. In the last ten years, in the Northern European countries, the governmental building regulations imposed to stakeholders more and more stringent obligations to reduce specific heating demand ; from 150 kWh/m2, it is now requiring ≤ 15 kWh/m2.
This is why the German “Passivhaus” standard seems to become a replicable successful experience and unique reference for Europe.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage
Heating and cooling demand for a typical single-family house	300-250 kWh/m²	200-150 kWh/m²	90-60 kWh/m²	≤ 15 kWh/m²
Heating	270-230	185-140	80-55	≤ 10
Cooling	30-20	15-10	10-5	≤ 5
Building standard	**Completely insufficient Thermal insulation** Structurally questionable, cost of space conditioning no longer economical	**Insufficient thermal insulation** Thermal renovation is clearly worth the trouble (typical of residential houses built in the 50s to 70s of the last century)	**Low-energy houses**	**Very low energy houses** Passive houses need to meet this parameter as part of the requirement profile
CO_2 emission	75 kg/m²	30 kg/m²	12 kg/m²	4,5 kg/m²

Fig. 10 – Keep cool in hot countries – Save natural resources.
Source: The ISOVER Multi–Comfort House.

For example, in Italy, regarding the EPBD 2 implementation, the situation seems to be strongly oriented towards a “standard” experimented in the north of the country, the CasaClima (KlimaHaus) concept, born in 2001 and inspired by the German standard.

The recent EU Directives (Directive 2002/91/CE on the Energy Performance of Buildings called “EPBD directive” and directive 2010/31/EC called “EPBD 2 directive”) further ask to build more and more energy-efficient homes, by promoting nearly zero energy homes within 2020. With current building technologies development and adequate political and financial resolves, this target could be achieved, even if a cultural (r)evolution is needed. Furthermore considering that the renewable energy contribution can be substantially increased.

Building energy demand can be reduced by up to 80% with proper climatic design and cost-efficient technologies. As buildings today use 45% of primary energy, the potential is immense, not in terms of energy generated but rather in terms of energy saved.

Reducing primary energy demand requires that stakeholders rethink the quality of design at all levels and all construction phases, from the urban/site plan to the detailed exploitation of the potential of walls, windows openings, floor tiling and of internal and external shutters. All of this contributes to the energy efficiency challenge, as well as materials, which should not only be selected on grounds of esthetics or structural criteria, but also according to their varying thermal properties: i.e. a masonry building will heat or cool slowly. Reducing primary energy demand requires a careful attention to all the energy needs of dwellings. They must be related to climatic elements (temperature, wind, availability of light, etc.), varying from southern to northern Europe. These well documented needs are mainly the following : heating, in winter and at night ; cooling ; day lighting and ventilation. Moreover, depending on the regional/local climate and the predominant need for heating or cooling, two majors strategies are possible :

- In cold weather : maximizing solar and other “free” heat gains, providing good heat distribution and storage, reducing heat losses and allowing the available day lighting and the suitable ventilation ;
- In hot weather : minimizing heat gains, avoiding overheating and optimizing air ventilation and other forms of passive/natural cooling.

It is also important to note that until the latest EU directives, most of the national building regulations related to energy were strongly oriented towards the strategies aiming at reducing the heating loads, and were neglecting the cooling issue and any climate-responsive approach. From northern to southern Europe, homes have been designed mainly to reduce heating consumption, which sometimes compromises the building need for summer loads and comfort. The IRH-Med scheme is proposing to consider both strategies conjointly.

As was said above, the IRH-Med partners agree that the Passivhaus has and is a phenomena for the European building sector : the development of homes that meet the Passivhaus standard has grown considerably. As of 2005, more than 6.000 homes conforming to the Passivhaus standard have been built in Europe, 4. 000 of which in Germany.

Possibly, what makes the Passivhaus concept so successful is that the standard codifies precisely energy and quality requirements for new homes and then provides a relatively standard set of solutions through which these requirements can be met. Consequently, a Passivhaus is a well-defined product, understood by the developer, architect, builder and owner ; everyone involved in the process know what they will be getting.

The Passivhaus standard was born to respond to the requirements of relatively cold central Europe. By examining it from a technical point of view (high whole envelope insulation with typically 25 to 40 cm of insulation, lack of significant thermal bridges, air leakages reduced to a minimum, active ventilation with highly efficient heat recovery and insulated window frames with triple, gas-filled, low-e glazing), we can easily understand that it is a brilliant invention for the northern countries.

- Heating criterion: The useful energy demand for space heating does not exceed 15 kWh per m² net habitable floor area per annum.
- Primary energy criterion: The primary energy demand for all energy services, including heating, domestic hot water, auxiliary and household electricity, does not exceed 120 kWh per m² net habitable floor area per annum.
- Air tightness: The building envelope must have a pressurization test result according to EN 13829 of no more than 0.6 h^{-1}.
- Comfort criterion room temperature winter: The operative room temperatures can be kept above 20 °C in winter, using the abovementioned amount of energy.
- All energy demand values are calculated according to the Passive House Planning Package (PHPP) and refer to the net habitable floor area, i.e. the sum of the net floor areas of all habitable rooms.

Fig. 11 – Current German Passivhaus Standard for Central European Countries

Homes in southern Europe have different needs and citizens have different lifestyles. Homes need not only to be warm in winter, but must also ensure comfort in summer. Without any conservative look at the reality, traditional vernacular architecture in southern parts of Spain and Italy reflects this need. One should revisit many of these traditional solutions with a modern Passive Design, rather than conforming to the Passivhaus design.

We are aware that a MED Passivhaus can be achievable and relevant in some areas with relatively severe if short winters and as well in some mountainous regions further south.

In the MED area, to achieve a successfully energy demand reduction (currently named "nZEB implementation" in the EU jargon) what is needed is not a passivhaus standard package but rather an *intelligent* and tailored transfer of knowledge. In this regard, the IRH-Med viewpoint is to invite building stakeholders and public decision-makers to explore which elements of the standard could be useful in promoting the diffusion of a MED nZEB design rather than of a MED Passivhaus design.

Technically and strategically, for new buildings, we consider that the outputs of the European IEE "Passive-on" project, which investigated the implementation of a Passive House (not Passivhaus) standard for warm European climates, could be a good reference to set up the MED strategy for reducing energy demand:

- Heating criterion: The useful energy demand for space heating does not exceed 15 kWh per m² net habitable floor area per annum.
- Cooling criterion: The useful, sensible energy demand for space cooling does not exceed 15 kWh per m² net habitable floor area per annum.
- Primary energy criterion: The primary energy demand for all energy services, including heating, domestic hot water, auxiliary and household electricity, does not exceed 120 kWh per m² net habitable floor area per annum.
- Air tightness: If good indoor air quality and high thermal comfort are achieved by means of a mechanical ventilation system, the building envelope should have a pressurization test (50 Pa) result according to EN 13829 of no more than 0.6 ach^{-1}. For locations with winter design ambient temperatures above 0 °C, a pressurization test result of 1.0 h^{-1} is usually sufficient to achieve the heating criterion.
- Comfort criterion room temperature winter: The operative room temperatures can be kept above 20 °C in winter, using the abovementioned amount of energy.
- Comfort criterion room temperature summer: In warm and hot seasons, operative room temperatures remain within the comfort range defined in EN 15251. Furthermore, if an active cooling system is the major cooling device, the operative room temperature can be kept below 26 °C.

Fig. 12 – As proposed on Passive House Standard for Warm European Climates by Passive-on project

As stated by the *Passive-on* project, it is achievable to reduce energy demand in homes (namely, to design nZEB) by using a passive design and custom-tailored solutions for MED climate areas; in particular, providing an effective strategy for passive summer cooling such as solar shading provided by roof eaves or Persian shutters reducing solar gains through windows. In addition, a natural night-time ventilation strategy supplemented with active cooling using a low power reversible heat pump on particularly warm days.

> *[…A typical German Passivhaus uses special 3 pane low-e windows. But 3 pane high performance windows are not widely available on the market in Italy apart in the area of Bolzano, and obviously they are more expensive and to a degree bulky which may not respond to the aesthetic tastes of everyone. Given the general milder climate of Italy it is reasonable to investigate whether less stringent characteristics can be applied to windows…]*
>
> *[…the Passivhaus Standard for cold climate tries to limit the undesired airflows and imposes to the permeability of the building envelope the limit of 0,60 h-1 at 50 Pa. Even if achievable, this value implies an increase of the building costs, and its attainment could cause some problems above all due to uncareful installation: it is generally necessary to carry out some test before meeting the Blower Door Test in the verification procedure. Relaxing the limit of the n50 parameter would allow a simplification in the construction process…]*

Source: European "Passive-on" project report

So, as demonstrated by the *Passive-on* project, we believe that some of the implicit and explicit requirements of the *Passivhaus* standard represent over-engineering (also in terms of up-front costs) in southern Europe. For example the Passivhaus standard makes an explicit requirement to limit the permeability of the building envelope (n50 ≤ 0,6 h1), which makes an implicit need for an active air ventilation system. However experience, for example from Spain and Portugal, shows that effective low energy homes can be built without the need for active ventilation systems and with less stringent building shell criteria.

So, we are convinced that it is necessary to find an *nZEB way*, focusing on appropriate climate-specific criteria. For example, proposing the introduction of an explicit limit for energy demand for summer cooling, some minimum requirements for summer comfort, relaxing the limit on the air tightness of the building envelope to n 50 ≤ 1 h1 (and in certain circumstances less) will allow the nZEB implementation without the need for an active ventilation system.

Assessing heating demand reduction

IRH-MED indicator: KWh/m2y heating demand

With regards to the Heating demand reduction, the IRH-Med aimed to urge building stakeholders to make a step ahead of the national regulation.

As it was previously stated, with the EPBD 1 and 2 implementations, the building regulations are changing and becoming more and more stringent. The national guidelines for certification and the minimum requirements for new buildings should be adapted by local governments (regions/autonomous provinces). Local decisions-makers should add more demanding elements to national regulations and adapt the national heating consumption targets to their local needs, in particular taking into account their specific climatic situation (heating degree days, outdoor temperature and solar radiation).

