Sustainability

SUZLON
one earth

SUZLON
POWERING A GREENER TOMORROW

First Edition 2009

For Private Circulation Only

ISBN 978-81-87693-05-5

Disclaimer

Every effort has been made to ensure that this book is as up to date as possible at the time of going to press.

Published by: Elephant Design Pvt. Ltd.
13 Kumar Srushti, S. No. 1 Pashan-NDA Road
Bavdhan Pune 411 021 India. Tel: +91–20-22951055 / 59
www.elephantdesign.com

Concept and Design: Elephant Strategy + Design

Printed by: Pragati Offset

Content: Synefra Project Team

Produced by:
Synefra Engineering & Construction Ltd.
www.synefra.com

synefra™
SYNEFRA ENGINEERING & CONSTRUCTION LIMITED

The Company

Synefra Engineering & Construction Ltd. was founded in the year 1998 with a focus to conceptualize, invest, develop and maintain hi-tech infrastructure globally for the Suzlon Group, the world's third* largest wind energy company. In the span of ten years, Synefra has grown to become a company with in-house capabilities to provide end-to-end, hi-tech infrastructure solutions right from concept to completion.

* Suzlon - REpower combined

Synefra is an ISO 9001:2008, 14001:2004 and OHSAS 18001:2007 certified company, having developed projects globally in different work environments and cultures (India, China, USA).

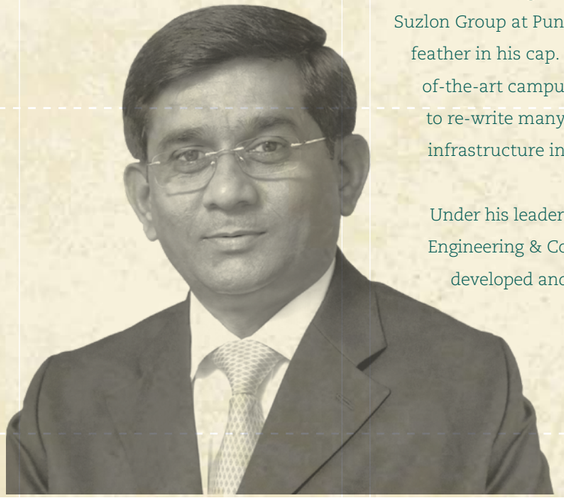
Backed by a team of more than 100 experienced professionals, Synefra is an efficient and effective techno – commercial solutions provider in the Engineering & Construction sector. The company further aims to nurture an environment that facilitates the development of technology, innovation, material science and its application in infrastructure. The focus of the company is on green and sustainable infrastructure with a vision to leave behind a legacy that future generations will be proud of.

Suzlon One Earth, commissioned by Suzlon Energy Limited, is a masterpiece in terms of setting industry benchmarks in the field of green and sustainable infrastructure.

This book by Synefra is a dedication to the spirit and pioneering efforts of the Suzlon Group in providing clean and green energy options globally.

The Visionary

J R Tanti, Managing Director, Synefra Engineering & Construction Ltd, is an architect by profession and a crusader for responsive and responsible infrastructure by choice. For the last 22 years, Mr. Tanti has been commissioning large scale industrial projects globally for the wind energy sector. A keen learner, he has kept abreast of his profession and constantly added to his repertoire of skills.



Over the past two years, Mr. Tanti has spearheaded the development of three hi-tech engineering Special Economic Zones in three different states, all of which are now fully operational. The recently completed Suzlon One Earth, global HQ of the Suzlon Group at Pune, is the latest feather in his cap. It is a state-of-the-art campus which is set to re-write many norms in the infrastructure industry.

Under his leadership, Synefra Engineering & Construction has developed and incorporated various initiatives like 'Sustainability & Responsibility', 'New & Relevant Technology' and 'Business Excellence', which have become integral to the day-to-day operations of the company.

An entrepreneur with vision, JR is considered a champion for Green Building Initiatives. His projects have always focused on and reflected environmentally responsible architecture adhering to values like energy efficiency, environment consciouness, neighborhood enhancement and social responsibility.

Content

Preface

Sustainability, in a broad sense, is the capacity to endure. In ecology, it is about how biological systems remain diverse and productive over time. For humans it is the potential for long-term maintenance of well being, which in turn depends on the well being of the natural world and the responsible use of natural resources.

What humanity has only recently begun to seriously appreciate is the fact that precious natural resources are not eternal and unless the world takes special and urgent steps to reverse or retard the all-pervading degradation of the planet, we are all facing a very dire future. Sustainability is the immediate need of the hour; we have to restore human use of natural resources to sustainable limits. This will require a major collective effort.

We are fortunate to have been associated with the Suzlon Group, which has always taken proactive steps to power a greener tomorrow. It is dedicated to promoting and generating

Suzlon believes in living its corporate philosophy in every aspect. For them, sustainability is a way of life.

The Chairman dreamt of a work place that was equipped with the latest technologies but was based on Indian tradition.

energy from wind – a renewable source.

Suzlon believes in living out its corporate philosophy in every aspect. For them, sustainability is a way of life.

Four years ago Tulsi Tanti, the visionary Chairman & Managing director of Suzlon, shared a dream. He envisaged a campus where Suzlonians could work amidst natural light and fresh air; a work place that would create cultural and emotional bonds and reflect company values. He dreamt of a work place that was equipped with the latest technologies but was based on Indian tradition. He wanted a corporate office that would be an inspiring place to work!

Our team was dedicated to achieving this vision for the campus and swung into action, putting together what seemed like an ambitious, but very rewarding task. What resulted was Suzlon One Earth – an amazing example of sustainability, and a tribute to Earth's unique existence as a self-replenishing eco-system.

Conceived and designed to be a green campus, We can proudly say that Suzlon One Earth can serve as the benchmark for energy efficient and sustainable solutions in all aspects of engineering and construction. Throughout its implementation, the project has consciously and responsibly adhered to norms of renewable energy usage, manpower health and safety, sanitation, hygiene, socio-environmental responsibility, and very stringent norms related to green building recognition.

A vast collective effort has gone into Suzlon One Earth, a coming together of the talents and experience of professionals ranging from architects,engineers, developers, and designers, to even vastu experts. The project showcases green initiatives such as efficient water management and rain water harvesting systems; unique architectural elements such as skylights and glass cylinders designed to utilize maximum natural daylight and ventilation; water bodies and landscape designed to keep surface temperature at its lowest and reduce the heat island effect; and green energy alternatives.

We have transformed the dreams and vision of Suzlon's Chairman into a reality. This book is our effort to showcase this reality and present this landmark project as an inspiring case study for others to replicate if possible. If Suzlon One Earth acts as an inspiration for industry, corporates, institutes and fellow citizens, we will have done our bit to keep this beautiful planet alive for future generations.

J.R. Tanti
Managing Director
Synefra Engineering & Construction

Intent

A Case for Sustainability

The world is constantly changing, and not all change is necessarily good. The last couple of centuries have seen civilization rapidly modernizing, an evolution that has brought its own set of attendant problems. With the onset of industrialization, agrarian economies took a back-seat and the whole concept of living slowly changed. Villages metamorphosed into towns, and towns into huge cities.

Progress was rampant, and for a long time the world closed its eyes to the downside of indiscriminate growth. Until there was irrefutable evidence of the disastrous effects of pursuing development at the cost of diminishing resources.

World leaders in various fields finally awoke to the fact that progress at the cost of the environment was dangerous, and the concept of sustainability began to be taken more seriously.

A healthy, self sustaining environment is what keeps the planet alive. The environment is the crucial life-supporting system for human existence and survival.

It also provides the raw materials required for socio-economic progress. If properly managed, it can comfortably meet our socio-economic needs without undue strain on natural resources. On the other hand, if irresponsibly managed, the environment could easily become hazardous and threatening to rapid socio-economic development and human survival.

Need for Sustainability

Environmental assets must be maintained at a level that meets the need of the present generation without jeopardizing the interests of future generations. This is the true meaning of sustainability, and one that the world urgently needs to wake up to.

As the population across the globe grows, the need to balance people with the availability of natural resources becomes more and more imperative. Increased population has led to a rise in natural calamities such as earthquakes, tsunamis, storms, and wildfires, especially in areas susceptible to natural hazards. Unprecedented climate changes are playing havoc with food production across the globe. Major environmental threats such as land degradation, deforestation, and land, water and air pollution are of great concern. These result from overuse of land, inappropriate technologies, indiscriminate urbanization, and callous use of resources.

A country's socio-economic development and environmental sustainability is significantly affected by all these factors.

With people, particularly industries and businesses, across the world blithely ignoring environmental concerns in their pursuit of progress, other man-made calamities have occurred with disastrous results. One of the worst tragedies was the explosion in 1986 of a reactor at the nuclear power plant at Chernobyl in the former Soviet Union. The environmental, health and social consequences are being felt more than 20 years later, and it may take generations for the true effects of the Chernobyl accident to be fully understood.

The explosion at the Union Carbide factory in Bhopal on 3 December 1984, when deadly methyl isocyanate gas leaked and spread across the city, is the worst industrial disaster in Indian history. The exact death toll will never be known but the Indian government puts it at more than 22,000 and climbing. A 1999 study, commissioned by Greenpeace International but conducted by independent scientists, concluded that Bhopal's groundwater contained heavy metals, volatile chemicals and levels of mercury that were millions of times higher than considered safe.

Another shocking environmental disaster caused by human hand occurred in 1989 when the Exxon Valdez oil spill fouled the waters of Prince William Sound, located on the south coast of Alaska. The oil coated more than a thousand miles of pristine coastline, and killed countless birds, fish and animals. Many years after the accident, and despite billions of dollars spent on cleanup efforts, crude oil can still be found under the rocks and sand on the beaches of southwest Alaska. The effects of the spill are still apparent in the lasting damage done to many native species.

These are only a few examples of the havoc that humans are wreaking in their selfish bid for development at all costs. Protection and sustainable use of the planet's natural environmental resources is thus absolutely necessary. Environmental assets must be maintained at a level that meets the need of the present generation without jeopardizing the interests of future generations. This is the true meaning of sustainability, and one that the world urgently needs to wake up to.

What is Sustainability?

Derived from the Latin word ‘sustinere’ (‘tenere’, to hold; ‘sus’, up), the word ‘sustain’ has several meanings, the most significant ones being to ‘maintain’, ‘support’, or ‘endure’. Since the 1980s however, the word ‘sustainability’ has been used more in the sense of human sustainability on planet Earth. The concept is not a new one, just one that was ignored and forgotten on our path to development and progress. The most widely quoted definition of sustainability states that ‘sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’.

The Earth Charter speaks of ‘a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace’.

The challenge then is to learn how to ‘use, conserve and enhance the community’s resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased’. The need is to find a ‘balance’ between using and replenishing. Simply put, each generation has a duty to preserve the world and its resources for the next. Sustainability involves improving the quality of human life without depleting supporting eco-systems.

Sustainability has become a wide-ranging term that can be applied to almost every facet of life on Earth, from a local to a global scale, and over various time periods. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. Invisible chemical cycles redistribute water, oxygen, nitrogen and carbon through the world’s living and non-living systems, and have sustained life for millions of years. However, as Earth’s human population has increased, natural eco-systems have declined and changes in the balance of natural cycles have had a negative impact on both humans and other living systems.

While there is still no universally-accepted definition of sustainability, it cannot be denied that the concept of sustainability is a call to action. It is a task in progress and based on common goals and values. The Earth Charter speaks of ‘a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace’.

It is heartening that governments and societies across the world are beginning to understand the need to control the present consumption of resources so as to ensure their provision in the future. Concerted efforts are being made, both through government legislation and otherwise, to improve the environment through reducing energy use, creating more green spaces, and working towards more responsible styles of living. Several pioneering efforts have been made to create environment friendly localities and encourage sustainability as a way of life.

Sustainability and Construction

The construction sector has laid the benchmark for development since ancient times. Even today countries boasting the tallest and grandest buildings are considered to be the most developed. However, the growing economic disparity in developed countries, loss of natural resources, and the recent economic recession have served as eye-openers. People have realized 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.

China and India today account for more than half of the world's new construction, yet the potential for efficiency gains in the building sector is largely being ignored. A majority of the buildings in Asia are inefficient when energy considerations are taken into account. The construction sector, in fact, accounts for a large percentage of the world's total energy consumption, and greenhouse gas emissions.

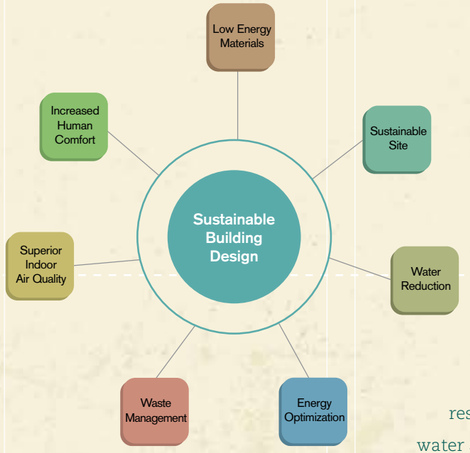
Sustainable construction practices result in 20-30% savings on energy and 30-50% savings on water for occupants of a building.

'Sustainable Building Design' is the effort to promote sustainably designed buildings with the aim of lessening their impact on the environment through energy and resource efficiency. A 'Sustainable Building' represents one of the most direct, immediate and effective opportunities to help maintain ecological balance. Such an approach to construction not only helps in reducing project development costs and equipment needs or lower operating costs but also minimizes the associated energy costs.

