

POLITECNICO DI TORINO
FIRST SCHOOL OF ARCHITECTURE
Master of Science in Architecture (Construction)
Honors theses

Energy performance rating and certification of residential buildings of the second postwar period in Turin

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The attention on energetic problem, carried by new European regulation (Directive *Energy Performance of Buildings*, 2002) and Italian regulations (D.Lgs. n.192/2005 and D.Lgs. n.311/2006), involves all the architectural production: more restrictive energy performance requirements are referred both to new constructions and to existing buildings, which, larger in number and needed relief efforts to cut down on energy consumption, have wide margin of action. To encourage actions that preserve buildings and environment where buildings are set, whole buildings will be provided with an energy certificate that state their “energy efficiency”, in relation to reference values and law requirements. The energy performance of a building will be a further parameter that influence property market price.

In national and European context, training corporations and specialists are still working for a methodology of calculation of energy performance of buildings, in order to draft the energy certificate and to find out reference values for existing constructions, so that energy performance results in belonging classes.

The work developed in my degree thesis is a contribution to reach these two targets, through the application and the check of energy rating methods, and the individuation of energy performance indicator reference values and input data for calculation.

Since the building patrimony is very wide, concerning space, time and use, the analysis is carried out for some residential buildings sited in Turin and belonging to the second postwar period. On the chosen buildings, each one featuring a decade of this historical period, an accurate research is performed, examining design documentation and executing on-field analysis, which is essential in order to record the present situation. For each building the main properties are delineated, drawing up cards with typological, constructive and technical equipment data. Through a methodology, the energy demand for every building is calculated and the energy performance indicator of primary energy use for heating, cooling and hot water heating is expressed; the energy qualification certificate, which is the document preliminary to the energy certificate, is compiled. The energy qualification certificate gives useful information about the solutions to adopt on each studied building, in order to improve its energy efficiency, comparing it with the minimum energy performance requirements by law.

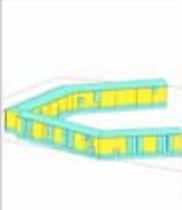
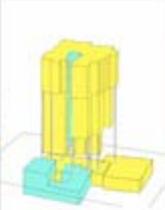
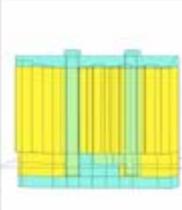
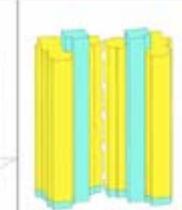
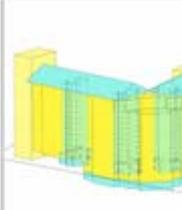
The standard calculated energy rating is followed by the measured energy rating, i.e. the actual values of energy consumption: through the comparison of the two different energy performance indicators, the methodology of calculation is validated and calibrated.

Regarding the second target, by means the research of the qualitative parameters of every building influencing the calculated energy performance indicators, it is possible to find out reference values of consumption of buildings in Turin comparable with the analyzed ones.

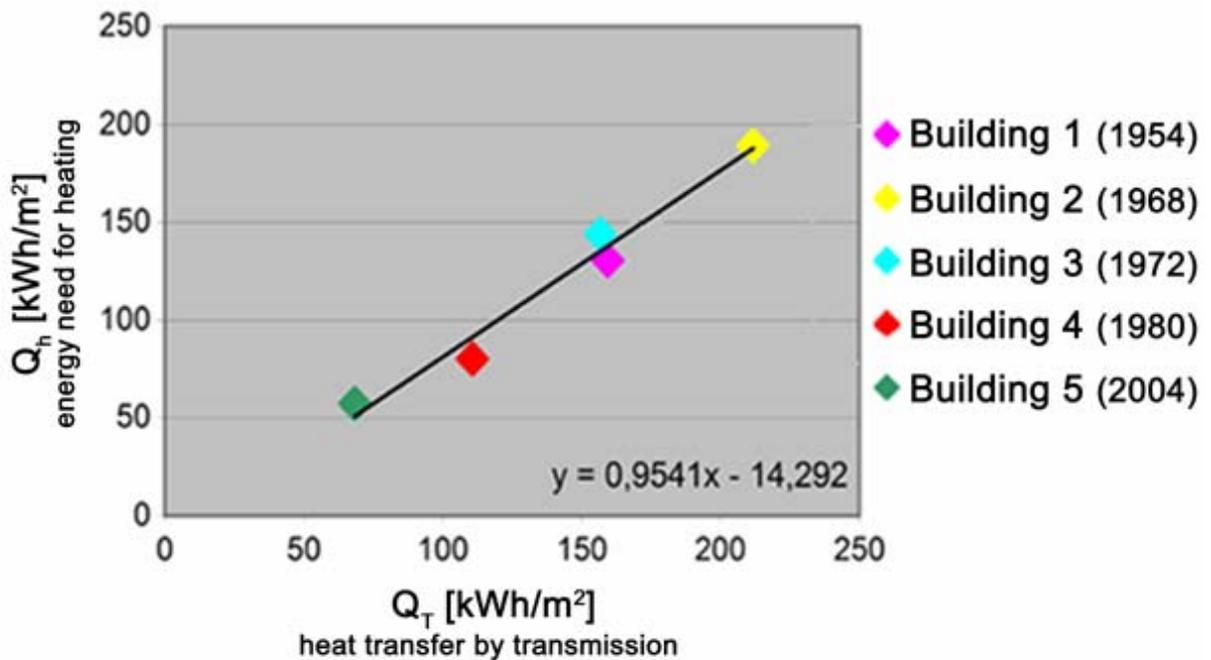
Finally, a historic-social analysis it is carried out on one of the buildings studied, in order to demonstrate that any evaluating method is not the starting point but the outcome of a historical and cultural process. The “measures” following from analysis are the result of decisions and operations done in specific social and legislative context by some subjects.

					
YEAR OF CONSTRUCTION	1954	1968-1969	1970-1972	1980	2003-2004
USE OF THE BUILDING	E.1	E.1 E.2	E.1 E.2 E.5	E.1	E.1
BUILDING TYPOLOGY	Courtyard	Tower	Linear	Tower	Courtyard
INSULATED BUILDING	NO	YES	NO	YES	YES
OPERATION FOR ENERGY EFFICIENCY	Individual	None	None	Global	None
HEATING SYSTEM	Central	Central	Central	Individual	Individual
HOT WATER HEATING SYSTEM	Individual	Individual	Central	Individual	Individual

Main data about the analysed buildings

					
HEATED VOLUME (V) [m ³]	19712	6606	14272	32740	10037
HEATED FLOOR AREA (A _f) [m ²]	5487	1712	3444	10320	2794
A/V [m ⁻¹]	0,50	0,60	0,37	0,41	0,44
A/A _f	1,82	2,30	1,52	1,31	1,57
A _v /A	0,09	0,07	0,10	0,23	0,11
A _v /A _f	0,16	0,17	0,15	0,31	0,18
ANNUAL ENERGY NEED FOR SPACE HEATING [kWh/m ²]	130,5	189,3	144,0	80,44	57,56
ANNUAL ENERGY USE FOR SPACE HEATING [kWh/m ²]	172,6	234,5	212,0	102,2	72,74

Summary of dimensional parameters and energy performance indicators as calculated



Example of the study about relations between qualitative parameters and energy performance indicators

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