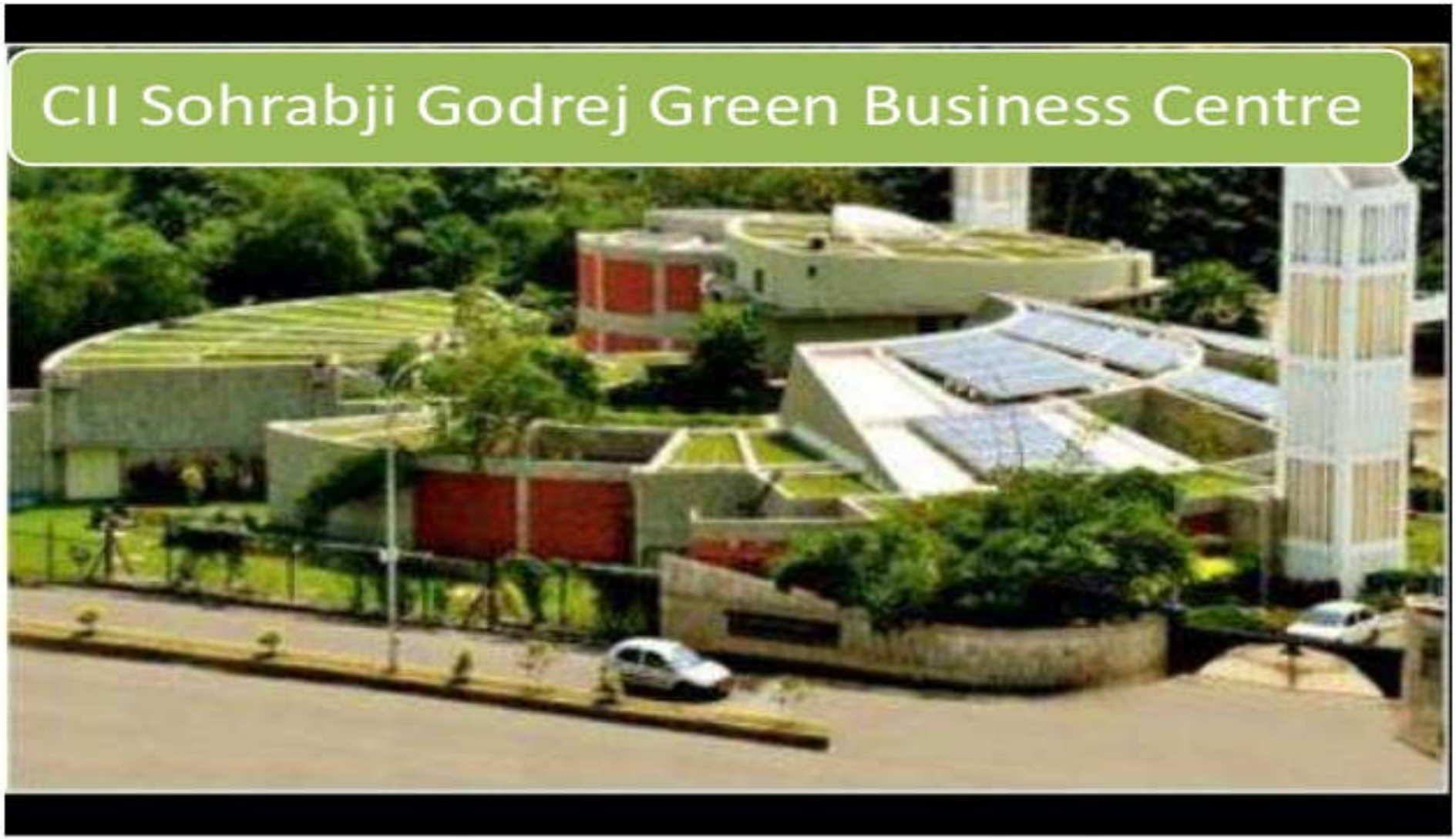
Green Building Technology



Dr. D. Palit

Definition :- "It is the practice of increasing efficiency with which buildings use resources- energy, water and materials-while reducing building impacts on human health and the environment."

``Green building technology should reach all"

Green Building Technology

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from sitting to design, construction, operation, maintenance, renovation and deconstruction.

Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:-

- Efficiently using energy, water, and other resources.
- Protecting occupant health and improving employee productivity.
- Reducing waste, pollution and environmental degradation.

History of Green BuildingTechnology

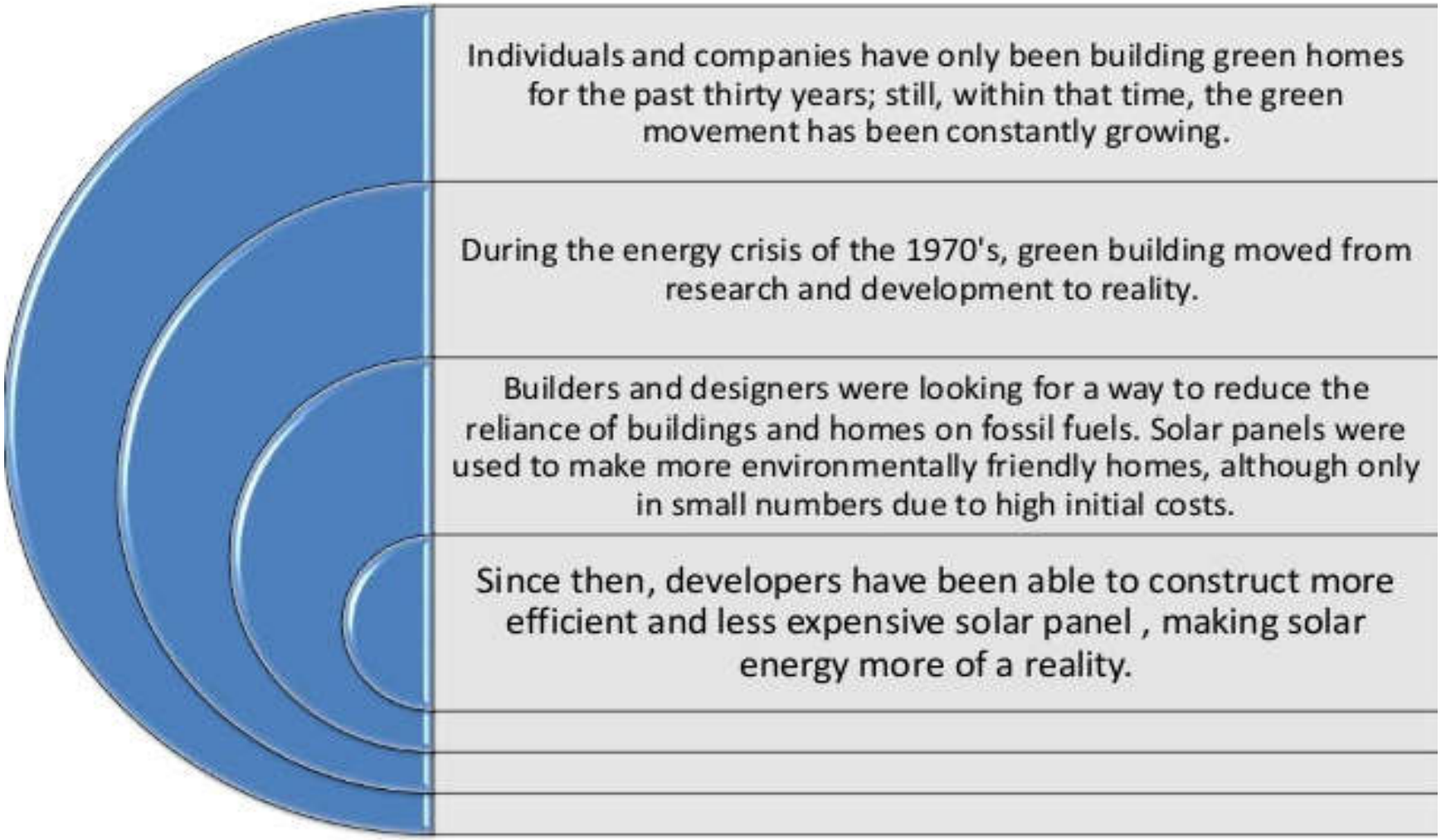
Green building is defined by the Office of the Federal Environmental Executive as the practice of:

1) increasing the efficiency with which buildings and their sites use energy, water, and materials.

2) reducing building impacts of human health and the environment, through better siting, design, construction, operation, maintenance, and removal throughout the complete life cycle.

While the green building movement has gained momentum in the last decade, the origin can be traced back to the late nineteenth century.

Origin of Green Building Technology



BENEFITS OF GREEN BUILDING

- Buildings have a large effect on the enviornment,human health and the economy.
- The successful adoption of GREEN BUILDING development can maximize both the economic and enviornmental performance of the buildings.

Benefits of Green Building ?

Environmental benefits

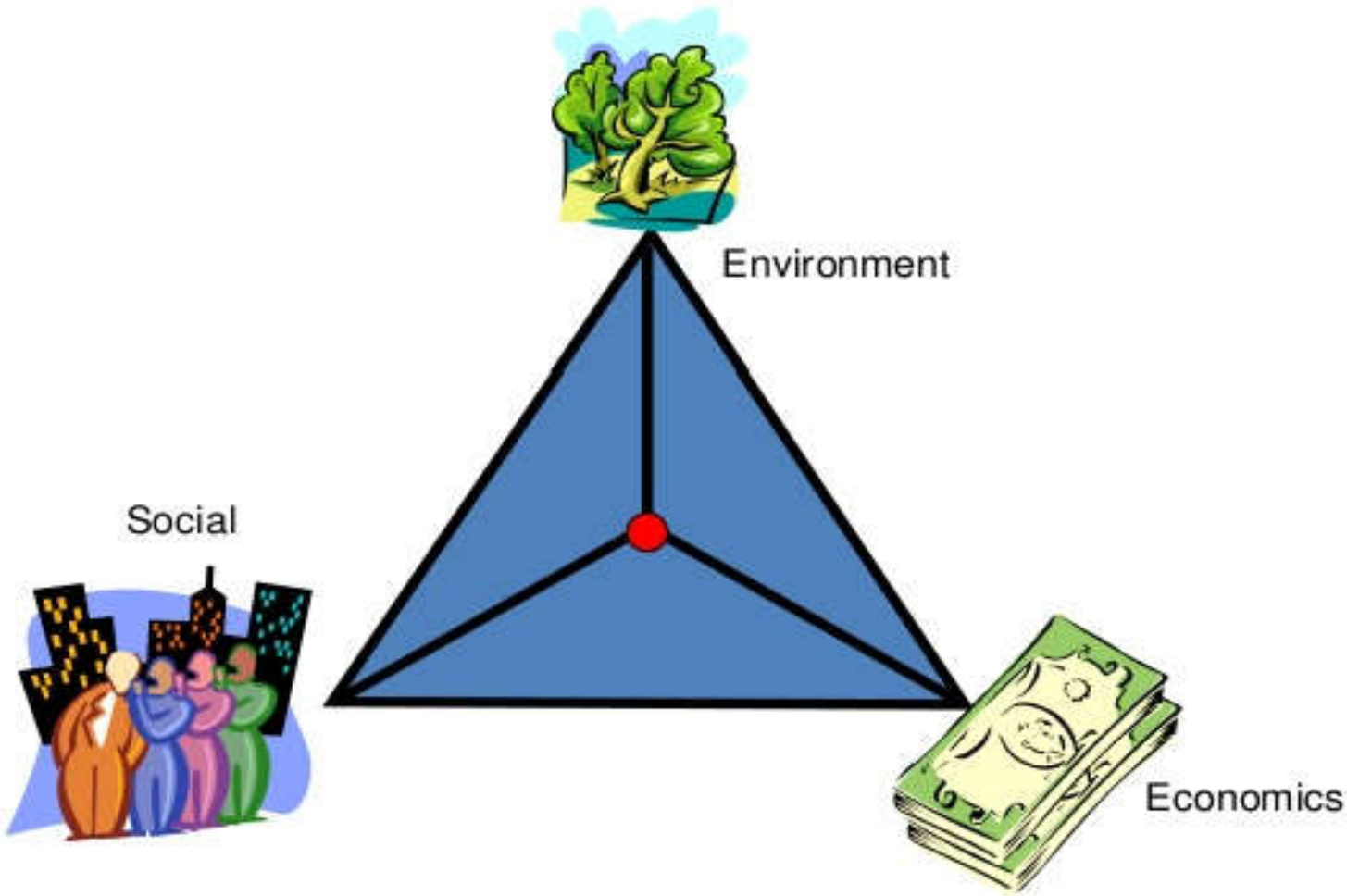
- Enhance and protect biodiversity and ecosystems
- Improve air and water quality
- Reduce waste streams
- Conserve and restore natural resources

Economic benefits

- Reduce operating costs
- Create, expand, and shape markets for green product and services
- Improve occupant productivity
- Optimize life-cycle economic performance

Social benefits

- Enhance occupant comfort and health
- Heighten aesthetic qualities
- Minimize strain on local infrastructure
- Improve overall quality of life


Environment
Social
Economics

Building Account For ?