A sustainable building is the result of a design philosophy which focuses on increasing the efficiency of usage of resources like energy, water, and materials, while minimizing the impact of the building on the environment during its lifecycle. In order to evaluate and assess buildings on a wide range of green attributes, several rating systems and standards have been adopted across the world by various bodies, including IGBC (LEED India) and MNRE (GRIHA) in India. These ratings systems are designed to evaluate not just new construction but also existing building structures, and are increasingly being considered by organizations with a social conscience.

A sustainable building project considers sustainability in all phases of its life: pre-construction, during construction, and post construction. The pre-construction phase involves policy and design decisions, such as suitable site selection and the decision to identify, protect and conserve areas rich in biodiversity. A climate responsive design takes into consideration the local weather including the temperature, wind direction and the daily sun-path to ensure optimal use of available natural resources.

The construction stage usually has maximum direct impact on the environment. Preventing soil erosion, facilitating proper storage of construction materials and waste like cement, sand, and steel reinforcements ensures that existing natural features of the site are affected minimally by construction activities. Other social and economic sustainability measures at this stage include efficient construction water management practices, disciplined work flow, provision of safety equipment and basic amenities for workers, efficient construction waste management to divert construction waste from the landfills, and monitoring noise and air pollution during construction.



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

Sustainable construction practices demonstrate 20-30% savings on energy and 30-50% savings on water as compared to conventional practices. The occupants of a sustainable building enjoy enhanced indoor air quality, and enhanced comfort resulting in increased productivity. While the occupants of a sustainable building are the direct beneficiaries of sustainable construction practices, the neighborhood, city and planet are also indirect beneficiaries in the long run.

"Achieving sustainable development is perhaps one of the most difficult and one of the most pressing goals we face. It requires on the part of all of us commitment, action, partnerships and, sometimes, sacrifices of our traditional life patterns and personal interests," said Mostafa Tolba, Chairman of the Commission on Sustainable Development. Sustainability is indeed the need of the hour, and adopting sustainable practices has to be a priority for industry across the globe. Initiating change at the work place is the first step towards making sustainable practices a way of life.

Suzlon's Vision of Sustainability

Since its inception in 1995, Suzlon Energy Limited has worked to promote the cause of clean, renewable and sustainable energy in India. With a philosophy that emphasizes innovation to drive its every aspect, the company has turned the dream of a greener world into a sustainable and profitable business. The goal is to contribute to the world by creating sustainable social, economic and ecological development, and by using the very best technology to help mitigate the global climate crisis.

Suzlon has long held that development needs to be fundamentally sustainable to be considered real and effective. For sustainable development, one only needs to look for the common, fundamental denominator for all human activity - energy. The acceptance of this reality is now universal, and is demonstrated in the commitment of nations and corporations to adopt renewable energy as a mainstream source of power.

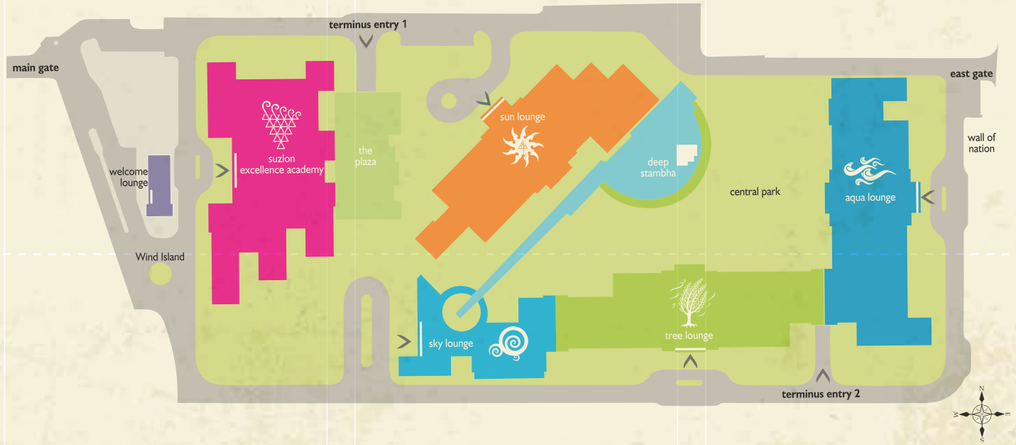
Wind energy is by far the most advanced utility scale renewable energy technology available to the world today, and the growth of the industry reflects the reality of wind energy taking its place as a mainstream and long term source of power.

Suzlon has consistently been at the forefront of the wave. In just over a decade the company has risen to rank among the top five wind turbine manufacturers in the world, and always, more important than the business has been the cause that Suzlon embodies.

The campus design, interiors, landscape and communication all reflect the core Suzlon values of agility, creativity, adding value, commitment, and integrity.

Suzlon One Earth

Building a corporate office was not the sole aim of the new campus. The Chairman & Managing Director, Tulsi Tanti's vision was to create a space that would proclaim the philosophy of Suzlon. One that would set a sterling example of how a company could operate in a sustainable environment, and inspire others to integrate attitude, behavior and beliefs to create a culture equipped for growth and development at both the individual and organizational level.



Representation of
Suzlon One Earth site plan

The campus architecture design, interiors, landscape and communication all reflect the core Suzlon values of agility, creativity, adding value, commitment, and integrity. With One Earth, the company wanted to create a brand experience for all stakeholders and visitors that would reflect the global Suzlon brand. The Synefra team was given a dream, a vision and an idea which they translated into impressive reality.

The One Earth campus is the knowledge and support base for the company's global operations that penetrate 21 countries. It is a 24/7 global shared service provider and think tank for the Group across all verticals. Most importantly, it provides Suzlonians the opportunity to work in a great atmosphere, a place where they can see the changing seasons, and breathe fresh air, even as they remain proud of the fact that they are part of an effort to conserve the scarce resources of this wonderful planet.

The Reality of One Earth

A large strategically placed globe signifies the true meaning of Suzlon One Earth – a sustainable corporate campus that pays homage to Earth's unique existence as an eco-system, and signifies a unified view of the planet.

The name 'One Earth' is dedicated to our precious planet, and reinforces the belief that co-existence and responsible use of natural resources are the only way to achieve sustainability.

Conceived to be a 'global village', a ground to earth, horizontally spread structure that complements nature, One Earth is spread over a sprawling area of 10.5 acres in Pune. In the simplest terms, One Earth is a corporate campus where Suzlonians can enjoy working in a congenial atmosphere, amidst serene surroundings, and with access to natural light and plenty of fresh air.

It is a work place that will create cultural and emotional bonds between Suzlonians and their company values. A benchmark green campus, it is a place that has been built with the latest technologies but is still strongly bonded with Indian values.

The campus has been designed according to Green Building practices, which will not only reduce negative environmental impacts but also result in added benefits like reduced operational costs, increased energy and water savings, enhanced building marketability, higher worker productivity, and reduced indoor air quality problems. In the true spirit of 'oneness', this project will bring benefits not only to Suzlon and its employees, but also to the general public at large.

Designed and implemented by a large team of professionals working in tandem, One Earth was built as per guidelines laid down by LEED India and MNRE GRIHA.

Sustainability is the hallmark of this special project. The name 'One Earth' is dedicated to our precious planet, and reinforces the belief that co-existence and responsible use of natural resources are the only way to achieve sustainability. The name is designed to draw attention to the fact that we have only one Earth and we need to preserve it for a sustainable future. 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 / sky), and Terminus (terra / Earth).

From dream to reality, One Earth is a tribute to the future.

Working Towards Sustainability

The Direction

Suzlon is committed to saving the planet for future generations; its corporate philosophy is 'powering a greener tomorrow'. So when Chairman & Managing Director Tulsi Tanti outlined his dream for a corporate campus, it was a given that what he intended was a completely sustainable campus. The idea was to create an ergonomically designed campus that would complement human scale and cater to all aspects of human faculty, emotional, functional and intellectual.

In his mind, the campus had to be simple, robust and minimal. The model that best suited the CMD's vision was a place with village-like characteristics such as proximity to nature, maximum use of natural light and ventilation, and neighborhoods that bond with technologically advanced facilities. Such a campus, he felt, would reflect the fact that Sustainability is at the core of the organization.

Sustainability being the guiding force, there were very definite directions for certain aspects of One Earth:

• Vastu Shastra, the traditional system of design based on directional alignments, was to play a very significant role in master planning, and the location of functions and services.

• Water efficiency measures were to be incorporated into the design.

• Architecture and architectural elements were to be designed to facilitate maximum use of natural resources.

• Provisions were to be made to ensure that part of the energy needs of the campus would be fulfilled by using natural energy generating methods such as wind turbine generators and solar panels.

• Optimized energy performance was to be facilitated.

• A Zero Waste Policy was to be initiated.

• Impact on the environment was to be minimized.

• Efforts were to be made to encourage use of green energy and sustainable practices within the staff through implementation of green policies.

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

The critical challenge was to methodically select not only the site for this campus, but also all the stakeholders involved in the process of building this into a reality.

The Team

The first priority was selection of the right project partners. For a project of such magnitude it was essential to involve the best talent from the fields of architecture, construction, interior design, landscape design, sustainability and communication design. It was also essential to build a team of like-minded professionals who would share a common vision for the campus, and whose joint capabilities would exceed that of any individual.

Finding an architect who would understand the vision and translate it into reality was the first major task. The search stopped at Christopher Charles Benninger Architects whose world class projects have always stood out as innovative and close to nature.

Vascon Engineers, a reputed company with the skills to tackle a project of such dimensions, was chosen to execute the engineering and construction.

One of the aims of the project was to merge the built up and open spaces and exhibit it as one entity. Experienced landscape architects Ravi & Varsha Gavandi were selected to create world class landscaping that would add value to the project.

From the exterior the focus moved indoors and Tao Architecture were chosen to create a congenial work place as they were already integrated with the project, in the role of design co-ordinators. Interior architects Space Matrix were selected to lend their vast execution experience to the large and multifaceted project.

Orienting the whole project team towards the ‘yet to be realized’ goal of sustainability was an important concern. For their global expertise in the energy modeling domain Environmental Design Solutions were selected as the green building project partners; and as sustainability facilitators who would act as a catalyst to integrate the design team and provide momentum towards achieving the goal of sustainability.

Communication is key to the success of any project, and the young and dynamic team at Elephant Design was selected to create all the communication and experience elements to help users and visitors understand and feel comfortable at Suzlon One Earth.

Knowledge Synergy

Team work is an essential component for the success of any project, especially one of the magnitude of One Earth. It was clear that the various agencies involved in the creation of the project had to work as a seamless team to achieve a common goal with maximum ease. It was decided to involve the whole team from the start (architects, developers, landscape designers, green building project partners and project managers). The aim was to have everyone on one page so that there would be a consensus and they could all work in a common direction. Several brainstorming sessions were held and gradually a uniform perspective emerged.

Synergy meets were held regularly at the design level to keep everyone on a common platform and integrate ideas into the overall design criteria. Fortnightly informal dinner meets were arranged and sponsored in rotation by different players. A common task force was formed with key members of the coordination and management agencies.

There was complete transparency of design and the developer and architect teams were merged to form a combined developer and construction-contractor team. The architect and interior designers also worked together and the green building project partners kept the much needed synchronization on track. This resulted in successful completion of the total construction process including civil, landscape and interiors, achieved from a 360-degree perspective including communication, branding and art installations.

Choosing the Site

Location is everything, and never more so than when planning a sustainable campus. The site for Suzlon One Earth was chosen after careful consideration to meet not only the physical requirements of the company but also all the criteria for a truly green project. In a city like Pune, this can seem a tall task, but Survey No. 170 of Sade Satra Nalli at Hadapsar seemed to fulfill all the requirements. Opposite the well known Magarpatta City, the 45,393 sq. m. site had the advantage of being located within an already developed area, flanked by corporate offices and residential areas.

The main criterion was to seek a site on which construction would have the lowest environmental impact. Other criteria required that no buildings, roads or parking areas would be built on land that was prime farmland; or land with elevation lower than 5 feet above the elevation of the 100-year flood level; or land specifically identified as habitat for any species on the threatened or endangered list of the Wildlife Institute of India; or land within 100 feet of any wetland as defined by local or state rule or law; or land which prior to acquisition for the project was public parkland.

It was important to the One Earth team to ensure that the site was located in an urban area with existing infrastructure, where they could also protect the existing biodiversity and preserve the habitat and natural resources. The chosen site was located within an existing minimum residential development density of 10 units per acre. It also had easy access to basic services such as a bank, place of worship, convenience grocery, day care, cleaners, fire station, medical/dental clinic, pharmacy, etc.

The Suzlon One Earth site and its surroundings in a 1.5 mile radius.

Design Approach

Spread over a sprawling 10.5 acres in Pune, the Suzlon One Earth campus was to be designed as per Sustainable Building practices. The entire design process of the campus, for both indoor and outdoor spaces, was to be created in a manner that would increase sustainability; in other words, improve the quality of life for Suzlonians while designing within the carrying capacity of supporting eco-systems.

