

# Coupling environmental and architectural quality in the urban context: Developments and trends in the Mediterranean

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## ABSTRACT

The paper is structured around the outcomes of the SB05MED International Conference entitled “*Sustainable Construction: Action for sustainability in the Mediterranean region*”, held in Athens, in June 2005. It will present existing approaches of environmental quality in buildings as well as methodologies, policies and standards for environmental quality in buildings and cities. Furthermore, it will explore the current situation of projects, systems and operations and present future trends as well as performance assessment tools and financial instruments and mechanisms towards sustainable construction in the Mediterranean region. The paper is also introducing a new operation SD-MEDbuilding process, inspired by the HQE® Process elaborated by SD-MED experts and validated by the HQE Association.

## 1. INTRODUCTION

The Mediterranean region is an area of vital strategic importance to Europe, which both the EU Council and the European Commission having identified as a key priority for the EU. The populations living along the coasts of the Mediterranean Basin (Fig. 1) are united not only by ancient historical and cultural ties, but also by the fact that they belong to the same ecosystem or eco-region. This historical and ecological unity are paralleled by many differences, which go over and above the traditional North-South divide. But regardless of the different backgrounds of the countries in the region, the future of the Mediterranean basin depends on its people's ability to conceive a collective management, manifest interdependencies linking them, whether geographical (the sea), political, economic (trade), social (migratory flows) or cultural. Sustainable development can restore the sense of a common future for this region and can provide the opportunity to ensure the convergence of strategies led by various agents.

Sustainable construction as a term used to express sustainable development applied to the construction and building sector can be a pertinent field for such a strategy.



Figure 1: Schematic view of the Mediterranean region

## 2. TRADITIONAL URBAN SPACE QUALITY AND CURRENT CONDITIONS

### 2.1 Overview

The Mediterranean region has traditionally developed exceptional expertise in architecture and urban design, showing great ingenuity in adapting to the climate. The choice of layouts, openings, materials, patios and fountains and narrow shady streets have produced an urban environment and architectural heritage perfectly adapted to the climate. However, recently, urban expansion and changes in lifestyles have been contributing to the emergence of urban developments and architectures that, by their design, are disconnected from the climate, leading to an over-consumption of energy for heating and cooling (ventilation and air-conditioning). Glass-encased skyscrapers are increasing in the Mediterranean cities despite their being totally unsuited to summer heat. Yet a few simple building rules, satisfying new demands for comfort and adapted to the climate, would enable substantial cumulative savings for the whole life cycle of the buildings. To get back in touch with its climate, Mediterranean architecture could reintroduce a few simple building principles that it has jettisoned rather too rapidly. The principle of *sustainable architecture in the region* can be mainly the

principle of bioclimatic architecture enriched by some parameters linked with modern sustainable building concept. Environmental quality so as to meet new demands for comfort and health for the occupants while reducing, even avoiding, energy expenditure on active heating, ventilation and cooling technologies, is one of these parameters. Nevertheless, social and economic efficiency should be taken seriously into account.

### 2.2 A developing “air-conditioning” culture

The Mediterranean region is particularly concerned by the very large expansion of air-conditioning which is awaited to continue as a result of urbanization phenomena and possibly global warming. Demand for artificial cooling has traditionally been very low in Europe. However, clear signs of a rapidly growing “air conditioning culture” have started to appear during the last decades. Reasons for this development include increasing thermal loads in buildings due to additional equipment, particularly office equipment, as well as cheaper and more widely available cooling technologies. Cooling has become a standard in cars, offices and commercial buildings which contributes to a demand for a “continuous” thermal comfort that is spreading also to households. This effect is much stronger in Mediterranean countries, where the climate and the rising living standards are creating a real “air conditioning culture”. The situation becomes more severe in urban Mediterranean environments due to the so-called “urban heat island” effect that increases the air temperature and consequently increases the needs for cooling and the smog formation in summer. The explosion of room air conditioners (RAC) sales confirms this trend. There is however a very large uncertainty in these projections due to the immaturity of the market.

The expansion of “air-conditioning” requires particular consideration from the point of view of the savings potential through

adapting construction technologies (natural ventilation, insulation, exposure), using high-performance devices and control equipment and improving micro-climate through urban layout and urban form related interventions .