39 Percent of Total Energy use.

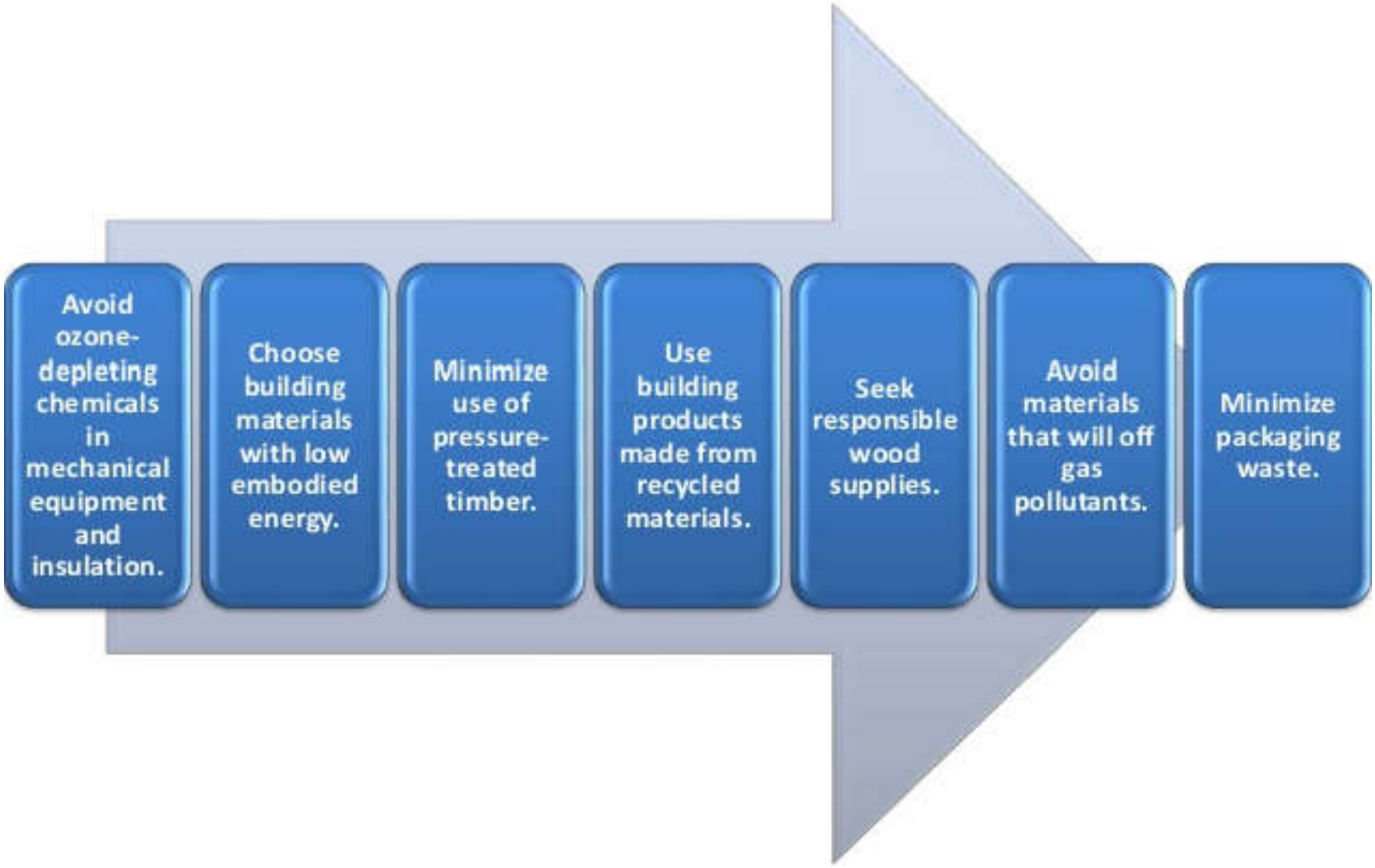
12 Percent of the Total water consumption.

68 Percent of Total Electricity Consumption.

38 Percent of the Carbon Dioxide Emissions.

Objectives & Goals of Green Building

Materials for Green Building



Equipments for Green Building

- **Install high-efficiency heating and cooling equipment:**
- **Install high-efficiency lights and appliances:**
- **Install water-efficient equipment:**
- **Install mechanical ventilation equipment:**

Source of Material

- Renewable sources: Forests
- Reuse from waste: old plumbing , doors etc..

Wool brick

- Obtained by adding wool and a natural polymer found in seaweed to the clay of the brick,
- 37% More strength than burnt bricks
- Resistant for cold and wet climate

Sustainable Concrete

- Crushed glass
- Wood chips or slag - a byproduct of steel manufacturing.
- Reduces the emission of CO_2

Solar Tiles

- Exist to simply protect a building
- They spend a large portion of the day absorbing energy from the sun.

Paper Insulation

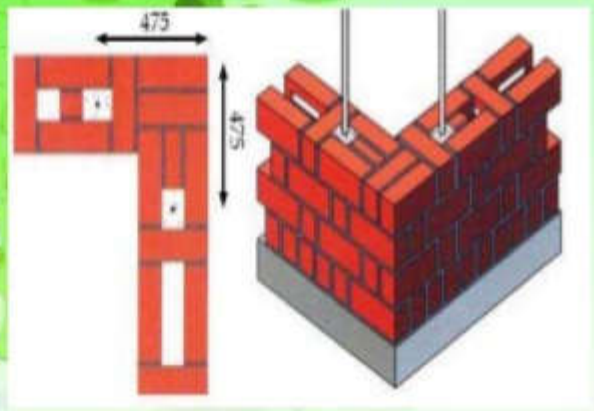
- Made from recycled newspapers and cardboard
- Then filled with chemical foam
- Insect resistant &fire retardant

