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30th International PLEA Conference: SUSTAINABLE HABITAT FOR DEVELOPING SOCIETIES – Choosing The Way December 16 -18, 2014; Ahmedabad, India


Proceedings


Edited by: Rajan Rawal, Sanyogita Manu, Nirmala Khadpekar


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Day 1: 11:30-13:10 – Tuesday, December 16, 2014

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**SUSTAINABLE HABITAT FOR
DEVELOPING SOCIETIES**
Choosing the way forward

December 16 -18, 2014

Proceedings
Vol. 4

CEPT University



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Sustainable habitat: market trends and testing of innovation products

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ABSTRACT

Sustainable development is recognised as a particular challenge, with the need to reduce costs and increase efficiency. In this contest there is continued interest in determining how to enhance innovation in the construction industry, since innovation is vital to successful, long-term company performance in the construction industry. But what is the role of the innovation for systems and components in the future? Will we be able to change the existent technological systems and to develop innovative products in order to influence the building market or create really new ideas capable of change to the life style of the people?

The objective is achieve a sustainable good quality construction as a continue process starting from the new characteristics and new opportunities for the enterprises and develop new components with high efficiency in order to satisfy the construction market and to meet the demand for high-performance by the users. To achieve this, a close relationship between research world and manufacturing companies play a key role, especially in the development phase of new performing products and for the improvement of new architectural solutions studied for their integrability in the buildings. A market trend, create by new business inquires, develop a greater attention on energetic and environmental issues.

INTRODUCTION

Several key factors influence the evolution of building energy consumption and emissions, including population growth, which increases demand for residential buildings and services. Building sector energy consumption grew 18% between 2000 and 2010, to reach 117 EJ – around one-third of global final energy use, producing about one-sixth of end-use direct CO₂ emissions. So the buildings are responsible for the largest share of energy consumption and associated greenhouse gas (CO₂) emissions.

The challenge of the future efforts of the construction sector should be properly addressed by policies in order to mobilize the market towards a low carbon society and trigger multiple benefits (such as the independence from energy imports from politically unstable areas, job creation, improved air quality and indoor comfort, reduced fuel poverty etc.).

Near-zero energy consumption in new – and existing – buildings and communities is possible. Designing a carefully chosen research and development strategy will enable the building industries to move from incremental – to substantial – energy savings and reductions in greenhouse gas emissions. The aim of the implementing agreement for a programme of research and development on energy in buildings is to take advantage of energy-saving opportunities to remove technical obstacles to market penetration of new energy conservation technologies for community systems and residential, commercial, and office buildings. To implement this strategy, research activities have to focus on dissemination, decision-making and building systems. When buildings are constructed or renovated, a whole-building perspective is preferred, which involves considering all parts of the building and the construction process to reveal opportunities to improve energy efficiency. Numerous whole-building perspectives and policy mechanisms exist, such as building performance certificates and whole-building labelling programmes.

Author is a professor in the Department of Architecture, Florence University, Italy.

In these perspectives, detail the building envelope's impact on energy consumption should not be underestimated. While whole-building approaches are ideal, every day building envelope components are upgraded or replaced using technologies that are often less efficient than the best options that will be available if we invest in the innovation. These advanced options, which are the primary focus of the future in the construction, are needed not only to support whole-building approaches but also to improve the energy efficiency of individual components:

- high levels of insulation in walls, roofs and floors, to reduce heat losses in cold climates, optimised through life-cycle cost (LCC) assessment;
- high-performance windows, with low thermal transmittance for the entire assembly (including frames and edge seals) and climate-appropriate solar heat gain coefficients;
- highly reflective surfaces in hot climates, including both white and “cool-coloured” roofs and walls, with glare minimized;
- properly sealed structures to ensure low air infiltration rates, with controlled ventilation for fresh air;
- minimisation of thermal bridges (components that easily conduct heat), such as high thermal conductive fasteners and structural members, while managing moisture concerns within integrated building components and materials.