Any specific technology may be proposed and climate-responsive residential architecture, using a passive/bioclimatic approach, is strongly recommended. This will further allow integrating the cooling issue in the building design.

To assess the heating demand reduction, local public decision-makers can adopt different approaches and indicators.

The suggested IRH-Med indicator is to provide a limit to heating consumption, in terms of *KWh/m2y heating demand*. If the evaluated home is under this defined threshold, the home is positively evaluated. However, this could be refined by imposing limits for U values of building envelope elements, etc.

For example, in the Italian ITACA protocol, the criteria heating demand reduction (B.1.2 – Reduction Primary Energy for Heating) is assessed within the following indicator :

PERFORMANCE SCALE	%	POINTS
NEGATIVE	<100	-1
SUFFICIENT	100.0	0
GOOD	55.0	3
OPTIMAL	25.0	5

Figure 13: Percentage ratio between annual primary energy for heating and primary energy limit

The Itaca weighting system is the same of the GBTool as the scoring system. All performance criteria and sub-criteria are set within performance scales ranging from –2 to +5, where 0 is the minimum acceptable performance in the industry practice. Performance scores refer always to an explicitly declared benchmark. The final result of the application of the protocol is a score ranging from –2 to +5 for the whole building.

	Before the building decision is taken	At the programming stage	During the designing stage	During the construction stage
Heating and cooling demand for a typical single-family house	300-250 kWh/m²	200-150 kWh/m²	90-60 kWh/m²	≤ 15 kWh/m²
Heating	270-230	185-140	80-55	≤ 10
Cooling	30-20	15-10	10-5	≤ 5

3.3.1.2 Cooling demand reduction

IRH-MED criteria: The reduction of the cooling demand through architectural design measures open opportunities for reducing the housing energy consumption.

Southern European homes often require little heating in winter ; more important is the cool comfort during hot summer days.

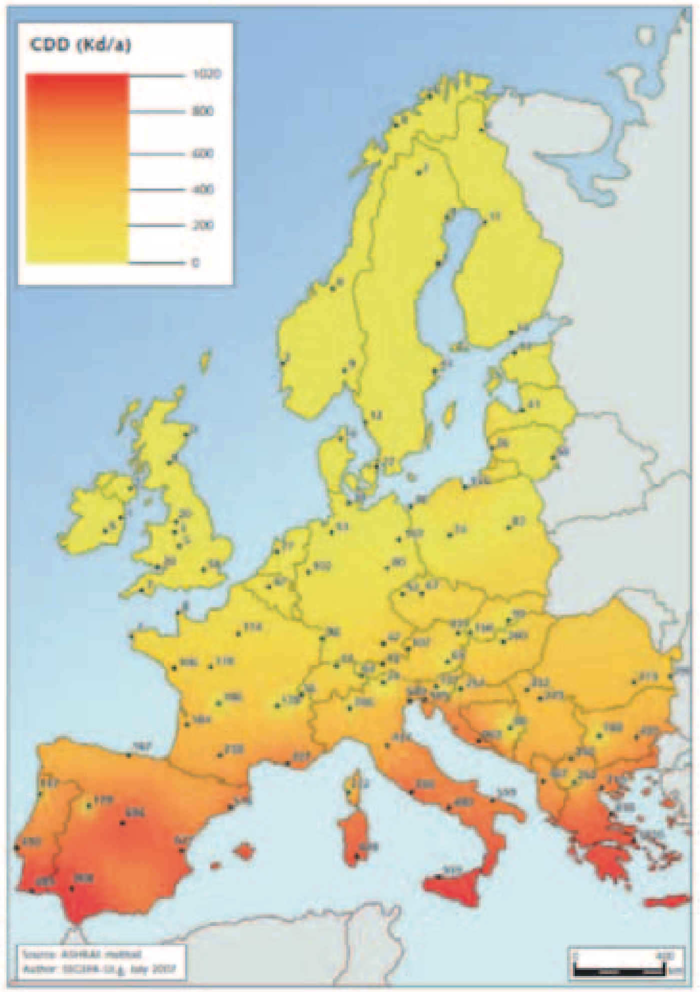


Figure 14: European cooling degree days (ASHRAE method)

There are a variety of approaches for house cooling and providing pleasant freshness for its inhabitants.

Recent studies predict a dramatic increase of cooling energy demand in Europe, despite the available knowledge and technologies of passive cooling. The EU studies - Energy Efficiency and Certification of Central Air Conditioners (EECCAC) and Energy Efficiency of Room Air-Conditioners (EERAC) - predict a four-fold growth in air conditioned space between 1990 and 2020.

Until recently, many EPB-regulations and much standardization work have more strongly addressed the energy consumption issue for space heating, neglecting the "cooling" one. However, the recent national transposition of the EPBD has started to change this status quo and growing attention is being given to the summer comfort issue (if possible without active cooling) or to the energy consumption caused by cooling. Nevertheless, it is clear that generally speaking, the methods for summer comfort and cooling are not yet as advanced as the methods for space heating, where several decades of operational experience have led to proven and mature calculation methodologies and requirements.

For example, in Italy, during the initial phase, the EPBD certification of the energy performance of buildings includes the primary energy used for heating and domestic hot water preparation. In addition, it was recommended to report the building energy need for space cooling (envelope performance) in the energy certificate. In a later phase, energy certification is covering as well primary energy use due to cooling and lighting ; nonetheless, the recommendations about the evaluation of the primary energy performance indicators for cooling and lighting and for their inclusion in the certificate are still missing at the moment.

Summer comfort and the energy consumption for cooling are a growing point of attention, not only in Mediterranean climates, but also in the more moderate summer climates of central and northern Europe. Even if in Northern European countries, cooling and overheating are not considered key issues, it seems that in recent years, summer comfort is becoming a growing point of attention in this European region too. This could be attributed to different factors : larger glazing areas in recently constructed buildings, the mild outdoor summer temperatures that lower the acceptable indoor comfort temperature for overheating (adaptive comfort) and the long summer days with low solar positions generating a lot of solar gains.

So, even if the EPB-regulation transposition in the different EU countries is rapidly evolving, the cooling energy demand and summer comfort appear as relatively new issues. Until recently, there was little international standardization that provided common concepts and uniform terminology. It is hoped that as the sector gradually becomes more familiar with the new European standards, the state of the art related to calculation methods will evolve positively.

The good news is that in the few countries where the EPB-regulation is in place, mostly situated in Southern and Eastern Europe, the consumption for cooling is always taken into consideration, albeit sometimes in an incomplete way or in a manner that is, to a greater or lesser extent, simplified.

It is interesting to note that, in some cases, some form of fictitious cooling consumption is considered (such as in Belgium) even if no active cooling system is installed, e.g. in the instance when the risk of overheating is considered to be too high. This may be a sort of anticipation that active cooling could be installed later in the course of the building life cycle when the overheating problems take place. It stimulates that even in buildings without active cooling, proper attention is given to the summer situation ; thus, the design does not focus exclusively on minimizing space heating needs in winter (through maximizing solar gains) to the detriment of summer comfort. The inclusion of fictitious cooling further facilitates the application of the above rule that the EPB-requirement is made independently of whether or not active cooling is installed.

A more detailed analysis of the cooling approaches reveals that a good deal of attention is already given to the consumption for cooling in the national/regional EPB-regulations but also in the basic status of the already implemented regulations. For example, regarding the thermal mass, sensible heat storage is considered, though sometimes in a simplified manner, and the latent heat storage (though phase change material) is never considered.

The current legislation situation is usually neglecting the potentialities of the passive cooling approach. The use of active cooling technologies is considered, while the use of passive cooling ones is rarely considered and recommended. Such passive cooling technologies, which are already available and cost effective (such as the use of well-designed sun shades, passive cooling via thermal exchange with the ground, night ventilation etc.) are not widely used in an integrated way today ; the most common choice for a building owner when addressing summer comfort issues still is mechanical cooling, often without previous investigation of other available measures regarding the optimization of envelope features (e.g. solar protections, glazing solar factor, thermal insulation of opaque surfaces, thermal mass).

By not giving an extra allowance for the maximum allowed primary energy consumption in the case of active cooling (as compared to the situation without active cooling), the countries could stimulate that a cooling system as efficient as possible is applied and/or that the extra consumption for cooling is compensated for by extra savings in other domains (heating, lighting, etc.).

Looking at the legislation in terms of summer comfort, the situation is similar. Few countries already include some kind of evaluation of the risk of overheating in their EPB-regulation, but none of these countries is a truly Mediterranean country. Moreover, for example, none of the countries incorporates as yet passive cooling techniques with a central heat dump (ground, surface water, ambient air through a heat exchanger etc.) in the overheating analysis.

An overheating analysis should be mandatory : it may be a means to strongly stimulate the attention which is being paid during the design stage to the summer situation. In addition, it will draw attention to the passive cooling means to avoid overheating. Thus, the chance that an active cooling system will be installed later on in the building life cycle, can be reduced ; if it nevertheless happens, the cooling consumption will be much lower if the building has been designed with due attention to the summer situation.

Different passive cooling strategies could be used, without promoting the use of Air Conditioning units, such as:

Intervene on the site layout and features which can affect summer comfort:
A compact urban layout may be useful to reduce irradiation on external surfaces in hot dry climates, while an openly spaced layout might be required in humid areas to increase ventilation possibilities ; the presence of vegetation and surface water, the choice of materials and finishing with low values of solar absorbance for urban surfaces (streets, parking spaces,…) can strongly influence surface and air temperatures in open spaces surrounding the buildings.

Control and reduce heat gains at the external surface of the envelope :
A high reduction of the amount of heat going through the external surface (or boundary) can be achieved by means of solar protections designed to shade windows when required (and possibly also walls and roofs), by surface finishings with adequate values of reflectivity and emissivity, and by means of limiting air exchanges when outside air is at a higher temperature than inside air.

