GREEN AUDIT REPORT

of Hindol College, Khajuriakata, Dhenkanal, Odisha

Submitted to:

Hindol College, Odisha

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PRINCIPAL
HINDOL COLLEGE
KHAJURIAKATA

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ACKNOWLEDGEMENT

Power Tech Consultants (PTC) places on record its sincere thanks to Principal of Hindol college for entrusting task of conducting the Energy audit and Green Building Audit of Hindol College, Khajuriakata.

PTC acknowledges with gratitude the wholehearted support and encouragement given by all Hindol Collage officials while carrying out the study at Hindol College, Khajuriakata.

PTC acknowledges with gratitude and sincerely thanks all the officials, staff members and students of Hindol College who have rendered their all possible co-operation and assistance to the study team during the entire period of the audit.

Our special thanks to Dr. Asit Kumar Jenamani (Principal), Sri. Jayanta Narayan Pati (I.Q.A.C Coordinator), Sri. Ashok Kumar Sahoo (HOD, Physics), Sri. Sashi Bhusan Behera (Accountant) for their whole hearted co-operation and guidance in carrying out the Energy Audit of Hindol College.

M/s. Power Tech Consultants
19.03.2020
Authorised Signatory

Mr. Bibhu Charan Swain
Sr. Consultant
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AUDIT TEAM DETAILS

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5. Mr. Nirjhar Biswal,(Project Associate)

1.0 OBJECTIVES

In recent time, the Green Audit of an institution has been becoming a paramount important for self assessment of the institution which reflects the role of the institution in mitigating the present environmental problems. The college has been putting efforts to keep our environment clean since its inception. But the auditing of this non-scholastic effort of the college has not been documented. Therefore, the purpose of the present green audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Green Audit are:

1. To map the Geographical Location of the college.
2. To document the floral and faunal diversity of the college.
3. To record the meteorological parameter of Khajuriakata where college is situated.
4. To estimate the Energy requirements of the college.
5. To document the Waste disposal system
6. To document the ambient environmental condition of air, water and noise of the college.
7. To introduce and aware students to real concerns of environment and its sustainability.

1.1 METHODOLOGY

The purpose of the green audit of Hindol College is to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution. The methodology include: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. Some data have also been taken from the students' research works carried out by various science departments of the college.

1.2 ABOUT THE COLLEGE

Effulgent worth the elegance of natural flora and fauna, enriched with green resources encompassed by hills and adorned by forest streams Hindol Sub-Division was one of the princely states till 1950. When our nation attained independence from the British rule, the wind of progress and educational awakening started flowing throughout the length and breadth of our motherland. The noble thought of establishing an institution of higher education for spread of knowledge and development of the rural people hovered in the minds of some of the enthusiastic intellectuals, political, leaders, distinguished personalities and common mass. Attempts were made previously in 1974 and 1976 for establishing a college in Hindol Sub-Division but only in 1977 the dream became a reality.

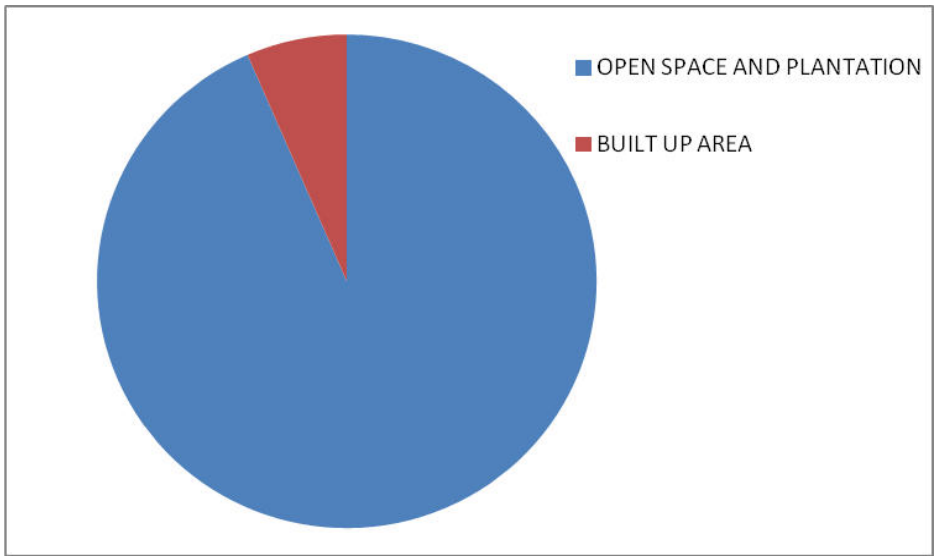
2.0 GREEN AUDIT AT HINDOL COLLEGE

The college has adopted the 'Green Campus' system for environmental conservation and sustainability. There are main three pillars i.e. zero environmental foot print, positive impact on occupant health and performance and 100% graduates demonstrating environmental literacy. The goal is to reduce CO2 emission, energy and water use, while creating atmosphere where students can learn and be healthy.