### *2.3 The urban micro-climate impact*

In-depth measurements have been made in Athens, where thirty automatic temperature and humidity stations have been installed giving hourly data during more than 3 years since 1996. The main objective of the project was to study various urban micro-climatic conditions. The following conclusions were drawn: a/. Cooling degree hours in the central area of the city is about 350% higher than in the suburban areas. b/. Maximum heat island intensity 2 in the very central area is close to 16 °C, while a mean value for the major central area of Athens is close to 12 °C. c./The Western Athens area, characterized by scarce vegetation, high building density and a high anthropogenic emission rate, presents twice as many cooling degree-days than the Northern or Southern Athens area. The heat island intensity in the central Park is close to 6.1 °C, compared to 10 °C in stations located nearby. The park further presents almost 40 % less cooling degree-hours than the other urban surrounding stations. d./Heating degree-hours in the very central area of Athens are about 40-60 % lower than in the surrounding suburban areas.

These results indicate clearly the role of urban layout, existence of vegetation and the type of building materials used, on the potential energy demand for cooling urban buildings.(Santamouris et al.,1999)

### *2.4 Urban and building design techniques*

Architecture in the region could thus exploit several parameters: 1. Using the building cell to absorb winter sun, reduce the heat input in summer, protect the building from wind and noise, and light the inside by exploiting the

particular luminosity of the region. Sustainable Architecture can reduce heat loss by good organization of space, a compact shape, efficient wall and ceiling insulation, protection against predominant winds, window sizes adapted to exposure, insulated night-time protection of windows, main facades oriented to the south, and a high thermal inertia of the building. It can reduce cooling needs by solar protection in windows, walls and roofs, good ventilation, the design of outdoor space to reduce outdoor temperatures, shady areas ( trees, green spaces) reflecting colors for walls and outer materials etc. 2. Using active technologies ( for heating and cooling ). The traditional Mediterranean habitat sometimes had no heating. Nowadays, occupants demand comfort ( heating, cooling, ventilation ) which is not necessarily more expensive, since there have been more energy efficiency improvements in the construction sector than in the household appliances, for example. There is considerable need for reducing heat loss and the costs of ventilation and cooling.

Furthermore, strategies to mitigate the urban heat islands in Southern European and Mediterranean cities can result to large energy savings and delay investments in electricity infrastructures, pavements and roofing. They can also improve local environment conditions, i.e. less smog, increased thermal comfort, and, at the same time, contribute to aesthetics and general well being. Increased urban temperatures have a direct effect on the buildings energy consumption, especially during the summer period accompanied by carbon dioxide and other pollutants emissions. In order to limit the effect of heat islands on energy demand and summer comfort, various urban design measures can be taken including the use of more appropriate materials, increased plantation and use of cool sinks. According to the URBACOOOL study project co-ordinated by the University of Athens ( Santamouris et al.,2001b) relevant action can rely on four main

axes: a/Improvement of the urban microclimate: promote cool sinks, decrease the impact of anthropogenic heat, and reduce the influence of the urban ambient environment on the cooling demand, b/Buildings design: improve building design in urban areas in order to make the best possible use of passive techniques, as well as of new advanced building materials c/Active cooling systems from district cooling to individual air conditioning appliances d/Demand-Side Management actions to manage and control the cooling energy needs in urban areas. The project includes also the study of the existing legislative framework on the application of advanced and energy efficient cooling systems and techniques in urban environments, identifies possible barriers and contributes to the development of appropriate national and European codes and standards. The results are integrated into a set of guidelines for city planners, building designers, installers of cooling systems, energy companies, etc. A set of integrated strategies that make possible the adoption of these guidelines is also proposed. Besides, theoretical studies have shown that the application of advanced techniques for the improvement of thermal characteristics of buildings, use of urban oriented central cooling systems and of advanced air conditioning equipment, as well as of techniques aiming at improving the urban environment and the corresponding thermal conditions, may decrease the Mediterranean buildings cooling load up to 70 percent (Santamouris, 1999). Consequently, major impact in the improvement of environmental conditions in Mediterranean cities can result from the integration of modern cooling strategies and energy efficiency measures in the rehabilitation of existing old building stock which would be a European priority or in new constructions, accompanied by the improvement of the ambient urban microclimate involving the use of appropriate materials, green spaces, cool sinks for heat dissipation, appropriate layout of urban canopies

etc., to counterbalance the effects of temperature increase.

