

# The Green Building Model for Existing AIET Building

Maya Kumawat B., Prof. Akash Ka. Patel, Prof. Purvesh Raval

Civil Engineering Department, Apollo Institute of Engineering and Technology, Ahmedabad, Gujarat, India

## ABSTRACT

The Conventional building effect on greenhouse gases (CO<sub>2</sub>), global warming and human health related. 90% of the time we are inside the building, so conventional building great effect on our health as well as environment. The first aim of this study is to existing Apollo Institute of Engineering & Technology (AIET) building convert into Green building without their demolition by use of natural source, save energy and green materials. The second aim is to study of Indian Green Building Council (IGBC) Green Existing Building Rating System.

**Keywords :** Existing Building, Green Buildings, Green Material, Vertical Garden, Solar Panels, Water Harvesting System, Water Saving System, IGBC Rating System.

## I. INTRODUCTION

Climate change, caused by the release of greenhouse gases into the atmosphere, has been the greatest threats of the 21st century. Being the largest primary energy consumers, buildings make the world's largest contribution to this growing menace. Increasing concentration of greenhouse gases and consequent global warming are the alarming problems the world is facing today.

Today green building is the only way for the construction industry to move towards achieving a sustainable development, taking into account environmental, socioeconomic and cultural issues.

The building footprint in India is growing at a rapid pace and is contributing immensely to the growth of the economy. This augurs well for the country and now there is an imminent need to introduce green building concepts in this sector, which can aid growth in a sustainable manner.

Green practices in the existing buildings can help address national issues like water efficiency, energy efficiency, reduction in fossil fuel use in commuting, handling of waste and conserving natural resources. Most importantly, these concepts can enhance occupant health, happiness and well-being.

A green building or environmental building or sustainable building is a building which seek to harness all these natural elements in its design and construction to an optimum level so as to have an eco-friendly, low energy & low water consumption building and at the same time provide fresh and healthy environment to its occupants. Green building refers to the design and construction of buildings that have a minimum negative impact on the environment.

## II. LITERATURE SURVEY

1. Green Buildings and Health (Journal & Publish Year: Springer, 10 July 2015)

In this paper specially focused on relationships between green buildings and health. Green buildings aim to improve human health through design of healthy indoor environment.

2. Green Building: Concepts and Awareness(Journal & Publish Year: International Research Journal of Engineering and Technology (IRJET), 07 July 2017) In this paper discuss reduce global warming by development of Green buildings and save the energy.By use high-performance windows, extra insulation in walls-ceilings-floors, effective window placement , Solar water heating , sensors for lights , Smart meter for energy use , Light Emitting Diode (LED) .

3. Role of Green Building in Sustainable Construction- Need Challenges and Scope in the Indian Scenario(Journal & Publish Year: IOSR Journal of Mechanical and Civil Engineering (IOSR-MCE) , Mar-Apr. 2015)

In this paper discuss change in climate, challenge Increasing Greenhouse effect and Global warming are the alarming problems the world is facing today. In India, the Indian Green Building Council (IGBC) provides LEED rating system for green building.CO2 reduce: 12,000 Tons (Millions Annual / Sq.ft),Energy saving: 15,000 MWh (Millions Annual/ Sq.ft).

4. Critical Project Management Factors of AEC Firms for Delivering Green Building Project in Singapore(Journal & Publish Year: Journal of Construction Engineering and Management ASCE, December 2011)

In Singapore, Green Mark, a certification for green building, has become a compulsory requirement for all new buildings. The purpose of this research is to identify the controllable critical project management factors with minimum cost for delivering Green Mark certified projects to achieve higher Green Mark ratings.