Control and modulate heat transfer through the building envelope :
This can be limited by appropriate use of insulating materials and the time lag by which it gets to the interior can be controlled by appropriate size and position of thermal mass.

Reduce internal gains :
Internal gains can be reduced by using efficient lighting sources and systems (notably the most efficient one, daylight) ; by direct venting of spot heat sources ; by using efficient appliances.,..

Use passive means to remove energy from the building:
Once having reduced external and internal gains and having allowed means to individually adapt, if the desired comfort objectives are still not met, use passive means to remove energy from the building and/or increase comfort (comfort daytime ventilation, night ventilation, use of the ground as a sink where to discharge heat removed from the building, open groundwater or surface water systems, radiation of energy to the night sky, direct or indirect evaporative cooling).

Source: European "Keep Cool" project

Assessing cooling demand reduction

IRH-MED indicator: KWh/m2y cooling demand
The suggested IRH-Med indicator is to provide a limit to cooling consumption, in terms of KWh/m2y cooling demand. If the evaluated home is under this defined threshold, the home is positively evaluated.

However, it is important to note that due to the basic calculation methodology approach of existing regulations, it is quite difficult to determine the cooling demand at the design phase. And often this specific issue is neglected during the design approach, which means that during the use phase, because of the discomfort, households "need" to adopt active cooling techniques such as the use of air conditioning units.

So, depending on the national legislative framework, a more refined assessment can be defined. For example, in Italy, the current legislation (DPR 2008) about reduction of cooling demand and control of summer indoor temperatures proposes different indicators:

1- Maximum legal values of energy need for space cooling :

Type of building	Max Legal value for cooling	Climatic zones
Residential	40 kWh/m2y	A-B
	30 kWh/m2y	C-D-E-F
Non residential	14 kWh/m2y	A-B
	10 kWh/m2y	C-D-E-F

Fig. 15 – Maximum legal values of energy need for space cooling in Italy

2- The designer has to evaluate in a precise way the effectiveness of shading systems over glazed surfaces (i.e. according to UNI EN 13659/2009, UNI EN 13363-1/2008, UNI EN 13363-2/2006, etc.) ;

3- In every site where monthly average solar irradiance on horizontal surfaces is higher than 290 W/m2 :

A- External opaque vertical walls, exposed from east to west, must have either a **superficial thermal mass** higher then 230 kg/m2 or **periodic thermal transmittance** lower then 0,12 W/m2K ;

Fig. 16 – IRH-Med pilot in Pesaro (I): sizing thermal inertia of external walls in accordance of solar orientation.

B- External opaque horizontal component must have **periodic thermal transmittance** lower then 0,20 W/m2K ;

C- It is possible to reach previous values of periodic thermal transmittance also **covering roof with vegetation** ("coperture a verde").

D-Designers should favour **natural ventilation** of the whole building using in the best way the external ambient conditions and disposition of indoor spaces. If it is not possible, mechanical ventilation systems can be installed ;

E- **External shading systems** are compulsory. If they are not cost-effective, they can be omitted if glazed surfaces are characterized by a **solar factor** not higher then 0,5. It has to be calculated according to UNI EN 410/2000.

Fig. 17 – IRH-Med pilot in Pesaro (I): using external desolidarized Southern balconies as shading devices and support for solar thermal and PV panels.

3.3.1.3. Reducing Heating and Cooling demand: A systemic approach

As briefly explained above, the evaluation of the Heating and Cooling demand reduction should be implemented by a systemic approach at different levels. More than in other climatic areas, in the MED area, the home design should implement a carefully climate-responsive architecture approach. This means to pay attention to the urban/site selection, to the materials selection (insulation, thermal inertia, etc.), to the day lighting design, amongst others.

This means as well that this issue should be inextricably linked to the social and economic assessment areas :

- Reducing Heating and Cooling demand means firstly that householders would save money. A correct home design is an important step towards this, yet householders need to be correctly and sufficiently informed about their energy consumption to change their energy consumption behaviour: the implementation of ICT-based services to save energy (smart metering, in-home energy displays, amongst other mechanisms) is a growing trial field.

Fig. 18 – ICE-WISH service: an ICT-Based coaching application to monitor energy and water consumption via standard home TV. Source: European ICT PSP demonstration project.

- Reducing Heating and Cooling demand could be achieved by using passive strategies, especially for cooling, so as to reduce the investment and running costs along the home life.

Moreover, reducing Heating and Cooling demand should be achieved by a balanced integration with the use of Renewable Energy Sources as imposed by the recent EU directives. Especially in MED area, due to the high solar radiation, the potential of renewable energy sources should be exploited in synergy with the energy conservation approach.

Last but not least, it is now acclaimed that in MED areas, special attention should be paid to cooling reduction demand. It should be clearly highlighted that this issue must be faced by considering the impact on the electricity demand reduction. In fact, in the residential sector, more and more householders are using electricity-based equipment to cool their dwellings over the summer overheating. For example, out of nearly 11, 6 million units of autonomous air conditioning units sold between 1990 and 2005, more than 8 million have been sold in the

2000-2005 period. This market has had a spectacular development in the whole MED area (air-conditioning manufacturers are mainly concentrated on the market with the highest growth, the Mediterranean countries, and in particular Italy and Spain).

So, it is easy to understand why the electrical energy consumption in MED countries has experienced a significant increase over the last 15 years (except for the last 4 years due to the economic crisis and subsequent reduced economic activity), and the summer electricity peak demand is higher and higher as compared to the winter one.

In the MED area, homes should further designed with energy-efficient domestic appliances and lighting equipment, enhancing day lighting design to adequately control electricity demand. However, as proposed in the IRH-Med guidelines, it is important to assess the home after a minimum of three years operation to check if the tenant/owner has used air conditioning units to solve summer overheating problems, jeopardizing not only the electricity demand but also the cooling demand assessment.

3.3.2. Water cycle optimization

Water is a major component of the human body and is a basis for life. Although there are large amounts of water in the world, part of it stored in the poles and other parts in the sub-soil or the sea, the usable water resources represent only 0.01% of the world water.

The Mediterranean is one of the world regions experiencing high hydric stress (especially in the south and in the east). Such stress is defined through a low rate of available water (1.000 m3 per year). Several regions witness an over-exploitation of their resources, meaning that the volume of water extracted from rivers and aquifers is greater than their renewal capacity. For all these reasons, water conservation is the second obvious concern when thinking about housing in MED regions and cities.

Typically, the MED climate is characterized by infrequent rainfalls with long periods of drought. On the other hand, when they occur, rainfalls may be particularly violent, resulting in sudden flooding. Thus water cycle optimization in the Mediterranean implies adapted strategies. The development of urban areas, and of the associated residential buildings, have a great impact on the water cycle ; three main impacts will be considered below :

- Increased surface runoff ;
- Increased consumption of potable water ;
- Higher water waste.

3.3.2.1. Site and water runoff

When considering the interaction between residential areas and water runoff, two main questions must be addressed.

The first one is related to the **site selection** (see 3.2 - Area 1 - Territory and site). Obviously, when auditing the site which is considered for building, flooding areas must be discarded, because of the risks entailed. The analysis of the site may further point out assets such as on-site water resources, storage opportunities, etc.; it should as well consider how to enhance the existing situation regarding water runoff management and water recovery ; and finally, it should further point out what should not be degraded during the construction or rehabilitation process.

The second one is that the creation of urban areas increases the surface runoff downstream by creating more impervious surfaces increasing runoff velocity, eliminating rainwater infiltration and reducing natural groundwater recharges. When building, the decision process — mainly regarding the **outdoor space** — must include considerations about minimizing the creation of these impervious surfaces while favouring solutions that will decrease the water runoff. As early as the programming stage, decisions may include :

- construction of rain water reservoirs at both the urban and the housing building level ;
- keeping or adding permeable soils ;
- favouring green roofs as they decrease runoff velocity ;
- landscaping that favours native drought-resistant plants, enables drip irrigation and also help reduce runoff (management of slopes, hedges…) ;
- etc…

TheVilla Fastiggi project in Pesaro[2] perfectly illustrates how the water issue can be addressed as early as the urban planning and the programming stage.

3.3.2.2. Potable water is highly valuable and there are existing solutions for limiting its use

Domestic water consumption depends on the housing typology. A study developed by the Autonomous University of Barcelona shows that the total water average consumption in the Metropolitan Area of Barcelona is 150 litters per day. However, the average consumption of individual homes is 200 litters per day while it is only 120 litters per day in intensive collective housing.

Today, in most residential buildings, potable water is used for cooking and washing up (sinks), showers, toilets, washing machines, gardening, etc. Some of these uses lead to grey water (showers) or black water (toilets). This has a high environmental cost, including the need for energy to produce, deliver and recycle discarded waters so as to enable their re-integration in the natural cycle of water.

A lot of these costs could be saved and a better **optimization of the water cycle** achieved by replacing drinking water whenever possible. In fact, there are many water usages that do not require drinking water quality (toilets, irrigation…) and can use appropriately treated grey-water — from showers mainly — or recovered rainwater (Figure 15).

[2] For more information, refer to electronic leaflet at IRH-Med webpage: http://www.irh-med.eu/leaflets/italy/IRH-Med_e_leaflet_Pesaro_rev1.pdf

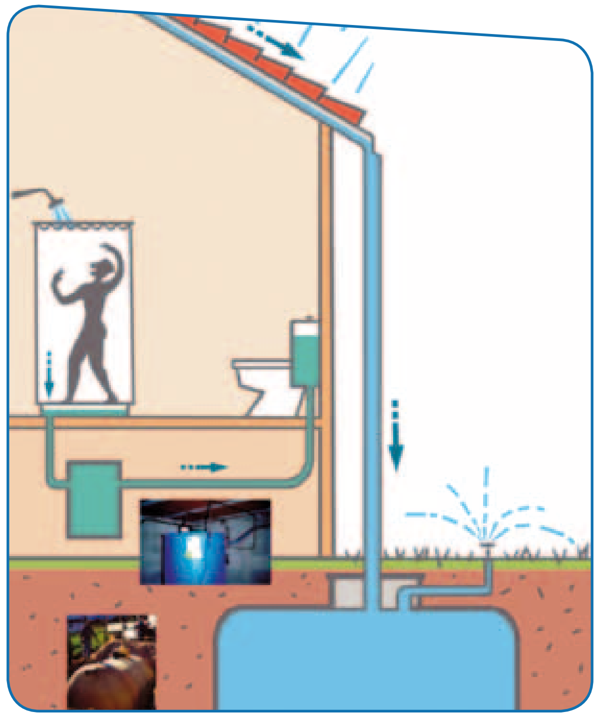


Fig. 19 – Source : Ecoaigua

The individual homes, usually the largest consumers of water, have better assets for implementing recycling and water recovery (space available to install recycling systems, existing gardens). The French Provencal example of Maison Dubent can illustrate some of these ideas[3]. The transnational inventory of technologies (part 4.3. and 4.4) brings more insights into these issues.

