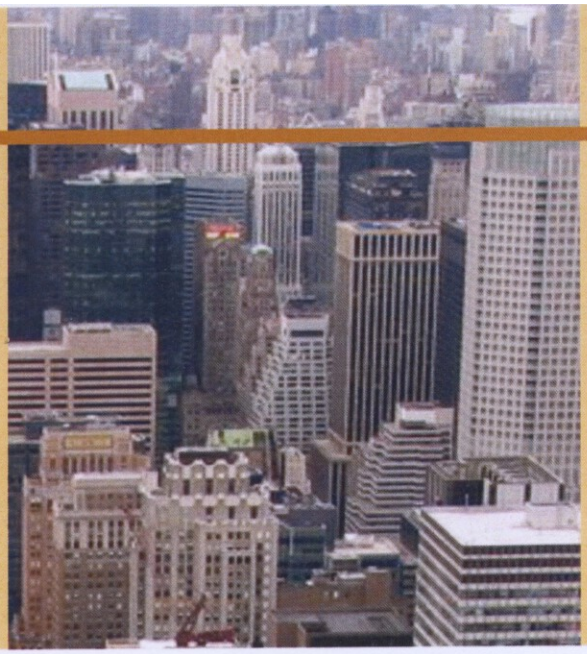

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of the International Conference on ***Changing Cities II***
Spatial, Design, Landscape & Socio-economic Dimensions

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EDITOR:
Prof. Aspa Gospodini,
University of Thessaly

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A sustainable future for historic buildings

F. Calvanus[1], M. Noonan[2], K. Theologidou[3]*

[1]Municipality of Bayonne, Sustainable Development Department, Place du Général Leclerc, 64100 Bayonne, France

[2]Elected member of Kilkenny County Council and Green Party of Ireland, Spokesperson for Environment Community and Local Government, City Hall Kilkenny, Ireland

[3]Architect, independent researcher specialized in conservation of monuments and sites P. Mela 22, Thessaloniki, 54622, Greece

*Corresponding author: E-mail: patrathe5@gmail.com, Tel: +306972770834

Abstract

In Europe there is much discourse and academic research towards improving the energy performance of historic buildings. Proper thermal regulations have yet to be adapted at national or European level, due to a concern that the necessary retrofitting works could affect their historic and cultural integrity. However, a lack of an adequate regulatory framework coupled with the need to improve thermal comfort in heritage buildings can often lead to interventions that are not sympathetic with the character, values and material properties of these buildings. Architectural heritage is a non- renewable resource. Therefore, proper conservation and adaptation to current and future needs, as a living organism and not as a frozen object, is urgent. In this paper, an attempt is made to explore the conditions and also the different tools and strategies to ensure harmony between the character and values of built heritage and its place in ever evolving urban spaces.

Keywords: Heritage; thermal regulations; sustainability; strategies.

1. INTRODUCTION

"Future proof historic centers" was the motto of LINKs project, realized within the URBACT II European program. Under the title "Low tech Inherited from the old European city as a Key for performance and sustainability", its main issue was "how can historic centers be considered as tomorrow's eco-districts". To succeed this, an integrated approach is crucial, which will answer to the four pillars of sustainable development: environmental protection, social equity, economic growth and cultural continuity. The city of Bayonne was the coordinator of the project and partner cities Almeria, Anderlecht, Brusov, Budrio, Delft, Kilkenny and Veria.

The old European town is "The sustainable city model". It has high architectural quality built mostly by local materials and techniques, strong identity, diversity and proximity of urban functions and holds a strong potential for cultural and economic growth [1].

Old buildings play an important role in the historic center, the old European town, as they mainly determine its architectural quality and historic character. However, they are in danger due to extensive retrofitting works and to a contradictory and often inadequate regulatory framework, both, from the preservation and energy efficiency point of view.

