CASE STUDY – **SUZLON ONE EARTH , PUNE**

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Environmental Design Solutions (EDS)

Introduction -Suzlon

Campus for world's largest integrated wind turbine manufacturers.

a. Office Complex b. Corporate learning center

Plot area – 45,392 sqm

Built up area- 70,865 sqm

Capacity – 3000 employees

SUZLON'S VISION OF SUSTAINABILITY

Suzlon began with a 3.34 megawatt (MW) wind farm project in India's western Gujarat state in 1995. Today, in the space of just 12 years, it is the world's fifth-largest wind turbine manufacturer with a market share of 6 per cent.

A successful takeover of German company REpower, for which it bid earlier this year, will make Suzlon one of the world's three top players in the wind energy sector.
Wind power accounts for less than 4 per cent of energy generated in India, but the government has been pushing renewable energy given rising prices of fossil fuels and growing consciousness of the environmental damage they cause.
Suzlon has 45 per cent of market share and, according to Mr.Tulsi Tanti, huge prospects for growth in an energy-hungry country. 'India has wind energy potential of 45,000 MW,' says, Mr.Tanti.

Tanti's efforts are global, with a majority of Suzlon Green Power's projects to be located in India and China, two areas with burgeoning energy needs.

Suzlon Green Energy said it will bring more electricity where it is desperately needed in developing regions, and help move those regions toward energy security. The commitment also will help several countries meet the requirements of the Kyoto protocol.

The company estimates that its projects will create 1,000 jobs directly and many times more indirectly, and will reduce seven million tons of CO2 equivalent per year.

Suzlon Green Power will invest resources and expertise in four key areas:
Acquire existing green power assets to develop scale and expertise.
Develop greenfield power projects.
Garner support and cooperation from a network of vendors, business partners, investors.
Partner with local NGOs and other organizations to develop neighborhoods where the power assets will be developed and operated.

The International Energy Agency estimates that the world's energy needs will increase more than 50¢percnt; by 2030, and both China and India's energy use is set to double between 2005 and 2030. Suzlon, with other global organizations, is exploring the most efficient renewable energy sources that can be brought to scale to meet this exponentially growing demand for energy.

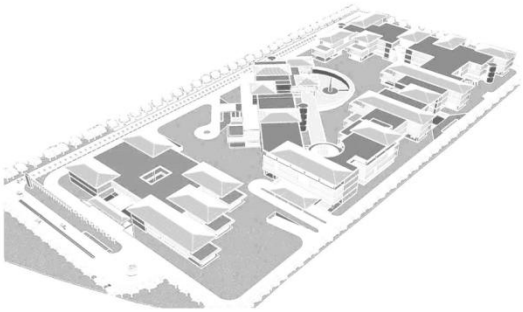
According to experts, the global wind energy industry has been growing at 27 per cent a year for the past five years. They predict that the global installed capacity for wind power, currently estimated to be about 62,000 MW, is set to double by 2009.
And Suzlon seems poised to ride the wind on this demand.
'The opportunity is global mainly because driving sustainable economic growth and mitigating the effects of climate change through clean, renewable energy sources are the need of the hour,' said Tanti. 'And we have leveraged ourselves to tap into market opportunities all over the world.'

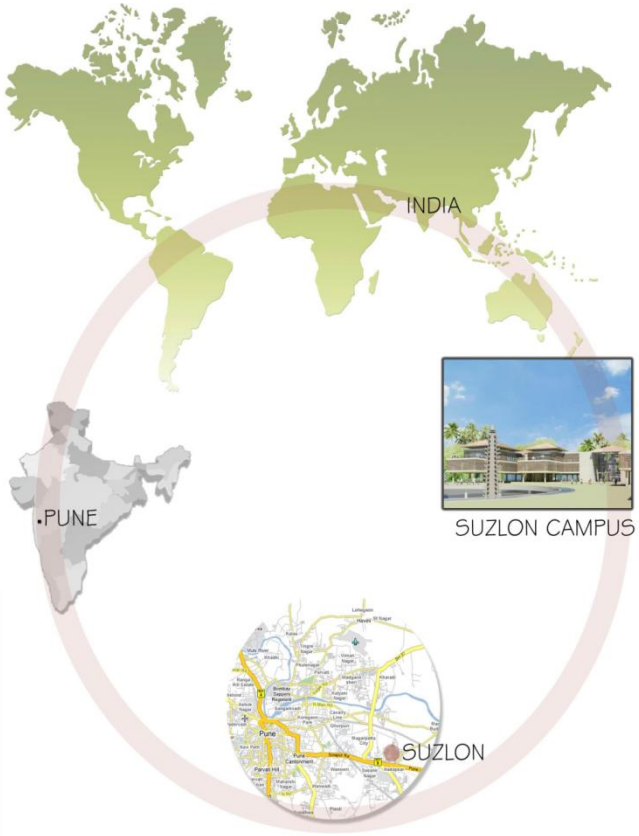
Campus project –
The suzlon office at Pune is transforming from a strategic center to being the global management headquarters.Currently the Pune office is catering to 14 countries and is now poised to cater to around 40 countries.
The occupancy profile of the campus is of a 24x7 global shared service provider and the think tank for the group across all verticals and locations. The campus shall be the knowledge and support base for global operations.

The campus highlights that suzlon is into renewable energy and the sustainability is at the core of the organization. Sustainability has been addressed in all stages and processes, right from site selection, design, construction and operation. Advanced technology has been used in the campus to make sustainability a reality.

The Site

The Site for Suzlon campus is located behind Kumat IT Park, Hadapsar, in Pune, Maharashtra, India.
This location is surrounded by large townships and IT parks.
The site rests amidst a fast growing suburbab context.





Campus at a Glance

The Corporate Campus is being developed by M/s Vascon Hadapsar Venture.

