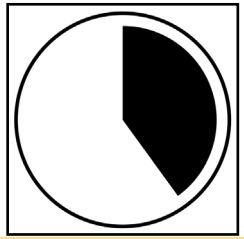
Introduction to Green Building Profession
Skill Training & Management

First step to becoming a Green Building Professional

Structure of the coursework:

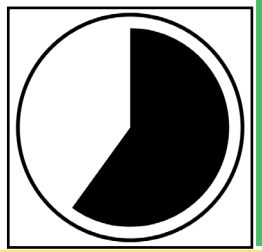
- The course is divided into 2 modules:

Module 1



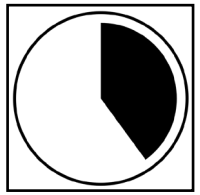
- Metrics of Sustainability
- Stakeholders in Sustainability
- Green Building Professions
- Sustainable design – The process
- Preparing the “Green Work Force”
- Forecast for the future

Module 2



- How to gain Green Experience?
- Range of Roles – Sustainability and Green Building Consultants
- Key environmental issues addressed by Green Building consultants

Module 1



- Sustainable design – The process
- Metrics of Sustainability
- Green Building Professions
- Stakeholders in Sustainability
- Preparing the Green Work Force
- Forecast for the future

Sustainable design as a well conceived process

Awareness and sensitivity to the environment and environmental challenges.

***Knowledge and understanding** of the environment and environmental challenges.*

Attitudes of concern for the environment and motivation to improve or maintain environmental quality.

***Skills to identify** and help resolve environmental challenges.*

Participation in activities that lead to the resolution of environmental challenges.

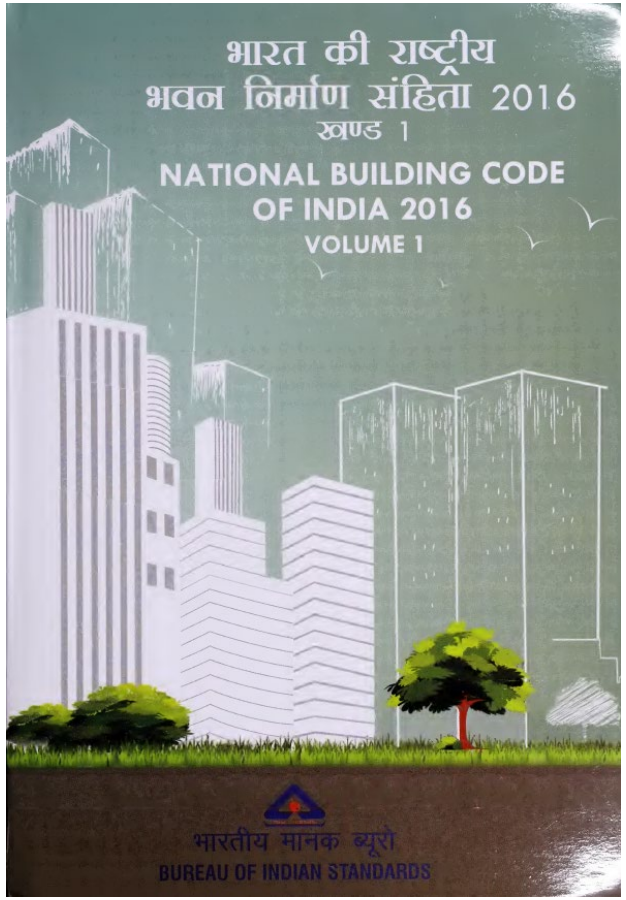
Metrics of Sustainability

- Standards
  - Mandatory
  - Voluntary
- Rating Systems

Metrics of Sustainability

- Standards
  - National Building Code
  - Model Building Byelaws
  - Energy Conservation Building Code
  - Eco-Niwas Samhita

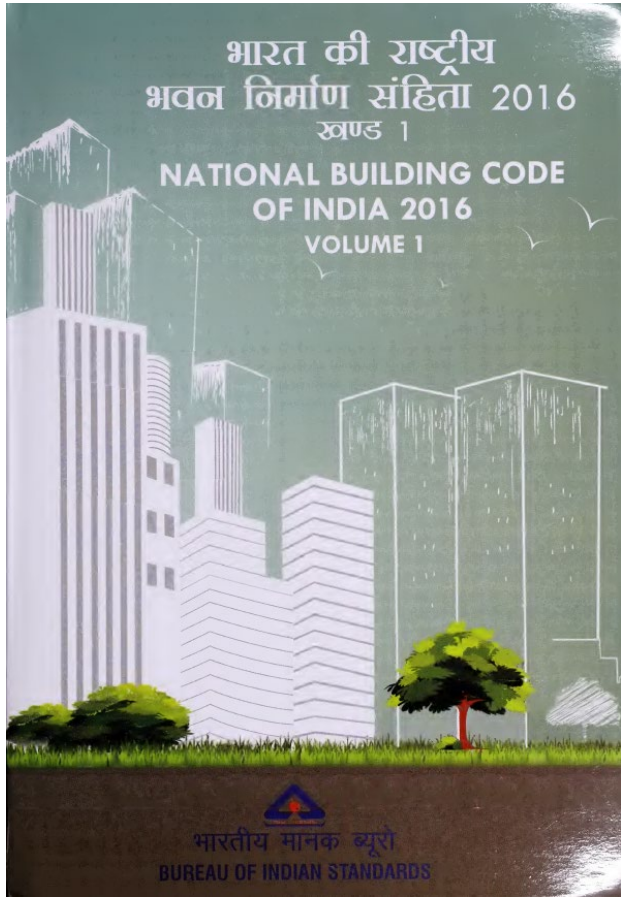
National Building Code



CONTENTS

Volume 1

National Building Code



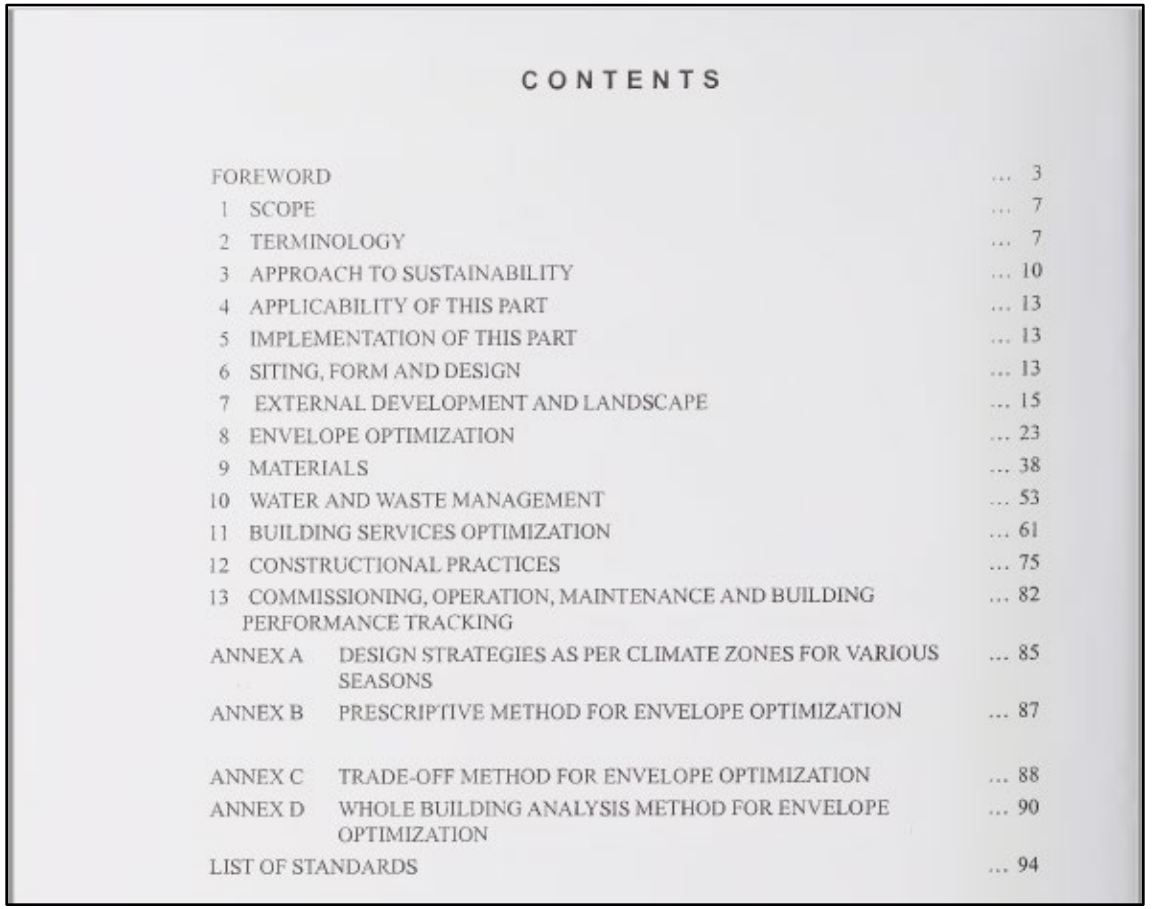
Volume 2

National Building Code

- The approach to sustainability is founded in the principles of Code to adequately protect public health, safety and welfare, and to meet requirements that do not unnecessarily increase construction-cost nor restrict the use of new innovative materials, products or methods of construction.