3.3.2.3. Prevent the waste of water and its associated energy consumption

As comfort gradually came to dwellings through potable tap water, the knowledge that water is a highly valuable resource has been lost. Water is now taken for granted in our civilized modern world, to such an extent that most of it is usually wasted through many inappropriate uses and behaviours.

Three main sources of potential water savings by preventing its waste can be included as early as the planning and designing stage :

- efficient domestic devices ;
- well-managed garden irrigation ;
- better management of hot water.

As for energy, **water waste** inside dwellings can be prevented through adapted devices and materials. These devices are gradually becoming mainstream and are available at low cost ; our inventory of technologies further shows that they are easily available now in most countries. In part 4.1., it describes those water efficient devices such as : low and dual flush WCs, delayed inlet valves in WCs, flow restrictors for taps and showers, water saving baths.

The monitoring that took place in the French pilot “Les deux moulins” shows that using these combined devices can lead to up to 60% water savings[4]. More generally, the pilots that took place during the IRH-Med project show a relevant simplification of this equipment.

Garden irrigation can as well lead to major wastes, especially if inappropriate plants are grown and if the watering is not well thought of. Of course, trying to grow an English lawn under a MED climate should be discarded from the start, although it doesn’t appear to be always the case. Carefully planned irrigation is also important ; part 4.2 of the inventory of technologies offers a good description of the IRH-Med project recommendations.

Finally, a careful insulation of hot water pipes as well as an optimized length of the hot water distribution grid can help reduce both energy and water consumption by minimizing the waste which occurs while making hot water available at the tap.

3.3.2.4 Assessing water conservation

The IRH-Med assessment scheme is deceptively simple as regards the proposals linked to the water area which address the water demand, the water cycle optimization and the use of local water resources.
As for example, three key indicators can be used to assess directly the cycle water optimization level of a project :

- Use of recycled water : % of reduction of drinking water in relation to the local average (indicator 1). The result obtain for this indicator facilitates the calculation of others (contribution to reduce energy and economic costs in the water network).
- % of wastewater treated in situ with tertiary treatment (infiltrated or reused) (indicator 2). This indicator further facilitates the calculation of contribution to reduce energy and economic costs in the water network.
- use of efficient systems for irrigation or use of non-potable water (% reduction of potable water on the local average) (indicator 3)

Evaluation of the degree of achievement of this criterion of sustainability is performed according to the measured value of the indicators ; other indicators could be implemented in relationship with the objectives set by each region.

Beyond these indicators which are directly linked with the water conservation issue, the concern for water can be added in the other areas and criteria, by implementing additional indicators. For example, the life cycle analysis (area 2) will not only consider energy but also water. This may lead to favouring dry construction processes.

[3] Refer to electronic leaflet http://www.irh-med.eu/leaflets/france/IRH-Med_e_leaflet_Maison%20Dubent_rev1.pdf, or link to video: http://www.youtube.com/watch?feature=player_embedded&v=a0kX0gH6BEM).

[4] See : http://www.irh-med.eu/leaflets/france/IRH-Med_e_leaflet_Nice%20Les%20Moulins_rev1.pdf).

In the economic field (area 7), water conservation can be assessed once more by adding indicators regarding the building works quality, so as to prevent waste during the construction phase.

And of course, the information or users (area 7) must include considerations about water. As comfort gradually came to dwellings through potable tap water, the knowledge that water is a highly valuable resource has been lost for many people. Water is now taken for granted in our civilized modern world, to such an extent that most of it is usually wasted through many inappropriate uses : water running while brushing teeth, long and many showers, inappropriate watering of the garden, use of cheap water inefficient dishwashers or washing machines.

Fig. 20 – Social Housing neighbourhood in Preganziol (I): harvesting rainwater and at reusing treated grey water with sustainable sanitation.
Source: www.she.coop – European VFP demonstration project.

3.3.2.5. A systemic approach

Not only is water a key issue when considering MED housing sustainability, but also a good way to illustrate how sustainable building and its assessment must always be addressed through a systemic approach.
As was shown above, optimizing the water cycle further means reducing energy consumption related to housing. If we only take into consideration the energy directly consumed in the building we do not have a clear and complete vision of what is at stake.

Providing drinking water and treating waste water result in huge energy expenses. In this sense, reducing drinking water use and waste as well as reducing waste water sent to treatment plants, not only has an impact on the optimization of the water cycle but also a very important impact on the reduction of energy consumption related to housing.

Moreover the economic impact of these measures, if systematically applied, can as well be very important for reducing Public Administration costs because usually, the price of water is partly external and doesn't reflect the total costs needed to produce drinking water and to treat waste water.

This systemic approach is illustrated by figure 17. It allows visualizing that the assessment scheme proposed by the IRH-Med partners goes beyond the simple accounting of direct punctuation for each criterion.

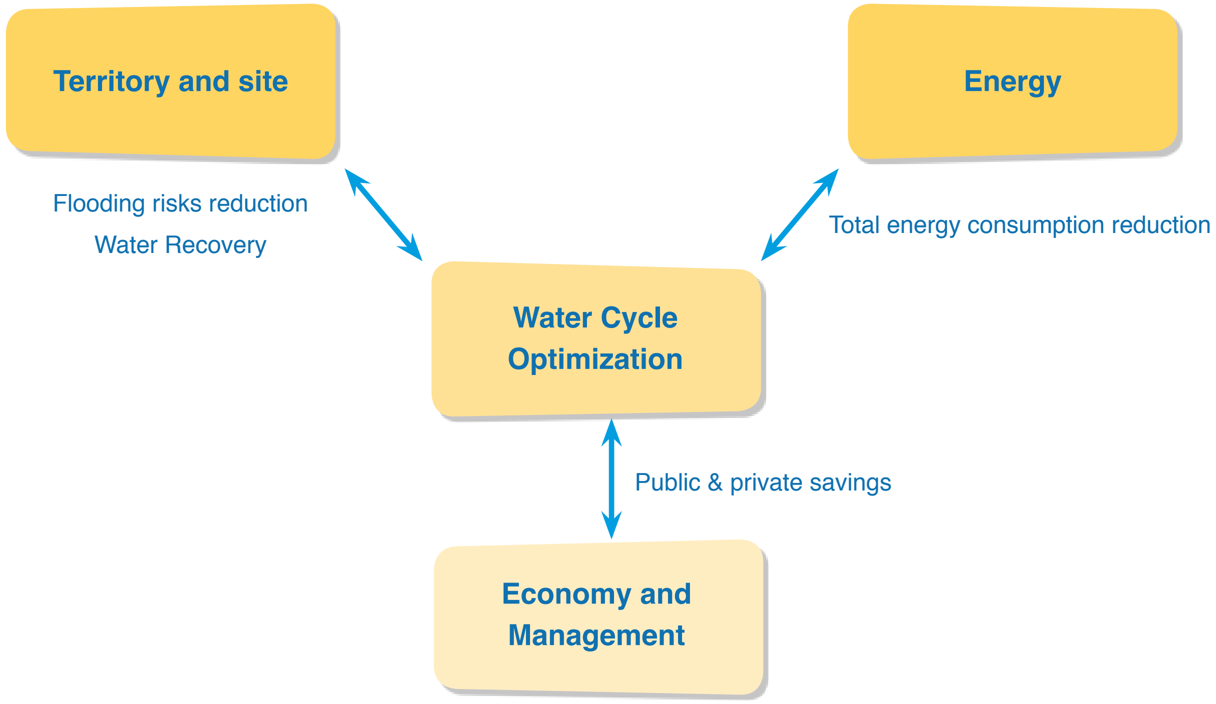


Fig. 21 – Systemic approach to housing sustainability

4 GOVERNANCE AND IMPLEMENTATION OF THE IRH-MED ASSESSMENT SCHEME

Beyond the general framework agreed upon for the IRH-Med assessment scheme, many other decisions need to be made in order to effectively implement it. This means that some governance issues have to be addressed as well, firstly from a strategic point on view, then with a practical insight.

4.1. Strategic issues to debate

As it is expected that the HSA scheme will be closely linked with issues like eco-conditionality, investments in public buildings, ruling and promulgating laws, a number of strategic questions must be answered so as to confer a solid legal base, wide acceptance and market effectiveness.

4.1.1. Decision on the right positioning for the HSA scheme

4.1.1.1. How marketing can enlighten the governance choices to be made ?

In our time, extraordinary contradictions are to be dealt with. Most Europeans are aware that they will soon have to adopt sustainable behaviours, but solar systems are still less popular than mobile phones, video games, airplane travels or even four-wheel drives. This leads to a tricky question about how to develop assessment systems that can be at the same time environmentally friendly, caring for social issues, economically viable as well as marketed in such a way that they are also enjoyable and desirable.

This means that sheer environmentalists must get out of their "green ghetto" and lean on solidarity values to conquer the mainstream economic world, keeping in mind a few tips, learnt through experience :

- playful systems are more successful than boring ones ,
- down to the earth systems are easier to implement than abstract ones ,
- make things happen rather than only make plans ,
- collective emulation can be more effective than certification ,
- collective intelligence is more efficient than individual technical solutions.