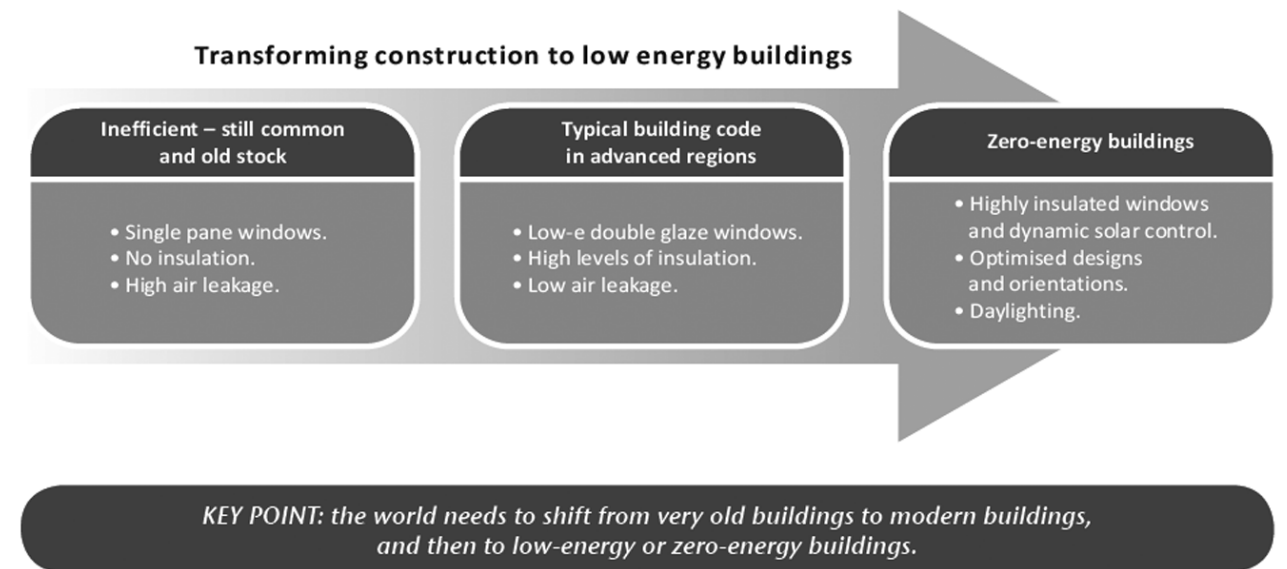


Figure 1 Progression construction of building envelopes from old stock to future technology. (Source: IEA Report Technology Roadmap Energy efficient building envelopes)

Analysis of building envelopes is complicated by the extreme global diversity of building materials, climates, and standards and practices of building design and construction, but it is vital to ensure for new and retrofit buildings, the use of the most efficient technologies. So, the suitability of energy-efficient technologies depends on the type of economy, climate and whether the materials are being used for new buildings or retrofits. To achieve the large energy savings that efficient building envelopes can offer, full market saturation of high-priority, energy-efficient building materials is essential. Not only but is more important to invest in RD&D on the following technologies that will lead to greater returns on investment:

- highly insulated windows
- advanced, high-performance, “thin” insulation
- less labour-intensive air sealing, and lower-cost validation testing
- lower-cost automated dynamic shading and glazings
- more durable and lower-cost reflective roof materials and reflective coatings.

Cost is a primary barrier to greater application and in some cases there are also concerns about long-term performance. There also is a lack of knowledge about innovative applications, and detailed design guidelines are limited. Greater effort is

needed to highlight applications that are viable in market terms, such as locations in buildings with space limitations that will usually require a combination of high thermal performance insulation with lower material cost. Also, a systems perspective can allow for high-performance insulations to reduce labour costs, especially for building renovations (e.g. interior wall insulation in historic buildings), so cost-effectiveness does not have to be limited just to the material cost of a system.

INTENT AND OBJECTIVES OF APPLIED RESEARCH WORK

What is the role of the innovation for systems and components in the future? Will we be able to change the existent technological systems and to develop innovative products in order to influence the building market or create really new ideas capable of change to the life style of the people? The answer to this questions is achieve a sustainable good quality construction as a continue process starting from the new characteristics and new opportunities for the enterprises and develop new components with high efficiency in order to satisfy the construction market and to meet the demand for high-performance by the users. Market barriers preventing the adoption of energy-efficient buildings or building materials can be real or perceived. As well as simple failures such as a lack of knowledge about alternative options, they can include concerns about the performance, expected energy savings, reliability and service life of a new product. Some new construction materials and approaches oblige builders to completely change the way a building is erected.