NATIONAL BUILDING CODE OF INDIA

PART 11 APPROACH TO SUSTAINABILITY



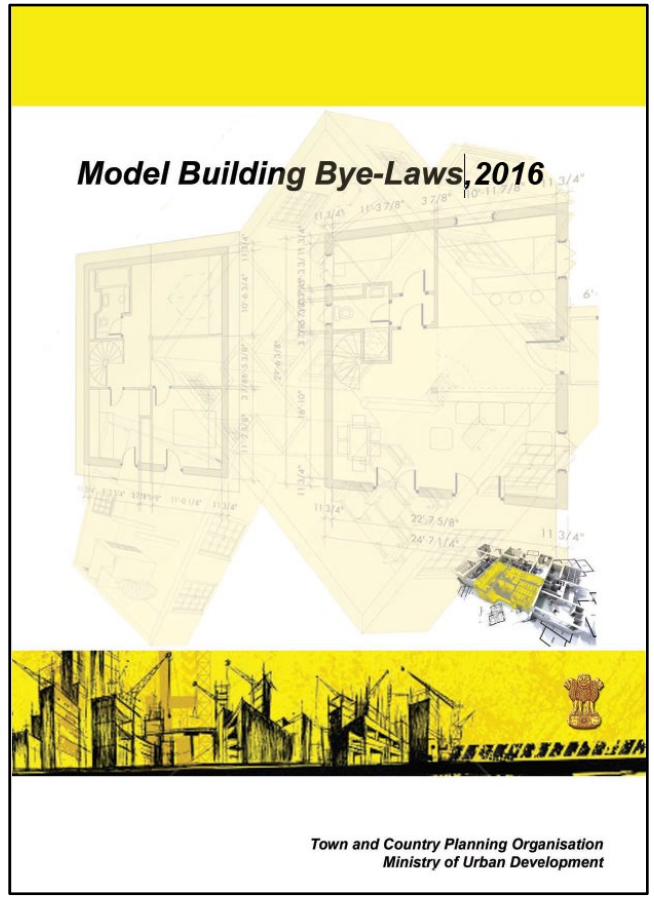
CONTENTS

National Building Code

- With a view to boost sustainability, the building code for the first time includes process for glazing in buildings with respect to their effect on energy, light and selection and manifestation of glass with respect to safety. It also focuses on energy conservation, use of solar energy by way of solar water heating systems, solar steam systems for cooking and laundry, solar-assisted refrigeration/air conditioning systems, solar photo voltaic systems, and efficient lighting.

Model Building Bye-Laws

- **Model Building Byelaws**, 2016 are legal tools used to regulate coverage, height, **building** bulk, and architectural design and **construction** aspects of **buildings** so as to achieve orderly development of an area.



10. GREEN BUILDINGS AND SUSTAINABILITY PROVISIONS

Modern buildings consume about 25 to 30 % of total energy, and up to 30 % of fresh potable water, and generate approximately 40 % of total waste. Sustainable buildings have demonstrated reduction in energy and water consumption to less than half of the present consumption in conventional buildings, and complete elimination of the construction and operational waste through recycling.

Thus, all buildings on various plot sizes above 100 sq.m. shall comply with the green norms and conform to the requirements mandatory for sanction as mentioned in this chapter.

These provisions are not specific to any rating system and are not intended to provide a single metric indication of overall building performance. These provisions allows the practitioners to easily exercise their engineering judgment in holistically and objectively applying the underlying principles of sustainability to a development or building facility, considering its functionality and required comfort level.

10.1 Provisions and Applicability

The green building provisions on various plot sizes are indicated in the table below:

Table 10.1 Provisions and applicability for various plot sizes (Residential and Non-Residential)

Plot Category	Applicable plot area (sq.m)	Provisions for Residential	Provisions for Non- Residential
I	Up to 100	Nil	Nil
II	100 to 500	1(a), 2(a), 2(b), 4(a)	1(a), 2(b), 4(a)
	500 to 1,000	1(a), 1(c), 2(b), 3(c), 4(a)	1(a), 1(c), 2(a), 2(b), 3(c), 4(a)
	1,000 to 3,000	1(a), 1(c), 1(d), 2(a), 2(b), 3(b), 3(c), 4(a)	1(a), 1(c), 1(d), 2(a), 2(b), 3(b), 3(c), 4(a)
III	Above 3,000	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 3(c), 4(a), 4(b)	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 3(c), 4(a), 4(b)

**Note: provisions marked 1(a), 2(b) etc are as per section 10.2.*
The schemes/ projects formulated on the basis of provisions given in Master plan/ Zonal Development Plan will require approval as indicated:
EIA/ ECC (as per MoEF), NBC (latest), ECBC 2007 or latest, BEE Star rating/ LEED of IGBC/ GRIHA of TERI Certification}
***EIA**- Environmental Impact Assessment Study Report,*
***ECC**- Environmental Clearance Certificate,*
***MoEF** – Ministry of Environment and Forest,*
***NBC** – National Building Code,*
***ECBC** – Energy Conservation Building Code,*
***BEE** – Bureau of Energy Efficiency,*
***LEED** – Leadership in Energy and Environment Design,*
***IGBC** –Indian Green Building Council,*
***GRIHA** – Green Rating for Integrated Habitat Assessment,*
***TERI** – The Energy and Resources Institute.*
The prevailing provisions of the above shall be applicable. However if there are any modification in the same, the modified provisions shall become automatically applicable.

10.2 Provisions for Sanction

1. Water Conservation and Management
   a) Rain Water Harvesting
   b) Low Water Consumption Plumbing Fixtures
   c) Waste Water Recycle and Reuse
   d) Reduction of Hardscape
2. Solar Energy Utilization
   a) Installation of Solar Photovoltaic Panels (detailed at section 10.2.3 below)
   b) Installation of Solar Assisted Water Heating Systems
3. Energy Efficiency (Concept of *passive solar design of buildings*) (Ref. Table 14.1-3)
   a) Low Energy Consumption Lighting Fixtures (Electrical Appliances – BEE Star and Energy Efficient Appliances)
   b) Energy Efficiency in HVAC systems.
   c) Lighting of Common areas by Solar energy/ LED devices.
4. Waste Management
   a) Segregation of Waste
   b) Organic Waste Management

In case owners of properties desire to procure green building ratings from one or more rating bodies, they may suitably incorporate any other provisions if required and additional incentive FAR as per Master Plan may be availed.

10.2.1 Provisions for City and Site level greening

In alignment with ***National Sustainable Habitat Mission***, the Authority shall encourage augmentation of green cover in the city/plot, by following:
The Urban Greening Guidelines, 2014 and other provisions as given below -

i. Provision of minimum 1 tree / every 80sqmt of plot area for plot sizes > 100sqmt and planted within the setback of the plot.
ii. Compensatory Plantation for felled/transplanted tress in the ratio 1:3 within the premises under consideration.
iii. Choice of species for plantation in site and abutting the road to be adopted as per Section 8 of the *Urban Green Guidelines, 2014*.
iv. The unpaved area shall be more than or equal to 20% of the recreational open spaces.

10.2.2 Water Re-use and Recycling

All building having a minimum discharge of 10,000 *l.* and above per day shall incorporate waste water recycling system. The recycled water should be used for horticultural purposes.

10.2.3 Roof Top Solar Energy Installations

Rooftop photovoltaic power station, or rooftop PV system, is a photovoltaic system that has its electricity-generating solar panels mounted on the rooftop of residential or commercial buildings. The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other

electrical accessories. Rooftop PV systems are faster than other types of renewable power plants. They're clean, quiet, and visually unobtrusive. Table 10.2 below stipulates the Norms for Roof Top Solar PV Installation-

Table 10.2 Norms for Roof Top Solar PV Installation and generation

S.No.	Category of buildings/area	Area standards	Generation requirement *
	Residential		
1	**Plotted Housing**	For HIG Plots and above	Minimum 5% of connected load or 20W/sqft for *"available roof space"***, whichever is less.
2	**Group Housing**	All proposals, as per Group Housing Norms	Minimum 5% of connected load or 20W/sqft for *"available roof space"*, whichever is less.
	All other buildings (Government or Private, defined as per clause 1.16 b to g) (mandatory for buildings having shadow free rooftop area > 50 sqmt)		
3 4 5 6 7 8	**Educational** **Institutional** **Commercial** **Industrial** **Mercantile** **Recreational**	Plot size of **500 sqmt and above**	Minimum 5% of connected load or 20W/sqft for *"available roof space"*, whichever is less.

* Area provisions on roof top shall be @12 sqmt per 1KWp, as suggested by Ministry of New and Renewable Energy.
** *"available rood area"* = 70% of the total roof size, considering 30% area reserved for residents' amenities.

10.2.4 Installation of Solar Assisted Water Heating System in Buildings

I. No new building in the following categories in which there is a system of installation for supplying hot water shall be built unless the system of the installation is also having an auxiliary solar assisted water heating system:-

a) Hospitals and Nursing Home.
b) Hotels, Lodges, Guest Houses, Group Housing with a plot area of 4000 sq m.
c) Hostels of Schools, Colleges and Training Centres with more than 100 Students.
d) Barracks of armed forces, paramilitary forces and police.
e) Individual residential buildings having more than 150 sq m. plinth area.
f) Functional Buildings of Railway Stations and Air Ports like waiting rooms, retiring rooms, rest rooms, inspection bungalows and catering units.
g) Community Centres, Banquet Halls, Barat Ghars, Mangal Karyalayas and buildings for similar use.