Architectural heritage is a non-renewable resource. Improper interventions might cause its permanent loss. The discourse and academic research at an international level has opened in the last decades in an effort to readapt the concept of protection and conservation in the current situation that is climate change and sustainable development. However, there is much to be done at international, national and local level.

Based on the results and the experience of LINKs project, this paper focuses mainly on buildings as vital part of historic centers under threat; moreover, it goes a step forward by further specifying

measures and strategies that will ensure their sustainable future.

2. HISTORIC BUILDING: "THE SUSTAINABLE BUILDING MODEL" UNDER THREAT

2.1 Tracing values

The debate to define the values of monuments goes back as far as the late 19th century and is constantly evolving. Historic values, aesthetic values, technical values, building values, age values, memory values, both individual and collective and use values are some of the most important characteristics to be examined in the process of evaluating the importance of historic buildings, while authenticity and intangible values are also considered very important. Often the different values are conflictual, even if the restoration work is performed in a very strict context from a preservation point of view. History, aesthetics and unity of form are very well known dilemmas [2].

Climate change brings to discussion more values from a different point of view. Embodied energy is probably a new meaning in the Heritage World, proved to be of great importance. As English Heritage mentions "...any historic building represents a significant past investment of energy and materials. Demolition and replacement means not only losing all of the resources embodied in the original buildings, but also the investment of yet more energy for demolition, the creation and delivery of new construction materials, the building process itself, and the disposal of the resulting waste" [3].

It worth also mentioning a recent research in the USA where it is argued that "it takes nearly 65 years for an energy efficient new building to save the amount of energy lost in demolishing an existing building ... the energy embodied in the construction of a building is 15 to 30 times its energy use" [4].

Sustainable development opens more issues relevant to values of the architectural heritage. It holds a strong potential for social cohesion, employment and economic development coming from different economic sectors, like construction and tourism. For example, the renovation and maintenance sector participated in 2013 with the 27,5% of the total in Europe's construction industry, while it was estimated that tourism contributed €415 billion to the EU GDP12. It worth also mentioning that 15,2 million jobs were created in 3,4 million tourism enterprises, many of which linked to heritage and 27% of EU travelers choose their travel destination on the basis of cultural heritage [5].

2.2 New trends in the conservation of architectural heritage

International Committees and Organizations have recognized the multiple role of our cultural heritage and have started, mostly in the last two decades, an effort to further develop attitudes and guidelines for its protection in the context of sustainable development, where people have a central role to play. Among others:
ICOMOS, adopted in 2011 the Paris Declaration "On heritage as a driver of development" which is part of a series of initiatives it has taken in the last 30 years that connect monuments to economic and social development [6].

UNESCO, celebrating the 40 years of the World Heritage Convention in Kyoto, 2012, chose as a theme "World Heritage and Sustainable Development: the Role of Local Communities", thus reflecting the emerging concern that the protection of cultural heritage is closely related to economic and social development and the involvement of local people [7].

ICCROM, promoting people-centered approaches, stresses the importance of exploring new approaches to conservation and management of heritage which should differ from the conventional methods. Among the different facets of conservation it includes the influence of heritage on the

contemporary life of people, the respect for people's voices in conservation and management of heritage and the recognition of the custodianship of people for the long-term care of heritage [8].

The Council of Europe for the Education, Youth, Culture and Sport declares that "wise heritage management can be successful and sustainable, for example through the energy-efficient re-use of historic buildings, and the promotion of greener transport and cultural tourism" [9].

In this context, all organizations recognize the need to readapt conservation approaches to current needs where important role plays the re-use and improvement of energy performance of historic buildings with compatible methods to their character and construction values.

National agencies in different countries have also taken action to promote the upgrading of the energy efficiency of traditional buildings. Completely indicative:

English Heritage has produced a lot of material around climate change and methods to improve the energy performance of historic buildings. Now, split into two organizations and under the new one called "Historic England", it has created a website where owners, as well as practitioners and interested public have important information about the proper renovation of their old building as well as information about its energy upgrading [10]. In order to help owners properly retrofit their properties a platform has been developed, called "Whole Home Energy Toolkit" [11] which gives different options for saving energy to their home.

