

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

ENERGY CONSUMPTION FOR THE HEATING IN WINTER OF RESIDENTIAL BUILDINGS IN TURIN

by Mario Pairona

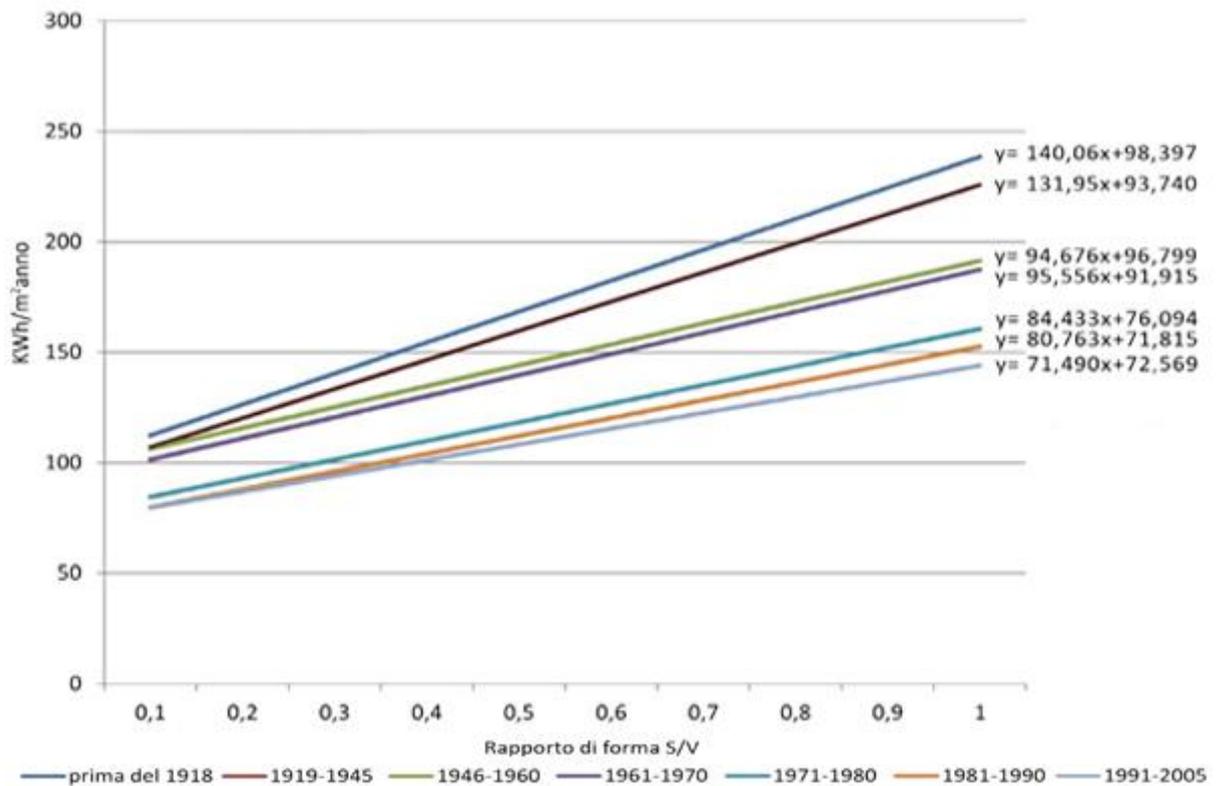
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This text proposes a method for the assessment of energy consumption on the town of Turin under the initiative *Cities on Power*. The calculation model is based on the real energy consumption for the winter heating of the real estate assets of Turin.

THE CONSUMPTION DATA For about 1000 buildings, bills of fuel consumption for the heating season 2010-2011 were collected; all these were served by a centralized system connected to district heating. The sample examined consists of 300 multi-storey residential buildings constructed between 1900 and 2005, located in Turin in districts 1, 3 and 5.

GAUSSIAN AND RESULTS The objective of the project is to create straight lines with consumption trends related to the relations of the form S/V , for each period of construction. To get the result we applied the theory of random errors.