It should be noted that, in our rather individualist society, solidarity is becoming a key value for efficiently changing behaviours[1]. So, the concept of solidarity marketing could well be very useful for the implementation of the IRH-Med assessment tool.

4.1.1.2. The legitimacy of a regional inter-professional approach

The IRH-Med project has concluded that the right level for efficient and reactive decision-making, regarding the development and management of a sustainable building assessment tool is regional, as long as it is also inter-professional.

This level enables local institutions and professionals, involved in housing building and management, to program, implement, manage and evaluate their own Region's sustainable projects with quick response capacity.

This is consistent with the EU rules about subsidiarity (article 3B of the Maastricht Treaty).
Regarding the national level, the situation varies according to the amount of centralization that can be found in each country. Spain and Italy, on the one hand, are highly decentralized countries where Regions are entitled to deal with energy and environmental issues ; so they are also naturally entitled to deal with sustainable housing assessment.

In more centralized countries, such as France and Greece, the energy regulatory laws are promulgated at the national level, the Regions having an inciting role only. There might be local historical or geographical exceptions such as :

- the status of the Greek islands;
- in France, Alsace (since World War II) and the overseas territories, that can regulate some aspects regarding energy;
- Southern France has adopted special energy regulations for individual housing.

From a strictly economic point of view, the German example shows that working with regional industrial structures creates far more jobs than industrial centralization. The latter certainly performs well for projects such as High Speed Trains or for Airbus, but much less so in the atomized building industry. Many economists give a simple reason for that : when income discrepancies between people and regions are too great, then growth become sluggish. Consequently, favouring the reinforcement of the regional industry fabric results in more employment than undertaking large national projects, as this only affects a few cities.
This is why the regional implementation of a sustainable building assessment system could be wisely linked with the creation of a local cluster of building companies (or the promotion of an existing one, which could take over the task).

SEE : PRIDES Region PACA (pôle régionaux de développement économiques et solidaires) http://www.regionpaca.fr/index.php?id=3115.

Among clusters related to our present issues : http://www.capenergies.fr ; http://www.abc-paca.fr ; http://polebdm.eu

[1] In that sense, the values that are advocated by IFOAM (see: www.ifoam.org) are very inspiring, as will be seen in part 4.1.4.3.

4.1.1.3. Seeking consistency : the right level of decision for the right rule

Today there is a need to work on simplifying and converging the rules. First of all, this requires analysing the situation of the different ruling and assessment systems, what they mean, their contradictions and aspirations, and then applying some collectively chosen governing principles.

This led us to develop a matrix aiming at analysing the existing situation and at facilitating choices about sustainable building assessment and other related decisions. This matrix is built by crossing two dimensions: the geographical decision level and the subject matter of the decision.

	1. Europe	2. National	3. Regional	4. Sub-regional	5. Project
A. General layout					
B. Program					
C. Answers					
D. Standards, units and grading					
D. Presentation					

Sustainable housing rulings and assessment systems can be decided at five geographical levels :

- international, which would be Europe in our case ;
- national ;
- regional ;
- sub-regional, because in some places various climate exist within the same region (examples like Med + Alpine, in Provence-Alpes-Côte d'Azur) ;
- project : this is the final stage at which demand meets offer. Usually, systems coming from one of the levels above are used. But in some cases, large owners or promoters operating on a very large scale may develop their own system. If they are not consistent with the other systems, it may add a layer of confusion. Similarly, the program proposed to designers must attempt to make technical selections and presentations in keeping with the aforementioned levels.

Yet, the ruling and assessment system must also take into account five different subject matters :

- **general layout** : IRH-Med proposes five technical areas of assessment (territory, materials, energy, water, health and comfort) and two transverse areas (social matters, economy and project management) ;
- **program** : this relates to the way the demand is expressed and detailed ;
- **response** : this relates to the way the designers, but also the building industry, respond to the demand (program) and how they implement these answers ;
- **standards, units and grading** : these should allow easy comparisons between assessment systems and their results, at any geographical level ;
- **presentation** : ergonomics and proper communication devices should raise awareness and accelerate adoption.

The following developments will go into further thinking to finally help fill in the decision-making matrix.

4.1.1.4. Principles of governing

The governing bodies must be based upon the following principles :

a) Development, management and updating by the professionals of each region, who are to integrate the economic, social, ecological, cultural, climatic and other relevant aspects of their Region which is the most coherent politico-economic level. The sub-regional or communal level would not be sensible because it would lead to uncontrolled public information. Moreover, the possibility that, of each project grading, its own values are not conducive to comparison and, therefore, is an impediment to improvement. On the other hand, the national or European levels do not allow a daily proximity of management nor adaptation to local cultures and climatic areas. In any case, by planning the development of the assessment tool for groups of regions or of countries, costs will be reduced and, thus, better legal protection can be obtained.

b) Composition of the regional committee or committees, which must be strictly guarantors of being representative of the whole building world. The management certification (ISO 26000, for instance) of these bodies may be required.

c) Obligation to follow-up the projects on at least 3 stages :

- Design and, if possible, upstream programming ;
- Construction ;
- Building life (after 2 years of operation at least, the first months being often not representative of what really happens on the long term).

4.1.1.5. Seeking coherence between assessment systems

If it is desirable that our assessment systems should be both firmly based and explicit, then we have to work on the following coherences :

- Strong coherence among European regions in the use of grading tools :

  - the general layout (areas, sub-areas…) : this can also include other major labels, i.e. the LEED and HQE type, in order to create bridges and not upset the professionals too much. This work calls for a previous precise and international definition of the vocabulary used, taking into account the context and the fact that the building decision-making process is both multi-criteria-based and contextualised.[2]

  - this search for coherence is of prime importance for the main areas and sub-areas ; beyond those, flexibility can be allowed. For example, if one compares an Alpine region and a Mediterranean region, the former is going to insist on thermal comfort during winter and the latter on thermal comfort during summer ; but the two will agree on the need for thermal comfort whatever the season, which is the accurate common sub-area.

  - a recurrent debate is that of knowing if the requirements must be uniquely quantitative ; experience shows that both are necessary. Qualitative assessment is useful for issues regarding how people feel, such as comfort or socio-economics and indeed project management. Moreover, it should be stressed that some qualitative evaluation is a necessary condition for the acceptability of sustainability assessment by some professionals, including architects.

  - another recurrent debate exists between the holders of the results obligations and those who defend the best effort obligations. The truth is that there are no universal rules apart from the fact that :

    - Best effort obligations will be used for simple projects with less experienced professionals, for example single homes.
    - Results obligations will be used for more complex projects and with better-qualified professionals.
    - And so, both will often be used.

  - a general philosophy of weighting and grading of the areas which does not mean that exact same weightings should be used everywhere. In the Med case for instance, the weight given to the water issues can be higher than in other climates.

- The answers (or offers) actually depend on economies and regional cultures, not to mention climate ; thus the sub-levels of the assessment tools may show less convergence.

- Coherence must also be sought in each country with the national regulations (when they exist and have precedence) and with existing labels such as LEED or Protocollo Itaca. At the same time, intense lobbying of our governments should seek to make sure that similar units of measure among countries are eventually adopted. The simple comparison between French and German EPBD labels is an edifying subject in itself ! It is clear that the notion of weighting and grading goes hand in hand with national regulations. If one country fixes a low level of energy requirements, the weight that a sustainable building designer assigns to this area must be greater than that given by a designer belonging to a country where energy regulations are very demanding.

- Researching presentation tools enables some juggling between the assessment system and a better management of the project. In this respect, certain assessment systems are so complicated that they infest the designing process, hence causing time losses, which can sometimes have adverse effects on the project's quality and sustainability (see chapter 4.2.3).

These considerations enable us to complete the table as follows:

	1. Europe	2. National	3. Regional	4. Sub-regional	5. Project
A. General layout	Inter-regional decision on the general layout and regional management of the details beyond it				
B. Program			Decision making : regional with sub-regional adjustments Management : regional		
C. Answers			Possible offer Regional management	Possible offer	Possible offer
D. Standards, units and grading		National promotion with research into European coherence			
D. Presentation		Possible offer with national management tool	Possible offer with regional management tools		

[2] See SUPERBUILDINGS project at http://cic.vtt.fi/superbuildings ; also see the work led by SBA at http://sballiance.org)

4.1.2. From housing to other types of buildings

The IRH-Med project was primarily focused on housing. We may even add that the main focus has been on new rather that retrofit housing.

In some of the Med countries, individual housing can represent up to 50% of the market. Usually, special policies are needed for this segment of the market : the individual owners' awareness and skills must be raised ; SMEs are usually involved which has a great positive impact on local economy but their know-how also has to be strengthened. This means that the assessment tools that are provided for this segment need to be sharply adapted and playful.

Collective housing, public or private, usually can rely on better management with skilled contracting owners and better organized building companies who are able to use more complex assessment tools and procedures.

Furthermore, because renovation of the stock of older dwellings is presently at stake, especially in terms of energy efficiency, useful adaptations of the assessment system proposed by IRH-Med should be rapidly considered.

Nevertheless, once implemented for housing, the assessment system may very well serve other purposes for other kinds of buildings such as tertiary and industrial ones, with little adaptation. This is already the case for Protocollo Itaca (in Italy) and BDM (in France) where the building environment for housing and for other types of buildings is relatively alike.
Thus, having a similar assessment system for housing buildings sustainability and for other types of buildings seems very important for accelerating its awareness, facilitating its adoption and making its operational implementation easier.

This means that the general basis of the assessment grid should allow flexible adaptations to address any kind of building type, new or retrofit. Keeping in mind this objective for a wider scope of implementation could prevent unnecessary development work entailed by more specialized and uncoordinated approaches.

4.1.3. Stakeholders' involvement

Any assessment system cannot go without stakeholders' involvement. This is a common basis for many standardization and certification systems as the IRH-Med project was able to show through a deep analysis of other existing certification.