Similar efforts have been undertaken by the "Maisons paysannes de France - National Association for the safeguard of built rural and landscape heritage". At its website owners and practitioners can select all relevant information about old buildings and energy-saving measures [12].

2.3 Energy improvement of architectural heritage in practice

We could broadly distinguish buildings in historic centers into two types: buildings of high importance which are listed and highly protected and buildings which form part of architectural ensembles, thus adding to the character of the area. In between there is of course a range of buildings that hold different values, which need to be examined case by case. These buildings are probably the majority in historic centers and perhaps these are the cases that need more concern.

According to the European Parliament Directive 2010/31/EU, built heritage maybe excluded from the national legislation for the Energy performance of buildings: "Member States may decide not to set or apply the requirements referred to in paragraph 1 to the following categories of buildings: (a) buildings officially protected as part of a designated environment or because of their special architectural or historical merit, in so far as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance [13]". A more careful reading of the directive, however, shows that in fact these buildings are not excluded, but only in case "certain minimum energy performance requirements would unacceptably alter their character or appearance". Moreover, the possibility of excluding heritage from this legislation does not concern only listed buildings, but also buildings "as part of a designated environment".

In practice, it seems that the regulatory framework is blear and can, in a way, differ from country to country, or from district to district or even from authorized person to authorized person, when personal interpretation is involved in assessing values as well as appropriateness of measures. Taking also into account the different legislation framework for the protection and the energy performance and the different authorities in charge, it can be understood why in some cases extensive retrofitting works are executed and in others, the works are quite limited, thus influencing the comfort levels of the tenants or cause suffer from fuel poverty to low-income populations. The above attitudes do not apply usually to historic buildings with a high degree of protection but rather

to the buildings whose different values need to be further defined. These buildings are the majority in historic centers and mainly determine their identity and character.

As a result of these uncertainties and under the need to improve the thermal comfort of the buildings and reduce the energy cost, the owners often proceed to retrofitting works that turn to be harmful, not reversible and not always effective. These include replacements of building's components such as windows and roofs, or inappropriate insulating materials for walls, floors, which turn to be under-performing and also harmful for traditional buildings. Moreover, their placement at the internal facade of the external walls affects the whole breathability of the building which, in humid climates, can cause major damage in less than 10 years, and also causes disfiguration of analogies and internal space.

