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INFRASTRUCTURE

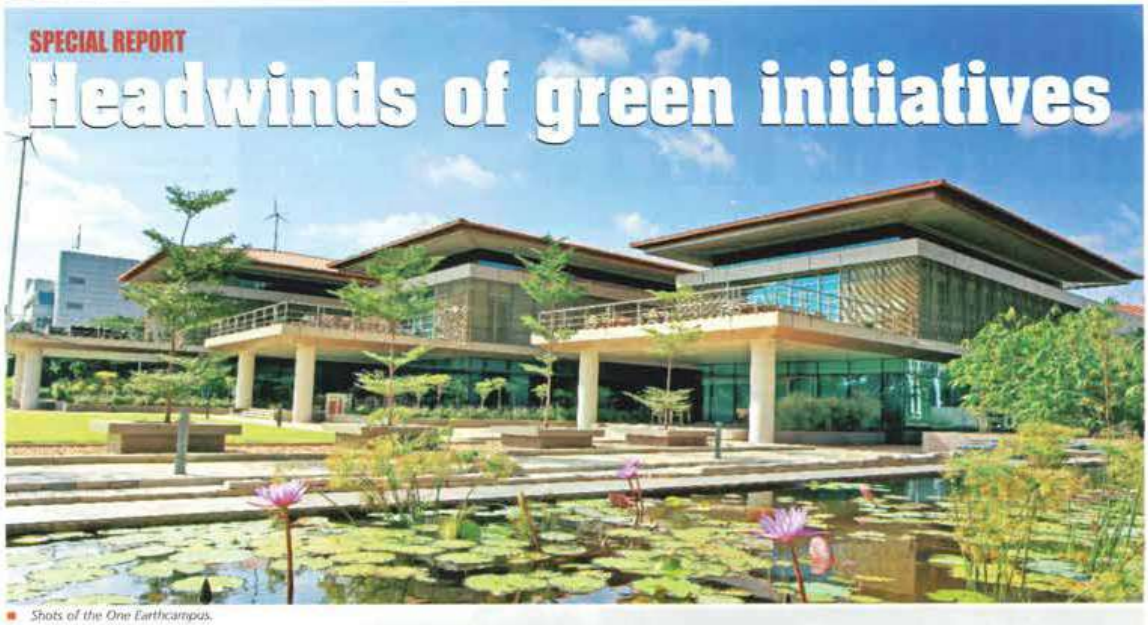
SUZLON ONE EARTH IN NEWS

Suzlon's 'One Earth' awarded

Synefra Engineering & Construction, a Tanti Group company's flagship project Suzlon One Earth, the Corporate HQ of Suzlon Group in Pune, was awarded the Leadership in Energy and Environment Design (LEED) Platinum award. Suzlon's 'One Earth' campus is among the first 100 sites in India to receive LEED certification. Developed on an area of 41,000 sqmt (10.13 acres) with a capacity to house 2,300 people, One Earth ranks among the largest green building projects in India. The facility sets new benchmarks in energy efficiency in all aspects of engineering and construction. Prof Christopher Benninger, the architect of the project, has recently been felicitated by Tulsi Tanti, Chairman of Suzlon Energy Ltd. Benninger conceived this project to be his masterpiece along with his award winning Mahindra United World College built 10 years ago.

SPECIAL REPORT

Headwinds of green initiatives



Shots of the One Earthcampus.

The new global headquarters of wind turbine maker Suzlon Energy, One Earth, was recently certified as an eco-friendly building with a Platinum rating by the US Green Building Council. **Projects Info** reports on the striking features of one of the largest green building projects in India.

The project

Sprawling over 10.70 acre, Suzlon One Earth, the global headquarters of the Suzlon Group is located in Pune, Maharashtra. The headquarters has two main structures which include functional blocks of the office complex with a terminus (basement), and a learning centre. The office complex is divided into four interconnected buildings having a central core with two wings each.

Project execution

Synefra Engineering and Construction was established with a focus to conceptualise, invest, develop and maintain hi-tech industrial infrastructure. The project was completed early this year and it was conceived, managed, and executed by Synefra Engineering and Construction. A comprehensive project execution plan was established well in advance at the conceptual stage. Stage gate process for planning and controlling was incorporated during the project life cycle. This method of managing large size projects minimises project risk and helps keep tab on project activities. A risk assessment and mitigation plan was prepared and updated regularly, which ensured overall project deliveries were in line with the main plan.

Rain water harvesting

At the planning stage, it was decided that the sanitary and drainage systems should be well designed, executed, operated and maintained according to the national building code and as per the provisions of the local municipal authority. There would be storm water drainage system to collect and carry rain water. For this, all building terraces need to have proper slopes for carrying out rain water towards catch point. The storm water drains should be further well connected for carrying unused water. In this system, rain water is collected from roof tops with a 150 diameter rain water pipe installed in the services shaft from roof level to ground level. Underground RCC hume pipes laid with man holes at designed locations in the campus along the road side and around the buildings to collect the rain water and carry the same with natural slope in pipelines towards rain water storage tanks with a total capacity of one million litres.

Waste management

At the project, an organic waste converter is designed and installed at campus terminus to treat the organic waste generated from the cafeteria, garden waste and paper waste-from office. The system has a capacity of 100 kg per hour. It is estimated that about 300 kg of organic waste would be generated. It takes about 12-15 days for organic waste to be converted into premium quality organic manure. All efforts have been taken to reduce the burden on municipal water supply. Recycled gray water is used for flushing, irrigation and heating, ventilation and air conditioning systems (HVAC).

Saving Energy

About six per cent of the total energy requirement of the project is supplied from onsite renewable energy installations like urban wind turbines, conventional solar panels and building integrated photovoltaic panels. Applications such as external lighting, communication server, and providing hot water in the cafeteria, are powered by onsite generation of renewable energy. The selection of all electrical equipments such as transformer, breakers, cables, DG sets earthings as per the specifications of ECBC 2007 and approved makes by the State Electricity Board. Light system based on fittings w.r.t. human comfort, proper lux levels, glare control, less heat dissipation, inbuilt electronic ballasts are installed in order to save maximum energy during operations. Due to energy efficient installations HVAC and lighting, the installed load has reduced from 6.5 MVA to 4 MVA. The light-emitting diode (LED) lightings are installed to achieve desired levels of energy conservation. Total load of external lightings is only 50 kW for the campus. During the day, all the buildings are designed to harvest maximum daylight through glass and louvers, which minimises the use of lights. Large parking spaces, common meeting rooms, and individual cabins are provided with occupancy sensors which are connected with the indoor office lighting system. These sensors help to control the energy consumption for lighting by around 10-15 per cent.

Major challenges

Handling and disposal of excavated soil was the most challenging part of the project. Considering its sustainable aspect it was essential that the right methods to reuse the soil were adapted. Apart from this, this was the first time that windmills were to be installed in an urban area, which is a low viability wind zone. It was a major task to convince the stakeholders and also decide the positions of these windmills. For the installation of these windmills, the concerned government departments were approached to secure the necessary legal permissions. After thorough groundwork, a vendor was sourced to provide the windmills.

Interview

'At Synefra, green or sustainability is part of the system'

J R Tanti, Managing Director at Synefra E&C, in an exclusive online interview with ***Cooling India***, says: Suzlon One Earth Project is an exemplary benchmark as an energy efficient and sustainable solution in all aspects of engineering and construction.

Synefra Engineering & Construction has developed and incorporated various initiatives like 'Sustainability and Responsibility', 'New and Relevant technology' and Business Excellence which have become integral for day-to-day operations.

Could you tell us about the vision behind One Earth Project and your aspirations from this project?

One Earth was conceptualized, designed, executed and commissioned with the vision of creating a "Green" workplace with minimal global footprint project based on a simple brief from the client for a need of a work place which would provide a view to all beyond the monitor screens, a chance to experience day light changes at workstations, a place where employees do not feel restricted in thought or movement and more importantly they do not miss the joy of changing seasons while they go about achieving targets. The master plan is similar to a campus which is based on an urban village concept, with features like –Horizontal open spaces instead of linear over bearing structures, large interactions courtyards instead of only meetings rooms, wide landscape (185,578 sq ft of functional spaces) to encourage activities instead of "keep off grass" signs, state-of-art outdoor lighting, functional and aesthetic outdoor furniture, prominent water bodies, traditional elements like Deep-stambh & a 20' diameter steel globe depicting Suzlon global presence. The campus can accommodate around 2300 team members. At Synefra, green or sustainability is part of the system. Green is not a separate science or a different effort that one needs to consider while designing or constructing; it is a practice which has to be adopted as an integrated approach.

Working in silos and individual expertise will not bring about a revolution. It is our fervent appeal to experts, policy makers, young and budding designers, architects, planners, engineers and service providers to connect and unite in order to pool resources – knowledge, material, skills, expertise and innovation – for a green movement which is now not just a choice but necessity. The need of the hour is a continuous communication link and a strong interface between designers, architects, engineers, technicians, suppliers, consultants and all vendors.
If we wish to leave a legacy on this earth for our future generations, commercial projects necessarily need to be built on principles of green and sustainability.

Why do you think there is an imperative need for energy conservation and how does the one earth project go about propagating this need?

Green means responsible and measures to be more responsible should not be a choice or an option but a way of life. Any conscious consultant or builder would think green if they consider themselves as responsible citizens of this ecology. The entire concept is in approach and planning. All the measures stated in the question above would definitely contribute towards a sustainable and green infrastructure but the process starts from the day the project gets conceived.
While the design definitely needs to support a structure that utilizes maximum available natural resources, sustainable site planning is then the first step towards a more conscious approach to the project.
Energy consumption, which contributes maximum towards disturbing the environment, is one of the key attributes to green building. At one of our projects, One Earth, corporate HQ of a multi-national, we drastically reduced HVAC load by cutting building heat gain through insulating the building by incorporating water cooled HVAC system which consumes 40 % less natural energy than other conventional systems. Integrated Building Management System (IBMS) is used to closely monitor power consumption and rectify accordingly in order to maintained specified load levels. Energy Efficient devices like VFDs, LED lights etc. are used extensively throughout the installation and centrally controlled though IBMS. The power demand during the operations is substantially low as compared with the buildings designed and built as per the National Building Code and ASHRAE standards.
The One Earth campus functions totally on renewable energy sources which are achieved by the installation of off-site wind turbines as well as onsite wind solar hybrid system. A total of 6% energy is fulfilled from onsite generation of green power.

How is the "One Earth Project" different from other such similar projects?

One Earth has not only been built with a green and sustainable approach but also conceived with a eco conscious vision. One Earth is a complete green corporate campus which is energy sufficient and sustainable solution project in all aspects. Energy consumption, which contributes maximum towards disturbing the environment, is one of the key attributes to green building. At One Earth, we drastically reduced HVAC load by cutting building heat gain through insulating the building by incorporating water cooled HVAC system which consuming 40 % less natural energy than other conventional HVAC systems.
Lighting is another area which needs attention in order to be more accountable towards the environment. At One Earth, we reduced the lighting load on the facility by incorporating efficient light fixtures along with day light and motion sensors as well as the architecture design complimented by harvesting maximum day light which allows almost 90% of the occupants not to switch on artificial sources during day hours.
Water saving is also a deciding element for a green building criteria. To save water we used low flow fixtures, dual flushing system and sensor based fixtures. Apart from this we have installed sewage water treatment plant at site and the same water is re-used for gardening, flushing and HVAC. So there is no wastage of water. One important decision we took is to collect huge amount of rain water, sort it and use it as required. We are collecting rain water from all premises into rain water tanks which can accommodate three days average rainfall water from entire area. Burning issue now-a-days at all the metros is waste management. We decided not to put any load of waste on Municipal Corporation, hence we initiated the process of waste segregation at source and treating them at site. All recyclable waste is sent for recycling. We have a tie up with approved local govt. bodies/organizations for disposal of e-waste and other hazardous waste.
Organic waste converter helps to recycle onsite organic waste like paper, horticulture waste and food waste. All the organic waste is converted into rich organic manure and used as landscape manure.
Material selection is an important activity as each material has embedded energy and hence assessing low energy material makes the space more environment friendly. Also, procurement plan and sourcing material is a key to choosing a more sustainable option and at One Earth we selected low energy material and also had preference for local material to substantially reduce transport cost. Health and well-being of building occupants and also building workers was on top priority for us. We initiated many efforts for working labor safety and achieved zero accident. We provided good sanitation facility to all construction workers. Crèche for all construction workers children with teaching facility was provided at the site. Regular health check-up camps were held for all workers/ labour. For building occupants we provided 30% more fresh air in building than a conventional building of this scale would offer and almost 90 % of the people are have an outside view to experience day light changes and seasons.
Building operation and maintenance is an important activity which will run throughout the building life cycle. To manage it effectively and achieve energy efficiency, we have adopted integrated building management system i.e. complete atomization of all the important services. This system keeps a close watch on all energy and water consumption helping reduce operational cost and monitoring performance as well as wastage.

Interview

The corporate campus built by us, functions totally on renewable energy sources which are achieved by the installation of offsite wind turbines as well as onsite wind solar hybrid system. A total of 6% energy is fulfilled from on site generation of green power.

How is the "One Earth Project" different from other such similar projects? Both conceptually and also from an architectural perspective?

The architecture was inspired by an 'office in a garden' – A place of human scale and proportion which was a unique concept where 95 per cent of the occupiers can view the external flora and fauna and would have enough natural light for most part of the day. Plants starting right from the basement and growing upwards in open to sky large glass cylinders was another novel master plan feature. The idea was to build a contextual place clearly in Pune, but High-Tech and internationally bench-marked. The architect created a system of shells in which landscape, interiors, services, utilities designers and branding designers emerge and synergize.

Water has been a key integrating idea from the beginning of the architecture design work. It was seen as both a visual devise and moreover as a way to involve the users in the spaces. Setting the Deep Sthambha (tower of light) in the centre of a water pool, fed by a stream, and a water fall, engages all inhabitants of One Earth. Water and light have always been the two "ever changing" elements that brighten up ones mind and spirit and hence have been exploited to the fullest logical solution in this architecture. As the project was large, complex and built-to-suit, it needed order, structure and a system to hold it together and hence the driving element of the architecture was its modularity. A module based architecture which was then easily adapted for the interior and the balance structure. Further, the architect then identified some key binding elements like an 'identifying' glass cylinder, water, entry portals and circular cores, a Deep stambh (tower of lamps), geometric angles for the structure, central spaces open to sky drawing energy within, a concept of 'in-between' spaces and hinge spaces that link areas and can turn corners and an underground Terminus which is a live hub of activities like parking, large record rooms, mailing room, employee lounges, gym, clinic and various opportunities of informal interactions. The final architecture plan is flexible, yet ordered; serves vehicles, yet is pedestrian, is a work place, yet a garden; allows concentration, yet gives the wandering eye a chance to relax. All of this creates a 'Sustainable' environment, which is A Great Place to Work.

The Suzlon tagline of "Powering a greener tomorrow today "was the main inspiration for the landscape design. The campus demanded a landscape that is sustainable. The building has a large footprint and the spaces created by the building brought a unique look and feel of the exteriors. The first focus of the landscape was the spaces closely associated with the profile of the building to ingrate the indoors and the outdoors. An approach of creating inner sanctuaries with tall plants in open to sky cylinders which would be experienced from each floor lounge was incorporated. The articulated and the formal edges of the master plan were addressed through softscape and hardscape elements.

The landscape architecture created an environment which is not only for viewing purpose but to be experienced as well thus providing an unique opportunity for learning, contemplating & stimulating senses for outdoor working. To achieve this quality, a" minimalist" approach of design has been adopted which also gels with the architectural language. The images associated with "minimalism" are smooth clean lines, geometrical forms, muted colour, clutter free design, tranquil & pure. Since the focus was on responsive and responsible landscape, plantation is all naturalized or native. Basically three layered principle is incorporated - trees, shrubbery where you play with cutting vision lines or adding colour to define spaces and a lower bed grass lawns with peripheral ground hugging plants. 70 % of the landscape is on a podium or a slab so that sub surface drainage and root barrier have been taken care. Rain water harvesting is achieved by catching, directing & recharging in ground through boreholes and use of porous paving like concrete grass pavers have been incorporated to reduce run off. Maximum irrigation with reused water and reuse of water for irrigation is a prominent design feature and by incorporating the drip irrigation system has allowed for a minimum loss of water. Further almost an acre of land area has been covered by stone grit which also looks aesthetically very pleasant and conserves water. Use of grit in place of ground covers to reduce water requirement & also surface run off is a sustainable solution and even the hardscape material used is recycled material like concrete with fly ash, certified wood or material extracted, harvested or recovered within 500 miles radius like limestone, granite & stone grit. The nature of the place that has been created is capturing positive energies creating an identity for the employees.

Could you tell us something about the HVAC technology used in this project?