One reason for involving stakeholders is that assessment is often considered to be a judgement in some ways. And if there is a judgement, there is a need for a legitimate judging process and judge. This legitimacy should be sought for by the initiator of the assessment system and a good way to do so, as sustainability in building is an inter-professional process, is to make sure that all the different stakeholders contribute to the implementation and management of it. In the building industry, four types of professionals can be identified :

- project owners (either public or private) ;
- project designers and managers, including engineering companies and other technical advisors ;
- building companies ;
- users.

Because they may also be involved in the marketing of the assessment system, other stakeholders could be added to the previous ones :

- local authorities that may change their rules so as to favour sustainable projects ;
- banks involved in financing sustainable building ;
- insurance companies dealing with both professional and building insurance.

These groups of stakeholders may be represented either collectively, or individually. The collective representation of professionals is usually done through syndicates or unions whose delegates may often be remunerated employees (instead of overbooked elected delegates of the professionals).

This is why we recommend that actual professionals also sit in the steering committee of the assessment systems, so as to bring their invaluable field experience.

Association Bâtiments Durables Méditerranéens COMPOSITION OF THE BOARD

There are 27 members :
- 12 are direct members
- 9 are professional organizations
- 6 are members of a sustainable building association.

This last group enables a good balance between the two other ones.

The projects evaluation commission is composed of 5 members of the board and 10 direct members of the association, all elected for one year. Its meetings are public and anyone can attend them.

4.1.4. Decide on the legal framework

4.1.4.1. From self-assessment to certification

The assessment of buildings can be a voluntary process for people who seek sustainability for their own use or because they have truly ethical concerns. In that case, enabling self-assessment can prove to be very effective.

In this respect, transparency and free access to the assessment scheme and to the accompanying guidelines and explanations (see chapter 3) should be guaranteed. This is the case with Démarche BDM, where anyone can register online and test their project or even several versions of it (for example, see the grid for new collective housing[3]: even if not going into the whole certification process.

Other assessment schemes such as LEED or KLIMAAKTIVHAUS offer the same opportunity to visualize their assessment scheme and to access the necessary explanations.

This choice for what could be called an "open-access tool" is very helpful and contributes to the promotion of the concept of sustainable building. By being able to freely question a project with the help of an available assessment scheme, people are able to take first steps towards better building ; it may also serve as a communication tool between involved parties (such as architect and client) at an early stage of the project and help define higher objectives for it.

This might be the case of the tricky energy efficiency refurbishment market, especially for individual housing, with little or no involvement of designers and engineers. A self-assessment system, based on a simplified version of BDM's tool for individual homes is under development and will be tested under a pilot activity of a Med Strategic project, Marie[4].

In other cases, builders will need to get an official approval of the sustainability assessment for various reasons among which :

- property developers want to ascertain the quality of their buildings and optimize their green value, thus being able to raise their selling price or their renting rates ;
- new owners or users need an official guarantee to help them make a better choice between housing offers ;
- banks or insurance companies may offer better rates on loans or premiums based on actual sustainability of the building ;
- national, regional or local authorities may base their incentives (grants, tax rebates, building plot ratio increase) on officially assessed sustainability characteristics…

This means that decisions must be made about the way the assessment of the buildings can be guaranteed, beyond self-assessment, as shown in figure XXX

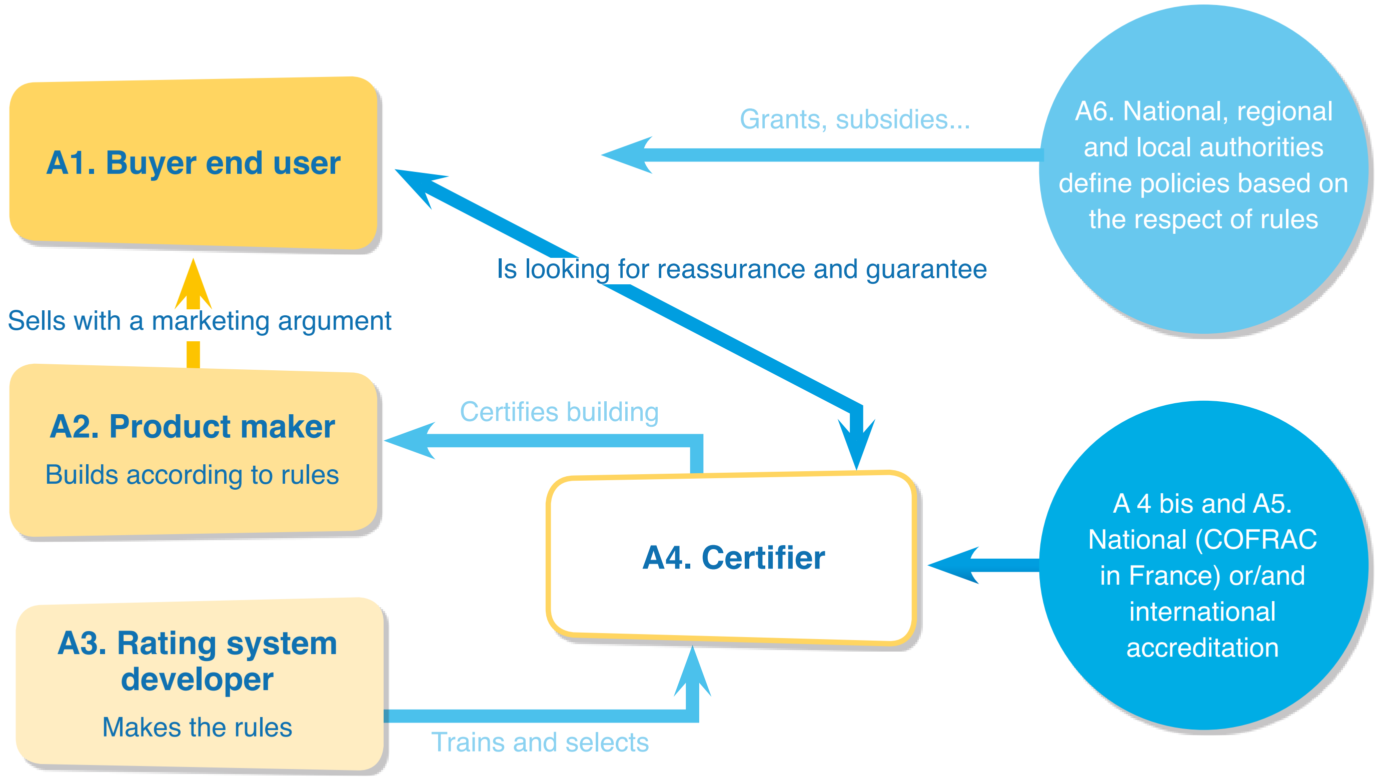


Figure 22 : Third party certification process

4.1.4.2. Third-party certification

The current trend in building certification — in line with the general trend in certifications — is the assignment of inspection and verification duties to independent accredited bodies. All the existing major sustainability labels (LEED, BREEAM…) work on this basis, which is supposed to bring further reassurance on the transparency and equity of the certification process.

In that case, the developer of the sustainability assessment tool keeps control over the assessment standards and evolution, while the process of verifying the compliance to the assessment requirements and the rating goes into the hands of accredited certification bodies. Thus, both processes are supposedly independent one from each other.

In Europe, this accreditation of third party certifying bodies is given by unique national accreditation organizations (EC Regulation N° 765/2008) : COFRAC in France, ACCREDIA in Italy, ENAC in Spain and ESYD in Greece. The developer of the sustainability assessment tool can collaborate with the national accreditation body to determine at what conditions a "to-be" certifying body will be accredited to do so. It can also control and verify the quality of the assessments made.

[3] See: "http://www.polebdm.eu/demarche-bdm/j-evalue-mon-projet/grille-habitation-collective-neuf"
[4] See http://www.marie-medstrategic.eu.

Experience with this system shows that it usually leads to higher costs (paying the certification body which includes loyalty fees for the owner of the system too, paying the necessary consultants that will deal with preparing for the certification process…) and lots of supplementary troublesome "paperwork", while it does not necessarily guarantee the actual independence that is sought for ; a careful look at the boards of the various bodies (owners, certifiers…) generally shows closely intertwined relationships between them.

Nevertheless, this third party certifying system can also lead to faster dissemination of the assessment tool. This is the path followed by Protocollo Itaca. This organization is presently working closely with ACCREDIA, to determine the accreditation conditions that must be respected to be able to deliver Protocollo Itaca certificates in Italy.

Several kinds of bodies either public (special inspection body) or private (i.e. companies specialized in control) will be able to go through the accreditation process which might lead to some competition between certifying bodies.

4.1.4.3. Participatory Guarantee System (PGS) : an alternative legal and social model

This alternative model has been firstly developed by the International Federation of Organic Agriculture Movements (IFOAM) and applies worldwide to certify organic agricultural products or processed food since the 1970's. This guarantee system is based on active participation of stakeholders and built on a foundation of trust, social networks and knowledge exchange.

The key characteristics of PGS are :

- shared vision : active awareness of why, how, and not least of all who is being served.
- participatory : PGS is based on a methodology presupposing intense involvement by those interested in the production and consumption of these products. As a result, the credibility of the production quality is a consequence of participation.
- transparency : all stakeholders must be aware of exactly how the guarantee mechanism generally works, the process and how decisions are made. People should be aware about the criteria of how decision on certification is made. This implies that there must be some written documents available about the PGS and that they are made available to all interested parties.
- trust : the advocates of PGS hold to the idea that producers can be trusted and the organic certification system should be an expression of this trust. It should reflect a community's capacity to demonstrate this trust through the application of their different social and cultural control mechanisms. Thus, a variety of culturally specific (local) quantitative and qualitative mechanisms for demonstrating and measuring organic integrity are recognized and celebrated. These are integral to the certification process.
- learning process : it is important that the process of certification contributes to the construction of knowledge nets that are built by all the actors involved in the production and consumption of the certified product. The effective involvement of the stakeholders on the elaboration and verification of the principles and rules not only leads to the generation of credibility of the product, but also to a permanent process of learning which develops capacities in the communities involved.
- horizontality : it means a share of power amongst all parties involved. The verification of the quality of a product is not concentrated in the hands of a few.