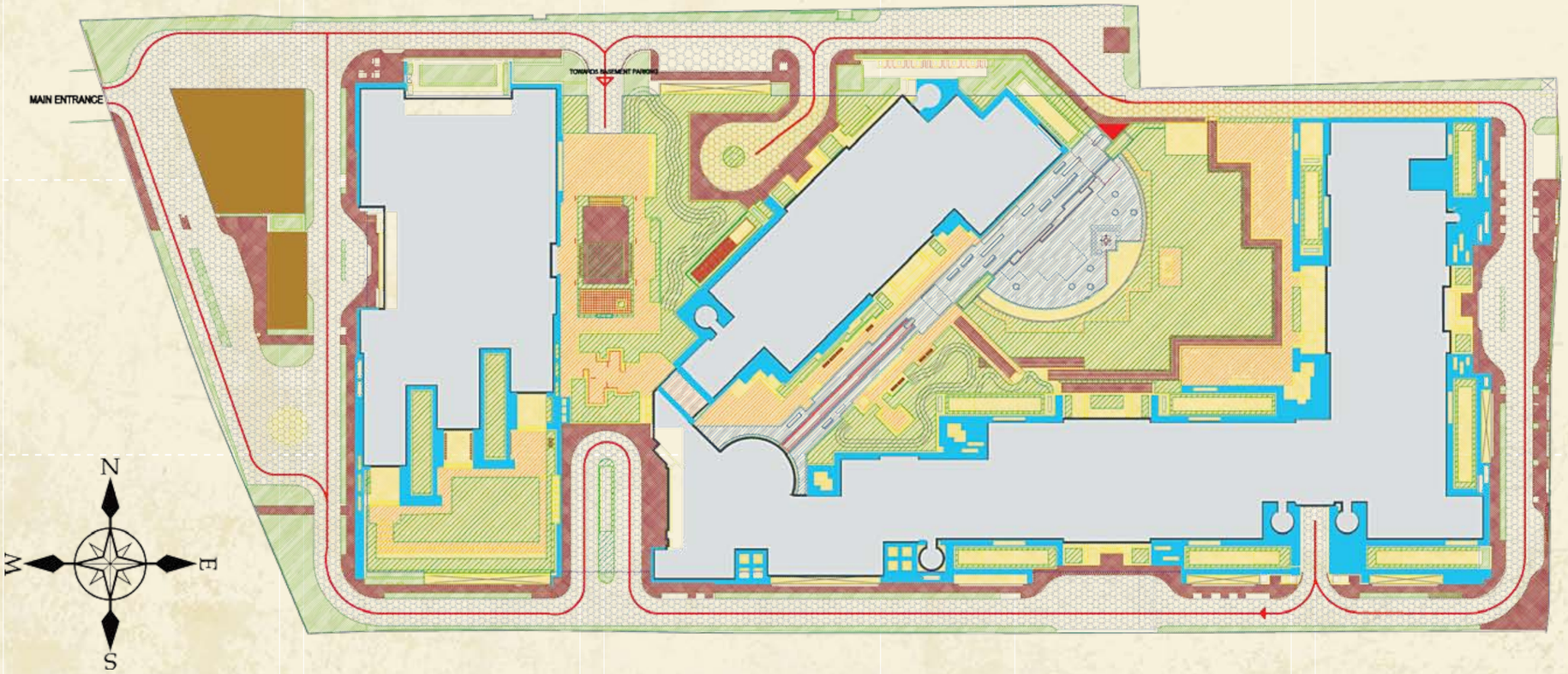
The important considerations were to preserve and protect the landscape during construction; ensure soil conservation; include existing site features in the design; reduce hard paving on-site; enhance outdoor lighting system efficiency; and plan utilities efficiently.

To ensure reduced site disturbance, One Earth was to be designed so that the open space exceeded local zoning open space requirements by 25%. This would help conserve existing natural areas and restore damaged areas to provide a suitable natural habitat and promote biodiversity.

As is required for Greenfield sites, site disturbance including earthwork and clearing of vegetation, was limited to 40 feet beyond the building perimeter.

The development footprint (refers to the entire building footprint, access roads and parking) were minimal to minimize site disruption.
Clearly marked construction boundaries also helped minimize disturbance of the existing site and restore previously degraded areas to their natural state.

Designing a campus on the principles of sustainability not only reduces the negative environmental impacts but also has added benefits like reducing operational costs.



LEGEND

SITE AREA = 42802.21 sq.m

GROUND COVERAGE AREA

ROADS

FOOT PATHS

VEHICULAR PATH

PEDESTRIAN ACCESS

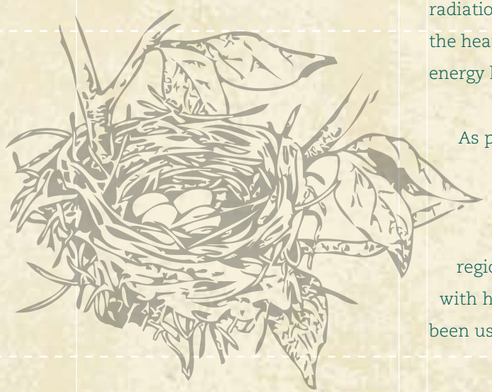
Master plan showing building footprint and landscaped areas

Design Process to Increase Sustainability

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, increasing productivity of workers, and reducing indoor air quality problems. All this benefits not only the owner and occupants of the campus, but also the general public at large.

The design brief was clear: sustainability was to be the hallmark, and several innovative measures were successfully adopted to make this campus the greenest in India - both literally and figuratively.

While the low slung campus is outfitted with the latest technology,



many elements of it are based on traditional Indian architecture, such as horizontal louvers that allow the sunlight inside while keeping the heat and glare outside, thus drastically reducing the need for artificial lighting during the day time.

The roofing design reflects solar radiation, delays heat gains, reduces the heat island effect and decreases energy loads.

As per the best practices of sustainability, more than 70% low-energy materials in the interiors, and regionally manufactured material with higher recycled content have been used.

A 100% 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.

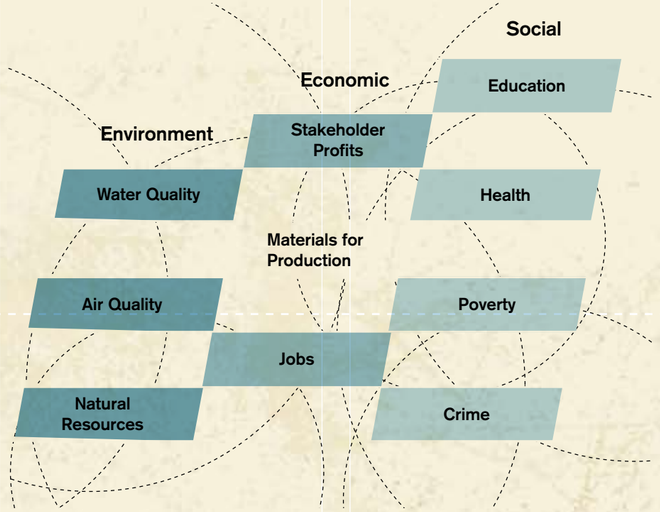
Charging points have been provided across the campus to promote the use of electric vehicles that reduce air pollution. Five percent of parking has been reserved for carpool users as consistent use of carpools is known to reduce CO_2 emission by 2.8 tons/ year.

The campus represents the company's core value of sustainability in every aspect of the project.

The architectural design uses horizontal louvers to allow maximum daylight into the work place while keeping away the glare and heat

Sustainability Indicators

The three most important indicators of sustainability are the environment, society and economy – these help us understand problem areas and show the way towards workable solutions. Traditional indicators of progress, such as corporate profits, measure change in one segment of a community as if they are entirely independent of other segments. Sustainability indicators take into account the fact that the environment, society and economy are interconnected.

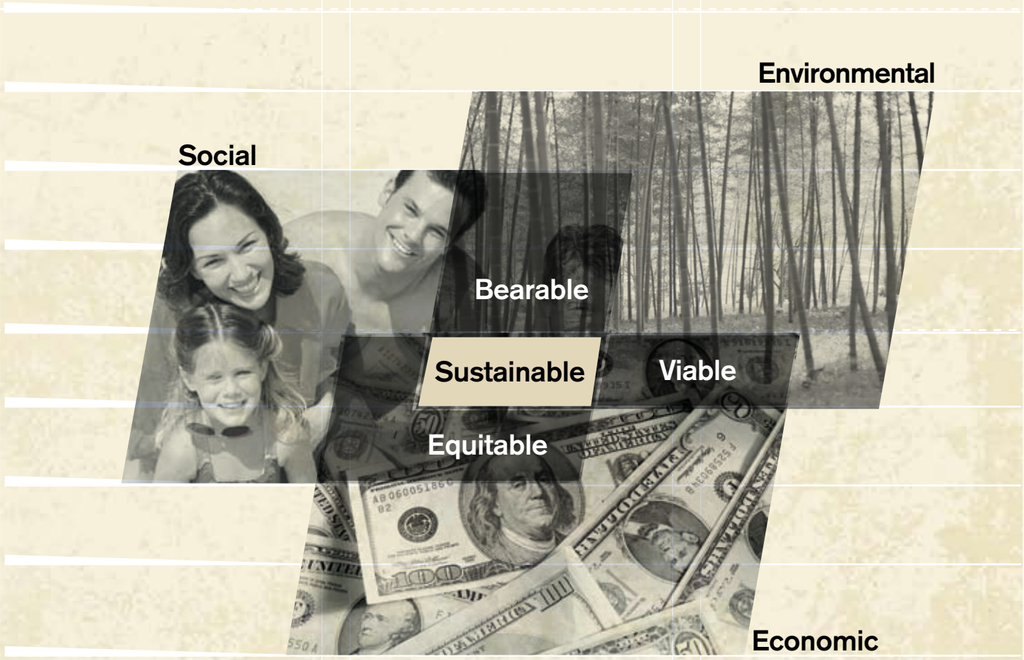


Communities are based on interactions between these segments. Natural resources provide raw materials for production, which directly affects jobs and profits. Jobs are connected to poverty rate, and thus to incidence of crime. Quality of air and water affects health which affects worker productivity, and thus profits. Nothing can be considered in isolation.

This integrated view of communities and the world is a requirement for sustainability. In any sustainable community, indicators help identify negative trends and can point the way to a better future, and through discussion and interaction, help to create a shared vision of what the community should be.

Environmental Sustainability

One of the main indicators of sustainability, environmental sustainability is the process of making sure that current methods of interaction with the environment are pursued with the idea of keeping the environment as pristine as naturally possible. Sustainability requires that human activity uses nature's resources, such as energy and water, at a rate at which they can be naturally replenished. It also implies the reduction of wastage at every level.



Energy

More than five percent of Suzlon One Earth's energy requirement is met by the use of renewable sources; windmills and solar panels with a capacity of 154 kW have been installed on-site.

Optimized Energy Performance

One of the primary design objectives of Suzlon One Earth was to design a campus that was an exemplary example of being energy-efficient. Conservative use of energy, and energy production from renewable sources, are synonymous with a sustainable project. To achieve optimal energy performance it was necessary to create a building design that would reduce conventional energy demand and optimize energy performance of the building within specified comfort limits. To begin with, the baseline for minimum level of energy efficiency was established.

Integrated design approach helped create a campus that makes optimal use of energy

Electrical Design

The requirements in the electrical design brief were quite clear. What was needed was an electrical installation which was modular, scalable, flexible and reliable. Each of the office blocks were to be provided with independent distribution and metering systems. The initial design was for 5600 kVA connected load and 6000 kVA transformer capacity. However this was reworked to meet the company's initiative towards creating a low energy consumption building, and finally fixed at 3600 kVA with transformer capacity of 4000 kVA.

Unique Features: 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% 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 (1 working + 1 standby) to feed power to critical equipment like computers, AV equipment, emergency lights, etc. This enhances reliability of power.

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 5% 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 liters per day has been installed, saving 135,501 kWh of electricity annualy.

Renewable energy generating methods using wind and solar energy have been integrated into the campus

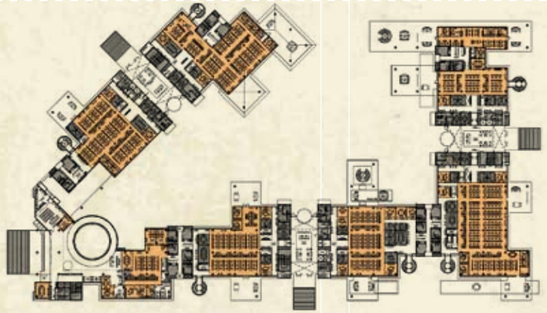
Some of the energy conservation measures include use of shading and overhangs, high performance glazing, efficient lighting design, direct-indirect evaporative cooling, jet fans for parking ventilation, etc.

Energy Optimization at Design Stage

A series of innovative measures were taken to reduce energy consumption across the campus.

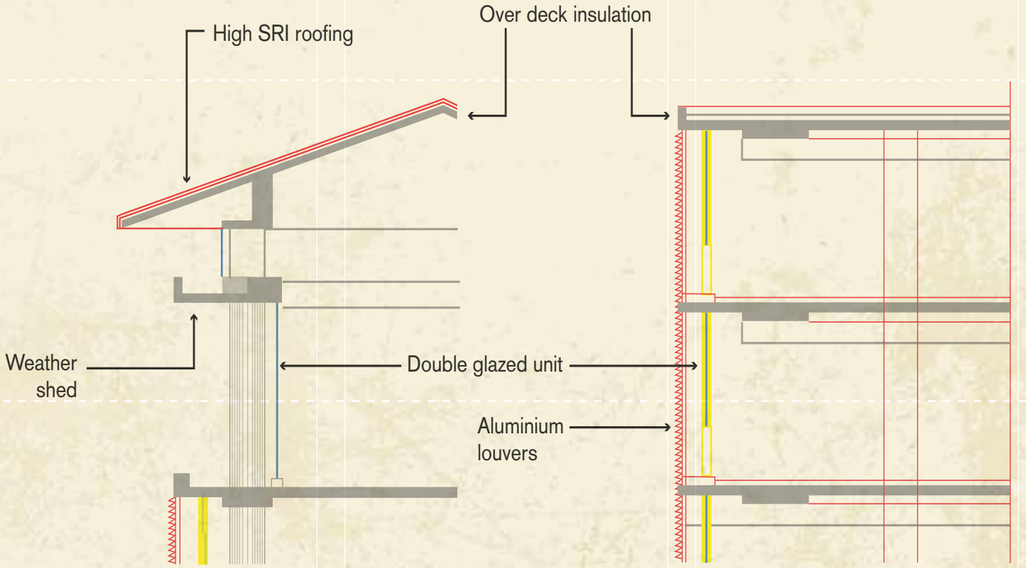
Envelope shading and overhangs: The building envelope optimizes the thermal performance of a building. It reduces the heat load, and allows maximum daylight harvesting, thereby reducing the energy requirement of the building.