### 3. HOW TO RE-ESTABLISH QUALITY OF URBAN SPACE IN THE MEDITERRANEAN?

#### *3.1 Coupling architectural with environmental quality towards sustainability*

The Athens 2005 SBMED Conference “*Sustainable Construction : action for sustainability in the Mediterranean region*”, initiated by the SD-MED International Association, focused on the necessary *coupling of architectural quality with the environmental one in the Mediterranean urban space*. This event constituted a synergy of international range aspiring to articulate local, national, regional and international initiatives for the promotion of both the idea and practice of sustainable urban environment and more specifically of sustainable building and construction. That is to say the building that beyond its classic architectural virtues, beyond its *architectural quality implying social, economic and environmental aspirations*, it is characterized by the minimization of its environmental impact, that is, it is mostly characterized by the environmental quality, from the excavation of raw materials for its construction, during its proper construction, operation, maintenance and demolition, that is during its whole life cycle and furthermore in all spatial scales, that is from the scale of its interior space, up to the planet scale.

The major outcomes of the SB05MED event were structured around four main axes : *The first one concerned methodologies, policies and standards for sustainable building and city*: There was agreement on the fact that given the cultural, technical and environmental specificities in the Mediterranean, linked with energy and water use and the fact that the region is a privileged zone of exchange and transfer between North and South, there is a *necessity to*

*establish places, instruments and opportunities of technology transfer.* Subsidiarity in the application of various levels' regulations ( local, national, regional-Mediterranean, European and international ) has been considered as a sensible issue for the region. Focal points in the discussion have been: the respective role and complementarity between regulations and market oriented measures, the problems and constraints related to the *need of new jobs, responsibilities, professional skills*, and the relationships between those different jobs. The follow-up of change and the need of concepts and simple tools, easily applicable and adapted to local cultures have been recommended as well. The discussion about sustainable projects cost has led to a double necessity : on the one hand favour investments and on the other hand develop innovative financial instruments and tax measures in this field.

*The second axe* concerned the degree of *implementation of sustainable building and city projects, systems and operations:* The inertia of the "old world" has been considered as the main constraint for implementation and the availability of the scientific and technological knowledge on SB was put in question, together with the lack of awareness among industrials, professionals and the public on issues related to the environmental impact of construction materials. The cost and affordability of sustainable building projects was another main issue, structured around the necessary integration and dissemination of the life cycle cost concept. A series of proposals and recommendations were made, such as : a/ establish a regional mechanism to gather data and knowledge, provide information to state and local authorities and propose design and evaluation instruments and tools to all actors involved in the construction, b/ integrate SB design as priority course in architectural schools, coordinate research with a focus on the existing building stock and disseminate

available techniques, multiply demonstration projects and support them financially.

*Third axe* has been the present and future of *Assessment and evaluation instruments and tools* ( Kyvelou, Sinou, 2006). Even if many methods for evaluating the environmental performance of buildings are being currently developed in the world, according to the local cultures and organisation (LEED, CASBEE, GBTool, BREEAM), tools developed in the Mediterranean are very limited. Among them, we should distinguish VERDE, a software system for assessing the environmental performance of buildings in Spain (Macias et al.,2005), and the HQE® process developed in France and presenting a mostly open character: it integrates a great number of parameters, requires a mode of management of the operations inspired by the international standard ISO 14001, and consists of a project methodology instead of a simple ex-post certification like in the majority of the other existing methods. Thus, HQE® offers an interesting framework for capitalising experience feedbacks, and for seeking common denominators. In the framework of a LIFE-ENV Project, a study has been carried out by experts of the SD-MED Network ( Kyvelou et al. 2006) to elaborate an innovative mediterranean methodology based on the existing methods and approaches. This study has been validated by the HQE Association. Conclusions and recommendations of the session have been as follows : a/ Assessment tools, either rating or labelling, should be simple and friendly to the user and should be based on benchmarking. b/ Sustainable city tools at different scales (urban planning scale, neighbourhood scale) have to be developed. Transfer of knowledge from existing tools ( e.g SUDEN tool, DPL tool) in Mediterranean countries should be supported. c/Integration of economic and social aspects in the tools has been proposed, as well as involvement of actors like decision makers, private companies, industrial actors

d/ usefulness of case-studies and related training and education programmes has been claimed  
e/The need to “work together” was finally revealed.  
f/ It has been argued that the effective use of such tools presupposes an appropriate substructure at national or regional level that would establish extensive databases with statistics, data on regulations etc.