4.1.4.4. Choose the right system

Although the two systems of certification complement each other, PGS Certification, with low direct costs and the heavy emphasis placed on involvement of the producers/local consumers, is well suited to local issues. Furthermore, because PGS procedures are more flexible, they may be more inclusive and appropriate for the local social context they serve.

Third Party Certification, on the other hand, with the heavy emphasis placed on detailed paperwork and third party auditing may be frustrating and unnecessarily burdensome for smaller companies and projects, but the mechanisms are absolutely necessary to provide credible quality assurance to customers far removed from the products they are buying.

Thus we may say that third party certification could be well suited for international investors and promoters, while other ways of certifying may be more suited for local markets, and especially the small SMEs companies that can be found on the new-built and refurbishment housing market.

In general terms, the two systems are found to have the following differences:

- Less paperwork in PGS programs,
- More commitment and responsibility of building developers in certification process (including inspections and consequences),
- Certification mechanisms are designed to be appropriate to the local social context and small SMEs they are serving,
- PGS programs are often more inclusive of newcomers,
- Involvement of Consumer is encouraged,
- Use of social control by involving and empowering local stakeholders thereby giving them "ownership" of the certification process,
- More empowerment and freedom in the marketplace with PGS programs.

4.1.5. Useful complementary objectives and services

Assessing sustainable building and developing a tool to do so is not an end in itself : it should rather be considered as a pretext to build sustainably. It may be said that the football game rules are a pretext to make children play and learn at the same time. Similarly, the evaluation of building sustainability should be a playful pretext to improve the building professionals skills and know-how. Of course, like in sports, there might be abuses but the general tendency remains sound.

This means that beyond the assessment tool, many other complementary objectives can be added. Most of them are classical clusters' objectives and services and contribute greatly to local economy :

- information : creation of a website, journals, brochures, conferences…
- capitalization : return on experience, dissemination…
- training : training about how to use the evaluation system ; use the return on experience to teach best practices and reduce their cost…

- innovation : through existing tools but also through new practices experienced on construction sites…
- promote the local chain of value : it is increasingly popular for organic products and tends to become so for local eco-building materials because of the growing importance of grey energy…
- look for bridges with other networks and clusters to create synergies.

4.2. Practical guide to implementing the assessment scheme

All this having been considered, a number of practical recommendations for implementing the assessment scheme remain to be explained. These recommendations intend that implementation is undertaken in such a way that burdens continue to be limited, because energy must be invested in better building rather than in more paperwork.

4.2.1. Types of actors involved during the assessment process

The actors that have to be gathered and mobilized for implementing sustainable building are listed hereunder.

First of all, each of these actors should assign a representative dealing with energy conservation and sustainability. The representative will know how to interact with all the other assigned representatives, relating to other actors. The need for such an appointment is pointed out in most existing reference tools, either certifying or not, and will remain until sustainable know-how and skills are firmly anchored at all levels.

The **public and private owners** : they will have to contract with competent designing and building bidding teams ; so, they need technical and legal knowhow ; they must also implement process evaluation.

The **project managers** (designers, architects, engineers…) : they must know how to manage the sharpest tools for energy conservation and sustainability ; they must also get rid of usual habits or frights, know enough about new materials ; they must design buildings that can be managed simply, still remaining comfortable.

The **building companies** : they must keep a high knowledge of new materials and how to implement them ; they must learn how to network with other companies and cooperate during construction.

The **final users** : they must consider that buildings are changing and that they can have a share of this change by expressing clear needs, and in acquiring sound and demanding management strategies.

4.2.2. Seek convergence between project management and assessment documenting

As was already said before, a sustainable assessment system should try and be as little troublesome as possible while still being demanding and stimulating.

Today, sustainable building is at a crossroads : it has to be more and more efficient at lower prices and less resources.

Inspiration and best practices could be found by looking at what has been made in France by AXXONE and Association BDM to help having a better sustainable management of projects. An idea of it can be found with the QEBSYS tool[5], a multi-actors software which has integrated from the start, the issues related to any assessment system (HQE, LEED, BREEAM or BDM).

This means that the repetitive, informative and organisational tasks have all been integrated, following the demands of each assessment system. It also includes the regulatory paperwork that has to be produced for other purposes.

After the necessary period of trial, the time gained on the project management more than compensates the time spent on evaluation, as long as the assessment system that has been chosen is sufficiently "paper-light".

The following figure sums up the whole evaluation/project management process (square rectangle).

	Programming	Designing	Construction	In use
Owner	*Verification*			
Design team		*Evaluation*		
Building company			*Evaluation*	
User				*Evaluation*

Fig. 23 – Evaluation / Project management process

[5] See: http://www.qebsys.fr/.

Thus, building assessments help engage in the virtuous circle which is described in the following sketch.

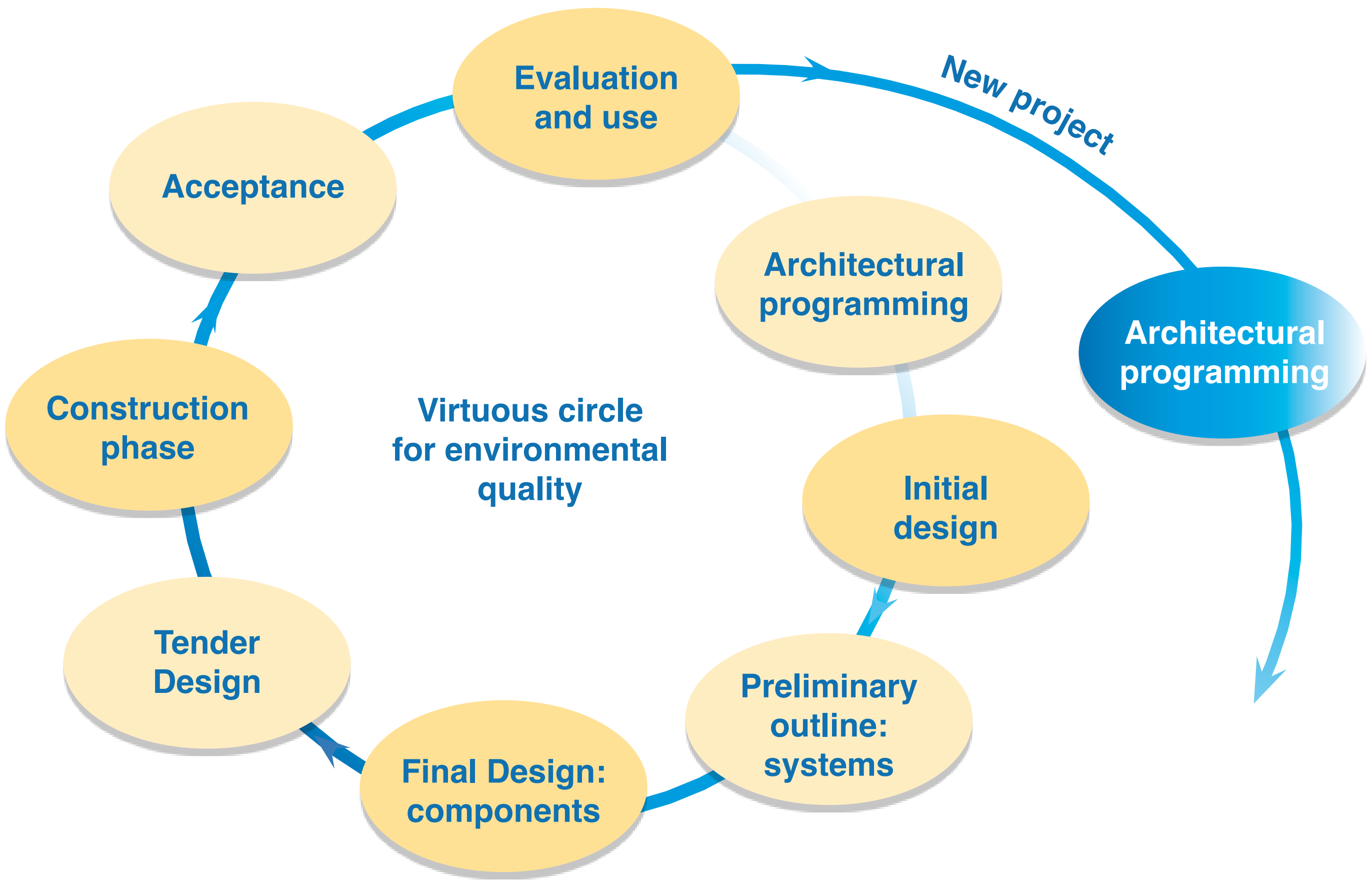


Fig. 24: Virtuous circle for environmental quality

4.2.3. When should the assessment occur ?

Official terminology for the project phases in France	Official terminology for the project phases in Croatia	Official terminology for the project phases in Catalan	Official terminology for the project phases in Italy	Translation found
Programme	Arhitektonski program	Programa	Programmazione Studi di fattibilità	Architectural programming
Esquisse	Koncepualno rješenje	Esquema	Progetto Preliminare	Schematic design phase, initial design, sketch,
APS (avant projet simplifié)	Idejni projekt	APS (Avantprojecte simplificat)		Preliminary outline, summary project draft
APD (avant projet definitive)	Glavni projekt	APD (avantprojecte definitiu)	Progetto Definitivo	Final design
	Građevinska dozvola		Progetto Esecutivo	
Dépôt de permis de construire	Dokumentacija za nadmetanje (tender)	Sol·licitud de permis de construcció	Richiesta permesso di costruire	Building permit application
	Faza gradnje, lokacija gradnje			
DCE	Ispitivanje zrakopropusnosti	Disseny plec de condicions	Capitolati speciali d'Appalto e Gare d'Appalto	Tender design, tender documents
Phase chantier	Dobivanje tehničkih dopuštenja	Fase de construcció	Cantierizzazione, gestione e controllo delle fasi esecutive	Construction phase, construction site, works site
Test étanchéité à l'air	Tehnički pregled zgrade	Prova estanqueïtat		Blower door test
Réception provisoire	Uporabna dozvola	Recepció provisional	Collaudo e Accettazione dell'opera	Provisional acceptance
Lever des réserves	Arhitektonski program	Retirada de reserves		Withdrawals of reservations, lifting of reservations
Réception définitive	Koncepualno rješenje	Recepció definitiva	Abilitabilità e Consegna Gestione e manutenzioni	Final acceptance

Fig. 25 – Project phases terminology

Experience shows that the assessment process should be closely linked to that of the building from programming to using the building. Within that cycle, there are some key times when an evaluation must occur. These might slightly differ from one region to the other, depending on the regulatory documenting process (see part 4.2.4.) ; Figure 25 offers the best translations available so as to clarify the vocabulary that will be used hereunder.