The design process started by way of receiving conceptual drawings for the building from the Architects. We generated design basis reports, conceptual plans and infrastructure requirement in terms of service shafts, plant rooms, AHU rooms for approval of various stake holders. The initial design was based on air cooled VRV system. Water cooled VRV system was thought of once when we decided to go ahead with LEED certification. Water cooled VRV system apart from gaining two additional points (as per LEED criteria) gives opportunity to reuse waste water from STP / rain water tanks and is more energy efficient system. Concept of providing 30% more fresh air as compared with ASHRAE standard was embedded right through design stages which lead to induction of treated fresh air unit. Use of indirect evaporative technologies was whole heartedly supported by client, which helped us to customize the equipment design and reduce a substantial air conditioning load. Evaporative cooling is mostly used in all common areas and

Interview

areas with short occupancies like employee lounge, cafeteria etc.

One Earth is the first project in India to deploy Water Cooled Variable VRV (Variable Refrigerant Volume) system, with installed capacity of 1100 TR.

VRV system offers individual controls for facilitating individual thermal comfort at the same time linear power consumption due to inverter based compressor system.

At the same time, Water cooled VRV system is considered to be the most energy efficient system resulting in lower specific power consumption.

The water requirement for air conditioning system is entirely met through the recycled water, thus reducing water demand. The system is provided with state of the art control system providing single point control of all relevant parameters for efficient operation of system without compromising thermal comfort.

HVAC load was substantially reduced right at design stage by value additions such as 'Innovative design approach for 40% energy saving; multi stage evaporative cooling system for providing the comfort cooling in the range of 20 to 28 degree Celsius with Humidity in the range of 40 to 70%. System is custom designed & engineered. This system is installed for comfort cooling for common / basement core areas. 'Multi stage evaporative cooling system has potential to save 60% energy as compared to Air Conditioning System. Thereby reducing substantial load on water cooled VRV system'. Other value addition was 'Customized design & engineering approach during selection of suitable system for different functional spaces and a strong focus on occupancy health & Indoor air quality'.

Treated fresh air units installed in each floor designed to provide 30 % more fresh air in the office area as compared to ASHRAE standards. These units not only filters fresh air but also cools the air before entering in to air conditioned area thus reducing load on the system.

A fully automatic Mechanized Ductless Ventilation system provided for terminus. It is connected with CO sensors which are controlled through IBMS. It saves around 80% of the energy as compared to a conventional duct basement with advantages as dramatic improvement in IAQ (Indoor Air Quality); elimination of all organic odours; near total eliminating of Fungi; reduction in Operating cost and

saving of fossilized fuels due to lower use of electric power.

Could you cite the highlights of this project and the various energy conservation measures it undertakes?

Project One Earth, the Global HQ of Suzlon Group, is developed at Pune on approximately 443,473 sq ft (10.13 acres) of land by Synefra for their client Suzlon Energy Limited. It is a benchmark as an energy-efficient and sustainable solution project in all aspects of design, engineering, construction and project management. It is an example of consciously adhering to global norms of renewable energy usage, health and safety, optimal energy planning and socio economic responsibility. Walking the talk of powering a greener tomorrow for its client, Suzlon the entire campus has been built on LEED - Platinum and GRIHA - 5 star standards. Governed by sustainable and green standards of engineering and construction, One Earth has integrated and innovative aspects like use of Sustainable & LEED certified material for construction, 100% renewable energy powered campus (solar & wind), deployment of CFCs and HCFCs free air conditioning systems, creation of rain and water harvesting facilities, use of recycled water for landscape, to name a few. The completed project is in accordance with requirements of ECBC 2007. Some of the features include 100% outdoor lighting on renewable energy., 10000 Liters of solar hot water system fulfilling the complete hot water requirement of the facility, all indoor and outdoor units for HVAC system CFCs ad HCFCs free, maximum day light harvesting and use of smart and intelligent lighting system through use of LEDs, occupancy sensor and zero night light pollution and complete energy modeling with a targeted saving of 40%.

How does it adhere to the green building norms?

As mentioned earlier, this project has incorporated green guidelines from the conceptualization to the building and final stage. One Earth has been certified with Platinum LEED rating by the USGBC and Griha 5 star standards. All materials and constructions in One Earth have been developed by green and sustainable means- 100% use of renewable energy for lighting, use of solar water systems, HVAC , rain water harvesting, LEDs, etc.

Could you please elucidate on the tagline "Creating Benchmarks in Green & Sustainable Infrastructure - 'Suzlon One Earth' Project"?

This project is an exemplary benchmark as an energy efficient and sustainable solution in all aspects of engineering and construction. During the entire construction phase the project has consciously and responsibly adhered to norms of renewable energy usage, manpower health & safety, sanitation and hygiene,socio environmental responsibility and very stringent norms related to green building recognition and much beyond.

One Earth today boasts of a total 3.9 million safe man-hours and is underway without any major accidents The structure has adhered to all basic norms of the Disabled Act.

Integration of an awareness program is designed for the occupants for this building. Structured tours are planned so as to imbibe the spirit of the campus and to make each and every occupant conscious of his / her responsibility as a green citizen of One Earth.

The beauty of this place is that it is simple, classic and hi tech. It is like a canvas created by a visionary and then each of the stakeholders has filled it with their colors without overpowering or disturbing the original canvas. Of course, there are platinum certified buildings but not on the scale of One Earth with such detailed and strict measures of environmentally responsible decisions. This project has been bench-marked by experts as being amongst the top 5 corporate campuses in the world today. ■

LEAD STORY
GREEN PROJECT

One EARTH

Conceptualised, designed, executed and commissioned with the vision of creating an eco-friendly workplace, One Earth is a project that is a real 'Green' marvel.

One Earth is a benchmark as an energy-efficient and sustainable solution project in all aspects of design, engineering, construction and project management. Many will agree to this. This Global HQ of Suzlon Group, is developed at Pune on about 443,473 sq ft (10.13 acres) by Synefra for their client Suzlon Energy Ltd. Walking the talk of powering a greener tomorrow, the entire campus has been built on LEED - Platinum and GRIHA - 5 star standards.

Green motto

One Earth was conceived, designed and completed with the vision of creating a 'Green' workplace with minimal global footprint project based on a simple brief from the client for a need of a work place which would provide a view to all beyond the monitor screens, a chance to experience daylight changes at workstations, a place where employees do not feel restricted in thought or movement and more importantly they do not miss the joy of changing seasons while they go about achieving targets. **JR Tanti, Managing Director, Synefra E&C,** says, "The One Earth project is an engineering marvel in all respects including excellent architectural design and seamless integration with building services based on the essential green building concepts of energy efficiency and sustainability."

Master plan

The master plan is similar to a campus which is based on an urban village

One Earth incorporates innovative aspects of engineering and construction.

LEAD STORY
GREEN PROJECT

It is considered to be the world's greenest corporate campus having achieved the dual distinction of a LEED Platinum and 5 Star GRIHA green building rating.

concept, with features like –Horizontal open spaces instead of linear over bearing structures, large interactions courtyards instead of only meeting rooms, wide landscape (185,578 sq ft of functional spaces) to encourage activities instead of 'keep off grass' signs, state-of-art outdoor lighting, functional and aesthetic outdoor furniture, prominent water bodies, traditional elements like *Deep-stambh* and a 20' diameter steel globe depicting Suzlon global presence. The campus can accommodate around 2,300 team members.

Governed by sustainable and green standards of engineering and construction, One Earth has integrated and innovative aspects like use of sustainable and LEED certified material for construction, 100 per cent renewable energy powered campus (solar and wind), deployment of CFCs and HCFCs free air conditioning systems, creation of rain and water harvesting facilities, use of recycled water for landscape, to name a few. The completed project is in accordance with requirements of ECBC 2007.

Challenges

When asked on the challenges faced in its making, Tanti says, "If we had to list down the challenges for One Earth, looking back I would like to highlight two – people and products. The main challenge lay in keeping the entire team with the common focus of creating a 'green' building. For several years now, most of the contractors and consultants have conventional ways of practice and unlearning for them was not so easy. Also among all the so-called modern development, it was a bigger challenge to fit our needs considering our climate, culture and using latest technology.

The project depicts an inspiring place to work by contributing immensely to employee productivity.

We had to ensure that the architecture and design should not only be green by its appearance and planning but by its technology especially focused for energy efficiency, water management and waste management."

"The next challenge was getting local materials which will not unnecessarily escalate the cost and still be compliant with required certifications of green buildings and would suit our environment. There are many local products that meet the criteria but are not certified. Nerolac actually customised the paint for this project for its large-scale application to meet the required criteria. The team put in its best efforts to enhance and upgrade the green supply chain and wherever possible it has worked with local vendors so as to educate and create awareness in terms of available sustainable solution which would benefit the sector at large," Tanti adds.

Cost comparison

The campus uses less energy, water and natural resources, creates minimal waste and is healthier for the occupants compared to a conventional building. The given table gives a comparison of the project with a standard building.

Setting an example

Suzlon One Earth has lot to offer with respect to workplace ambience, aesthetic and social dynamics thereby contributing

LEAD STORY
GREEN PROJECT


Construction material deployed is manufactured regionally and uses higher recycled content.


This 20' diameter steel globe depicts Suzlon global presence.

immensely to employee productivity through an inspiring place to work. Synefra has achieved an overall 30 – 40 per cent reduction in operating costs due to 40 per cent energy saving and 30 per cent water saving solutions. The green initiatives taken here can set examples for many others to follow. Let the green sheen prevail all over!


It features the largest outdoor LED installation for all external lighting.

Comparison of costs of One Earth vs a standard building

Particulars	One Earth (% of total cost)	Conventional project (% of total cost)
Cold Shell cost	24.30	31.56
Special building finishes	7.26	6.51
Green building cost *	11.35	1.50
Basement cost	4.29	9.91
Utilities cost - HVAC	3.89	3.17
Utilities cost - Electrical	5.43	4.84
Other utilities	3.25	5.81
Landscaping cost	3.70	3.05
Building and signages	2.22	2.05
Interior cost	25.59	23.91
AV and IT cost	8.72	7.69
TOTAL	100	100

(* renewable energy, special material used, water management, etc)

Project highlights

- The site is in accordance with specified distances from wetlands and farmlands. The design of the premises incorporates open spaces that exceed local zoning requirements by as much as 25 per cent, thus ensuring little or no site disturbance.
- 70 per cent of construction material deployed is low energy in nature, manufactured regionally and uses higher recycled content.
- It has a 100 per cent renewable energy powered campus (solar and wind), along with deployment of chlorofluorocarbon- (CFC) and Hydrochlorofluorocarbons- (HCFCs) free air conditioning systems.
- It is in tune with water conservation efforts, the premise has a maximum capacity rainwater harvesting system and an onsite sewage treatment plant that aids recycling sewage water for air conditioning and landscape. The campus uses a 'pebble drain' technology to reduce soil erosion and collect rain water.
- It features the largest outdoor light-emitting diode (LED) installation for all external lighting, water-cooled Variable Refrigerant Volume (VRV) air conditioning and an urban installation of 18 onsite wind turbines.

Suzlon One Earth, a built-to-suit office space for Suzlon Group, world's third largest wind Energy Company, was awarded for development to Synefra from concept to commissioning.

Highest rated green campus

Suzlon One Earth Project is a global village concept complimented beautifully by office-in garden architecture is a perfect fit for target market and has become a game changer infrastructure as it is a counterblast to the prevailing tall glass box office architecture commonly dotting the ugly skylines.

Being the global headquarters of Suzlon Group, this development is ideally suited for the target audience catering to the entire gamut of services as required by the client. Being the location of company's think tank, the project needed a quiet place but still easily accessible for business needs.

There are two major programmes at One Earth:

- Corporate office (Four interconnected office buildings)
- Suzlon Excellence Academy – Global Learning and Development

The Corporate Office houses all the functional business verticals of the Group and the Suzlon Excellence Academy within its premises. Taking the theme of One Earth further, the corporate offices have named after five key elements of nature - Aqua (Water), Tree (Wind + Wood), Sky (Ether) and Sun (Fire) and the entire basement as Terra (Earth) to make the One Earth complete.

Wellbeing

- Sustainable solution and practices are integrated towards efficiency in energy use, water use, waste management, material use, healthy air quality, practices. A Green Design Education provision through defined green awareness signage, wind gallery and open door policy for visitors on defined days. Green Housekeeping policy is through which green housekeeping products and process have been implemented. Exemplary performance by using regional materials which measure to about 50% of the total value of the materials in the project.

The project offsets more than 50% annual energy consumption used during construction with renewable energy. Light (Electricity, Lighting, Renewable energy). When we talk about reducing the energy load and making the services and utilities more efficient the major criteria to be taken care are HVAC, lighting and water related. This was a big task and also a challenge for the team but by bringing in the hybrid solar and wind power changed the complete equation. This kind of thought came in almost after a year into the work progress but it changed the way of looking at low energy building and helped in achieving targets set for Green certification. The common brief and the basic challenge that was given to each expert consultant was that the design solution should have the basic five criteria: Independent for each building yet centralized to IBMS to save cost, control operative costs per building and also failure or fault at one spot should not affect balance spaces. LEED and GRIHA specified benchmarks were the minimal standards to be achieved and go beyond. Most of the services have achieved the same. The focus was on long term cost savings and not just initial cost cutting in order to avoid recurring cost escalation during operations and maintenance.

Cover Story

Green Projects

Traditional deepstambh at Suzlon One Earth

RENEWABLE ENERGY SOLUTION

Wind Solar Hybrid system

There are total 18 Nos. Wind turbines provided which are mounted on a tubular tower of 24 meters. The towers are situated in the outer periphery of the entire complex. Each tower is having capacity of the @4.75 KW. The solar photovoltaic panels of capacity 230 Watt, 243 numbers are mounted on the roof top of the SEA and Aqua Lounge. The combination of solar and wind system which are divided into four cluster is charging a set of batteries (for battery bank details refer file no SOE/BATT/11) and convert the battery DC power to 230V AC sine wave through the PCU (Power Conditioning Unit) which will act as a back up as well as main stream power with the help of MPPT (Maximum Power point tracking mode).

Ventilation System

i) Evaporative cooling system: Principle of Operation: The evaporative cooling system is also called as Indirect-Direct Evaporative cooling system. This system consists of two stages of the cooling for the air being circulated in the core area. The air is passed through a fine filter of 10 micron capacity and then passed through the heat exchanger which air to air type the cools the air by absorbing its sensible heat and sent to the second heat exchanger where air cooled by circulating water it follows an adiabatic process and sent to cooling tower where this heat from water is release to atmosphere. Multi stage evaporative cooling system is selected for providing the comfort cooling in the range of 20 to 28 degree Celsius with Humidity in the range of 40 to 70 %. System is custom designed, engineered, supplied and installed by Mumbai based 'Unidyne Energy Systems'. This system is installed for comfort cooling at Energy Court (S.E.A.) and similar system is provided by 'Sumaya HMX' Bangalore, which is been installed at Building Lounges, Cafeteria & Gym.

Highlights of the system:

One earth is the first campus in India wherein LED lights are used extensively for external general lighting to achieve desired levels of energy conservation.

- Total load of external lighting is only 50 kW for the entire campus.
- External light design is on the basis of minimum light pollution at night.
- All buildings are designed to harvest maximum day light through glass & louvers with almost 90% of regularly occupied places not requiring switching on lights during daytime.
- Large parking spaces, Common meeting rooms, individual cabins are provided with occupancy sensors while parking areas and open work stations are equipped with day light sensors and occupancy sensor combination to control lighting load and wastage thereof.
- Entire office space is provided with task lighting over the working areas and is controlled individually as well as through occupancy sensors.
- 1850 m ED strips used for external lighting gives the building a floating effect. There is no UV, no heat dissipation from the usage of this lights and their lifespan is 5,000 burning hours.
- Landscape lighting is fixed in a way that it will compliment and illuminate the features of the architecture and landscape as visualized by the designers. According to LEED requirement, landscape cannot have more than 5 per cent of light load as upward light hence very few up lighters are used that illuminate only what is needed and yet gives the entire garden a highly enhanced ambience. The Deepstambh or the tower of light located as pivotal campus element uses fiber optics for all the forty arms of the tower which come out of a single light source box, which is maintenance friendly and the makes the lamp accessible for repair etc.
- The common areas created by the buildings have been provided a very beautiful lounge effect which is created by indirect lighting.

Parking ventilation system

The entire Terminus area is provided with the new technological concept of ductless jet fans. These fans have the suction of the air from one end and delivery on the other where as the delivery of the all fans are discharged to the atmosphere with a help of a common extraction fan unit of 32500 CFM.

Aesthetic landscape at Suzlon One Earth

Cafeteria at Suzlon One Earth

Separate ventilation system has been provided for the toilets. The system consists of exhaust fan located at the terraces and ducting provide up to toilet. This exhaust fan creating negative pressure in toilet and getting fresh air from office area.

