



POLITECNICO
DI TORINO

Honors thesis

COURSE OF
"ARCHITECTURE FOR THE SUSTAINABILITY DESIGN"

Abstract

Innovative methodologies in the digital era: BIM for "cost optimal analysis".

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by
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The case study of the thesis concerns the project of a medical center for Alzheimer's patients at the sanctuary of "Trompone" in Moncrivello, a little town located in the Northwest Italy. Although it is part of a new building, the project is actually an integral part of an intervention that involved the whole complex of Trompone, through the contribution of a group of students in different fields. The common thread is represented by the utilization of BIM technology for the construction and management of health facilities.

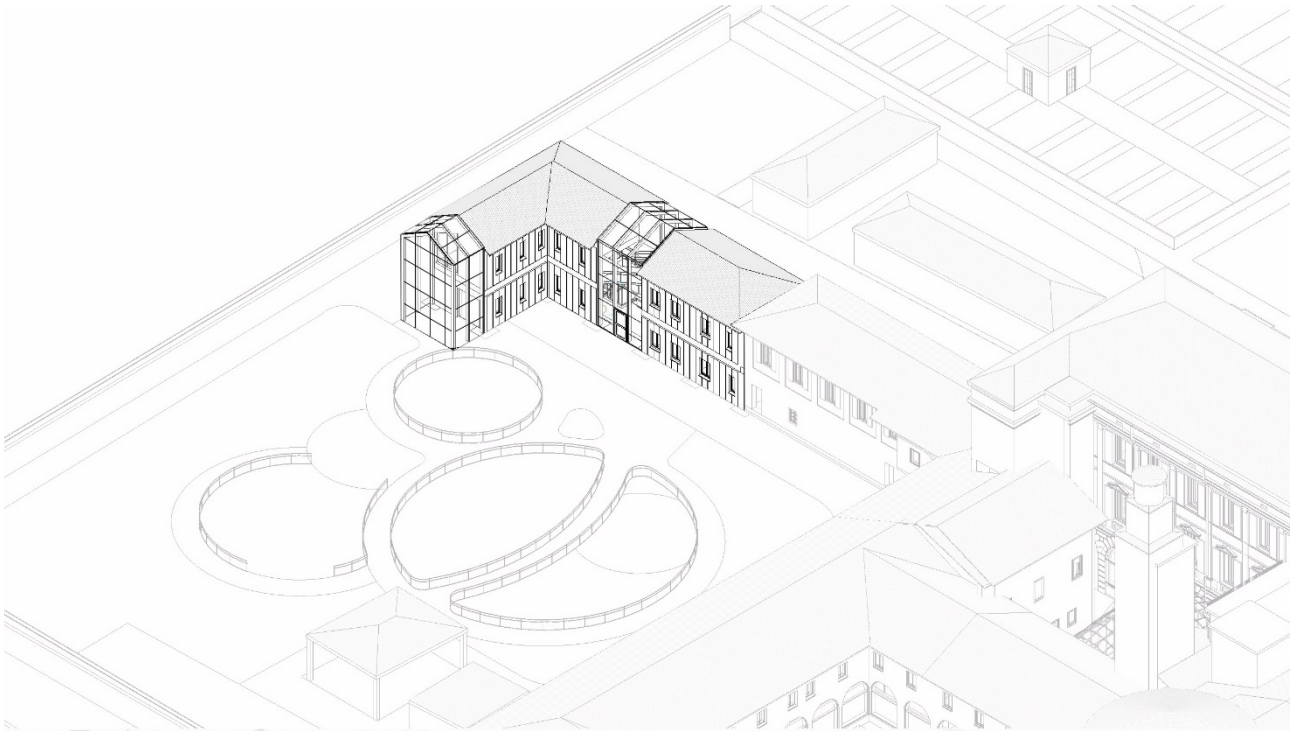


Figure 1. Axonometric view of the medical center.

The central theme of the thesis concerns the assessment of the sustainability of design choices aimed at saving energy. There are several tools useful to address this thematic and one of these is represented by the Cost Optimal Analysis, defined as a methodology through which it is possible to identify the best level of energy performance in terms of costs. It is therefore a question of merging the economic sphere with energy and the environment. The goal is to make energy saving choices by optimizing costs.

From a practical point of view, the "cost optimality" consists in creating a series of design alternatives conceived as combinations of different technological and plant-engineering solutions. These will then be subjected to energy and economic analysis evaluating the performance throughout their life cycle. In this way it is possible to check the effects that the single design solution causes on the energy and economic performance of the entire building. This procedure, if used since the preliminary phases of the design process, requires time and involves multiple design areas. A response to this assumption may be given by the adoption of new digital design tools such as Building Information Modeling (BIM).

The aim of the thesis was therefore to propose a methodological application of integration between BIM and Cost Optimality, in order to create a decision making tool that can be used from the preliminary phases of design process and which, subsequently, allows a continuous control of the energetic and economic performances for every project development. This premise was created thanks to the creation of a workflow that exploited interoperability for the sharing of heterogeneous information contained in the parametric 3D model to perform energy and economic analyzes.

