

Introduction

The Corporate office of V-Guard Industries Ltd at Vennala, Kochi-682028, Kerala is a twelve storied magnificent structure designed with the objective of creating an environment –friendly building, employing green building principles from concept to commissioning. This office presently houses, besides the corporate office of V-Guard, its Research & development Wing, Various product groups and the marketing team. Work stations are provided for about 400 employees in the Building. It also has a cafeteria that can accommodate 200 people, 4 conference Halls of varying capacities from 20 to 200 persons and a roof top meeting place that can accommodate about 500 people. The Building has a roof garden, fitness centre, recreation room, library etc besides extensive open area in all floors, retiring rooms for visitors and guests and a 2 meter wide open verandah on the periphery of each floor which itself occupies 20% of the total construction area. The building site is a 1.5 acre plot with greenery all around.



The Corporate Office of V-GUARD INDUSTRIES LTD, at Vennala, Kochi- 682028

Though the building may not comply fully with the Green Building requirements, it has many unique features that are environment friendly and comparable to green buildings. This building is unique in many respects. The uniqueness of the design is that it has an outer shell that protects the core of the building that houses the work areas and meeting rooms from direct sunlight and heat, while allowing free flow of air and unhindered access to natural light. The outer shell is separated by a verandah and planter trough of 2 meterwidth from the core building and surrounds the building on all the four sides. The plan of the building is square shaped with an aesthetic elevation from all the four sides, that blends with the external environment.

Salient features of the Building

The basic objective while making the design was to reduce the overall impact of the building on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation.



The fundamental principles we have kept in mind while designing and construction were:

- Siting and structure Design efficiency
- Energy Efficiency
- Water Efficiency
- Materials efficiency
- Indoor environmental Quality enhancement
- Operations and maintenance optimisation and
- Waste and Toxics reduction

The essence of the building design was to optimize one or more of the above principles. On the aesthetic side of the architecture, the consideration was to have a sustainable design that is in harmony with the natural features and resources surrounding the site. These issues are discussed in detail below:



- **Siting and structure design efficiency**

The site has been selected considering its closeness to the seaport- airport road and convenience of employees who come to work in the office and customers who visit our premises.. It is away from the crowded city, yet accessible to all important destinations through connecting roads. All aspects of efficiency and economy coupled with a comfortable working environment were considered in the design and its impact on cost and performance. In designing such an environmentally optimal building, the main objective was to minimize the total environmental impact associated with all life-cycle stages of the building project.



- **Energy efficiency**

To increase the energy efficiency of the building, we have provided a roof overhang of 2 metre all around the building. This area, besides providing a free and open veranda, allow maximum day light to enter the building. The 2 meter width verandha area is utilised as a planter trough andas garden with all types of flowering plants. The building is designed in such a way that the sunlight



will not fall directly on the inner walls. To reduce the sunlight falling on the inner walls and to minimize heat, a roof overhang is also provided. With glazed windows on all sides, there is enough daylight in all rooms which makes artificial lighting unnecessary during normal sunny days. There will be huge savings in electricity bill due to this. The same way, the design allows free flow of air all through the floors thus minimizing the use of electric fans. All these features add to the energy efficiency of the building.

To supplement the lighting needs, we have used maximum of CFL fittings to save energy. Provision of solar energy for lighting is also provided which will be an additional advantage for meeting our future requirements

Solar Water heating systems are also provided in the building to further reduce energy loads. We have provided a solar water heating system of 1500 LPD which can be used for hot water requirements in our building.

The requirement of usage of fans and Air conditioners are very less in view of the special design that allows good air flow in all rooms. Though fans are provided for use when needed, A/Cs are limited to meeting rooms and server room which is a technical requirement.

- **Water efficiency**

Reducing water consumption and protecting water quality are key objectives of our design of this sustainable building. One critical issue of water consumption is that in many areas in our locality, the supply from the Municipal corporation is inadequate to meet the increasing requirements. Hence, the approach adopted was that, to the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site. The protection and conservation of water is accomplished by designing for dual plumbing that recycles water in toilet flushing. Waste-water has been minimized by utilizing water conserving fixtures such as ultra-low flush toilets and low-flow shower heads.



Rain Water harvesting has been effectively implemented in our building. We Have a Rain Water harvesting tank of 3,30,000 litre capacity and all rain water that falls on the roof is being collected to this tank which can be treated and used for drinking/domestic purpose, irrigation etc. The additional source of water is a well in the compound and water from the well is treated through various process for drinking and domestic purposes. The water used for washing and flushing are collected and recycled/treated properly in a sewage treatment plant. This water is used for irrigation for gardens in all the 12 floors and for landscaping at the ground. It is an automated irrigation system by which wastage of water is minimized.