Building layout showing areas receiving direct sunlight (represented in orange)

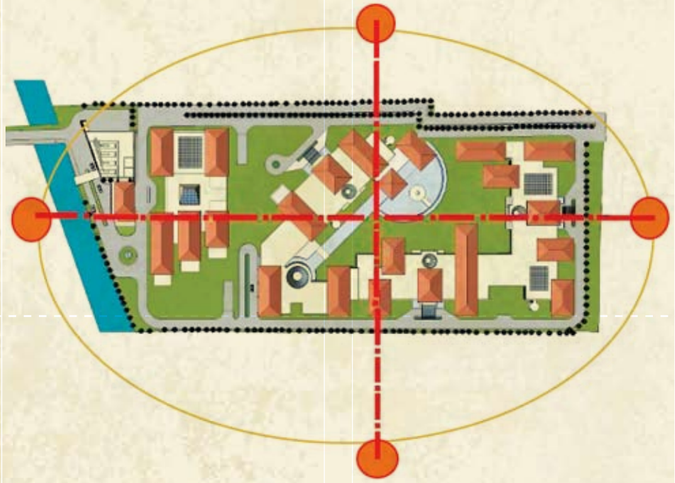


At One Earth, terraces and pavilions extending out provide shade to the ground floor glass. The first floor largely extends over the ground, adding to the shaded areas. The most effective shading is provided by the roof overhangs on the third floor, and external louvers on the first and second floor, which provide 100% shading.

Efficient lighting design: One of the key factors to saving energy is making maximum utilization of daylight. The 9 ft. full height glazing coupled with a narrow floor plate - 79 ft. in general and 59 ft. in the Sun Lounge - provide tremendous potential for daylight harvesting. This potential has been fully utilized by non-obtrusive placement of enclosures



Cross sections of the roof and building envelope showing the roof overhang, and layers of glazing and thermal protection



The solar path was studied and marked out before designing the lighting systems for the interiors

like conference rooms and the use of intelligent lighting controls. Approximately 7 ft. wide cutouts all along the periphery and a large one at the center of the building cut down the need for basement lighting during the daytime. This ensures that the quality of space in the basement is far superior to and more productive than a conventional basement which is used only for parking.

The lighting system in the interiors is smartly designed by employing dimmable ballasts, electronic ballasts, occupancy sensors, motion sensors and daylight sensors. This ensures that lights get switched on only when required. The general lighting level from the ceiling luminaries is fixed at 350 lux. The artificial lights can be dimmed up and down from 0% to 100% depending on the adequacy of available daylight to meet the 350 lux requirement. The task lights have an intelligent built-in occupancy sensor in conjunction with a continuous dimmer. Lighting of individual offices is controlled by combined daylight and occupancy sensors.

HVAC (Heating Ventilation Air Conditioning) Systems: The indoor unit's cooling operation offers flexibility to the user to control the desired temperature in any location in the premises according to individual preferences. Controls for switching on or switching off, scheduling, temperature and air flow are possible for each enclosed space. Such flexibility of operation based on users' needs curtails wastage and enables substantially higher energy savings than conventional systems. The space conditioning is applied in the following ways and spaces at the Suzlon One Earth campus:

Pre-cooling and heat recovery at Treated Fresh Air (TFA) units: These provide fresh air throughout the buildings. The fresh air required for the AC system is supplied to spaces separately after being passed through a TFA unit based on indirect evaporative cooling. A sensible heat exchanger is used as a pre-cooler to sink the temperature of incoming air to match the indoor temperature. The heat exchanger uses water available from a common sump. The temperature is further brought down by heat recovery from the exhaust air of the office. This exhaust air has a very low WBT and is used as 'scavenge' air. Water sprayed in the path of the return air evaporates, imparting coolness to incoming air in adjacent chambers without adding moisture. This system offers better recovery as compared to conventional heat wheels and that too without the costliest moving part - the wheel itself. Fresh air pushed inside is 30% more than the ASHRAE standard.

Direct-indirect evaporative cooling: Systems such as Indirect Evaporative Cooling have been used in short

occupancy areas like the café, gym, employee lounge, etc. to help maintain comfortable temperatures of 25°C and eliminate the need for air conditioners. This has helped reduce the total air conditioning required for the project by approximately 300 tons.

The technology operates in 3 steps:
1) Sensible cooling of approximately 130% of fresh air in an efficient heat exchanger, using pre-cooled water.
2) Further cooling of air, and simultaneous cooling of water in the indirect evaporative cooling section of the unit. Air required for the cooling tower part of this section is drawn from the outlet of the same section. (This is the excess 30% quantity which has been cooled in the first and the second sections). This air is commonly termed as 'scavenge air'.
3) Direct evaporative cooling of 100% air in the final section.

Jet fans for parking ventilation:
As opposed to conventional ducted arrangement, fresh air is drawn through large openings provided on the periphery of the basement, and pushed by PLC controlled dual speed jet fans towards the center of the basement. The foul air is picked up at 10 locations and exhausted onto the terrace level by exhaust fans. The connected load is brought down to 216 kW as opposed to 472 kW expected in conventional ways. The operation of fans is based on signals received from CO sensors which act only when required resulting in further reduction of electrical consumption.

Refrigerant Management

The problem of ozone depletion is caused by high levels of chlorine and bromine compounds in the stratosphere. The origins of these compounds are chlorofluorocarbons (CFC), generally used as cooling substances in air conditioners and refrigerators, or as aerosol

Jet fans that provide ventilation to the entire One Earth parking area are a great energy saving feature

propellants; and bromofluorocarbons (halons) used in fire extinguishers. As a result of depletion of the ozone layer more UV radiation comes to Earth and causes damage to living organisms. UV radiation seems responsible for skin cancer in humans; it lowers production of phytoplankton, and thus also affects other aquatic organisms.

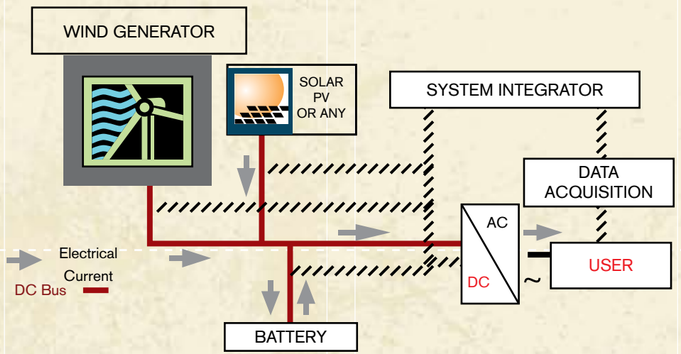
The One Earth project aims at reducing ozone depletion through zero use of CFC-based refrigerants in the new building's HVAC&R base building systems. The HVAC&R and fire suppression systems are free of CFC, HCFCs and halons.

The project utilizes three kinds of cooling systems: water cooled VRV units manufactured by Daikin for office areas; air-cooled units as backup for critical areas like server rooms; and multi-stage indirect-direct evaporative cooling units for short occupancy areas including lift lobbies, core areas, cafeteria, gym, and training center lobby. The indirect-direct evaporative cooling system employs only air and water for both the indirect and direct cooling stages. The fire-fighting system is entirely water-sprinkler based and does not use any halons.

Renewable Energy

At least 5% of the building's energy is provided by on-site renewable wind and solar energy systems. The idea is to encourage self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use. The domestic hot water requirement is met entirely by solar water heaters. The wind-solar hybrid system installed on-site comprises five clusters of windmills and solar panels that provide 5% of the energy required for the campus. One cluster is dedicated to supplying green power (all renewable energy) to the communication server, thus realizing Suzlon's vision of Green Communication.

Integration of the Wind-Solar Hybrid System at Suzlon One Earth



Green Power

Green power is derived from solar, wind, geothermal, biomass, or low-impact hydro sources. Suzlon is making a concerted attempt to offset the environmental impact of energy consumed by the facility by using green power. The company is encouraging investments in off-site renewable energy technologies to be exported to the grid. The off-site green power produced is 100% of the project's energy consumption. Windmills installed in Maharashtra and Gujarat are supplying power to the State Electricity Board to compensate for power consumed by the One Earth Campus.

Water

Water efficient fixtures, and the use of captured rainwater and treated gray water (waste water generated from domestic activities) reduces water use by more than 50% at Suzlon One Earth.

Efficient Water Management

Water is one of our scarcest resources, and managing it efficiently is one of the most challenging tasks of any project designed to be sustainable. One of the most important goals of the One Earth project was 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% less potable water.

Water Use Reduction

Water efficient fixtures and the use of captured rainwater and treated gray water (waste water generated from domestic activities) reduced water use by more than 50%. Conservation and water efficiency has been achieved by several different measures:

- Recycled gray water is used for flushing, irrigation, and HVAC.

- A Rain Water Treatment Plant and Sewage Treatment Plant have been installed on-site.

- Potable water consumption for site irrigation purposes has been reduced by 50% through high efficiency irrigation technology, use of recycled site water, and captured rain water.

The pebble drain from where all excess water on hard surfaces is drained out

- The landscape uses the concept of 'pebble drain' where all the excess water from the hard surfaces on the podium is drained onto a pebble drain. Drainage mats have been used below all the soft landscape areas on the podium to prevent soil erosion and to collect excess water.

The project has attempted to maximize water efficiency within buildings to minimize the burden on municipal water supply by reducing the demand for potable water and reusing waste water. For achieving this, high efficiency fixtures that

reduce the building's water use by 20-30% have been installed, such as dual flush full (6 Lpf) and half (3 Lpf) - water closets, urinals with hytronic sensors, efficient flow plumbing fixtures, pressure reducing devices, and water conserving shower heads. Reusing storm water and gray water for non-potable applications such as toilet and urinal flushing, mechanical systems, and custodial uses has also been integrated in the services.

An important measure that is unique to Suzlon One Earth is the efficient use of water during construction. Various water consuming processes during construction such as tile cutting, cleaning of batching plant or curing of concrete structures were oriented towards the goal of using water efficiently.

Water Efficient Landscaping

With a large part of the campus given over to green spaces, water efficient landscaping was a priority. The goal was to limit or eliminate the use of potable water for landscape irrigation. High efficiency irrigation technologies were used in order to achieve this. Captured rain or recycled site water was used to reduce potable water use for site irrigation (except for initial watering to establish plants) by 50%. Permanent landscape irrigation systems were not installed. A soil and climate analysis was performed to determine appropriate landscape types. The landscape design focused on indigenous plants to reduce or eliminate irrigation requirements.

Selection of species: In order to eliminate the use of potable water for landscape irrigation, a multi-pronged approach has been adopted.

The landscape design consists of a variety of native or naturalized species whose water requirement and maintenance is low. The landscape design on native species alone has helped reduce irrigation demand by about 18%. It not only takes into account the functional and psychological needs of humans, but also seeks to promote bio-diversity by providing a suitable habitat for birds and butterflies. A variety

Native species of plants used in the landscape design to reduce irrigation needs

of native plant species have been selected based on their adaptability to the region's soil and climate. The favorable conditions of Pune support an abundance of native plants with low water requirement and drought-resistant properties, such as kanchan, amla, rubber, peepal, bakul, chandan, bamboo; and water plants like lotus and lily. In addition, they reflect seasonal changes and pose fewer maintenance problems than many exotic plants.

A significant reduction in water consumption and landscape maintenance has been achieved through the use of patios, decks, shrub beds and groundcovers instead of water-sensitive lawns. The size of lawns has been reduced to the bare functional requirement.

• Placement of trees along with shrubs has been meticulously planned as has planting of shrubs and ground cover on all exposed soil surfaces.

• The landscape design uses mulching to aid plant growth, and to retain soil fertility and moisture.

• A seasonal maintenance plan and integrated pest control plan have been conceived and incorporated.

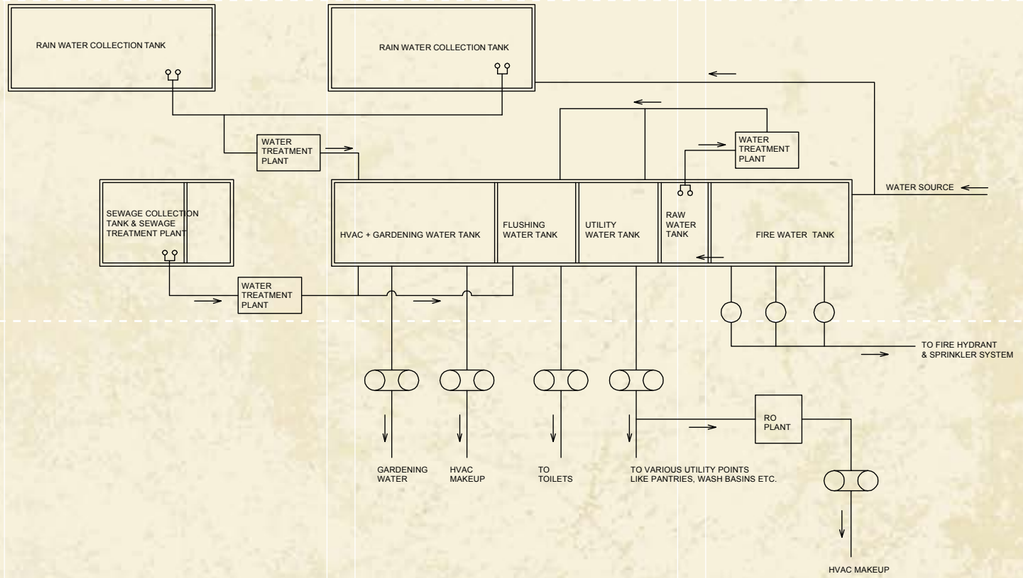
• Losses due to inefficiency of irrigation are cut by the use of technologies like sprinkler and drip irrigation.

