

POLITECNICO DI TORINO  
SECOND SCHOOL OF ARCHITECTURE  
Master of Science in Architecture  
*Honors theses*

**Energetic certification and environmental quality of a library: checking performances and proposing retrofit scenarios**

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*Louis Kahn in his writing of 1957 said: “ Global quality of a space is measured by the temperature, light and perimeter (...). A man with his book goes towards the light. That’s how a library begins. The place of reading is a niche, that can be the beginning of the spacial order of its structure (...). The architect chooses and composes in order to translate the institutions of mankind in spatial and environmental reports”.*

This sentence, in a special way, summarizes the reasons of the thesis , which deals with the retrofit of a public library, located in Chatillon (Aosta, Italy).

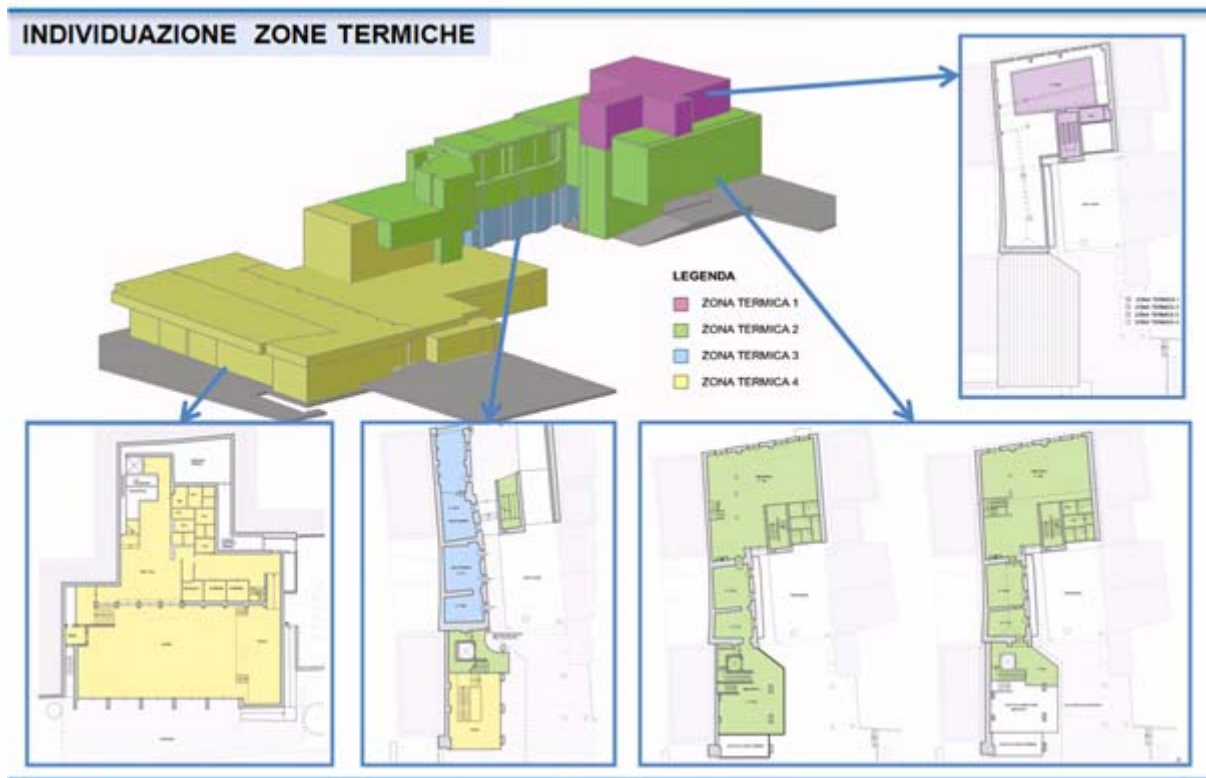


The renovation of a building implies, basically, the improvement of the users quality of life, in according with the climate, the traditions and the environment of the regional context, using energy and resource in a rational way, recycling or reusing materials and, more generally, reducing the release of dangerous substances in the local and global ecosystem during its entire life cycle.