II. Definitions

i)	"Solar Assisted Water Heating System"	A device to heat water using solar energy as heat source.
ii)	"Auxiliary back-up"	Electricity operated or fuel fired boilers/systems to heat water coming out from solar water heating system to meet continuous requirement of hot water.
iii)	"New Building"	Such buildings of above said categories for which construction plans have been submitted to the Authority for clearance.
iv)	"Existing building"	Such buildings, which are licensed to perform their respective business.

III. Installation of Solar Water Heating System

a) *New Buildings:* Clearance of plan for the construction of new buildings of the aforesaid categories shall only be given if they have a provision in the building design itself for an insulated pipeline from the rooftop in the building to various distribution points where hot water is required. The building must have a provision for continuous water supply to the solar water heating system. The building should also have open space on the rooftop, which receives direct sun light. The load bearing capacity of the roof should at least be 50 kg. per sq m. All new buildings of above said categories must complete installation of solar water heating systems before obtaining necessary license to commence their business.

b) *Existing Buildings:* Installation of Solar Assisted Water Heating Systems in the existing building shall be made mandatory at the time of change of use to above said category provided there is a system or installation for supplying hot water.

IV. *Capacity:* The capacity of solar water heating system to be installed on the building of different categories shall be decided in consultation with the local bodies. The recommended minimum capacity shall not be less than 25 litres per day for each bathroom and kitchen subject to the condition that maximum of 50% of the total roof area is provided with the system.

V. *Specifications:* Installation of Solar Assisted Water Heating Systems shall conform to BIS specification IS 12933. The solar collectors used in the system shall have the BIS certification mark.

VI. *Auxiliary System:* Wherever hot water requirement is continuous, auxiliary heating arrangement either with electric elements or oil of adequate capacity can be provided.

10.2.5 Sustainable Waste Management

Zero Waste is a concept of waste management and planning approaches that emphasize waste prevention as opposed to end waste management. This means restructuring production and distribution systems, designing and managing products and processes to systematically follow the 3R rule of Reduce, Re-use and Re-cycle the volume of waste, to conserve and recover all used resources, and therefore eliminating all discharges to landfills, and prevent air, water and land pollution.

Zero Waste/ land-fill can be achieved by adopting systematic approach of segregation at source by planning, by collection facilitation and most importantly by creating public awareness.

The green waste can be converted into fuel cakes, kitchen waste into manure, construction & demolition waste into bricks, plastic waste into oil, paper, glass and steel back into the same and all residual inert materials can also be converted into bricks. Achieving zero land-fill is more conveniently possible, if

a) The collection is made from house to house and some segregation is done at household level and
b) Separate wet and dry bins must be provided at the ground level.
c) The recycling is done at decentralized, say, ward or even lower levels.

10.2.6 Sustainability of Building Materials

Sustainability of natural resources for building materials shall be ensured through conservation of available natural resources and use of supplementary materials such as industrial/agricultural by-products, renewable resources, factory made building components and recycled construction and demolition waste.

Supplementary building materials (derived or processed waste) shall be suitably used in combination with conventional resources offers dual advantages in purview of health & environmental benefits.

Use of Factory made pre-fab/pre-cast and recycled components with *Green benefits*:

a) Panels, hollow slabs, hollow blocks–etc. - conservation of materials, less water requirement.
b) Fly Ash bricks, Portland Pozzolana cement, Fly ash concrete, phosphogypsum based walling & roofing panels, particle wood – recycled use of industrial/ agricultural by-products. (Ref. Table 14)
c) Fly ash/ AAC (Autoclaved aerated light weight concrete) panels/ CLC (Cellular light weight concrete) panels- ensures thermal comfort (significant reduction in air conditioning requirement)
d) Use of bamboo & rapidly growing plantation timbers- environmental benefits.

Local materials are generally suitable for prevailing geo-climatic conditions & have advantage of low transportation cost & time. Sustainable use of building materials shall be encouraged which may combine certain mandatory provisions and incentives.

10.3 Various Guidelines for Green Rating systems

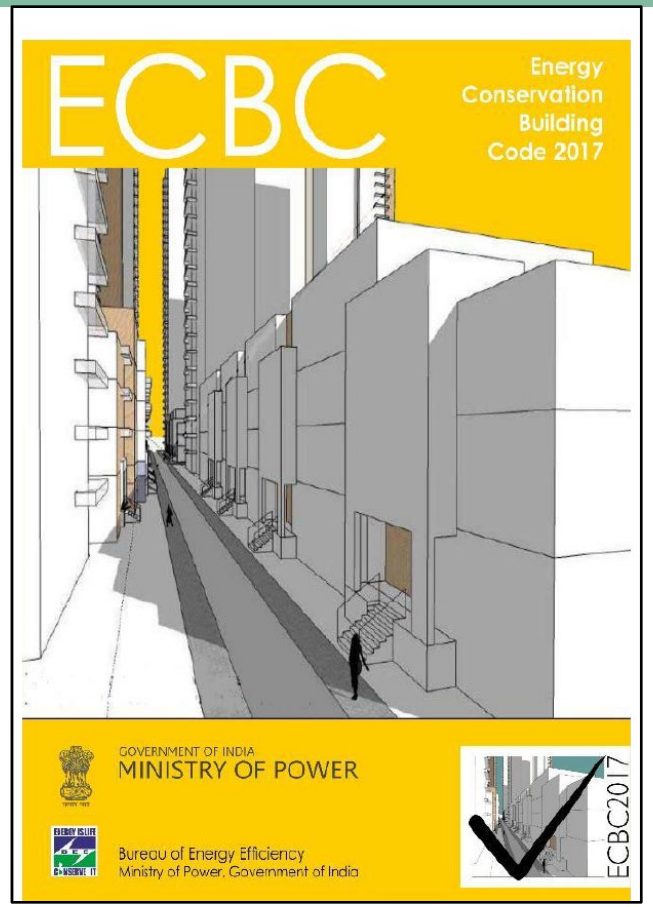
The respective State Governments may prepare their separate *Green Rating* systems for buildings by selectively combining/adopting/amending the provisions between the following guidelines:

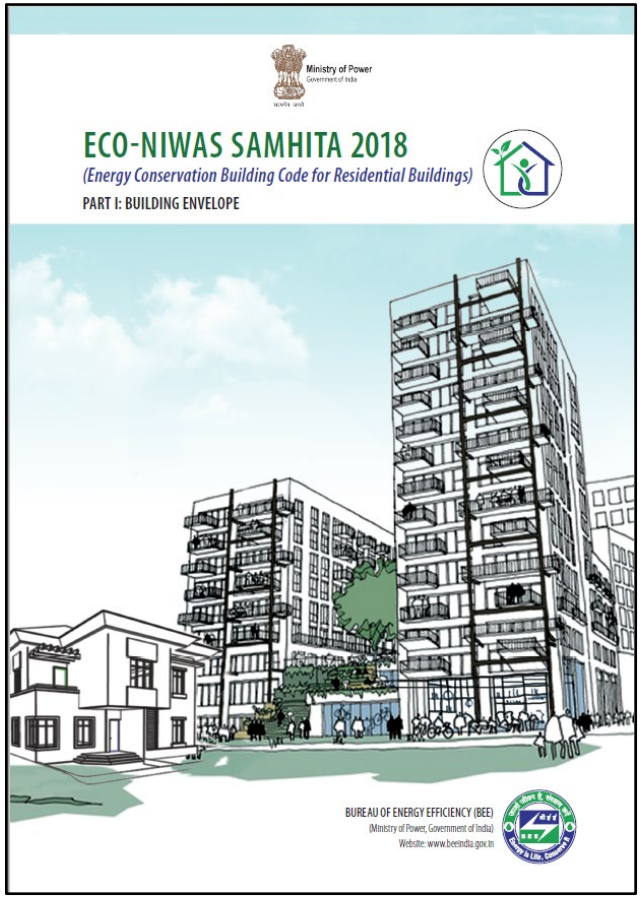
1. IGBC guidelines by the Confederation of Indian Industries.
2. GRIHA guidelines by the Ministry of New and Renewable Energy. GoI.