Triple-Glazed Windows

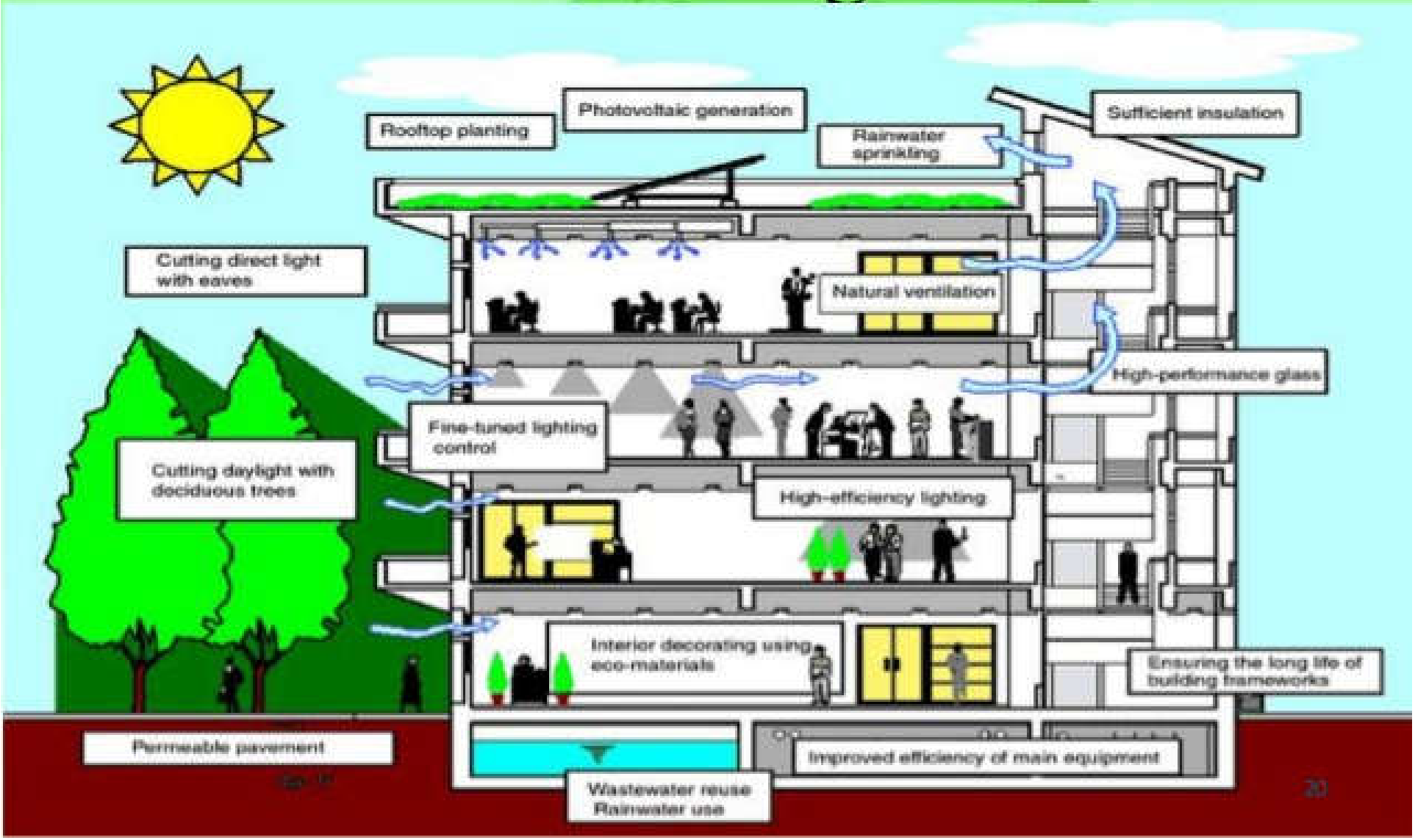
- Super-efficient windows
- Stops heat to enter the building & from direct sunlight

Eco Friendly

- Using Bamboo Replacing The Steel Bars



Typical Layout Of Green Building

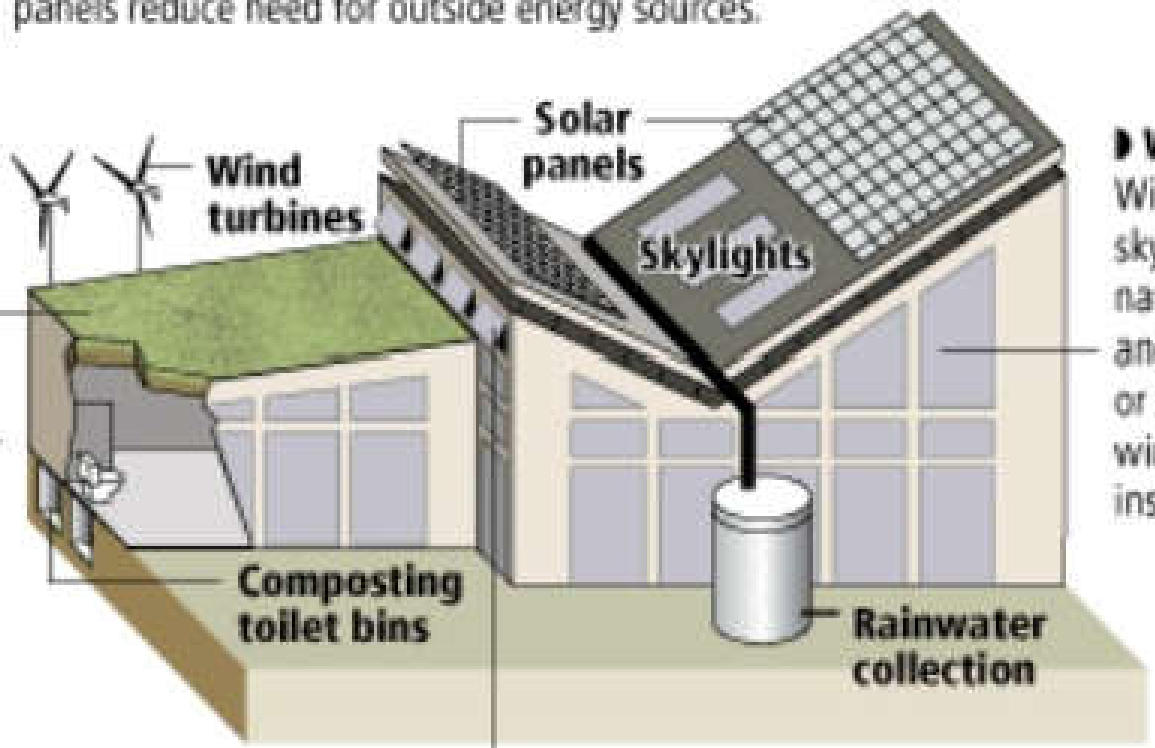


ECOFRIENDLY CONSTRUCTION

With 32 "green" buildings, Seattle has become a leader in environmentally sensitive building and design. Green construction aims to reduce pollution and reduce dependence on power plants and logging.

GREEN ROOFS: A thin layer of plants and soil on rooftops provides insulation, reduces stormwater runoff, absorbs carbon dioxide and creates oxygen.

ALTERNATIVE ENERGY: Roof-mounted wind turbines and solar panels reduce need for outside energy sources.



WINDOWS Windows and skylights provide natural lighting and heat. Glazed or double-paned windows provide insulation.

WATER EFFICIENCY Cisterns collect rainwater to use for landscaping irrigation. Low-flow, waterless or composting toilets help reduce water use.

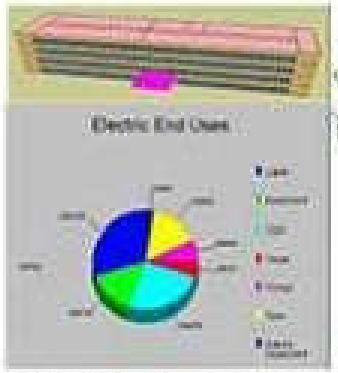
VENTILATION: Vents and operable windows assist in heating and cooling by circulating air better.

BUILDING MATERIALS: Recycled building materials reduce waste. Building with certified lumber helps protect forests and using non-toxic paints and carpets creates a healthier interior space.