Barriers in emerging markets can include import tariffs, a lack of product performance metrics and a lack of installation procedures. In many countries there are also institutional barriers such as lack of government oversight or interest, lack of appropriate market signals to promote efficiency, and lack of basic infrastructure. To deploy energy-efficient buildings, several institutional and market barriers need to be overcome. The following core elements should serve as good starting points for policy makers in regions where construction practices do not typically include energy-efficiency strategies:

there is a large array of technical requirements to enable the installation of more efficient building envelopes. These include proper test performance metrics and associated testing equipment so that third-party test ratings, certificates and labels can be established. Skilled labour is essential to conduct tests, assess alternative building solutions, promote efficient building policy, install new materials, conduct inspections and ensure compliance. It is also vital to make available general education materials such as guidelines adapted for the specific markets; energy calculators based on local climate, energy prices and occupant behavior; and an overall improved knowledge base of more efficient options.

while demonstration buildings can be built with materials imported from distant places, for energy-efficient buildings to become viable the materials need to be manufactured much closer to the construction region, since shipping costs for large, heavy materials can be prohibitively high.

to ensure that factories are built that can produce commodity materials on a large scale, governments need to give clear signals about their interest in promoting efficient building envelopes, and often other support such as market-based or higher energy prices (higher tariffs). Policy makers need to have an open dialogue with the building material industry about key elements that will help drive investment. Manufacturing building materials domestically, or at least regionally, creates jobs not only in local manufacturing but also for global investors involved in specialised tooling and unique raw materials.

In this contest, in Italy, to overcome these barriers and stimulated by the scenarios provided by the European Community, the regional administration of Tuscany, has funded a research project "Abitare Mediterraneo" (www.abitaremediterraneo.eu) aimed to develop synergy between industrial companies, builders and research centres, to increase competitiveness in building sector and meet European and National standard requirements. The project aimed to increase the energy saving in Mediterranean climate, focusing on summer comfort, developing and testing innovative solutions with national and EU companies. The research has developed advanced tools, as a Database, a Test Cell, and a new Spin-off on sustainable architecture and innovative products.

APPROACH AND OUTCOMES

The catalog of meta-design solutions "Abitare Mediterraneo" analyzes performance requirements of specifics of building innovative components for Mediterranean climate. This library is a reference point for designers that approaching not only at energetic projects but also at projects were, new pattern of space, contribute at indoor comfort. The database want create a map of the building system were technical and innovative typological solution are connoted by the requirements of space and

performance of solution. Inside the database it's possible choose, within a large group of products for building, components and technological systems (new and existent) more efficient to energy saving; the user can develop meta-design solutions in terms of performance and in relation to environmental characteristics of Mediterranean areas. For every solution is possible identify the most important requirements and some meta-design indications, connected with the technical solution database where it is possible to found different solution for answer at requirements indicated.

