

# Teaching, sustainability and environment in UPC buildings

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## ABSTRACT

Universities must motivate future professionals so that they are able to apply their experience over and beyond the scientific and technological context <sup>[1]</sup>. These professionals should also be trained so that they are aware of the current position as regards the economy and limited energy resources, and they must be creative, knowledgeable and committed if they are to rethink the current model.

The Departments of Architectural Technology II and Applied Physics, in collaboration with the Interdisciplinary Centre of Technology, Innovation and Education for Sustainability (CITIES), believed that students could be given the opportunity to specialise in the area of sustainable development by means of their final theses <sup>[2]</sup>. With this objective in mind, a line of theses called Energy Assessments was created as part of the Plan for Resource Consumption Efficiency (PECR). The line was based on a learning strategy that focused on the student.

The teaching staff was able to observe that, in terms of cognitive aspects, the students improved their knowledge of environmental issues and the associated skills, and that they were more able to solve problems in the area of sustainability and had greater concerns about this subject matter after having completed their theses.

By means of a survey, the students also stated that their sensitivity and attitudes to the environment had changed and that, after having carried out the energy assessment, they all felt they had acquired new attitudes. This is highly positive, since it indicates that carrying out a project relating to the environment has an influence in shaping students' values, and this different outlook will undoubtedly lead them to adopt different attitudes in their chosen professions.

At present, 27 UPC buildings had been assessed from Architecture Students during 2003-2006 years. The initiatives have been highly successful from the point of view of academics and lecturers, so the works in set to continue. The remainder of university buildings will be examined through future official calls following our experience.

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The main purpose of this communication is to present the energy assessment as a reliable systematic process to obtain data about building's energy consumption, with the goal of making consumption as rational and efficient as possible.

We want also emphasize how this initiative has implemented the student's cognitive aspects, their attitudes and their sensitivity relating the environment

## INTRODUCTION

Since May 2003, through the initiative of the Associate Vice-Rectorate of Buildings at the Technical University of Catalonia (UPC), the Interdisciplinary Centre of Technology, Innovations and Education for Sustainability (CITIES), has drawn up and implemented its Plan for Resource Consumption Efficiency (PECR), whose goal is to lay down policies and define lines of action for saving and making more effective use of energy and water resources on UPC's premises.

This paper has the objective of publicising the results, from an academic standpoint, of a specific action carried out within the framework of the Energy Efficiency Plan <sup>[1]</sup> that is now being implemented and that will allow the existing commitment to greening the university studies in Technical Architecture School, to be strengthened. The first stage, this task was performed through the energy audit of 27 UPC buildings, and now, second stage is been developed though introducing energy savings in some of these buildings.

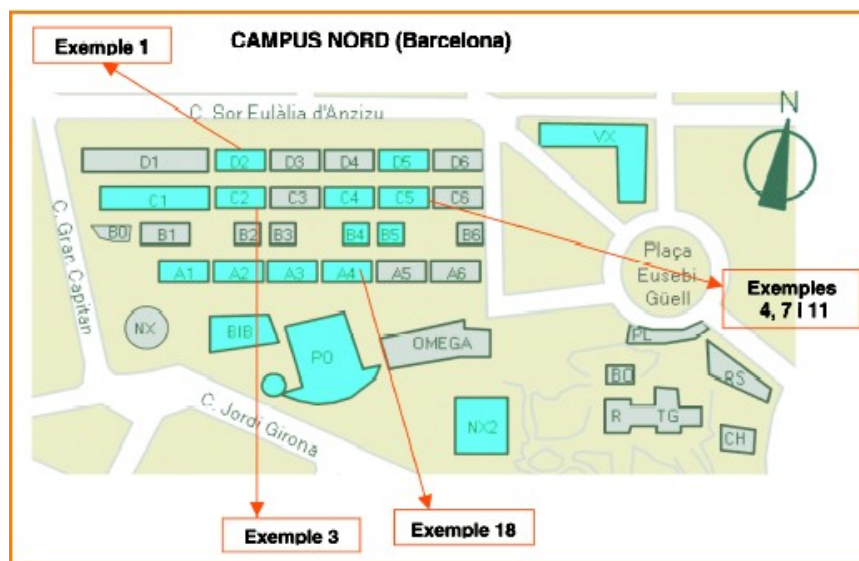


Figure 1: North Campus UPC buildings with energy assessment completed.

## ENERGY POLICIES IN UPC BUILDINGS.

Over the past few years, processes, regulations and strategies have been implemented that make it possible for buildings constructed before energy saving became a priority to become more efficient. These buildings had unsustainable and excessive consumption rates that were not questioned by their managers because they did not have reliable information on hand that enabled them to quantify or asses' consumption. As a result, no energy-savings policies were

set up, which in some cases could have contributed to the well-being and comfort of consumers without the need for a huge investment. Furthermore, such policies would have significantly added greater value to the quality of a building's use, would have led to financial savings and would have increased commitment to what is known as “environmental solidarity”.

