

Building a Green Campus

NIIT University, Neemrana, Rajasthan

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Vinod Gupta

The NIIT University campus is located about half way between Delhi and Jaipur on National Highway 8, in a very dry and hot part of Rajasthan. An outcrop of the Aravalli Range to the east of the campus gives a special character to the site. Rainfall is scarce in this region but when it does rain, water running down the hills can cause flash floods. The promoters of the NIIT campus were keen to build an economically and environmentally sustainable campus. The need for environmental sustainability is understandable, but economic sustainability meant that one had to build at an affordable price.

Looking at the tools available for making a sustainable campus, one realised that simply making green buildings

that are efficient users of water, energy and materials would not create a green campus. Even if the buildings managed wastes and created better indoor air quality, they would not be able to create a sustainable campus. Much of the energy in a campus is used outside the buildings and even more so outside the campus. Students and teachers consume energy to get to the campus and that can sometimes be more than the energy they would consume in the buildings.

Like any other large construction project, a campus construction also requires an environmental clearance. The environmental impact assessment (EIA) process, more broad based than green building norms, deals with existing technologies only and merely ensures compliance with existing standards for water and energy use along with solid



and liquid waste management. Additionally, EIA deals with natural features of the site and with building materials but it does not promote alternative technology or behavioural change that can make a real difference. The green goals of a large campus are severely limited by merely following the green building norms and the EIA process. The goal of the NIIT University campus was to establish standards by which campuses ought to be built as also to define appropriate ways of building in the hot and dry desert region.

LAND

The first task was to establish the carrying capacity of the site and to use the available 75 acres in the best possible way. Two important guiding factors for this were water availability and the constraints of the zoning regulations. The Neemrana region receives only 570 mm of rainfall in a year and that limited the 75 acre site to about 3000 resident students only. This number would not have been economically sustainable for the University. Many towns in Rajasthan depend upon man made lakes for water supply and on further investigation, it was found that the site does not have a sustainable source of water supply due to the nearby hills. For turning this disadvantage into an advantage, it was decided that rainwater from the hills would be harvested by creating check dams and planting trees along the slopes. The water supply enhanced in this way would be able to support a larger population that would be limited only by the permitted floor area ratio (FAR). At the planned capacity of 7500 students, the NIIT campus would be about 20 times the density of Jawaharlal Nehru University (JNU), New Delhi and 6 times the density of the Indian Institute of Technology (IIT) Delhi.

Land is in short supply in India and educational campuses are some of the biggest wasters of land. New IIT's are being built on more than 1000 acres of land and National Institutes of Technology (NIT's) on 750 acres of land. Such campuses will never pass the standard for sustainability even if they are built with green buildings. Low density developments take away agricultural or forest land, create infrastructure with high costs including high transportation costs leading to higher carbon emissions. Traditional Indian towns were high density energy conserving places. The city of Jaipur is many times denser than the newer planned city of Chandigarh. Most newly planned high density developments are designed simply to maximise FAR, not to reduce carbon emissions.

The NIIT University campus is built on fallow land considered unusable for agriculture. The layout of the campus was designed to minimise development costs by putting students and teachers housing complexes next to the academic buildings, making the campus entirely walkable

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- reducing the need for motorised transport within the campus. This minimised the need for pitched roads, and in order to make this work well, shaded and rain protected walkways have been provided on the campus. Students live on the campus and walk to the academic areas from the hostels. On campus staff residential accommodation has not yet been completed and presently the staff commutes from the nearby residential areas by car pool.

Green infrastructure planning at the NIIT campus includes preservation of the natural water courses and grading with minimum cut and fill, keeping in line with the natural features of the land. The landscape was planned with local species of plants that do not require much water to sustain and can withstand the rigours of the desert. Grassy areas requiring high maintenance and irrigation, have been limited to a minimum.

WATER

Having established a sustainable source of water and a system for harvesting rainwater from the hills, the next step was to create a system of water use that would use less water as well as treat and reuse waste water. Water conserving toilet fixtures were used and a sewage treatment plant installed. The treated waste water is used for drip irrigation of landscape within and outside the campus and for flushing toilets in the campus buildings.

ENERGY: LIGHTING AND AIR CONDITIONING

Having planned an infrastructure that saves energy in transport, the buildings were also designed to save energy in lighting and in providing thermal comfort and dust control. The buildings were planned with windows facing north-south where passive sun shades could be provided to minimise the heat load on buildings. The class rooms and laboratories use day light to the fullest. Shallower class rooms where windows can provide adequate day light were planned on the north side while deeper laboratories were planned on the south side where light shelves have been built to bring light deep in to the space. Internal corridors and deeper rooms at the top floors are lit through skylights. There are a few dark areas in the buildings without day lighting and it is



planned to light these with a grid interactive system of solar photovoltaic (SPV) lighting without battery back up.

Like other green buildings, the NIIT buildings have insulated walls and roof, but the system for thermal control required a great deal of thought. Simple passive architectural systems with natural ventilation cannot provide dust control during summer and humidity control during the monsoon months. Passive draught systems are also incapable of controlling dust and humidity. Evaporative cooling provides comfort during summer but not during monsoons. After due evaluation of the various options, it was decided to install a combined system of evaporative cooling and regular air conditioning together with a system for pre-cooling fresh air by passing it through a system of underground tunnels. This system controls heat during summer, cold during winter and dust all year round. It is a low energy system that provides a reasonable degree of comfort in the academic buildings at a low energy performance index (EPI) of 33 kWh/sq m/year. Comparatively the Energy Conservation Building Code (ECBC) norm is 140 kWh/sq m/year for air conditioned buildings and a Green Rating for Integrated Habitat Assessment (GRIHA) 5 star rated academic building at Kanpur has an EPI of 98 kWh/sq m/year.

After the first set of buildings were built and used, it was found that the tunnel pre-cooling system cost a lot more than originally envisaged and some of the newer buildings are being built without it. The combined system

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of evaporative cooling and air conditioning has been found to be cost effective and that is being continued. However, winter heating is not possible through this system.

COSTS

It is well known that green buildings cost more than other buildings but it is not necessary that a green campus should cost more than others. In case of the NIIT campus there were savings due to environment friendly campus planning while the other systems described above did cost more. Infrastructure costs of roads and services were reduced with compact walkable campus planning. The campus started with a very small developed area and the linear growth pattern allowed the cost of electricity, water supply, sewage and drainage to be limited since extra areas without buildings did not have to be developed. The savings in infrastructure costs more than offset the additional costs of the buildings. ❁

The author is Head, Space Design Consultants, New Delhi.