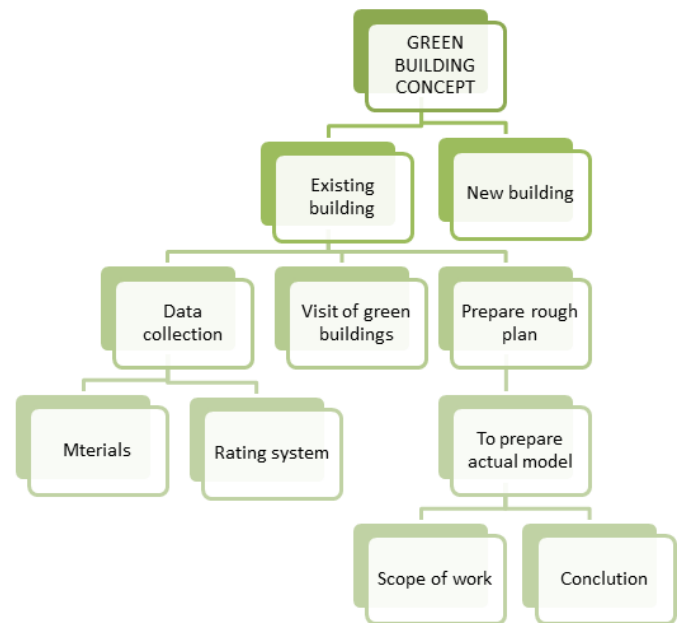
5. Benefits of Green Building: A Literature Review(Journal & Publish Year: Research Gate, April 2018)

This paper reports a review of the existing body of knowledge about reported and hence most important benefits of Green building in the literature are reduced lifecycle costs, energy saving, enhanced occupants health & comfort, and improved overall productivity and environmental protection.

### III. VISIT OF GREEN BUILDINGS

1. Sohrabji Godrej Green Business Centre Building in Hyderabad
2. Conference and Exhibition IGBC 2019 Hyderabad
3. Birla international school Jaipur Rajasthan
4. Gayatri Residency House Gandhinagar
5. Shapath V Ahmedabad

### METHODOLOGY CHART



### IV. METHODS

Whether Green buildings are really green is to be decided against the predefined rating systems. There are three primary Rating systems in India.

A. GRIHA (Green Rating for Integrated Habitat Assessment)

B. IGBC (Indian Green Building Council )

C.LEED (Leadership in Energy & Environmental Design)

We have to preferred the IGBC Rating system because of IGBC has launched the 22 different green rating programs so far to suit all types of construction projects.

IGBC Green Existing Building Rating System. criteria for certification levels area sunder.

Certification Level	Points	Recognition
Certified	50-59	Best Practices
Silver	60-69	Outstanding Performance
Gold	70-79	National Excellence
Platinum	80-100	Global Leadership

Vertical gardens are the gardens that grow vertically upward using a support system like trellis and can be grown both in the interior or exterior walls covered with the various plant species in two different ways; pre-vegetated in other words; “prefabricated modular panel” or in situ applied panels.



Fig. 1 Vertical Garden

Area of 4 outer wall AIET building=2562.77 Sq. m

**PROPOSED SYSTEM**

- ✓ Solar panels
- ✓ Vertical garden
- ✓ Water harvesting system
- ✓ Water saving system
- ✓ Air filter
- ✓ Emergency exit
- ✓ Sensors
- ✓ Fire resisting doors
- ✓ LED lights

Windows	No.	Area (Sq.m)
W1	62	1.6104
W2	16	1.4288
D	1	19.1285

Available area for vertical garden  
 = 2562.77 - ((62\*1.6104)+(16\*1.4288)+(1\*19.1285))  
 =2426.65 Sq. m=26110.75 sq. ft≈26111 sq. ft  
 Cost of vertical garden 1 sq. ft =1400Rs  
 There for, 26111\*1400=3,65,555,400Rs