The Plot Area is approximately 45,392 sq.m

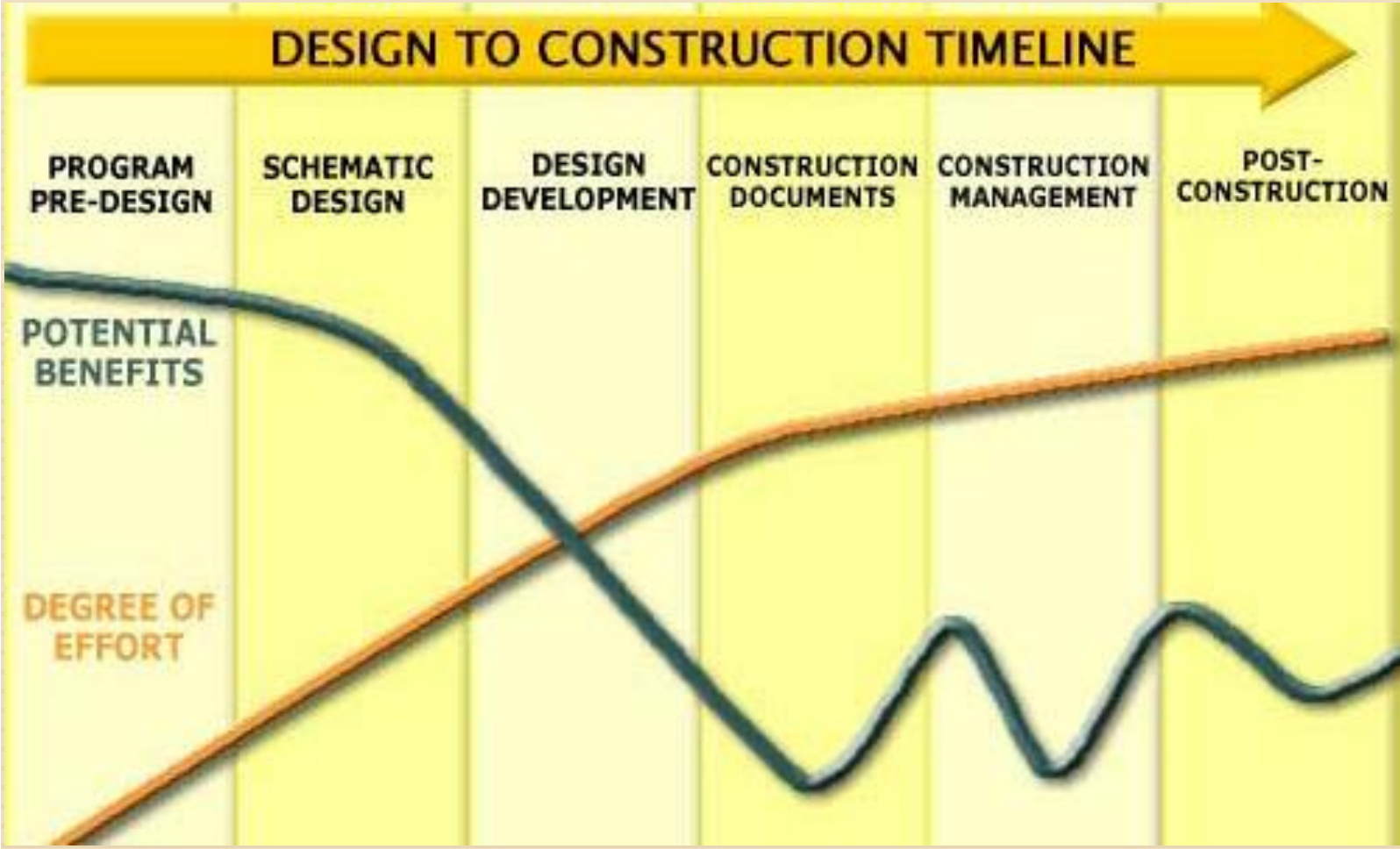
Built up area shall be approximately 70865.58 sq.m

The Campus shall also accommodate approximately 2500 Suzlon Employees.

The Master Plan would have the following building components:

Corporate Campus

1. Office Complex
2. Corporate Learning Centre



Integrated Process is a must for optimum design

Stakeholders of the project

- **Client** – Suzlon Energy Ltd.
- **Principal Architect** – Christopher Charles Benninger Architects
- **Developers** – Vascon Engineer
- **Landscape Architects** – Ravi and Varsha Gavandi
- **Interior Architects** – Tao Architecture and Space Matrix
- **Electrical consultants** – Power Engineers
- **HVAC consultants** – Refrysinth
- **Plumbing Consultant** – Rahul Dhadphale
- **Lighting consultants** – Ministry of Lights
- **Communication and Experience** – Elephant design
- **Green Building Design and Certification** – Environmental Design Solution

DESIGN PROCESS

ENVIRONMENTAL DESIGN SOLUTIONS

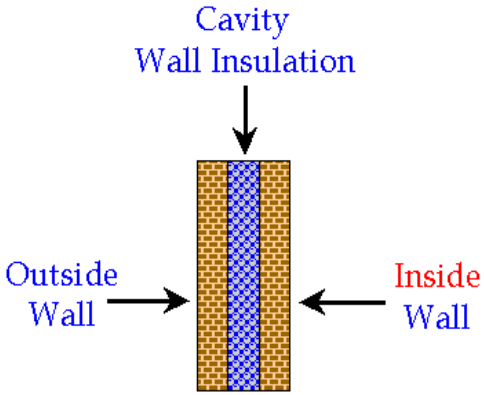
Design Benchmarks and Targets

Project Performance Targets - Energy

- Carbon Neutral (through on site + off site energy)
  - Zero Net Energy for Lighting (through On-Site generation)
    - PV systems integrated in design
    - Micro Wind (to be evaluated)
    - Biomass (Kitchen waste + STP output + landscape Waste)
- Positive Life Cycle cost of all investments Energy Systems (Except renewable to have a payback < 5 years

Building Performance Targets

- Envelope Performance
  - Minimal Heat Gain (40% better than ASHRAE 90.1 2007 and ECBC envelope standards)
  - 100% shaded Glazing during summer (April-October)
  - Natural Ventilation Potential in transition spaces
  - Daylighting (>90% Daylit spaces)