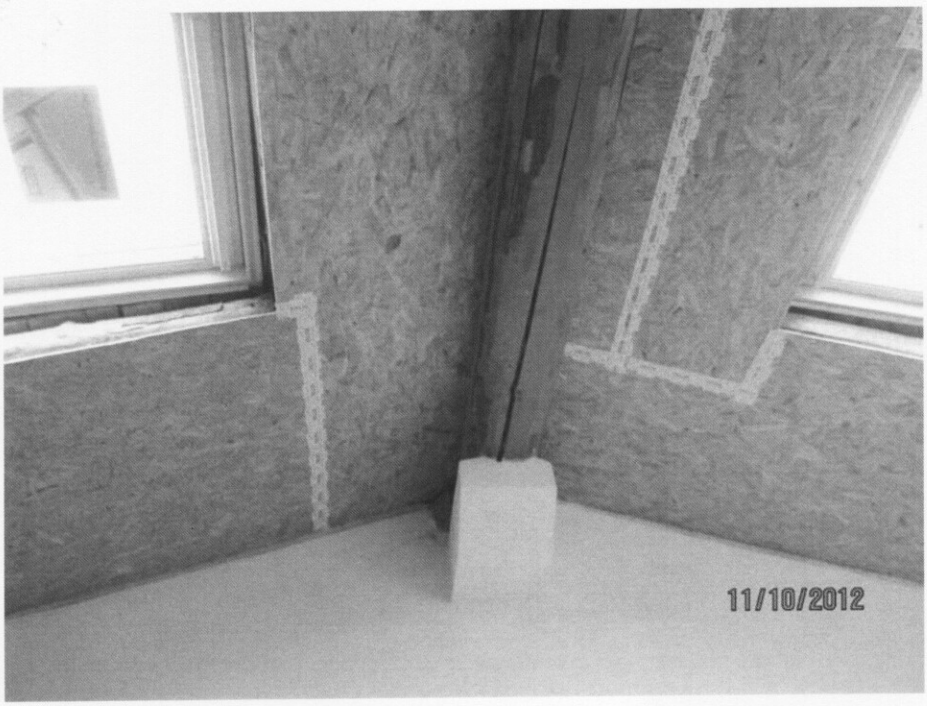

Figure 1. Insulation at the internal façade of the external walls.

However, different examples and more protected attitudes prove that there are different alternatives [14, 15], which can improve the thermal performance of the buildings and at the same time preserve the character and the building components [16].

In the case of the house '22 rue Bourgneuf, Bayonne, built in the 19th century, several solutions for insulation were discussed and compared, mainly based on "conventional insulation techniques" and ended to two options; either all the external walls to be insulated with mineral wool or as an alternative the masonries to be coated with hemp and lime and the timber wall with wood wool. The computer modelling results of the energy performance led to the conclusion that a better performance is achieved for winter with the integral insulation; however, in this case the summer comfort is unobtainable. Moreover, the climate in Basque areas requires a particular attention to be given to the breathability of the building. These considerations combined with the necessary attention to the global environmental footprint of the restoration, led the owner to choose the alternative solution, now recognized as an eco-restoration solution.

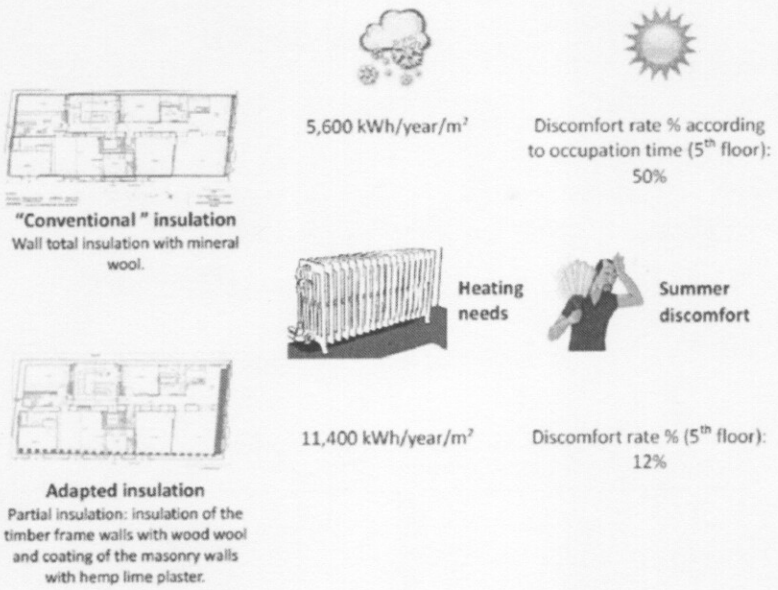

Figure 2. The house '22 rue Bourgneuf in Bayonne. Insulation alternatives. (source: LINKs Recommendations, 24)

In the case of protected buildings of great importance, heritage values usually prevail over energy improvement. In these cases, innovative solutions are often applied lately, which guarantee their sustainability.