Geographical Location:
Latitude : 20°41'35.46" N
Longitude : 85°18'12.60" E

2.1 LAND USE DATA OF HINDOL COLLEGE

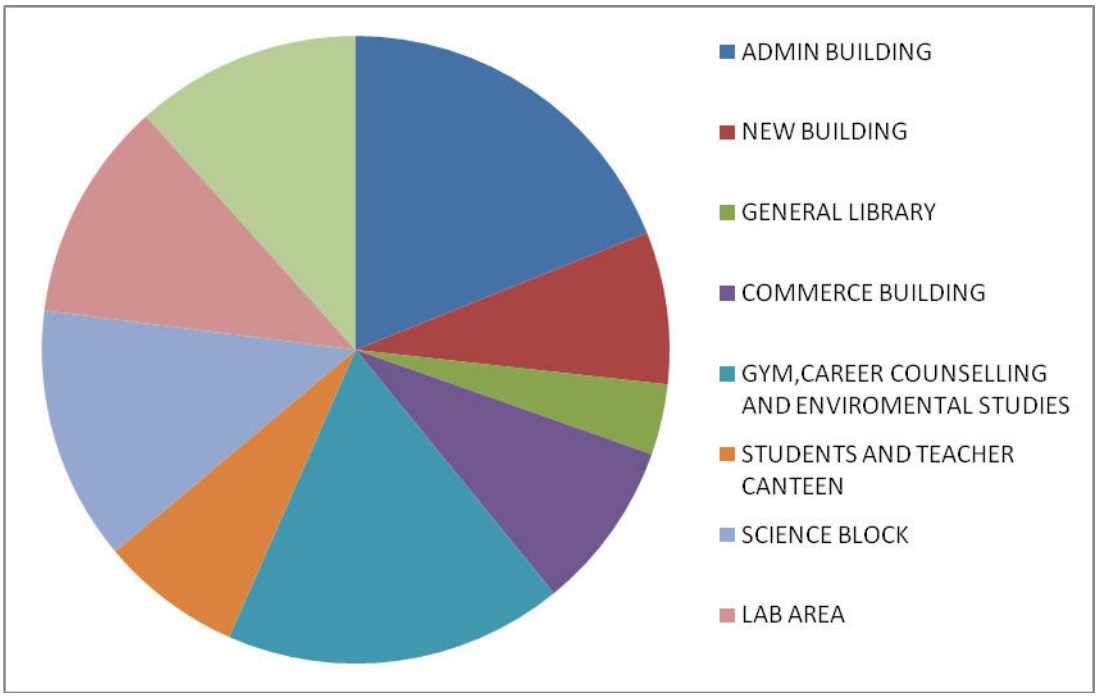
CATEGORIES OF LAND USE AREA IN SQ METERS	
OPEN SPACE AND PLANTATION	45758.997
BUILT UP AREA	3187
TOTAL AREA	**48945.997**

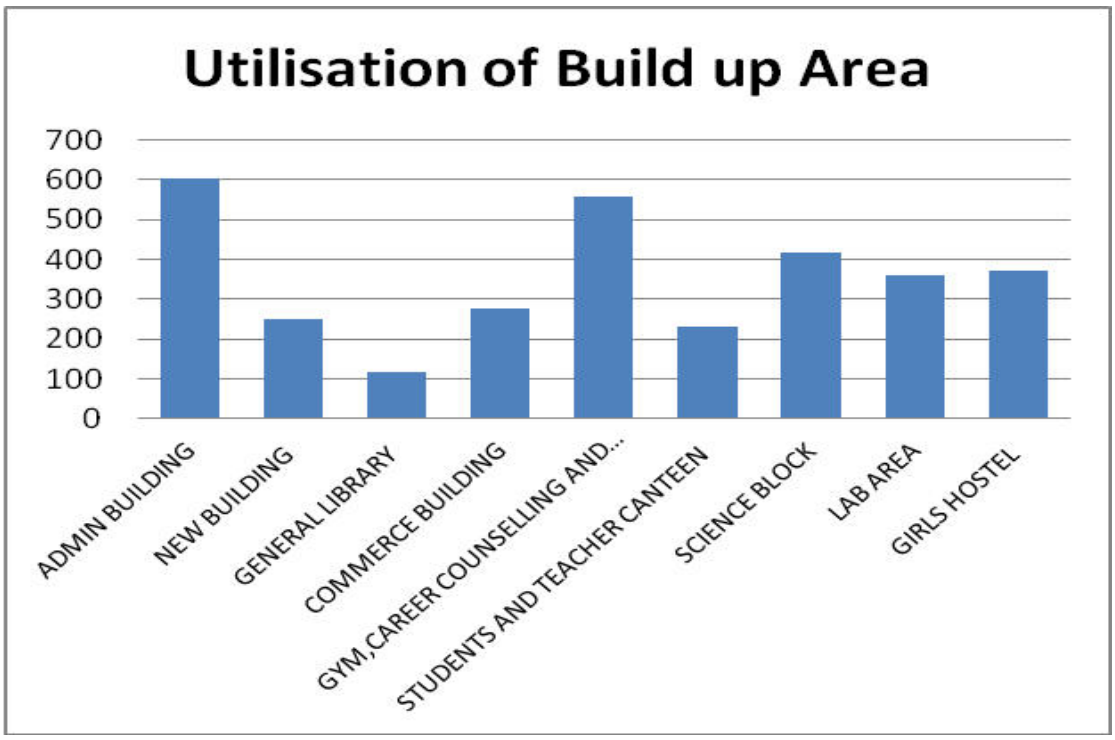


The total area of Hindol College is **48945.997** sq meters out of which the built up area is 6.5% (i.e. 3187 sq meters) and open space & plantation area is 93.5% (i.e. 45758.997 sq meters).

2.2 LAND USE (BUILT UP AREA) ANALYSIS

Building Name	Area (Sq Meter)
ADMIN BUILDING	603
NEW BUILDING	250
GENERAL LIBRARY	116
COMMERCE BUILDING	278
GYM,CAREER COUNSELLING AND ENVIROMENTAL STUDIES	557
STUDENTS AND TEACHER CANTEEN	232
SCIENCE BLOCK	418
LAB AREA	362
GIRLS HOSTEL	371
TOTAL	**3187**


ADMIN BUILDING
NEW BUILDING
GENERAL LIBRARY
COMMERCE BUILDING
GYM,CAREER COUNSELLING AND ENVIROMENTAL STUDIES
STUDENTS AND TEACHER CANTEEN
SCIENCE BLOCK
LAB AREA


Utilisation of Build up Area
700
600
500
400
300
200
100
0
ADMIN BUILDING
NEW BUILDING
GENERAL LIBRARY
COMMERCE BUILDING
GYM,CAREER COUNSELLING AND...
STUDENTS AND TEACHER CANTEEN
SCIENCE BLOCK
LAB AREA
GIRLS HOSTEL