**PLAN & CALCULATION**



Plan in Auto Cad

**Vertical garden**

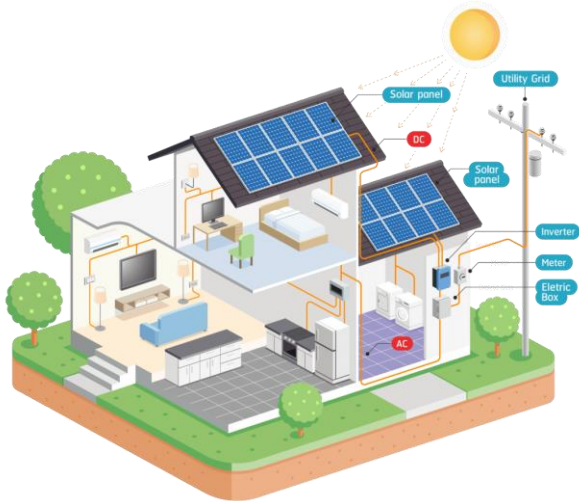
**Solar panels**

Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. Here are the main steps for how solar panels work for your home:

1. Photovoltaic cells absorb the sun’s energy and convert it to DC electricity
2. The solar inverter converts DC electricity from your solar modules to AC electricity, which is used by most home appliances
3. Electricity flows through your home, powering

electronic devices

- Excess electricity produced by solar panels is fed to the electric grid



**Fig. 2 Solar Panels**

There are 3 types of technology utilized in the solar panels Available on the market today: monocrystalline, polycrystalline and thin film amorphous. Most common solar panel used in India are polycrystalline. At a 100 sq.ft for every kW of solar panels require space. Cost of solar panels and government subsidies available for their installation.

For example,

Description	Cost
Approximate Cost of 1kW rooftop solar system	1,00,000
Subsidy @ 30%	30,000
Cost after subsidy	70,000
Accelerated Depreciation @ 80%	56,000
Tax rate @ 35% saved after AD	19,600
Net Cost after Subsidy and AD savings	50,400

### Water harvesting system

Today all our reliance of cities on groundwater is 60%. Every second property has somewhere around one bore well. Tenacious water extraction is making bore wells go dry.

Rain filters are designed with self-cleaning mechanisms and can be fixed to wall by connecting rooftop rainwater drain pipes. The rainwater along with direct particles enters into the inlet of filter through the hollow pipe slowly generated to centrifugal force direct particles and debris is separated out from water. Clean water then flows through outlet pipe and dirt particles and debris are separated out from garbage outlet. It is instead utilized to recharge bore wells and make them active again. Trap of this filter is 250micro. There are no extra filters and valve are required.



**Fig. 3 self-cleaning mechanisms of rain filter**



**Fig. 4 Rain water harvesting filtration system**

There are two tank exist in AIET building  
For tank 1,

L=5.14M, B=5.45M, H=4.07M



Capacity of tank 1=5.14\*5.45\*4.07  
 =114.013 cub.m=114013 liters

For tank 2,  
 L=8.90m, B=7.10m, H=2.90m  
 Capacity of tank 2=8.90\*7.10\*2.90  
 =183.25 cub.m=183251 Litters

Tank 1+tank 2= 114013+183251  
 =297246 Litters

**Rainwater Harvesting by Rooftops**

Total Rooftop Area (A)=2306.4135 Sq.m  
 Average Annual Rainfall in mm (R) =750mm  
 =0.750m

Runoff co-efficient for building=0.75  
 Annual water harvesting potential through total terrace = A \* R \* C  
 =2306.4135\*0.75\*0.75  
 =1297.357594 cub.m  
 =1297357.59 Litters

Hence, we have annually rain water harvesting  
 1297357.59 litters and bore well Recharge  
 = 1297357.59-297246  
 =1000111.594 litters

Item	No.	Per Cost Rs	Total cost rs
Rain water filter	10	4500	45000

**Water saving system**

Today 700 million people in 43 countries suffer from water scarcity. By 2030, almost half of the world will live under conditions of high water stress. Water efficient fixture save water and money and go green buildings worldwide. This fixture is easy to install, result in immediate saving.