The resultant demand after the implementation of these measures is wholly fulfilled by non potable sources like recycled gray water from S.T.P. or harvested rainwater.

Water Efficient Air Conditioning

Captured rain water or recycled water has been used for air conditioning units to reduce water consumption by 50%. To achieve this, water efficient chillers to reduce water requirement for cooling tower make-up were selected. Potable water requirements for cooling tower make-up in the water cooled chillers was estimated.

Schematic chart of the Water Management System at Suzlon One Earth



Reuse of storm water or gray water generated within the site has also been considered for water for air conditioning make-up.

Waste Water Reuse

Innovative waste water technologies have been used across the campus. All the waste water generated in the building including in 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.

The potable water for sewage conveyance has been reduced by 50%. The main aim was to reduce the generation of waste water and potable water demand, while increasing the local aquifer recharge. The requirement was to reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, or treat 100% of waste water on-site to tertiary standards.

Specific high efficiency fixtures have been used to reduce waste water volumes. The reuse of storm water or gray water for sewage conveyance via on-site waste water treatment systems has also been implemented.

Storm Water Management Plan

An important aspect of sustainable site planning is an efficient storm water management plan that limits disruption of natural water flows by eliminating storm water runoff, increasing on-site infiltration, and eliminating contaminants.
The project site was accordingly designed to maintain natural storm water flows by promoting infiltration. Storm water generated is redirected for non-potable uses such as landscape irrigation, toilet and urinal flushing, and custodial uses.

Rainwater run-off from the roof and landscape is channeled into two rainwater harvesting tanks of 500,000 liters capacity through an extensive network of drains at the external site level, and pipes at the basement ceiling level under the podium.

A separate storm water system for the basement comprises a widthwise slope to collect water in storm water collection chambers with grating. Water collected in different sumps in the basement is pumped to the storm water system on the surface.

One working and one stand-by pump has been provided for four dewatering sumps in four corners. The water is de-silted to a large extent during the conveyance in de-silting chambers and utilized for flushing, HVAC, and irrigation after treatment.

The use of alternative surfaces (pervious pavement) and nonstructural techniques (disconnection of imperviousness, rainwater recycling) has helped reduce imperviousness and promote infiltration, thereby lowering pollutant loadings. The storm water management system ensures removal of 80% of the average annual post development total suspended solids (TTS).

Waste

Approximately 50% of construction, demolition, and land clearing waste from Suzlon One Earth was recycled or salvaged.

Waste Management

A society that engages in wasteful behavior is one that will never achieve the goals of sustainability. The idea of a sustainable project is not only to reduce the wastage of scarce resources, but also to ensure the responsible reuse, as far as possible, of any waste generated. Optimum reuse and recycling of material helps pare down the negative effects of waste on the environment.

Construction Waste Management

Generally a huge amount of waste is generated during the construction process, and reducing this is a priority for any project that aims to be sustainable. A construction waste management plan for One Earth was developed and implemented, quantifying waste diversion goals. Construction waste was properly segregated, packed and diverted for recycling to appropriate vendors or channels to avoid land fill dumping.

Efforts were made to recycle materials like cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet, and insulation. Areas were designated on the construction site for segregated or commingled collection of recyclable material, and recycling efforts tracked throughout the construction process. Construction haulers and recyclers handling the designated materials were identified.

The company tied up with NGO 'Swachh' for collection of recyclable materials from the construction site. Provision was made for 'Operational Waste Management' by installing segregated waste collection units for recyclable materials on every floor, with a large dedicated storage area in the basement.

Zero Waste Policy

In addition a Zero Waste Policy has been formulated that is slated to become a very ambitious, committed and synchronous part of Suzlon's already established list of Green Corporate Social Measures. The Zero Waste Policy will guide people to redesign their resource use system with the aim of reducing waste to zero. It will also help to make people understand that resources such as paper, cardboard, food, etc. should be used responsibly in order to achieve a green office environment. The policy will project

the fundamental understanding that waste management starts at an individual level and that the person generating waste should be aware of its importance.

Operational Waste Management

In line with the implementation of the Zero Waste Policy, specific plans were drawn out for storage and collection of the operational waste with the aim of reducing the additional waste generated by building occupants that needs to be hauled to and disposed of in landfills. An easily accessible area that serves the entire building has been provided; this is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals.

The size and functionality of the recycling areas have been coordinated with the anticipated collection services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas. Consideration has been given to employing cardboard balers, aluminum can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling program.

Stringent measures were taken at every step to ensure that the One Earth campus adhered to the demands of sustainability at every stage of its execution. The completed campus heralds the future for energy efficient projects and represents a significant step in the battle against global warming.

Suzlon One Earth has been designed to create an inspiring place to work for Suzlonians

Social Sustainability

The concept of social sustainability encompasses human rights, labor rights, and corporate governance. It is based on the idea that future generations should have responsible access to social resources. The integrated project management team ensured that the One Earth project reflected the tenets of social sustainability from conception to implementation.

Humanistic

In order to improve productivity and have a positive psychological effect on employees 90% of spaces allow access to the view outside.

Working Comfort

It was the well known British statesman Sir Winston Churchill who so aptly said, “We shape our buildings; thereafter they shape us.” Today it is a well accepted fact that human health, comfort and productivity are influenced by our built-up environment. A sustainable building enhances the indoor environment quality and working condition of occupants by providing them with greater exposure to natural light, creating a soothing effect on the mind, and maintaining good indoor air quality. Besides helping to reduce power and water consumption, such buildings offer greater human comfort, and have a positive effect on well being and productivity. Research indicates that satisfaction with the working environment influences job satisfaction.

Indoor Environmental Quality

A sustainable building is one that goes beyond mere material and building techniques to safeguard the quality of the indoor environment. An uncomfortable work ambience not only affects productivity and morale of the occupants, it also counteracts all the care taken to design and build the exterior envelope.

Indoor Air Quality

One of the main considerations is to ensure that the quality of indoor air is suitable for occupants of the building. Mechanical ventilation systems have been designed to allow 30% more fresh air to circulate indoors and augment the comfort and well-being of occupants. This is higher than the required standard. CO_2 monitoring systems are installed in high density zones to regulate inflow of fresh air through use of dampeners and the TFA Units.

Maximum potential occupancy load has been considered while calculating outside air in all spaces. Fresh air quantities have been calculated on the basis of 30% more than ASHRAE recommendations for office areas, and 100% fresh air for short occupancy areas including cafeteria, gym, lift lobbies and core areas.

An efficient HVAC system and treated Fresh Air Units have been provided in the service cores at all floors. Fresh air monitoring devices in these units, and CO_2 sensors through a BMS integrated scheme ensure that the planned fresh air intakes are maintained.

The purpose of Construction Indoor Air Quality (IAQ) Management is to reduce indoor air quality problems resulting from the construction process in order to help sustain the comfort and well being of construction workers and building occupants. The IAQ management plan was completed before beginning construction and included construction related IAQ procedures in pre-construction and construction progress meeting agendas.

Technicans montoring the various systems on the IBMS

Instructions were given to the general contractor and awareness regarding the same was created by spreading relevant information among persons working on the site.

The project adopted the SMACNA (Sheet Metal and Air Conditioning National Contractors Association) guidelines to prevent indoor air quality problems with regard to HVAC protection, source control, pathway interruption, housekeeping, and scheduling.

HVAC Protection: Permanently installed HVAC equipment was not used during the construction process as it could cause contamination of the HVAC system. The system was properly covered to ensure it remained free from dust and debris during the construction. Dedicated places were assigned for storage of ducting materials and HVAC equipment. Coating on ductwork and internal insulation was checked for dust before installation. Duct ends were covered by plastic sheets or a tarpaulin of good quality. Open ends of ducts and overnight pending work were properly sealed and tied firmly with string or cord.

Source Control: Low VOC content materials such as paints, adhesives and sealants as well as carpets and composite wood with low toxicity levels were used. Containers housing toxic materials were recovered and isolated, and in some cases ventilated.

Pathway Interruption: Areas of work were isolated to prevent contamination of clean or occupied spaces during construction. Temporary barriers were used to prevent dust entry from construction site to finished areas.

Housekeeping: All electrical panels were covered with water proofing covers to protect from water entry. Moisture absorbing agents like carpets, furniture, adhesives, sealants, cements, etc. were stored in a moisture proof dry room.

Various combinations of lighting create a congenial work environment, give employees controlability and also help save energy

Scheduling: All construction activities over the duration of the project were sequenced carefully to minimize the impact on the indoor air quality. Upon completion of construction, all filtration media were replaced immediately prior to occupancy; only a single set of final filtration media equivalent to MERV 13 or higher was installed.

Outdoor Air Delivery Monitoring

A monitoring system ensures fresh air intake quantities are maintained and when the conditions vary by 10% or more from the set point, it generates an alarm via the building automation system alarm to the building operator. The regularly occupied areas in the project are conditioned by using a water cooled VRV system whose outdoor units are located on each floor in each block in a separate AHU room. Fresh air required for offices is pre-treated in fresh air treatment units.

The VRV system's Central Control Unit and the building's central BMS work in a co-ordinated way for outdoor air delivery monitoring. The field devices employed to maintain minimum ventilation requirements are:

- Modulating dampers at T.F.A.s (M)
- CO2 sensors within all densely occupied spaces (those with a design occupant density greater than or equal to 25 people per 1000 sq.ft)

Environmental Tobacco Smoke Control

In view of the health hazards posed by tobacco smoking in the work space, the entire One Earth campus is a strictly no-smoking zone.
A 'no smoking' policy has been chalked out by the management of Suzlon to ensure that a global environmental concern is taken care of even at the individual and corporate levels.

Controllability of Systems

Lighting plays a significant role in human comfort – too much can be as disturbing as too little. Over 90% of the regularly occupied areas have been provided with individual lighting controls. This gives flexibility to the individual and helps save power. Individual lighting controls have been provided for large cabin occupants and medium cabin occupants, and work stations have been equipped with task lighting.

Individual air conditioning controls allow the user to operate the unit only when needed; temperature control and air speed controls are available for each enclosed space.

Office areas have been air conditioned by using water cooled VRV units manufactured by Daikin. Water cooled outdoor units are located on each floor in each block in a separate AHU room. Refrigerant piping connects the outdoor units with various indoor units (minimum one per enclosed area). The system is 100% BMS compatible and all individual settings can be monitored and controlled, including features like scheduling and individual unit consumption.

For thermal comfort of occupants standards have been followed as per the ASHRAE standard 55-2004.

This specifies the combinations for indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space. The environmental factors addressed are temperature, thermal radiation, humidity and air speed. A permanent temperature and humidity monitoring system will operate in all seasons.

The thermal comfort survey of building occupants will be implemented by the facility manager within a period of 6 to 12 months after occupancy as part of the enhanced commissioning work.

After the survey thermal comfort complaints of occupants will be addressed by the BMS operator or maintenance staff on the phone. The complaints will be analyzed and corrective actions will be taken, such as fine tuning the air balancing by adjusting the diffuser settings, changing temperature set points, and

so forth. The possibility of opening glass windows for thermal comfort, increased ventilation, and to save power has also been taken into account.

Indoor Chemical and Pollutant Source Control

Special care has been taken to ensure that polluting zones such as toilets, copier rooms, etc. where chemicals are used have deck-to-deck full height partitions with self-closing doors. Make-up air in all these areas is drawn from outside or adjacent occupied spaces. Special care has been taken to ensure that all exhaust locations are at least 25 feet away from fresh air intakes of air handling units.

Separate exhausts and modulated air pressure have been provided in copier rooms so that polluted air does not mix with air conditioning and fresh air supply.

Permanent entryway systems (3M mats) to capture dirt and particulates are employed at all high volume entryways.

Daylight

The daylight zone and prediction calculations from daylight simulation results demonstrate a minimum Daylight Factor of 2% in 75% of all space occupied for critical visual tasks. That means 75% of all regularly occupied spaces get adequate daylight, diminishing the need for artificial light and creating more natural conditions in the workspace.

Views

In order to improve productivity and have a positive psychological effect on employees 90% of spaces allow access to the view outside. It is believed that access to a window that allows enough daylight and an outside view is beneficial to occupants and that it affects their satisfaction with their work space.

Transportation

In any city, commuting to the work place and getting secure parking is a major problem. Alleviating this problem considerably increases the comfort level of the employees.

Extensive views of beautifully landscaped outdoors help employees to destress while at work

Use of non-polluting e-vehicles is being strongly advocated at Suzlon One Earth

The One Earth campus comprising the office complex and a corporate learning center is estimated to eventually accommodate 2,500 people; thus smooth and efficient traffic management was an important factor of the design. While sufficient parking space has been allocated to accommodate the large number of personnel slated to use the campus, measures have also been initiated to reduce pollution from automobile use. The idea is to reduce individual transport requirements and employ alternate transportation such as campus bus lines, car pools, etc.

In the interests of sustainability, initiatives like car pooling are encouraged. Five percent of the total vehicle parking capacity on-site is earmarked as dedicated parking for carpooling.