The house "De Witte Roos" was one of the pilot projects at LINKs project, implemented by the Foundation De Witte Roos, the City of Delft and the National Service for Cultural Heritage. A national listed building in Delft, it was built in 1536 and had different alterations in the following centuries, with a major one in the 18th c., when a new façade was given to it. A range of special measures were taken to reduce energy use down to 80% and carbon dioxide (CO2) to 90%, compared to a conventionally restored historic building. Due to aesthetic reasons, the roof was partly insulated; walls and glazing were not insulated due to their monumental value, while the ground floor was insulated and also installation pipes were located under it. Architectural transparent elements were added, like a veranda and an inner courtyard, covered with a glass roof, mainly for use reasons, which also help to the reduction of energy losses [17].

Figure 3. The house "De Witte Roos" in Delft.

2.4 How much do we know about the energy performance of historic buildings?

Gradually, it becomes wider accepted that the existing knowledge about the thermal behavior of traditional buildings is inadequate and often misleads to inappropriate interventions. Historic buildings often perform better than assumed, as the thick walls with the limited openings create a more energy efficient environment than a post-war construction [18].

The materials and techniques used to improve the energy performance are usually unsuitable for traditional buildings as they were designed for post-war constructions with quite different qualities. At the same time, the knowledge for the thermal qualities of traditional materials, as well as composite constructions like stonewalls, brick walls or timber walls is quite limited, if not missing.

The existing computing models are also unsuitable to render the complexity of the thermal behavior of old buildings; a significant difference is often found between the real and the calculated energy consumption. This was established by a national research program, entitled BATAN (Batiments Anciens) implemented in France. The project has been leaded by the Ministry of Ecology and Sustainable Development and the Environment and the Agency for Environment and Energy Management (ADEME) in an attempt to model the thermal behavior of traditional buildings. The City of Bayonne participated to this program. Three buildings in the historic centre of Bayonne were monitored during a year. The diagram ... shows the considerable discrepancy between the real energy consumption of old buildings and the outcomes from three computer simulations [19]. According to this project three characteristics define the specific behavior of traditional buildings built prior to 1948, on which current computing models meet problems:

- The influence of the local environment: special sensitivity to the local climate, urban microclimate, bioclimatic integration of the building in its environment
- The transfers of heat and moisture within the envelope, inertia and permeability to air and water vapor, and
- The role of occupant (misfits occupation scenarios)

Thus, the main objectives of the project BATAN were:

- To analyze the physical phenomena that characterize the thermal behavior of old buildings,
- To develop a new calculation model for assessing the thermal behavior of these old buildings.

The project allowed to identify several typologies of buildings according to their thermal behavior and new models has been developed. The determination of the heating needs and summer discomfort is now possible for buildings that meet the typologies identified in the project. However, the project also identified limits to the detailed knowledge, due to the complexity of the traditional materials and architectural organization of the old buildings.

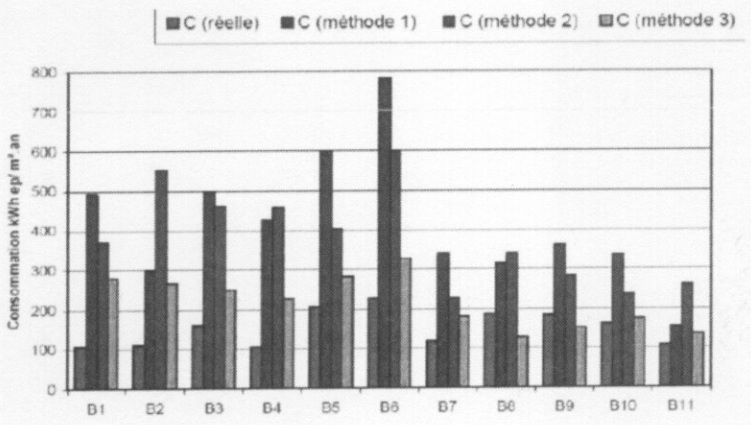

Figure 4. BATAN's results showing discrepancy real energy consumption (left column) and computer simulations (source: LINKs Recommendations, 23)

