

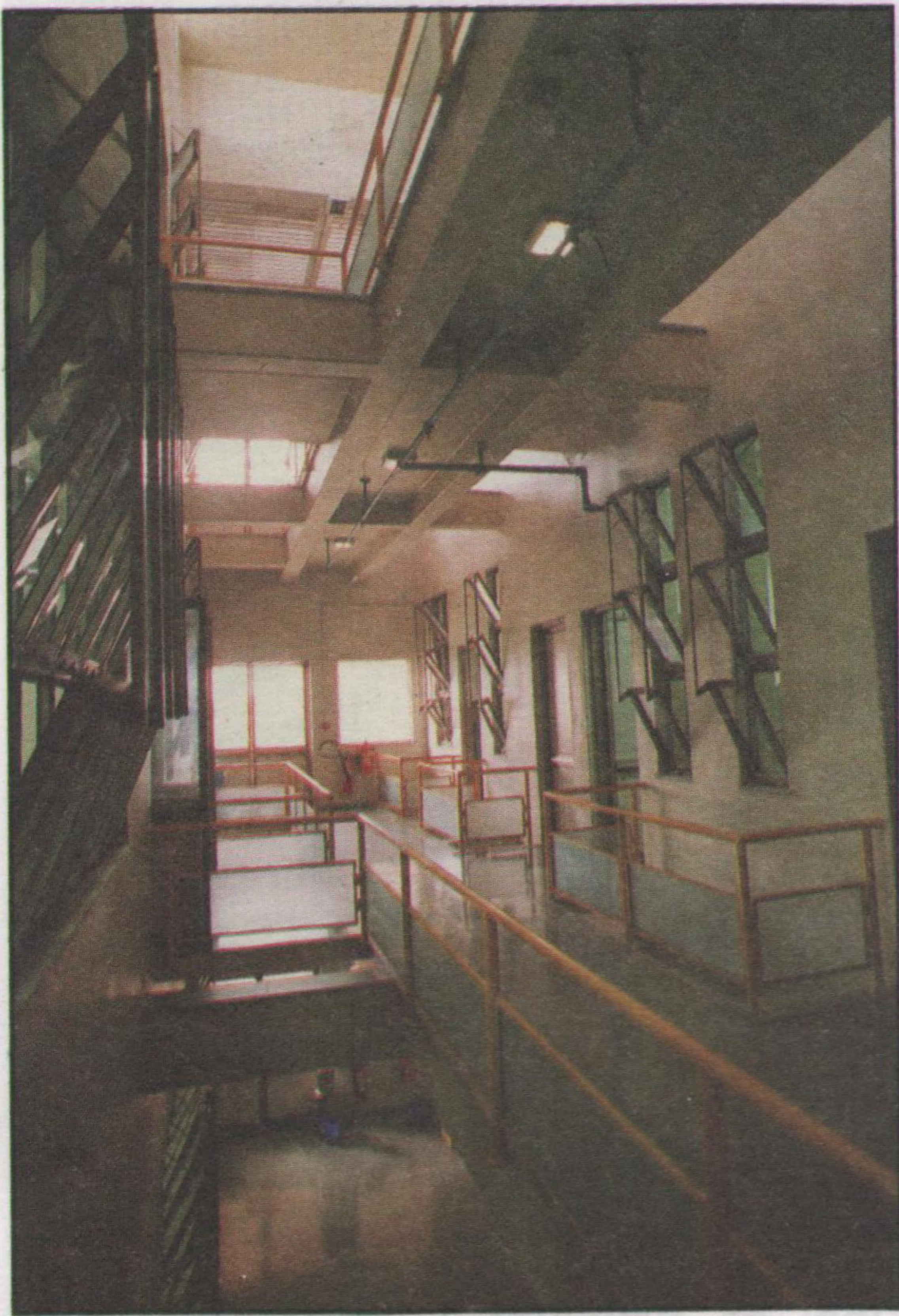


Developed societies, with their sustained focus on the increasing importance of individuals, have caused excessive consumption of electrical energy for cooling the internal spaces of the buildings. This has made mechanical cooling an inherent necessity for almost all spaces in any modern building in semi-arid regions of the world.

Consequently, a majority of the buildings designed in such regions assume, for human comfort, the

use of artificial lighting and air-conditioning systems, even during daylight hours. A building that does not use electrical energy to maintain human comfort is almost inconceivable.

Such assumptions are a myth, in addition to being detrimental to the objectives of resource conservation, which ought to be a priority, particularly amongst the developing countries of the world, with their constrained resources.



In an attempt to find technological solutions to the problems of our country from within our own resources, Abhikram, since its inception, has been designing buildings which primarily work with natural light and ventilation during the daylight hours.

Torrent Research Centre for Torrent Pharmaceuticals

Ltd., Ahmedabad, an example of such objectives, has demonstrated that it is possible to provide human comfort with minimal use of energy almost throughout the year.

THE PROJECT :

A complex of pharmaceutical research laboratories, with its supportive and ancillary facilities and infrastructure, in the outskirts of Ahmedabad, the project comprises almost all the disciplines of pharmaceutical research with their resultant range of the cleanest of areas (requiring Class 10000 atmosphere), as well as the dirtiest of the areas (emitting obnoxious gases).



THE ATTEMPTS :

- Use of innovative problem solving approaches in Design as well as Construction processes, which strike a satisfactory balance between the varied requirements of the activities, without compromising with any functional needs and the ambience.
- Conservation of resources through Eco-friendly principles of design, and design decisions in all aspects.
- Minimal use of artificial light, through strategic and adequate placement of openings.
- All laboratory spaces to maximize the use of consistent light from the North.
- Increased dust control.
- Minimal use of conventional air-conditioning system with the introduction of the Passive

Down-draft Evaporative Cooling (PDEC) system.