In the context of this scenario, UPC set itself the task of implementing the PECR (which includes the carrying out of energy assessments). The PECR is a tool that helps those responsible for the management and maintenance of buildings to gauge the current state of consumption of resources so that a reduction in consumption can be brought about, without sacrificing user's basic comfort requirements.

Energy assessments give an indication of the lines of action to be taken and suggest ways of reducing the environmental impact to a minimum. Therefore, the measures that may arise as a result of the assessment process mainly respond to this goal, without losing sight of other factors that will also have a bearing on the decision-making process and will define the set of priorities to be laid down.



Figure 2: *Sirena Project*: Information System as a key for the Sustainability Strategy

In this moment, CITIES has been developed the Sirena Project, an informatic tool that allows checking and controlling energy consumptions on-line, for each UPC building. This program also permits to compare static and dynamic data in order to obtain reports and indicators tables.

### Energy efficiency, diagnosis and lines of action.

Assessing a building's energy efficiency requires an overall outlook as there are a great number of parameters involved in the assessment, which in one way or another have an effect on its design. Errors sometimes arise because concepts are misinterpreted and at other times due to improvise terms or changes in usage and even due to a lack of maintenance and inefficient management.

That is why we believe that one of the most significant contributions made by energy assessments is to ascertain whether energy consumption in real terms, that is whether the energy bought, corresponds to a building's requirements under the conditions for which it was designed, or, in other words, whether the energy demand derived from the comfort parameters for each building is being met by the energy that the building really consumes. This test should provide us with the first alarm signals as regards whether a building is efficient or not, and it should also make us reflect on whether we are perhaps expecting a building to be more comfortable or perform better than its design allows it to.

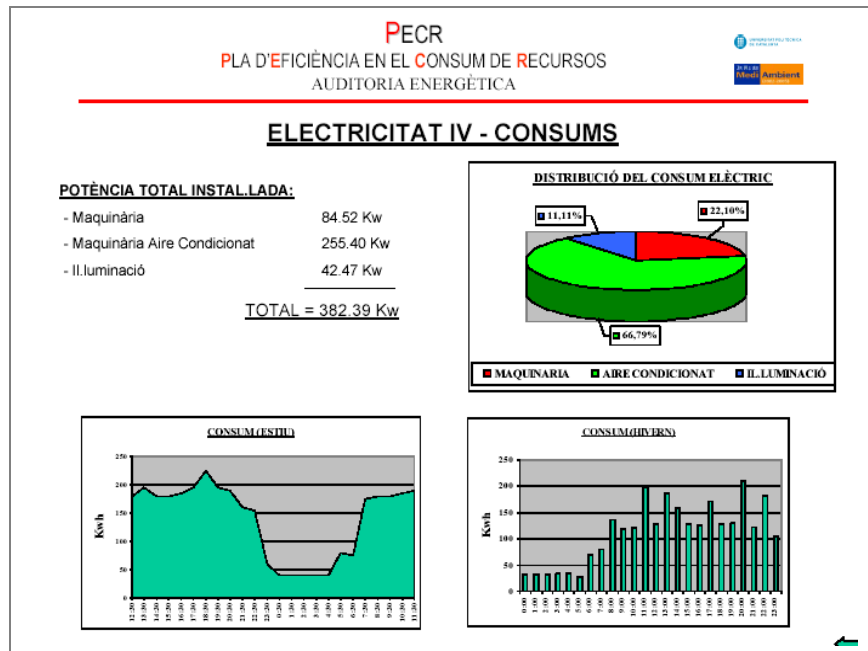


Figure 3: Electricity consumptions in Modul 5, North campus.

## LINES OF PERFORMANCE AND PROPOSALS OF INTERVENTION.

At the end of all this process <sup>[3]</sup>, we can define the lines of performance in which it is necessary to take part and the specific actions that must be developed. Different proposals are grouped in which we called "lines of performance", related with the methodology used during the data measurement and the evaluation. At the end, we defined:

- Actuacions related with the building envelope: architectonic and constructive characteristics of the building, especially focused on the façades and roofs. The objective of this kind of proposals is to reduce the energy performance level.
- Actuacions on the energy resources systems: lighting, air conditioning, and others.
- Performances related to the management of the power resources: occupation of the buildings, uses and functions (timetables, periods, etc.)