Easily accessible parking spaces near entrance lobbies in the basement of the building have also been allocated for differently abled personnel.

The company bus service caters to employees of One Earth, providing pick ups from convenient locations around the city.

The company has also provided 96 e-charging points in the basement that can serve more than 3% of building occupants. Dedicated and labeled preferred parking spaces have been identified in the parking area for the same.

Communication

Pioneering initiatives such as Green Education and Green Housekeeping have been undertaken to ensure that the occupants of One Earth use resources sustainably.

Communication & Awareness

A building is a physical and stationary component while the occupants are dynamic. The inter-relationship between the two needs to be synergized with the larger goal of environment. Suzlon has identified various processes to recognize values in order to develop the human behavioral skills necessary to understand and appreciate the inter-relationship between man and his bio-physical surroundings. The entire One Earth campus is based upon the principle of promoting and initiating awareness about sustainability. The built component, i.e., the Suzlon One Earth campus, is used as an added communication tool to portray an overall perspective, which acknowledges the fact that the natural environment and the man-made environment are interdependent.

Among the various communication strategies adopted at Suzlon One Earth are Green Education, Green Signage, and the Green Tour. These strategies create a continuous process for effectively communicating the goals of sustainability through the building and its users. The end result is human resource that learns about and from the environment on a continuous basis.

Infrastructure has also been incorporated to facilitate communication amonsgt Suzlonians across the world from the comfort of the Suzlon One Earth office.

Green Education

The Green Education initiative was implemented within the company in three phases. The first phase involved a series of workshops for everyone from top management to the workforce. This had three levels – safety and Kaizen, ecological footprint, and company values.

The second phase was an induction program before actually moving to the campus. In this each batch was taken through every aspect of the campus to orient them with the spirit behind the planning and facilities.

Suzlonians attending a Green Education workshop

This internal education was aimed at orienting people for a culture fit in the new premises. The third phase involved surfacing and bridging gaps between 'aspired and as is' through proper training, information sharing, informal interactions, and printed communiqués.

Green Education also involves outbound-nature awareness through outdoor activities, education about food consciousness in everyday choices, backyard science and similar projects, and information about careers in sustainability.

Green Tour

Green signage has been set up across the campus to provide information about the sustainability measures undertaken, not only for occupants but also for visitors. A Green Tour allows visitors to view operations at One Earth. Signage has been designed for various spots from the start to the finish point. A Green Tour map will be provided to visitors who will be accompanied by a guide.

A dedicated technology park displays actual components of the Suzlon wind turbine with the purpose of educating and familiarizing people with this technology. A Wind Gallery showcases the history of the endeavor of human beings to harness wind down the ages.

The Wind Gallery at Suzlon One Earth that informs visitors about windmills and wind energy

Strategically placed Green Signage helps employees and visitors understand the mechanisms, systems, and material used to create a sustainable environment at One Earth

Green Housekeeping

Creating a sustainable building is just one of the steps to sustainability. Once a building is completed, construction material disposed, and the HVAC system balanced, the single greatest controllable impact on the green building environment is housekeeping and maintenance. The real challenge is to maintain and ensure that all systems set in place continue to run that way. Preventing cross-contamination, reducing waste, and ensuring proper use of all systems is very important.

Supervisors, workers and contractors need to be educated about cleaning for health, improving current cleaning standards, understanding green products and equipment, and identifying areas for improvement in a green building.

Proper maintenance ensures improved Indoor Air Quality, a healthier workplace, reduced long term maintenance costs, improved productivity and attendance, increased revenues, more productive workers, and safer materials and less exposure to hazardous materials.

It is through this process of continuous green education that Suzlon One Earth is communicating with the workforce and sensitizing them to environmental issues.

Audio Video Communication

The Suzlon One Earth campus revolves around people. It has been designed to be scalable, user-friendly, and accommodate Suzlon's needs as the company grows and expands.

Suzlon has a global presence with offices across 21 countries and factories and manufacturing units in five countries. Constant interaction has to be maintained between these offices and the headquarters. To reduce time and resources spent on commuting to the headquarters in Pune, a well-planned telecommunication infrastructure including tele-conferencing facilities with extensive audio and visual services has been provided on the campus.

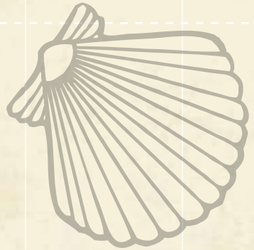
The telecommunication facilities are in keeping with the team's commitment to providing the greenest possible environment, along with functional and easy-to-use solutions that are in tune with the needs of the employees.

The campus also features the most advanced digital signage solutions and uses innovative devices, such as LCD displays that can be converted into writing surfaces. This allows discussions to take place at every possible location on the campus.

An interactive projection on floor near the coartyard in the Suzlon Excellence Academy has also been created to entertain guests and create a 'wow factor'.

Environment, Health & Safety

While great care was taken to ensure the comfort of the final occupants of the One Earth Campus, the team ensured that equal attention was paid to a generally ignored human resource: the laborers who undertook the actual construction. Efforts were taken to ensure 'Socially Responsible Construction' at all stages of the project. Consistent health and safety measures were taken for the well-being of laborers and their family members.



Prevention of air pollution: A screen was provided along the site boundary to prevent construction dust from spreading in the neighborhood. Water was regularly sprinkled on the approach road to prevent dust from vehicle movements.

Prevention of noise pollution: Acoustic enclosures were provided for all DG sets used during construction. Acceptable outdoor and indoor noise levels were checked regularly during construction.

Prevention of water pollution: A sedimentation tank was constructed near the concrete batching plant to prevent underground water pollution. Waste water recycling and reuse was facilitated during construction.

Health Initiatives

Qualified doctors conducted regular health check-ups for the workers at the site. Well maintained sanitary facilities were provided at the site as well as in the labor camp. Clean drinking water from the Municipal Corporation water supply was made available for the workers working at the site as well as in the labor camp.

Safety Initiatives

Signage highlighting safety measures was displayed at the site to create awareness among the workers. Safety tool box meetings were conducted on-site every day. An assembly point was demarcated for workers to gather in case of an emergency. Regular mock drills were conducted to check their readiness in case of an emergency. The use of safety nets was mandatory for all heights more than 15 m.

Social Initiatives

With the help of the NGOs Intervida, India and Jagruti, a crèche was provided at the site for the children of laborers. Constant motivation and encouragement was provided to enroll families in education and health programs conducted on-site. Items like school uniforms, sweaters, shoes, toys and school bags were also distributed.

Economic Sustainability

When we talk about economic sustainability it is not just about achieving economic growth year on year. More accurately, it involves understanding that economic growth is only sustainable if it simultaneously improves our quality of life and the environment. While long term savings are indeed a goal, what is more important is how those savings were arrived at, and the impact on the environment in the process.

Materials & Resources

Sustainability implies the use of environment friendly material from renewable resources. It advocates the use and reuse of recycled material, especially from indigenous and regional sources that are more likely to suit the requirements of a project in a particular area.

The One Earth project adhered to three main parameters with regard to selection of materials – they were either recycled, regional, or rapidly renewable.

Recycled material: During construction the intent was to decrease the embodied energy of the building by selecting materials with higher recycled content thereby reducing impacts resulting from extraction and processing of energy extensive materials.

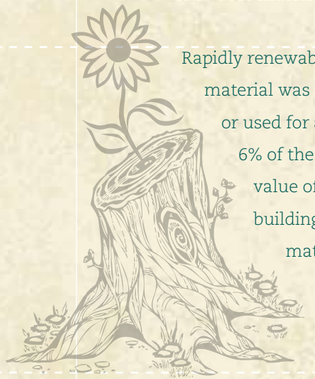
The project used materials with higher recycled content so that the sum of the post-consumer recycled content plus one-half of the post-industrial content constituted at least 10% of the total value of the materials in the project. The materials used at the campus had not only higher recycled content but many interior finishes such as ceilings and glass partitions composed of recycled material.

The strategy was to establish a project goal for recycled content materials and identify material suppliers that could achieve this goal. During construction, care was taken to install the specified recycled content materials covering a range of environmental, economic and performance attributes.

Regional material: This refers to material available within an area delivery radius of 800 kms in order to avoid unnecessary expenditure of fuel and time on transportation. The aim of the project was to increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation. The project has used 80% regional materials, which is noteworthy by any standards.

The strategy was to establish a project goal for locally sourced materials and identify materials and material suppliers that could achieve this goal. A range of environmental, economic and performance attributes were also considered when selecting products and materials. Efforts were made during construction to ensure that the specified local materials were installed, and processes were put in place to quantify the total percentage of local materials installed.

Rapidly renewable materials and products: These materials are made from plants that are typically harvested within a ten-year or shorter cycle. The intent was to reduce the use and depletion of finite raw, and long-cycle renewable materials by replacing them with rapidly renewable materials.



Rapidly renewable material was specified or used for almost 6% of the total value of all building materials and products used in the project. The project used energy efficient materials in the interiors.

A project goal for rapidly renewable materials was established and product suppliers that could support the achievement of this goal identified. Materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork were used in flooring, skirting, ceiling tiles, walls or partitions, etc. It was ensured that the specified rapidly renewable materials were installed during construction.

Certified Wood

One of the aims of the project was to encourage environmentally responsible forest management, and therefore only certified wood was utilized for various requirements for virgin wood.

Efforts were made to use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council's Principles and Criteria, for wood building components including structural framing.

A project goal for FSC-certified wood products was established and products and suppliers that could achieve this goal identified. During construction, it was ensured that the FSC-certified wood products would be installed and that the total percentage of FSC-certified wood products installed would be quantified.

Integration of Construction Process

It was of utmost importance that all the different sustainable features and services of the campus were planned and integrated right from the beginning, to ensure optimal use of time and resources, and reduce wastage over the duration of the project.

The emphasis was on the synergy of different services with the underlying but all-important sustainable initiative. The sequence of construction activities was decided and designed in such a manner that the right item was available at the right time. The various systems installed were integrated with the building management system for better control of the operations, an endeavor that surpassed green building requirements.

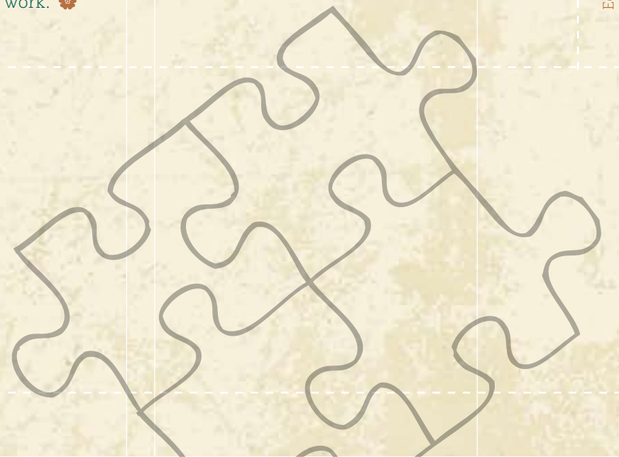
The overall project was divided into three parts from the execution point of view: the Learning Center and the Sun Lounge were in the first phase, followed by the Sky and Tree Lounges, and finally the Aqua Lounge.

The excavation of the plot was undertaken in a box type of cutting. This ensured speed of construction as well ease in handling of material at the basement level. The services which needed to go underground were designed and kept ready, and installed along with the foundations for building columns. The rafts followed immediately after.

Landscaping activities were planned simultaneously with the basic building and infrastructure. Landscape plantation activity was planned to coincide with the onset of the monsoon. The lighting for the landscape was also integrated with these activities.

Infrastructure for various services like the water requirement for the water cooled VRV system, rain water storage tanks, wind mills for generation of energy, etc. was accommodated with optimum space efficiency.

Separate shafts for individual services facilitated the simultaneous working of different teams. Multiple teams working in the same shaft, like electrical and IBMS, were staggered on a time scale. These activities were managed in such a fashion that the overlap of one service would not affect the other activity. The plumbing electrical works were started along with the building envelope. Fire fighting works for the building started from the basement for the sprinkler system and continued on upper floors along with the development of the work.



Commissioning

Buildings are very complex systems, especially 'high performance' buildings. The role of engineering is conventionally limited till the completion of construction when all the building systems are installed as designed. Hardly any connect is established in the post occupancy and operation maintenance stage of the installed systems with the overall goals of sustainability. Sustainable engineering solutions are often not used to solve existing operational and comfort problems in buildings. Part of the reason is a lack of understanding of the problems and a lack of engineering knowledge on the part of the facility operations staff.

This is where building commissioning comes in; it is essential to ensure that all systems in a completed building work properly. Basically, commissioning is a Systematic Quality Assurance Process for achieving, verifying and documenting the performance of equipment; meeting the operational needs of the facility within the capabilities of the design; and meeting the design documentation and the owner's functional criteria.

At Suzlon One Earth, right from the design concept stage man hours were dedicated to chalk out a wholesome engineering process based on the most relevant concepts of sustainable commissioning. This was intended to focus on improving the overall system control and operations for the building as designed and used, and to meet existing facility needs. The building services, commissioning and project management teams worked in tandem with the sustainability partners to ensure that an integrated approach was used to ensure local system optimization and adherence to improved operational schedules.

The commissioning process went beyond an operations and maintenance program; it was closer to a comprehensive commissioning evaluation that developed operational parameters and schedules to meet occupants' needs. In addition to energy, resource and cost savings, on a physical scale this enabled sustainable engineering solutions to operational problems; superior energy performance; increased staff skills; and reduced maintenance costs.

On the human scale it improved the comfort, health and safety of building occupants and helped increase occupant productivity, and lower absenteeism.