2.3 TREE INTENSITY OF HINDOL COLLEGE, KHAJURIAKATA

Hindol College is within the geo-position of latitude 20°41'35.46" N and longitude 85°18'12.60" E in Khajuriakata, Dhenkanal, Odisha. The Dhenkanal district is known for its beautiful landscape and hills cover with green trees. The nearest forest range is Hindol-Badamba which is safest place of wild life like Elephant, dear, fox, monkey and hyena and many more. It covers an area of about 6.15 acre. The area is immensely Intense with a variety of tree species performing a variety of functions. The trees of the college have increased the quality of life, not only the college fraternity but also the people around of the college in terms of contributing to our environment by providing oxygen, improving air quality, climate amelioration, conservation of water, preserving soil, and supporting wildlife, controlling climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer. Many animals are dependent on these trees mainly for food and shelter. Flowers and fruits are eaten by monkeys, and nectar is a favorite of birds and many insects. Leaf – covered branches keep many animals, such as birds and squirrels, out of reach of predators. Different species display a seemingly endless variety of shapes, forms, texture and vibrant colors. Even individual trees vary their appearance throughout the course of the year as the seasons change. The strength, long lifespan and regal stature of trees give them a monument – like quality. They also remind us the glorious history of our institution. We often make an emotional connection with these trees and sometime become personally attached to the ones that we see every day. A thick belt of large shady trees in the periphery of the college have found to be bringing down noise and cut down dust and storms. A recent study has revealed that the rich diversity of tree species of about 16 species have sequestrated a total of 6.556 ton of organic carbon. Thus, the college has been playing a significant role in maintaining the environment of the entire Khajuriakata town and its surrounding areas.

The following are the tree species with whom we are being attached:

Sr. No	Name of the plant species	Number
1	Neem Tree	2
2	Coconut Tree	3
3	Bel Tree	2
4	Banyan Tree	12
5	Mango Tree	3
6	Mahua Plant	5
7	Kusuma Tree	1

8	Deodaru	100
9	Emblic Myrebalan	5
10	Teak (Saguwan)	100
11	Acasia	20
12	Eucalyptus	30
13	Krushnacuda	3
14	Kanchna	10
15	Peepal Tree	1
16	Banyan Tree	1

College interface covered with Tree

College entrance gate covered with Deodar Trees which impact more positive energy to students

Recommendation: Plantation of tree in College campus

Trees shade our homes, add beauty to our communities and countryside, and protect biodiversity by providing food and habitat for birds and animals. Trees are natural air filters - taking in carbon dioxide and releasing oxygen. Trees protect sources of drinking water by preventing soil erosion. Trees absorb and store greenhouse gases from the atmosphere as they grow, making them an essential tool to fight against climate change.

Therefore, we conclude that trees should be regularly planted to save the mankind and the animal world. College should plant more trees in their college-compounds and in the front-yards, backyards and side-yards of their college and near their own houses and in other places wherever possible. They should explain to their students and neighbours the goodness of tree-plantation and encourage them to plant and care new trees. We should consider the fact that we all need trees and trees are important to us humans. Save them and they will save us in return. Plant more trees and as you plant trees you are planting life too because of the fact that they are giving us fresh air, woods that we people used to build our houses. They stands as our shelter most specially to the animals, a shield to heat. Sometimes we are being rude to them, we cut them without replacements and we are the reason why they are being fewer. Have mercy on them because they are one of the reason why we still have fresh air now. Wherever you live in the province, trees are essential to your health and well-being.

2.4 ELECTRICAL POWER CONSUMPTION AT HINDOL COLLEGE

The college is getting power from the nearby 33/11 kV substation of Chainpal which is about 32 km from the college in 11 kV supply line. Hindol College, is one of reputed college of Dhenkanal, Odisha consumes on an average 8165 kWh (units) of electricity which turns out to be 97981 kW-hr per year only to maintain its volumetric activities throughout the year. A small fraction, i.e., 864 kW-hr of this power requirement is met through the installed solar LED lights. In terms of percentage, this contribution turns out to be 0.88%. The college authority is planning to install more LED lights to increase this contribution. The contribution of LED bulbs and LED tubes to the net power consumption is 17.53 %. The authority keep on replacing the old filament bulbs, CFL bulbs and tube lights by low energy consuming LED bulbs and LED tubes and bulky high power consuming fans by energy efficient fans in order to keep the electricity consumption of the college as low as possible. College working hour is 8-9 hours per day.

Recommendation: Installation of solar power plant in college premises.

The total buildup area of Hindol college is **3187** sq meter which is divided into number of building. Current electricity cost of the college is Rs. 5.60/unit. Considering the solar panel efficiency of 19%, it is recommended to install 10kWp solar power plant. The average annual solar irradiance of the Dhenkanal, Odisha is 5.37 kWh/m^2/day.

Installation of Solar Power Plant shall cause reduction in energy consumption. By this installation annual energy generation shall be 16644 kWh, annual saving shall be Rupees 93206, investment required shall be Rs. 600000 and simple payback period shall be 6.4 years.

Cost Benefit Analysis:

Establishment of Roof Top Solar Power Plant at Hindol College		
Units Generation	**Unit**	**Value**
Installed Power Generation Capacity	KW	10
Capacity Utilization Factor	%	19%
Total Power to be Generated in a day	kWh	45.6
Annual Power to be Generated	kWh	16644
Hence Total Project Cost in Rupees	Rs.	600000
Annual Energy Exported to Grid by College (Net Metering) 60 Days a Holiday	kWh	2736
Net Annual Consumption by College	kWh	3712
Average Cost of Solar Energy	Rs./kWh	5.6
Annual Revenue Generation due to avoidance in cost by availing power supply from DISCOM	Rupees	93206
Simple Payback Period	Years	6.4

CO_2 emissions reduced by installation of 10 kW solar power plant is around 283 Tons per year.

(Proposed Site for installation of rooftop solar Power Plant)

Concept of Net Metering:

Net metering is the concept which records net energy between export of generated energy and import of DISCOM energy for a billing month. Alternatively, the meter, having the feature of recording both the import and export values, also are generally allowed for arriving net energy for the billing period.

Principle of Net metering:

Based on available roof area / ground area solar PV panels will be installed. The output of the panels (DC electricity) will be connected to the power conditioning unit / inverter which converts DC to AC. The inverter output will be connected to the control panel or distribution board of the building to utilise the power. The inverter synchronises with grid and also with any backup power source to produce smooth power to power the loads with preference of consuming solar power first. If the solar power is more than the load requirement, the excess power is automatically fed to the grid. For larger capacity systems connection through step up transformer and switch yard will be used to feed the power to grid.