Water Distribution System:

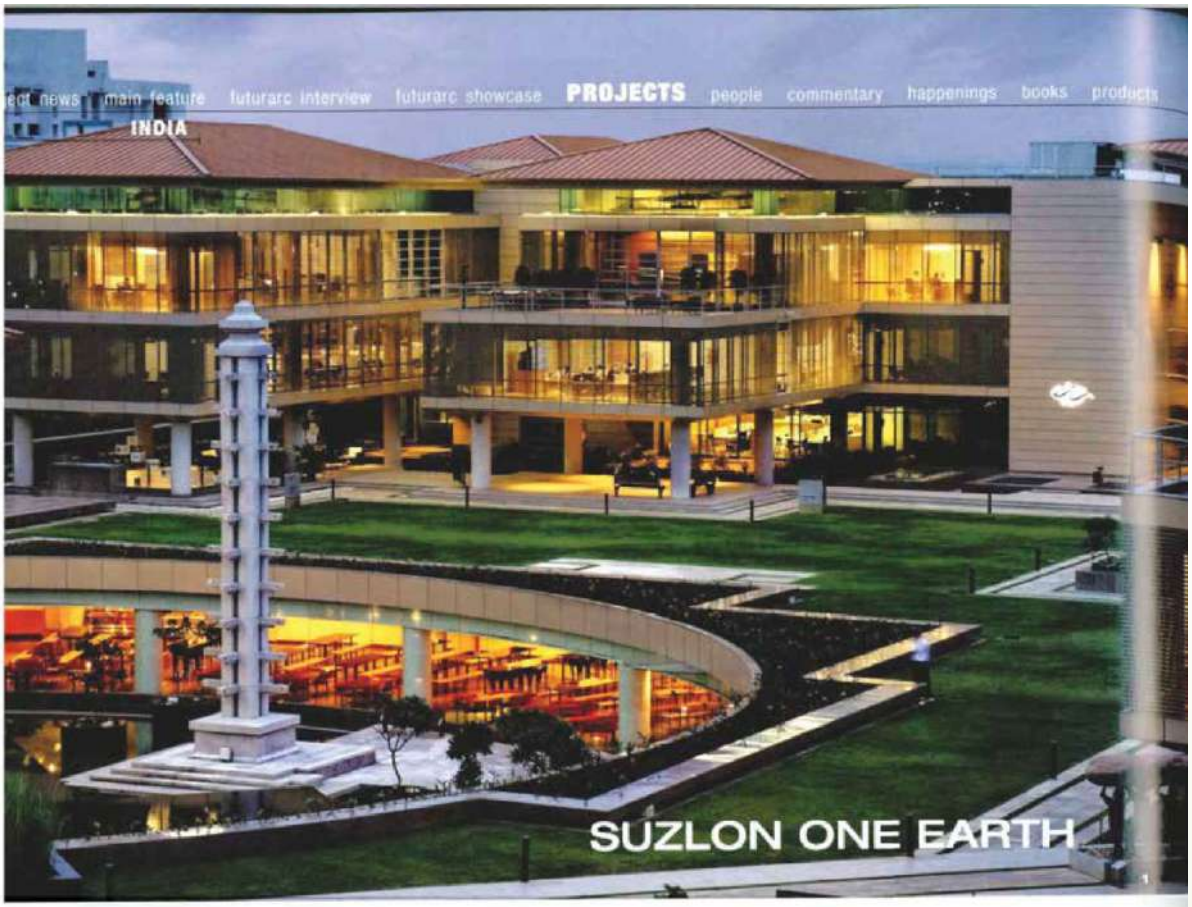
Water distribution network is designed to provide minimum pressure of 1.1 kg/cm2 to all the taps with adequate discharge. There are two separate distribution networks for domestic & flushing water. Flushing water is treated sewage/ raw water & is supplied for flushing, Irrigation and HVAC. Domestic water (drinking quality) is supplied to all taps other than flushing.

Waste management solution

All waste is get collected at this room and segregated, All recyclable waste is sold to scrap vendor and non recyclable, hazardous waste is send for treatment to authorized agency by pollution control board. All organic waste which is coming from water from cafeteria, landscape and pantries is treated through Organic waste converter.

OrganicWaste Converter (OWC):

The organic waste converter in the Suzlon One Earth Project treats the waste that is generated from the office canteen. Food waste is mixed with a bucket of saw dust or a bucket of compost manure as additives along with a big spoon of bioculum bacteria mix. Water is sprinkled over the mixture through a pipe line. After around 15 minutes this compost and saw dust mixes with the wet garbage and a brown colored mix is the output from OWC. The OWC blends the waste with the saw dust and manure giving an odour-free output. This material loaded in plastic trays after composting for 10 days becomes free flowing manure. ■



Suzlon One Earth is the corporate headquarters of Suzlon Energy Ltd, one of the leading wind power companies in the world today. As such, it was designed to reflect the values and vision of the company and its patrons. Among other criteria, LEED and GRIHA (a Green building rating tool in India) were specified as the minimal standards to be achieved. The project also utilises a hybrid solar and wind power system to supplement its energy needs.

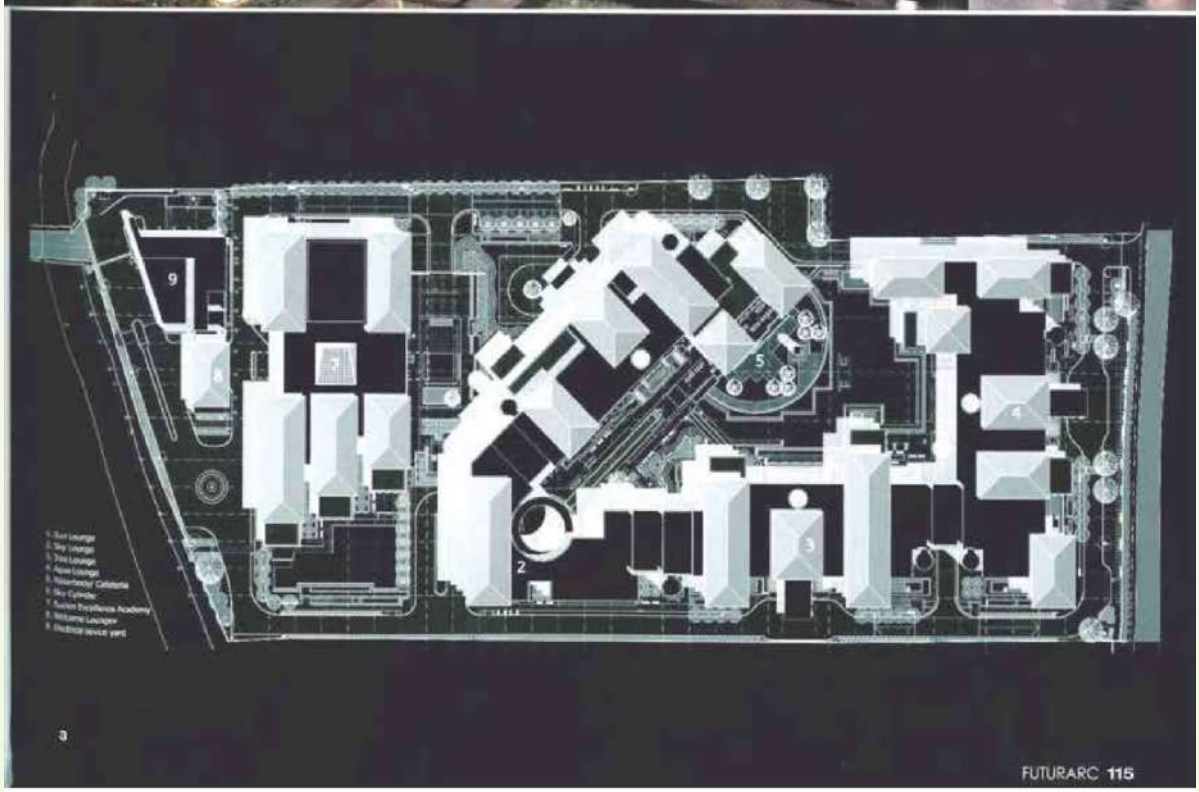
Instead of a regular tall glass box structure in congested urban infrastructure, One Earth is spread out in the form of a campus, focused around a large central courtyard that contains a crescent reflecting pool with a contemporary *Deepastambha*, an obelisk holding hundreds of lamps. There are four functional buildings; the Suzlon Excellence Academy (Learning Centre) is also located on the same premise. Interior spaces are designed to connect to the outdoors. As such, the campus is interspersed with green spaces and water bodies and all common areas in the buildings are orientated towards landscape views. Spaces are designed to provide users with the flexibility of utilising them in indoor/outdoor settings, and employees are encouraged to use the landscaped areas rather than having a 'keep-off-the-grass' policy. The buildings are designed for maximum daylighting with louvres and glazing to keep out the glare. One of the unique features of the project is the 'open-top' glass cylinders incorporated within the buildings which not only aid in daylighting but also provide ventilation to the basement.

Apart from the use of renewable energy, the team also focused on making services and utilities such as HVAC, lighting and water more efficient to reduce the energy load. All the utility services are controlled by an automatic centralised system, the Integrated Building Management System (IBMS).

RENEWABLE ENERGY

The hybrid solar and wind power system comprises 18 solar-wind hybrid domestic windmills installed on site (each yields 4.75 kW); 243 conventional solar panels (each yields 230 W); and 128 BIPVs installed at the Excellence Academy

1 The central courtyard with the *Deepastambha* (tower of lamps) **2** BIPV installation at the Excellence Academy **3** Site plan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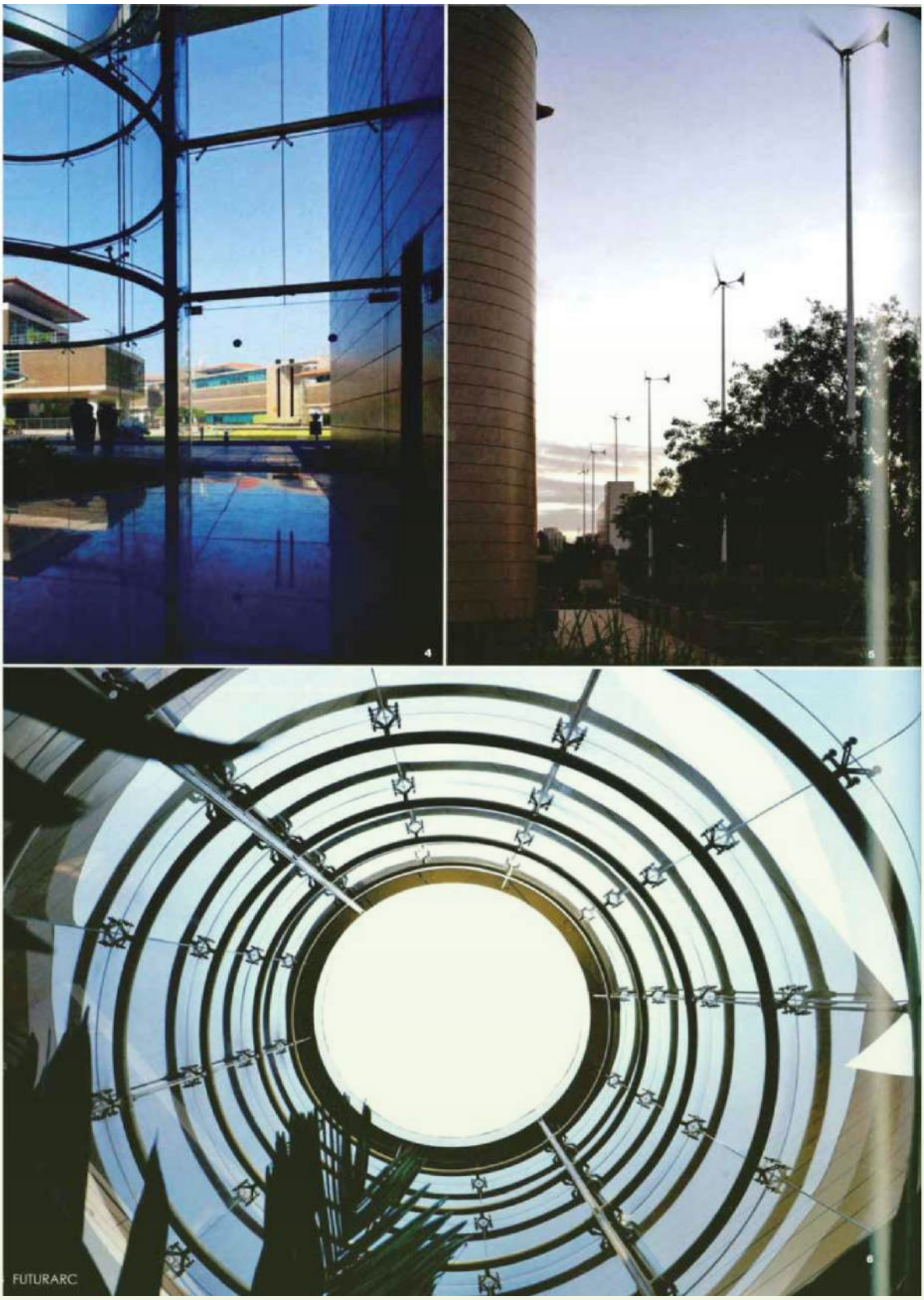
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(each yields 105 W). In total, the system generates 154.83 kW. Approximately 35 kW of renewable energy is channelled to the communication server. The external lighting is fully powered by renewable energy. Part of the air-conditioning and internal lighting load is also on this system. Around 5 percent of the total energy requirement of One Earth is fulfilled from on-site renewable energy installations. In addition, off-site wind turbines with a 4.63 MVA capacity have also been installed at Kutch, Gujarat to compensate the total installed electrical load of 4 MVA; the current demand is around 2.3 MVA.

HVAC

One Earth utilises the water-cooled variable VRV system, which is considered to be more energy-efficient than conventional ones. The power consumption is as low as 0.5 kW/TR. This has reduced the air-conditioning load by 40 percent. The short occupancy zones such as the lift lobbies, learning centre lobbies, cafeteria and gymnasium are air-conditioned by an indirect evaporative cooling system, which cools air without refrigeration.

The HVAC load has also been substantially reduced right at the design stage by incorporating the following features:

- Providing roof insulation
- Use of high performance glass
- Energy recovery from return air using treated fresh air units. The treated fresh air units are installed in each floor and are designed to provide 30 percent fresh air in the office area as compared to 20 percent stipulated in the ASHRAE guidelines. The units are connected with CO_2 sensors and are controlled through the IBMS.
- Use of multi-stage evaporative cooling systems for common areas such as cafeteria, basement cores, etc.
- A fully automatic mechanised ductless ventilation system was provided for the terminus. It is connected with CO_2 sensors which are controlled through the IBMS. It saves around 80 percent of the energy as compared to a conventional duct basement.

LIGHTING

LED lights are used extensively for external general lighting for better energy efficiency. The total load of external lighting is only 50 kW for the entire campus. All buildings are designed to harvest maximum daylight through glass and louvres; almost 90 percent of the occupants do not require artificial lighting during the day. Large parking spaces, common meeting rooms and individual cabins are provided with occupancy sensors while parking areas and open workstations are equipped with daylight sensors to control lighting load and reduce wastage. Task lights are also provided at the workstations to minimise common lighting usage.

WATER

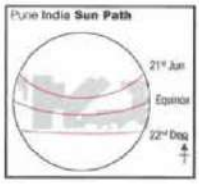
The total peak water requirement is 250 m³/day. Water is sourced through bore wells, rainwater harvesting and recycling water. Water storage tanks are designed to store three days' water requirement (capacity 750 m³); rainwater harvesting tanks are designed to collect three days' worth of rainfall (capacity 1,000 m³). Water from the landscaped areas are collected centrally and re-circulated through the rainwater collection system. The sewage treatment plant yields 100 m³/day of recycled water which is used for HVAC needs and irrigation. The use of a solar water heating system for employee washrooms and showers (10 m³/day) results in savings of 1.4 Lac kWh of electricity per annum.

WASTE MANAGEMENT

The project adopts a zero waste management policy where a waste minimisation steering committee works towards reducing waste. Waste segregation is done at the source. Organic waste generated from the cafeteria and garden, and paper waste from office bins is converted into manure by an organic waste converter (with a capacity of 100 kg/hr), which is used for gardening. Electrical and electronic waste (e-waste) is treated through a pollution control board authorised agency. Recyclable waste is segregated and sold to recycling vendors.

PROJECT DATA

Project Name
Suzlon One Earth
Location
Hadapsar, Pune, India
Completion
October 2009
Site Area
41,000 m²
Gross Floor Area
816,000 square feet
Number of Rooms
5 buildings with a total of 26 functional wings (floors)
Building Height
15.50 metres
Client/Owner
Suzlon Energy Ltd
Project Manager
Conceived, managed and executed by J.R. Tanti, MD, Synefra E & C Ltd
Architecture Firm
Christopher Charles Benninger Architects
Principal Architect
Christopher Charles Benninger
Main Contractor
Vascon Engineers
Mechanical & Electrical Engineer
Power Engineers
Civil & Structural Engineer
Vastec
Interior Architects
Space Matrix, Singapore in association with Tao Architecture
Landscape Architect
Ravi Varsha Gavandi
Green Consultants
Environmental Design Solutions
Branding & Communication
Elephant Design
Images/Photos
Synefra E & C photo bank



4 Glass cylinder **5** On-site wind turbine installations **6** Interior view of glass cylinder **7** Suzlon Excellence Academy **8** BIPV installation

COVER STORY

The One Earth Vision

The first concern is for people who work here

BUILT ON 10.13 ACRES OF land, Suzlon's global headquarters in Pune - One Earth - is one of the largest green building projects in India with a built up area of over 8,00,000 sft. This LEED Platinum-rated building was conceptualised to be a green workplace with a minimal global footprint.

