Louise Labé Secondary School

- Demo case studied through the project: IEA Annex 36: Energy Retrofit of Educational Buildings

Demonstration Project Brochure

Innovative application

- Wall insulation
- Double-glazed windows
- Day lighting maximising
- Mechanical ventilation
- Building Management System

General information:

- Project developer (designer):
  - P.Boinay : architect
  - Region Rhone Alpes: builder
- Location: Lycée Louise Labé, Boulevard Yves Farge, 69007 (Lyon-France)
- Project starting date (year) : 1997
- Project status: completed in 2001

Summary of project:

The Louise Labé Secondary School, dedicated to technical teaching, was built in 1953. Although the heating system of the school was improved in 1987, the general state required a complete refurbishment and an important enlargement. In fact, the renovation of the school was carried out in 2000, different energy efficient retrofit measures were taken-up during the renovation process.

The Louise Labé Secondary School of Lyon was involved in the international project IEA Annex 36 – Energy Retrofit of Education Buildings. The implementation of this project aimed to provide useful tools and guidelines for decision makers and designer to improve the learning and teaching environment of educational facilities through energy- efficient retrofitting; as one of 33 cases studied through the project, energy efficient retrofit measures applied in the Louise Labé Secondary School for existing educational were analysed. The information collected through IEA Annex 36 is shown in this brochure.

In the present case, the renovation of the school aimed at enlarging the Secondary School built area and at reorganizing spaces in order to unify teaching areas, to refurbish the building's general aspect and to correct acoustics, thermal conditions and access for physically handicapped people.

View of the building from the patio

Description of project:

The school is located on a large green site in Lyon and one part of it is classified as of special ecological interest. It was originally made of 2 linear L-shape buildings with concrete façades, like most constructions of the 1950's and 1960's.

The new building has the following main features:

• an enlarged block (2 floors) along the main road with a central corridor

• a central open garden ("patio") around which are distributed the added rooms at the first floor (especially the large workrooms for dress-making teaching) and whose ground floor is used partly as a covered playroom

• an extension of the building to connect with the gymnasium

European Project "Eco-Building International Club for advanced European sustainable energy technology dissemination in Europe and China"

Project partners:

ENEA (IT), ISNOVA (IT), FINCO (IT), ADEME (FR), AIMCC (FR), DTI (DK), DI (DK), CRES (GR), EBHE(GR), GPREC (GR), SEC(B), ZERI (CN), CBEEA (CN)

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Thereby, the total floor area has been extended from 5000 m² to 9000 m² and the school can currently welcome until 600 pupils.

Many innovative building technologies have been implemented in this school to maximise energy savings, insulation, natural lighting, heating and ventilation.

In particular, the main retrofit features are as follows:

- Wall insulation and roof insulation
- Double-glazed windows
- Heat exchanger on the district heating service
- Increase of day lighting
- Mechanical ventilation
- Building Management System

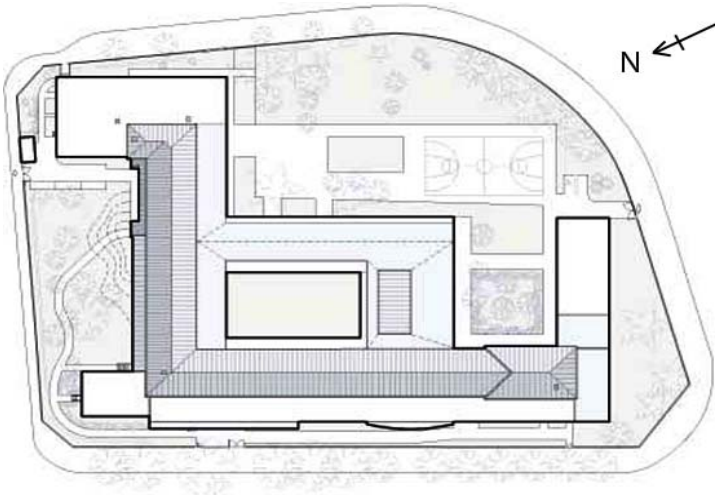
Technical description

- Climate condition

In Lyon, the microclimate is semi-continental, that is to say that summer are hot and winter are cold (average annual temperature is 11.5°C, with 4.8°C as an average winter temperature)

- Technical requirements of the buildings

The total floor area has been extended to 9000 m² and each classroom size is 60.8 m², having 17.8 m² of glass area/windows.



Site plan

- Innovative building technologies

Energy saving concept

Energy saving was not the main aim of the retrofit project, but energy conservation for space heating should be achieved thanks to better insulation of the envelope, weather stripping of windows and the increase of day lighting in general and particularly in some rooms (eg the library and circulation spaces).

o Building insulation:

Wall insulation is 8 cm glasswool plus 4 cm polyurethane on the lightweight façades and 8 cm polystyrene for masonry walls (U value = 0.47W/m2K or 0.43 W/m2K).

Roof insulation is 20 cm glasswool (U value = 0.39 W/m2K). Replacement of single-glazed windows by double-glazing (4/12/4) with aluminium frames but low thermal bridges (U value = 4.3 W/m2K).

o Heating improvement:

The oil boilers have been replaced by a heat exchanger on the district heating service. Hot water is distributed to the rooms at a variable temperature depending on the zone of the building. Ducts are insulated with 3 cm glasswool.