**Image1 water saving tabs**

Save up to 90% of current water consumption. More than 4 years of life span. Returns of investment in just couple of months.

Item	No.	Per Cost Rs	Total cost rs
WS1001	40	75	3000

Item No.	WS1001	WS1002	WS1003	WS1004
Water Saving	70%	50%	80% & 50%	90%
Flow Type	Shower	Foam	Mist & Shower	Mist/Sprinkle
Flow Rate	2 LPM	4 LPM	1.25 & 45 LPM	< 1 LPM
Water Pressure	< 1 Bar	< 1 Bar	< 1 Bar	< 1 Bar
Suitable Tap Sizes	M -24mm F -22mm	M -24mm F -22mm	M -24mm F -22mm	M -24mm F -22mm
Suitable Location	Bathroom & Common Area Washbasin	Kitchen	All places	Bathroom & Common Area Washbasin

**Image 2.** comparison of water saving tabs

**Air filter**

This air filters are widely use for clean air. That saves both money and the environment, while the indoor air quality of your building is greatly improved. The starting cost of air filter is 750 rs per sq.ft area.



**Image 3 air filter**

Item	Sq. ft	Per Cost Rs	Total cost rs
air filter	5	750	3750



**LED lights**

LED stands for **light emitting diode**. LED lighting products produce light approximately 90% more efficiently than incandescent light bulbs. How do they work? An electrical current passes through a microchip, which illuminates the tiny light sources we call LEDs and the result is visible light. To prevent performance issues, the heat LEDs produce is absorbed into a heat sink. The **useful life** of LED lighting products is defined differently than that of other light. An LED driver’s main purpose is to rectify higher voltage, alternating current to low voltage, direct current.



**Fig.5** LED bulb

**COMPARISON BETWEEN EXISTING AIET BUILDING AND AFTER GREEN AIET BUILDING**

Sr. no.	Item	Existing AIET Building	After Green AIET Building
1	Initial cost	Low	High
2	Life	Less	Long
3	Environment	Not good, Uncomfortable	Good, Comfortable
4	Indoor quality	Not good	Good
5	Energy	Not generate	Generate
6	Electricity bill	More	Negligible
7	Lighting fixture	Tube light	LEED Tube
8	Plumbing fixture	Conventional fixture	Special green fixture

9	Paints	Plastic	Green Certified
10	Cooling	Less	High
11	Wall	Conventional	Vertical garden
12	Water harvesting	No	To establish
13	Sprinkler	Old	Smart
14	Sensor	Not use	Use
15	Wi Fi control	Not use	Use
16	Use of lights and fans	More	Less
17	Health related	Not healthy	Healthy
18	Investment	No return	After few years start to return
19	Government scheme	No subsidy	Subsidy provide