Optimum Orientation and Massing

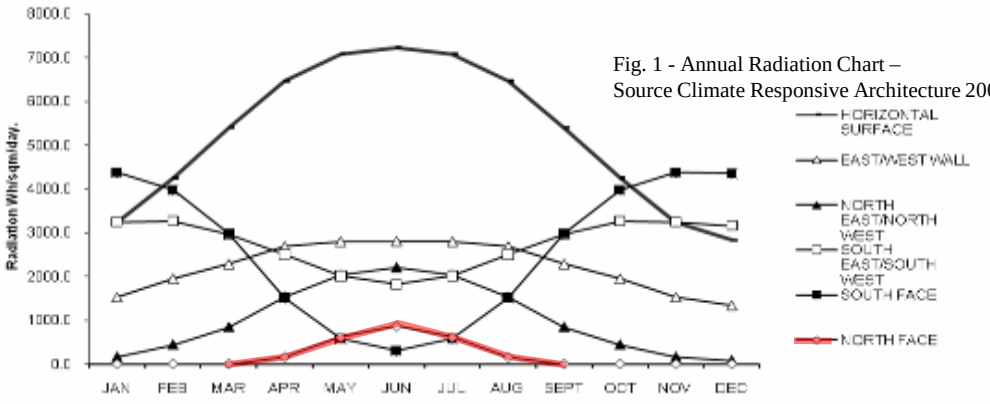


Fig. 1 - Annual Radiation Chart –
Source Climate Responsive Architecture 2004

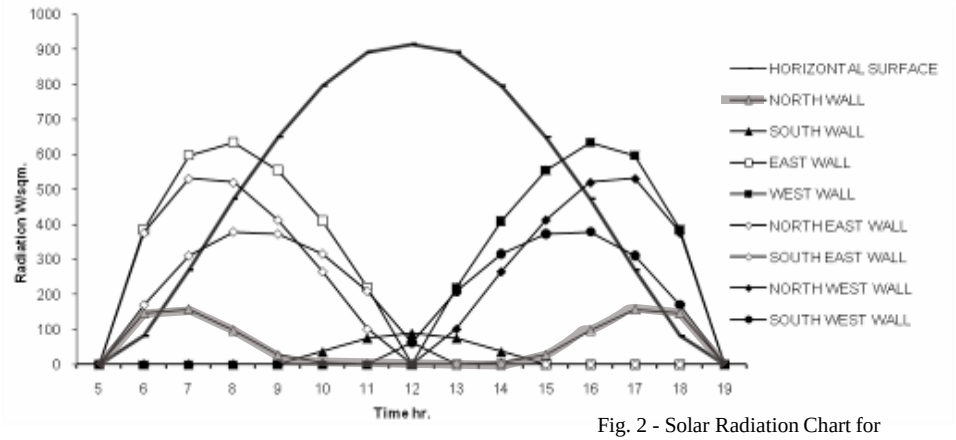
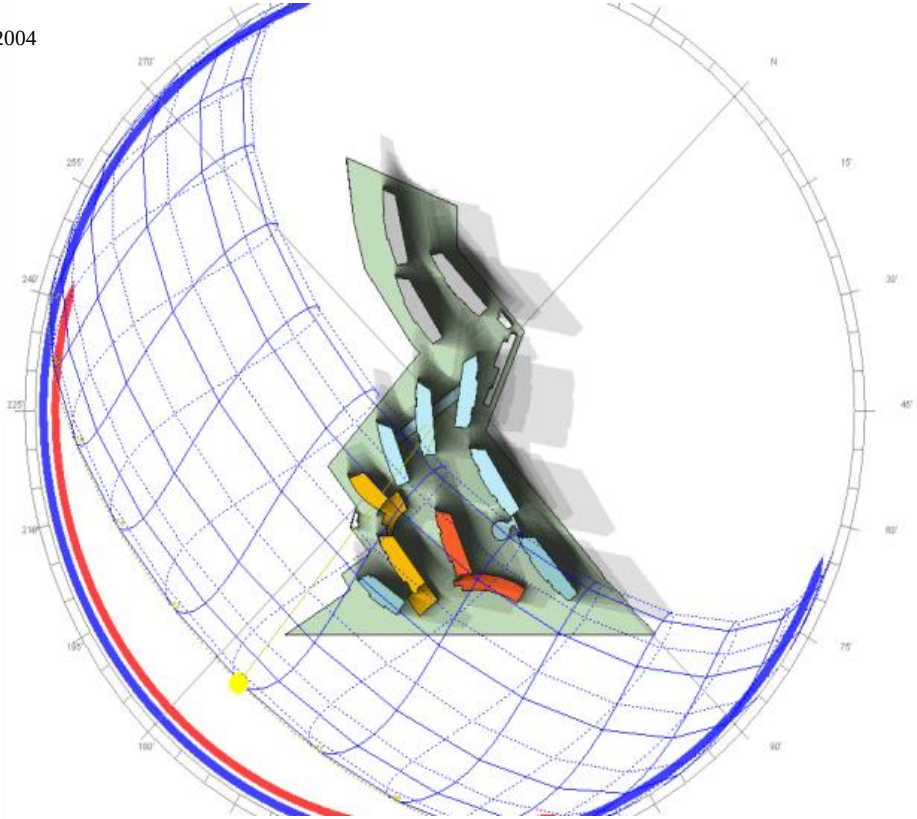
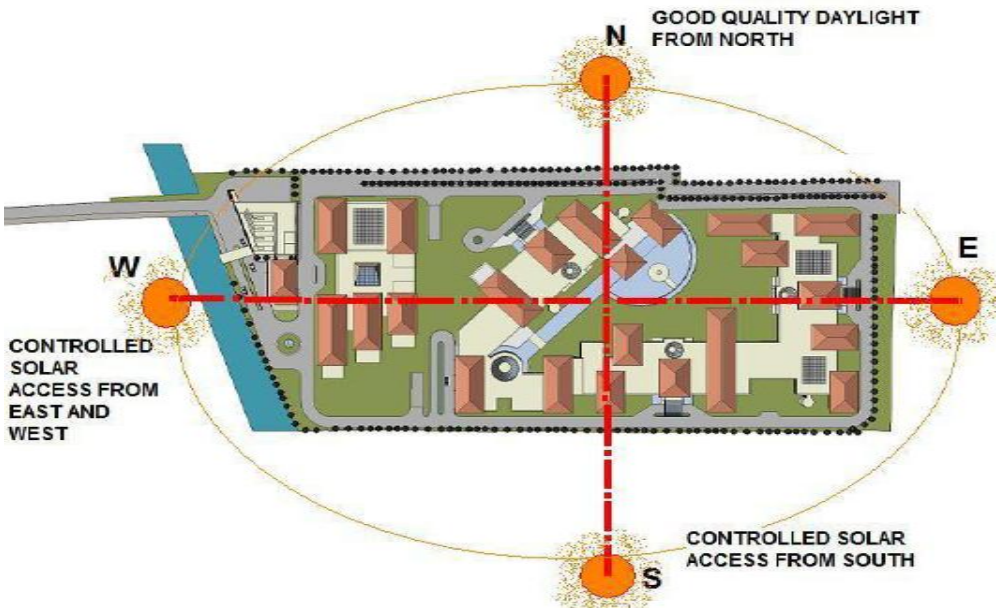
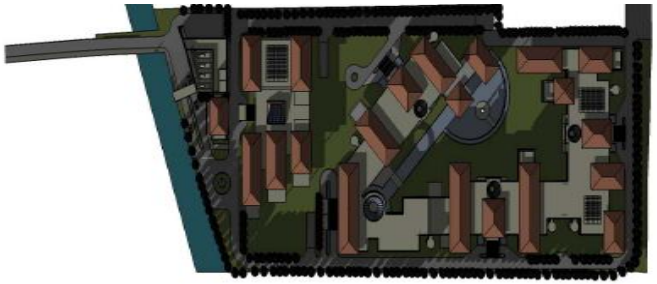