The client's brief to designers Synefra Engineering & Construction was simple – create a workplace which provides a view beyond monitor screens, a chance to experience daylight changes at workstations, a place where employees do not feel restricted in thought or movement, and more importantly, they do not miss the joy of changing seasons while they go about achieving targets.

Here's what got One Earth the Green Building of the Year 2010 recognition:

- Its site is in accordance with specified distances from wetlands and farm lands
- The premises' design incorporates open spaces that exceed local zoning requirements by as much as 25%, thus ensuring little or no site disturbance
- 70% of construction material used is low energy in nature, is manufactured regionally, and uses higher recycled content
- The building has a 100% renewable energy-powered campus (solar & wind)
- The premise has a maximum-capacity rain water harvesting system and an on-site sewage treatment plant, and it uses 'pebble drain' technology to reduce soil erosion and collect rain water
- It features one of the largest outdoor LED installation for external lighting, water-cooled variable refrigerant volume (VRV) air-conditioning, and an urban installation of 18 on-site wind turbines

Special Feature

FORTIFYING THE PLANET

Sabiha Ghiasi takes a tour around Suzlon's global headquarters in Pune and discovers what sustainable architecture is all about

The construction sector has laid a benchmark for development since ancient times. Of late, people have realised that contrary to long-held belief, material wealth is not a reliable indicator of progress. A small country like Bhutan is actually one of the richest in the world when it comes to overall human development and the sustainable use of natural capital, two aspects that hold immense relevance in today's time. This feature explores India's contribution towards sustainability.

Dial G for green

Enter: Suzlon's headquarters in Pune. Christened 'One Earth' in June 2008, the office is sprawled across 11.5 acres and promises a unique brand experience for all its stakeholders and visitors. A landmark project, One Earth was built on a construction budget of about ₹280 crores by Synefra Engineering and Construction. While the location was selected in December 2005, the building was rendered functional in a short span of around four years

composite wood with low toxicity levels were used for the construction of One Earth. The company also ensured that containers housing toxic materials were recovered, isolated and ventilated whenever required.

Since the project uses a lot of software and technology, it required an integrated software that would monitor each of these in a holistic manner. Synefra built its own customised software as there was no ready-made software in the market meeting their requirements.

The Integrated Building Management System (IBMS)

JR Tanti, Managing Director at Synefra Engineering and Construction, says that power, water, waste management and vigilance are some of the most important aspects attached to this project and were given the most attention during the planning stages.

A network with an edge

The basic distribution network, consisting of the main LT panel and block panels, provides a modular and reliable system. Each block is independently fed from the main substation through two different sources and each block panel is provided with an automatic transfer switch for switching over power within 30 microseconds in case of power failure from one of the sources.

The main LT panel is provided with 100 per cent DG back up so that the possibilities of the block getting isolated from power are eliminated to a great extent. Each block is provided with an independent UPS set (working + standby) to feed power to critical equipment like computers, AVs, emergency lights, etc. This enhances the reliability of power supply within One Earth.

The performance of each aspect could easily be monitored and assessed individually; the challenge was to evaluate performance in an integrated manner and get an idea of how each of these resources is being used. This was when IBMS was designed to monitor the energy resources. This online system tracks power, water and waste management every 15 minutes. The aim of such a system is to help the management and consumers realise the excessive use of energy as and when it happens and not at a later date, like the following month. Most importantly, the benefit of this system is that the maker does not control any resource, while the user is made an active part of the plan. This system is on display on a large LCD TV in the lobby and depicts energy consumption on a ticker. Employees are made aware of excessive consumption or wastage through such active measures. The beauty of this system is that it is not a compulsion levied on the user but a lifestyle in itself, which is encouraged at Suzlon.

The company faced various challenges during the project that it overcame as sustainably and efficiently as possible. A few of its triumphs are mentioned below:

Excavated soil disposal and handling

During the construction stages, huge quantities of soil had to be excavated at the site. The challenge was in preserving and reusing this soil without affecting the environment. The fertile soil excavated during construction was transported to a nearby site where the

in March 2010. One of the primary design objectives of this campus was to set an example for a completely energy-efficient corporate space. Conservative use of energy and energy production from renewable sources were the key concepts on which this project was based.

One Earth has the following features that ensure energy conservation and optimum utilisation of resources for sustainability:

Renewable energy generation

The campus generates a good amount of energy through a combination of wind-solar hybrid system and Building Integrated Photovoltaic panels (BIPV). More than five per cent of the project's energy consumption is met by renewable sources like windmills and solar panels. A solar water heating system with a capacity of 10,000 litres per day has been installed, saving 1,35,501 kwhr of electricity annually.

Electrical design

Each of the office blocks are provided with independent distribution and metering systems. The initial design was for 5,600 kVA connected load and 6,000 kVA transformer capacity. However, this was reworked to meet the company's initiative towards creating a low energy consumption building, and fixed at 3600 kVA with a transformer capacity of 4000 kVA.

Envelope shading and overhangs

The building envelope is made in such a way that it optimises the thermal performance by reducing the head load and allowing maximum daylight harvesting. The energy requirement of the building is hence very low.

The lighting system in the interiors is smartly designed and employs dimmable ballasts, electronic ballasts, occupancy sensors, motion sensors and daylight sensors. This ensures that lights are on only when required.

Jet fans for parking ventilation

As opposed to the conventional duct arrangement, fresh air in all buildings in One Earth is drawn through large openings provided on the periphery of the basement and pushed by PLC-controlled dual speed jet fans towards the centre of the basement. The air within the buildings is sucked out from ten locations and exhausted onto the terrace by exhaust fans.

A few conscious efforts were made during the construction of the project to ensure appropriate waste management and recycling of resources. A few of these are listed below:

In keeping with the One Earth theme, the names of functional blocks in the campus represent the five renewable elements of nature: Sun (fire), Aqua (water), Tree (wind/wood), Sky (space) and Terminus (terra/earth)

Construction waste management

As part of a new waste management process, all construction waste was properly segregated, packed and diverted for recycling to appropriate vendors or channels to avoid land fill dumping. The company ensured that maximum efforts were made to recycle materials like cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation.

Suzlon designated areas on the construction site for the collection of recyclable material and tracked recycling efforts throughout the construction process. Construction haulers and recyclers handling the designated materials were identified. The size and functionality of the recycling areas were coordinated with the collection services for glass, plastic, office paper, newspaper, cardboard and organic wastes to maximise effectiveness of the dedicated areas. The company has also given consideration to employing cardboard balers, aluminum can crushers, recycling chutes and collection bins at individual workstations to further enhance the recycling programme.

Source control

Low VOC content materials such as paints, adhesives and sealants as well as carpets and

Keeping sustainability in mind, certain aspects of One Earth have a defined direction:

Water efficiency measures have been incorporated into the design

Architectural elements are designed to facilitate maximum use of natural resources

Provisions are made to ensure that part of the energy needs of the campus are fulfilled by using natural energy-generating methods such as wind turbine generators and solar panels A zero-waste policy is initiated.

Department of Irrigation planned to construct a park. Some soil was stored at a nearby plot and reused for landscaping at the campus. Murum was also stacked at a nearby plot and used for backfilling to achieve desired levels.

Windmill installation in the urban zone

The fact that the site was located in an urban area led to speculation that legal requirements would have to be met before the company could install windmills. However, after constant follow up with the relevant government agencies, the Suzlon team discovered that legal permission for installation of windmills was not essential as per existing laws. Hence it went ahead with the windmill installation plans.

BIPV integration with existing roof design

Building Integrated Photovoltaics (BIPV) are photovoltaic materials that are used to replace conventional building materials in parts of the building envelope such as the roof, skylights or façades. They act as a principal source of electrical power, and are increasingly being preferred in sustainable buildings. Suzlon carefully considered material specifications and design aspects before going ahead with the installation.

Project specifications
Developed by: Synefra Engineering
Contractors: Vascon Construction Company
Interiors conceptualised by: Tao Design
Interiors implemented by: Space Matrix, Singapore

Water sourcing and effective water management

Identification of water sources was one of the priorities of the project, followed by innovative water conservation and recycling measures. Once specific targets were set, it became easier to use technology to reach the desired goals. The required result was kept in mind while the appropriate water management system was put in place.

Mr Tanti believes that there is still a lot of room for improvement in construction, especially in the sphere of sustainable architecture. With respect to One Earth, he feels that the design and engineering could have been better. However, according to him, the building is only a benchmark and in future, detailing aspects will be handled more efficiently.

Mr Tanti also highlights a major problem sustainable development faces today—that of not being taken seriously. In his opinion, the government needs to understand the depth of the situation and offer more support for sustainable development. The government has, only in very recent times, come up with a policy to lessen duties on 'green' buildings. He believes that it needs to make an effort to understand, recognise and provide support to sustainable builders. In this way, more of such efforts on the builders' part will be encouraged.

Green

GUSTO FOR GREEN

In a conversation with JR Tanti, Managing Director, Synefra E&C, Mitali Saha discovers the aspects of efficiency that must be kept in mind when building responsibly

In today's lexicon, 'green' means 'responsible', and measures to be more responsible should not be a choice or an option, but a way of life. Today, conscious consultants or builders think green if they consider themselves responsible citizens of this ecology. The entire concept is based on approach and planning. Exploring the right materials and appliances, maintaining the indoor air quality of properties and keeping costs low throughout the building lifecycle using facilities management definitely contributes towards a sustainable and green infrastructure, but the process starts from the day the project is conceived. While the design definitely needs to support the structure using optimum available natural resources, sustainable site planning is the first step towards a more conscious approach to the project.

This approach has been adopted by Synefra E&C in its project, 'One Earth,' which has been sustainably developed on an area of 443,473 square feet (10.75 acres) and is expected to be one of the largest green building projects in the country.

One Earth has the capacity to accommodate around 2,300 employees, and is so named as a tribute to earth's unique existence as a self-replenishing eco-system. An overall 20 per cent project cost saving in comparison to a similar scale project has been reaped. One Earth has been built on the principles of Leadership in Energy and Environmental Design (LEED) and Green Rating for Integrated Habitat Assessment (GRIHA), the national rating system of India developed by TERI. In an exclusive with TJCD, Mr Tantri reveals his passion for sustainable property development.

A few highlights of the project:

- The site is in accordance with specified distances from wetlands and farmlands. The design of the premises incorporates open spaces that exceed local zoning requirements by as much as 25 per cent, thus ensuring little or no site disturbance.
- 70 per cent of construction material deployed is low-energy in nature; it is manufactured regionally and uses higher recycled content.
- It has a 100 per cent renewable energy-powered campus (solar and wind), along with deployment of chlorofluorocarbon-free and hydrochlorofluorocarbon-free air conditioning systems.
- It is in tune with water conservation efforts, the premises have a maximum-capacity rain water harvesting system and an onsite sewage treatment plant that aids recycling sewage water for air conditioning and landscape use. The campus uses 'pebble drain' technology to reduce soil erosion and collect rain water.
- It features one of the largest outdoor light-emitting diode (LED) installations for all external lighting, water-cooled variable refrigerant volume (VRV) air conditioning and an urban installation of 18 onsite wind turbines.

recycling. Tie-ups have been undertaken with local government-approved organisations for responsible disposal of e-waste and other hazardous waste. An organic waste convertor helps recycle onsite organic waste such as paper, horticulture waste and food waste. All organic waste is converted into rich organic manure and used as landscape manure.

What are the new technologies that need to become more accessible and economical for wide-spread use?

There is tremendous scope for innovation in the field of infrastructure. Today, when the need for both industrial and commercial infrastructure is high-solution providers, they are compromising on quality due to time constraints. Air-conditioning which is one of the major energy-consuming services in buildings, can be re-thought. A water-cooled VRV system is a non-explored technology which consumes almost 40 per cent less energy than conventional systems.

An organic waste converter is another available, but rarely-used technology, which would reduce the unnecessary burden on civic bodies as well as generate organic by-products which can be further utilised for better living.

The use of LED is more energy-efficient than using compact fluorescent lamp (CFL) lights and needs to be popularised and implemented widely. This innovation is a tremendous resource lying untapped due to set conventions and thought processes of designers. Maxmising the use of natural light while designing and installing renewable resources like photovoltaic cells, conventional solar panels and domestic wind turbines needs to be promoted widely.

What is the market acceptability of these projects and in which areas is there a need for regulatory action?

The end user today has definitely become more informed and is demanding value for every penny spent. Hence, there is definitely a demand for properties with open areas, landscaped areas, daylight access and efficient light fixtures to reduce electricity bills and provide comfort. Just as users are asking for value for their money, developers need to wake up to the fact that green cannot be sold as luxury, but as an essential. They need to design, plan, build, execute, and if required, operate and maintain, in order to translate more beneficial green projects that are economical in the long run. Services and

utilities, comprising mainly HVAC, lighting, electricals and water, are the major sectors where green can revolutionise the way we deal with projects. If innovative and efficient resources are tapped by engineers and architects, great results can be achieved. Sustainable development has to become a way of life and companies must continue to improve practices and innovate in each and every area of infrastructure development as well as project management. There is high potential demand for sustainable and green infrastructure in the future and forward-looking players must position themselves into a space that presently seems to have large vacancies.

Unless governments integrate mandates pertaining to the requirement of green building criteria in existing town planning and local bodies' procedures, it would become difficult to implement or simplify green practices in construction. A very real and sincere intention of Central, state and local bodies to implement regulations can be witnessed today, but a synergy and connect with existing systems along with necessary changes in existing laws and regulations is the need of the day.

GREEN

Sustainable Infrastructure Development

Sustainable infrastructure and sustainable design are fast becoming a norm rather than exception. **JR Tanti** discusses how it can not only save energy but also improve the condition of the environment.

Photo voltaic cells on the ceiling of Synefra's One Earth, Pune.

Sustainability is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. And while it is not a regularly used term, sustainable infrastructure refers to anything built or used in a way that contributes to the overall sustainability of natural resources. In most cases, this is related to energy consumption and water use, two of the most high profile conservation areas.

Infrastructure development generally consists of several key stages: (1) planning; (2) design; (3) construction; (4) operation; and (5) recycling and disposal. Sustainable Infrastructure Development can be seen as the design of new infrastructure, and the re-design, rehabilitation, re-use or optimisation of existing infrastructure, which is consistent with the principles of urban and global sustainable development.

The general principles on which sustainable infrastructure is based are:

- minimising the use of non-renewable resources
- minimising impacts on the natural environment
- protecting biodiversity
- using renewable resources in a sustainable manner

Sustainable architecture can help reduce the energy consumption of buildings by using, among other things, energy-efficient windows and better environmental systems. Some even include more recent innovations such as solar energy panels or green roofs.

The construction sector accounts for a large percentage of the worlds total energy consumption and greenhouse gas emissions. Sustainable construction practices result in 20-30 per cent savings in energy and 30-

50 per cent saving on water consumption. All these form an inherent part of sustainable infrastructure development.

Sustainability in construction means being responsive to social needs, governance friendly and being innovative.

Sustainable architecture can help reduce the energy consumption of buildings by using, among other things, better environmental systems like energy-efficient windows.

CHALLENGES IN SUSTAINABILITY

Among the challenges we face today, a significant number can be considered engineering, architecture, urban planning, environmental and infrastructure-related problems. These include the following:

- Climate: need to consider the local weather, including the temperature, wind direction and the daily sun path to ensure optimal use of available natural resources.
- Fragile overstressed environment
- Insufficient resources
- Technology: Increasing purchasing power and wasteful consumption is stressing the resources. Traditional practices that are eco friendly and sustainable need to be encouraged. Efforts to identify, evaluate and introduce such technologies should be made.
- Our civil infrastructure, including drinking water, sanitary sewer, electricity, natural gas, and transportation systems, is forever ageing and deteriorating. Much of it is already near or past the end of its service life, and yet the resources available to deal with these problems are limited, and often deficient for the task at hand.
- Particularly in urban areas around the world, populations are quickly outpacing our ability to maintain and expand the infrastructure needed to meet the demand. This fact applies not only to civil infrastructure, but to other economic, social and environmental systems on which we depend or which we value, including agriculture and food production, healthcare, and healthy natural ecosystems.
- Many of our industrial practices and standards, as well as our consumer habits, have a detrimental effect on our health and the environment. The practices have proven difficult to change, despite their potential to cause global warming, pollution and wasteful misuse of our limited resources.

These problems ultimately affect us all, and many experts believe that we face a serious global sustainability crisis, unless action is taken. Within the last few years, sustainability and sustainable design have emerged as hot topics to address this growing problem, not because they represent silver bullets to solve the problem, but because they represent a common-sense paradigm-shift in thinking.

