POLITECNICO DI TORINO
Repository ISTITUZIONALE

Industrial Heritage: reflections on the use compatibility of cultural sustainability and energy efficiency

Original
Industrial Heritage: reflections on the use compatibility of cultural sustainability and energy efficiency / Romeo, E., Morezzi, E., Rudiero, R.. - In: ENERGY PROCEDIA. - ISSN 1876-6102. - ELETTRONICO. - (2015), pp. 1-6. (6th International conference on Building Physics for a Sustainable Built Environment Torino 14-17 June 2015) [10.1016/j.egypro.2015.11.145].

Availability:
This version is available at: 11583/2612763 since: 2025-02-18T05:04:53Z

Publisher:
Elsevier

Published
DOI:10.1016/j.egypro.2015.11.145

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)

14 October 2026

Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 78 (2015) 1305 – 1310

Energy Procedia

6th International Building Physics Conference, IBPC 2015

Industrial heritage: reflections on the use compatibility of cultural sustainability and energy efficiency.

Emanuele Romeo[a], Emanuele Morezzi[a], Riccardo Rudiero[a]

[a]*Politecnico di Torino, Viale Mattioli 39 - 10125, Turin,Italy*

Abstract

Today the industrial heritage represents a great functional and cultural resource. In fact, analyzing the international situation about it, it's possible to identify features that meet the increasing demand for architectural and urban spaces intended to cultural and social needs.
However the type of industrial complexes discharged suggests solutions regarding their sustainability for what concerns the energy standards. At the same time the cultural sustainability demands the utmost respect to the architectural elements, the space, the materials and to the structures that have historically characterized the proto-industry. The contribution, through a specific set of examples, analyzes projects and proposes actions in which the intervention achieves both the respect to the compatibility of use and the requirements of cultural and energy sustainability.

© 2015 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license
(http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the CENTRO CONGRESSI INTERNAZIONALE SRL

Keywords: conservation, industrial heritage, sustainability

The industrial heritage conservation between memory value and present-day importance

The industrial heritage is represented by a set of strongly stratified architectural complexes characterized by different technical, formal, and distributive solutions that were gradually added and superimposed to one another, when required by the evolution of technology and by the changes in production processes. Actually, it is this stratification (additions, changes of use, momentary abandonment and subsequent reuse, accompanied by architectural and technological adjustments) that gives an industrial complex a particular value[1, 2, 3].

Indeed, the continuous evolution is the essence of this particular architectural form. From the birth of the first factories to present day, the industrial buildings have been able to quickly change their architectural form and their material and formal consistency according for the work and production needs. For this reason, we have now the

1876-6102 © 2015 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license
(http://creativecommons.org/licenses/by-nc-nd/4.0/).
Peer-review under responsibility of the CENTRO CONGRESSI INTERNAZIONALE SRL
doi:10.1016/j.egypro.2015.11.145

opportunity to read a "history of architecture" consisting of a sequence of materials and technologies that have been subsequently replaced or superimposed to one another, in a list of examples related to the testing of reinforced concrete, of iron, cast iron, steel; or to the use of large glass surfaces or shed roofs; or to the use of natural and artificial energy sources. The natural consequence of this history is that, when a new function is identified for an industrial building, one cannot exclude the use of technologies that introduce improvements - provided that these improvements are necessary for the new function of the building itself - guided by the discipline of building physics, in order to increase energy performance, improve the efficiency of the architectural structure, optimize the cost of the initial design and of the subsequent maintenance [4, 5].

However, if in the past the changes and adaptations obeyed to functional or economic requirements,

today the culture of conservation suggests, most of all, respect for the cultural value of the existing architecture, though recognizing the need for structural, formal and energy adjustments. For many years the culture of protection and conservation has been considering these complexes important also for their potentiality. As a matter of fact some current functions, if properly chosen, can be inserted within the disused industrial areas, by using open spaces and architectures as places for cultural and musical events, as museums, or as spaces for education, training and social services.

What might then be the theoretical and methodological guidelines to reach a fair compromise between conservation of the memory values of an industrial complex and the necessary adjustments to meet energy or environmental sustainability?

An aid to address this issue is given by the content of two important international documents that provide guidance on how to act on this heritage.