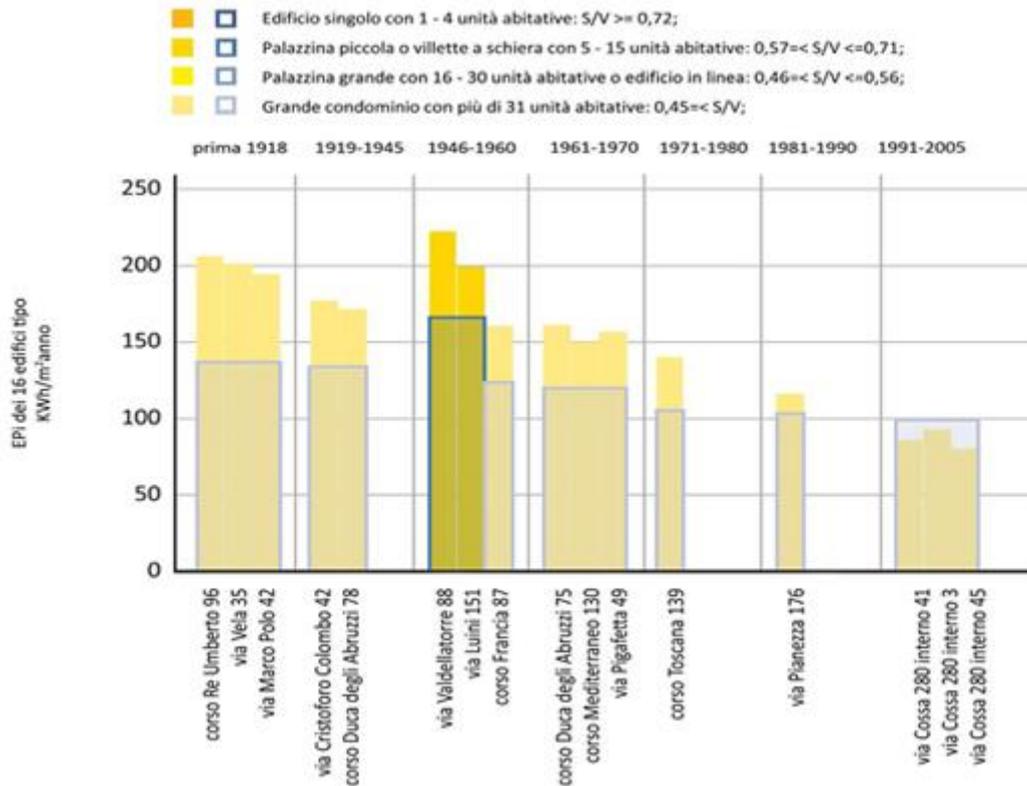
As we were researching for a direct correlation between the values of x and those of y , we built a series of Gaussians for each period of construction and established the acceptance region. The data are normalized with the climatic conditions of the 2010-2011 season; and each building is associated with its S/V and the period of construction. Reporting the data on the graph, we drew the following lines of the trend:



Trend lines for the ages of construction

CHOICE AND ANALYSIS OF BUILDINGS TYPE Every era is represented by 1 to 3 buildings, for which a detailed analysis was performed with the redesign of plans, elevations and section.