*Financial instruments and mechanisms* as well as realities and perspectives of *market development* have been the *fourth axe* of the conference agenda:  
a/ It was claimed that scarce public resources and funds mainly for rehabilitation of public buildings and other infrastructures lead to the need to implement public-private partnership and third party financing schemes.  
b/ It has been argued that provision of energy services has to be combined with the proper energy management in buildings.  
d/ Development of ESCOs in the Mediterranean is inhibited by some legislative and market constraints.  
e/ indirect financial instruments were proposed. Share of cost between the user and the community has been also mentioned, already practiced in some cases. Important recommendations have been a/ the complementarity of financial tools with policy tools, training and qualification measures.  
b/ since subsidies are not adequate, nor sufficient, the need to identify best practices of financial instruments to mobilize funds and involve proactive key-players (investors, contractors, ESCOs etc. has been outlined.  
c/ Experience has to be developed in the Mediterranean from pilot projects implementing third party financing schemes  
d/ Efforts and willingness of Mediterranean countries to clarify relevant legal framework have to be supported since key market actors are ready to act.  
e/ the need of raising public awareness and informing the public on SB implementation instruments has been identified. User’s participation has been also identified.  
f/ to attract investors and other key-players one has to convince about the profits of SB, about what is

good for the user and the community as well, in terms, mainly, of value for money.  
g/ development of ESCOs has been recommended meaning not only energy but environmental service companies which implies the need of tools to quantify environmental quality .  
h/ Finally, the need to develop Life Cycle Cost Tools has been mentioned to facilitate not only energy but environmental performance contracting.

Finally, a general way of action has been drafted by the main rapporteurs (Kyvelou, Bidou, 2005) to constitute a suggestion to SB05Tokyo: In order to achieve an effective macro-regional implementation concerning sustainable built environment, one has to find a solution to the following contradiction: on the one hand *create a common language*, necessary to exchange experiences and knowledge and on the other hand promote *specific ways to reach environmental performances* according to the geographical, cultural and technical local contexts. To be efficient at a macro-regional level, one should certainly think about *a mechanism to elaborate methodological bases* needed to explore environmental excellence and diversity in different local conditions. These bases have to respond to specific problems and needs to help local actors to create their own systems. Thus, a proposal for coordinated action has been formed concerning the establishment of a *Sustainable Building Observation Network* in the Mediterranean. This was an already outlined joint proposal of the main rapporteurs (Kyvelou, Bidou, 2003). This observatory has to keep an independent, non-governmental and coordinating character so as effective participation of all actors, players and stakeholders be ensured (international organisations, states, local authorities, construction sector, and mainly NGO’s, civil society). This observation network could also constitute a framework in order to : regularly monitor the environmental performance of the building sector in the region,

encourage greener public purchasing strategies for construction procurement and undertake ex-post evaluation of policy instruments. (OECD, 2003)

### 3.2 A Mediterranean Sustainable Building method?

The idea of a new Mediterranean building performance assessment tool was for the first time initiated by a French-Hellenic cooperation network (see <http://www.sd-med.org>), in the framework of a LIFE-ENV Project. The project, mostly based on the French approach HQE® aimed at shaping a specific Mediterranean methodology, with adaptability at a macro-regional level. The Project team of experts (Kyvelou et al., 2006) has agreed on the principle that a new mediterranean methodology has to be an operation methodology (covering building decision making, design, construction, use of the bulidng and end of the building) based on the concept of “Efficiency” from both the *social, economic* and *environmental* point of view, that is taking into account modern building sustainability approaches involving all three above major parameters. Given the fact that the HQE® process concerns mainly the minimisation of the building environmental impact, the team of experts has examined in all the existing tools how the three above dimensions have been integrated and proposed a method based on the systemic and multi-criterial HQE® process but enriched with *social and economic factors* as well. The fact that the proposed method improves the HQE® process has been validated by the HQE Association, which pinpoints the need to extend the Environmental Management System (SME) to a Sustainable Development Management System. (SDMM).

