

SUSTAINABILITY REPORT

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DEA 2550
10/24/11**



INTRODUCTION

This report was written for DEA 2550/6590: Introduction to Facility Planning and Management, taught by Frank Becker at Cornell University. It is an overview of different types of facilities throughout the world that incorporate sustainability in their design, construction, technology, and function. These sustainable practices and features are explored, as well as the implementation strategies and drivers behind them.

Suzlon One Earth Headquarters

Pune, India

DESCRIPTION

- Third largest manufacturer of wind turbines in the world
- Largest facility in India to achieve LEED Platinum status
- Acts as a “living laboratory” of sustainable technologies
- Sustainability in the areas of human and environmental health, site development, energy efficiency, materials and resources.

BUILDING DESIGN&CONSTRUCTION

- Neutral-colored shade screens, large roof overhangs, and thin building profiles provide more natural light
- Holistic approach to design; “One Earth” represents the Earth as a self-replenishing ecosystem
- More than 70% of the materials used have a reduced carbon footprint, have lower embodied energy, and are rapidly renewable



Source: <http://www.architeria.com>

LANDSCAPING

- Landscaped courtyards, reflecting pools, and green roofs and terraces contribute to the microclimate of the facility.
- Designed as a spread-out garden campus, unlike most urban “glass box” business parks
- Roof gardens provide insulation and passive cooling

Suzlon One Earth Headquarters

Pune, India

ENERGY&WATER

- Over 150 kW of power is generated on-site
- 80% of this power comes from micro wind turbines
- Other 20% comes from a PV (solar power) system
- Glass ventilating tubes and jet fans pull cool air from the basement and push out air that is heated by sunlight
- Low-E glass is used to reflect heat when there is no direct sunlight
- Hot water is provided through solar thermal heating
- 100% of water used is recycled
- All rainwater is channeled into a controlled flow, preventing soil erosion, facilitating silt removal, and decreasing storm water runoff.



Source: <http://www.robaid.com>

LIGHTING

- Exterior lighting consists of LED street lights that are powered entirely by renewable energy-based systems located on site, reducing lighting costs by 25%
- 90% of regularly occupied spaces have daylight exposure, saving on artificial lighting
- Occupancy sensors control lighting in unoccupied workstations, saving 20% on energy costs.
- Aluminum louvres shade interiors while providing natural illumination

Suzlon One Earth Headquarters

Pune, India

DRIVERS

- Consistent with the purpose of the company
- Promotes Suzlon's commitment to sustainability
- Energy and building costs are reduced

CRITICAL SUCCESS FACTORS

- Whole-building approach to sustainability resulted in lower construction costs and long-term savings.
- Synthesis of architecture and landscape design, which both contribute to sustainability
- Upcoming Green Building Movement in India and Energy Conservation Building Codes initiated by India's government



Source: <http://www.aecworldxp.com>

Dalby Forest Visitor Center

North Yorkshire, U.K.

DESCRIPTION

- Visitor center for UK's North Riding Forest Park
- Optimized to minimize energy consumption
- One of the Forestry Commission's first visitor centers with a focus on sustainability
- A flagship structure for sustainable construction in the U.K.

MATERIALS & CONSTRUCTION

- Entire building can be recycled at the end of its life
- Locally sourced materials
- Roofing membrane was made from local tires
- Yogurt pots, Wellington boots and mobile phones were recycled to make the reception desk
- Main timber structure was prefabricated; This reduced site traffic and disruption
- Concrete-free foundation
- Only touches ground very lightly



Source: <http://www.halcrow.com>

- Roof cladding made from off-cuts of local cedar
- Timber frame is certified by the Forest Stewardship Council
- Building is clad in larch growth milled in the forest
- Wood source reduces the building's embodied energy and supports local business.

Dalby Forest Visitor Center

North Yorkshire, U.K.

ENERGY&WATER

- Neighboring forest supplies woodchips to power the boiler
- Electricity is supplied by a micro wind turbine and photovoltaic panels
- Designed for maximum natural ventilation and lighting
- Toilets are flushed with rainwater, which is collected on the roof and stored in a tank; this reduces the amount that has to be taken from the village well
- Site waste treatment reduces impact on local resources



Source: <http://www.glassisgreen.blogspot.com>

DRIVERS

- Educate visitors about sustainability
- Forestry Commission will use it as a model for nationwide redevelopment of visitor centers
- Reduce costs/strain on local resources

CRITICAL SUCCESS FACTORS

- Site is ideal for sourcing building materials
- Support from Forestry Commission