We are maintaining “Zero Discharge” policy as per Pollution Control Norms. Other Solid wastes are disposed through “Kudumbasree” units

During rains, the storm water is permitted to percolate to ground. To facilitate this, we have selected pavers/blocks that enable that the entire rain water to percolate to the ground. Roof water is collected directly to the RWH tank and recycled.

- **Materials efficiency**

The building materials used have been selected carefully to minimise the impact on environment. The use of natural wood has been avoided and all windows are made of Aluminium shutters All handrails are of steel and all furniture used in the building is made of PVC and Steel.

Partitioning for cabins have been made with fibre boards and room partitioning inside each floor has been made with gypsum boards, which is manufactured with waste gypsum from fertiliserfactories.other products that are non-toxic, reusable, renewable, and/or recyclable (e.g. [Trass](#), [Linoleum](#),



- **Indoor environmental quality enhancement**

Environmental Quality (IEQ) category as specified in LEED standards, one of the five environmental categories, is intended to provide comfort, well-being, and productivity of occupants. The LEED IEQ category addresses design and construction guidelines especially: indoor air quality (IAQ), thermal quality, and lighting quality.

For this building indoor air quality is ensured with adequate ventilation from all the four sides of the building. In the cafeteria also, food is not prepared, but is prepared elsewhere and brought for serving. This avoids emission of smoke and gases while cooking, that has an impact on a clean and comfortable working environment. Coupled with this, the unique design with an outer shell surrounding the building also aid in increasing the building's thermal quality. Creating a high performance luminous environment through the careful integration of natural and artificial light sources has improved the lighting quality of the structure.



The Fully ventilating system adopted in this building is more efficient and it helps to minimize usage of lights and fan in the office area. As the half height partitions are used, air circulation is also most efficient in office area.

- **Operations and maintenance optimization**

While designing the building itself, all the activities that are required to ensure an eco-friendly maintenance and operations of all facilities have been planned. Adequate operating and maintenance personnel are provided to ensure that this building and the premises including the gardens are operated responsibly and maintained properly, so as to retain the green criteria designed at the onset of the project. The addition of new green technologies such as future generation of power from wind/solar energy to meet the requirements of this building is also under the scope of the operation and the maintenance programme. As already mentioned, the systems of Zero effluent discharge and recycling of water etc has reduced wastes and improved the air and water quality in the environment.



- **Waste reduction**

Green architecture also seeks to reduce waste of energy, water and materials used during construction and also during the operation and maintenance of the building. As already mentioned, wastewater from sources such as washing areas is used for subsurface irrigation after treatment and to flush toilets and wash floors etc.. Rainwater collectors are used for similar purposes. As regards solid waste, since the quantity does not justify putting up of waste treatment system, the same is disposed through the “Kudumbasree” units. These wastes are later used for treatment in the Corporation’s solid waste treatment facility for conversion as fertilisers.



Cost

The construction of environmentally friendly buildings involves additional cost initially, but it is expected that in the long run there will be savings that justify the additional up - front cost involved. The total cost for the building is around 13 crores for 1,20,000 sq. feet built up area, of which about 20% built up area has been utilised for providing green building features. This would mean that if conventional building architecture were used, there would have been saving in the built up area to the extent. However, the recurring cost of operating and maintaining the building has been reduced significantly by adopting the green building practices.

Details of savings:

1. Power Saving by use of natural ventillation supplemented by Electric Fans in areas that require air conditioning in traditional building for keeping the working environment comfortable :

The total carpet area of the building is 74,344 sq. feet, which requires air conditioning for providing a comfortable work environment for engineers and marketing professionals. With the eco-friendly design features, these work areas now require only Fans to maintain a comfortable working environment. A total of 425 fans are provided in the building. Comparing to a conventional design, there will be an energy saving of 3250KiloUnits per year due to the green building design. The annual saving on this account will be around Rs 126 Lakhs per year.

Details of working are shown in Annexure "A"

2. Saving due to use of CFL Lamp in place of incandescent lamps

There is a saving of 51177 Watts by using CFL lamps throughout the building. The annual saving is calculated at Rs 1.2 lakhs per year.

Details are given in Annexure "B"

3. Energy Saving due to Computers

The office has 210 computers, all of which use TFT monitors in place of CRT monitors. It is estimated that there is an energy saving of Rs 1.7 lakhs per year due to this change.