In pursuance of the *National Sustainable Habitat Mission* on *Energy Efficiency* in Buildings, the Authority shall encourage the provisions of the following Energy efficiency guidelines by certain mandatory provisions and incentives-

3. ECBC guidelines prepared by Bureau of Energy Efficiency, Ministry of Power. GoI
4. Model Energy Efficiency guidelines. (NSMH Sub report by Bureau of Energy Efficiency)

Energy Conservation Building Code and Eco NIWAS Samhita





Metrics of Sustainability

- **Rating Systems:**
  - GRIHA
  - LEED
  - IGBC
  - EDGE
  - GEM

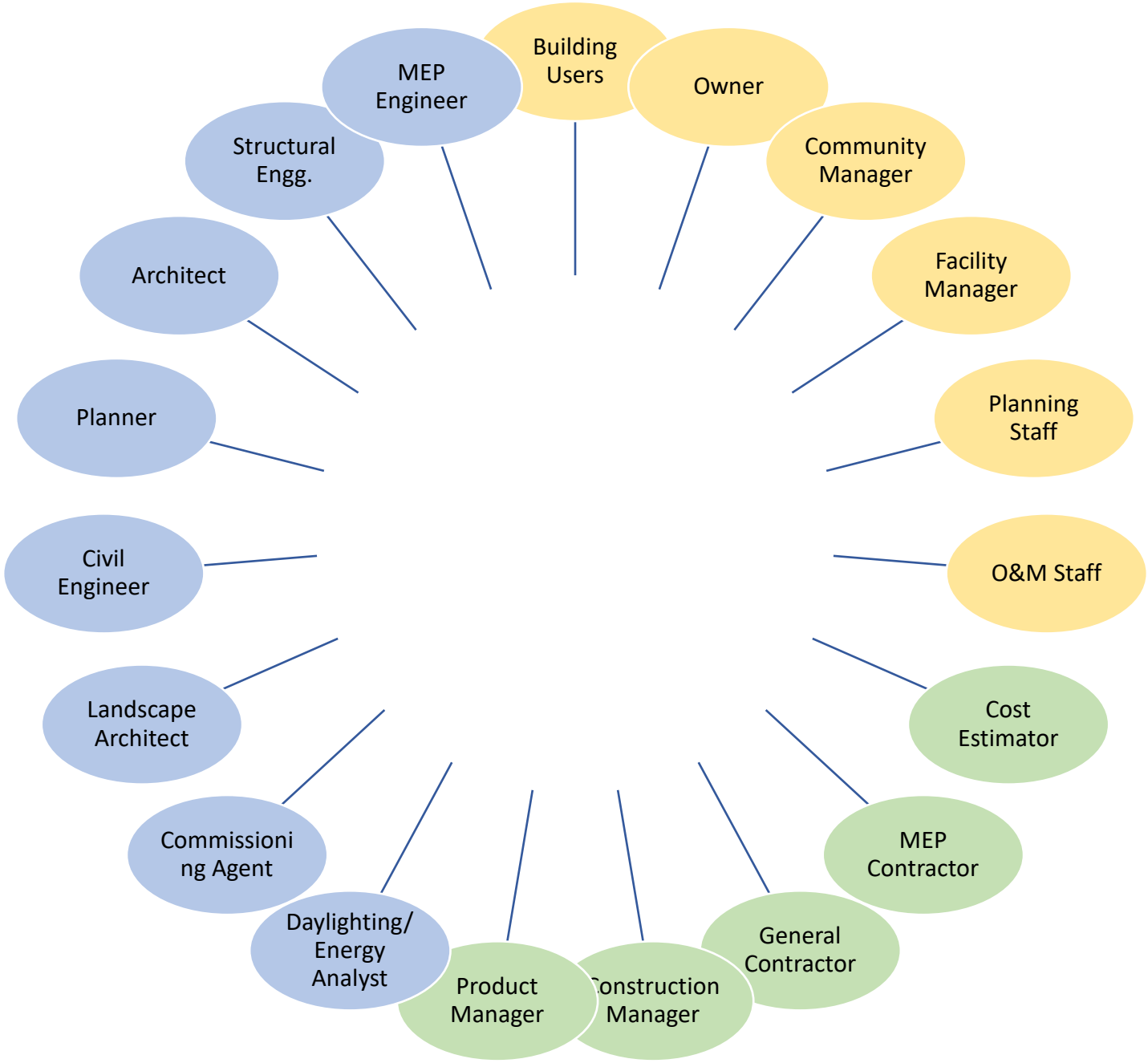
Common core factors between rating systems:

- Location, site features & building orientation
- Water efficiency
- Energy efficiency
- Material and resource selection/reduction
- Indoor air and environmental quality
- Toxin reduction / elimination

Green Building Professions

- Academic
- Architect
- Building owner
- Chief sustainability officer
- Civil engineer
- Commissioning agent
- Contractor
- Electrical engineer
- Environmental consultant
- Facility manager
- Interior designer
- Landscape architect
- Mechanical engineer
- Non-profit member
- Plumbing engineer
- Real estate professional

Stakeholdership in Sustainability



Courtesy: The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability, Authored by Bill Reed and 7group
Adapted from: Graphic by Bill Reed

Entire project as learning wheel

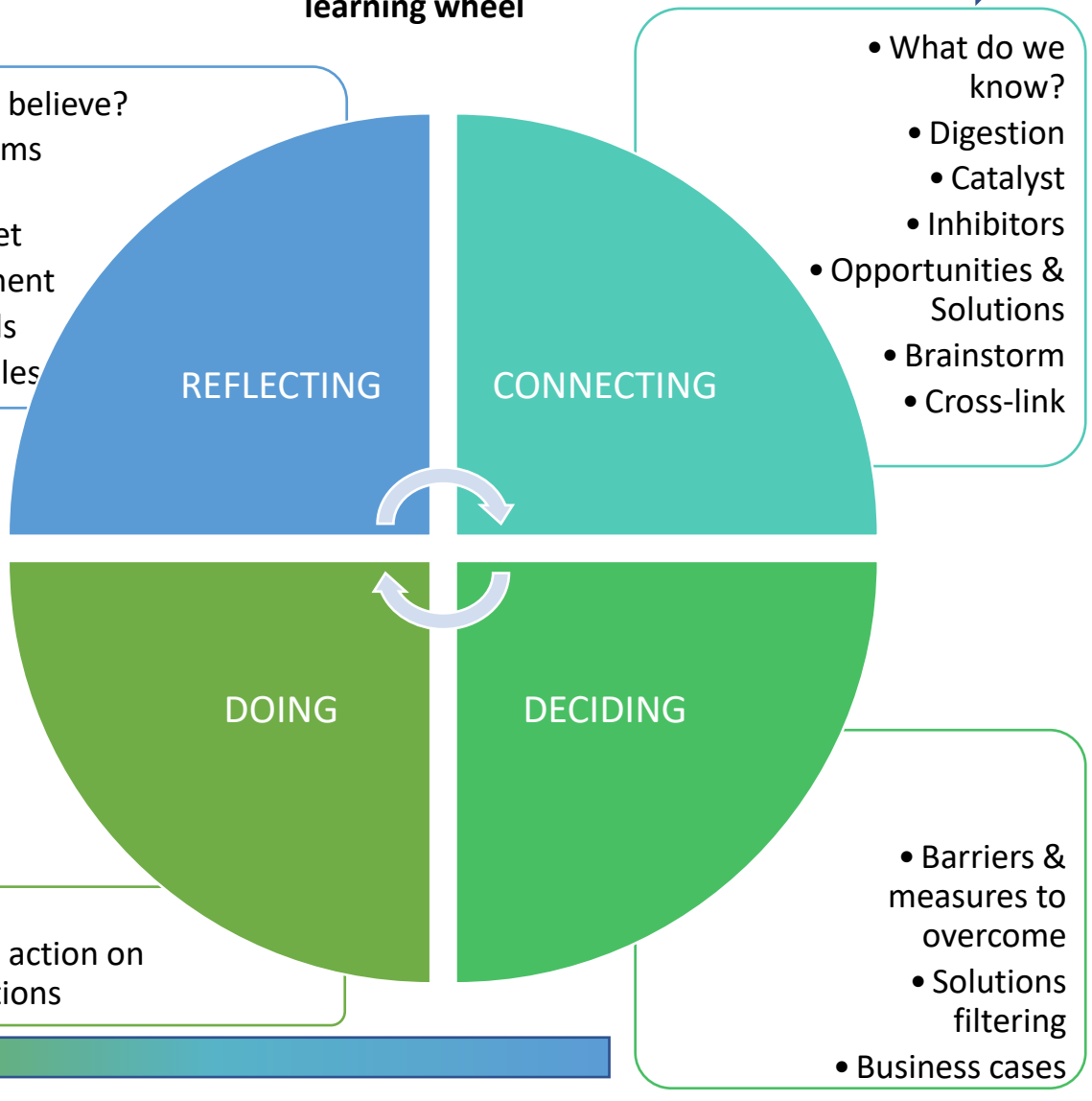
REFLECTING
Pre-Project

- What do we believe?
- Organizational context
- Assemble right team
- Right charge to team - Goals
- Team alignment

Past Projects
-Collect Data
-Analyse in-use realty
-Refine operations

DOING
Constructing

- Follow through



CONNECTING
Discovery

- What do we know?
- Data gathering: site, project.
- I.D. key systems
- Baseline traditional design and budget
- Owners vision and design intent

DECIDING
Finalizing Design

- Final business cases

DIAGRAM OF THE LEARNING WHEEL. ADAPTED FROM IDEAS PRESENTED IN PETER M. SENGE ET AL., THE FIFTH DISCIPLINE FIELDBOOK: STRATEGIES AND TOOLS FOR BUILDING A LEARNING ORGANIZATION

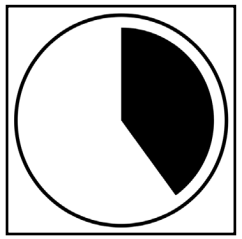
How do you best prepare young professionals for the green work force?

- Encourage the application of sustainable and restorative research to studio projects.
- Provide research, collaboration, and hands-on building opportunities that encourage multidisciplinary collaboration and sustainable building.
- Incorporate new scholarship, research, and practice in the coursework to better enable students to contribute to the further advancement of the discipline.

Forecast for the future in the field of sustainability

- Continuous improvement in our understanding of sustainability and our effectiveness in achieving it;
- Continued shift in the priorities in all students and faculty to hold sustainability as a core measure of a design's effectiveness, along with things like cost, constructability, aesthetics, and functionality;
- Shift in emphasis from sustainability to regenerative design;
- Expansion of the scale that is addressed in green building to look at whole cities and regions.