**EXISTING CONDITION OF BUILDING**

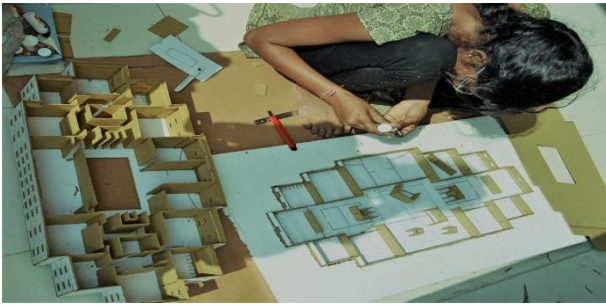


**Image 4.** Apollo Institute of Engineering & Technology

**MODEL MAKING**



**Image 5.** Basement of AIET Building



**Image 6.** While Prepare Floors



**Image 7.** Model of Current Condition of AIET Building

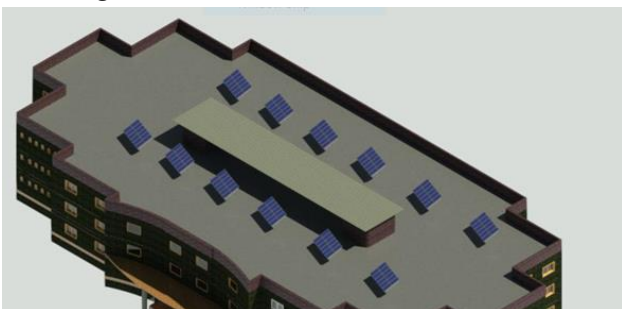
## V. IMPLEMENTATION RESULTS



**Image 8.** Green Building Model for Existing AIET Building



**Image 6.** Back Side of Green model of AIET



**Image 9.** Green Building Model for Existing AIET Building in Software

## VI. CONCLUSION

This study has shown that we have taken AIET building in Ahmedabad. The study area of AIET building is 2,306.4135 sq. meter. Overall, provide indoor environmental quality and health in green buildings versus non-green buildings. Health is directly proportional to the greenery. According to my knowledge and research related to my work brings me to a close decision that Awareness of green building, Education training and research right from the lower school systems and to institutions of higher learning would produce environmentally focused graduates who will easily embrace sustainability concepts in their projects. The Indian Green Building Council (IGBC) has launched 'IGBC Green Existing Building Rating System' to address the National priorities. By applying IGBC Green Existing Building criteria, existing buildings can be sustainable over the life cycle of the building.

## VII. REFERENCES

- [1]. Joseph G. Allen, Piers MacNaughton , Guillermo Cedeno Laurent , Skye S. Flanigan , Erika Sita Eitland , John D. Spengler "Green Buildings and Health" Springer,10 July 2015.
- [2]. Mohd Yasir Laeq, Dr. Syed Khursheed Ahmad, Khubhaib Altamash "Green Building: Concepts and Awareness" International Research Journal of Engineering and Technology(IRJET) , 07 July 2017.
- [3]. Devarshi Tathagat, Dr. Ramesh D. Dod "Role of Green Building in Sustainable Construction-Need Challenges and Scope in the Indian Scenario" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) , Mar-Apr. 2015.
- [4]. Amos Darko , Albert P.C. Chan , Emmanuel Kingsford Owusu , Maxwell Fordjour Antwi-Afari "Benefits of Green Building: A Literature Review" Research Gate, April 2018.
- [5]. Yuan Yuan Li, Po-Han Chen, David Ah Seng Chew, Chee Chong Teo<sup>4</sup>, Rong Gui Ding<sup>5</sup>



- “Critical Project Management Factors of AEC Firms for Delivering Green Building Project in Singapore” Journal of Construction Engineering and Management ASCE, December 2011.
- [6]. Shang-Yuan Chen \* and Jui-Ting Huang “A Smart Green Building: An Environmental Health Control Design” Journal of energies, 21 May 2012.
- [7]. J.T. Kevern, AM.ASCE “Green Building and Sustainable Infrastructure: Sustainability Education for Civil Engineers” ASCE Journal of Professional Practice in Engineering Education and Practice, September 2, 2010.
- [8]. Neha Mary Bobby, Shanta Pragyash Dash, Deepika Shetty “Exploring Feasibility of Incorporating Vertical Gardens in Indian Context” International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-4, November 2019.
- [9]. Prof. Akash N Ka Patel, Pavar P. Nandsingh, Pavar V. Satpalsingh, Dhule Pranav(Model of Rainwater Harvesting System) International Journal of Scientific Research in Science, Engineering and Technology March-April-2020.

**Cite this article as :**

Dr. R. M. Sherekar, Dr. R. U. Sambhe, "Rapid Prototyping : An Effective Tool for Manufacturing of Intricate Geometries of Automotive Components : A Case Study", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 7 Issue 2, pp. 377-384, March-April 2020. Available at doi : <https://doi.org/10.32628/IJSRSET207285>  
Journal URL : <http://ijsrset.com/IJSRSET207285>