POLITECNICO DI TORINO

Honors thesis

MASTER IN ARCHITECTURE HERITAGE
PRESERVATION AND ENHANCEMENT

Abstract

Energetic modeling and simulation of a historical building.

The case study of Conservatorio di musica *Giuseppe Verdi* in Turin.

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The United Nations Environment Programme (UNEP) attributed 40% of the World's energy consumption to the building sector.
Nowadays, international energy policies aim to reduce both energy consumption and greenhouse gas emissions in order to develop a more sustainable future.
Considering that 30% of the Italian built environment has been raised before 1945, the energy consumption in our country is enormous. The national scenario shows a considerable amount of historical buildings, only 1,8% of which is listed. Energy expense in these buildings is high and it strains the budget of the public administration, which often manages the majority of those.
As the literature states, energy efficiency measures are innovative yet incisive on modern buildings, while historical buildings struggle to improve their efficiency without compromising architectural and core values.

Energy simulation software is currently the most qualified tool to understand energy performance in both modern and historic buildings. Their use could help the designing process but, despite its benefits, it is rarely applied to develop retrofit solutions for historic buildings.
On the other side, these software carry critical issues: they can hardly shape a completely accurate simulation. Energy consumption is indeed influenced by the users' behaviour, a variability that could lead the software to fail.
This work aims to overcome the limits of the simulation tool by entering a building's real usage data. The goal is to obtain a reliable model and to identify the eventual energy waste, due to inaccurate energy management of the building. The study will therefore implement desirable strategies to reduce energy consumption and develop optimal management.

The research focused on a historical building in Turin, the Conservatorio di Musica "Giuseppe Verdi." The selected tool has been the dynamic simulation software IDA-ICE (Indoor Climate and Energy by EQUA Simulation).
The working method develops through four main phases, as follow:
1. Geometric model construction
2. Plant modelling and real use data input
3. Dynamic simulation and calibration
4. Implementation of optimal energy management strategies

Following on from a further simulation run after the energy management optimisation, the results show that it is possible to reduce energy consumption by adopting energy-saving behaviours regarding the HVAC system's functioning.

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