Advantages of Net metering:

The grid connected roof top / ground mounted solar PV system would fulfill the partial / full power needs of large scale buildings. The following are some of the benefits of roof top SPV systems:

- Generation of environmentally clean energy
- Consumer becomes generator for his own electricity requirements
- Reduction in electricity consumption from the grid
- Reduction in diesel consumption wherever DG backup is provided
- Feeding excess power to the grid

Implementation:

1. The total project cost to be borne by the consumer, however consumer is eligible for any subsidy / grant from State Govt./ Central Govt. / MNRE as applicable from time to time Implementation of net metering facility shall be made applicable for the consumers having 3-phase supply service connection.

2. Protection system including its switch gear to be certified by concerned Ex. Engineer and harmonic suppressive device to be installed by such SPV generator to suppress the harmonics injection as harmonics is more in case of solar plants where conversion of DC to AC is taking place. Islanding protection requirements to be provided.

3. The SPV generator shall provide the indication of solar PV plant at the injection point for easy identification to the operating personnel.

4. The SPV generator needs to get statutory approvals from appropriate authority like Electrical Inspector for the connected equipment including its solar panels.

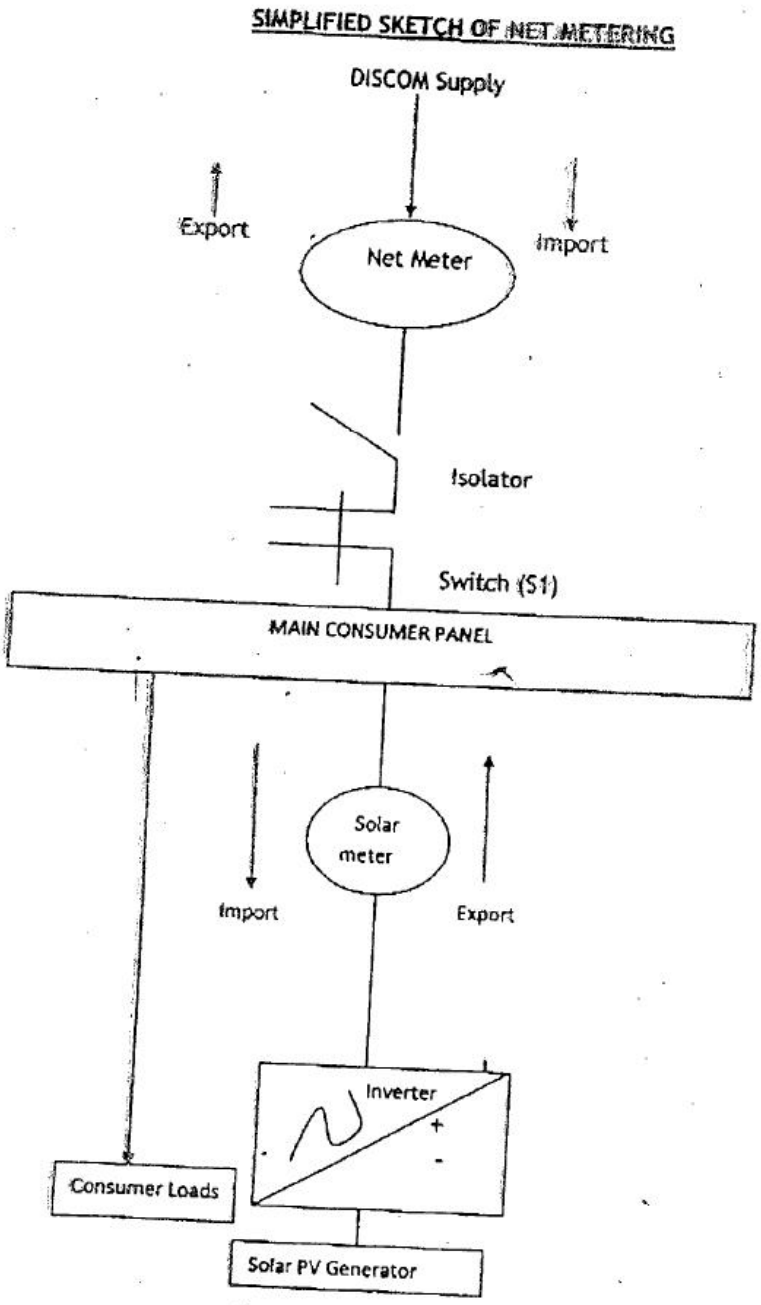
5. The proposed generator shall submit the prescribed application to the concerned Executive Engineer of local DISCOM who should be nodal authority for approval of the same.

5. The net meter / meter to be used for arriving net energy shall have the specifications prescribed.

6. Concerned JE of DISCOM shall issue a technical feasibility certificate and witness the synchronization of SPV plant with distribution network.

7. 0.5 class accuracy, tri-vector based energy meter, non ABT having the MRI downloading facility along with related accessories shall have to be installed by the SPV generator as per the specifications of DISCOM.

8. Spot billing is to be arranged by concerned DISCOM as per the billing period. DISCOM shall arrange to develop suitable software and incorporate in the billing instrument for such billing.



Normally, solar generating system is connected with grid. When grid fails, inverter controlled switch S1 will open. On grid restoration S1 will close. Solar meter may be installed, wherever applicable.

2.5 WATER CONSUMPTION AT HINDOL COLLEGE

The quantity of water consumption in the campus is given below:

Water Consumption of Hindol College				
Sl. No.	**Location**	**Student & Staff Strength**	**Consumption Demand (lpcd)**	**Water Quantity (Liter)**
1	Institute	1767	20	35340
2	Canteen	1000	25	25000
3	Hostel	25	50	1250
Total (Per day)				61590
Total (Annually)				22480350

The rainfall statistics of the district for last four years is given below:

Rainfall in mm

FY	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Total	Avg
2015-16	592.2	372.6	1259.1	2615.7	1674	998.4	257.4	0	185	13	257	256.2	8480.6	706.72
2016-17	17.3	778.2	950.2	2959.8	2754.4	964.2	542.2	168.8	0	0	0	304.2	9439.3	786.61
2017-18	47.1	594	1010.8	1575.8	1935	1792.6	1342.5	450.6	15.1	0	0	3.9	8767.4	730.62
2018-19	774.7	927.5	1369.3	3379.1	2122.6	2871.9	1237.1	0	274.5	0	185	175	13317	1109.73

Recommendation: Rain Water Harvesting

Background:

Rainwater harvesting (RWH) is a simple method by which rainfall is collected for future usage. The collected rainwater may be stored, utilized in different ways or directly used for recharge purposes. With depleting groundwater levels and fluctuating climate conditions, RWH can go a long way to help mitigate these effects. Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scarce zones.