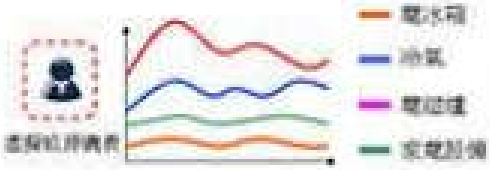
Source: P-I reporting

SEATTLE POST-INTELLIGENCER

Technologies for Smart Green Building



S/W & Tools for System Simulation

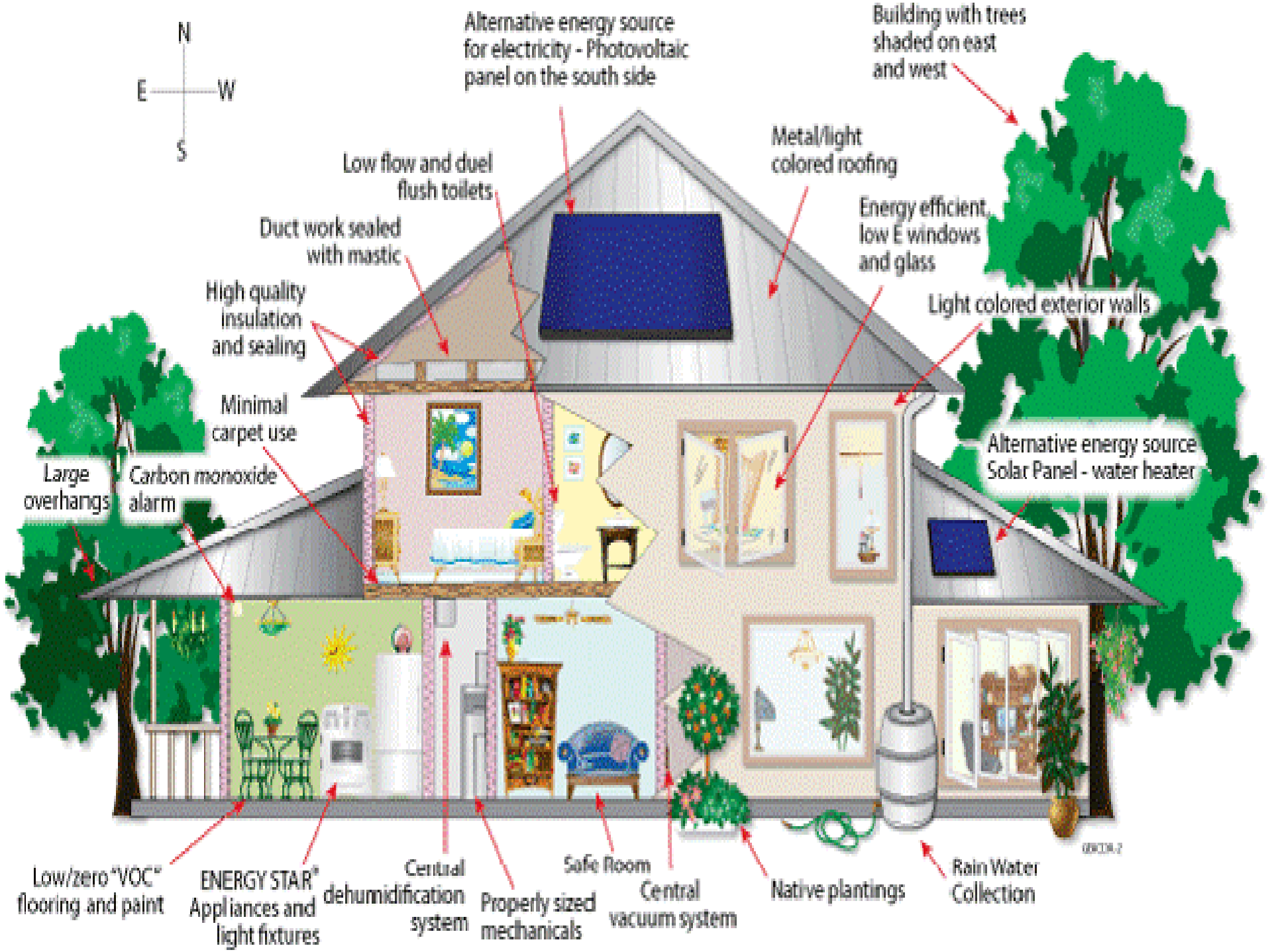


Wireless Monitoring

Low E Facilities & Management

LED Lighting System

System Integration Platform


N
E
W
S
Alternative energy source for electricity - Photovoltaic panel on the south side
Building with trees shaded on east and west
Metal/light colored roofing
Low flow and duel flush toilets
Duct work sealed with mastic
Energy efficient, low E windows and glass
High quality insulation and sealing
Light colored exterior walls
Minimal carpet use
Alternative energy source Solar Panel - water heater
Large overhangs
Carbon monoxide alarm
Low/zero "VOC" flooring and paint
ENERGY STAR® Appliances and light fixtures
Central dehumidification system
Properly sized mechanicals
Safe Room
Central vacuum system
Native plantings
Rain Water Collection

Green features and sustainable technologies

Energy Efficiency

- State-of-art Building management system were installed for real time monitoring of energy consumption.
- The use of aerated concrete blocks for facades reduces the load on air-conditioning by 15-20%
- Double-glazed units with argon gas filling between the glass panes enhance the thermal properties.
- Water-cooled scroll chiller.
- Installed two 25TR chillers.
- Secondary chilled water pumps installed with Variable Frequency Drives (VFDs).
- Energy efficient lighting design through Compact Fluorescent Lamps (CFLs).
- Roof garden covering 60% of area.

Zero Water Discharge Building

- All of the wastewater, including grey and black water, generated in the building is treated biologically through a process called the Root Zone Treatment System.
- The outlet-treated water meets the Central Pollution Control Board (CPCB) norms.
- Rain water harvesting system

Materials and Resources:

- 80% of the materials used in the building were sourced within 500 miles from the project site.
- Fly-ash based bricks, glass, alluminium and ceramic tiles, which have post-consumer and industrial waste were used in constructing the building to encourage usage of recycled content
- Office furniture is made of bagasse-based composite wood.
- More than 50% of the construction waste was recycled within the building or sent to other sites and diverted from landfill.

Sustainable Site:

- The building design was conceived to have minimum disturbance to the surrounding ecological environment.
- The disturbance to the site was limited within 40 feet from the building footprint during the construction phase.
- The majority of the existing flora & fauna and natural microbiological organisms were retained around the building.
- Extensive erosion and sedimentation control measures to prevent top soil erosion were implemented at the site during construction.
- Large vegetative open spaces.

Indoor Environmental Quality:

- Indoor Air Quality is continuously monitored and minimum fresh air is pumped into the conditioned spaces at all times.
- Fresh air is also drawn into the building through wind towers.
- Use of low Volatile Organic Compound (VOC) paints and coatings, adhesives, sealants and carpets.
- Maximum day-lighting.
- Operable windows and lighting controls for better day-lighting and views.

Project Cost

- This was the first green building in the country. Hence, the incremental cost was 18% higher.
- However, green buildings coming up now are being delivered at an incremental cost of 6-8%.
- The initial incremental cost gets paid back in 3 to 4 years.