SFO Terminal 2

San Francisco, CA

DESCRIPTION

- San Francisco International Airport's Terminal 2 is undergoing renovation in order to increase sustainability
- Projected to be the first LEED Gold-certified airport terminal in the US
- Sustainability initiatives include a recycling program and a more welcoming environment for travelers.
- Designed to improve indoor air quality and reduce energy consumption

RECYCLING

- 90% of the building materials from the original structure (built in 1954) were recycled to build the new terminal
- Zero Waste Program requires that all the waste generated during construction projects is recycled or reused
- Source separation of all recyclable solid waste is also required. The goal is 90% recycling by 2020



Terminal 2 before (in 1954) and after its renovation
Source: <http://www.flysfo.com>

SFO Terminal 2

San Francisco, CA

ENERGY

- The airport provides PC Air and 400 Hz power to aircraft at all T2 gates, which reduces jet fuel consumption by 1.4 million gallons a year and reduces carbon emissions by 15,000 tons per year
- Energy efficient lighting and machinery also reduces carbon emissions and natural gas consumption
- Recycled building materials reduce the global warming impact of the terminal
- Electric and Hybrid vehicles are given preferential parking spaces in the parking garage.
- Chargers for Ground Services Equipment were installed at all gates, reducing fuel usage and CO2 emissions

WATER

- Dual plumbing system is a stand-alone system for toilets and urinals that uses reclaimed water from the airport's treatment plant
- The airport is planning on reusing treated effluent from the treatment plant for gray water use throughout the airport



Water bottle filling stations

Source: <http://www.re-nest.com>

- Water bottle filling stations are installed at the entrance of the terminal to encourage tap water usage and decrease waste resulting from bottled water

SFO Terminal 2

San Francisco, CA

CONCESSIONS PROGRAM

- All T2 food vendors are required to use biodegradable tableware and separate all waste for transport to composting facilities
- Food and beverage tenants are expected to provide sustainable food including:
 - organic foods
 - locally sourced products
 - sustainable seafood
 - fairly-traded coffee
- Tenants were encouraged to use green building materials to construct their facilities
- Required to recycle and compost

ENVIRONMENT

- T2 is designed to provide an environment in which travelers can relax during their wait while being energy and waste-conscious
- Multiple areas for sorted waste
- Seating is provided after security; This area is called "Recompose"
- SFO is the only U.S. airport that is also an art museum; local art is installed throughout T2



Source: <http://www.flysfo.com>

DRIVERS

- Providing a sustainable traveling experience
- Innovative terminal to compete with facilities in Europe and Asia

CRITICAL SUCCESS FACTORS

- Mostly built out of recycled construction materials

Meyer Hospital

Florence, Italy

DESCRIPTION

- Pediatric hospital
- Member of the European Network of Health Promoting Hospitals
- Located in a 1930's villa surrounded by parkland of trees and Florentine hills
- Site demanded that environmental and cultural heritage be preserved and updated
- Sustainable balance of structure, technology, and environmental sensitivity
- Harnesses architecture to help the healing process

BUILDING AND LANDSCAPE DESIGN

- Early 20th century structure with a new sustainable wing
- Extensive green roof creates continuity between the new pavilion, existing structure, and surrounding hills
- Daylight, art and open spaces create a healing environment
- Entrance is located in the original complex to create a historical environment and reduce stress associated with typical hospital settings



Source: <http://www.worldhealthdesign.com>

- Patients go through a "healing garden" leading to the new building atrium
- Columns in the new building resemble trees, which provides continuity between the exterior and interior spaces

Meyer Hospital

Florence, Italy

BUILDING DESIGN & ENERGY

- Pillars integrate PV panels that filter light, produce electricity and enhance their aesthetic value
- Green roof is a healing garden for the patients, as well as acting as insulation for the building and contributing to the energy balance of the building
- Conical skylights protrude from the roof and provide the building with natural light
- Light quality plays a large role in the well-being of the patients as well as enhancing the visual connection with the landscape
- Interactions between color, light, and views of the landscape create an ideal atmosphere for healing
- Hospital is a car-free system with many green areas
- Cluster scheme of space organization encourages openness and social interaction



Source: <http://www.inhabitat.com>

DRIVERS

- Create an environment that encourages healing and interaction with nature
- Maximize technology for a patient-focused facility and energy efficiency

CRITICAL SUCCESS FACTORS

- Location in Florence hills
- Architectural consideration of existing facility and environment