Module 1

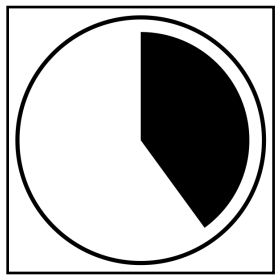


- What are the different metrics of sustainability?
- Who are the various green building professions?
- Who are the stakeholders in sustainability?
- Preparing the Green Work Force
- Forecast for the future

Structure of the coursework:

- The course is divided into 2 modules:

Module 1



- Metrics of Sustainability
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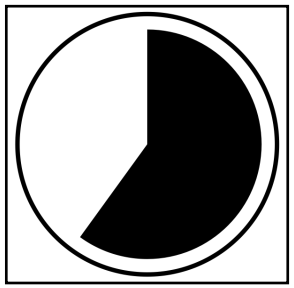
Module 2



- How to gain Green Experience?
- Range of Roles – Sustainability and Green Building Consultants
- Key environmental issues addressed by Green Building consultants

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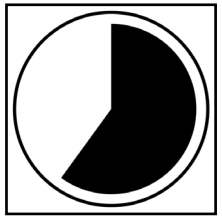


Green Economy Map

Industries and Sectors within the Green Economy

Courtesy: GreenCareerCentral.com
Source: https://www.3blmedia.com/News/Transitioning-Greener-More-Sustainable-Career-Experts-Provide-How-Advice-During-Webinar-Hosted

Range of Roles

- Sustainability consultants
- Green Building consultants

Range of Roles – Sustainability Consultants

Assessments

- Provide **gap analysis** (a status report that looks at where a company is and where it wants to be) of current company with recommended action steps.
- Assess energy sources and use, **review the supply chain**, and look at **operation audits**.
- Research/analysis, such as **benchmarking** of competition or trends in the market.
- Finance for **green strategies**.

Range of Roles – Sustainability Consultants

Plans

- Provide **sustainability plans**/assessments/reporting.
- Strategize for **green change management**/employee engagement.

Range of Roles – Sustainability Consultants

Reports

- **Recommendations** for internal and external communication
- **Training/presentation** to internal staff on sustainability goals
- **Advising** internal chief sustainability officers (CSOs)

Range of Roles – Sustainability Consultants

- **Facilitate the vision/goal-setting** with the owner in terms of the environmental aspects of the building.
- **Help with site selection** based on environmental issues such as regional resources (water, renewable energy, etc.), urban infrastructure, and site conditions.
- Determine if it would make more sense to **utilize an existing building** or to build new.
- Assist in optimum team selection with **specialized expertise** based on project goals.
- Recommend building orientation to **best capitalize on natural resources** such as maximizing daylighting.

Key environmental issues addressed by Green Building consultants

- Site Issues
- Water
- Energy
- Materials
- Air
- Awareness/Facilitation/Implementation

Key environmental issues addressed by Green Building consultants

- Site Issues:
  - Heat Island Effect
  - Brownfield Remediation

Site Issues: Urban Heat Island Effect

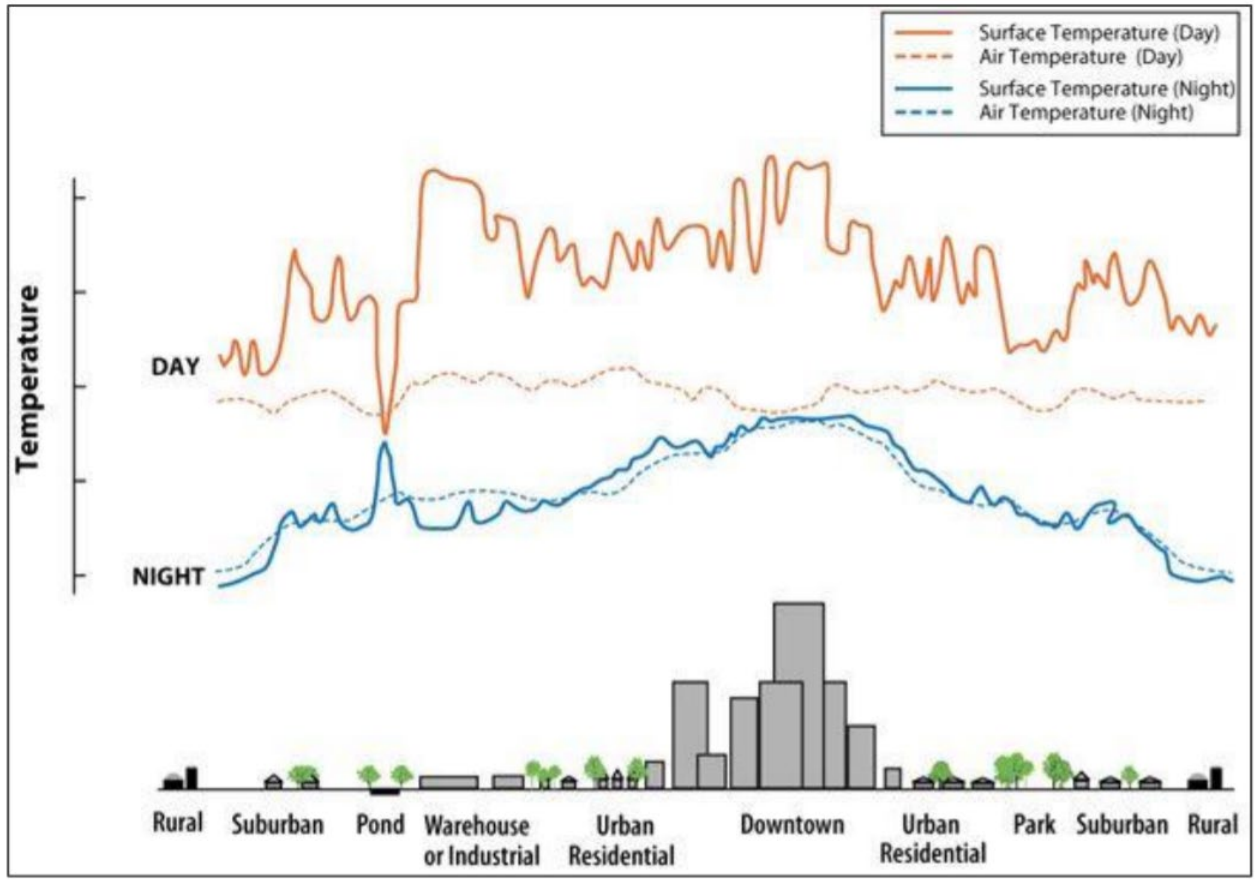
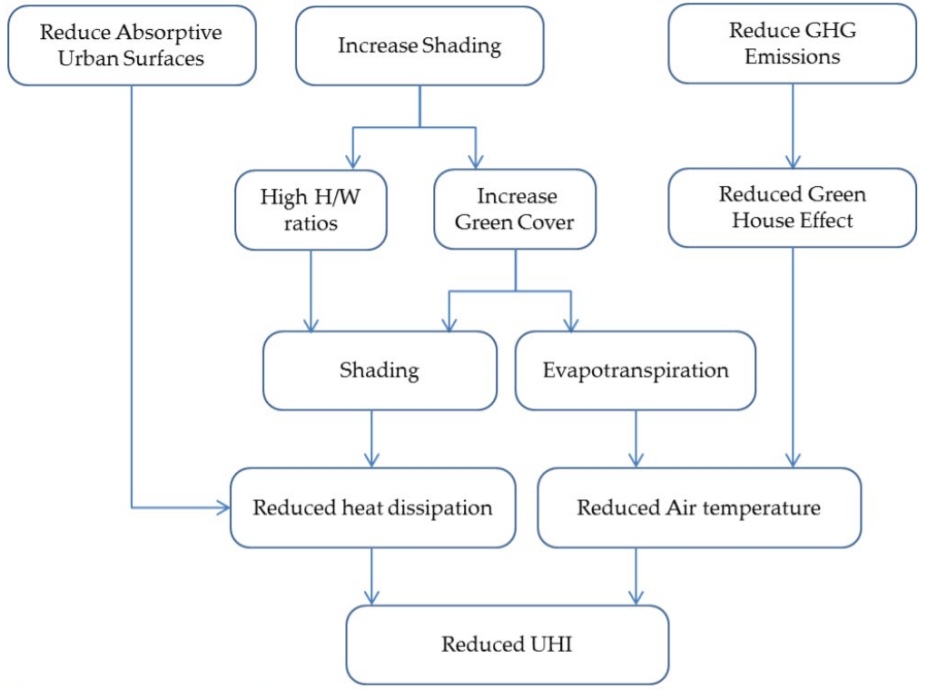


Figure 3-1 Variations of Surface and Air Temperatures in different types of urban areas compared to rural peripheries. (1)



UHI Mitigation Approaches

Site Issues: Brownfield Remediation

- Create employment opportunities
- Increase in taxes
- Increase in property value
- Promote green economy
- Reduce urban sprawl
- Increase competitiveness for cities
- Increase export potential for cleanup technologies

