



Reprint of “Guidelines on energy efficiency of cultural heritage”[☆]



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SUMMARY

The AiCARR Guidelines “Energy Efficiency in Historic Buildings” (February 2014) provide information to evaluate and improve the energy performance of historic buildings, fully respecting their significance and expression; where applicable these Guidelines will include the most recent legislation on the subject existing in Italy. These guidelines are intended for both design engineers and superintendencies. They provide the design engineers with a tool for the energy audit of the historic building and offer a framework for the design of possible energy upgrades, which are conceptually similar to that provided for non-protected buildings, but appropriately tailored to the needs and peculiarities of the cultural heritage. On the other hand, these Guidelines provide the institutions responsible for protecting the building, the possibility to objectively decide on the level of energy efficiency achieved as a result of the rehabilitation in accordance with the conservation criteria.

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1. Introduction

Whenever an intervention is required to a protected property or nevertheless to property of cultural value, it should be considered that the work to be carried out falls within the scope of restoration and the priority objectives are *to preserve and bring* these assets *in line with the future* in the best possible condition (Charter for conservation and restoration, Italian Ministry of Instruction, 1972).

Even the energy efficiency measures should pursue the above stated purposes, which means considering energy efficiency as a tool for protecting – rather than a process of upgrading that conflicts with the conservation requirements. It follows that the design choices should be made by consulting with the conservation experts. In this regard, the following criteria set out in the Venice Charter for Conservation and Restoration are of invaluable help: compatibility, minimum intervention, reversibility, distinguishability, expressive authenticity, durability and respect of the original fabric.

However, these Guidelines have a more ambitious objective. Its aim is to provide an insight into the relationship between restoration and installations that today is still little explored from a theoretical point of view, and definitely less, for example, than

the corresponding relationship between restoration and the need for full accessibility – or even between restoration and structural consolidation works.

Even in this case, as for the structural consolidation, it is necessary to radically rethink the concept, which is reflected in a new methodological approach, an example of which is suggested in these Guidelines.

If we start from the same experience that years ago brought about a debate on the problems related to the historical-critical process, and to the scientific-technical process for consolidation restoration projects, which recognized the need of a rigorous method of unity, this same method is proposed for the energy efficiency of a cultural asset.

In the restoration-HVAC systems relation we still see a gap in the rules and regulations. Notwithstanding this gap, the need to include systems in the restoration concept and the three point criteria (minimum intervention, reversibility and compatibility) is well established.

In this regard, these Guidelines also propose that the concept of “improvement” replace the concept of “adaptation” in the current standards and requirements also with regard to safety and comfort, elaborated along the lines of “integrated conservation” (Congress on the European Architectural Heritage, the Declaration of Amsterdam, 1975).

Proposals to *improve* the energy compliance of a historic building (or, even, of a cultural landscape) can be made by taking appropriate measures that are well-balanced for a suitable architectural or landscape integration. This means that you will often have to settle for a partial architectural integration, rather

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than a total integration, as would be desirable for new buildings. The required level of integration must be such that the interventions proposed do not upset the asset itself, which is the case when “adapting” it to the current standards and requirements, as if it were a new building.

The proposed methodology should be based on an interdisciplinary approach, the main steps of which are clearly set out in the Guidelines. These steps include: following the general principles and the concepts; an analysis of the plant engineering systems; measuring the environmental quality and determining the risks to historical buildings (including the identification of the proposed intervention as it relates to the building and the system.)

As to the application of these principles, these Guidelines refer to the existing legislation with non-binding methods that, given the nature of evolution over time, may and will be subject to revision and updates [1–27].

The Guidelines are therefore both a point of arrival (if a univocity of languages among different regulations is reached), but above all serve as a starting point and a stimulus for further advances and progress in a sector that will be of fundamental importance to the development of our future society.

Finally, the Guidelines refer to the existing buildings needs in order to match both the energy efficiency enhancement [28,29] and the carbon dioxide emissions reduction by means of new carbon-free fuels application along with more complex energy scenarios development [30,31].