Fig. 2 - Solar Radiation Chart for Gurgaon, summers –
Source Climate Responsive Architecture 2004



Controlled Solar Access
Shading with Mass articulation





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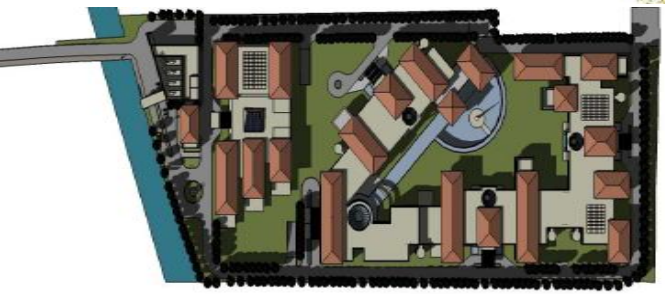
21 June 2:00 pm



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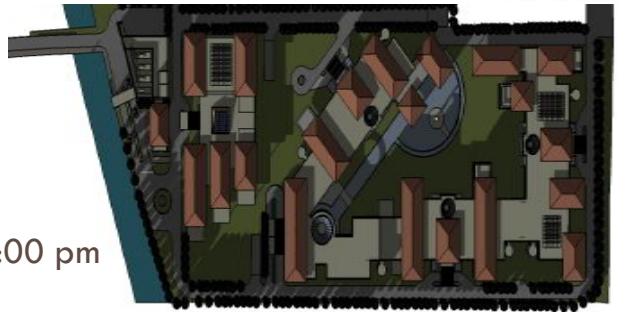

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Shading Strategies

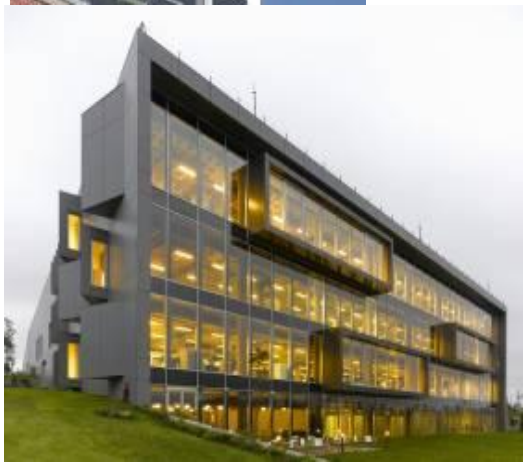
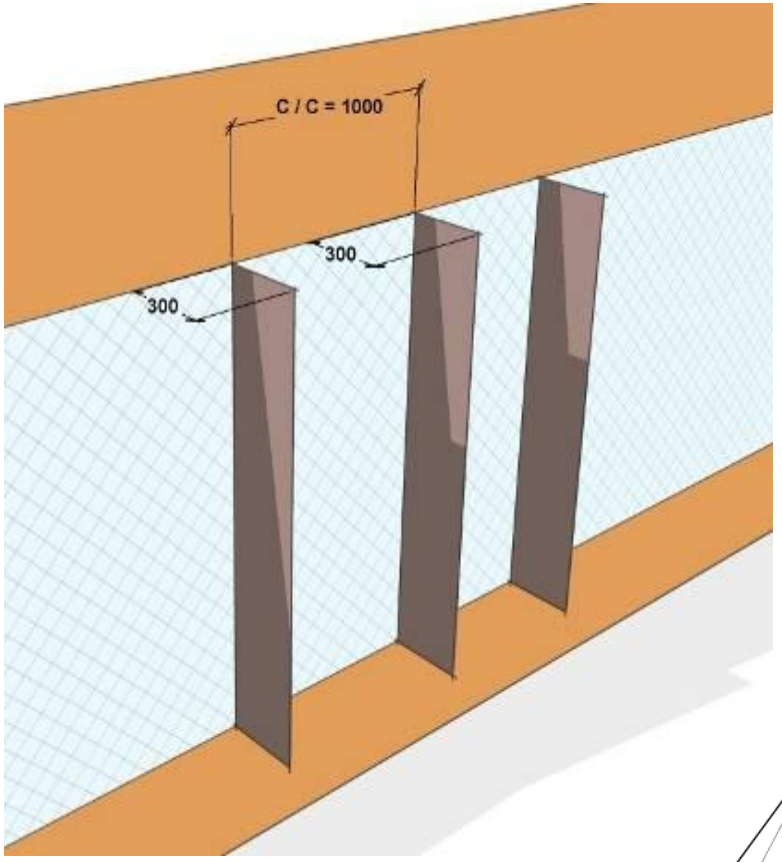