- Design of building elements to perform functions, in addition to their basic functions.
- The aesthetic language to represent the inherent character of the building functions and result in a simple but attractive and imposing appearance, which has a quality of timelessness.

THE 'PDEC' SYSTEM :

The system of sealed evaporative cooling, called Passive Down-draft Evaporative Cooling (PDEC) was evolved by Brian Ford of Short & Ford Associates, UK, an Environmental Consultant, for a typical Laboratory Module with inputs from Abhikram. Subsequently, Abhikram independently evolved the design of the Main Administrative Block, the Central Core, and other similar Laboratory Modules. These were



vetted, for their design, by Dr. C.L. Gupta of Solar Agni International, Pondicherry, India, an internationally renowned Environmental Scientist. The team of engineers of the Torrent Research Centre has executed the mechanical and electrical engineering aspect of the system.

The resultant building offered a climatically sealed environment with only designated inlets and

outlets of air through which, a fine spray of water is used to cool the air at the point of entry. The building is insulated with a natural mineral instead of chemically incongruent materials.

Passive cooling for human comfort is achieved through a system of inlets and outlet shafts which, as a consequence of their locations, sizes and heights, and through their complex but simulated and in-depth researched configuration, generates the required movement of air in different spaces using minimal mechanical or electrical energy. During the monsoon months, with high saturation, the system is expected to provide human comfort only through the use of fans.

The project comprises ten major buildings totalling to approx. 19700 sq.mts. of Built-up Area, spread over a 30-acre site.



THE CONSEQUENCES :

The consequences, of this major experiment and a step forward in the direction of energy saving, have been under observation since the first occupation of the buildings, and will continue to be carried for the coming three years. However, the observations, till date, clearly indicate that, in the three principal seasons, since its occupation, the human comfort conditions have not been compromised.

Some of the observations are as under :

- In summer, the inside

temperature remains between 29 °C to 31 °C, even when the outside temperature rises to 43 °C;

- Six to nine air changes per hour have been noted in summer on different floors, including in a chemistry laboratory;
- The temperature fluctuations inside the building do not exceed beyond 3 to 4 degrees Centigrade, over any 24-hour period, when the temperature fluctuations outside are as much as 14 to 17 degrees Centigrade;
- Very rarely, does the inside temperature fluctuations cause any level of discomfort to its occupants.

THE ECONOMICS :

The economic viability of the project is demonstrated by the

following indicators, which are computed for the total project, on the basis of the results from the buildings under observation. They are :

- Additional civil works cost of the project including insulation etc. works out to about 13% of the civil works cost of a conventional building.
- Air-conditioning plant capacity saved, is about 200 M. tonnes, which works out to about 7% of the civil cost;
- The annual savings in the electrical consumption including the savings on account of non-use of artificial lighting during the day will be approximately Rs. 50.00 lakh, at the current tariffs;
- The payback period of the total capital cost, from the

saving of the electrical consumption alone, works out to a little more than one year.

- The payback period for the cost of entire complex, from the savings of the electrical consumption as well as plant replacement costs, works out to around 15 years.

USER STATEMENT :

"When the proposal was initially mooted we were skeptical but decided to listen to what our architects had to say. As the story unfolded and drawings made, it became increasingly more interesting and even exciting to think of a system that would use little energy and yet provide comfort for almost 9-10 months in a year. We had nothing to lose the additional cost of the construction versus the saving on O and M of plant and equipment for almost 200 TR of cooling was attractive.

Summer of 1997 was the acid test for one of the buildings and the results were very gratifying. We had held up placement of fans in the labs to know the reactions. There were no complaints. No one felt the need for one. The labs were comfortable to work in without fans. They were not stuffy or smelly as most chemistry labs are even when air-conditioned. This was the added bonus.

Monsoon, as expected, was not so comfortable, the labs were muggy and we had to instal fans to provide comfort for these 2-3 months. There was some reverse flow of air from the exhausts to the inlets on days that were windy."

Dr. C. Dutt
Director, Torrent Research Centre

THE WIDER IMPACT :

If this approach to designing buildings is adopted by more people, and if it becomes an Energy Saving Movement through Building Design, with its inherent appropriateness leading to a snow-balling effect, then the scenario in the power sector needs can change substantially over the next decade, apart from the other enormous advantages towards decrease in pollution and fuel consumption.

What is required are more number of Clients with the kind of courage that the Management of Torrent Pharmaceuticals Ltd. has shown, and an attitude to conserve the energy, from an increasing number of Architects, Utility Consultants and Engineers to take the second, third and the fourth step in the direction of realizing this dream of Abhikram.

ABHIKRAM's ADVISORY APPROACH

The success of this experiment opens doors to it being tried in every conceivable building type in the semi-arid region where requirement for the comfort conditions are not extremely stringent.

Although it requires considerable scientific inputs to evolve the design, it is possible to pursue it as an objective, by developing our understanding of the principles of physics and thermodynamics by any well intentioned architect with the help of a building scientist.

Abhikram also offers Advisory Consultancy services to Architects/ Architectural firms professionally to further its cause of increasing the impact of such Energy Saving attempts.

The write-up on Human Comfort System is an excerpt of presentation given by ABHIKRAM during our **AMBUJA LECTURE SERIES**, which was organised at Chandigarh during the month of November, 1999.

For further information on the subject, communication address is below.

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