ARCHITECTURAL PROGRAMMING (SEE FIGURE N° 26[6])

This is a most important stage, at which the evaluation must seek to check whether the designers, builders and final users will be given enough assets to actually ensure the sustainability of the building. It is also the right time to proceed to the site analysis.

Using the assessment grid as a guide at this early stage of the project is very useful. The decisions made can be kept in the project logbook meant to follow its development from A to Z. At this stage, the evaluation can remain rather light, even though the decisions made are of upmost importance.

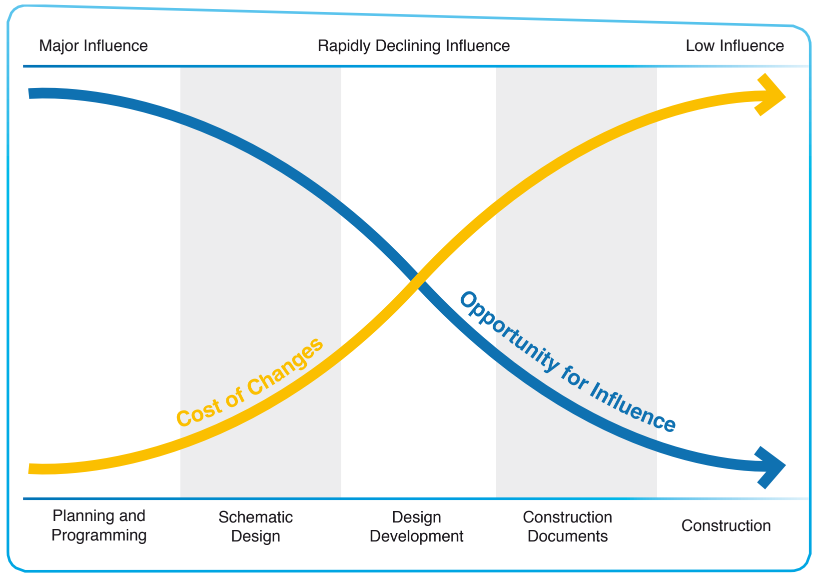


Fig. 26 – Programming

Designing stage :

At this stage, the evaluation is much more complex and should be compulsory. The audit should start as early as the initial sketches and carry on until the tender documents are written which ends the designing stage. The assessment serves a two-fold objective : evaluate the commitment of the owner and check how they have been taken into account by the designing team.

Construction stage :

During the construction stage, the owner entrusts the supervision of the works to architects and engineers that must check that the commitments made at earlier stages are respected and implemented. A new assessment at this stage is necessary, between provisional acceptance and withdrawal of the reservations.

Building life :

Few existing systems take into account that last stage, although it is of upmost importance for the actual efficiency and sustainability of the building. What has been planned and expected should be checked as well as the easiness and efficiency of the management. At least two years of usage should pass before this last assessment occurs to let things settle down and become familiar. Assessment at this stage might well point out unexpected behaviours and habits that shake what had been planned in the beginning. There are already signs that this latter issue will need to be explored by further research for which this kind of evaluation will certainly be a useful input. In the years to come, it might help improve and modify habits at the programming stage for future buildings.

4.2.4. Going beyond "2 years" evaluation: global costs

Residential buildings global cost should also be considered. Actually, it is one of the criteria included in the area 7, economy and management.

When making decisions, the concept of global cost is very useful to thoroughly visualize and consider all what takes place during the life time of the building. Considering the global cost of a building allows a deep analysis and balance (comparing costs and benefits) at all stages of the building life.

4.2.4.1. Keeping records

Today, most residential buildings have no records about the main aspects of their life ; usually, large aspects of their past history is lost. It makes it difficult to avoid mistakes and errors in new buildings or refurbishment. Register and assess the complete life and costs of residential buildings is a good practice that must be developed.

In the future, not only this data can help a better management of the building (refurbishment decisions for instance) but it will also help strengthen the global cost concept definition and methodology of calculation.

The IRH-Med can help implementing such record :

- Registering actual data during the construction and the complete life including demolition. The calculation of IRH-MED indicators periodically can greatly facilitate the generation of knowledge related to the building evolution and its use.
- Assessing periodically the main changes of the IRH-MED indicators calculation results, including also new information and comments from users, owners or managers. Unexpected behaviours and habits, and other kind of impacts and costs that modify what had been planned should also be included in the assessment.

[6] Source : Architectural Programming, by Edith Cherry and John Petronis : « we define architectural programming as the research and decision-making process that identifies the scope of work to be designed. Synonyms include "facility programming," "functional and operational requirements," and "scoping". (http://www.wbdg.org/design/dd_archprogramming.php#top)

4.2.4.2. Calculating global cost

Global cost analysis and calculation is gradually becoming a real concern and objective for many actors involved in sustainable building, as it may support new decision-making paradigms. Sustainable building raises new questions such as "who will pay for the wrong decisions and their consequences ?". Today, in most cases, the person or actor who has to pay is not responsible for the wrong decision, not talking about the externalities that weigh on the environment or society as a whole[7]. Considering the whole housing costs (including externalities) all along its life time is a necessary step to reduce the risk of errors and their costs.

There is a steady flow of research that has greatly explored and tested this issue, which is now well documented. But there is still a lack of easy-to-use tools, which certainly opens the way for future projects.

The SET-SHE model is a Life Cycle Cost Analysis Tool for Buildings (including externalities) developed by the SHE project[8]. This model uses the Overall Life Cycle Costing approach as a decision-support tool for builders to analyse and assess the economic, social and environmental costs of different construction options at the design stage so as to promote sustainable housing

This tool facilitates understanding the cost involved for each actor (social housing company-owner, resident, local authorities, state or society), considering building costs at short (30 years) or at long term (60 years).

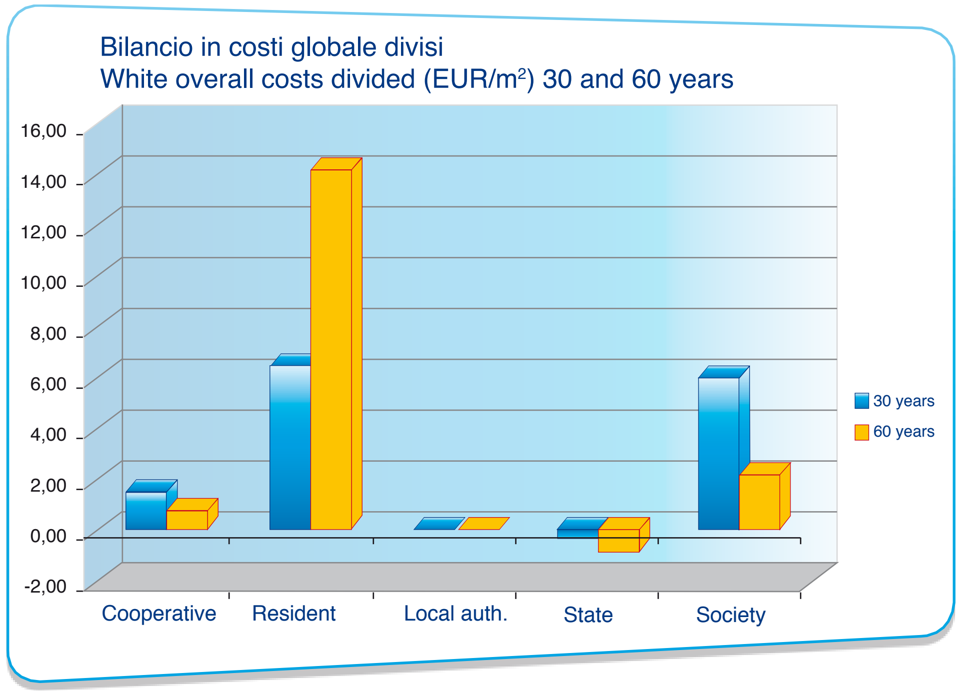


Figure 27: Shared Life Cycle Cost – Pesaro Project

The tool produced by the SHE project allows determining the economic effects of alternative designs, choices and decisions made during the building life and related to the building system ; it also quantifies these effects, expressing them in euros.

According to the WBDG[9], housing related costs usually fall into the following categories:

- **Initial or Investment costs** : purchase, land acquisition, construction.
- **Fuel costs** : energy and water operational and construction costs (for instance, taking into account the energy embodied in materials is included as an externality ; the same for transportation costs due to the location of the building).
- **Operation, maintenance, repair and refurbishment costs** : these costs are not easy to determine because operating schedules and standards of maintenance vary a lot from building to building.
- **Replacement costs** : capital replacement depends on estimated and real life of the components and systems.
- **Residual values** : remaining values.
- **Other Costs** : financial, fiscal, health care…

In Provence-Alpes-Côte d'Azur, a simple open-access toll has been developed for tertiary buildings. Further developments regarding housing are being considered.[10]

[7] See : http://www.areneidf.org/medias/fichiers/Constrdurablepdf.pdf
[8] Sustainable Housing in Europe ; see : http://www.she.coop
[9] Whole Building Design Guide ; see : http://www.wbdg.org/resources/lcca.php
[10] See : http://www.enviroboite.net/spip.php?page=notice&id_document=784&id_rubrique=12
http://www.enviroboite.net/spip.php?page=notice&id_document=796&id_rubrique=12

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