2. The meaning of these guidelines

The Code of cultural and landscape heritage states that: cultural heritage is made up of both cultural and landscape heritage and that cultural assets are intangible and tangible goods that, pursuant to Articles 10 and 11, are of artistic, historical, archaeological, ethno-anthropological, archival and bibliographic interest and other things identified by the law or pursuant to the law as evidence of civilization value [21]. The Hague Convention of 1954 also considers as cultural assets (a) movable or immovable property of great importance to the cultural heritage of every people, such as monuments of architecture, art or history, whether religious or secular; archaeological sites, groups of buildings which as a whole, are of historical or artistic interest; ... (b) buildings whose main and effective purpose is to preserve or exhibit the movable cultural property defined in sub-paragraph (a) such as museums, large libraries and depositories of archives, and refuges intended to shelter, in the event of armed conflict, the movable cultural property defined in subparagraph (a); (c) centers containing a large amount of cultural property, as defined in sub-paragraphs (a) and (b), to be known as “centers containing monuments”. The historic buildings are, therefore, a cultural heritage that must be preserved and enhanced, as evidence of history and culture.

Italy is characterized by a widespread and diffused presence of historic buildings throughout the country; these buildings are often still used as homes and museums. For this reason, the energy upgrade of historic buildings represents two major challenges: intervention on an artifact subject to historical and architectural constraints and sometimes also structural ones, and carrying out work that can affect both the envelope as well as the building systems, and requires great care and skill by the professional entrusted with the design engineering.

3. The legislation context

The assessment of energy performance in the building–plant system is performed under both winter and summer conditions. The assessment is based upon the energy performance index

EP, which expresses the primary energy consumption referred to the useful area or gross volume, expressed respectively in kWh/(m² year) or kWh/(m³ year), and which is calculated according to the instructions provided by law.

The EP is a standardized performance indicator whose value may change according to the technical and technological solutions adopted. For this reason, when choosing the energy production system and/or the envelope components, it is important to weigh the different solutions that can be adopted. The goal should be to evaluate the energy feasibility of each possible solution with a goal of maximizing energy efficiency while meeting the regulatory restraints imposed on the renovation of historic buildings.

It should be remembered that legislation and regulations identify the building services as a single block: however, during the assessment of energy performance, it is advisable to distinguish the energy requirements for: cooling, heating, the HVAC system and the primary building–plant system. This characterization allows an energy audit to be performed in a more comprehensible manner so as to evaluate possible inefficiencies in energy transformation operations.

In recent years the Italian legislation on energy saving has since undergone a series of changes¹ until the issue of Legislative Decree n° 63/13, which is the first legal instrument prescribing requirements for historic buildings. In fact, until the publication of Legislative Decree n° 63/13 (Italian Government, 2013), converted into law on August 3, 2013 (Italian Parliament, 2013), some protected buildings, including historic buildings, did not fall within the scope of the legislation on energy saving in buildings.

As of August 4, 2013 the obligation to drawing up the certificate of energy performance in buildings, in accordance with Article 6, and the operation, maintenance and inspections of technical installations applies.

It should be emphasized that Legislative Decree 311/06 provided that the previous provisions concerning the energy performance of historic buildings were not applicable in the case where they entailed *an unacceptable alteration to their character or appearance with particular reference to historical or artistic character*. Since Legislative Decree 63/13 modifies 192/95, clarification should be made as to whether the latter condition has been confirmed or not.

For historic buildings that fall within the scope of Legislative Decree n° 63/13 the EP should be calculated and the related building energy class must also be checked, in order to fill out the energy performance certificate. The calculation procedure must comply with the rules in force in the field of energy saving in the building sector.

4. A procedure proposal to improve the energy efficiency of historic buildings

Energy improvement means to perform one or more interventions with the aim of reducing the energy performance index without changing the structural and architectural condition of the artifact, while trying to improve the quality of the environment.

Fig. 1 shows the flow chart of the proposal made by AiCARR regarding the best improvement procedure on how to improve energy efficiency.

The procedure involves some preliminary actions aimed at a correct energy audit, downstream of which the actual energy performance index must be calculated. The energy audit should also be used to evaluate the possible improvement actions, which must

¹ A key role was played by the European Directives 91/02 (European Parliament, 2002), known as the EPBD, and 31/10 (European Parliament, 2010), known as EPBD recast, which led to the Legislative Decree 192/05 (Italian Government, 2005) and subsequent amendments and Legislative Decree 63/13 (Italian Government, 2013).

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