3. TOWARDS A RENOVATED, SUSTAINABLE AND PEOPLE CENTRED RESTORATION

The need to adapt heritage buildings to current needs and improve their thermal performance and the renovation works carried out helped in:

- Gradually building the concept of improving the energy performance of historic buildings among authorities on one hand and citizens/users on the other
- Developing techniques to improve the energy performance of historic buildings
- Applying techniques to a number of buildings, which creates knowledge and also motives for a greater number of owners/users
- Broadening concepts and theories for the protection of built heritage at an international, European and national level
- Developing research and international discourse
- Developing local markets by structuring demands and improving offers

This experience also highlighted the problems and the risks when retrofitting historic buildings. It seems, however, that the time is matured to precede a step forward to ensure a sustainable future for historic buildings by taking parallel actions at international, European, national and local level on a common base. This means:

- Promote knowledge to improve the energy performance of traditional buildings tailored to their thermal qualities; the wide dissemination of this knowledge is crucial.
- Broaden the values of historic buildings to include both heritage and environmental values. Sustainable development values have also a central role to play and they should also be incorporated.
- Ensure an effective administrative model that will bring together the different building actors, thus reducing uncertainties and bureaucracy
- Improve the environmental conditions of historic centers through planning at different city levels; that is city, neighborhood, building, by increasing for example green
- Encourage participation of all actors; stakeholders and citizens
- Ensure Economic motivations
- Apply effective monitoring of implementation at all administrative levels

All above need deep change to the attitudes of all actors.

3.1 Knowledge: a turn to the art of eco-restoring

Further to the international dialogue and relevant declarations and guidelines, scientific research is urgent, focused on traditional building and materials. They should include measuring methods and computer models to assess the thermal performance of traditional materials, building components and especially composite constructions. In the Paris declaration of ICOMOS [20], the need "to adapt methods of performance assessment and analysis of structures, thermal properties and safety to heritage requirements and not vice versa" is stressed.

Moreover, in the same declaration, the need to bring back traditional building skills and use traditional materials in the restoration of historic structures is pointed out, which makes it crucial to have good knowledge of their properties and compatible methods to improve their properties. Another characteristic of traditional materials is their locality, which means that readapting former techniques and local supply chains to current needs opens huge perspectives for local economies, as mentioned in LINKs recommendations.

3.2 Introducing renewable energy

A sustainable future for historic buildings means, among others, continuous use which presupposes good living conditions, where central position hold the sense of comfort and low energy cost. It is

reasonable that in many cases the historic values of traditional buildings will limit the possibilities to improve adequately their thermal performance. In this case, there are two options. Either proceeds to retrofitting works that will reduce these values, such as replacement of building components or pay additional energy bills. This is where renewable energy could help.

The use of renewables on buildings in historic centers either listed or not, sounds awkward and distasteful. However, and under specific conditions, this option could be preferable. The discussion has already started and in some countries different alternatives are tested.

English Heritage in "Climate change and the historic environment", 2008, argues: "Some types of micro-generation equipment, such as mini wind turbines, or micro combined heat and power plants, are unlikely to present problems if sensitively located on historic buildings; others may be more visually intrusive and difficult to accommodate. Consideration should be given to minimizing physical impacts on the historic fabric of buildings and ensuring reversibility wherever practicable". In some cases the use of photovoltaic is permitted like in Denmark under the condition that they are hidden and do not affect the landscape. Similarly in Delft, a partner city in LINKs project, the use of photovoltaic on the roof of historic buildings is permitted on condition that they are not visible and the intervention is reversible, including the preservation of roof tiles. A special reference is made to the new generation of photovoltaic, with tiny dimensions, in the near future [21]. There are also other possibilities for the use of different forms of renewable energy. In the case of Tailin, sea water was used for heating the Estonian Maritime museum, built in 1914 [22]. In other cases biomechanical energy is used, meaning the use of piezoelectric floors, in buildings where human traffic is of a high level [23].