The first document is the Charter of Nizhny Tagil on *Industrial Heritage*, drawn up in 2003 in Moscow [6, 7][1]. This document specifies the values of industrial heritage and the operations of maintenance and conservation; moreover, it suggests actions that, in the respect of the original organism, provide interventions aimed also to meet the requirements of energy and environmental sustainability: “The adaptation of an industrial site to a new use ensuring its preservation is generally acceptable, except in the case of sites of particular historical importance. New uses should respect the significant material and maintain the original models and distribution activities, and should be as compatible as possible with the original use or main building” [7, 8][2]. Hence, interventions aimed to energetic improvement are allowed especially if they respect the documentary and cultural value of the architectural complex. Indeed, such actions are desirable because they improve the performance of the factory as well as the standards of social and economic quality of the life of the population to which the cultural heritage belongs[3].

The second document is the Madrid Document of 2011 on the *Criteria for the Conservation of the Architectures of the 20th Century*. Although this document suggests how to preserve and enhance the archeological heritage of the 20th century in general, it provides interesting solutions for the conservation and the refunctionalization of the industrial complexes[4]. For example, it says that if any regulations (for example those related to energy saving) require an adaptation to standard, it is necessary to adopt "flexible" solutions in compliance with the regulations, provided that the cultural significance of the architectural heritage is preserved[5]. Therefore, in the cases where an action is needed to optimize energy performance, one could propose an intervention that is not of "adaptation" but of

[1] Charter of Nizhny Tagil, paragraph 5 (Mantenimiento y conservatiòn) article IV.
[2] *Idem.*
[3] Charter of Nizhny Tagil, paragraph V: “Continue to adapt and to use industrial buildings avoids wasting energy and contributes to sustainable development. The heritage may have an important role in the economic regeneration of damaged areas or declining. The continuity implies reuse may provide to psychological stability communities facing the sudden end a source of work many years”.
[4] The ICOMOS International Scientific Committee for Twentieth Century Heritage (ISC 20C) is developing guidelines for the conservation of heritage sites of the twentieth century during 2011–2012. As a contribution to this debate, the International Conference “Intervention Approaches for the Twentieth Century Architectural Heritage” - “CAH 20thC” adopted on 16 June 2011 the following text “Approaches for the Conservation of Twentieth Century Architectural Heritage, Madrid Document 2011.
[5] Madrid Document 2011, section: *The application of standard building codes needs flexible and innovative approaches to ensure appropriate heritage conservation solutions*: “The application of standardised building codes (e.g. accessibility requirements, health and safety code requirements, fire - safety requirements, seismic retrofitting, and measures to improve energy efficiency) may need to be flexibly adapted to conserve cultural significance. Thorough analysis and negotiation with the relevant authorities should aim to avoid or minimize any adverse heritage impact. Each case should be judged on its individual merits”.

"improvement" as already imposed by regulations concerning structural interventions on historic buildings of the "specialist type" [7]. In this case one could think to *partially* fulfill the requirements of energy sustainability, or to calibrate the intervention of technical adjustment by analyzing more carefully the building to which we want to assign a new function. Therefore, it can be said that the choice of the function for which energy, sound, lighting, plant adjustments are required, cannot be made "a priori", but must rather be made after carefully evaluating the capacity of the industrial building to receive such radical adjustments or changes [9]. In this concern the Madrid Document is clear when it states that "Discrete interventions can be introduced that improve the performance and functionality of a heritage site on condition that its cultural significance is not adversely impacted. When change of use is under consideration, care must be taken to find an appropriate reuse that conserves the cultural significance"[6].

Many European experiences of conservation and reuse of industrial buildings have already considered this approach: the choice of the new functions is dictated by the flexibility of the building towards the necessary technical and energy adjustments. This is to achieve a proper balance between respect for the historical memory of the building and the need to adapt to the standards of energy and environmental sustainability. Even in some interventions on the industrial heritage of Piemonte a similar methodological approach was implemented, that led to the results described below.

(E. R.)

Methodological approaches to the conservation of the industrial heritage

Now we focus on an emblematic case where were applied a methodological synthesis of what was previously expressed. This is the large abandoned factory of IPCA in Ciriè (TO), sadly known for the several numbers of deaths caused by the use of highly toxic components in the production and, in recent years, subject of a feasibility study for its redevelopment. Of three planned scenarios - one more conservative, one in which the new buildings would be predominant and one in which there is the mediation between the two previous proposals - the latter prevailed. The programmatic document contains directions for action on each building.