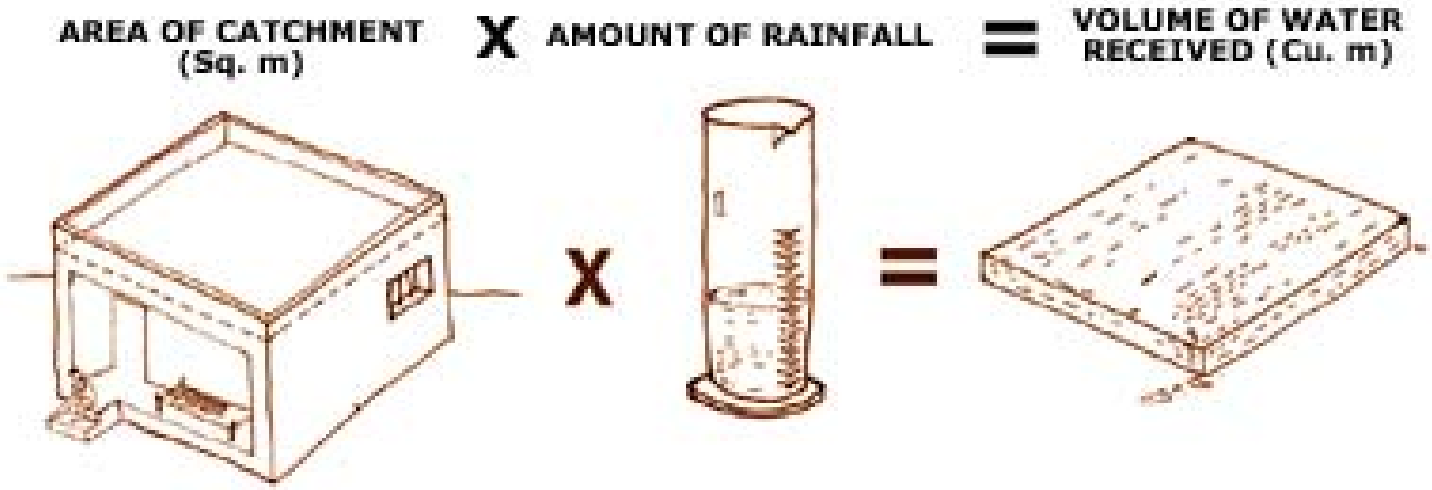
- Reduce pressure on Greenfields
- Reduce pollution
- Improve environment quality
- Promote utilization of renewable resources at brownfield sites
- Improve sustainable development index
- Environmental Justice

- Renewal of old community
- Develop brownfield into community, commercial market or eco-industrial park
- Improvement in public infrastructure (School, hospital, recreation etc.)
- Improve accessibility

Key environmental issues addressed by Green Building consultants

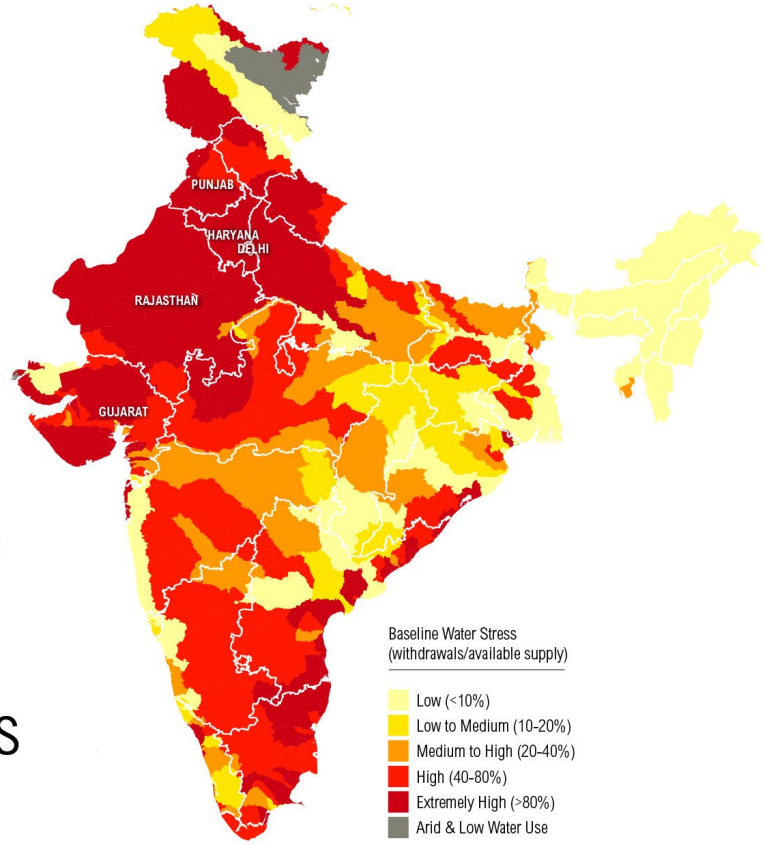
- Water:
  - Rainwater Harvesting
  - Resource Management

Water: Rainwater Harvesting



Water: Resource Management

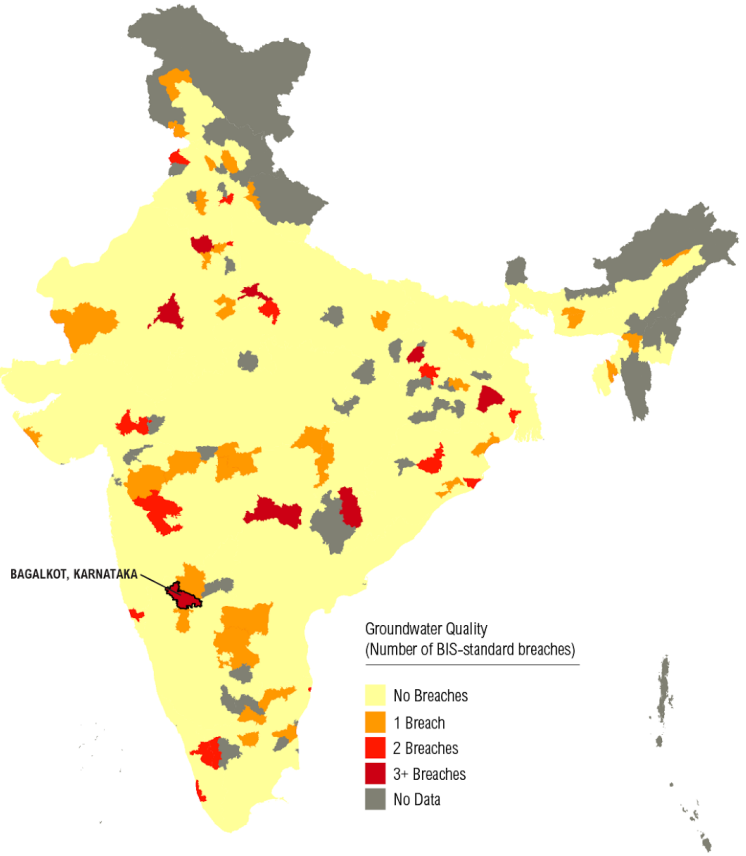
54% of India Faces **High** to **Extremely High** Water Stress