Moreover, renewable energy could be designed and used at district level to serve groups of buildings, like the use of geothermal.

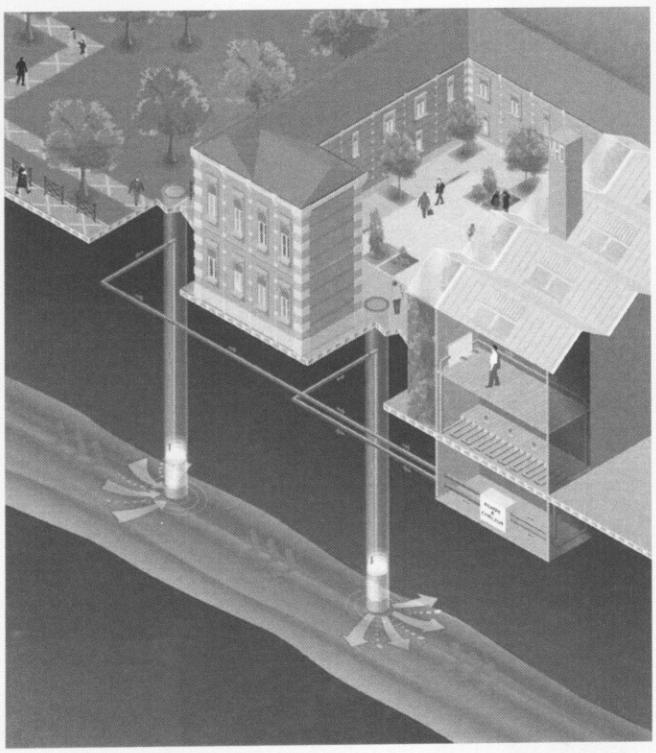

Figure 5. Geothermal heating pump in Lille (source: Living green, 28)

Renewables versus replacements and permanent loss of authenticity seems to be a new dilemma.

3.3 Innovative governance

Innovative governance is crucial to ensure effectiveness. Action plans at city levels to include all relevant issues need to be elaborated and executed. Besides administrative matters, they should also include participatory procedures, financial incentives, dissemination of knowledge /training and monitoring of the implementation.

The empowerment of participatory procedures is essential "to create a sense of common ownership and involvement in the protection and creative continuity of the processes of conservation and the management of change" [24].

As analyzed above, the opposite views among authorities for the protection of heritage and environment may not be beneficial for historic buildings; they may also cause serious delays to the approvals procedures, thus discouraging any attempt for retrofitting. It seems very important to gradually produce a common legal framework based on the collaboration among the different actors and real knowledge about the energy needs of historic buildings and different alternatives to their improvement and support. The creation also of different tools to assess their different values would help to reduce uncertainties [25]. Furthermore, the unification of all responsible actors in the future to one authority with clear regulations and operating rules will be one more step ahead to the effectiveness and the reduction of bureaucracy.

Financial incentives to the owners to meet the additional costs resulting from the traditional character of their buildings are necessary. It looks as if these people are punished because they are owners or tenants in such buildings; they have a higher energy bill to pay, higher maintenance costs and probably less comfort in their home, the moment that the whole city and citizens benefit from the protection and enhancement of the historic center (development of tourism, economic development, improvement of quality of life). Therefore, they need to share the economic burden with all beneficiaries in a proportionate way; that means grants for the additional expenditures deriving from the specific character of their property.

4. CONCLUSIONS

In this paper many and different issues were brought to discussion. Each of them belongs to a specific scientific field. However, it was considered crucial to put them all together in the effort for an integrated approach, necessary for the adoption of effective measures and attitudes.

LINKs project (2009-2012) coincides with a period of an increasing interest, at an international level, to redefine the values of monuments and set a new framework of interventions to meet current needs relevant to climate change and sustainable development. However, and despite the efforts, the field is still uncertain. In the meantime, inappropriate restorations continue to be carried out which results not only in the loss of the authenticity and values of traditional buildings in the coming years but also in an enormous loss of money.