Fig. 3a – Large glazed areas on North face to allow diffused light for office spaces.
Source : World Architecture News.com



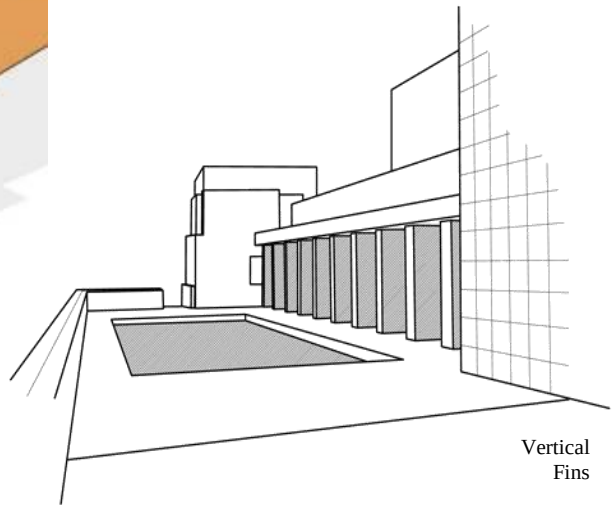
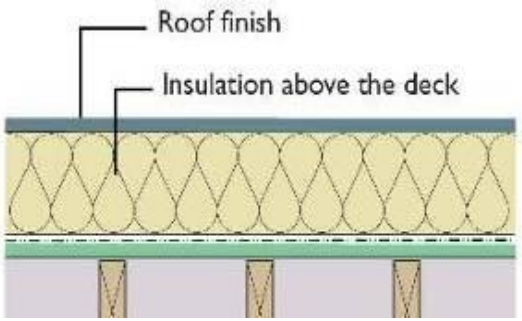


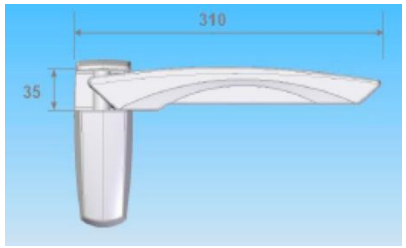
Fig. 3b – Window with vertical shades to cut off early morning and late evening sun, from North side.

INSULATED/GREEN ROOF



Building Performance Targets

- Illuminance Levels
  - As per NBC 350 Lux average
  - Lighting Load (<0.8 W/sft for offices)
  - Suspended direct indirect light fittings
  - Desk and furniture mounted task light



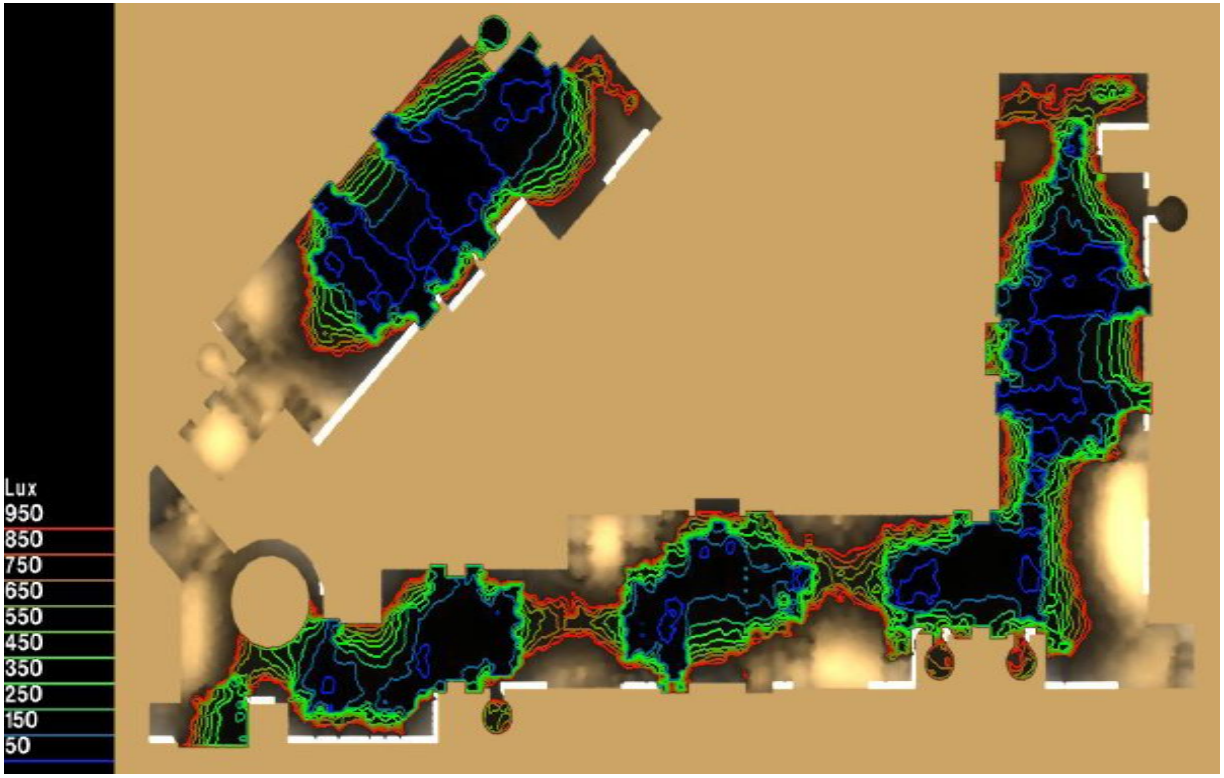
Energy end use

- Optimize building design to reduce the conventional energy demand
- Optimize the energy performance of the building within specified comfort limits

Envelope

- HIGH PERFORMANCE GLAZING-
- The exposed glass is 4mm Clear Annealed + 0.76mm PVB + 6mm KT 455 + 12mm Air gap + 6mm Clear Heat-Strengthened.
- U value- 0.32 Btu/hr.ft2.°F; Solar Factor- 0.26 which is less than 0.3 prescribed by ECBC for moderate climate zones. Thus, no additional shading is necessary for these.

