India’s 1\textsuperscript{st}
India’s 1st Sustainable Net Zero Energy Showroom
• WALLS : - 200 mm Porotherm blocks with both sides cement plastered
  - U Value 0.1473 Btu/hr.ft².0°F

• SLABS : - Ready Mix Concrete with GGBS mix for structure
  - Recycled steel

• ROOF OVER DECK INSULATION : - Over deck extruded polystyrene insulation (XPS)

• GLAZING : - High performance facade
  - Reduced HVAC system load
  - U value 0.4984 Btu/hr.ft².0°F; SHGC 0.52; VLT 60 % (entrance)
  - U value 0.655 Btu/hr.ft².0°F; SHGC 0.24; VLT 22 % (others)
• **CLADDING:** - Pre fabricated concrete panels used for the front facade

• **PAINTS:** - Low VOC paints

• **FALSE CEILING:** - Recycled Bamboo

• **FURNITURE:** - All wood used is made from composite woods

• **ADHESIVES & SEALANTS:** - Low VOC content materials

• **DOORS & WINDOWS:** - Majorly UPVC and Aluminum; Minimum hardwoods
• More than 90% of interior spaces have direct views to natural daylight

• Use of artificial lighting is thus minimized

• 75% of interior spaces achieve daylight illuminance levels of 25 foot candles (fc) (270 lux) as minimum and 500 fc (5,400 lux) as maximum – sunny sky is 10,000 lux

• The same has been simulated and verified through Lighting Simulation.
NIGHT VIEW OF THE SHOWROOM
ARTIFICIAL LIGHTING
• Lighting Power Densities (LPD) of all areas – almost 30% to 40% less than standards (ASHRAE/ISENA. Std 90.1. 2004)

• Location values :
  - Retail space 0.463 W/sq.ft
  - Lobby 0.435 W/sq.ft
  - Passage 0.954 W/sq.ft
  - Toilet 0.713 W/sq.ft

• Occupancy sensing provides automatic on/off control

• Lighting Fixtures :
  - Energy Efficient Fixtures used which consume fewer watts for the same lumen output
  - LED’s used for façade lighting and retail display track lights
Showroom interiors with floor grilles
INNOVATIVE COOLING SYSTEMS
• Earth Air Tunnel (EAT):

- Used for free cooling and pre-cooling of fresh air

- Outlet temperature of 25.5°C when ambient is 36°C (peak summers) and 24°C when ambient is 10°C to 13°C

- Centrifugal fan has a VFD drive with VAV boxes to vary air quantities based on room CO₂ levels (coupled with under floor air distribution)

- VAV’s modulate the zone pre cooled fresh air quantity based on CO₂ sensor signals

- VFD drives modulate fan motor speeds based on demands of zones

- The outside / fresh air considered is 35% more than comparable minimum fresh air requirements of ASHRAE 62.1.2004 (3500 CFM)
- Water Cooled VRV:
  - Replacing air cooled systems for higher efficiencies
  - Savings in energy, 2 kW at full load
  - At 60% part load, energy savings drop to 0.5 kW (cooling tower load is constant)
  - COP is 4.4 (at full load) & 5.0 (at 60% part load)
  - Cost of additional cooling tower and pump piping (Rs. 2.2 Lakh)
  - Achieved Zero Discharge by using Water Cooled VRV
Natural draft FRP cooling tower
WATER CONSERVATION

FRP COOLING TOWER
• Reuse of Water:
  - Water is treated and reused for flushing, landscaping and as make up water for cooling towers

• Sewage Treatment Plant:
  - All water is being recycled and treated to tertiary standards for reuse

• Low Flow Plumbing Fixtures:
  - Low water consuming flushes for water closets and urinals
  - Dual flush in water closets specified

• Rain Water Harvesting:
  - Most of site run off water from ground and terrace is collected, treated and reused
- MBR type STP at full load  
  - Discharge of treated water at full load 4.9 to 5 kLD  
  - Use for cooling tower makeup 2 kLD  
  - Toilet flushing at full load 2.5 kLD  
  - Gardening and landscaping 0.4 kLD  
  - Total consumption 4.9 kLD  
  - Monsoon and cloudy 2 kLD

- Hence Zero Discharge at Full Load
PV panels on the building facade
BIPV
• Building Integrated Photo Voltaic (BIPV)

• The solar PV module collectors are installed on the terrace roof top

• The PV module collectors generate a total energy of 42,000 kWh / yr.
• Computational Fluid Dynamics analysis performed in the XY, YZ and XZ plane
• Velocity, Pressure and Temperature profiles measured
• The generated profiles used for diffuser positions and stack effect analysis
• Temperature and Velocity profiles confirm to ASHRAE 62.1, 2010 and ASHRAE 55, 2010 requirements
• Positive pressure validation done by CFD model (keep infiltration out)
OTHER INNOVATIONS

Room Control Panels    Atrium Exhaust Fan    Unit Piping
• Eco Friendly Refrigerant:
  - The refrigerant used minimizes or eliminates the emission of compounds that contribute to ozone depletion and global warming
  - Base buildings have only CFC & HCFC free refrigerants

• Free Cooling of Retail Areas:
  - Free cooling has been considered for retail spaces when the temperature goes below 20°C
  - 100% fresh air considered in the space volume which is exhausted through stack effect with extractors on the roof
• Under Floor Air Distribution system provides better and efficient comfort conditions at occupied zones

• Product focused LED lighting with occupancy sensors and lux controllers used instead of general lighting in turn reducing artificial lighting loads

• Natural draft FRP cooling towers reduce spillage & power consumption

• IBMS system ensures balance between working of indoor units and EAT based free cooling (control based on temperature, RH and IAQ)
Retail Store (Ground, Mezzanine & First Floor):

- Base Energy consumption: 46,741 kWh / yr
- Energy consumption reduction due to EAT: 4,846 kWh / yr
- Final Energy consumption: 41,895 kWh / yr

- Misc. equipments such as all computers, printers, machines, plug loads etc. have been included
- External equipment like lifts have been included
- Area: 11,970 ft²
- Energy Consumption Index: 37.65 kWh / m².yr
• ZERO Energy Calculation:
  - Solar PV module rating 28 kW
  - 5 sunlight hours for energy generation through PV panels
  - Total number of sunny days in Bangalore is 300
  - Total Energy Generated: 28 X 5 X 300  = 42,000 kWh / yr
• Retail Store (Ground, Mezzanine & First Floor):
  - Base Energy consumption \(46,741\) kWh / yr
  - Energy consumption reduction due to EAT \(4,846\) kWh / yr
  - Final Energy consumption \(41,895\) kWh / yr
  - Misc. equipments such as all computers, printers, machines, plug loads etc. have been included
  - External equipment like lifts have been included
  - Area \(11,970\) ft\(^2\)
  - Energy Consumption Index \(37.65\) kWh / m\(^2\).yr

• ZERO Energy Calculation:
  - Solar PV module rating \(28\) kW
  - 5 sunlight hours for energy generation through PV panels
  - Total number of sunny days in Bangalore is 300
  - Total Energy Generated : \(28 \times 5 \times 300\) \(42,000\) kWh / yr
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