THE THREE SPHERES OF SUSTANABILITY

The field of sustainable development can be conceptually broken into three constituent parts:

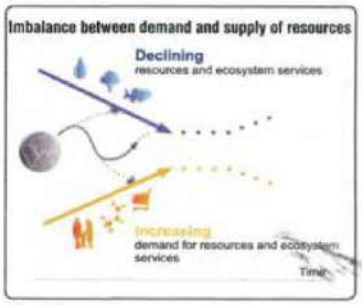
- Environmental sustainability
- Economic sustainability
- Social sustainability

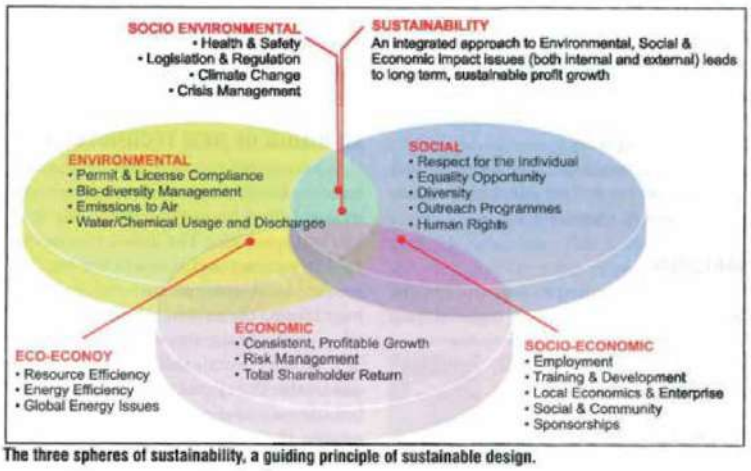
The diagram given below introduces the concept of the Three Spheres of Sustainability, a guiding principle of sustainable design. As the diagram illustrates, sustainability of a system is achieved when the three essential aspects of responsible design—economic, social and environmental—are adequately balanced with one another.

To achieve this balance, the designer must be equally sensitive to social-environmental, environmental-economic, and economic-social issues, and must be willing and able to address difficult concerns, such as natural resource stewardship, energy efficiency, business ethics and worker's rights.

DESIGN

A sustainable building is the result of a design philosophy which focuses on increasing the efficiency of usage of resources like water, energy, and material while





The three spheres of sustainability, a guiding principle of sustainable design.

maintaining the impact of the building on the environment during its lifecycle.

CONSTRUCTION

A sustainable building project considers sustainability in all phases of its life: pre construction, in construction and post construction.

Pre construction involves policy and design decisions, such as site selection, and decisions to identify, protect and conserve areas that are rich in biodiversity.

The construction stage usually has maximum direct impact on the environment like preventing soil excavation, facilitating proper storage of construction materials, etc. We need to ensure that waste like cement, sand, etc, have minimal effect on the natural features at the site.

> Sustainability of a system is achieved when the three essential aspects of responsible design—economic, social and environmental—are balanced.

Detailing has to be done to include efficient construction water management practices, disciplined water flow, provision of safety equipment and availibility of basic amenities to workers.

Post construction measures ensure reduction in use and recycling of resources such as energy, waste and water.

MATERIAL

Sustainable infrastructure implies the use of environment friendly material from renewable resources. It advocates use of recycled material, especially from indigenous and regional resources.

OPERATION

Various stakeholders like the government, NGOs and the private sector play a very important role in the development and management of sustainable infrastructure. The role of the private sector lies in improved management and higher efficiency, as well as increased access to private capital for maintenance and expansion.

The public sector, meanwhile, could strengthen provisions of sustainable infrastructure through economic, financial, legal, and institutional reforms as well as adopting eco-efficient practices in management and provision. Civil society and NGOs can play an important role in the accountability of infrastructure institutions through consumer participation or through participation in monitoring and overall evaluation.

RECYCLING AND DISPOSAL

Recycling involves processing used materials (waste) into new products to prevent waste of potentially useful materials, reducing the consumption of fresh raw materials, reducing energy usage, reducing air pollution (from incineration) and water pollution (from land filling) by reducing the need for "conventional" waste disposal, and lowering greenhouse gas emissions as compared to virgin production. Recycling is a key component of modern waste reduction and is the third component of "Reduce, Reuse, Recycle".

Some methods of waste disposal release air pollutants and greenhouse gases into the atmosphere. Waste recycling offers us means of reducing the impacts of waste disposal on the atmosphere, but there are other methods of waste disposal which are more environmentally friendly.

ADOPTION OF NEW TECHNOLOGIES

Our ancient system of architecture and building mechanisms were sustainable and were able to achieve the balance of energy in a better manner. The ancient houses are cold in summer and warm in winter. The use of local natural material helps in maintaining the natural balance of ecology, which is in consistency with the principles of urban sustainability and global sustainable development. While forming a holistic view of the role of infrastructure in society, the work builds upon methods of life cycle analysis and ecological footprinting, and draws upon perspectives of urban economics, macroeconomics, urban planning and business. The research primarily focuses on city infrastructure.

Let us hope the work might eventually contribute towards a means of designing and pricing civil infrastructure in a manner which reduces environmental problems such as urban sprawl, emission of greenhouse gases, air and water pollution. There is a need to look at the costs and benefits of infrastructure elements beyond the boundaries of its physical location and beyond the finances of the investing party. Once the infrastructure can be understood within the context of the workings of a city as a whole, this very understanding has to be brought back into the civil engineering design.

To combat this problem:

- Many water utilities invest a significant portion of revenue in an ongoing capital improvement plan and for purification. Together, these help promote sustainable practices.
- Reservoirs may be another factor in sustainable infrastructure. These vast stores of water allow arid regions to tap into water supply that is consistent.
- Regarding energy consumption, sustainable infrastructure means putting the pieces in place that can help reduce the dependence on fossil fuel—a non-renewable energy source.

NEW ECO-FRIENDLY TECHNOLOGIES

- Use of renewable energy such as wind-solar hybrid system, energy efficient HVAC systems like water-cooled VRV systems
- Maximum daylight harvesting
- Reduction of heat load on HVAC system through appropriate mechanisms like insulation, walls of appropriate material or glass in appropriate combination
- Use of energy efficient equipments like hydro-pneumatic pumps and use of VFDs as applicable
- Use of water recirculation systems
- Use of appropriate lighting systems like light emitting diodes

Our ancient system of architecture and building mechanisms were sustainable and were able to achieve the balance of energy in a better manner.

- This may include developing mass transportation alternatives such as light rail, subways and bus routes.
- It may also mean providing electrical hookups for car recharging, hydrogen refilling stations and other such equipment for alternative fuels.

In terms of energy creation, especially electricity, sustainable infrastructure means using methods that are not heavily reliant upon fossil fuel. This includes building infrastructure such as wind farms, nuclear power plants and even hydroelectric plants that do not rely on these resources. In the long run, the main goal of sustainable infrastructure is to promote sustainable living amongst the entire population to eventually be carbon neutral.

MEASUREMENT

Certainly, technology has changed the way we live, do business and has also had an impact on our views about the world. However, whether technology can also be leveraged to create a more sustainable society is an entirely different question. Many people, for example, might argue that we need to simplify our lives to make them more sustainable. Which is largely true, however, there is a need of finding better ways of measuring exactly how sustainable our current practices are, so that we can tell if (and when) we need to improve or revise these practices. Likewise, we need to be able to accurately measure sustainability over the lifetime of new policies, processes and products. In general, these concepts all tie back into the base idea of sustainable infrastructure.

One of the initial attempts to express human impact mathematically was developed in the 70s and is called the I PAT formula. This formulation attempts to explain human consumption in terms of three components: population numbers, levels of consumption (which it terms "affluence", although the usage is different), and impact per unit of resource use (which is termed "technology", because this impact depends on the technology used). The equation is expressed as:

$$I = P \times A \times T$$

Where: I = Environmental impact, P = Population, A= Affluence, T = Technology

The most broadly accepted criterion for corporate sustainability constitutes a firm's efficient use of natural capital.

- Eco-efficiency is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact.
- Socio-efficiency describes the relation between a firm's value added and its social impact.

Both eco-efficiency and socio-efficiency are concerned primarily with increasing economic sustainability. In this process they instrumentalise both natural and social capital aiming to benefit from win-win situations.

By establishing quantitative measures for sustainability it becomes possible to set goals, apply management strategies, and measure progress.

There are now a vast number of sustainability indicators, metrics, benchmarks, indices, reporting procedures, audits and more. They include environmental, social and economic measures separately or together over many scales and contexts. Environmental factors are integrated with economics through ecological economics, resource economics and thermo-economics, and social factors through metrics like the Happy Planet Index which measures the well-being of people in the nations of the world while taking into account their environmental impact. Some of the best known and most widely used sustainability measures include corporate sustainability reporting.

At the global level, and from the equation I = PAT, it is clear that measuring sustainability requires a knowledge of the world's expected population. We also need estimates of how many people the earth can support. This is a tall order but for many years now scientists have been refining models of the carrying capacity of planet earth by measuring key human impacts, especially those that relate to biodiversity.

GREEN DESIGN IS A TOOLSET

As Nicholson points out, contrary to popular belief, green design is not simply another word for sustainable design. Rather, green design is just one of the many toolsets available to designers to help achieve sustainability.

Consider a green roof, for example. Installing a green roof on a commercial office building may, in fact, be less sustainable than a conventional membrane roof, unless a number of other criterias are met:

- A maintenance plan must be established
- Adequate staffing, training and funding must be provided over the long-term
- There should be some way of measuring the energy savings, water conservation or similar benefits that the green roof provides

As the green roof example illustrates, sustainability is both complex and difficult to achieve. It should not be confused with green design, which is just a toolset.

CONCLUSION

Sustainable infrastructure promises to change all of that. Perhaps, in future it will be possible to obtain a measure of sustainability in our neighbourhood, our street, our property, or even within individual rooms of our house—rather than of just our city or state. Such a paradigm shift begs the question: "How sustainable is our lifestyle?" When one considers how this question relates to individual accountability and self-reflection, this becomes a very different and far more poignant question than just asking "How sustainable is our infrastructure and society?"

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पर्यावरणपूरक प्रकल्प : ‘सुझलॉन वनअर्थ’

सुझलॉन वनअर्थच्या पर्यावरणपूरक इमारतीचे छायाचित्र.

देशातील सर्वांत मोठा इको-फ्रेंडली सुझलॉन वनअर्थ प्रकल्प पुण्यात उभारण्यात आला असून, हा प्रकल्प पवन ऊर्जा क्षेत्रातील सुझलॉन एनर्जीचा आहे. कंपनीने यासाठी तब्बल २८० कोटी रुपये खर्च केले असून, प्रकल्प १०.१३ एकरावर उभारण्यात आला आहे. येथे वापरण्यात आलेल्या तंत्रज्ञानामुळे आणि विशेष रचनेमुळे पाण्याची तीस टक्के, तर ऊर्जेची चाळीस टक्के बचत झाली आहे.

ओंकार भिडे

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GREEN CRUSADERS

JR Tanti

MD, Synefra E&C

Green materials are environmentally responsible because their impacts are considered over the production and life of the product, evaluated and then utilized depending upon project-specific goals.

The concept of sustainable building incorporates and integrates a variety of strategies across project lifecycle. Use of green building materials and products represents one important strategy in the design of a building. Green building materials offer the following benefits to the building owner and building occupants: Energy conservation, Improved occupant health & productivity, Lower operating costs, Reduced maintenance/replacement costs over the life of the building and Greater design flexibility.

Integrating green products into building projects also help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of the materials. In olden days, we always had sustainable buildings. With a lot of influence from West, we gradually missed the issues and began practices which were not so green but which gave fabulous looking structures.

Most of the products are available in India as mostly green products are locally sourced. But there is very low manufacturer and consumer awareness in the market. The vendor is not aware of the green facts of the product requirement. Indian brands need to help raise consumer consciousness.

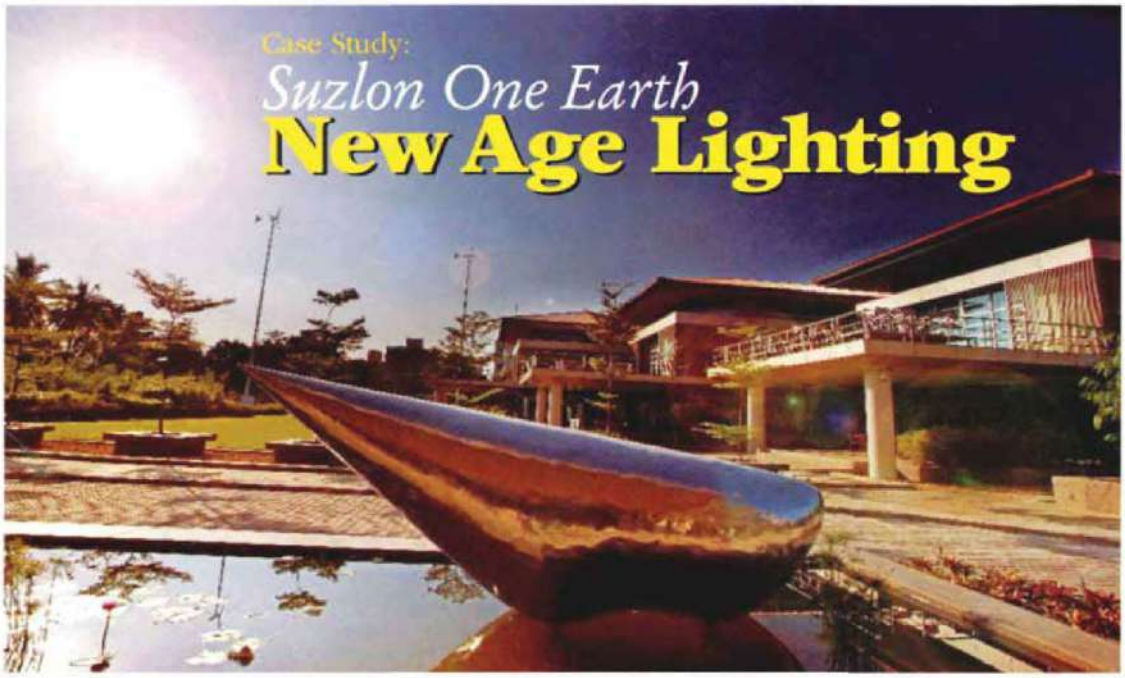
Yes, most available products are competitively priced. There are a few which are highly priced but products like these also have high utility value.

No, the mechanism is not adequate. In India the manufacturers submit a declaration or certain test reports wherever applicable proclaiming that the product sold is green. This is considered as valid, but there is no cross checking done by any institute.

COVER STORY

Case Study:

Suzlon One Earth
New Age Lighting



From office lighting to residential illumination, innovation in lighting components is taking advantage of broad-based technological progress. Lighting technology has now shifted towards the combination of optical and electronic elements, i.e. to optoelectronics. Optoelectronic competence means mastering all the new challenges with excellence: electronic component heat management, development of efficient optical systems, optimizing control gear and use of solid state lighting products. One such project where extensive and very innovative use of LEDs is used is the Suzlon One Earth project in Pune done by Synefra Engineering and Construction Ltd.

One Earth is the first campus in India where LED lights are used extensively for external general lighting to achieve desired levels of energy conservation. Since the external light design is on the basis of zero light pollution at night, a total load of external lighting is only 50kW for the entire campus. All buildings are designed to harvest maximum daylight through glass and louvers with almost 90% of the users not requiring switching on lights during daytime.

Large parking spaces, common meeting rooms and individual cabins are provided with occupancy sensors while parking areas and open work stations are equipped with day light sensors to control lighting load and wastage thereof. The entire office space is provided with task lighting over the working areas and is controlled individually as well as through occupancy sensors.