The project proposal, that follows all methodological criteria of Restoration, focused particularly on that of the sustainability, in the wide spectrum that this concept assumes. Indeed, in addition to the economical and energetic declination that this word may intuitively have, the intervention follows the cultural and social sustainability with the introduction of compatible functions in the complex that highlights not only the productive innovations, but also the painful past imprinted in the historical memory of the workers.

However, this paragraph will exclusively focus on methodological indications regarding the adaptation of the buildings to the thermal energy containment.

Depending on how we want energetically improve the building envelope (which must respond to the standard rules for each type of activity) we will have essentially two distinct scenarios, based on the fact that we want preserve the internal volumetric integrity or external facade with its skyline and its materials. There are many examples where the interventions were massive on the interior to protect the external appearance through different methods that can be summarized in two main cases: the covering of the walls with insulating materials or the inclusion of elements spatially and technologically independent - a box in the box - keeping more or less intact the original walls. Instead the cases where the factories have been reworked externally are more rare because, coherently with a conservative vision that tends to pursue the recognition of the complex in its landscapes (urban or rural), it is usually preferable to maintain the outward appearance, preferring rather avowedly modern additions that do not affect the recognition of the original elements[7].

To enter in the choices made in Ciriè we will discuss now about four pavilions, through which we will justify the guidelines followed. Two of them are located in the area called Ni4, characterized by the concentration of buildings that should accommodate services (pavilions 4 and 9); the second, in Ni3, is a massive volume where would seat the municipal theater and, finally, a business incubator (pavilion 17), which is located in Ni2 [10].

[6] Madrid Document 2011, section: *Manage change sensitively*: paragraph 5.1.
[7] An emblematic example is the famous Tate Modern in London in which the intervention of Herzog and De Meuron is compatibly grafted on the original core, which remains recognizable in its material and formal aspect.

Fig. 1. (a) Pavilions highlighted on a plan project. In yellow the pavilion 4 flanked by the pavilion 5, in red; in blue, the pavilion 7; in green the pavilion 17 and in purple the pavilion 18 (original plan from Politecnico di Torino, DICAS. Studio di fattibilità cit., p. 74). (b) The IPCA site.

Starting from the area Ni4, firstly we want to talk about the pavilion 4 which would become the memory center of the complex and, for that reason, should not undergo significant tampering of any order (not even to adapt the building to contemporary needs of energy saving) but, rather, to conserve it as much as possible intact. In this case, the thermal comfort of the visitor could be guaranteed through system solutions the least invasive as possible and, in any case, that does not adversely affect the image of the building either internally or externally. This requirement is also needed in order to adequately maintain the production machinery still in place and the signs of the work. In the same context, there are two pavilions that the project would destine to services. Of these, one had already directional function (building 5) but for the fact that it is directly connected to the museum pavilion we don't want to alter its composition outside. The other one had strictly productive function; it has four floors and a reinforced concrete structure, externally coated in plaster and exposed bricks [10]. Also because this building is later than the original core of the IPCA it may be the only case in which we could introduce a coating of the external structure. This choice is justified because the building will be connected to the adjacent pavilion by a new building organism that although it will be light and compositionally neutral [10] inevitably will change the perception of this complex. It is possible to hypothesize an intervention by very clean lines but also one that gives significantly different looks than the current[8].

The philosophy underlying the building 17, instead, is to have an external wall totally unaffected and an internal volume clearly perceptible. In this case it was decided to isolate the internal walls and to divide the environment through intermediate floors with the same scan of the actual state. The vertical internal partitions should be transparent, so as to make possible the perception of the volume and of the characteristic elements (roof shed and its supporting structure).

Finally, the theater in the pavilion 18. The casing of the existing building must be restored as if it were a "shell" that encloses the new functional activity which is characterized by the independence of its structures compared to the pre-existence [10]. So, except for the necessary interventions on the walls (to eliminate degradation) and on fixtures, energy containment efforts should focus on the new interior construction organism, offering solutions such that the original building remains unchanged in its appearance.

(R. R.)

Suggestions and reflection about the area transformation

The attention that any appropriate conservation project requires [11], is often aimed at maintaining the specific characters of the object of the intervention. It is, basically, to identify some features that, better than others, may be

[8] For example, the former Post Office building in Bolzano, which has become the provincial administrative center with a standard of passive building (www.provincia.bz.it/edilizia/opere-ultimate/475.asp).

representative of the building potential, they can communicate the story and enhance the value of identity. This attitude is often declined in the restoration with the decision to maintain the parts that can be defined 'authentic structure', meaning with authentic, the original ones belonging to a particular time of the building construction. In the detailed project assumed for the industrial compound of the IPCA Cirié[9], it is then reflected at length in an attempt to frame the identifying features of each building, in order to classify them and safeguard them within a project of recovery and restoration.