INDIAN GREEN BUILDING COUNCIL

- The Indian Green Building Council (IGBC) was formed in the year 2001 by Confederation of Indian Industry (CII).
- The aim of the council is to bring green building movement in India and facilitate India to become one of the global leaders in green buildings by 2015.

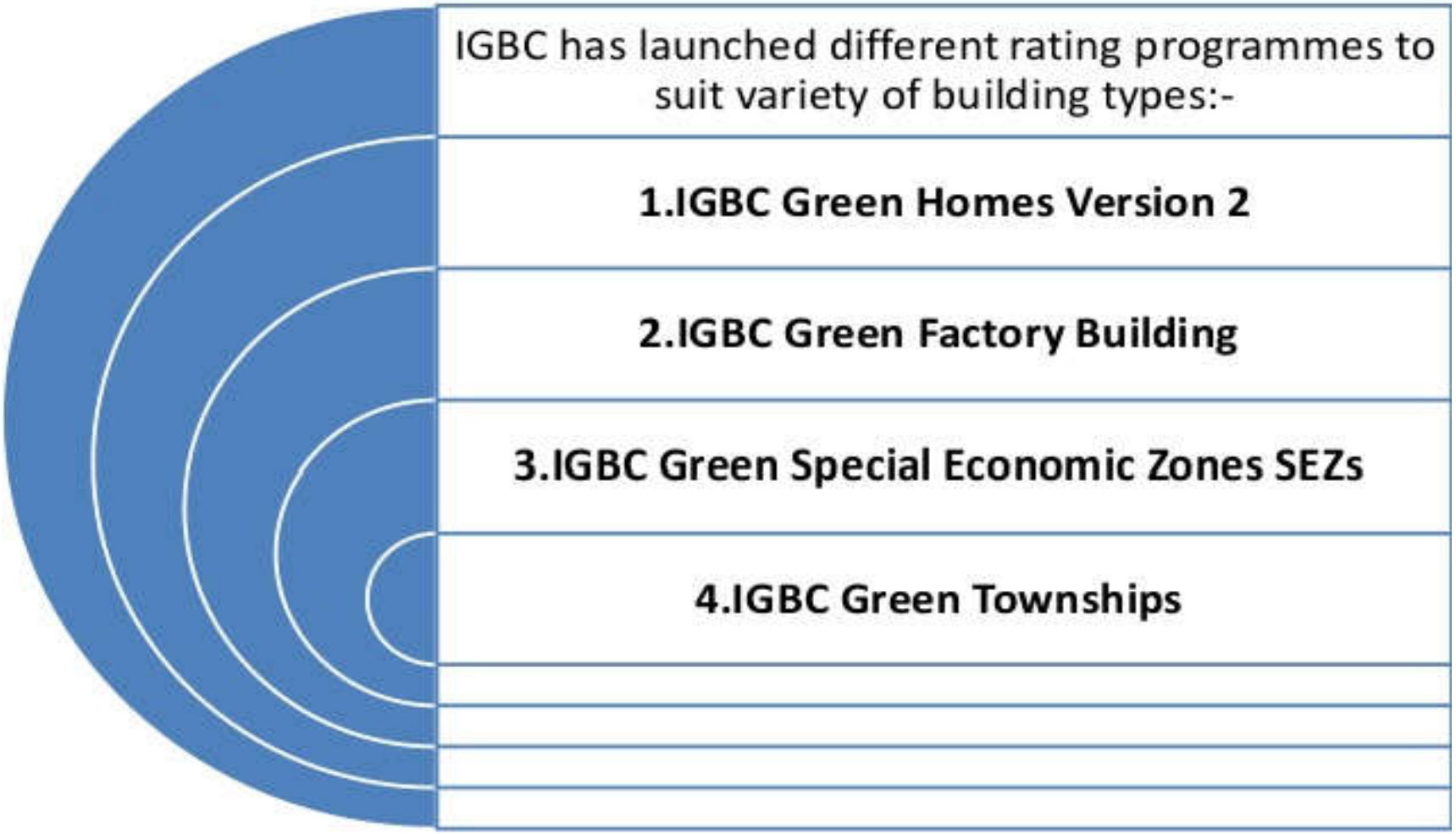
GREEN BUILDING IN INDIA

INDIAN GREEN BUILDING COUNCIL(IGBC)

IGBC formed by Confederation of Indian Industry (CII) in the year 2001.

*IGBC has licensed the **LEED** Green Building Standard from the U.S. Green Building Council and currently is responsible for certifying LEED-New Construction and LEED-Core and Shell buildings in India.*

Today, India has **461 certified green buildings**, which are fully functional and operational.