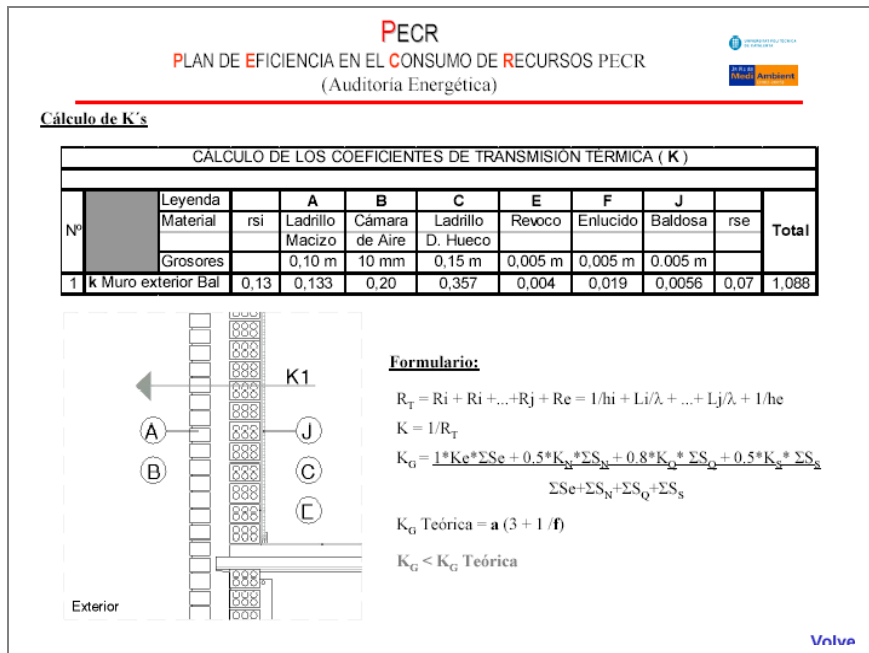


Figure 4: Thermal Transmission in FME Building, South Campus.

Each one of the performances identified must be valued according technical, economics and logistic viabilities and it's necessary to provide the priorities framework in order to ensure that available resources will be invested the most effective and efficient way [4].

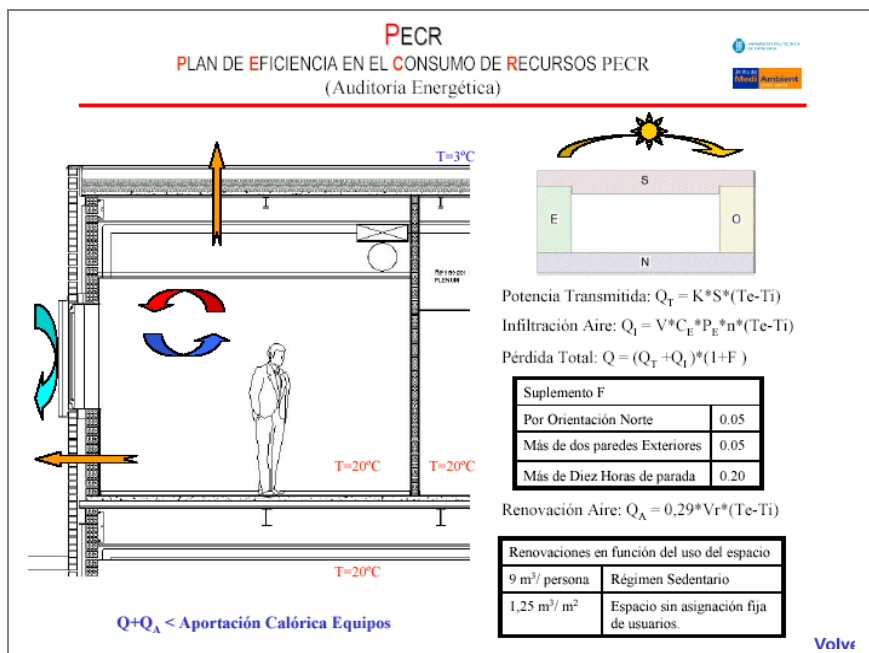


Figure 5: Thermal equilibrium in FME Building, South Campus.

## CONCLUSIONS

The discussion of sustainability and its relationship with architecture often turns on an evaluation of the impact of the materials and energy consumed in the use of the buildings. But

the most important impact that University activities can incorporate in the environmental is to generate new attitudes in the students, as part of their education.

Universities must redirect the teaching-learning process in order to become real change agents who are capable of making significant contributions by creating a new model for society. Responding to change is a fundamental part of a university's role in society. The United Nations Decade on Education for Sustainable Development (2005-2014) offers a great opportunity to consolidate and replicate this existing good practice across the international higher education community<sup>[5]</sup>.

The development of this work has permitted to integrate, in a positive experience, the main working groups of the university: investigators, managers and professors. This confirms the need to define the objectives of the sustainability from an interdisciplinary perspective.

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