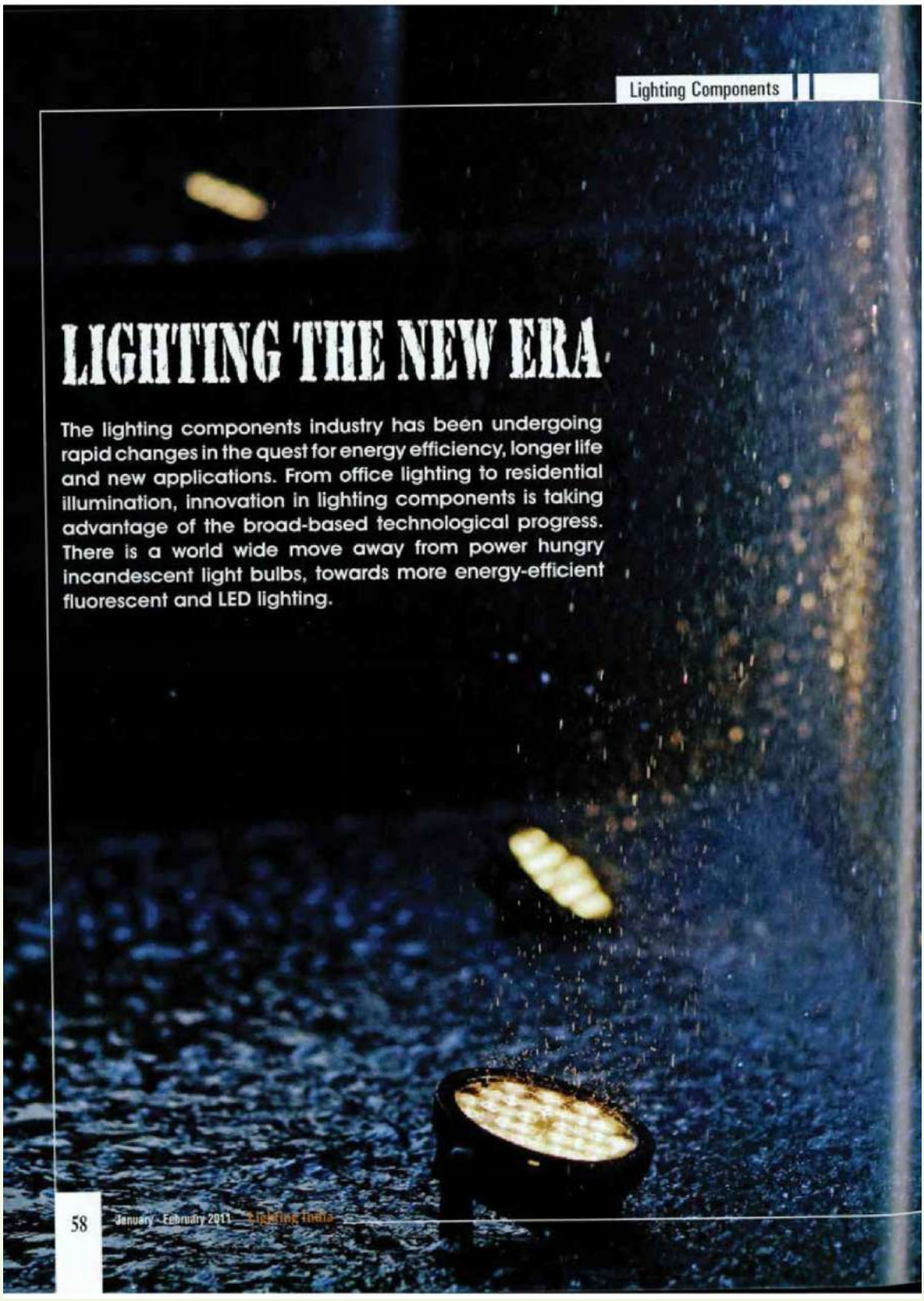
About 3,000m of LED strips have been used for external lighting giving the building a floating effect. There is no UV, no heat dissipation from the usage of these lights and their lifespan is for 30,000 to 50,000 burning hours.

Landscape lighting is fixed in a way that it compliments and illuminates the features of the architecture and landscape as visualized by the designers. According to the LEED requirement, landscape cannot have more than 5% of light load as upward light hence only 440 up lighters are used to illuminate only what is needed and yet give the entire garden a highly enhanced ambience.

The *deepstambh* or the tower of light located as pivotal campus element uses fibre optics for all the 40 arms of the tower which come out of a single box. This box is maintenance friendly and the makes the lamp accessible for repair.

The common areas created by the buildings have been provided with a beautiful lounge effect created by indirect lighting. The designer has played with light and darkness as much as possible. Lighting merges with the landscape so as to not overpower architecture and landscape features.

The principles of energy efficiency and dark sky were taken on priority, without compromising on the ambience. The latest from solid state lighting technology and conventional technology were combined to achieve the grand result, so much so that newer benchmarks were set at each step. ■


Lighting Components
LIGHTING THE NEW ERA
The lighting components industry has been undergoing rapid changes in the quest for energy efficiency, longer life and new applications. From office lighting to residential illumination, innovation in lighting components is taking advantage of the broad-based technological progress. There is a world wide move away from power hungry incandescent light bulbs, towards more energy-efficient fluorescent and LED lighting.
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Lighting Components

A Light-Emitting Diode (LED) is an electronic light source. LEDs are based on the semiconductor diode. The LED is usually small in area with integrated optical components to shape its radiation pattern and assist in reflection.

LEDs present many advantages over traditional light sources including lower electricity consumption, longer lifetime, improved robustness, smaller size, silent operation and faster switching. They produce more light per Watt!

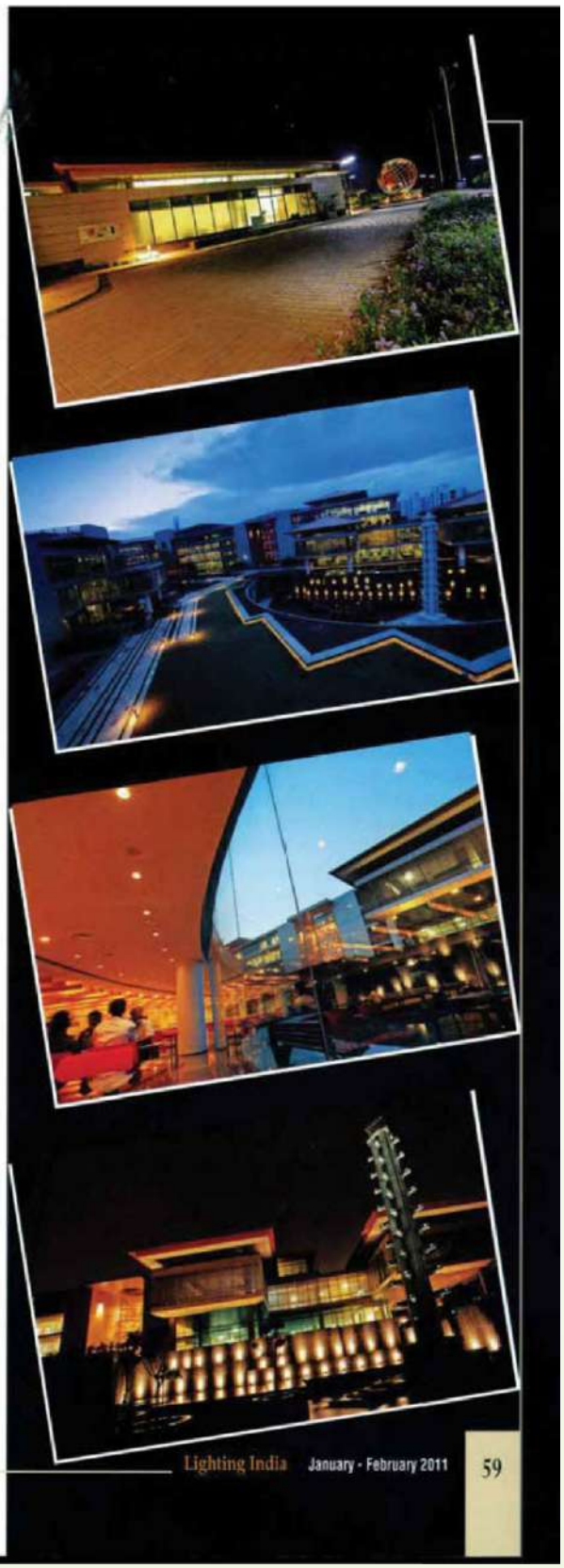
LED lamps are used for both general and special-purpose lighting. Where colored light is needed, LEDs come in multiple colors, which are emitted with no need for filters. LEDs using the color-mixing principle can emit a wide range of colors by changing the proportions of light generated in each primary color. This allows full color mixing in lamps with LEDs of different colors.

The LED sources are compact, which gives flexibility in designing lighting fixtures and good control over the distribution of light with small reflectors or lenses. Due to the small size of LEDs, control of the spatial distribution of illumination is extremely flexible, and the light output and spatial distribution of a LED array can be controlled with no efficiency loss.

LED lamps have no glass tubes to break, and their internal parts are rigidly supported, making them resistant to vibration and impact. With proper driver electronics design, an LED lamp can be made dimmable over a wide range; there is no minimum current needed to sustain lamp operation.

LEDs, as compared to modern day CFLs, incandescent bulbs, tubes and other light sources, produce less heat assisting in maintaining lower temperatures even at places with extremely high lighting requirements. LEDs not only help you save on electricity spent on lighting, it also helps you save on air-conditioning bills by emitting less heat. Eco-Friendly alternative to conventional light sources, LEDs do not use harmful gases such as mercury or sodium, LEDs are eligible for Carbon Credits and their long life helps users to not worry about regular replacement and disposal.

One such project where extensive and very innovative use of LED's is used is the Suzlon One Earth project in Pune done by Synefra Engineering and Construction ltd. The breakthrough of LEDs to become an important light source has caused the focus in lighting technology to shift towards the combination of optical and electronic elements, i.e.



to optoelectronics. Optoelectronic competence means mastering all the new challenges with excellence: from electronic component heat management to the development of efficient optical systems and from optimizing control gear, SSL Products used in Suzlon One Earth, the global headquarters of Suzlon are classic examples of this.

- One earth is the first campus in India wherein LED lights are used extensively for external general lighting to achieve desired levels of energy conservation.
- Total load of external lighting is only 50 kW for the entire campus.
- External light design is on the basis of zero light pollution at night.
- All buildings are designed to harvest maximum day light through glass & louvers with almost 90% of the users not requiring switching on lights during daytime.
- Large parking spaces, common meeting rooms, individual cabins are provided with occupancy sensors while parking areas and open work stations are equipped with day light sensors to control lighting load and wastage thereof.
- Entire office space is provided with task lighting over their working areas and is controlled individually as well as through occupancy sensors.
- 3,000 meters of LED strips used for external lighting gives the building a floating effect. There is no UV, no heat dissipation from the usage of this lights and their lifespan is for 30,000 to 50,000 burning hours.
- Landscape lighting is fixed in a way that it will compliment and illuminate the features of the architecture and landscape as visualized by the designers. According to LEED requirement, landscape cannot have more than 5 per cent of light load as upward light hence only 440 up lighters are used that illuminate only what is needed and yet gives the entire garden a highly enhanced ambience.
- The deepstambh or the tower of light located as pivotal campus element uses fibre optics for all the forty arms of the tower which come out of a single box, which is maintenance friendly and the makes the lamp accessible for repair etc.
- The common areas created by the buildings have been provided a very beautiful lounge effect which is created by indirect lighting. The designer has played with light and darkness as much as possible which has seen the lighting merging with the landscape so as to not overpower architecture and landscape features.

The principles of energy efficiency and dark sky were taken on priority, without compromising on the ambience. The latest from Solid state lighting technology and conventional technology were combined to achieve the grand result, so much so that newer benchmarks were set at each step.

To Conclude, Suzlon One Earth is a project which not only dreamed big but today is a classic example of Cutting Edge Lighting Design along with some of the best products handpicked from various parts of the globe to achieve the BEST.

The future of LEDs however is bright as they are energy-efficient, pollution-free and have a handsome payback period. ■

Courtesy:
Synefra Engineering & Construction

CASE STUDY
SUZLON ONE EARTH

WHERE THERE'S A **WIND...**

THERE'S A WAY TO BE ENVIRONMENT-FRIENDLY EVEN WHEN YOU BUILD – AS THE SUZLON ONE EARTH CAMPUS DEMONSTRATES, SAYS MARIA LOUIS AFTER VISITING THE BRAND-NEW PLATINUM-RATED LEED BUILDING IN PUNE

1. Project One Earth is the global headquarters of the Suzlon Group, which specialises in wind power generation.

Is it possible to create a self-sustaining design for a sprawling campus? The answer is blowing in the wind, literally, at Project One Earth – the global corporate headquarters of the Suzlon Group, a company that specialises in wind power generation. Built on approx 443,473sqft (10.70 acres) of land by Synefra for Suzlon Energy Limited (the flagship company of the Group), it sets a benchmark in energy efficient and sustainable building solutions in all aspects of design, engineering, construction and project management. Designed by Christopher Charles Benninger Architects according to LEED Platinum and GRIHA 5-star standards, this campus boasts a minimal global footprint based on the client's requirement for a workplace that would provide a view beyond the monitor screens, a chance to experience daylight changes at workstations, a place where employees do not feel restricted in thought or movement and, more importantly, do not miss the joy of changing seasons while they chase challenging targets.

Since the company works with nature and the environment and applies high technology to efficiently glean energy from nature, the corporate environment had to reflect the nexus between intellect, technology and the natural environment.

The master plan is based on an urban village concept, with features like horizontal open spaces instead

PHOTOGRAPHS: COURTESY CCBA

PHOTOGRAPH: COURTESY SYNEFRA

of overbearing structures, interactive courtyards rather than just meeting rooms, wide landscape (1,85,578sqft of functional spaces) to encourage activities in place of "keep off the grass" signs, state-of-the-art outdoor lighting, aesthetic outdoor furniture, prominent water bodies – apart from traditional elements like the *deepstambha* and a 20ft diameter steel globe depicting Suzlon's global presence.

CONCEPT

The concept for this campus housing 2,300 people was sketched out in detail during the first week of design development itself, and carried forward right into the final built form as seen today. Lush gardens, water pools, a *deepstambha*, glass cylinders, gentle sloping roofs, all of which were elements of the original concept, bring a human scale into the built form, which derives its roots from Fatehpur Sikri in Agra and Nishitbagh wwin Kashmir.

Working closely with Christopher Charles Benninger Architects, were long-term associates Varsha and Ravi Gavandi – landscape designers who have seamlessly integrated gardens and water bodies as envisioned by Benninger conceptually. While the interior architects Space Matrix and Tao Architects have carried forward the aura of the architecture into the interior spaces, project management firm Synefra, headed by Jitendra Tanti, played a pivotal role as the client's representative in integrating myriad design groups, vendors and agencies to realise the project.

Amidst the wannabe westernised corporate buildings mushrooming on the Indian urbanscape, Suzlon One Earth is not only a counterblast to the glass box, but is a truly modern and high-tech Indian corporate office. Credited as one of the greenest buildings in the world with a Platinum rating by LEED and shortlisted for a 5-star rating by GRIHA, it is a case study for architects, developers and companies seeking poetry in sustainable architecture.

Governed by Green standards of engineering, construction, interiors and operations, One Earth has innovative and integrated aspects such as the use of sustainable and LEED-certified material for construction, 100% renewable energy (solar and wind), deployment of CFC- and HCFC-free air-conditioning systems, creation of rainwater harvesting facilities, use of recycled water for landscaping, etc. The campus, which accommodates around 2,300 team members, is in accordance with the requirements of ECBC (Energy Conservation Building Code) 2007.

The Suzlon campus has been designed through the application of architectural elements and components. "Materials, colours, dimensional systems and proportions are examples of elements that persist through the Suzlon campus," explains architect Christopher Benninger. This approach has resulted in a basic module of construction which is square in shape, both in plan and in elevation. The dimensions are drawn from the

2. The linear water basin that feeds the waterfall through a pumping system can be seen through the sky cylinders.

3. Sky cylinders mark the main entrances to the constituent parts of the campus, bringing light into each structure.

functional relief modules that can be sprinkled about the fabric for the comfort of the staff when they take their breaks.

The architects have employed glass sky cylinders that mark the main entrances to the constituent parts of the campus by bringing light into the structure. They are internal gardens for areca nut, palm and other foliage. Being circular in shape, the glass sky cylinders act as hinges between major buildings and groups.

The Suzlon campus is analogous to a Lego building block set. The modules, sky cylinders, retreat areas and stairs can be plugged into the structures where required. The triangular stairs are set within circular cylinders, while skylights within the roofs lend indirect clearstory light that shines down the conical shafts, along the sides of the stairs. These components add intrigue to the rectilinear walls as well as the modular aggregations.

Some components, such as break areas, have an elemental quality in the ease with which they can be inserted into the building fabric. These units include toilets; a pantry for self-help coffee or tea; and a small reference library for self-education. There is also a 'smoking porch' as well as a small dialogue table, a photocopying machine and a utility closet.

The *deepstambha*, a traditional Maharashtrian oil-lamp, is auspiciously placed in a central position. It can be seen from all the entrances and throughout the garden – most importantly, from the glass Brahmasthal. This approx 40ft tall pillar, covered with LED lights, is set in the centre of the Suzlon reflecting pool at the basement level.

The waterfront cafeteria located on the same level opens on to the water body. In the background, there is a water cascade flowing down three levels of tiers, with traditional step-like objects giving rhythm to the backdrop. A long water basin that is visible from the sky cylinders feeds the waterfall through a pumping system. The linear basin links the Brahmasthal to a waterfall. These auspicious components protect the campus from unwanted influences and create a central focus. They also add distinct Indian features to an otherwise global, high-tech ambience.

The resulting system lends itself to change and re-adjustment. There are no columns within the generous spaces, and the scheme uses flat slabs in modules conducive to office landscape systems, change and adjustment. "All these elements and components of the building design and the resulting compositions are mere reflections of the demands and needs of the Suzlon corporate group," maintains Prof Benninger, who was recently felicitated by chairman of Suzlon Energy Limited, Tulsi Tanti, for translating his vision and creating a work environment that is not only sustainable – but a great place to work.