If, in fact, the previous phases were concentrated on whether or not to intervene on a building, drawing the possible future scenarios relating to its conservation or its transformation, in the final phase, the work done by the research groups focused more on how to intervene on the original material. The most significant issues interested, of course, buildings undergoing a transformation, since any work on them could lead to a serious deterioration of the original conformation, with the consequent loss of those authentic characters that the project wanted, on the contrary, to maintain. For example, the increase of volume (eventually required for some facilities) could altering the morphological readability and therefore the understanding of the shed within the entire complex.

Similarly, the preservation of the original surface of each building, which still shows the construction features and materials of the local tradition, appeared as very important in order to convey information about the buildings and their past: how could be possible any insertion over the native walls surface? The feasibility study, therefore, wanted to conclude his observations by providing some guidelines for action on this heritage, to guide a possible future intervention on these assets. This part is configured as a zoom on some of the issues considered significant from the conservation point of view, and has the aim to raise appropriate considerations regarding the storage of the characters of authenticity of the industrial complex. The transformation and the functional adaptation and plant engineering industrial property in question, in fact, should be framed within a project that places primary emphasis on the cultural heritage of the area, important for their history and their culture . The idea of sustainability that the project aims to achieve will be, first of all, a cultural sustainability, the results of which will have repercussions on the materials of the existing buildings, their management, and ultimately on their energy consumption. The contribution is intended to provide some thoughts that may be useful to a future action on heritage, reiterating as a suitable conservation project depends on many disciplines and numerous personalities and their fruitful cooperation.

Compared to the first aspect of intervention on the material, linked to the project for the conservation of existing surfaces and their transformation to adapt them to energy regulations, the choice of the most appropriate intervention strategy arises as the first functional step in the project. The industrial complex IPCA in fact, is today as an heterogeneous set of abandoned industrial building, and distinctive characteristics of each pavilion together define a complete whole area. Compared to these considerations, any energy adjustment intervention must be made within severe reflections on the effects that such changes might have on the entire area. In essence, the modification to the outer surface of an existing building, for example through the application of an insulation coat that can make it functional energetically, would alter not only the appearance of such asset, but also the appearance of the whole industrial complex that would be so irreparably changed.

From these considerations, it seems correct to emphasize that any changes to the original material and therefore authentic structures should take place within a perspective that might favor, first of all, the appearance of the conservation and restoration. Similarly, we recommend the use of insulating characterized by their high technical performances even in a few centimeters thick, with the aim of changing the least possible external conformation and also the morphology of the buildings. All the buildings in the area, in fact, are characterized by extremely simple and basic profiles and the use of few materials, from which it follows an easy readability architectural and technological of the building. A radical transformation of the asset, although necessary to reach the law requirements, would then alter irreparably the building, causing a bad authenticity conservation.

Similarly, the use of appropriate lighting [4], in addition to compliance with regulations on the matter, will have the task of evoking also the natural and artificial light once used to work in the factory. All of the buildings of the area, in fact, are characterized by the presence of the shed which, in addition to clearly define their industrial

[9] All the information concerning the research will be soon published in Romeo E. (edit by), *Memoria, conservazione, riuso del patrimonio industriale. Il caso studio dell'IPCA di Ciriè*, Roma: Aracne, 2015.

function, were used to bring inside the light necessary to machining and the health of the places. Today, in a conservation intervention, it seems appropriate to suggest strategies that can exploit the historical past of the property, for the purpose of research aimed at a light that is not just a simple means of illumination but real historical memory of the places [12-22]. Is equally plausible, in fact, draw a lighting design that can enhance the features historical and cultural values of the assets of the area. In this perspective, the light can become a real tool for enhancement of existing facilities, and, at the same time convey the most important features of the area, in a project that is not only functional, but also didactic and descriptive structures so safeguarded.

The intervention on the existing buildings, in short, will have to face many problems related to the complexity of the structures. It's however important to emphasize that the intellectual conflict between the demands of conservation (liable to a minimum intervention on the structure, distinguishability, compatibility and, where possible, reversibility) and requests of building physics (linked to the demands of regulatory standards and functional requirements) may be mediated by a project that can involve numerous knowledge, each of which functional to the realization of an appropriate intervention on the heritage.