Day lighting



% Area With Daylight Factor >2.5%

S.No.	Floor	Regularly Occupied Area (sq m)	Area with DF>2.5% (sq m)	% Dalighting
1	Ground Floor	4395	3541	80.57
2	First Floor	6480	5175	79.86
3	Second Floor	4582	3746	81.75
4	Third Floor	1499	1067	71.18
5	CLC GF	48	11	22.92
6	CLC FF	569	546	95.96
7	Basement	1672	1672	100.00
	Total	19245	15758	81.88

More than 75% of Regularly occupied spaces are day lit with a DF of >2.5%

Efficient Lighting Design

- Dimmable ballasts in conjunction with daylight sensors are used throughout the Open Office space.
- General Lighting at 350 Lux.
- The Artificial Lights - dimmed up & dimmed down from 0% to 100% depending on the adequacy of available daylight to meet the 350lux 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.
- 90 % of the Luminaries in the Office space are with dimmable ballasts & are either connected to Occulux sensors, daylight sensors or Occuswitch sensors.
- The installed lighting of office spaces has been designed at 0.8 W/sq. ft., 0.75W/Sq.ft. for cores, 0.23W/ sq. ft. for basement parking. Overall L.P.D. by whole building area method is 0.8 W/ sq. ft.

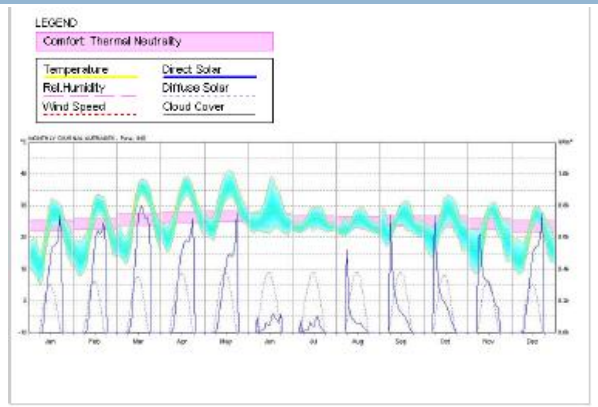
Energy Efficient HVAC System

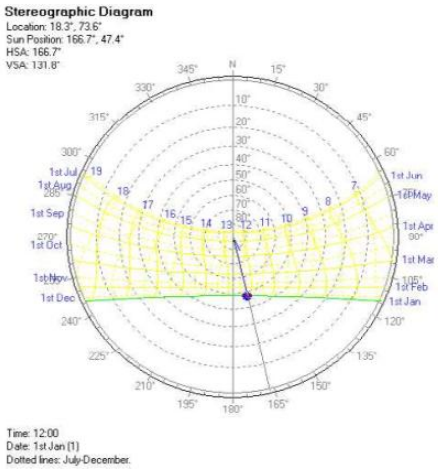
- SYSTEM FLEXIBILTY OF VARIABLE REFRIGERANT VOLUME SYSTEM- The indoor unit's cooling operation can be controlled to maintain desired temperature in any location in the premises according to end user's needs and preferences.
- PRE-COOLING AND HEAT RECOVERY AT T.F.A.s-
- A sensible heat exchanger is used as pre-cooler to sink the temperature of incoming air (say 38.4°C DBT approx.) to approx.27.66°C.
- DIRECT-INDIRECT EVAPORATIVE COOLING
- 1) Sensible cooling of approx 130% of fresh air in an efficient heat exchanger, using pre-cooled water.
- 2) Further cooling of air, and simultaneous cooling of water in indirect evaporative cooling section of the unit. Air required for cooling tower part 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 termed commonly as "scavenge air".
- 3) Direct evaporative cooling of 100% air in the final section.

Energy performance

Projected Energy savings –

47.2% over Benchmarked Energy Consumption Recommended by GRIHA.





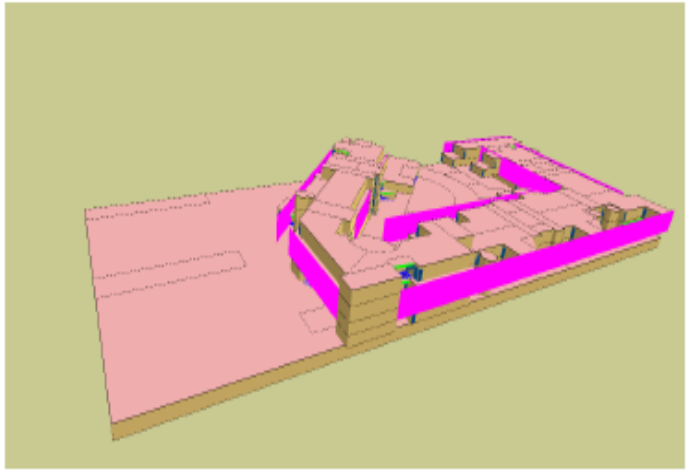


Figure 5- 3D View of the Corporate Office Block Simulation Model

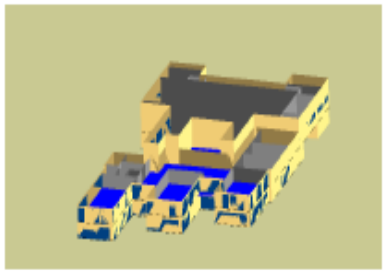


Figure 6- 3D View of the Corporate Learning Center Simulation Model

The building has been evaluated using Visual DOE, a front-end to the DOE- 2.1E engine as the simulation tool.