Radiators with thermostatic valves contribute to the heat diffusion at a controlled temperature in the main part of the building. In the entrance hall, heat is assured by 3 fan assisted convectors inserted into the suspended ceiling. In the library an underfloor system provides the base heating. In the theatre, a displacement ventilation system provides either heating or cooling from an air handling unit.

Domestic hot water for the kitchen and the lavatories is also produced by the heat exchanger through an intermediate storage vessel.

o Building Management System:

Finally, a building management system has been installed to manage heating, ventilation, alarms and maintenance.

The project aims at promoting and widespread disseminating EU innovative Research and Technology Development and Demonstration results, as well as eco-sustainability criteria in building sector, which include:

- energy efficient building materials, components and systems not yet introduced into the building market or in their first market phase;
- innovative applications of heating/cooling and power supply technologies, combined with the use of renewable energy sources, in building sector;
- best EU demonstration eco-building projects.

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o Mechanical ventilation:

Before the refurbishment, there was no mechanical ventilation system and air renewal being only by opening windows.

Now, for general teaching classrooms, a minimum ventilation flow is provided by mechanical ventilation. Additional needs are covered by manual opening of the windows. Air inlets are located in the upper part of the windows and air outlets at the opposite wall.

Fans run under the control of Building Management System set according to the hours of occupation.

Mechanical extract ventilation in the lavatories runs continuously. When gas is used inside a teaching laboratory, extract ventilation is provided. In the kitchen, a balanced ventilation system is installed. There is no air treatment to cool, dehumidify or preheat air to the classrooms and the offices. Only the theatre is equipped with an air handling unit (heating/cooling), with large diffusers at the bottom part of the room and ceiling mounted air outlets to extract pollutants.

o Lighting:

Natural lighting is largely provided through highly glazed façades (ratio glazings/façade=0.79). Windows are equipped with roller blinds (ground floor) or outdoor screens (first floor) and horizontal solar protection in the form of aluminium fins is installed on east, west and south façades. In the workrooms of the first floor, light-shelves provide lighting from above.

In the classrooms, artificial lighting is provided by ceiling mounted luminaries with fluorescent tubes (4 x 18W), plus blackboard lighting (tubes of 58W). In other rooms and corridors, ceiling inserted spots with compact fluorescent lamps (2x18W): 50 of these are controlled by 5 switches and 242 in the corridors are controlled with time switches by the Building Management System.

Performance:

Energy data: first results and comparison show that the new building is clearly more energy efficient.

The here-under table presents energy consumptions before and after the refurbishment. The data have been directly collected from the school's energy bill.

	Before refurbishment (average for years 95, 96, 97)	After refurbishment (year 2001)	Evolution "before→after"
Heating consumption ratio	174 kWh/m².y	93 kWh/m².y	**- 47%**
Electricity consumption ratio	24 kWh/m².y	31 kWh/m².y	**+ 29 %**
Total building consumption ratio	198 kWh/m².y	124 kWh/m².y	**- 37 %**
Natural gas consumption	7755 kWh	6363 kWh	**- 18 %**
Water consumption	1717 m^3	1355 m^3	**- 21 %**

Even if the school almost multipies by 2 its size after the refurbishment, it clearly appears that electricity consumption, all others consumptions have extensively decreased.

Economic data: the global cost of this project was 62,3 MF (€9,5 million). The different expenses were distributed as follows:

- Envelope Building works: €4,700,000
- Windows: €690,000
- Systems Lighting and electrical appliances: €600,000
- HVAC: €790,000
- Building Management Systems: €75,000
- Approximate increase in cost of project due to the discovery of asbestos: €37,000.

Environmental data (Carbon Dioxide emission reduced): No data are available on this point. Nevertheless, we can guess a significant reduction of emission as the heating system previously used 722.370 kWh of oil and 148.902 kWh of natural gas.

User Evaluation:

Occupants' satisfaction regarding the refurbished building was studied through a questionnaire. The surveyed sample included 4 teachers and 24 students, and no administrative staff. The results were as follows:

- About thermal comfort: In general terms, the level of temperature is good for 30% of the occupants, and acceptable for another 40%

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- About the quality of daylight and artificial light: overall satisfaction, less than 30% quoted that there was sometimes a problem of insufficient lighting of blackboards or annoying glare.
- About acoustics: No problem was reported about the equipment, but some dissatisfaction relative to noise insulation between rooms or between rooms and circulation spaces.

Left: Patio Before Refurbishment / Right: Patio After Refurbishement

Project Builder: Region Rhône-Alpes

Architect: P.Boinay

Further information:

Name of project owner	Région Rhône-Alpes
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Eco-Building Club: an innovative RTD&D results' promotion approach

Different from common market promotion approaches, where market operators are only simple message receivers, the project proposes an innovative approach: Eco-Building Club is a virtual round table, around which building market operators will be main actors for market penetration of research and demonstration results, through the following actions:

- determining what are more appropriated innovative RTD&D results for local market transferring;
- demonstrating the feasibilities of the research and demonstration results on real cases.