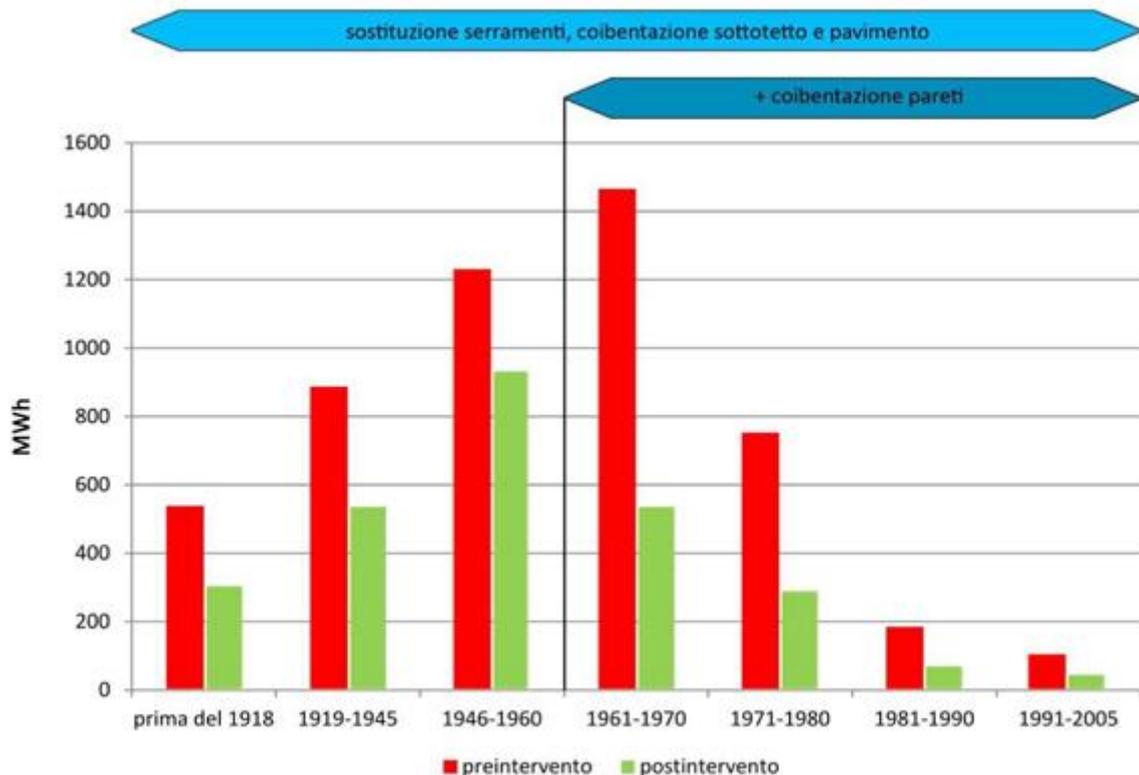
COMPARISON BETWEEN REAL DATA AND CERTIFICATIONS The differences found are due to the existence of stochastic variables related to the user as the values of air exchange, the contributions of internal heat, the mode of operation of plants and the number of operating hours. The graph shown the value of consumption calculated with the simulation software; generally this value is superior compared to the real one of AES.



Town of Turin, graph of real consumption in blue (source AES) and of consumption calculated with TERMOLOG Epix 3 in yellow

The buildings were divided into two main groups; for the first three epochs was proposed the insulation of the floors to the basement, to the attic and the replacement of windows; for the remaining four, it was proposed the construction of a thermal coat, the insulation of the floors to the basement, and the attic and the replacement of fixtures. The data shows an average decrease in consumption of 33% for the first and of 58% for the latter.

APPLICATION OF THE MODEL TO THE CITY OF TURIN The calculation of the energy savings for each period considers the average consumption compared to the surface area. These savings vary respectively from 49% to 24% for the first 3 epochs and 63% to 54% for the remaining 4. By performing the action described above, there would be an overall reduction of about 47% of the primary energy consumption for heating. Most of the buildings was built in the period 1946-1970, and more than 51 % of MWh consumed annually, is used to heat these buildings.



Overall reduction of consumption in MWh applied to the park building of Turin

With the proposed interventions in terms of energy saving, the total consumption resulting from heating could be reduced by more than 50%. By applying the interventions proposed in this study, it will be possible to achieve the proposed targets for both 2020 and for 2050 aiming for the overall reduction of consumption. With the decrease of the price of the insulating materials and the steady increase in energy, it is desirable to think that in the coming years it will be favored the recovery of these types of properties that are now antiquated from an energy point of view. This work could be used by the citizens to learn about the prospects for energy saving of their own buildings and of the public administration in order to implement energy policies which fell on the ground. What emerges is the need to have a land register energy not only for public buildings but also for the private ones and intervene to optimize the result of the energy upgrading.

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