www.chaitanyaproducts.com

WORLD RESOURCES INSTITUTE

More than **100 MILLION** People Live in Areas of Poor Water Quality



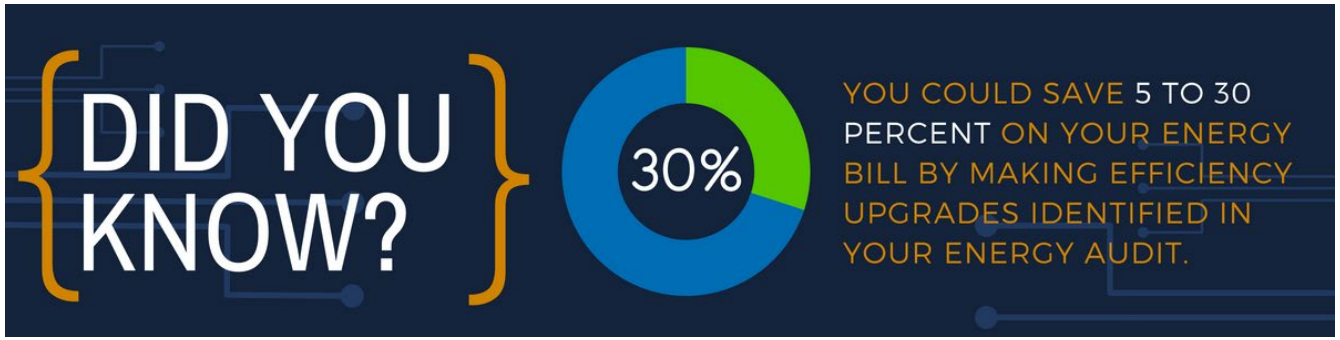
www.indiawatertool.in

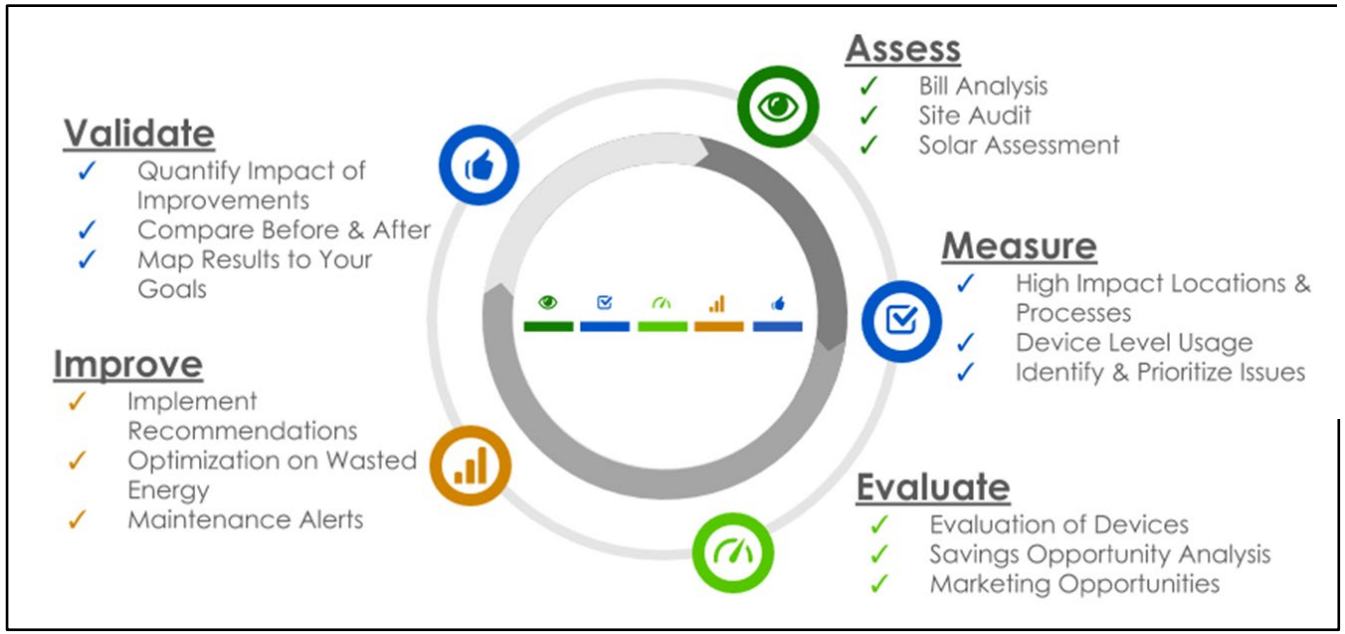
WORLD RESOURCES INSTITUTE

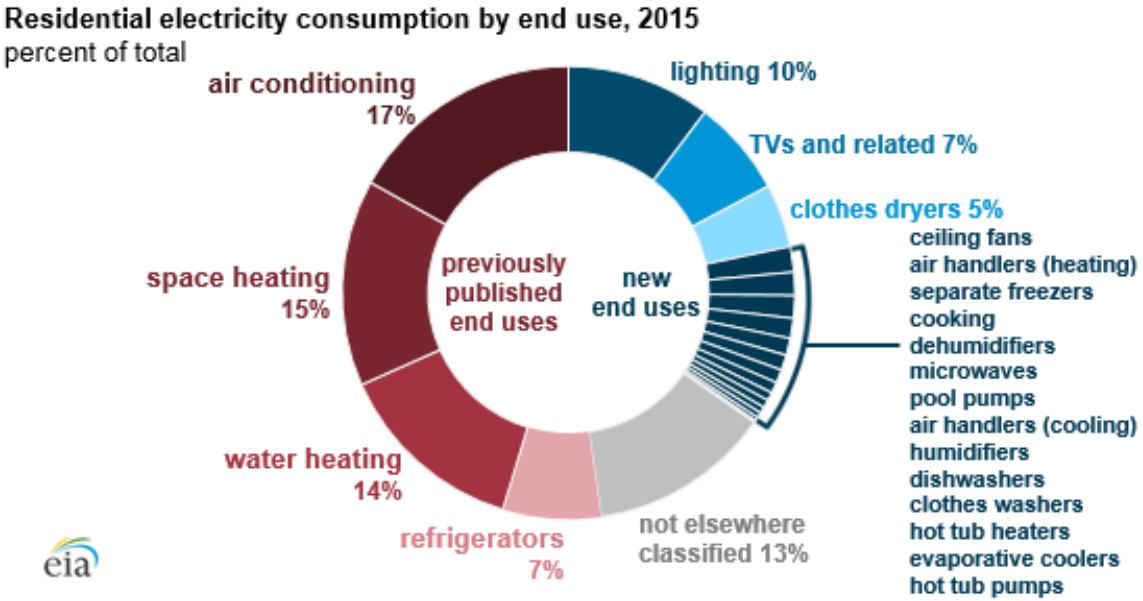
Key environmental issues addressed by Green Building consultants

- Energy:
  - Energy Modelling
  - Daylight Design
  - Energy Audits
  - Building Automation Systems

