



Climamed 2017 – Mediterranean Conference of HVAC; Historical buildings retrofit in the Mediterranean area, 12-13 May 2017, Matera, Italy

## The energy efficiency challenge for a historical building undergone to seismic and energy refurbishment

Iole Nardi<sup>a\*</sup>, Tullio de Rubeis<sup>a</sup>, Marilena Taddei<sup>b</sup>, Dario Ambrosini<sup>a</sup>, Stefano Sfarra<sup>a</sup>

<sup>a</sup> University of L'Aquila, DIIE Dept., Piazzale E. Pontieri 1, L'Aquila 67100, Italy

<sup>b</sup> University of Rome, Campus Bio-Medico, Via Álvaro del Portillo, 21 00128 Rome

---

### Abstract

The renovation of historical buildings assumes a crucial role in the renovation processes of a historical city, and it is important to foresee appropriate interventions.

A case study in L'Aquila city center is proposed in this work. The building, belonging to listed buildings for its historical value, being built in the 1930s, underwent to seismic and energy refurbishment, since it was damaged by the earthquake of 2009. The solution proposed aimed at improving the energy efficiency of the structure, by using an additional insulating layer, made of natural material (i.e. hemp), on the inside of the wall. The ceilings of the unheated spaces have been insulated, too, by using pure cellulose flocks.

Moreover, an endothermic membrane has been employed on the external walls of the building.

Analyses on the envelope were carried out by using thermographic inspections, performed both in summer and in winter seasons, and by measuring the total thermal transmittance of the wall assembly before and after the refurbishment with the help of a heat flow meter.

© 2017 The Authors. Published by Elsevier Ltd.

Peer-review under responsibility of the scientific committee of the Climamed 2017 – Mediterranean Conference of HVAC; Historical buildings retrofit in the Mediterranean area

*Keywords:* Historical building; listed building; seismic and energy refurbishment.

---

---

\* Corresponding author. Tel.: +39 0862 434363.

E-mail address: [iole.nardi@univaq.it](mailto:iole.nardi@univaq.it)

## 1. Introduction

The Italian laws in force require high energy performance for new buildings, and for buildings which undergo a refurbishment. This regulation is quite important for Italy, since its building stock is characterized by low quality and energy-efficiency levels.

A separate discussion is reserved for those buildings defined “historic”, that in Italy account for about 30% of the total building stock [1]. For these buildings, in most of the cases, the best available technologies (in terms of technical and economic feasibility) set up for common buildings are not applicable, since they are in contrast with the conservation of their historic value. Most of the technological solutions adopted for the energy renovation of buildings have a high impact on the real estate architecture, which should be preserved through the renovation intervention of the building.

Due to the noteworthy difficulties, which occur in the integration of the solutions for energy saving in historic buildings, the European Directives, in turn adopted by the Member States, issue waivers to the strict norms which impose minimum energy requirements for buildings.

On one hand, it could be effective to exempt some buildings from the fulfillment of requirements, whose realization could alter the aspect of the estate; on the other hand, the waiver to energy renovation constrains seems in contrast with the appropriate and essential refurbishment of the built environment.

It is worth noting that there is a difference between historic building and listed building.

The historic feature is linked to the time of construction and to the employed technique. The cultural feature is connected to the artistic, historic and archeologic value of the estate; therefore, it is safeguarded by dedicated evaluation procedures.

More precisely, a construction which represents “a material witness having civilization value”, which is recognized in a historic period following the one in which the art-work has been built, is referred as “historical building”.

In this sense, in the European zone the last historic period is assumed to end in 1945, year conventionally assumed as divide between the pre-industrialization and the actual era; therefore, each building built before 1945, according to construction processes and techniques, and using materials belonging to such “pre industrialization” period, can be considered as historical building. Nevertheless, a building built after 1945, but with the abovementioned features can be referred as historical.

A building constitutes a cultural heritage, according to the Italian Decree Law 42/2004 [2] (which is the Cultural Heritage and Landscape Code), when it is characterized by an acknowledged “artistic, historic, archeologic and ethno-anthropological” value. In this case, the building belongs to the “listed buildings” and it is submitted to the Commission for the Architectural and Landscape Heritage, an organism of the Ministry of Cultural Heritage and Activities and Tourism, which has the role to approve any intervention on the estate.

Restrictions imposed by the Commission might be applied even on single parts of the buildings (for example, only on the façade).

It is clear that renovation processes and the refurbishment of historic and listed buildings is a complex matter, and different issues and constrains have to be satisfied [3].

On one side, the need for energy efficiency requires interventions, which are often invasive. On the other side, buildings’ features and characteristics, which constitutes their historic or artistic value, must be preserved. For these reasons, customized solutions for each building are foreseen, in order to carry out the best choice case by case [4].

In any case, a systematic procedure for the energy retrofit can be applied, and it can work on complex of buildings, structures or infrastructures, as proposed in previous work [5].

All the different needs explained before are in the spotlight of the reconstruction processes of historic cities, like in the case of L’Aquila, in the center of Italy, not far from Rome.

The city of L’Aquila was founded in the 13th century, and together with its outskirt was hit in 2009 by a devastating earthquake. Almost the 70% of the buildings (in which lived about 65.000 inhabitants), were seriously damaged, and several of them were listed buildings.

The reconstruction phase of the city and the restoration processes of the buildings are ongoing and are obviously taking into account the energy efficiency requirements.

Download English Version:

<https://daneshyari.com/en/article/7918877>

Download Persian Version:

<https://daneshyari.com/article/7918877>

[Daneshyari.com](https://daneshyari.com)