Energy: embodied and construction

- Utilization of fly ash in the building structure
- Reduce volume, weight, and time of construction by adopting an efficient technology
- Use low-energy material in the interiors

Utilization of fly ash in the building structure

15% Replacement Of Cement With Fly Ash By Weight Of Cement In Total Structural Concrete

Sr No.	Activity	Grade of Concrete	Quantity in cum	Cement Quantity (Bags)		% OF Fly ash in Wt of cement as per manufacturer test report of PPC	Flyash per bag of cement (Kg) as per design mix report of OPC	Weight of Flyash in per Cum	Quantity of Fly ash used (Kg)
	PCC & RCC								
1	PCC below footing, raft, floor	M-15	4,576	cum	20,591	23%	7.5	33.75	154429.1663
2	Plumb concrete		7,232		32,545			33.75	244089.7875
3	Tremix,IPS	M-25	5,742		40,192			52.5	301441.875
4	RCC footing, RW, lift raft		10,400		72,800			52.5	546000
5	RCC beams-slabs, column & staircase	M-35	22,196		182,007			61.5	1365054
					348,135	Bags		Total	2611014.829 Kg
					17,406,766	Kg			
In 17406766 Kg of cement total 2611014kg of fly ash used which is 15 % of total cement used									
Thus according to the requirement of Griha there is a 15% replacement of cement with fly ash, by weight of cement used in the total structural concrete ,for Suzlon One Earth.									

Reduce volume, weight, and time of construction by adopting an energy-efficient technology

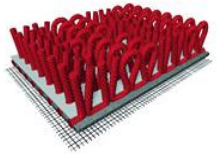
Low Energy Technology/materials in structural application- PT Slab

Low Energy Technology/materials in non-structural application- Siporex blocks

FOR SLAB AND BEAM	SAVING IN CONCRETE	37%
FOR COLUMN AND FOOTING	SAVING IN CONCRETE	10%
EXCLUDING STRANDS	SAVING IN STEEL	50%

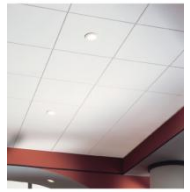
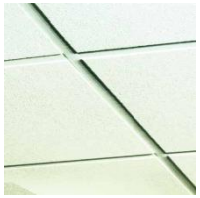
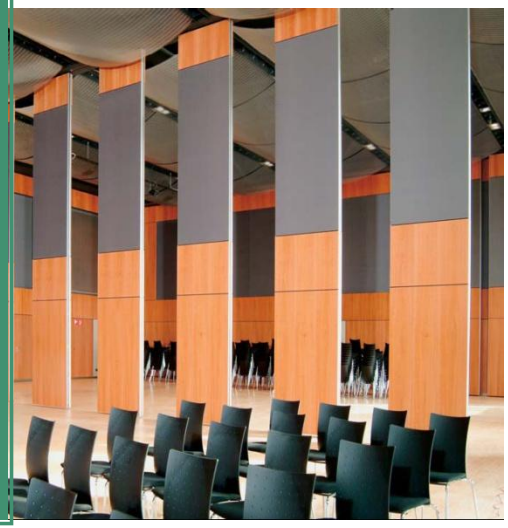
Use low-energy material in the interiors

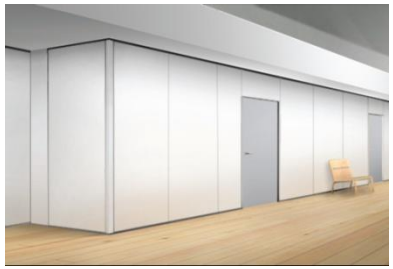
- Recycled Content
- Local / Regional Materials
- Rapidly Renewable Materials
- Low-Emitting Materials









Energy: renewable

- Renewable energy utilization
- Renewable-energy-based hot water system

Renewable energy utilization

BIPV

Solar Panels

ESTIMATED ENERGY P.A =20,000 KWH

Renewable energy utilization

ESTIMATED ENERGY (18 WIND MILL + 243 SOLAR PANEL) P.A =2, 30,000 KWH

Renewable-energy-based hot water system

100% of hot water requirement is met by the SHW system installed on site

Water

- Reduce landscape water requirement
- Reduce building water use
- Efficient water use during construction

Reduce landscape water requirement

- ✓ Selection of species
- ✓ All permanent planting is of native Species
- ✓ Minimization of high maintenance lawn area
- ✓ Placements of trees along with shrubs
- ✓ Planting of shrubs and ground cover on all exposed soil surfaces
- ✓ Use of mulching is done to aid plant growth, and retain soil fertility and moisture
- ✓ Seasonal maintenance plan
- ✓ Integrated Pest Control plan
- ✓ Innovative ways to control wastage of water
- ✓ Use of water from non-potable sources

Reduce building water use

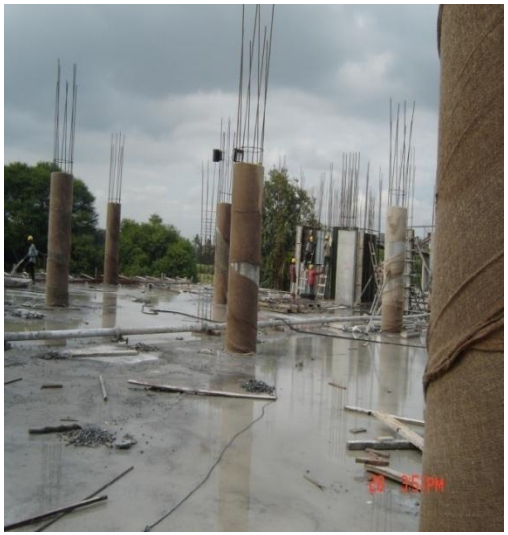
- ✓ Water Closets
- ☐ DUAL FLUSH FULL (6 LPF) and HALF (3 LPF)
- ✓ Sensor Based urinals
- ☐ URINALS WITH HYTRONIC URINAL SENSORS
- ✓ Efficient flow and plumbing fixtures
- ☐ PRESSURE REDUCING DEVICE
- ☐ WATER CONSERVING SHOWER HEADS