In his speech of thanks at the gala ceremony held last month, Prof Benninger called the Tanti family true patrons of architecture comparable to the Sarabhais, the Guggenheims and the Rockefellers. He declared that this project was his latest masterpiece (after his award-winning Mahindra United World College that was built 10 years ago).

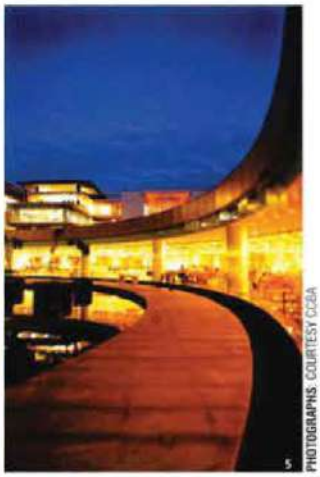
6. Light and greenery are an integral part of the design of the Suzlon campus.

PHOTOGRAPH: COURTESY SYNEFRA

PROJECT DETAILS

Conceived and Managed by
JR Tanti, MD, Synefra Engineering & Construction
Project Team Information Owner
Tulsi R Tanti, CMD, Suzlon Energy
Architect
Christopher Charles Benninger Architects
Landscape Architect
Ravi & Varsha Gavandi
Design Co-ordination
Tao Architecture
Interior Architects
Space Matrix Design Consultants
Consultants
Electrical: Power Engineers
HVAC: Refrisynth Engineers
Plumbing: Rahul Dhadphale
Lighting: Light Vision India & The Ministry of lights
Green Building Design and Certification
Environmental Design Solutions
Communication Design
Elephant Design

CASE STUDY
SUZLON ONE EARTH



PHOTOGRAPHS: COURTESY CCEA

4. The energy courtyard in the Corporate Learning Centre.

5. The cafeteria, the dining-room and a major conference hall open on to the water body.

MATERIAL/SYSTEM/EQUIPMENT USED	SUPPLIER	SALIENT FEATURES /FUNCTION
Post tensioning SS strands in RCC (reinforced cement concrete)	Tata Steel	Adds value in functionality of space, reduces volume of the concrete by 15% and reinforcement steel by 10%.
High performance soft coated glass - KT-455 DGU (double glazed unit) for peripheral glazing	Saint Gobain	Reduces outside heat transmission in the interior office space and hence substantially reduces the HVAC load by almost 15%.
Aluminium composite panels for façade	Alucobond	Recycled material.
Louvers	Hunter Douglas	Recycled material.
Kalzip copper roofing for sloping roofs along with insulation	Tata-Corus and Texsa Spain	High reflectivity index helps reduce outside heat transmission into the interior office space, which substantially reduces the HVAC load by almost 15%.
Elevators in lobbies	Otis	Energy efficient, BMS compatible, gearless, no machine rooms, durable, best available technology.
Water-cooled VRV System (indoor machines), HVAC in the office area	Daikin	Energy efficient and BMS compatible.
22 KV HT Breaker electrical substation	Areva T&D	Energy efficient and BMS compatible.
Utility pumping system in Terminus pump room	Halward	Pumping of flushing water from UGR to flushing units.
Light fixtures in the landscape area	Erco	Energy efficient and durable.
Light fixtures for street lights	Hess Ag	Energy efficient and durable.
Light fixtures for façade lighting in Core area and Terminus	Osram	Energy efficient and durable.
Carpet soft flooring	Interface and C&A	Eco-friendly raw material and manufacturing process.
Modular straight desking, chairs and tables for interiors	Steelcase	Durable, efficient space planning. Ergonomical and recycled material has been used.
Servers in the IT-Data Centre	IBM	Efficient servers; mail servers are fed partially from power generated by a hybrid system of wind and solar energy.

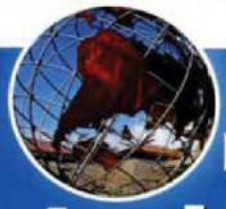
most logical ceiling-to-ceiling height, which is reflected in the plan. The system envisioned uses a flat slab; a dropped ceiling of about 20 inches and a floor-to-ceiling height of 9ft8in.

The structure is finished in champagne-coloured aluminium composite panels – giving it a very Indian, warm and tactile finish. The columns and beams leave a square cut-out enclosed by horizontal louvers that allow cross-ventilation while keeping out direct sunlight. This reduces the need for artificial lighting and mechanical ventilation. As an air-conditioned structure, heat gain is minimised; and the rooftop insulation contributes to the blocking of heat. The system also allows uninterrupted views to the gardens surrounding the complex.

The basic module can be added and subtracted so that endless combinations and permutations can be created from a simple geometry. These options include the grouping of 12ft x 12 ft squares. The spacing of columns can be varied, or columns can hold up the roof sections to create pergolas, or pavilions can be placed on the roofs. The modular system is easy to construct and uses multiples of standard materials and items. The rich vocabulary can generate exciting forms and spaces.

While architectural elements persist through the system, the components are both functional and dramatic. They solve problems in poetic and lyrical ways, giving a unique nature to the campus – often with idiosyncratic solutions to notional problems, such as stairways and sky courts bringing in light and allowing nature to grow within the fabric. These components may be atria, stair towers or even very

GOING GREEN

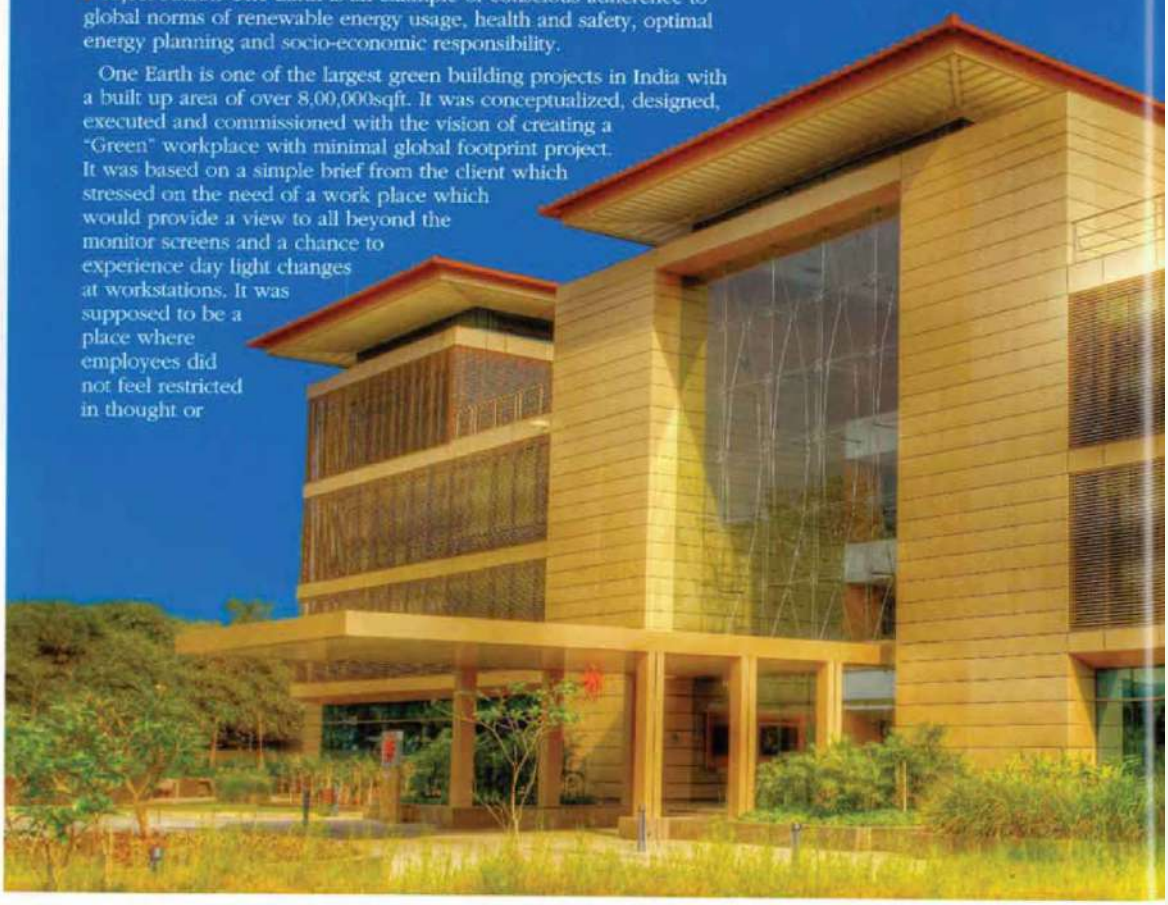


ne Earth: Looking beyond the monitor screens

Suzlon's new corporate headquarters-One Earth in Pune is completely powered by renewable energy and has got LEED (Leadership in Energy and Environment Design) Platinum rating by Indian Green Building Council. The new campus of India's largest wind turbine manufacturer covers 41,000 sqm (10.13 acres) and can accommodate up to 2,300 team members.

Project Suzlon One Earth is an example of conscious adherence to global norms of renewable energy usage, health and safety, optimal energy planning and socio-economic responsibility.

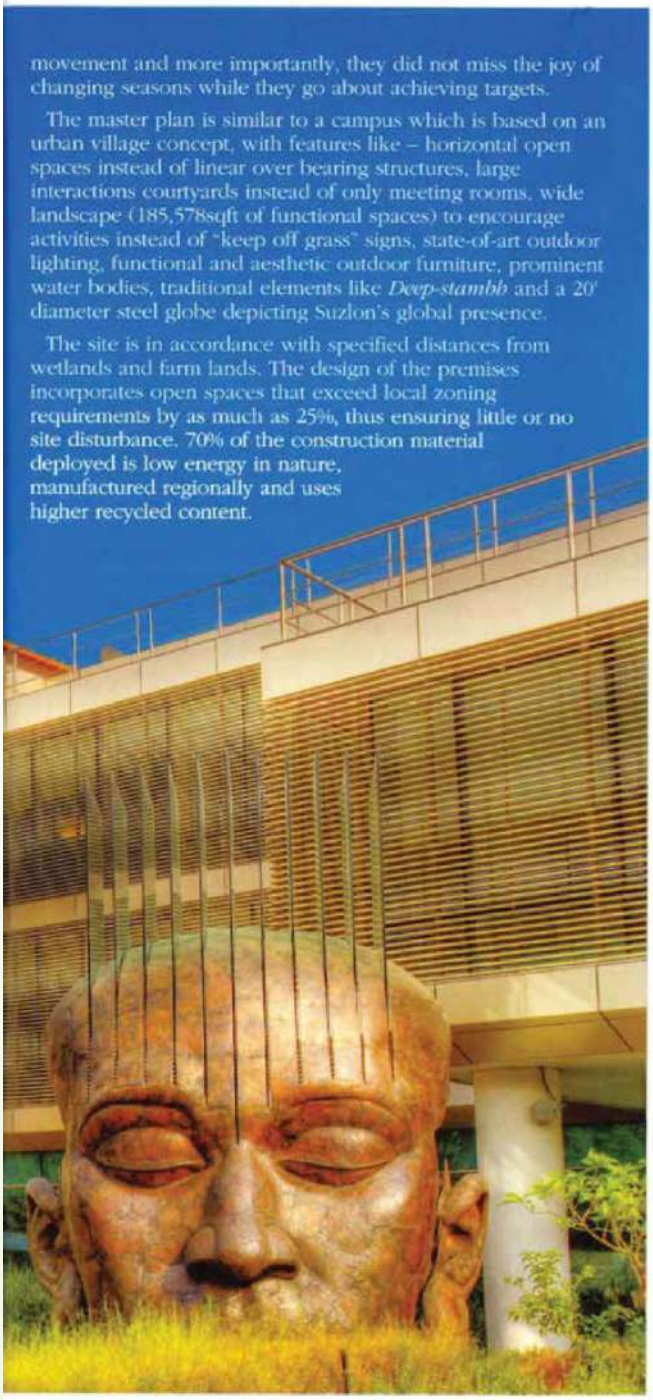
One Earth is one of the largest green building projects in India with a built up area of over 8,00,000sqft. It was conceptualized, designed, executed and commissioned with the vision of creating a "Green" workplace with minimal global footprint project. It was based on a simple brief from the client which stressed on the need of a work place which would provide a view to all beyond the monitor screens and a chance to experience day light changes at workstations. It was supposed to be a place where employees did not feel restricted in thought or



movement and more importantly, they did not miss the joy of changing seasons while they go about achieving targets.

The master plan is similar to a campus which is based on an urban village concept, with features like – horizontal open spaces instead of linear over bearing structures, large interactions courtyards instead of only meeting rooms, wide landscape (185,578sqft of functional spaces) to encourage activities instead of "keep off grass" signs, state-of-art outdoor lighting, functional and aesthetic outdoor furniture, prominent water bodies, traditional elements like *Deep-stambh* and a 20' diameter steel globe depicting Suzlon's global presence.

The site is in accordance with specified distances from wetlands and farm lands. The design of the premises incorporates open spaces that exceed local zoning requirements by as much as 25%, thus ensuring little or no site disturbance. 70% of the construction material deployed is low energy in nature, manufactured regionally and uses higher recycled content.



GOING GREEN

The campus is 100% renewable energy powered (solar and wind), along with deployment of chlorofluorocarbon (CFC) and Hydrochlorofluorocarbons (HCFCs) free air conditioning systems.

The premise has a maximum capacity of 1000m3 capacity rainwater harvesting system and an onsite sewage treatment plant that aids recycling sewage water for air-conditioning and landscape. The campus uses a 'pebble drain' technology to reduce soil erosion and collect rainwater. A sewage treatment plant of 120m3/day has been set up. All the water is reused for HVAC, gardening and flushing. The landscape area above the podium slab is provided with proper storm water collection pipeline which carries the excess water from the landscape garden towards the rain water storage tank. There is zero discharge of waste water into nearby natural stream.

One Earth features the largest outdoor light-emitting diode (LED) installation for all external lighting, water-cooled Variable Refrigerant Volume (VRV) air-conditioning and an urban installation of 18 onsite wind turbines. Treated fresh air units are installed on each floor to provide 30% more fresh air in office area as compared with the guidelines mentioned in the ASHRAE standards. CO_2 sensors are installed in the office area and connected with indoor machines to maintain the CO_2 level within acceptable limits through automated processes ensuring optimal indoor air quality for human health. Mechanized ductless ventilation systems have been designed and installed at Terminus level and multi-stage evaporative cooling systems have been installed for providing comfort cooling in the range of 20° to 28° Celsius with humidity in the range of 40 to 70%. This is custom designed and engineered for One Earth and results in saving of 60% energy.

Waste segregation systems are also installed at source for better recycling and reuse methods.

Organic waste generated from the cafeteria, garden and office in the form of paper are converted into manure by organic waste controller of capacity 100kg/hr which is used as organic manure for landscape. All kinds of e-waste (Electrical and electronic waste) is treated through Pollution Control Board authorized agencies and recyclable waste such as paper and cardboard is collected and sent for recycling through dedicated NGOs working for the stated cause.

One Earth also has IBMS with advanced features in order to minimize, monitor, supervise and keep track of issues related to services like energy, water, waste, security and untoward incidents.

The 4.63MVA capacity off-site Wind Turbines installed at the Satara and Kutch windfarms in Gujarat compensate for the total installed load of 4MVA from the electricity board, thus making One Earth powered by 100% green power. Around 60% of energy comes from on site wind solar hybrid system of 155kw which includes 18 onsite windmills and solar panel installations. The communication server is powered by 35kW of RE. Overall 50% saving in electricity is achieved in this project.

One Earth is also the very first project building in India to use full fledged LED lighting for energy conservation for its street lights. Maximum day light harvesting is achieved in the architecture design through glass and louvers combination which are also integrated in the interiors. Task lights at workstations are encouraged to minimize common light usage, thus saving productive energy.

This flagship project conceived, managed and executed by Synefra Engineering & Construction Ltd, has Principal Architect Christopher Benninger – who created an urban village design, Landscape architect Ravi Varsha Gavandi who worked on the landscape and Vascon Engineers who looked after the Interior Architect Space Matrix and Construction in the team. ■

SPECIAL FEATURE

Make the world a better place

The LEED certified Suzlon One Earth project is testimony to the fact that a synergetic approach can work wonders

Padma Ramakrishnan

The aesthetically designed and inspiring global headquarters of Suzlon, the Suzlon One Earth project at Hadapsar in Pune has set new benchmarks in sustainable construction.

A Platinum LEED certified building with five star rating by Green Rating for Integrated Habitat Assessment (GRIHA), the office building complex is conceived as a spread out garden campus; a contrast to the 'glass box' corporate business park typology that is populating the urban landscape. Developed on an area of 41,000 square meters (10.13 acres) with a capacity to house 2,300 people, One Earth ranks among the largest green building projects in India.

The project conceived, managed and executed by Synefra E & C Limited,was the outcome of a vision of Suzlon Chairman and Managing director, Tulsi Tanti, who envisaged a campus where Suzlonians could work amidst natural light and fresh air, a work place that was equipped with the latest technologies but was based on Indian tradition.