The total amount of water that is received in the form of rainfall over an area is called the rainwater endowment of that area. Out of this, the amount that can be effectively harvested is called the **water harvesting potential.**

Rain Water Harvesting at Hindol College		
Rainfall in Area (average)	MM	833.41
Surface area of Roof	Sq Meter	3187
Annual Water Harvesting Potential	Liters	2656078

Analysis:

Water Requirement for Buildings (college):

Schools/Educational institutions:	Domestic litres per head/ day	Flushing Litres per head/ day	Total Consumption Litres per head/ day
a) Without boarding facilities	25	20	45
b) With boarding facilities	90	45	135

Utilization of stored Rain Water		
Number of person in a day	Nos	1767
Consumption per day	Litres	238545
Stored Rain Water	Litres	2656078
Utilization of water	Days	11.13449

Steps taken by the Central Government to promote rain water harvesting in the country are as follows:

1. Hon'ble Prime Minister has written a letter to all sarpanchs on 08.06.2019 regarding the importance of water conservation and harvesting and exhorted them to adopt all appropriate measures to make water conservation a mass movement.

2. Creation of a new Ministry of Jal Shakti for dealing with all matters relating to water at one place in an integrated manner.

3. The National Water Policy (2012) has been formulated by Department of Water Resources, RD & GR, inter-alia, advocates rain water harvesting and conservation of water and highlights the need for augmenting the availability of water through direct use of rainfall. It also, inter-alia, advocates conservation of river, river bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. Further, encroachment and diversion of water bodies and drainage channels must not be allowed and wherever, it has taken place, it should be restored to the extent feasible and maintained properly.

4. In compliance to the decision taken by the Committee of Secretaries, an 'Inter-Ministerial Committee' under the Chairmanship of Secretary(WR, RD & GR) has been constituted to take forward the subject of 'Push on Water Conservation Related Activities for Optimum Utilization of Monsoon Rainfall'.

5. DoWR, RD &GR has circulated a Model Bill to all the States/UTs to enable them to enact suitable ground water legislation for its regulation and development, which includes provision of rain water harvesting. So far, 15 States/UTs have adopted and implemented the ground water legislation on the lines of Model bill.

6. Central Ground Water Authority (CGWA) has issued directions under Section 5 of "The Environment Protection Act, 1986" for mandatory Rain Water Harvesting / Roof Top Rain Water Harvesting for all target areas in the Country including UTs. While granting 'No Objection Certificate (NOC)' for drawing ground water, CGWA insists for mandatory rain water harvesting as per the guidelines issued.

7. Central Ground Water Board (CGWB) under DoWR, RD & GR has also prepared a conceptual document entitled "Master Plan for Artificial Recharge to Ground Water in India" during the year 2013, which envisages construction of 1.11 crore rain water harvesting and artificial recharge structures in the Country at an estimated cost of Rs.

79,178 crores to harness 85 BCM (Billion Cubic Metre) of water, in an area of 9,41,541 sq.km by harnessing surplus monsoon runoff to augment ground water resources.

8. Besides, CGWB has taken up Aquifer Mapping and Management programme during XII Plan, under the scheme of Ground Water Management and Regulation. The Aquifer Mapping is aimed to delineate aquifer disposition and their characterization for preparation of aquifer/area specific ground water management plans with community participation. The management plans are shared with the respective State Governments for taking appropriate measures.

9. Department of Water Resource, RD&GR has instituted National Water Awards to incentivise good practices in water conservation and ground water recharge.

10. Mass awareness programmes (Trainings, Seminars, Workshops, Exhibitions, Trade Fares and Painting Competitions etc.) are conducted from time to time each year under the Information, Education & Communication (IEC) Scheme of DoWR, RD & GR in various parts of the Country to promote rain water harvesting and artificial recharge to ground water.

11. The Ministry of Rural Development in consultation and agreement with the Department of Water Resources, RD & GR and the Ministry of Agriculture & Farmers' Welfare has developed an actionable framework for Natural Resources Management (NRM), titled "Mission Water Conservation" to ensure gainful utilization of funds. The Framework strives to ensure synergies in Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), erstwhile Integrated Watershed Management Programme (IWMP) now PMKSY-Watershed Development Component and Command Area Development & Water Management (CAD&WM), given their common objectives. Types of common works undertaken under these programmes/schemes are water conservation and management, water harvesting, soil and moisture conservation, groundwater recharge, flood protection, land development, Command Area Development & Watershed Management

12. Department of Land Resources is currently implementing 8214 watershed development projects in 28 States covering an area of about 39.07 million ha. under the Watershed Development Component (WDC) of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) principally for development of rainfed portions of net cultivated area and culturable wastelands. The major activities taken up under the WDC-PMKSY, inter-alia, include ridge area treatment, drainage line afforestation, soil and moisture conservation, rain water harvesting, horticulture, and pasture development etc.

13. Ministry of Housing & Urban Affairs has released Model Building Bye-laws, 2016 which recommends Rainwater Harvesting for all types of Building with plot size 100 sq.m or