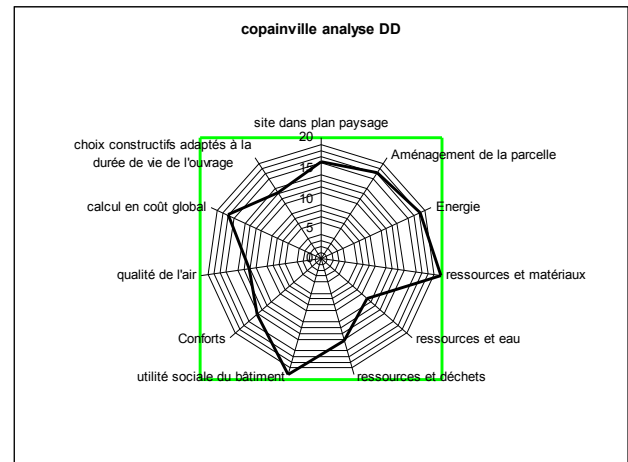


Fig.1 An example of sustainable development analysis for buildings, Source : J.Hetzel

The factors to be taken into account for the built-up of a new method proposed by the experts’ team (Kyvelou et al., 2006) working on the project are being presented in Table 1.

Table 1- Factors to be taken into account in a Mediterranean *SD-MED* process

<b>A. Criteria affecting environmental efficiency</b>	
<b>A1. Resources and environmental impact</b>	
Minimize impacts on Resources (ENIC)	<ol style="list-style-type: none"> <li>1. impact on energy resources</li> <li>2. depletion of raw materials</li> <li>3. water use and water management</li> </ol>
Minimize Pollution emission (ENIC)	<ol style="list-style-type: none"> <li>1. emission to air (CO2)</li> <li>2. water effluents</li> <li>3. solid waste generation</li> </ol>
Minimize Local and regional impacts (ENIC)	<ol style="list-style-type: none"> <li>1. impact of building with regard to urban form</li> <li>2. heat island effect</li> <li>3. atmospheric light pollution</li> </ol>
<b>A2. Environmental quality</b>	
Improving Indoor environment (ENIC)	<ol style="list-style-type: none"> <li>1. Acoustic comfort</li> <li>2. Thermal comfort</li> <li>3. Visual Comfort</li> <li>4. Air Quality</li> <li>5. Activity comfort</li> <li>6. Olfactory Comfort</li> <li>7. Adaptive opportunity</li> </ol>
Improving Quality of service (ENIC)	<ol style="list-style-type: none"> <li>1. Functionality- Controllability</li> <li>2. Flexibility-Adaptability</li> <li>3. Durability-maintenance</li> <li>4. Waste management</li> </ol>
<b>B. Criteria affecting economic efficiency</b>	

Improving Economic efficiency (ECIC)	<ol style="list-style-type: none"> <li>1. Cost of land and construction</li> <li>2. Life Cycle cost (€/year)</li> <li>3. Waste management and emission costs (€/year)</li> </ol>
<b>C. Criteria affecting social efficiency</b>	
Improving Social efficiency (SIC)	<ol style="list-style-type: none"> <li>1. health and productivity</li> <li>2. security for building users</li> <li>3. access for physically handicapped persons</li> <li>4. access to direct sunlight from living areas of dwelling units</li> <li>5. access to private open space from dwelling units</li> <li>6. visual privacy from the exterior in principal areas of dwelling units</li> <li>7. access to views from work areas on offices and other commercial buildings</li> <li>8. user participation</li> <li>9. job creation</li> </ol>
ENIC :	<i>Environmental Issue of Concern</i>
SIC :	<i>Social Issue of Concern</i>
ECIC :	<i>Economic Issue of Concern</i>

#### 4. CONCLUSIONS

Sustainable building or sustainable built environment is the logical outcome of building or built environment with quality. Nevertheless, sustainable building is not a new technique. It is more a frame of mind, taking into account the consequences of all building-related decisions. In most cases, the techniques or know-how already exist. Specifically in the Mediterranean, local traditional architecture can provide numerous and very significant examples of environmental quality in building with emphasis to passive solar design and systems. Currently, in order to proceed to the elaboration of effective macro-regional tools, we have to find a solution to the following contradiction: on the one hand create a common language, which will be necessary to exchange experiences and knowledge, and on the other hand promote specific ways to reach environmental performances according to the geographical, cultural and technical local contexts ( Bidou, Kyvelou, 2003). In the above analysed context,

environmental management systems, certification, standardization, technical tools and solutions can have a crucial role. Nevertheless they cannot bring best solutions by themselves. They can only be tools for both the decision-makers, the contracting authorities, the architects and the engineers. The way to use those tools will continue to be a matter of human ability to create built environment, with sensibility, technical competence, sense of dialog and experience. This has been the concluding major outcome of the Euro-Mediterranean Athens Conference.

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