Shanghai Tower

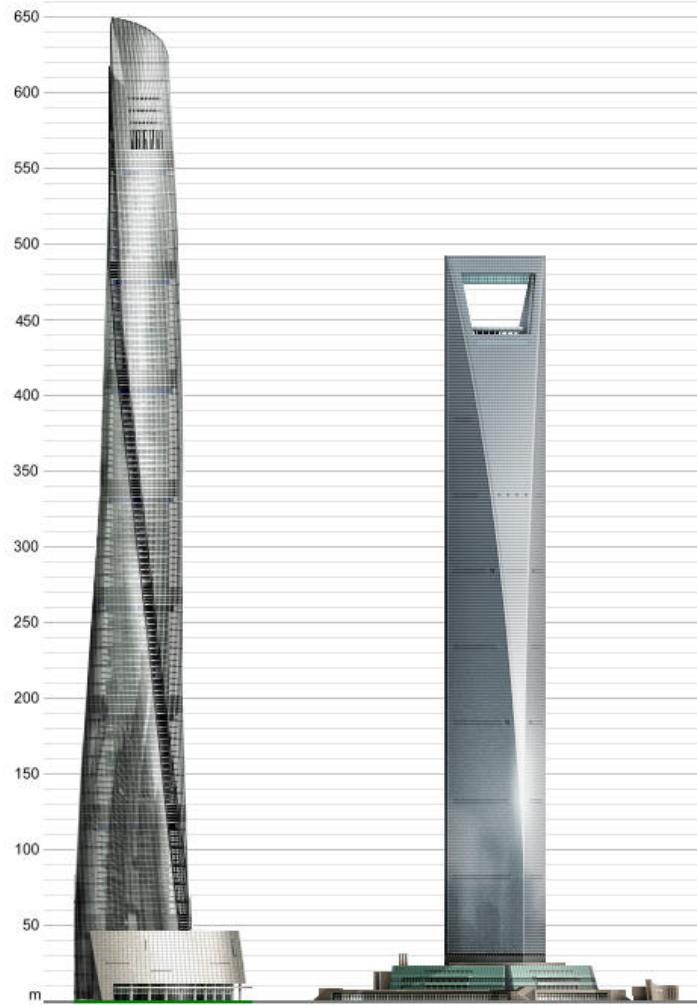
Shanghai, China

DESCRIPTION

- A 138 story, mixed-use building that will be completed in 2014
- When completed, will measure 632 meters; It will be the tallest building in China and the World's second tallest building, after the Burj Dubai in the UAE
- Complex will include space for offices, a hotel, nine sky gardens, retail spaces, and a Shanghai Metro stop
- Owners hope to receive certification from China and U.S. Green Building Councils

ENERGY

- Wind turbines located under the parapet will generate on-site power
- Glass maximizes daylight in the building, decreasing the demand for artificial lighting
- Glass has a spectrally selective low-E coating that helps reduce heating and cooling loads
- Transparent walls that are still energy efficient
- Atrium spaces will decrease the elevator usage and save energy by encouraging walking
- Atria between inner and outer glass walls modulate temperatures
- Rainwater is collected in parapet for heating and air-conditioning systems



Profile of the new Shanghai Tower (left) and a neighboring building

Source: <http://www.davidkiyokawa.com>

Shanghai Tower

Shanghai, China

BUILDING DESIGN&CONSTRUCTION

- Goal is to create a sustainable community within a high-rise building
- Nine cylindrical buildings stacked on top of each other, all enclosed by a glass facade
- Between each of the nine layers, there will be an atrium featuring space for shopping, gardens, and views of the city
- Gardens create a thermal buffer zone and improve indoor air quality
- Façade is made of a double layer of transparent glass, which reflects heat without requiring opacity
- Glass façade will reduce wind loads on the building by 24%
- Therefore, fewer construction materials are needed, including 25% less structural steel
- The double skin of the building will allow for seven “vertical parks” that are meant for public use
- Built using locally sourced and recycled materials when possible



Source: <http://www.gensleron.com>

DRIVERS

- Building will be icon of a sustainable community in Shanghai
- The scale of the project

CRITICAL SUCCESS FACTORS

- Engineering innovation
- Funding for Gensler's design

CONCLUSION

Although sustainability has become a common concern among architects, engineers and facility planners, it is not the only driver behind the construction of new facilities. Many new sustainable buildings are created as an example of the future of design, especially in underdeveloped regions of the world. New materials and practices are being implemented to reduce energy usage, CO₂ emissions, and depletion of fossil fuels. Although some of the examples of innovation in this report are too unconventional or costly to become widely adopted, there are countless ways that facilities can become more sustainable. The environment has already become a mainstream concern to people in many fields, who will hopefully continue to incorporate sustainability in their building and work practices.

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