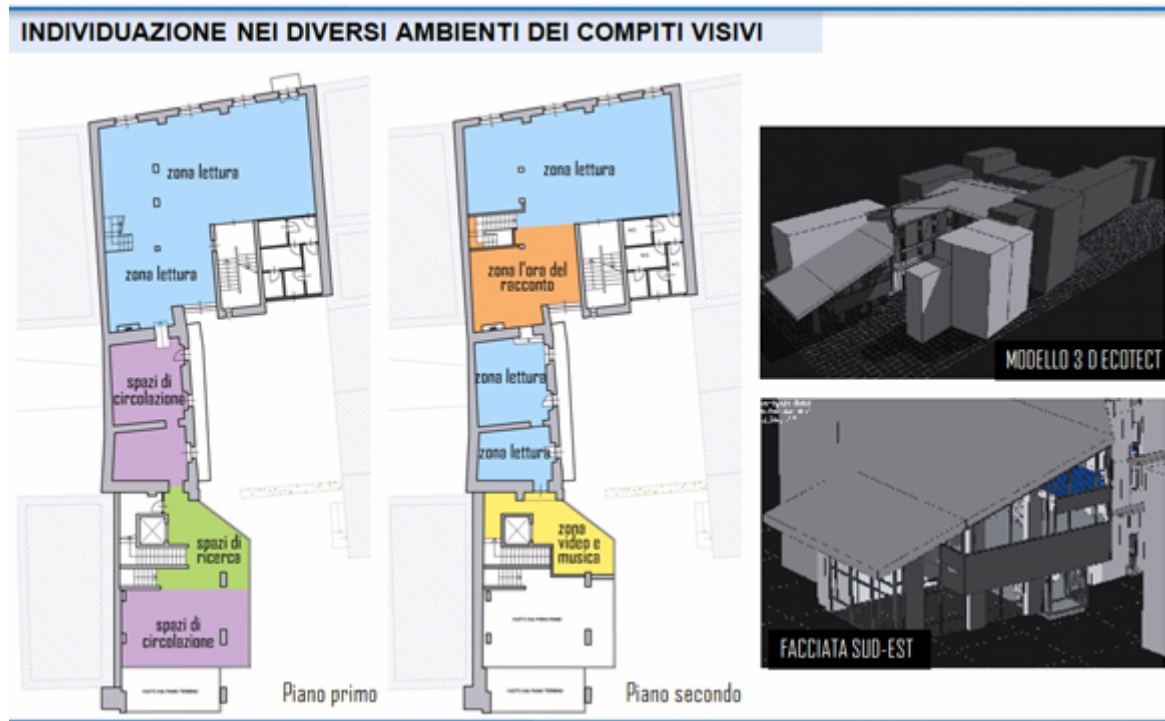
The thesis has been developed through three main steps:

1. the assessment of the library thermal, lighting and acoustics conditions through simulation, measurements and a subjective analysis (questionnaire)
2. the identification of the main criticisms and of the retrofit interventions
3. the economic assessment of the retrofit solution

The building energy behaviour from the thermal point of view was assessed through the calculation of the primary energy needed for heating and cooling, according to the national standard on energy certification (UNI/TS 11300 part 1 and 2), compared with the limit values, as defined by national (D. Lgs 311/2006, D.P.R. 59/2009) and local Legislation.



For what concern the library lighting conditions it was evaluated the illuminance level in different zones of the library, through the software Radiance and the Daylight autonomy, through the software Daysim.



With reference to the building acoustic behaviour, the passive acoustic requirements of the building envelope components were calculated and compared with the limit values (D.P.C.M 5/12/1997).

In order to evaluate the environmental quality of the building as perceived from the users, a subjective analysis was then performed through a questionnaire.

Through this analysis the main criticalities were pointed out: from the thermal point of view high primary energy demand was due to the high heat loss through the building envelope and to the very low global efficiency of the obsolete heating plant. From the lighting point of view a very poor contribution of daylighting determined an extensive use of artificial lighting during the year and caused visual discomfort.

Five different retrofit solutions were then proposed able to overcome the identified problems, using both non invasive and simple solutions, as adding an external insulation, substituting the windows, adding shading devices...

In order to evaluate also the economic feasibility of the intervention a cost-benefit analysis was performed on each solution, determining as well the most convenient approach with the most energy efficient.

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