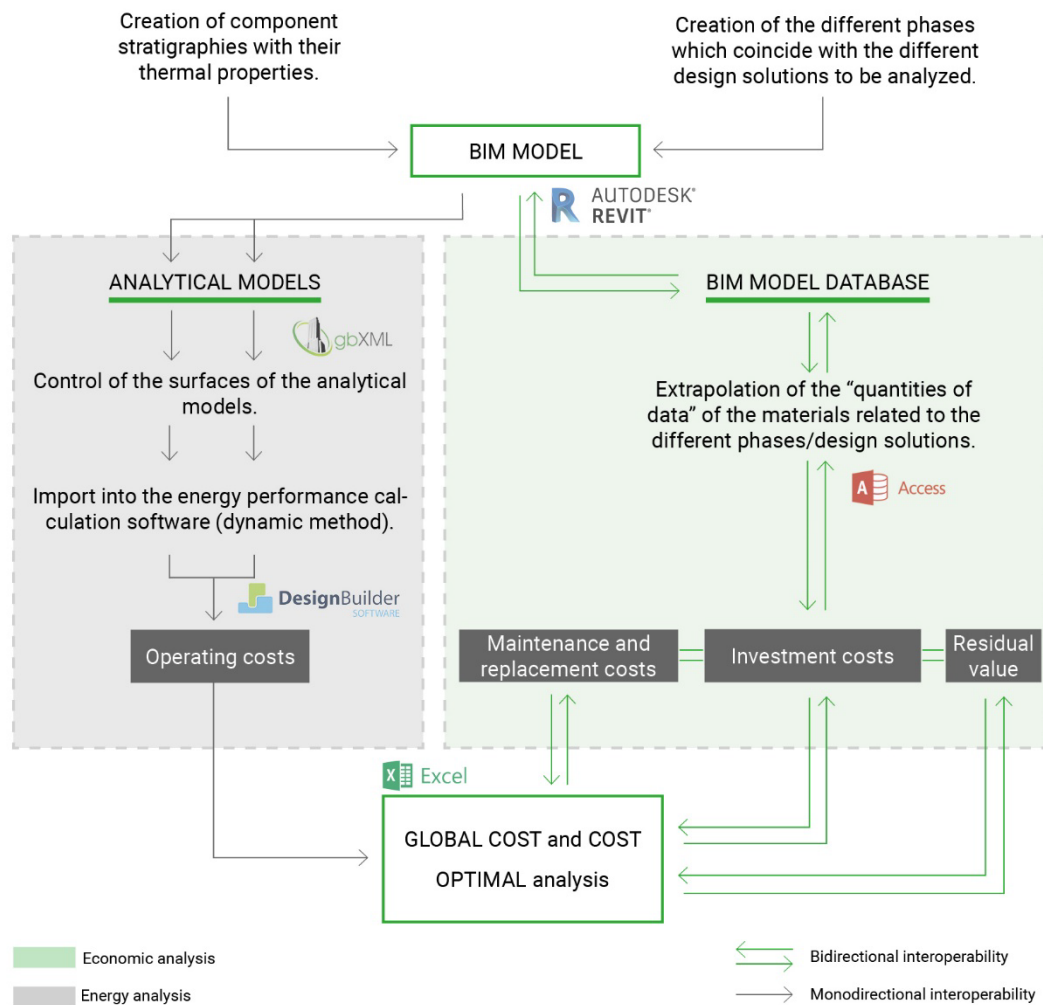
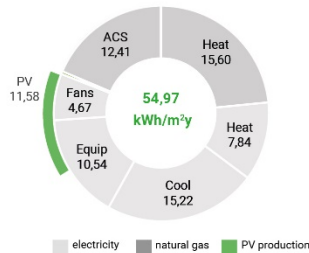
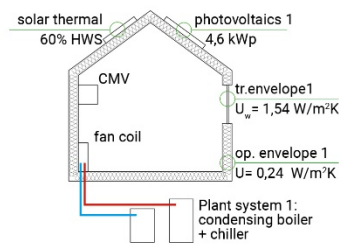


Figure 2. Scheme of the operating methodology used.

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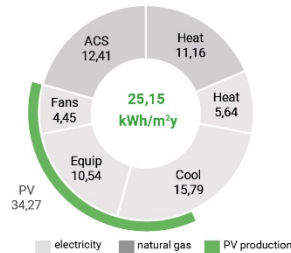
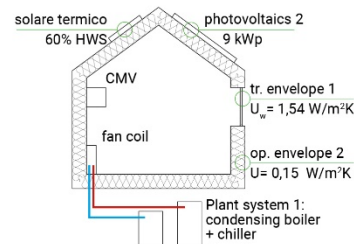
Set of design choices that guarantee the **minimum regulatory standards** for energy savings.



GLOBAL COST
602 €/m²

_solution 13

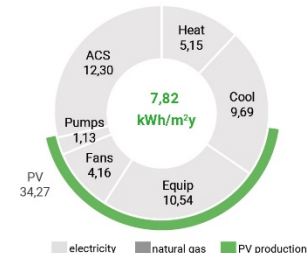
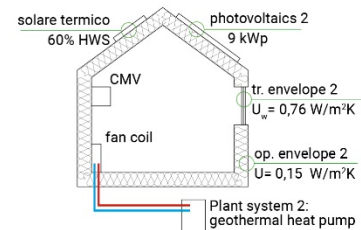
Set of design choices that guarantee the **best level of energy performance in terms of costs**.



GLOBAL COST
540 €/m²

_solution 16

Set of design choices aimed at **maximizing energy savings**.



GLOBAL COST
616 €/m²

Figure 3. Comparison between some design solutions.

The most significant results concern the analysis of interoperability between different software. Overall, there were no critical issues that could jeopardize the project but there are some aspects that conflict with the BIM methodology. These critical issues mainly concern energy analysis. In fact, there is no possibility of sharing information with energy simulation software in a bidirectional way. Furthermore, the accuracy of the analytical model requires a series of measures that often concern the simplification of the architectural model. At advanced design levels, this aspect hinders the great advantage of having a single model shared among all the figures involved in the design process.

Although the result can be considered satisfactory, further studies and researches on the implementation of BIM interoperability is needed in order to fully exploit its potential by speeding up and improving integrated design more and more.

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