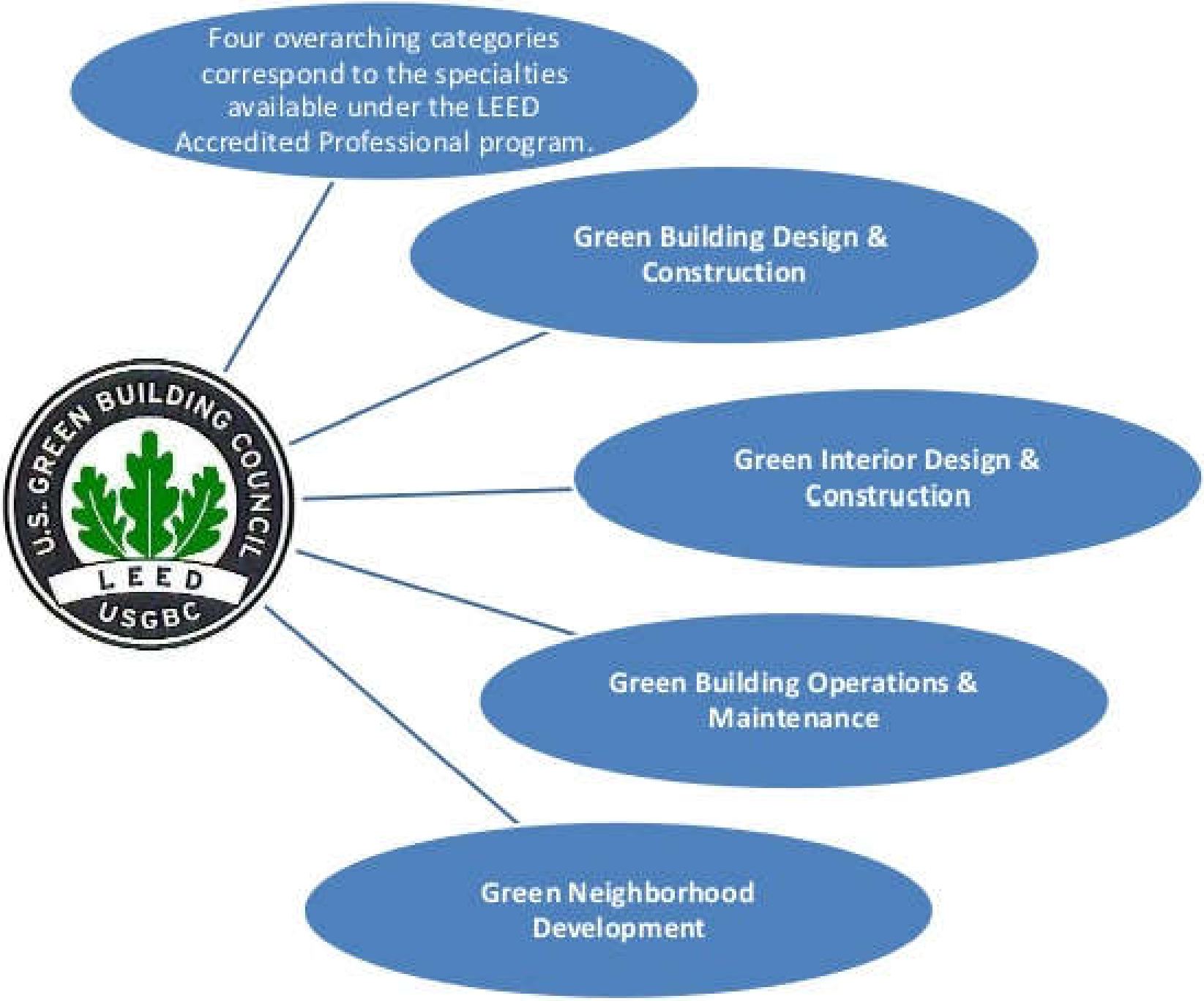

IGBC has launched different rating programmes to suit variety of building types:-
1.IGBC Green Homes Version 2
2.IGBC Green Factory Building
3.IGBC Green Special Economic Zones SEZs
4.IGBC Green Townships

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN(LEED)

LEED is a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes and neighborhoods.

Developed by the U.S. Green Building Council (USGBC), LEED is intended to help building owners and operators be environmentally responsible and use resources efficiently.

Proposals to modify the LEED standards are offered and publicly reviewed by USGBC's member organizations, which number almost 20,000.


Four overarching categories correspond to the specialties available under the LEED Accredited Professional program.
Green Building Design & Construction
Green Interior Design & Construction
Green Building Operations & Maintenance
Green Neighborhood Development
U.S. GREEN BUILDING COUNCIL
LEED
USGBC

IGBC RATING SYSTEM

- IGBC has developed green building rating programmes to cover commercial, residential, factory buildings, etc.
- Each rating system divided into different levels of certification are as follows:

➢ 'Certified' to recognise best practices.
➢ 'Silver' to recognise outstanding performance.
➢ 'Gold' to recognise national excellence.
➢ 'Platinum' to recognise global leadership.

Buildings can qualify for four levels of certification:

Certified: 40–49 points

Silver: 50–59 points

Gold: 60–79 points

Platinum: 80 points and above

GREEN BUILDINGS PROJECT IN INDIA

- Suzlon Energy Limited-Pune
- Biodiversity Conservation India-Bangalore
- Olympia Technology Park-Chennai
- ITC Green Centre-Gurgaon
- The Druk White Lotus School-Ladakh
- Doon School-Dehradun
- Raintree Hotels-Chennai
- Nokia-Gurgaon
- Rajiv Gandhi International Airport-Hyderabad
- Hiranandini-BG House, Powai
- ABN Amro Bank, Chennai
- Palais Royale at Worli, Mumbai
- Punjab Forest Complex,Mohali

- **SUZLON ENERGY LIMITED,PUNE:**

➢ Several accolades continue to shower upon Suzlon's global headquarter in Pune "One Earth".

➢ LEED certified it as 'PLATINUM' and it is built on an area of 10.13acres.

➢ One Earth can be counted as among the largest green building projects in India.

- **RAJIV GANDHI INTERNATIONAL AIRPORT-HYDERABAD:**

- India's first Greenfield airport is undeniably among the top 10 green buildings in India.
- First airport in asia to be certified with 'SILVER' rating.
- This green building ensures optimal use of natural light and minimal wastage of electricity or energy consumption.

- **<u>NOKIA-GURGAON:</u>**

➢ 'GOLD' rated building by LEED.

➢ Its smart lighting, heat recovery wheel and high efficiency chillers makes this office stand out from the rest.

Location- Hyderabad, India

Size - 4.5 acres (total site area) 1,858 m2 (total built up area),1,115 m2 (total air-conditioned area)

Type - Office building

Architectural Design - Karan Grover and Associates, India

Ratings- Awarded the LEED Platinum Rating in November 2003.