Understanding the need for meticulous commissioning, the project management team appointed a third party commissioning agency, to ensure that system performance and multi-layer commissioning processes were established and followed. Performance is certified by the agency for its correctness with the help of specialized stimulation tools and software.

The commissioning process started at the installation stage with the preparation of pre-commissioning checklists for the start-up system / equipment. The actual commissioning process involved sequential checks by vendors, designers, project management consultants, facility team and client; and third party agencies.

The project team established operation and maintenance systems in consultation with all stakeholders. O&M formats and checklists were prepared for monitoring and controlling performance and operating staff given basic training in the same.

Economic sustainability was achieved because all stakeholders involved in One Earth collaborated and worked together without losing focus of the aim to create a truly sustainable campus on all counts.

Challenges & Learning

A project of the magnitude of Suzlon One Earth cannot be implemented without encountering challenges, some small and easily handled, others of a more serious nature. In many ways, this was a path breaking project, and apart from the usual challenges of building a multi-faceted campus, this one had to consistently adhere to the principles of sustainability.

The precedents were not many, and the One Earth team had to come up with innovative solutions that ensured the project went ahead smoothly. Sometimes it seemed as if the hurdles, in areas ranging from design to execution, were insurmountable, but consistent efforts and patience soon revealed surprising solutions. What the One Earth team has taken back from the experience will prove invaluable, not only in terms of lessons learnt, but also as a case study for future projects.

The challenges started appearing in the early stages, and each time it seemed that one had been successfully tackled, something else came up that had the team putting together their resources and experience towards a sustainable solution. This is a brief overview of the challenges and the learnings faced.

Excavated soil disposal & handling: Huge quantities of soil had to be excavated at the site. The challenge was how to preserve and reuse this soil without affecting the environment. The fertile soil excavated during the construction was transported to a nearby site where the Department of Irrigation planned to construct a park. Some soil was stored at a nearby plot and reused for landscaping at the campus. Hard murum was also stacked at a nearby plot and used for backfilling to achieve desired levels.

Windmill installation in 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 windmills could be installed. However, after a lot of follow up with the relevant government agencies, the team discovered that legal permission was not essential as per existing laws.

All the various stakeholders had to be convinced towards the incorporation and placement of on-site wind

turbines in their individual design schemas, such as in the architectural site plan or the landscape plan. This was achieved through gruelling sessions of integrated design exercise in project meetings. It turned out that the integration of this ambitious concept was possible without compromising on the aesthetics, image or functionality of the project. The end result was that the electricity generating wind turbines were duly set up on the campus and are used to power the Data Center and external lighting for the campus.

Ironically, the biggest challenge for a company that is a leading global wind turbine manufacturer was evaluating a product to suit their scale and choosing the right vendor. For windmill manufacturers, selling a windmill to Suzlon was like offering to sell a car to an automobile major! Techno commercial evaluation of vendors from across the globe was done based on the concept of product life cycle cost, and this required considerable study and analysis at the team level. After much deliberation, Unitron, a company located near Pune, was eventually chosen and 18 windmills and solar panels were thereafter installed and successfully commissioned.

Glass cylinder installation : One of the highlights of the design for One Earth was the installation of huge glass cylinders located in the different wings to allow penetration of daylight inside the building. The challenges involved finding a competent agency to design these unique cylinders, and another to execute work of the required precision, aesthetics and quality.

The team discovered that it was possible to build environment friendly structures on this scale; technologies were available provided the end requirement was clear and that the task was conceived in a systematic manner. Despite the fact that there was no precedent for a similar structure, it was possible to develop and train agencies to execute and deliver the desired results with appropriate support and guidance from technical experts in the field.

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 facades. They act as a principal or ancillary source of electrical power, and are increasingly being preferred in sustainable buildings. The concept of BIPV had to be explained to the stakeholders, along with details on how it could be seamlessly integrated with the rest of the building without affecting the basic design intent. The material specifications and design aspects had to be carefully considered before going ahead with the installation.

Co-ordination among various stakeholders: Creating and maintaining synergy among the various stakeholders was one of the biggest challenges for the Suzlon team. Fortunately every stakeholder shared the common goal of sustainability, and worked in tandem with others to achieve it. There was a strong synergy amongst the team members and regular communication ensured that each of them was on the same page at every stage of the project. Proper documentation by all stakeholders helped the team to remain focused and established greater clarity on contentious issues. This proved more effective than relying on verbal discussions.

Water sourcing and effective water management: Along with energy, water is one of the most precious renewable resources facing constant threat of depletion. Identification of water sources was thus 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 desired goals. The end was always kept in mind while working to overcome this challenge, and an impressive water management system was put in place.

Achieving all the targets set by the client: Apart from the general brief on sustainability and green building, several out of the box goals were laid out, which added to the already formidable list of benchmarks to be achieved. The team discovered that spending more time at the drawing board, without setting foot on the site, was a very profitable investment as it facilitated a clear design brief. A coherent design brief is half the job done for any designer. Accordingly, extensive design briefs for architecture, landscaping, interiors, electrical, HVAC, water, waste, etc. were prepared, resulting in increased clarity and learning for the entire team.

Integration of various systems on a common platform: An Integrated Building Management System (IBMS) had to be created and followed to achieve sustainability at every level of the project. While the task seemed monumental, the team discovered the advantages of keeping all their options open. What is essential is to demand what you desire and solutions will then follow. An important learning was that setting low targets ended in low results; it was only the most demanding targets that brought the most noteworthy results.

First installation of water cooled VRV system in India: Among the many firsts that this project saw, was the installation of a water cooled VRV system, the first attempt in India by the vendor (Refrisynth). Though the concept was completely new, a systematic design and construction approach helped mitigate the risk involved and achieve the targets set out. The far-sighted team discovered that sometimes it was essential to go beyond geographical limits and set norms to achieve desired engineering solutions. The system, which reuses water from rain water tanks and treated sewage water, is more energy efficient and helped to significantly reduce the air conditioning load.

Reduction in lighting load: A truly sustainable project is one that saves significant amounts of energy. Reduction of the lighting load was thus a priority. The use of LED lights, light sensors, and daylight harvesting resulted in reducing the internal lighting load to 0.8 watt / sq. ft., apart from bringing major cost reductions as well. While the odds may seem high, calculated risks need to be taken for innovative solutions, a fact that the team learnt over and over again as the project progressed.

Zero waste infrastructure: Waste is not a concept that can be lightly dealt with in a sustainable project of the size of One Earth. While effective waste management seemed like an intimidating task, a systematic approach and appropriate technical expertise led to feasible solutions. The project was able to achieve the goal of implementing an effective infrastructure targeting zero waste at One Earth.

Global slowdown effect: The project was well underway when the effects of the global slowdown were felt across the board, especially on the financial front. Effective fund management helped operations to continue smoothly without affecting the goals, and consistently sustained the project.

The glass cylinder at One Earth that channels light and fresh air into the building

Economics of a Sustainable Project

The Suzlon 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. The Suzlon One Earth campus uses less energy, water and natural resources, creates minimal waste, and is healthier for the occupants compared to a standard conventional building.

The appearance of a Green Building may be similar to any other building. However, the difference is in the approach, which revolves around a concern for conservation of natural resources, human comfort and productivity.

Green Building Benefits: Green building trends and perspectives around the world have clearly indicated the Global Construction Output in year 2007 as US$4.7 trillion in Asia and US$0.81 billion in India, which contributes 8% to 10% of GDP.

Green building accreditation provides rich dividends by carefully giving inputs in design, construction, operation and relocation of built environment in an extremely cautious, energy efficient and sustainable manner in the following areas of concern:

- Sustainable Site Planning and Design
- Water Efficiency
- Energy Efficiency and Ozone Protection
- Low Energy Materials and Resources
- Enhanced Indoor Environmental Quality

Suzlon One Earth and Sustainability

From concept to completion of this project, we have achieved major milestones resulting in reduction of operating costs on energy and water, besides several intangible benefits like:

- Minimal disturbance to the natural ecology of the site
- Use of recycled and environment friendly building materials
- Use of non-toxic and recycled/ recyclable materials
- Efficient use of water and water recycling
- Use of energy efficient and eco-friendly equipment
- Use of renewable energy resources (wind/solar)
- Indoor air quality for human safety and comfort
- Effective controls and building management systems

Suzlon One Earth offers a range of Economic and Environmental Benefits:

- Enhanced comfort for occupants
- Improved productivity of occupants
- 30% to 40% reduction in operating cost, due to energy savings at 40% and water savings at 30%
- Health and safety of building occupants
- Adoption of best operational practices from day one
- Incorporation of latest techniques and technologies
- Projection of green corporate image from the outset

Special care was taken in the following areas:

- Preservation and reuse of topsoil for landscaping of pre-identified site
- Substantial daylight harvesting on all office floors
- Central courtyards with provision for daylight, and evaporative cooling system
- Ductless ventilation system at terminus level to achieve minimum 40% energy saving

• Use of energy-efficient ventilation system in toilets and other utility areas
• Use of treated gray water for irrigation and air conditioning cooling water make up
• Energy efficient building envelope by providing almost 100% over deck insulation and high performance glazing
• Use of energy-efficient air conditioning systems with water cooled VRV system
• Use of energy-efficient utilities like a hydro-pneumatic pumping system
• On-site renewable energy through wind turbines and solar photovoltaic panels
• Off-site wind turbines to supply electricity to national grid even ducting construction stage
• Post-occupancy monitoring procedures planned in advance through IBMS
• Careful handling of construction waste through efficient implementation of EHS plan focused towards effective waste management
• Installation of Organic Waste Converter for processing organic waste like food waste, garden waste, etc.
• Use of materials with recycled content like ACP, glass, wooden flooring, fly ash in concrete and masonry, etc.
• Resource reuse such as stone from excavation used for boundary wall substructure, and reuse of construction water through water collection sedimentation plants
• Use of paints, sealants, and adhesives with low VOC
• Provision of infrastructure to charge e-vehicles to encourage the use of eco-friendly transportation .

It should be noted in the correct perspective that substantial savings are achieved due to adherence to post tensioned slabs and beams over conventional RCC design.

• Reduction in reinforcement steel volume by 50% (Excluding Strands)
• Reduction in concrete volume for slabs and beams by 37%
• Reduction in concrete volume for column and footing by 10%

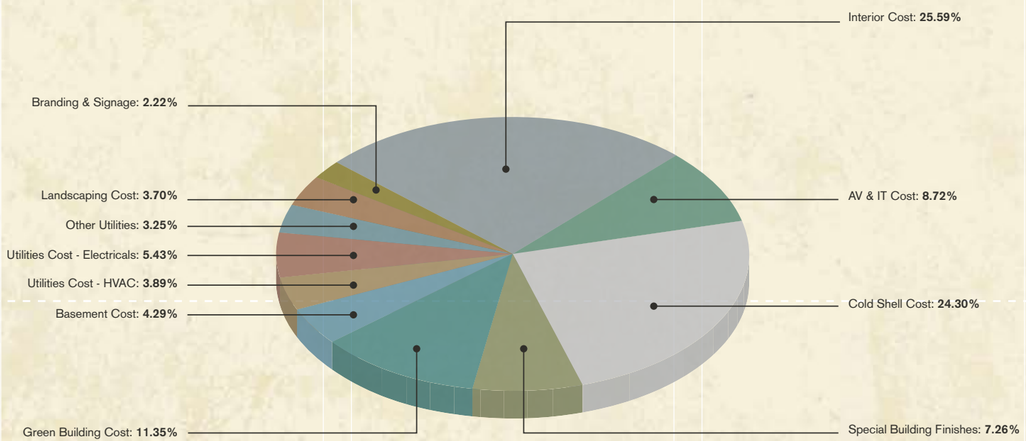
Arguably, Suzlon One Earth is one of the best examples of sustainable

Economics

The following data provides a comparison of the cost aspects of a standard building vs. Suzlon One Earth, which is aiming for LEED NC Platinum rating and GRIHA Five Star rating:

Sr. No	Particulars	One Earth Project	Conventional Project
		Percentage of total cost	Percentage of total cost
1	Cold Shell Cost	**24.30%**	31.56%
2	Special Building Finishes	**7.26%**	6.51%
3	Green Building Cost	**11.35%**	1.50%
4	Basement Cost	**4.29%**	9.91%
5	Utilities Cost-HVAC	**3.89%**	3.17%
6	Utilities Cost-Electricals	**5.43%**	4.84%
7	Other Utilities	**3.25%**	5.81%
8	Landscaping Cost	**3.70%**	3.05%
9	Branding & Signages	**2.22%**	2.05%
10	Interior Cost	**25.59%**	23.91%
11	AV & IT Cost	**8.72%**	7.69%
	Total	**100%**	100%

Suzlon One Earth: Overall Percentage - Cost Breakup Without Land Cost



design and construction in an urban area. The project is a benchmark and offers a case study for professionals like architects, designers, services consultants, engineers, and developers not only in terns of design and execution but also for the economies achieved.

The Economics of Green Buildings in India

The Indian Green Building Council has played a pivotal role in promoting the green building movement in the country. It is imperative for our very existence that all new infrastructure development in India follows sustainable design norms. The cost of green building construction and operation in India has come down considerably since the early days (2004) when the additional cost for a LEED certified building was as high as 25%. Today, a green building can achieve a Silver level certification at an incremental cost of 5%, Gold at about 10%, and Platinum at 15-20%, depending on its size, location, and basic cost. This does not typically include the renewable energy component, which can add another 10-20% depending on the size and renewable energy technology.

