



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

Historical buildings retrofit: the city hall of the city of Motta di Livenza (TV)

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Abstract

Issues related to energy saving, environmental sustainability and safety in case of seismic events are more and more the focus of attention of public opinion and the various actors of the construction sector. The Italian housing stock needs a strong energy adjustment, functional and seismic. The majority of buildings dating back to before the entry into force of the laws on energy saving of 1976 and first of the orders on the seismic design of 2003. The intervention on private buildings is favored by various financial systems and various facilities but to intervention on the public housing stock it is not easy. Most of the public buildings are identified as historical and therefore listed by the Superintendence of Cultural Heritage. Historical constraints, facades and fine decorations and inhomogeneity of the construction techniques and materials used make it very difficult to intervene in these buildings. The article will analyze a case study: the city hall of the municipality of Motta di Livenza (TV). This historic building, listed by the Super-intendent, has been subject to an energy audit that defines what are the best measures of energy efficiency and their economic sustainability. The search result will define which are the most cost-effective interventions to associate with the project of seismic improvement already underway. The case study is a real example of finding a balance between the need for seismic and energy intervention, constraints placed by the Superintendent, the data constraints by decorations and valuable items cannot be modified and the need for improvement of interior comfort.

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

Keywords: Type your keywords here, separated by semicolons ;

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Issues related to energy saving, environmental sustainability and safety in case of seismic events are more and more the focus of attention of public opinion and the various stakeholders of the construction sector. The Italian housing stock needs a strong energy adjustment, functional and seismic. The European Community [1] has set the objectives of greenhouse gas emissions in the coming years, and in Italy to make it more interesting to intervene on private assets various tax breaks and incentives are been proposed in order to make buildings more energy efficient but also more secure, given the recent seismic events have demonstrated the inadequacy of the Italian building stock (in Molise in 2002, L'Aquila in 2009, Emilia in 2012). The majority of residential buildings [2] dating back to before the entry into force of the laws on energy saving of 1976 and first of the orders on the seismic de-sign of 2003. The intervention on private buildings is favoured by various financial incentives but the intervention on the public housing stock it is not easy: most of the public buildings are inadequate today, both in terms of energy and functional and above all seismic as built before the 70's; moreover many public buildings are identified as historical and therefore listed by the Superintendence of Cultural Heritage. In these cases, proposals for interventions in newer buildings energy intervention requirements and seismic standards are not achievable. Historical constraints, facades and fine decorations and inhomogeneity of the construction techniques and materials make very difficult to intervene in these buildings. The recipe must wrap it case by case basis and is not so obvious that we can intervene in a linear and complete fashion.

2. METHODOLOGY FOR ENERGY AUDIT

The methodology for the energy audit used in the building is composed of three parts: the analysis of the energy performance in the current situation, the analysis of energy performance ensured by the interventions and the economic evaluation of each intervention. The first analysis foresees a deepened inspection that detects all geometrical and performance characteristics of the existing building-system. Therefore, it is analyzed the geometry of the building, the orientation, the proximity to other buildings, the characteristics and thickness of the wall and floor, the type of doors and windows and the features of the heating and cooling plant. All the found characteristics are synthesized in a mathematic model showing the energy performance in the building. This model is calibrated with historical data of energy consumption obtained by bills. This model allows to verify how much each intervention influence the energy performance of the building. The interventions that could increase the energy performance are both in architectural envelope and system. The building could be give better improving the insulation of walls, floors, roof and the substitution of windows. The improvements in the plant performance could be obtained substituting the generator, insulating the distribution tube and improving the plant regulation. A great step to reducing electrical consumption in the buildings is to intervene on the efficiency of internal lighting and installing renewable energy source, moreover for not-residential building where electrical consumption is higher. The convenience of the intervention of energy performance improvement is evaluated based on a less time to save money in the bills that will cover the cost of the intervention. In the last years, the European State Members has incentivized the private sphere to achieve some interventions of building restoration offering economic facilitation and incentives. In Italy, over the economic facilitation dedicated to private, incentives to public administration are available, concerning both the intervention about the architectural building, but also the requalification of the system.

2.1. *Geometric survey and mathematical model*

The energy performance in the building depends on a lot of factors: the geometry, orientation, urban context, use of building and type of use. But it depends also on performance of the building and plant. It must be measured all these characteristics examining in depth the characteristics and thickness of the wall and floor, the type of doors and windows and the features of the heating and cooling plant. The inspections must observe every geometrical and performance features of the existing building-plant apparatus. All these information are synthesized in a mathematic model able to simulate the energy attitude in dynamic "capacity". Thank the use of the specific software is possible to analyze the energy performance compliance the applicable normative. For this operation, it is used EnergyPlus with the used of Design Builder as a graphic interface for making the energy simulation. To increase the goodness of the results in the mathematic model, it is equilibrated with the historic data of real consumption studied in energy

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