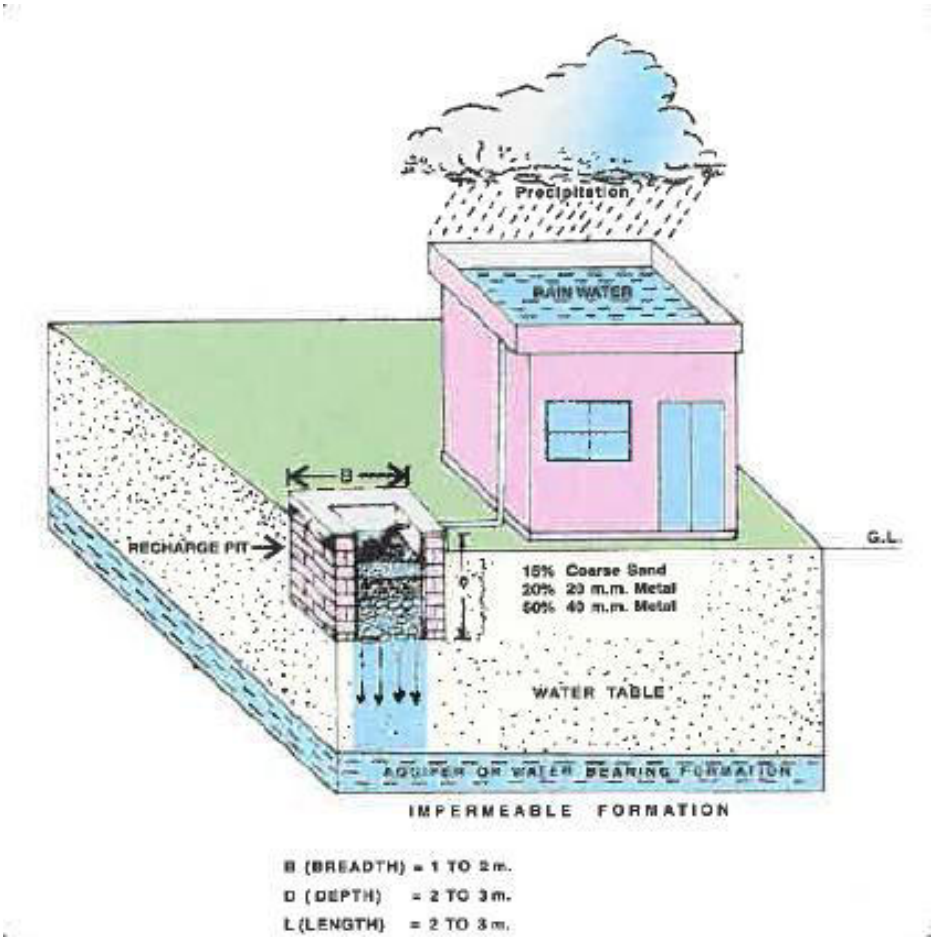
more. Barring the States/UT of Sikkim, Mizoram and Lakshadweep, all the States have incorporated the provisions in their respective building bye laws. The plans submitted to the local bodies shall indicate the system of storm water drainage along with points of collection of rain water in surface reservoirs or in recharge wells. Further, all building having a minimum discharge of 10,000 litre and above per day shall incorporate waste water recycling system. The recycled water should be used for horticultural purposes.

14. Government of India has approved Atal Bhujal Yojana (Atal Jal), a Rs. 6000 Crore Central Sector Scheme, for sustainable management of ground water resources with community participation in water stressed blocks of Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

2.6 RAIN WATER HARVESTING TECHNIQUES TO AUGMENT GROUND WATER

(i) Roof top rain water harvesting through recharge pit:

- In areas where permeable rocks are exposed on the land surface or at very shallow depth, roof top rain water harvesting can be done through recharge pits.
- This technique is suitable for buildings having a roof area of 100 sq m and is constructed for recharging the shallow aquifers.
- Recharge Pits may be of any shape and size and are generally constructed 1 to 2m. wide and 2 to 3m deep which are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (l .5-2 mm) in graded form- Boulders at the bottom, gravels in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the coarse sand layer and can easily be removed. For smaller roof area, pit may be filled with broken bricks / cobbles.
- A mesh should be provided at the roof so that leaves or any other solid waste/ debris is prevented from entering the pit and a desilting/collection chamber may also be provided at the ground to arrest the flow of finer particles to the recharge pit.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.
- By-pass arrangement is provided before the collection chamber to reject the first showers.


Precipitation
RAIN WATER
B
RECHARGE PIT
G.L.
D
15% Coarse Sand
20% 20 m.m. Metal
50% 40 m.m. Metal
WATER TABLE
AQUIFER OR WATER BEARING FORMATION
IMPERMEABLE FORMATION
B (BREADTH) = 1 TO 2 m.
D (DEPTH) = 2 TO 3 m.
L (LENGTH) = 2 TO 3 m.

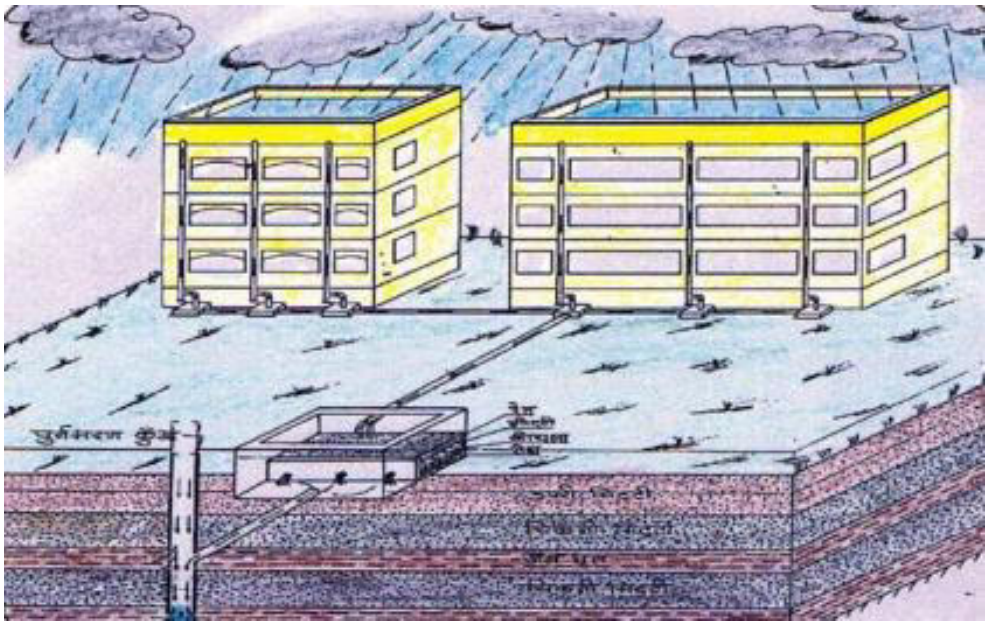
(ii) Roof top rain water harvesting through recharge trench:

- Recharge trenches are suitable for buildings having roof area of 200-300 sq. m. and where permeable strata are available at shallow depths.
- Trench may be 0.5 to 1 m. wide, 1 to I .5m deep and 10 to 20m long depending upon availability of water to be recharged.
- These are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1 .5-2 mm) in graded form - boulders at the bottom, gravel in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the sand layer and can easily be removed.
- A mesh should be provided at the roof so that leaves or any other solid waste/ debris is prevented from entering the trench and a desilting/collection chamber may also be provided on ground to arrest the flow of finer particles to the trench.
- By-pass arrangement be provided before the collection chamber to reject the first showers.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.