(E. M.)

References

[1] Ronchetta C., Trisciuoglio M., (edit by) *Progettare per il patrimonio industriale,* Torino 2008.
[2] Alvarez Areces M. A. (edit by) *Arquitectura industrial. Restauraciòn y conservaciòn en tiempo de crisis* on "Revista de cultura y ciencias sociales", n° 70, 2001.
[3] Baldi P., *Archeologia industriale dismessa: conservazione/sostituzione,* in Fontana G. L., Bonaventura M. G., Novello E., Covino R., Monte A. (edit by) *Archeologia industriale in Italia. Temi, progetti, esperienze,* Brescia 2005.
[4] Aghemo C., *Illuminazione, comunicazione e sicurezza negli edifici storico - monumentali. Un esempio di soluzione integrata,* on: Luce, 2006, pp. 48-51.
[5] La Malva F., Astolfi A., Bottalico P., Lo Verso V. R. M, Lingua A., *Sistemi informativi spaziali per implementare la tutela, valorizzazione, progettazione e divulgazione del soundscape in ambiente storico-urbano: Torino negli ultimi 150 anni,* on: AIA 2011 38Â Convegno Nazionale dell'Associazione Italiana di Acustica, pp. 1-8.
[6] El TICCIH (El Comité Internacional para la Conservación del Patrimonio Industrial) es la organización mundial encargada del patrimonio industrial y es asesor especial de ICOMOS en cuestiones de patrimonio industrial. El texto de esta carta ha sido aprobado por los delegados reunidos en la Asamblea Nacional del TICCIH, que tuvo lugar en Moscú el 17 de julio de 2003.
[7] Charter of Nizhny Tagil, paragraph 5 (Mantenimiento y conservatiòn) article IV.
[8] Casiello S., *Norme e raccomandazioni per il consolidamento degli edifici in muratura: note critich*e in Casiello S. (edit by) *Restauro: criteri, metodi, esperienze,* Napoli 1990, pp.17-25.
[9] Aghemo C., Pellegrino A., Piccablotto G., Taraglio R., *Illuminazione e controllo ambientale: problematiche e criteri di intervento,* in: Vaudetti M., Minucciani V., Canepa S. (edit by) *Mostrare l'archeologia. Per un manuale-atlante degli interventi di valorizzazione,* Torino 2013, pp. 86-102.
[10] Politecnico di Torino, DICAS. *Studio di fattibilità per scenari di conservazione e valorizzazione dell'area ex IPCA (ambito di proprietà pubblica) e del suo contesto, sita nel comune di Ciriè. Secondo Rapporto*. Torino 2012.
[11] Ronchetta C., *Recuperare il patrimonio industriale,* in Ronchetta C., Trisciuoglio M., (edit by) *Progettare per il patrimonio industriale,* Torino 2008, pag 138.
[12] Frascarolo M., *Manuale di progettazione illuminotecnica,* M. E. Architectural Book and Review, Roma 2010.
[13] Ravizza D., *Architettura in luce. Il progetto di illuminazione d'esterni: ruoli e funzioni della luce, criteri e metodologia di progetto, materiali e tecnologia, realizzazioni,* Milano: Franco Angeli, 2006.
[14] Palladino P. (edited by), *Manuale di illuminazione,* Milano: Tecniche nuove, 2005.
[15] Forcolini G., *Illuminazione di parchi e giardini,* Bologna: Calderini Edagricole, 2000.
[16] Forcolini G., *Illuminazione di esterni: criteri di progettazione e soluzioni illuminotecniche per città, grandi aree, impianti sportivi, strade e gallerie,* Milano: Hoepli, 1993
[17] Frettoloso C., *Dal consumo alla fruizione: tecnologie innovative per il patrimonio archeologico,* Firenze: Alinea Editrice, 2010.
[18] Massironi M., *Comunicare per immagini,* Bologna: Il Mulino, 1989.
[19] Massironi M., *Fenomenologia della percezione visiva,* Bologna: Il Mulino, 1998.
[20] Palladino P., *Illuminazione architettonica in esterno. Guida alla progettazione degli impianti,* Milano: Tecniche Nuove, 1993.
[21] Lennox Moyer J., *The Landscape Lighting book,* 2nd edition, Hoboken, New Jersey: John Wiley & sons, 2005.
[22] Palladino P., Coppedè C., *La luce in architettura. Guida alla progettazione,* Milano: Maggioli Editore, 2012.