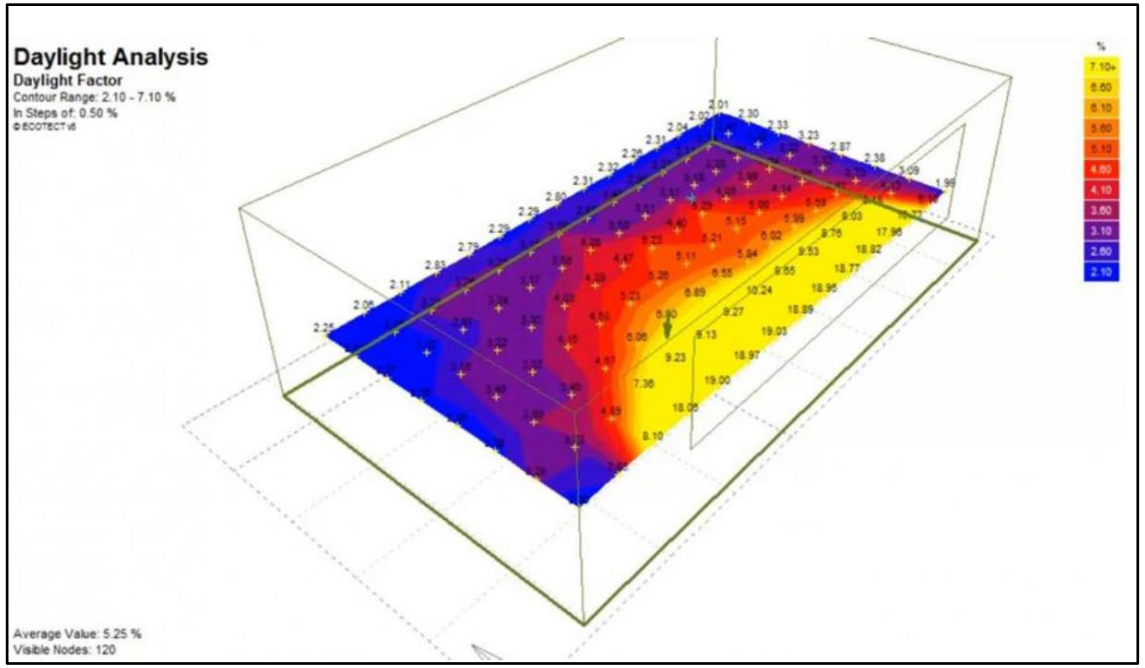
Energy: Energy Modelling

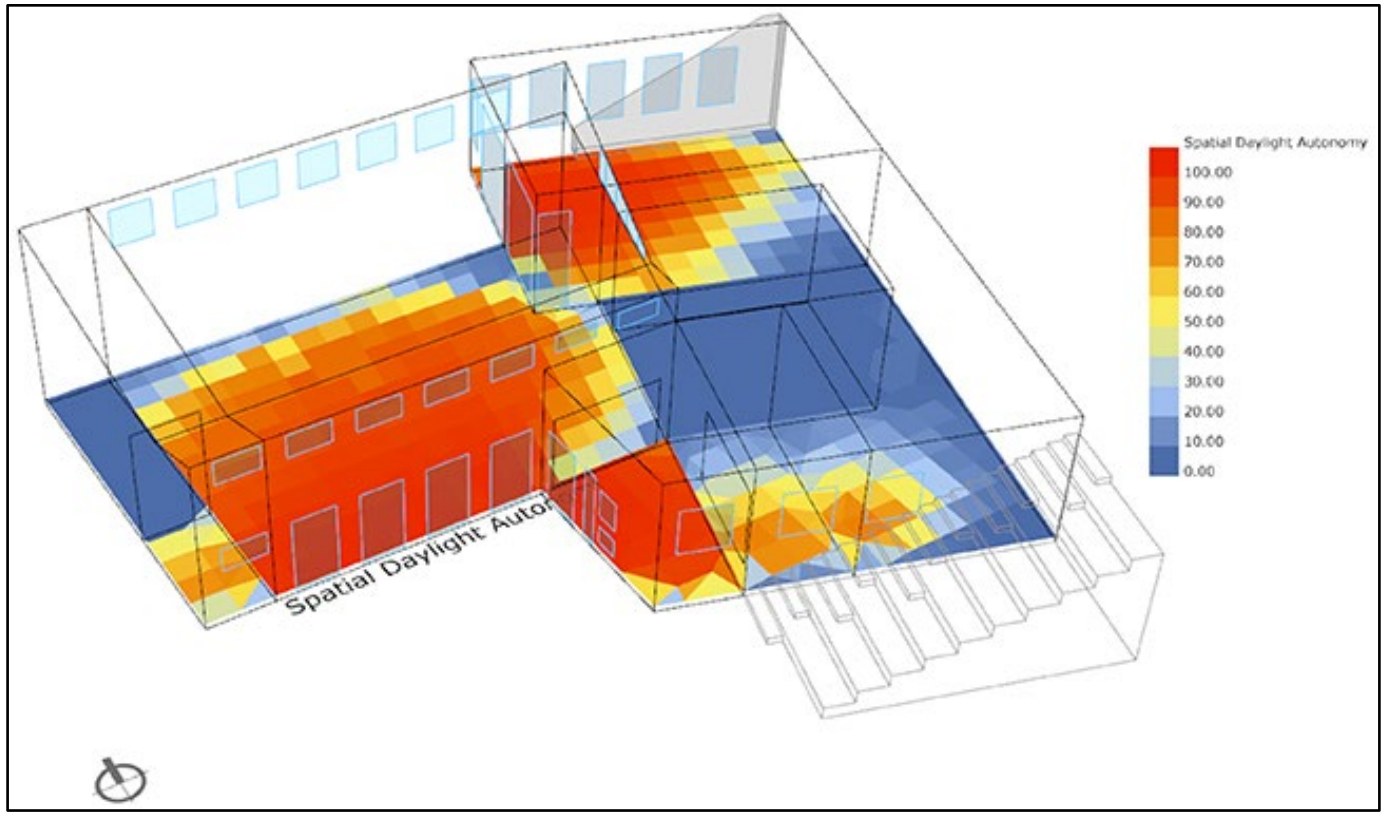






Energy: Daylight Design

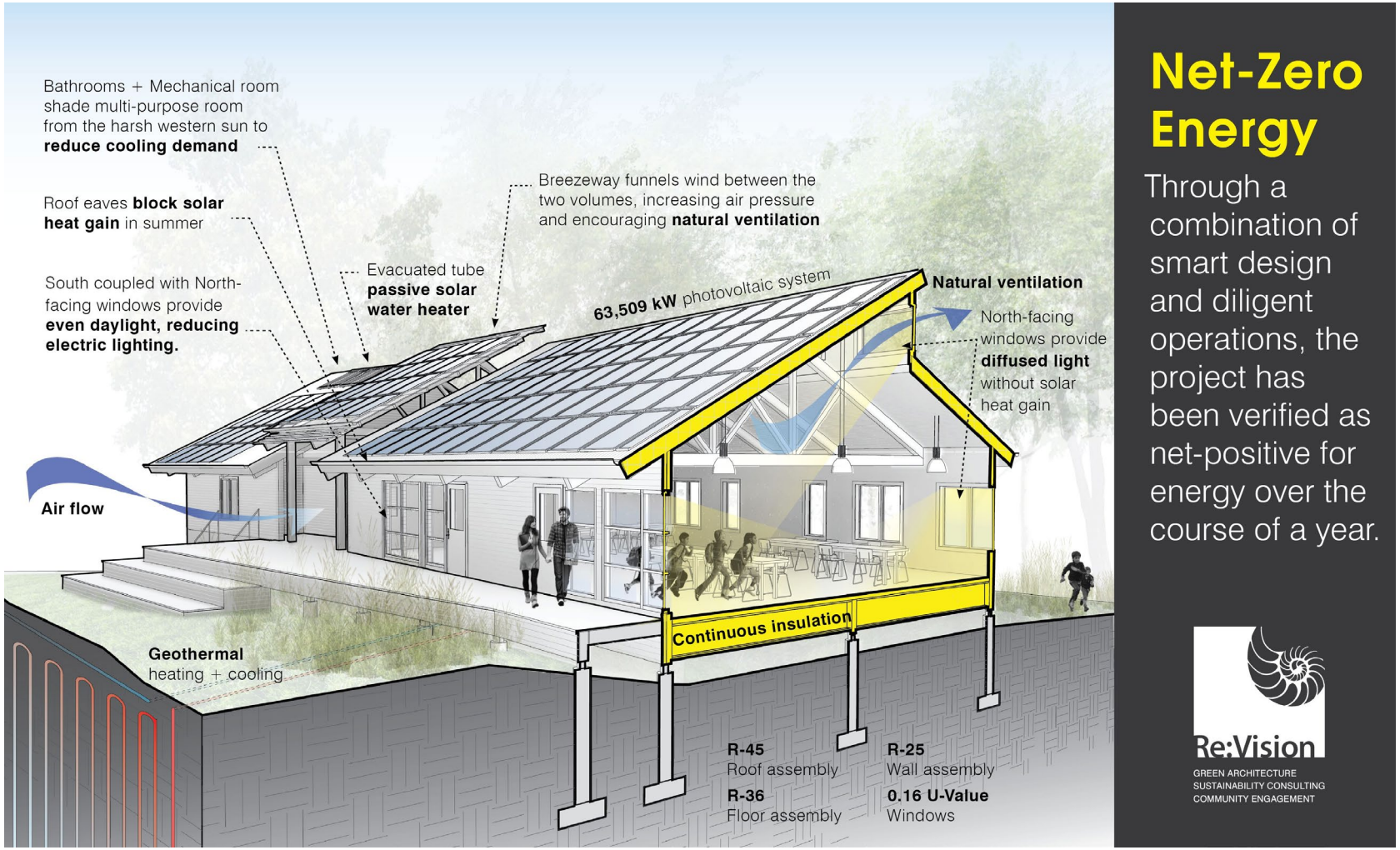




Key environmental issues addressed by Green Building consultants

- Future of Energy:
  - Net-Zero Energy Building
  - Carbon Neutrality
  - Green power integration

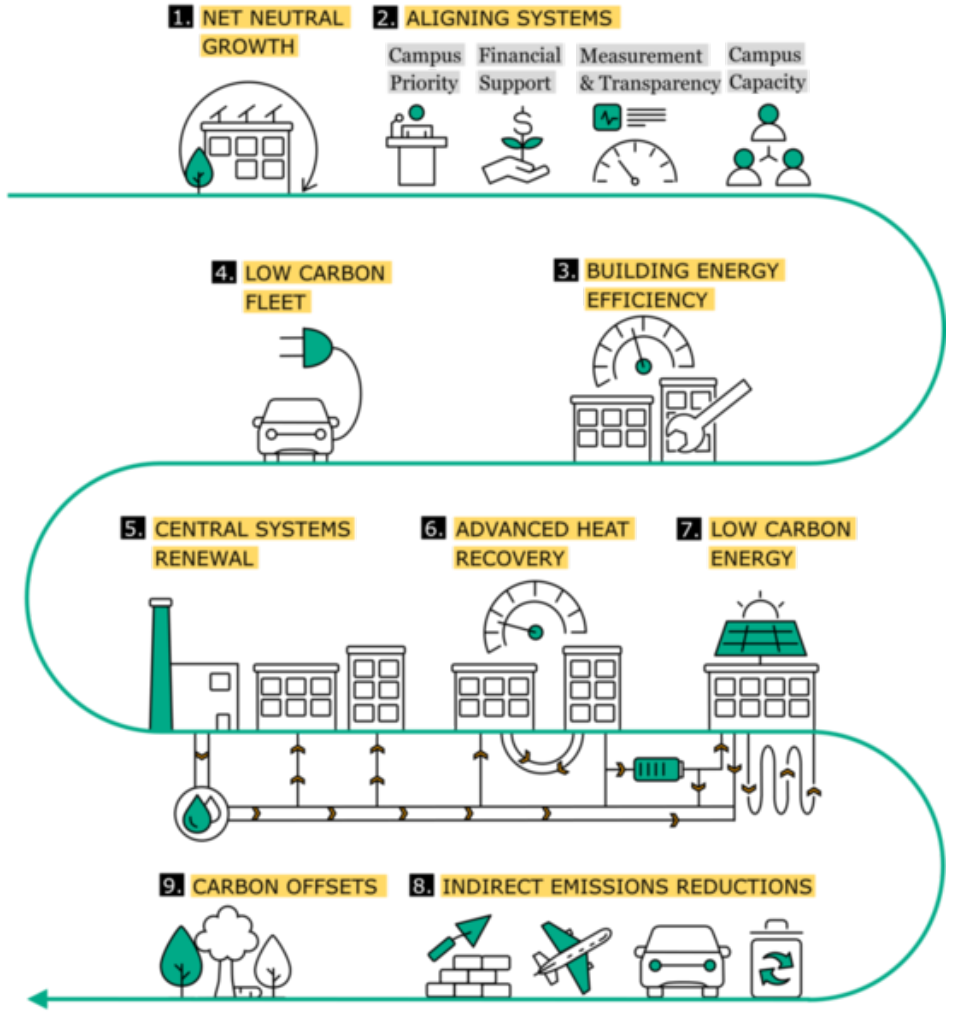
Future of Energy: Net-Zero Energy Building



Future of Energy: Carbon Neutrality

Embodied Carbon
Manufacture, transport and installation of construction materials

Operational Carbon
Building energy consumption



Key environmental issues addressed by Green Building consultants

- Materials:
  - Material Certification (e.g. Environmental product declarations)
  - Greenhouse gases and other emission
  - Life-cycle analysis (LCA) & Life-cycle Cost Analysis (LCCA)
  - Resource reuse
  - Toxicity
  - Waste diversion/recycling

Key environmental issues addressed by Green Building consultants

- Air:
  - Indoor Air Quality
  - VOC Assessment
  - HVAC Design

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- Materials:
  - Material Certification (e.g. Environmental product declarations)
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Key environmental issues addressed by Green Building consultants

- Awareness/Facilitation/Implementation to the end user:
  - Education in the form of training or presentations on green building
  - Facilitation of strategic planning
  - Facilitation of sustainable processes
  - Facilitation of green building rating systems
  - Implementation of sustainable or green building goals

Thank You!