B (BREDTH) = 0.50 to 1 M.
D (DEPTH) = 1.0 to 1.5 M.

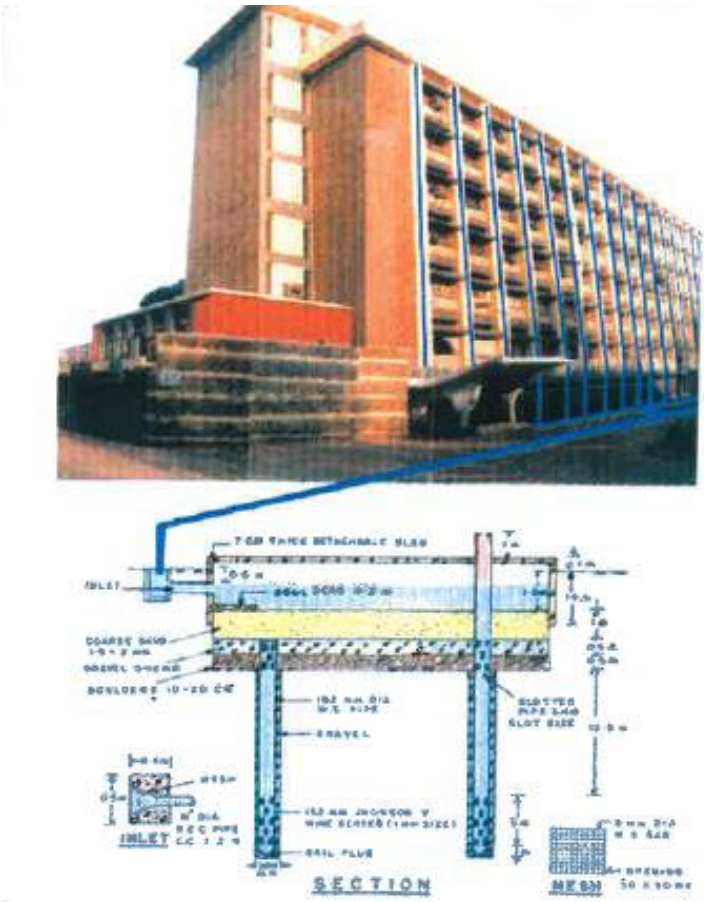
(iii) Roof top rain water harvesting through existing tubewells:

- In areas where the shallow aquifers have dried up and existing tubewells are tapping deeper aquifer, rooftop rain water harvesting through existing tubewell can be adopted to recharge the deeper aquifers.
- PVC pipes of 10 cm dia are connected to roof drains to collect rain water. The first roof runoff is let off through the bottom of drain pipe. After closing the bottom pipe, the rain water of subsequent rain showers is taken through a T to an online PVC filter. The filter maybe provided before water enters the tubewell.
- The filter is 1-1.2 m. in length and is made up of PVC pipe. It's diameter should vary depending on the area of roof, 15 cm if roof area is less than 150 m and 20cm if the roof area is more. The filter is provided with a reducer of 6.25 cm on both the sides. Filter is divided into three chambers by PVC screens so that filter material is not mixed up. The first chambers is filled up with gravel (6-10 mm), middle chamber With pebbles (12-20 mm)and last chamber with bigger pebbles (20-40mm).
- If the roof area is more, a filter pit may be provided. Rain water from roofs is taken to collection/desilting chambers located on ground. These collection chambers are interconnected as well as connected to the filter pit through pipes having a Slope of 1:15. The filter pit may vary in shape and size depending upon available run off and are back-filled with graded material, boulder at the bottom, gravel in the middle and sand at the top with varying thickness (0.30-0.50 m) and may be separated by screen. The pit is divided into two chambers, filter material in one chamber and other chamber is kept empty to accommodate excess filtered water and to monitor the quality of filtered water. A connecting pipe with recharge well is provided at the bottom of the pit for recharging of filtered water through well.



(iv) Roof top rain water harvesting through trench with recharge well:

- In areas where the surface soil is impervious and large quantities of roof water or surface runoff is available within a very short period of heavy rainfall, the use of trench/ pits is made to store the water in a filter media and subsequently recharge to groundwater through specially constructed recharge wells.
- This technique is ideally suited for area where permeable horizon is within 3m below ground level.
- Recharge well of 100-300 diameter is constructed to a depth of at least 3 to 5 m below the water level. Based on the lithology of the area assembly is designed with slotted pipe against the shallow and deeper aquifer.
- A lateral trench of 1.5 to 3m width and 10 to 30 m length, depending upon the availability of water is constructed with the recharge well in the centre.
- The number of recharge wells in the trench can be decided on the basis of water availability and local vertical permeability of the rocks.
- The trench is backfilled with boulders, gravels and coarse sand to act as a filter media for the recharge wells.
- If the aquifer is available at greater depth say more than 20 m, a shallow shaft of 2 to 5 m diameter and 3-5metres deep may be constructed depending upon availability of runoff. Inside the shaft a recharge well of 100-300mm dia is constructed for recharging the available water to the deeper aquifers, At the bottom of the shaft a filter media is provided to avoid choking of recharge well.



2.7 AIR QUALITY& NOISE QUALITY MONITORING

The Minister for Environment, Forests & Climate Change launched 'The National Air Quality Index' (AQI). 'One Number-One Colour-One Description' for the common man to judge the air quality within his vicinity. The formulation of the index was a continuation of the initiatives under Swachh Bharat Mission envisioned by the Hon'ble Prime Minister Shri Narendra Modi.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM10, PM2.5, NO2, SO2, CO, O3, NH3, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed.

Good (0-50)	Satisfactory (51-100)	Moderately polluted (101-200)	Poor (201-300)	Very poor (301-400)	Severe (> 401)

AQI	Associated Health Impacts
Good (0–50)	Minimal Impact
Satisfactory (51–100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101–200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease
Very Poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401-500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during light physical activity.