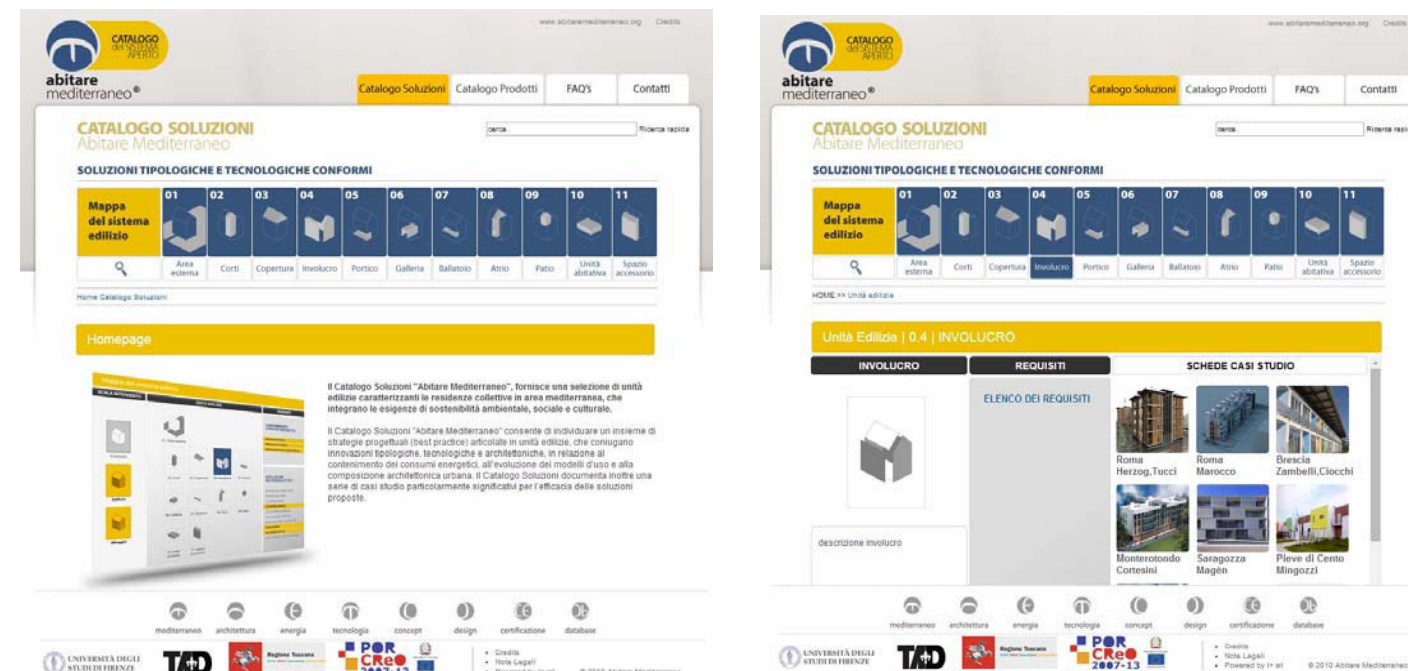


Figure 1 The database web screen with Database structure (Source: www.abitaremediterraneo.eu)

This database structure have developed a system to surfing inside a specific meta-design, technical and performance solutions of building and envelop in relationship with the energy legislation. Moreover, the multimedia library create a complete tool to help designers, companies and public administrations to design building in Mediterranean climate.

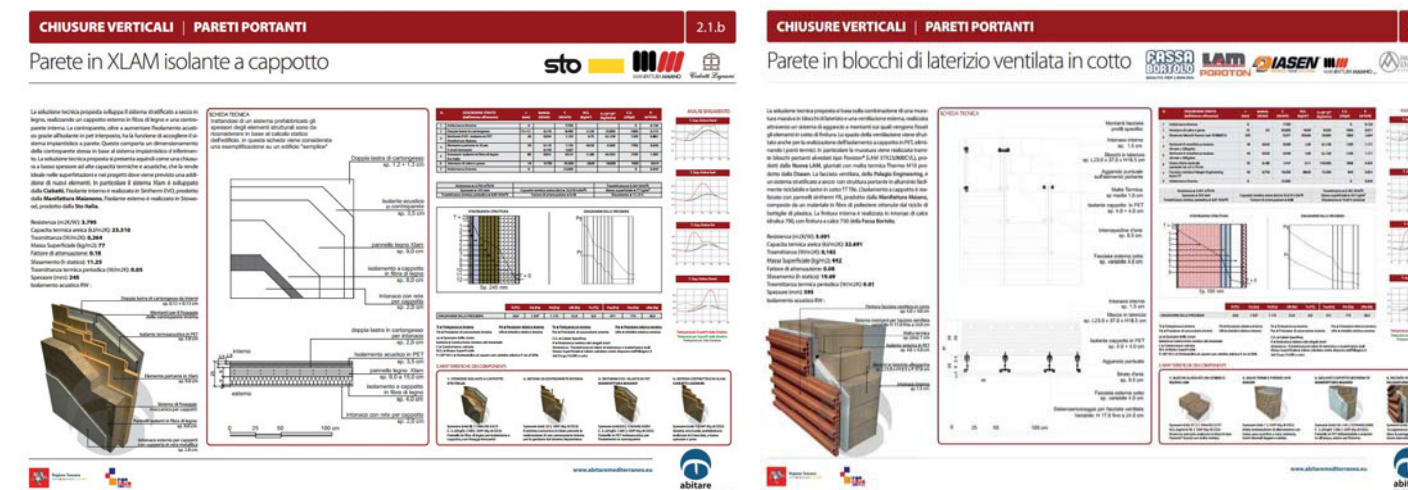


Figure 2 The database web screen with the products and the specific performance that characterize them (Source: www.abitaremediterraneo.eu)

At the moment the research group have not yet carried out any checks on how this tool has been used until now. The next step will require a careful analysis to verify, through a dedicated monitoring system for the evaluation of the results and thus validate the effectiveness of this tool.

Another important result of Abitare Mediterraneo research, was the construction of an outdoor Test Cell to assess the dynamic thermal behavior of building surfaces; an instrument for giving the opportunity principally to local building market to test new products that need to be used in Mediterranean Climate, products that are able to reduce annual energy consumption in buildings working with a sufficient insulation level and appropriate thermal inertia if necessary. In fact, with this tool, can be run tests on innovative exterior wall elements, in exterior ambient conditions and the data that can be obtained, include thermal damping factor, delays, solar aperture factor and U value. The test cell features instruments for multi-channel monitoring a weather station and their own analysis software. Outdoor test cells, where there is a high degree of control of the indoor environment, well-specified constructions and high levels of instrumentation, can certainly fill the gap between laboratory testing and full-scale building testing. In fact the main use of testing in outdoor test cells is the link with simulation modelling.

