Holcim Awards 2005
Latin America

Escola Minima-Energia, Rio de Janeiro, Brasil

Project data

Type of project: Architecture (education)  
Start of construction: Begin of 2006

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Project description by author

The ZEROS Energy School is a building complex for 1200 students, composed of a access/administration building, class rooms in the north and south wing, a centre of laboratories, a library and an auditorium. The total floor space is around 11 000 m2. From the very beginning this project focused on user’s comfort as well as on a very low energy consumption, with the option of full energy autarky in the future. To reach this ambitious goal, an integrated approach was realized, focusing on:

- improvement of the micro-climate
- natural ventilation
- daylighting and shading
- building surfaces with minimum thermal mass and optimised albedo
- optimised artificial lighting system with daylight sensors
- solar energy

improvement of the micro-climate: due to its important impact on the natural ventilation, great emphasis was given on the improvement of the microclimate. Of the total area of 16,226 m2, 29% will be covered with grass for leisure activities, 33% with native trees from the Mata Atlântica and 29% with intensive & extensive green roofs. That makes a total of 94.5% of unsealed surfaces. Comparing the monthly potential of evaporation and the monthly precipitation, a maximum of 12,350 MWh/year of evaporation cooling can be achieved by natural means on the building site. The remaining rain water run-off will be collected in cisterns and used in a solar driven high-pressure evaporation-cooling system. Since May 2004 a weather station is recording the climate data of the building site. Parably a scientific project on green roofs is going on since 2005, measuring surface temperatures and run-off rates and improving different substrate blends and adequate plants. The results are being integrated into the project.

Natural ventilation: due to glass louver windows, cross ventilation is working in all class rooms. To tackle the biggest problem of natural ventilation, the acoustic comfort, several measures were taken: the creation of a big tropical garden between the north and south wing, keeping distance between them; the placement of the recess areas, always opposite to the other wing, using each building as a noise barrier during the breaks, necessary due to different time-tables; the integration of artificial waterfalls in the north façades, creating a sound mask (+ cooling effect: diffuse sound). The international style with fully glazed façades is a main reason for high energy consumption in buildings worldwide. This project features a regional modern style, based on climatic parameters and regional (modern) traditions. This means a change of paradigm. Own research and development activities led to new and innovative solutions in design tools and building technologies, e.g. a special software to calculate yearly daylight autonomy, façade integrated waterfalls and green roofs adapted to local climate and cost structures. All concepts, building technologies and materials are locally available and comply with local financial possibilities, therefore a full transferrability to similar projects in tropical countries is possible.

Ecological quality and energy conservation

A careful implementation of the building complex and the use of green roofs result in a 95% unsealed building site, recovering parts of the original rain forest. The unsealed surfaces contribute to a potential of evaporation cooling of up to 12,350 MWh/year. Carefully developed façades provide, together with a corresponding building layout, a yearly daylight autonomy of 86% in class rooms. A 1m2 PV-panel is enough for the artificial lighting of a 60m2 class room. Due to the combination of improvements of the microclimate, natural ventilation, sun-shading and thermally neutral building surfaces no air conditioning is necessary. No toxic building materials being used. The reduced rain water run-off will be collected in cisterns for further use in a solar driven evaporation-cooling system.

Economic performance and compatibility

Instead of spending 25% of the building costs on AC, high energy costs and investment eg. for coated glasses, this project invests in daylight control systems, improvements of the microclimate, green roofs, improve the performance of users due to daylight and no AC-related diseases. A reduced need of artificial lighting brings the use of PV for energy autarky into a economic viable range.

Contextual response and aesthetic impact

The client, a non-profit private school fostering a classic education inspired by Humboldt, carries out social and environmental projects in the poor neighbourhood. The project was developed in cooperation with all stakeholders.

As architects we assume that the firms to build this project will respect all ethical standards demanded through Brazilian legislation.

Relevance to target issues (by author)

Quantum change and transferrability

The work inventively implements a comprehensive series of environmentally sensitive features in a public school facility. Deserving attention are such features as natural ventilation, natural lighting with protection provided from direct solar radiation, and an accessible roof garden. Although such measures are widely deployed, this project is distinguished as an innovative contribution to the region. Instead of manifesting a foreign element in the environment, great care is taken to effectively integrate the ensemble of indoor and outdoor spaces into the natural surroundings, suggesting an expanded conception of ecosystems. In addition to these concerns, every attempt has been made to maximise performance of both the architectural and natural patrimony. Also deserving merit is the intensive analysis of the building’s adaptability to changing light conditions throughout the year. Contextual sensitivity is further underlined by the skilful combination of modern expression and responsiveness to local parameters. Stakeholders play a direct role in the design and decision making process. Overall, the work presents a very legible spatial order that is aesthetically cultivated and attuned to the needs of diverse local interests.

Comment of the Holcim Awards 2005 jury for Latin America

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Image No. 1

Image No. 2

Image No. 3

Image No. 4

Image No. 5

Image No. 6

Image No. 7

Image No. 8

Image No. 9

Image No. 10