Since air quality plays a vital role for good health. Air Quality monitoring instrument is used to monitor quarterly the criteria pollutants. The most important air quality parameters, which are measured, are NO_2, SO_2 & PM_{10}. The other criteria pollutants such as Ozone, Carbon Monoxide and Lead are not measured because there are no nearby industries located near the college, which are emitting these pollutants. Noise equally plays a vital role in the environment, hence noise measurement are also done at the institute quarterly.

2.8 WASTE MANAGEMENT

This indicator addresses waste production and disposal of different wastes like paper. food, plastic, glass, dust etc. Furthermore, solid waste often includes wasted material resources that could otherwise be channelled into better service through recycling, repair and reuse. Solid waste generation and management is a burning issue. Unscientific handling of solid waste can create threats to everyone.

The present Prime Minister of India Sri Narendra Modi launched **'Swachh Bharat Abhiyan' (Clean India Mission)** on 2nd October, 2014. In this mission, the proper use of dust/waste bins is one of the major priorities. For the implementation of this mission,

collective mass effort is necessary. For proper segregation and management, proper use of waste bins is the only solution for waste management purpose in the college campuses.

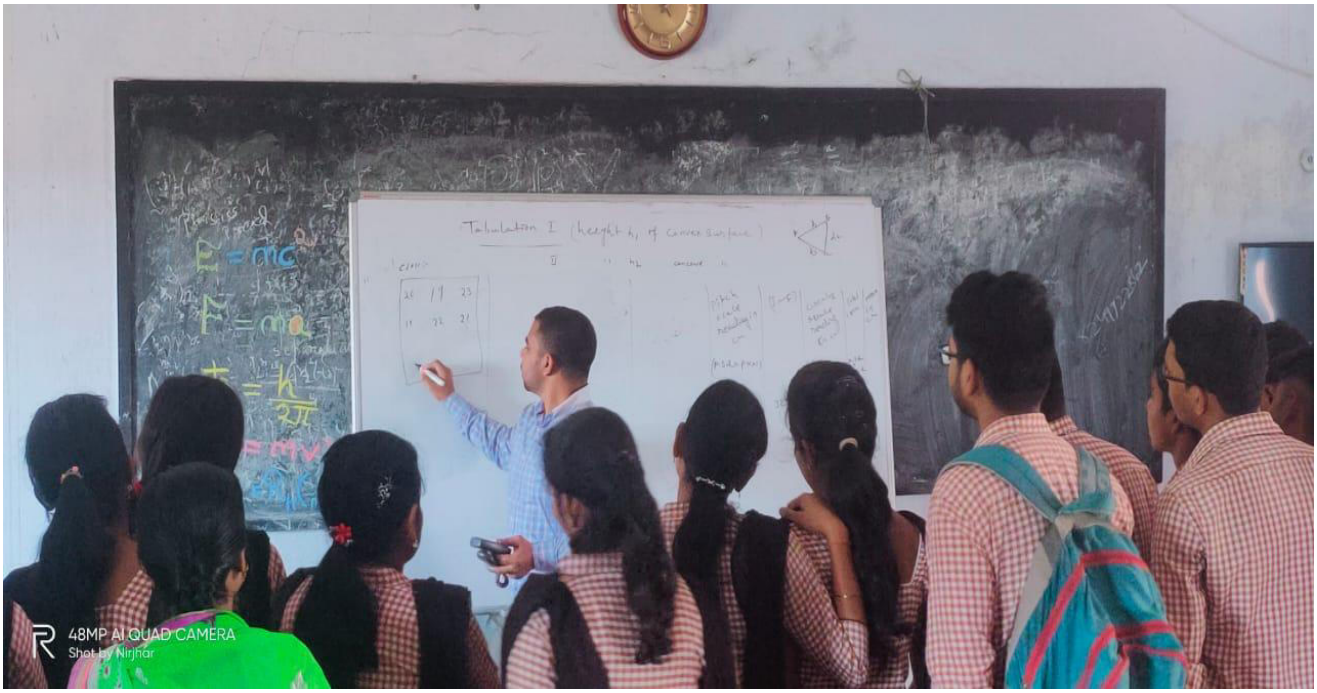
For this purpose, Hindol College has employed waste bins for proper segregation of solid wastes in the campuses. It includes provision for plastic/glass waste, food waste and metal/e-waste in a single compact system.

Waste bins for solid wastes in the campus

Waste Bins		
Sr. No.	**Location**	**Waste (kg)/per day**
1	Canteen	70
2	Field and Campus	90
Total		160

Introduction of Green Audit in Hindol College:

Some visuals during introduction of Green Audit




HINDOL COLLEGE, KHAJURIAKATA


WORKSHOP ON ENERGYAUDIT
GREEN AUDIT
HINDOL, COLLEGE KHAJURIAKATA
18·02·2020
2020/2/18 12:46


WORKSHOP ON ENERGYAUDIT
AND GREEN AUDIT
(IQAC) HINDOL, COLLEGE KHAJURIAKATA
18·02·2020
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2.9 SUGGESTIONS AND RECOMMENDATIONS

- The electricity consumption is high and can be reduced by adopting renewable energy. In this context, solar energy can be used as alternative energy source of the College campuses.
- The use of plastic products should be banned in the College campuses.
- The College campuses are no doubt biodiversity but more plantations especially medicinal plantations are required in the campuses. Plantation of fruit plants will attract more birds.
- There is urgent need to form a Green Monitoring Team. The priority of this body is to maintain the greenery of the College campuses.
- The Green Monitoring Team should consist of members from teaching staffs, Non-teaching staffs, and students.
- Vermicompost facility may be practiced, the product of which can be used as manure or fertilizer for plantation purpose.
- Sustainable use of resources and ecological balance of the college campuses must be maintained throughout the year.
- Training is the key to sustain energy conservation. So training and awareness programme can be conducted to adopt new attitudes towards energy wastage and reduction of wastes.

3.0 CONCLUSION

It is observed that the Hindol college campus can be a green campus by adopting renewable energy, tree plantation, waste management and water management to reduce CO2 emission, maintain zero environmental foot print, and increase positive impact on occupant health by creating atmosphere where students can learn and be healthy. Hence the college should adopt the 'Green Campus' system for environmental conservation and sustainability and we feel college management needs to put best effort to achieve Energy Conservation in its campus.