Designed by architect Christopher Charles Benninger, it recycles hundred percent of the water it uses, employs roof gardens and insulation for passive cooling and generates 154 KW of energy on site through a combination of windmills (80 per cent) and photovoltaic panels (20 per cent). All water heating is accomplished through solar heating. Aluminum louvers shade the glass walled interiors from direct sun light while providing natural illumination within, saving on lighting energy.

Vascon Engineers who were responsible for the engineering and construction part, set new benchmarks in energy efficiency in all aspects of engineering and construction. The whole-building approach to sustainability helped secure the highest LEED rating by focusing on key areas such as human and environmental health; sustainable site development; efficient water; energy and waste methods, materials and resource selection; and indoor environmental quality and innovation. This approach also made it possible to construct the facility at a lower cost compared to other facilities of comparable size, ultimately leading to a lower lifecycle cost and smaller environmental footprint in the long term.

The features that distinguish Suzlon One Earth from other green buildings, is the remarkable integration of renewable energy with building design and landscape. "Very few buildings in the country of this scale have such an integrated approach towards building design, site planning and renewable energy," says J R Tanti, Managing director, Synefra Engineering & Construction.

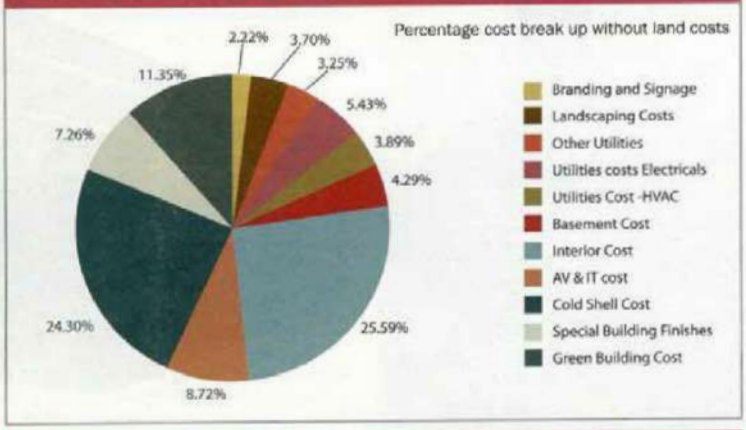
"What stands out in case of the Suzlon One Earth project is the strong interface between designers, architects, engineers, technicians, suppliers, consultants and all vendors. Suzlon's mission of 'Powering a greener tomorrow,' was the inspiration to create a place which will walk the talk and go much beyond," says Tanti.

Suzlon's sustainable corporate campus is modeled to be a global village

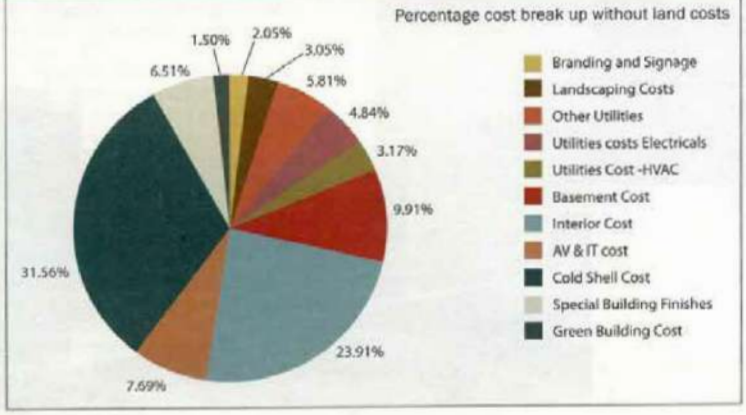
Photographs: Vinayak Bogam

One of the most important goals of the One Earth project was also to establish an efficient water management plan that included measures such as rain water harvesting and water recycling systems to ensure the use of 40 per cent less potable water. The goal was to limit or eliminate the use of potable water for

Suzlon one earth project



Conventional projects



landscape irrigation. High efficiency irrigation technologies were used in order to achieve this. Innovative waste water technologies have been used across the campus. All the waste water generated in the building including the kitchen, toilets and washing areas is treated to tertiary standards through a sewage treatment plant of capacity 120kL/day. The treated water is suitable for landscape, HVAC and flushing applications.

As per the best practice of sustainability, more than 70 per cent low-energy materials in the interiors and regionally manufactured material with higher recycled content were used. A 100 per cent recyclable, sewage treatment plant aids in water management. An integrated building management system (IBMS) calculates the use of water and electricity consumed by each block.

Value-added design solutions like on-site power generation through a wind-solar hybrid system, solar hot water system, and e-vehicle charging facility were integrated into the design. The One-Earth campus generates 154 Kw through a combination of wind-solar hybrid system and Building Integrated Photovoltaic Panels (BIPV). More than five per cent of the project's energy consumption is met by renewable sources, windmills and solar panels. A solar water heating system with a capacity of 10,000 litres per day has been installed, saving 135,501 kwh of electricity annually.

4.63MVA capacity off site wind turbines compensate for the total installed load of 4 MVA from electricity board. Thus One Earth is powered by 100 per cent green power.

The first building in India to use full fledged LED lighting for energy conservation for its street lights, another feature is the task lights at workstations which minimize common light usage thus saving productive energy.

Installation of water cooled VRV (Variable Refrigerant Volume) system result in saving 40 per cent energy as compared to conventional air-conditioning system. Treated fresh air units installed on each floor provide 30 per cent more fresh air in office area as compared to the guidelines mentioned in the ASHRAE standards.

Carbon-di-oxide sensors installed in the office area and connected with indoor machines maintain the carbon di oxide levels within acceptable limits through automated processes ensuring optimal indoor air quality for human health.

Designing a campus on the principles of sustainability not only reduces the negative environmental impacts but also has added benefits like reducing operational costs, maximizing energy and water savings, enhancing building marketability, increased productivity of workers and reduced indoor air quality problems.

The name One Earth highlights Earth's unique existence as an eco system and draws attention to the fact that we have only one earth and need to preserve it for a sustainable future.

For more special features log on to **www.pwindia.in**

[project features]

Project: Suzlon One Earth Global Corporate Headquarters, Pune

Architects: Christopher Charles Benninger Architects, Pune

BETWEEN THE
Eternal and the Transformational

Suzlon One Earth is the corporate headquarters of Suzlon Wind Energy Systems. The campus is a mirror of the values and vision of the patrons who commissioned it and who built one of the world's largest sustainable energy companies. Instead of a tall, glass box on a congested site, it is spread out in the form of a campus, centered on a generous garden, accented by water streams leading to a magnificent water fall, nurturing a crescent reflecting pool that holds a contemporary *Deepastambha*, an obelisk holding hundreds of lamps emitting positive energy. Three glass chimneys, facilitated by "sky courts" suck air out from the basement. These iconic motifs, and the main corporate atrium, are all aligned with the *Deepastambha*, acting as focal points in the lush, green garden. The corporate atrium reflects this idea with a large circular enclosed glass garden from which the campus water emanates and flows. While building a green building complex, was a matter of civic responsibility, the objective of the design was to make a great place to work. This took the shape of a land scraper, opposing the idea of a skyscraper! It is a counter blast to "the glass box."

Balance with Tradition

The project derives its inspiration from large Indian historical campuses like Fatehpur Sikri and the Meenakshi Sundareshvara Temple complex in Madurai. Both employ an interpositioning of open and closed spaces that balance one another. Both have strong horizontal elements that tie

the complexes together and accent features that emphasise quadrants and sacred places, like the *gopura* at Meenakshi. The Panch Mahal at Fatehpur Sikri is a multi-storeyed structure that maintains its scale through the employment of modular construction, whose components are expressed, gifting the structure scale and proportions. In these historical precedents there are also water bodies and open courtyards, as in Suzlon One Earth. Ground level pavilions and arcades open into the courts and allow the "borrowing" of visual experiences. These great campus complexes inspired the architecture as a starting point. From their legacy of concepts the architect selected motifs, components and elements to build a modern garden campus, with a modern function. To these he transposed motifs like the *Deepastambha*, which is a traditional "marker" in the Pune region. The glass cylinders began to line out auspicious, ordinate axis and gave sequences to intersecting axis that unite the complex into one whole.

Cover Story

India's Largest Manufacturer of Construction Equipment

TCB

Structural marvel

Suzlon's One Earth is advanced structure demonstrates a project governed by green and sustainable aspects of construction, interiors and operations has lot to offer with respect to work place ambience and social dynamics. A complete visual and functional harmony of architecture, landscape, interior. A aesthetic experience

J R Tanti, Managing Director, Synefra Engineering & Construction is an architect by profession and a crusader for responsive and responsible infrastructure by choice

Synefra Engineering & Construction Ltd a Tanti Group Company, formerly known us Suzlon Infrastructure Limited was established in 1998 with a focus to conceptualise, invest, develop and maintain Hi-Tech industrial infrastructure globally for Suzlon Group companies. With more than a decade of execution expertise, Synefra has today evolved to be an innovative infrastructure solutions provider to different industrial business segments. With experienced professionals comprising of engineers, architects, finance and management specialists, Synefra offers a wide array of specialised services in Efficient Project Management (e-PM), engineering and construction (E&C) and Integrated Facility Management Services (I-FM). Having made its mark as a Hi-tech Industrial Park Developer, Synefra has diversified its business operations to other infrastructure segments such as project management consultancy right from conceptualisation to commissioning of projects, land development, construction of commercial complexes, industrial infrastructure, port infrastructure, and auxiliary development of roads, airports and power stations. As an endeavor to provide end to end service to the clients, Synefra offers its Facility Management Services (FMS) post commissioning in all its SEZs.

What have they done?

These SEZs are eco consciously developed on 641 acres land in Mangalore (Karnataka), 386 acres land in Vadodara (Gujarat) and 376 acres land in Coimbatore (Tamil Nadu) and are one of the fastest developed SEZs in India. Synefra's other significant international projects commissioned so far are commissioning of 62 acres of world's largest integrated wind turbine component

manufacturing premises at Tianjin, China and a large component engineering product facility of 40 acres at Pipestone, USA. Adding to its successful track records, the firm has recently commissioned Suzlon Group's Global HQ at Pune in a sprawling 11 acres campus. The campus named as 'One Earth' is an exemplary structure and stands testimony to Synefra's vision of incorporating green building concepts and innovative project management.

One Earth - Project Brief

Project One Earth has been developed on approximately 10.7acres of land having two major activities is a benchmark as an energy-efficient and sustainable solution project in all aspects of design, engineering, construction and management. Suzlon the entire campus has been built on LEED - Platinum and GRIHA - 5 star standards

- Functional blocks of office complex with a terminus (basement).
- Suzlon Excellence Academy

The office complex is divided into four interconnected buildings having central core with two wings each.The total built-up area is -

- 607,171 sq ft of office complex
- 209,000 sq ft of basement

One Earth was conceptualised, designed, executed and commissioned with a vision of creating a 'Green' workplace with minimal global footprint project based on the simple brief from the client for a need of a work place which, would provide a view to all beyond the monitor screens, a chance to experience day light changes at workstations, a place where employees do not feel restricted in thought or movement and more importantly they do not miss the joy of changing seasons while they go about achieving targets.

Landscape area comprises of 1,85,578 sq ft of functional spaces and state-of-art outdoor lighting, outdoor furniture, water bodies and special design elements like deep-stambh 20' diameter steel globe etc elements like deep stambh, 20 diameter steel globe etc. An ideal example of consciously adhering to global norms of renewable energy usage, health and safety, optimal energy planning and socio economic responsibility. The master plan is similar to a campus which, is based on an urban village concept, with features like -horizontal open spaces instead of linear over bearing structures, large interactions courtyards instead of only meetings rooms, wide landscape to encourage activities instead of 'keep off grass' signs.

Governed by sustainable and green standards of engineering and construction, One Earth has integrated and innovative aspects like use of Sustainable and LEED certified material for construction, 100 percent renewable energy powered campus (solar and wind, deployment of CFCs and HCFCs free air conditioning systems, creation of rain and water harvesting facilities, use of recycled water for landscape, to name a few. The completed project is in accordance with requirements of ECBC 2007. This technologically advanced structure demonstrates a project governed by green and sustainable aspects of construction, interiors and operations.

Trendsetting innovations achieved by Synefra at One Earth -

- Largest LED lights installation for 100 percent external lighting - a first in India
- Installation of 18 on site functional wind turbines
- Use of Building Integrated Photovoltaic Panels (BIPV)
- Use of water cooled Variable Refrigerant Flow system with fresh air units - first such installation in India.
- Complete building envelope insulation by use of hi performance glass, louvers and maximum over deck insulation.
- Installed load reduced from 6.5 MVA to 4 MVA by using renewable energy options, energy efficient installations of HVAC and lighting at design stage.

Innovation, technology, material and methodology during construction

- Minimum construction material wastage (total material waste is 0.4 percent as compared with the industry benchmark of one percent)
- Mass excavation (80,000 cum)
- Pre-identification of location to store and place the excavated soil
- Tie up with irrigation department to fill up the low laying area with soil at to create a garden (75 percent soil) store and reuse of soil for horticulture at One Earth (25 percent soil)
- Reinforced cement concrete
- Post Tensioning (PT) technology for RCC to reduce the entire concrete volume by 15 percent, steel volume by 12 percent and enhancing the speed and quality of construction.
- German light weight shuttering for entire terminus slab to reduce the time and cost and to maintain the

uniform quality
- Concrete pumping system to minimise the wastage, reduce the process time and maintain the uniform and desired quality of concrete
- Use of 20 percent flies ash for RCC to reduce the quantity of cement
- Environmental protection by creating sedimentation tanks to reuse the construction water and to avoid ground water contamination
- Reuse of stone excavated during construction for boundary wall
- Concrete block masonry (use of 40 percent fly ash).

Aluminum Louvers: To use to enhance indirect day light harvesting in office space, minimum maintenance

High performance glass-Double glazed units to reduce the heat ingress by minimum 30 percent. Eventually the reduction in HVAC installed load by 20 percent.

Over deck insulation-75 mm thick roofmate. Reduction of heat ingress from the roof top by 25 percent. First installation in India by Texas, India.

Pumping system: Irrigation, domestic use and utilities most energy efficient system designed and installed by Halward, Holland. One million litres capacity rain water storage tank.

Deep stambha: Built in natural granite stone. Total weight 40 tones. Erected without any mechanical equipment by local team of Chakan near Pune. These peoples ancestors were doing the job of large stone handling for the building of forts during the Kingdom of Shivaji.
- **Draintex system:** Use of draintex system for collection of all the excess water of garden above terminus slab.
- **Kalzip roofing** - Aluminum composite sheet supplied by Tata Corus, South Africa. Engineering and erection done to have a aesthetic appeal, smooth flow of rainwater, insulation to reduce the heat ingress, low maintenance and long lasting product.
- Aluminium Composite Panels (ACP) supplied by Dura build, Ranjangaon factory. Recycled content-long lasting product. Minimum maintenance.
- Maximum use of natural stones-Granite, Kotah. Use of eco-tiles- in landscape having recycled content, durable, low maintenance.
- Use of white tiles on entire flat roof to minimize the heat ingress. Landscape-low water consuming species, local species, rapidly renewable species eg bamboo plantation.

Zero waste management policy

Waste segregation systems installed at source for better recycling and reuse methods. Organic waste generated from the cafeteria, garden and office in form of paper etc converted into manure by organic waste controller of capacity 100 kg/hr installed at One Earth which is used as organic manure for landscape. Electrical and electronic waste i.e E-waste is treated through pollution control board authorised agencies. Recyclable waste such as paper, cardboard etc. It is collected and sent for recycling through dedicated NGOs working for the stated cause. IBMS has advanced features in order to minimize, monitor, supervise and keep track of issues related to services like energy, water, waste, security and untoward incidents.

LCD screens have been placed all around the campus to create awareness, communicate and propagate a message towards a place built on green and sustainable standards, company values, on-line news and corporate messages. A proper tour plan with required detailed display has been designed with dedicated staff arrangement provided to serve the people who want to know about the green features of One Earth. Adequate E-charging points and cycle parking spaces in the premises to encourage a healthy and green travel options.

Project Mnangement:

Synefra has led this project right from understanding client's need to executing the same onsite with a complete synergy of specialised consultants and vendors. Principle Architect Christopher Benninger has created an urban village design which is complimented by Landscape architect Ravi Varsha Gavandi, Interior Architect Space Matrix and Construction by Vascon Engineers. Synefra managed a total of 25 specialised design consultants and 97 main suppliers and contractors. One Earth has re-defined architecture presenting complete visual and functional harmony of architecture, landscape, interior and aesthetic experience. The name One Earth highlights earth's unique existence as an eco system and signifies a unified view of the planet. While buildings focus on the aesthetic as well as the look and feel of the place, Suzlon one earth goes a step beyond to focus on human scale, their comfort and health aspects.

Prime focus was on air quality and day light harvesting. The air quality, especially indoor air quality is controlled by CO sensors installed in the office area. These maintain two levels of CO level within acceptable limits. Even the terminus has CO sensors which monitor desired levels and to activating jet air fans if required. This is the first biggest installation of wind solar hybrid system in urban infrastructure in India. ■