Solar PV systems

Indoor air quality monitoring

High efficiency HVAC system

Passive cooling system with wind towers

High performance glasses

Rain water harvesting

SOME IMAGES OF GREEN BUILDINGS









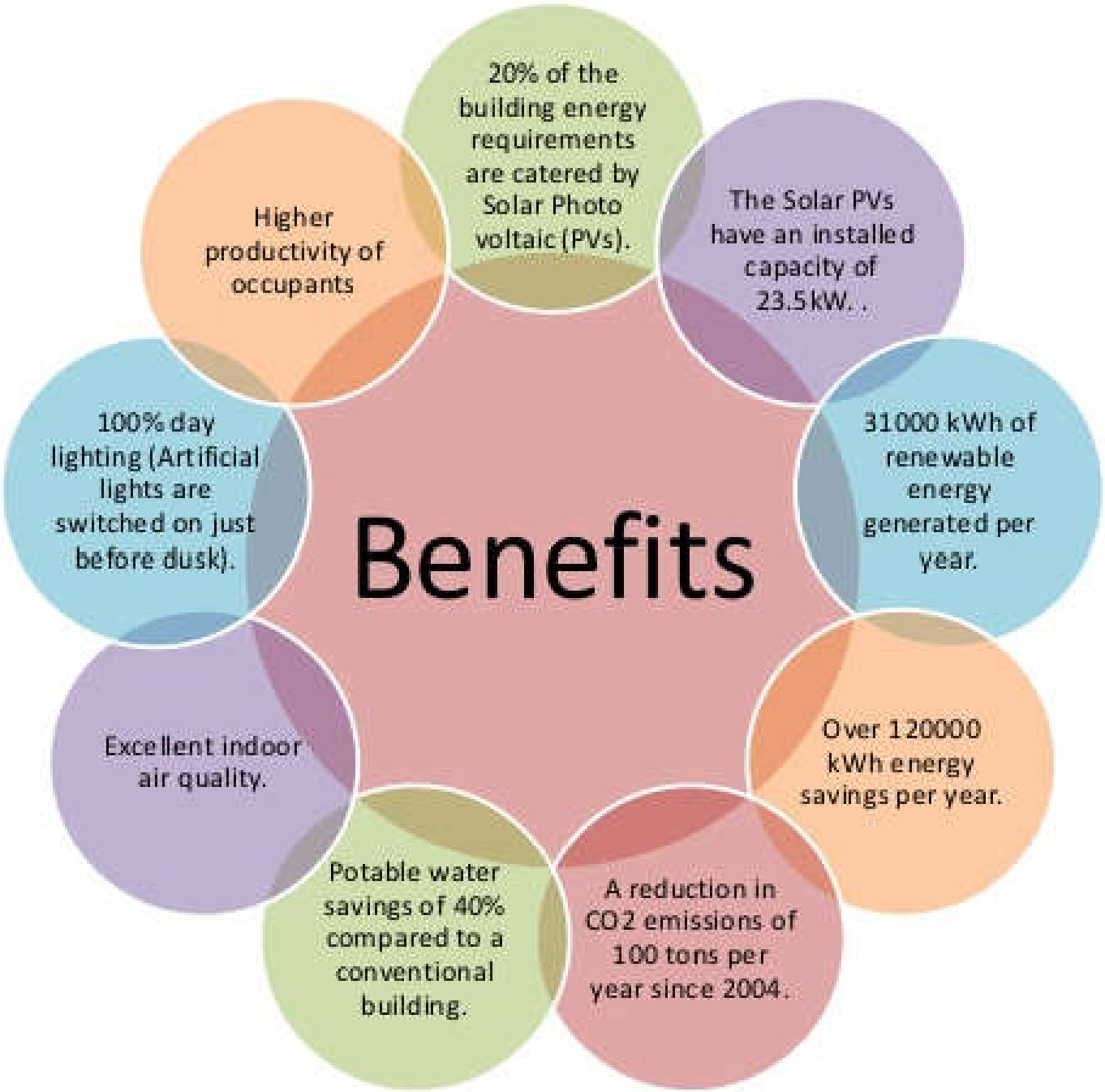


DIFFERENT FROM OTHER BUILDINGS

- The design,maintaince and construction of buildings have tremendous effect on our enviornment and natural resources.
- Green Building is different from the other buildings because it use a minimum amount of nonrenewable energy, produce minimal pollution, increases the comfort, health and safety of the people who work in them.
- It also minimize the waste in construction by recovering materials and reusing or recycling them.

AFFECT ON NATURAL RESOURCES

- According to surveys conducted in 2006, 107.3 million acres of total land area is developed, which represents an increase of 24 percent land covering green buildings over the past 3 years.
- In terms of energy, buildings accounted for 39.4 percent of total energy consumption and 67.9 percent of total electricity consumption.

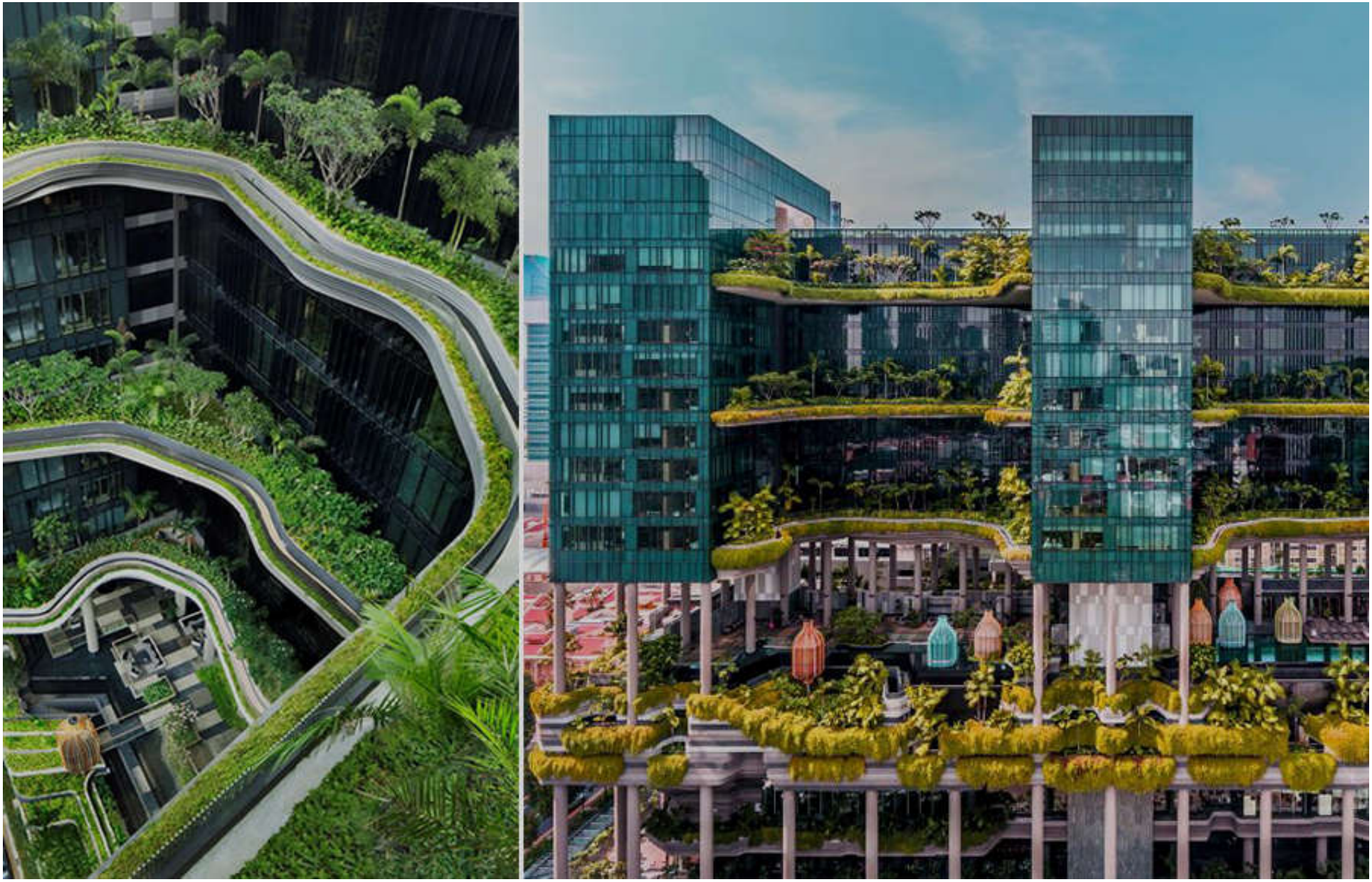

Benefits
20% of the building energy requirements are catered by Solar Photo voltaic (PVs).
The Solar PVs have an installed capacity of 23.5 kW. .
31000 kWh of renewable energy generated per year.
Over 120000 kWh energy savings per year.
A reduction in CO2 emissions of 100 tons per year since 2004.
Potable water savings of 40% compared to a conventional building.
Excellent indoor air quality.
100% day lighting (Artificial lights are switched on just before dusk).
Higher productivity of occupants

GREEN BUILDING IN GUJARAT

GREEN BUILDING IN VADODARA

AGORA TOWER, TAPEI, TAIWAN | Conceptual architecture,

Tree Tower Toronto



ParkRoyal Hotel Pickering in Singapore

Eco Building in Singapore




START THINKING GREEN