Details are given in Annexure "C"

4. Energy saving due to Solar Water Heater

We have installed a 1500 ltr solar water heater for our hot water requirements instead of using electric water heater or other means of heating. There is a saving of approxRs 1 lakh per year due to this.

Details are provided in Annexure "D"

The total saving due to all the above energy saving measures is Rs 130 lakhs per annum

Annexure "A"

Energy Conservation

FANS

By using Ceiling FAN

Total No. of FAN = 425Nos.

Watts of 1No. Fan =75W

Total Wattage of Fans = 425 X 75 = 31875Watts = 31.875KWetails of savings are given below

While using Centralized Air conditioners

Total carpet Area = 74,344Sq. Ft

AC Tonnage = $\frac{74,344}{120}$ = 619.5Ton

Total wattage of AC = 619.5 X 1800 =1115.10KW

Power saving by using FAN = 1115.10 – 31.875 = 1083.22 KW.

Amount saving by using FAN:

While using Centralized Air conditioners

Approximate working hour per day = 10Hrs.

Approx. working days per year = 300Days.

Energy consumed by AC for 1Year = 1115.10 X 10 X 300 (KW X Hr.X Days)
= 3345.3 Kilo Units

Unit consumed by AC for 1 Year = **3345Kilo Units**

By Using Ceiling FAN

Total No. of FAN = 425Nos.

Watts of 1No. Fan =75W

Energy consumed by fans for 1Year = 425 X 75 X 10 X 300 (Nos.X Watts X Hr.X Days)

Unit consumed by AC for 1 Year = **95.625 Kilo Units**

Energy Savings by using Fan = 3345 – 95.625 = 3249.37Kilo Units/Year

Rate/Unit (Average) = Rs.3.88

Amount savings = 3249.37 X 3.88 = **126 Lakh/Year**

Annexure "B"

Energy saving - Light fittings

11W CFL lamp = 40W Incandescent lamp

Total Numbers of 11W CFL Fittings = 267Nos.
Total Watts by using CFL = $267 \times 11 = 2937$ watts
While using Incandescent lamp = $267 \times 40 = 10680$ watts

18W CFL lamp = 75W Incandescent lamp

Total Numbers of 18W CFL = 362Nos.
Total Watts by using CFL = $362 \times 18 = 6516$ watts
While using Incandescent lamp = $362 \times 75 = 27150$ watts

36W CFL Lamp = 150W Incandescent lamp

Total Numbers of 36W CFL = 200Nos.
Total Watts by using CFL = $200 \times 36 = 7200$ watts
While using Incandescent lamp = $200 \times 150 = 30000$ watts
Total CFL Wattage = $2937 + 6516 + 7200 = 16653$ watts
Total Incandescent lamp Watts = $10680 + 27150 + 30000 = 67830$ watts

Power savings by using CFL = $67830 - 16653 = 51177$ watts

Amount saving by using CFL:

Energy consumed by CFL for 1Year = $51177 \times 2 \times 300$ (Watts X Hr.X Days)
Unit consumed by CFL for 1 Year = 30706.2KWH
Rate/Unit (Average) = Rs.3.88
Amount savings = $30706.2 \times 3.88 = \underline{\underline{Rs.119140/Year}}$

Annexure "C"

Energy saving - Computers

Computers

Total Numbers of TFT Monitors = 210 Nos.

Total Watts by using TFT monitors = $210 \times 50 = 10500$ watts

While using CRT Monitors = $210 \times 120 = 25200$ watts

Power savings by using TFT Monitor = $25200 - 10500 = 14700$ watts

Amount saving by using TFT Monitor:

Energy consumed by TFT monitor for 1Year = $14700 \times 10 \times 300$ (Watts X Hr.X Days)

Unit consumed by TFT monitor for 1 Year = 44100 KWH

Rate/Unit (Average) = Rs.3.88

Amount savings = $44100 \times 3.88 = \underline{\underline{Rs.1,71,108/Year}}$

Annexure "D"

Energy saving - Solar Water heaters

| | |
|--|------------------------------|
| Solar Water heater capacity | = 1500 Ltr. |
| While working in Electricity wattage rating= | 9000Watts |
| Time for 1Unit of consumption | = 7Mins. |
| No. of working hours /day | = 10Hrs. |
| Unit consumption/Day | = 85 Unit |
| Energy consumed by W.H for 1Year | = 85 X 300 (KWH/ Day X Days) |
| | = 25500KWH |

Amount saving by using Solar water Heater

| | |
|---------------------|--|
| Rate/Unit (Average) | = Rs.3.88 |
| Amount savings/year | = 25500X 3.88= Rs. <u>98,940/Year</u> |