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

Energy certification: from requalification of existing buildings to passive house's design

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The aim of my study is to concern with the energy certification and supports the importance of adopting a requalification policy of existing buildings, which reduces consumptions related to winter climatization and hot water production. Two studying cases of energy requalification were considered, both residential buildings, located in Fiano and Rivalta, in province of Turin.

Residential house in Fiano (TO)

The residential building, built during the 1970s in Fiano, had different problems, for example an over loss of heating in opaque and transparent parts and an interstitial condensate perimeter wall in winter.
It is a G rated building, which means that it is the least energy efficient building with an energy demand of 288 KWh/m² year.
The calculated initial heating demand from the initial state shows that the energy consumption rate was only 40.000 in January.
The requalification design consists of enlarging the living room area with a solar glass house, a perimeter wall cohibentation with cork, a roof isolation, changing windows and solar panels installation in order to provide hot water. According to our energy demand calculation, we notice that a relevant gain is given by the contribution of the glass house and it is 31% of total amount.
At its initial condition we reached high value of 40000 MJ of heating loss, then at design condition it decreases at 14000 MJ in January. At 37,96 KWh/m² year consumption a year, it changes from G rate to B rate in addition to solving the interstitial condensation problem.
Another calculation considers energy demand for winter climatization that includes heating systems performances; we observe a saving of 70% energy costs and a decrease of CO2 emissions for 69%.

Residential house in Rivalta (TO)

Also the residential building in Rivalta originally presented an inequality between gains and losses; the main objective is to reach Passive House's standard (15 KWh/m²year).
A 20 cm thick isolation of perimeter wall and roof cohibentation has been made.
We've chosen triple-glazing windows with low-emissions frames and we've tried to reset every kind of thermal bridges.
The external air is heated before, with a system of pipe set 2 meters underground. In this way, the heat-recovery system is improved because ventilation losses decrease considerably.
So, energy demand for heating is 14,21 KWh/m² year, while energy demand for winter climatization is 14,79 KWh/m²year, costed 405 € yearly in an area of 447 m² circa.
I've also supposed some hypothetical changes of the building considered and how those changes might affect energy performances.
For example, reducing all kinds of nook or patchiness, we notice a 20% decrease of S/V factor (Surface of opaque parts / Volume of building). If we removed shadings formed by objects, energy demand would reach 9%. If we didn't build an entire heat-pipe system, losses would increase of 75%.
In short, during the design phase energy issues are very important; in particular, the S/V factor, building and roof orientation, volume and surfaces.
In order to construct an efficient building are not necessary innovative materials and techniques.
Saving energy helps us to contribute in increasing air quality. Energy certification is a fundamental instrument for sustainable development and a certainty, especially during this crisis period.

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