Suzlon One Earth has achieved Platinum level certification standards and over 150 kW (5% of its annual energy use) with a total incremental cost of about 11%. There are no other LEED certified buildings with this level of certification and on-site renewable energy that have achieved this kind of cost-efficiency. This has been possible due to early incorporation of green principles in the planning and design of the building, strategic investments in high-tech energy efficient technologies, and overall optimization of materials and resources.

Suzlon One Earth has proved that it is not only possible to make a green building of the highest rating, but that it can be made cost effectively without compromising on features, finishes, or utility.

A Legacy for the Future

Unique Sustainable Features

Sustainability was the main requirement of the brief for Suzlon One Earth, and obviously it was one that was followed to the minutest detail. While innovative features were introduced at every stage of the project, there were some aspects that are unique to it and bear repetition. These are the features that distinguish Suzlon One Earth from other green buildings, and will be highlighted in any reference to this ambitious project.

Renewable Energy Integration - Turbines and Solar

Suzlon One Earth showcases a remarkable integration of renewable energy (RE) with the building design and landscape for a typical urban setup. With an installed RE capacity of over 150 kW, it signifies Suzlon's commitment towards environmental excellence in more than one way.

Suzlon One Earth has 18 wind turbines with a cumulative installed capacity of 85.5 kW, located on 24 m high towers situated on the outer periphery of the complex. The solar modules have been strategically integrated with the CLC block roof and the terraces of A/B/C blocks. This wind-solar hybrid system comprising five clusters of windmills and solar panels is able to meet 5% of the project's energy requirements.

The implementation of a wind-solar hybrid system on an urban scale is a monumental task given the technical difficulties of locating the system, and the financial challenge posed by the long projected payback period of over 15 years. Very few buildings in the country of this scale have such a integrated approach towards building design, site planning, and renewable energy.

Incorporation of Concourse / Terminus as a Functional and Utility Space

By definition a concourse is a public square, courtyard or open space, and the terminus defines the finishing point or the limit.

Suzlon One Earth interweaves the vocabulary of these two terms in its architectural design for the basement level. The basement is designed to be an active part of the structure and not a dead end meant only as a parking area. It houses the cafeteria and the central plaza and receives useful daylight through punctures

in the upper slab. The result of this approach is a sense of openness and visual connect in the basement, making the area activity oriented even while ensuring optimal use of space.

Task Lighting at Each Workstation / Daylight Harvesting Design / Exterior LED Street Lights

The building envelope optimizes its daylight harvesting potential, thereby greatly reducing the energy requirement of the building.

Efficient Lighting Design

Making maximum use of daylight helps save a significant amount of energy. The 9-ft full height glazing coupled with a narrow floor plate - 79 ft in general and 59 ft in the Sun Lounge provide tremendous potential for daylight harvesting. This potential has been fully utilized by non-obtrusive placement of enclosures like conference rooms and the use of intelligent lighting controls. Cutouts along the periphery wall in the basement and a large one at the center of the building cut down the need for basement lighting during the daytime.

The lighting system in the interiors incorporates dimmable ballasts, electronic ballasts, occupancy sensors, motion sensors and daylight sensors. These ensure that lights get switched on only when required. The general lighting level from the ceiling luminaries is fixed at 350 lux. The artificial lights can be dimmed up and down from 0% to 100% depending on the adequacy of available daylight to meet the 350 lux requirement. The task lights have a built-in occupancy sensor in conjunction with a continuous dimmer. Lighting of individual offices is controlled by combined daylight and occupancy sensors.

The project also showcases enhanced energy savings due to a LED based Outdoor Lighting system, which results in around 65% savings (in terms of wattage) when compared with a conventional scheme. All the outdoor lights are controlled through the Integrated Building Management System.

Green Education Aspects / Green Tour

A truly unique feature of Suzlon One Earth is the creation of enriched human dynamics that is environmentally aware, socially responsible, and compatible with the built space it occupies.

Suzlon has identified various processes to recognize and develop the human behavioral skills necessary to understand and appreciate the inter-relationship between man and his bio-physical surrounding. The entire One Earth campus is based upon the principle of initiating and promoting awareness about sustainability. The built component, i.e., the Suzlon One Earth campus, is used as an added communication tool to portray an overall perspective, which acknowledges the fact that the natural environment and man-made environment are interdependent.

Among the various communication strategies adopted at Suzlon One Earth are Green Design Education, Green Signage, and the Green Tour. These strategies consider the built environment in its totality and create a continuous process for effectively communicating the goals of social sustainability through the building and its users. The end result is an inter-disciplinary human resource that learns about and from the environment on a continuous basis.

Commitment and Involvement of Top Management

It is rare for a corporate project to see the consistent levels of involvement and commitment from top management that Suzlon One Earth has wintessed. The implementation team benefited tremendously from the active involvement of the top management at every phase of the project, whether it was at the design stage, or during execution, commissioning, or O&M. The keen involvement of the management helped orient the project team towards aiming for excellence, even while providing timely support at all critical times. This support encouraged the project team to introduce many path breaking ideas that they were able to execute with the help of an outstanding array of logical procedures.

Continuity of Project Values in Operations

Operations and Maintenance (O&M) is one area which defines the performance of all the project management processes, and reflects the aftermath of the critical decisions taken thus far. In a conventional approach, once the project is commissioned those responsible for O&M fail to procure synergy from the project values that were reinforced during the project management. This gap has been eliminated at Suzlon One Earth where the process continues beyond commissioning. The general operations and maintenance program is tailored to be a comprehensive evaluation that not only takes care of the O&M but is also able to develop operational parameters and schedules to meet the needs of occupants. In addition to energy, resource and cost savings, on a physical scale this process serves as a sustainable engineering solution to operational problems, and increases staff skills; whereas on a human scale it aims to increase the productivity of occupants.

This is Suzlon's legacy for the future. With One Earth, it has created a superlative environment not only for its people, but also set into motion a process that will save the planet for generations to come.

A Sustainable Future

The end of a project brings with it not only a sense of accomplishment but also the chance to retrospect and mull over the eventful journey from conception to completion. Suzlon One Earth is up and running, testimony to the fact that one man's vision can and has been translated into a believable reality. While sustainability was the hallmark of this amazing project, what held it all together was a remarkable synergy.

One of the most important skills for effective project management is the ability to synergize. The primary challenge of project management is to achieve all the project goals and objectives while honoring the preconceived project constraints.

Various stakeholders need to carry the initial vision from the designer's table to the engineering solutions and construction, and then commission it without losing any value.

Ever since people began forming groups to accomplish aims that they could not otherwise achieve as individuals, good management has been essential to ensure coordinated and concerted efforts to achieve success. Society thus has come to rely increasingly on synergy and pooled knowledge. Synergizing is the process of conceptualizing, designing, constructing and maintaining an environment in which individuals, working together in groups, efficiently select aims and set targets for achievement.

When the Synefra team took on the Suzlon One Earth project they were daring to dream. And dream big. To take the dream to reality involved relentless work, planning and managing strategies and policies, a far sighted entrepreneurial approach, meticulous organization, and most importantly, thinking out of the box. The taskforce worked as a cohesive entity, displaying explicit faith in the team leader as well as all the stakeholders, right from the initial stages through to closure management of the project. Each member has put in Herculean efforts and innumerable man hours to create Suzlon One Earth, an engineering marvel conceived to adhere to the exacting green building standards of LEED Platinum and GRIHA Five Star building certifications.

For the Synefra team, successfully completing the task at hand was more than just another notch on our progress chart. Every member of the team took on this immense challenge to ensure the continuance of sustainability and for the betterment of future generations. It is a universal truth that contemporary building design should focus on energy conservation to be able to sustain the power resources of a nation. Suzlon One Earth was our contribution to taking 'green' to 'greener'.

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 a 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.

Let us open up new avenues for the future of the construction industry. This is a relay where the race cannot be won unless the baton is passed on in time. Unless the seed that is planted by a visionary is not nurtured

by all the stakeholders involved, a strong tree will not emerge. It is time to work on a concept to encourage stakeholders in the industry to shift to sustainable and greener building design, materials, and technologies, and to facilitate exchange of ideas amongst participants and experts.

This is a call to action for our fraternity to reinforce and synergize resources to sustain this planet, which we have borrowed from our future generations. It is up to us to work towards the betterment of our own society, while moving towards a sustainable future, and averting the depletion of our limited natural resources.

We all have dreams. With commitment and focus and dedication we can make them come true. This is not the end of a story – it is the beginning of a new consciousness.

The center of the One Earth Campus, the Deep Stambh is visible from all the buildings and the cafeteria

Acknowledgment

This book would be incomplete and inadequate without acknowledging the contribution of some key drivers on the aspects of sustainability, whose resilient spirit to learn and yearn made One Earth a unique project. This book exists because of a team of individuals and agencies who agreed to walk that extra mile and push themselves beyond the obvious.

First and foremost, I acknowledge with pride and gratitude the spirit of my Synefra team. Sujit Dengale, Shimon Samuel and Prashant Trivedi for technical applications and improvisations, Manoj Modi for commercial management, and overall coordination and leadership of Jitesh Donga. The never-say-die spirit of this team supported by all their colleagues pushed boundaries at every stage and crossed each hurdle to reach the desired goals.

Our construction management team of Knight Frank has been a strong support to ensure that the set norms were adhered to and closed as required.

Anjali Dwivedi from the Synefra team has patiently and relentlessly documented, coordinated and matched the zeal of the team to publish this book.

Our gratitude to Suzlon Energy Limited who provided us this wonderful platform to stretch our knowledge base and set benchmarks in sustainable and green infrastructure space. Their mission of 'Powering a greener tomorrow, today' was our inspiration to create a place which will Walk their Talk and go much beyond.

From the Suzlon team, my special thanks to Mr. Yesheen Vibhakar from Business Excellence, who ignited the 'green' flame in all of us. His initial directions and guidance helped us clear our vision and made our mission achievable. The Technology, Engineering, Marketing and Liaison Teams of Suzlon Energy were our executing partners and guides in their respective areas of expertise. Special mention for the Suzlon IT team who have stood by us right from the conceptual stage and have been an integral part of the team to integrate the audio, visual and data technology as required for this state-of-the-art infrastructure.

Environmental Design Solutions (EDS) headed by Tanmay Tathgat and ably supported by Kavita Jain are pivotal in bringing our 'sustainable' dream to reality. Our aspirations and vision were matched by their approach and knowledge of the subject which helped us conquer known and

unknown territories in the field of green and sustainable buildings.

Our due respect and gratitude to all our dedicated consultants and engineers who have been our partners in executing this project as per stringent standards of LEED and GRIHA requirements. We acknowledge the contribution of Power Engineers, Refrisynth Engineers, LED Inc., Ministry of Lights, Axis Façade Consultant, Oasis Consultants and Vastec Consultants.

An army of multi-discipline designers, processors, engineers and technicians who have burned the mid night lamp to create, detail, document, resource, archive and realise green and sustainable initiatives for One Earth are indeed invaluable for this project. We gratefully appreciate the efforts of Aparna Phunde, Darius Choksi, Dipti Talwar, Firoj Khalip, Imran Khan, Jagadish Talluri, Kavita Jain, Madhu Ambidi, Mamta Bajaj, Mansi Sahu, Narendra Badave, Nikhil Divekar, Nikhil Tamde, Nirmal Gajare, Poonam Patil, Rajendra Dhawade, Rashmi Abhyankar, Sachin Boradia, Sambhaji Naubade, Shubhankar Nag, Shubhra Kothari, Sibi Sidharthan, Sushil Khairnar and Visharad Sharma.

Last, but not the least, my deepest gratitude to all key project stakeholders of One Earth, Christopher Charles Benninger Associates, Principle Architects; Tao Architecture, Design coordination; Vascon Engineers, Engineering and Construction; Ravi Varsha Gavandi, Landscape Architects; Space Matrix, Interior Architects and Elephant Strategy + Design, Communication and Experience Designers.

J.R. Tanti
Managing Director
Synefra Engineering & Construction

The entrance to Suzlon One Earth is dominated by a replica of our globe and is a reminder of the global reach of Suzlon

Accessories, Technology and Material from the Best Global Brands

TATA Steel, India

Saint Gobain, Germany

Hunter Douglas, Holland

Texsa, Spain

Tata – Corus, South Africa

Dorma, Germany

India Gypsum, India

OTIS, United States of America

Gabritt, Switzerland

RAK, United Arab Emirates

Jaquar, India

Buzlon, Spain

Kirloskar, India

Daikin, Japan

Unidyne, India & Germany

Blue Star, India

Schneider, Germany

Areva T & D, India & Germany

Transfab, India

Legrand, France

Polycab, India

GE, United States of America

Bosch, Germany

Honeywell, United States of America

HALWARD, Holland

Thermax, India

Erco, Germany

Hess Ag, Germany

Osram, Germany

DGA, Italy

ES System, Poland

Modular, Germany

E-Lux, Germany

EYELEDS, Germany

Bega, Germany

Unitron, India

Integra, India

Suntechnics, Germany

Tarkett, China

Steelcase, Germany

Triplan, Denmark

Armstrong, United States of America

Anutone, Sweden

Rockfon, Denmark

Archidply, India

India Gypsum, India

IBM, United States of America

Stulz, Germany

Kidde, India

DB Power Electronics, India

Cisco, United States of America

AMP, United States of America

Wipro, India

AMX, United States of America

Samsung, Korea

Comms, Singapore

Lighthouse, Singapore

Barco, Germany

Polycomm, United States of America

Cannon, Japan

Bose, United States of America

Sony, Japan

Shure, USA

Crestron, USA

Havells, United Kingdom

Targetti, Italy

Tridonic, Austria

Bruck, Germany

Philips, Holland

Archillum, India