Efficient water use during construction

Use Of Ready Mix Concrete

Efficient Curing System

Chemical Curing



Use of Recycled Water for various construction process

Tile Cutting

Cleaning Batching Plant

Recycle, recharge, and reuse of water

- Waste-water treatment
- Water recycle and reuse

Waste-water treatment

- WTP2 – Water Treatment Plant for Raw Water
- RO - Water Treatment Plant using RO Technology – Max 200LPH
- WTP1 - Water Treatment Plant for Rain Water Harvesting System (Recycle and reuse)
- STP – Sewage Treatment Plant (Recycle and reuse)

Water recycle and reuse

Table 20.2 Water reuse datasheet									
	Quantity of water treated (kL)	Quantity of water harvested (kL)	Water requirement of the building (kL)	Landscape demand (kL)	Water reused for building (kL)	Water reused for landscape (kL)	Water recharged (kL)	water reuse (%)	Fraction of water recharged
Month	A	B	C	D	x	y	z	(x+y)/(C+D)*100	(z/B)*100
January	3645.6	0	7052.5	1085	2560.6	1085	0	44.8	#DIV/0!
February	3292.8	0	6370	1050	2312.8	1050	0	45.321	#DIV/0!
March	3645.6	0	7052.5	1085	2560.6	1085	0	44.8	#DIV/0!
April	3528	0	6825	1050	2478	1050	0	44.8	#DIV/0!
May	3645.6	0	7052.5	1085	2560.6	1085	0	44.8	#DIV/0!
June	3528	2700	6825	300	5925	300	207	87.368	7.6667
July	3645.6	2700	7052.5	310	6122.5	310	213	87.368	7.8889
August	3645.6	2700	7052.5	310	6122.5	310	213	87.368	7.8889
September	3528	2700	6825	300	5925	300	207	87.368	7.6667
October	3645.6	0	7052.5	1085	2560.6	1085	0	44.8	#DIV/0!
November	3528	0	6825	1050	2478	1050	0	44.8	#DIV/0!
December	3645.6	0	7052.5	1085	2560.6	1085	0	44.8	#DIV/0!
								58.33 % Avg	

Annual water reuse of 58.33%

Waste management

- Reduction in waste during construction
- Efficient waste segregation
- Storage and disposal of waste
- Resource recovery from waste

Waste management


Landfill Materials Description	Landfill Hauler Location	Quantity of Land filled Waste	Units (tons)
Miscellaneous garbage	Landfill	500	ton
General Construction Waste	Irrigation Landfill	45392	tons
Total Construction Waste Sent to Landfill		45892	tons
Total of all Construction Waste		199153.73	tons
Percentage of Construction Waste Diverted from Landfill		76.96%	tons

Health and well-being of occupants

- Use of low VOC (volatile organic compounds) paints/adhesives/sealants
- Minimize ozone-depleting substances
- Ensure water quality
- Acceptable outdoor and indoor noise levels
- Tobacco and smoke control
- Provide the minimum level of accessibility for persons with disabilities.

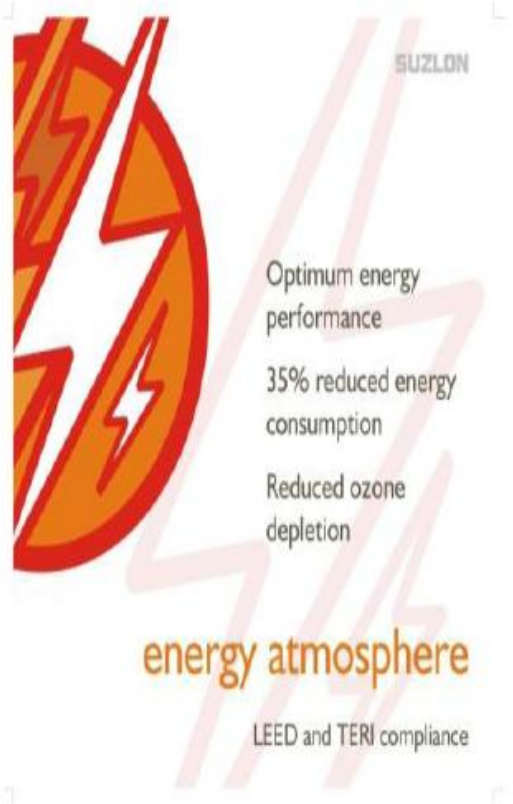
Other energy efficient measures

- Carpooling
- E-charging points
- Environmental education
- Integrated pest management
- Offsite green power
- Zero waste management policy
- Construction on renewable energy

Transportation Energy

- Carpooling is encouraged by providing 5% of total vehicle parking capacity on site as dedicated parking for carpooling.
- Electrical charging points to serve 97 vehicles (16.9% of Total Vehicle Parking capacity) at one time.

Green education in the campus



Construction on renewable energy

Construction on renewable energy

Summary of Power Consumption from DG and MSEB				
Sr. no	From DG	From MSEB	Total Consumption	Actual power generated from offsite wind mill
1.	34151.4	60097	94248.4	7208180

Offsite green power

Suzlon is making an attempt to offset the environmental impact of energy consumed by the facility, since the **Offsite Green Power** produced is more than 50% of **Project's Energy Consumption.**

Safety /Sanitation Facilities For Construction Workers

Personal Protective Equipment for construction workers

Sanitation and drinking water facility as the labor camp

Crèche for kids of laborer's

Practices to Reduce Air Pollution during construction

Cover and Enclosure

Awareness Programmes

NO SMOKING policy on site

Water spraying

Net impact

Performance Metric	Impact/Savings
Energy use	~ 47 %
GHG impact	~ 50%
Water use	~ 60%
Material use	~ 40% offset by recycled and renewable
Cost (incremental)	~ 10%
Pay back period	~ 2 years

Sustainable design is not a reworking of conventional approaches and technologies, but a fundamental change in thinking and in ways of operating - you can't put spots on an elephant and call it a cheetah.

THANKS

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