The revitalization is also a chance to slow down the urban sprawl, and therefore should be a priority. It is urgent for Europe to launch a vast program of research, information, training, financial and technical support. It is urgent for the authorities in charge to change attitudes and adopt a clear and common legal framework for the protection both, of heritage and environment. Now that the private and public financial resources are minimal, it is time to implement one of the most pragmatic principle of the sustainable development: doing better with less.

References

1. URBACT II-LINKs, Future-proof historic centres, 2010, *brochure*, Bayonne, 4-7.
2. URBACT II-LINKs, Future-proof historic centres, *Newsletter 3*, 2011, 2.

3. English Heritage, 2008. Climate change and the historic environment.
4. Rypkema D. D., 2008. Heritage conservation and sustainable development-initiatives in the United States. *Proceedings of the CHRESP: 8th EC Conference on Sustaining Europe's Cultural Heritage*, November 10-12, Ljubljana, Slovenia, 255-256.
5. Council of the European Union, 2011. Conclusions on cultural heritage as a strategic resource for a sustainable Europe. Education, Youth, Culture and Sport Council, Brussels.
6. ICOMOS, 2011. The Paris Declaration on heritage as a driver of development, Paris.
7. UNESCO, 2013. World Heritage Centre, Report on the 40th Anniversary of the World Heritage Convention, Kyoto.
8. ICCROM, http://www.iccrom.org/priority-areas/living-heritage/, 2015
9. Council of the European Union, 2011. Conclusions on cultural heritage as a strategic resource for a sustainable Europe. Education, Youth, Culture and Sport Council, Brussels.
10. http://www.historicengland.org.uk/advice/your-home
11. http://www.climatechangeandyourhome.org.uk/live/homepage.aspx
12. http://www.maisons-paysannes.org/actions/economies-denergie
13. European Parliament Directive 2010/31/EU, article 4, paragraph 2, 19
14. Cago C.W., 2013. Urban identity: heritage protection and comfort regulations in Geneva's current housing. *Proceedings of the International Conference on "Changing Cities" Spatial, morphological, formal & socio-economic dimensions* (ed. A. Gospodini), June 18-21, Skiathos.
15. Duran S.C., 2011. *Architecture and energy efficiency*. Loft, Barcelona.
16. Norrstrom H., 2013. Sustainable and Balanced Efficiency and Preservation in Our Built Heritage, *Sustainability,* **5,** www.mdpi.com/journal/sustainability, 2623-2643
17. URBACT II-LINKs: Future proof historic centers, 2012. Recommendations, 21-22 and URBACT II-LINKs: Future proof historic centers, Local Action Plans, 2012. 106-109.
18. English Heritage, 2008. Climate change and the historic environment.
19. URBACT II-LINKs: Future proof historic centers, 2012. Recommendations, 23-24
20. ICOMOS, 2011. The Paris Declaration on heritage as a driver of development, Paris.
21. Dulski B., Vliet C., Unen W., 2012. How progressive can cultural heritage management be? www.europeanenergyinnovation.eu
22. EU pilot project Tallinn: Restoration of seaplane harbour – Estonian Maritime museum www.meremuuseum.ee, http://www.youtube.com/watch?v=y0L_mHfdO7A
23. https://buildingenergyefficiency.wordpress.com/2012/12/11/reports-from-copenhagen-workshops-1what-can-cities-do-to-improve-energy-efficiency-in-historic-buildings-by-kleopatra-theologidou/, 2012
24. Rodwell D., 2010. Conservation and sustainability in historic cities. *Ricerche e progetti per il territorio, la citta e l' architettura,* 1, 3-30.
25. Norrstrom H., 2013. Sustainable and Balanced Efficiency and Preservation in Our Built Heritage, *Sustainability,* **5,** www.mdpi.com/journal/sustainability, 2623-2643