

71st Conference of the Italian Thermal Machines Engineering Association, ATI2016, 14-16
September 2016, Turin, Italy

Energy audit of public buildings: the energy consumption of a University with modern and historical buildings. Some results.

A.Magrini^{a,*}, L.Gobbi^b, F.R.d'Ambrosio^c

^a Department of Civil Engineering and Architecture - University of Pavia, Via Ferrata 1, 27100 Pavia, Italy

^b Facilities and utilities management service – University of Pavia, Palazzo del Maino, Via Mentana, 4, 27100 Pavia, Italy

^c Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132 - 84084 - Fisciano (SA), Italy

Abstract

The reduction of energy consumption in public buildings is a priority indicated in European Directives and national legislative documents. Some aspects of this problem are presented and discussed in reference to the University of Pavia, one of the oldest universities in Europe, founded in 1361, which has a 40% of her total built area represented by building built before the II World War. The energy audit of the whole University building stock, the intervention potential, and particularly the energy consumption reduction in the historical buildings, allow to outline an overview of the accessible energy savings, and their costs.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the Scientific Committee of ATI 2016.

Keywords: Refurbishment, energy audit, historical buildings, public buildings, historic buildings, energy consumption

Nomenclature

IEN Normalised Energy Indicator for Heating

HDD Heating Degrees Day

PBT Pay Back Time

* Corresponding author: Anna Magrini. Tel.: +39.0382.985724; fax: +39.0382.985889

E-mail address: magrini@unipv.it

1. Introduction

The reduction of energy consumption in public buildings is a priority indicated in European Directive 2010/31/EU (EU Parliament 2010 [1]).

Among the public buildings categories, a wide stock characterized by a continuous use is the ones dedicated to learning activities. They are spread uniformly in the territory, and they are affected by high energy consumption, due also to the particular IEQ needs of the young people (as highlighted by EN 15251 Standard (CEN, 2007 [2] that will be soon superseded by EN 16798-1 and -2 Standard [3]).

The public buildings of the Universities are characterised by a very high multiplicity of activities (classrooms, libraries, offices, conference rooms, laboratories, bars, refectories, sports gyms) with various occupancy profiles, which must be taken into account jointly with the particular buildings features: a wide knowledge of the management issues and an accurate energy audit represent basic pillars for the critical issues of energy consumption, to support decisions on priority actions and their costs.

The energy consumption reduction is not always easy to obtain in this field, mostly when the University building stock includes a mix of contemporary and historical buildings. A more ambitious challenge is represented by the energy performance improvement of the historic buildings, that are important from the History's point of view, whereas a historical building is only related to the past (Mazzarella, 2015 [4]).

Regarding the historic and historical buildings, the Directive states that the Member States may decide not to set or apply the requirements referred to energy performance to “buildings officially protected as part of a designated environment or because of their special architectural or historical merit, in so far as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance”.

In Italy, most of the buildings edified before 1919 (that represent quite 20% of the national building stock) are Museums, like Palazzo Pitti, Galleria Farnese and Museo di Capodimonte, or representative buildings, like Quirinale, Palazzo Chigi and Ambasciata Francese.

Historic and historical buildings host the historic Universities also. The oldest Italian Universities started their activities before the 16th century: the first one was settled in Bologna traditionally in 1088, the University of Napoli, the first secular one, was founded on 1224, the University of Pavia in 1361.

At University of Pavia up to now 77,000 m² surface is occupied by historic and historical buildings, located in the town center, while 60,000 m² were built before the II World War, and 85,000 m² in the '80s, in other areas occupied by the modern edification, for a total built area of 230,000 m².

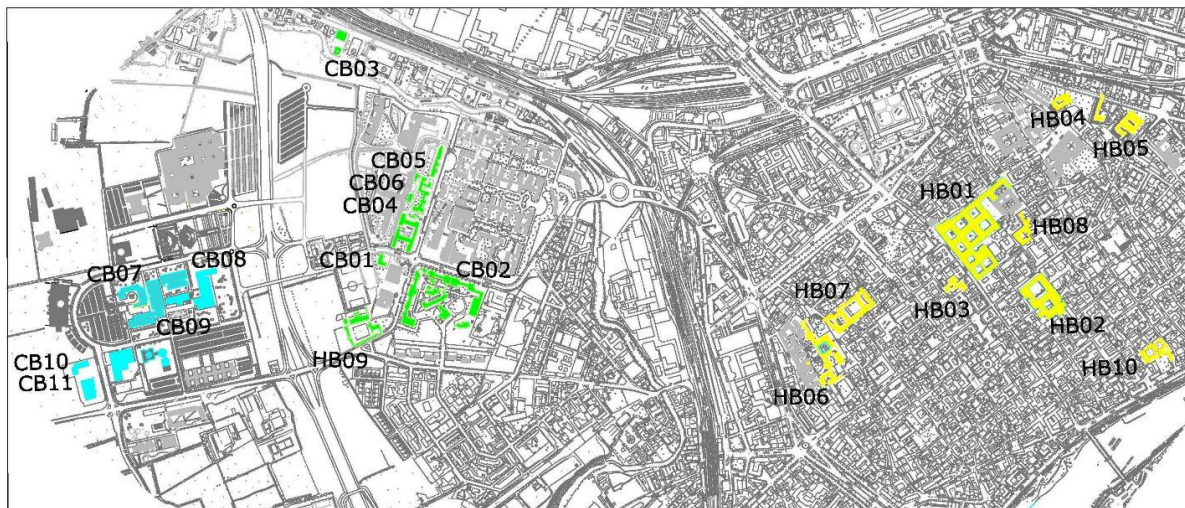


Figure 1 – Location of the University buildings in the town center (Historical Buildings, HB, yellow, right side), in the modern expansion (Contemporary Buildings, CB, green) and outside the town (CB, blue, left side)

Download English Version:

<https://daneshyari.com/en/article/5446450>

Download Persian Version:

<https://daneshyari.com/article/5446450>

[Daneshyari.com](https://daneshyari.com)