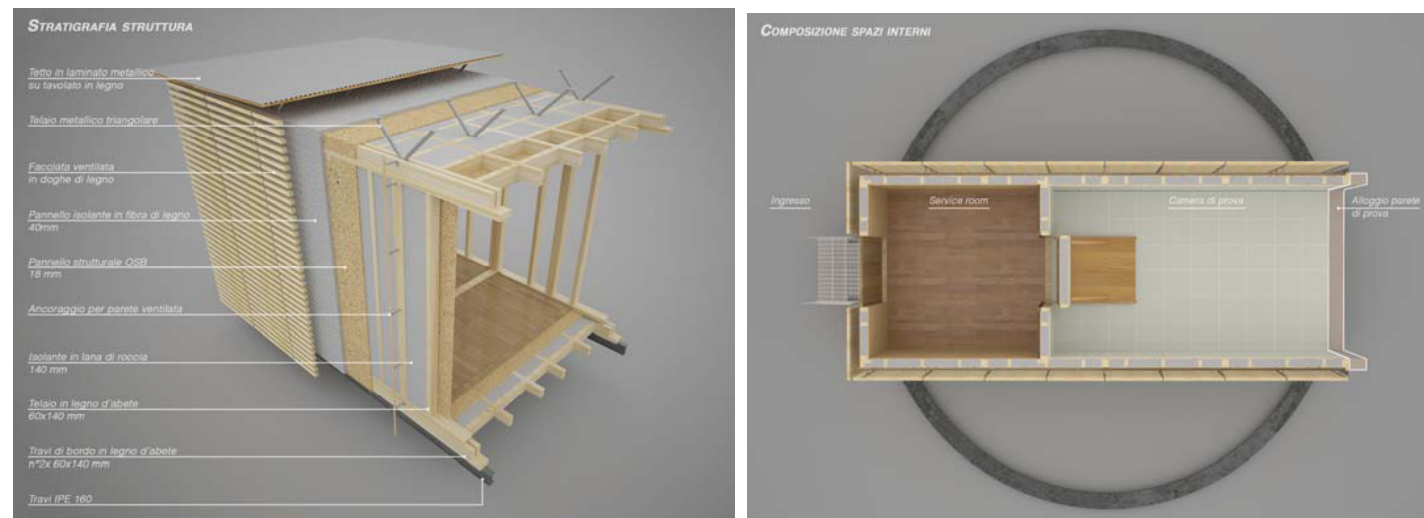


Figure 3 The structural and technological project of outdoor Test Cell realised in Italy (Florence) within the Abitare Mediterraneo project. (Source: www.abitaremediterraneo.eu)

The innovative perspective is that dynamic simulation programs have improved in capability and validity and can therefore be used with some confidence in predicting energy and environmental performance of buildings. However, where a new component is under development, for example an advanced glazing, a hybrid photovoltaic module or shading component, then high quality datasets from outdoor experiments can be used to ensure that the simulation program is capable of modelling that component. If so, it is considered that the simulation program can then be used to model the component when integrated into a full-scale building.

Basically the principal mission of this research programme was to develop and facilitate the integration of new technologies and processes for energy efficiency and conservation into healthy, low emission, and sustainable buildings and communities, through innovation and research. So the outdoor test cell realized in Italy within the Abitare Mediterraneo project, is a point of reference for companies and manufacturers of innovative components; a technology lab with an extensive program of service and open to all producers who wish to verify the performance of new products for the building to be placed on the market to promote energy conservation and sustainability in construction.



Figure 3 The outdoor Test Cell located in Italy (Florence) in the University Campus (Source: www.abitaremediterraneo.eu)

CONCLUSION

Innovation within a project, company and occupational industry provides the opportunity to realize significant benefits and, in a competitive market, is a requirement for continued existence. All companies must innovate at some level in order to stay competitive. Innovation in the construction industry may take place at a lower rate compared to other industries due to the structure and characteristics of the industry and projects, but it does, and must, occur in a competitive market.

Product innovation is an important activity in corporate entrepreneurship and technology management. The successful introduction of new products into the market is a critical factor for the survival and growth of companies. However, the increasingly dynamic and turbulent environment in which firms compete makes the commercialization of a new product not only a necessary, but also a risky venture.

Anyway, to unleash the full potential of energy savings related to buildings, the additional value of improved energy efficiency (e.g. improved indoor climate, reduced energy cost, improved property value, etc.) must be recognised, and the lifetime costs of buildings have to be considered rather than just focusing on investment costs. Over the last decade, building policies in the European Union increased in their scope and coverage and are moving towards an integrated approach taking into account the energy, environmental, financial and comfort related aspects.

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