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REPORT ON
GREEN AUDIT,
ENERGY AUDIT &
ENVIRONMENTAL AUDIT
KARNPURA COLLEGE, BARKAGAON
HAZARIBAGH, JHARKHAND - 825311

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**GREEN DONE
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Striving to make the globe greener

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Table of Contents

1. Executive Summary:.....	3
2. Acknowledgment:.....	7
3. Audit Team:.....	8
4. Introduction:	9
1.1. About Institute:.....	9
1.2. Vision Statement of the College	9
1.3. Mission Statement of the College.....	9
1. Objectives of Green Audit:.....	11
2. Target Areas of Green Audit:	11
2.1. Auditing for Water Management	12
2.2. Auditing for Energy Management.....	12
2.3. Auditing for Waste Management:	12
2.4. Auditing for Green Campus Management:.....	13
2.5. Auditing for Carbon Footprint:	13
3. METHODOLOGY ADOPTED:	13
4. AUDIT STAGE:.....	15
5. GREEN AUDIT REPORT	15
5.1. Water Quality Assessment:.....	15
5.2. Water Management:.....	16
5.3. Energy Audit Report:.....	17
5.3.1. Electrical Bill Analysis:	17
5.3.2. Electrical Consumers:.....	18
5.4. Alternate Sources of Energy and Energy Conservation Measures	18
5.5. Waste Management:	19
5.5.1. Waste Management Practices Adopted by the College:	20
5.6. Green Campus:.....	21
5.6.1. Green Campus Initiatives:.....	23
5.6.2. Quality audits on Environment and Energy:.....	24
5.6.3. Routine Green Practices:	24
5.6.4. Disabled-Friendly Environment:	24
5.6.5. Air Quality & Ventilation:.....	25

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.6.6. Infrastructure Usage:	25
5.6.7. Green IT Culture:	26
6. Carbon Foot Print Analysis:	27
6.1. CO2e Calculation:	27
7. SUGGESTIONS AND RECOMMENDATIONS:	28
7.1. Water Management:	28
7.2. Energy Management:	28
7.3. Green Campus:	29
7.4. Waste Management:	29

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

1. Executive Summary:

Eco campus is a concept implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment.

Waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus. To find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus the conducting Green Audit of institution is essential.

The green auditing of ‘**Karnpura College, Hazaribagh, Jharkhand**’, enables to assess the practices, action and its impact on the environment. This audit was mainly focused on **Green Indicators** like consumption of energy in terms of electricity and fossil fuel, quality & utilization of water, vegetation, waste management practices and carbon foot print of the campus etc.



Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

The premises were evaluated against the various criteria laid down by the National Assessment and Accreditation Council (NAAC). The major observations are provided below.

Renewable Energy

- The college has installed a 0.5 kWp Roof-top Solar Photovoltaic System for self-use.
- The quantity of plate waste (organic waste with higher starch contents) is not very substantial, consequently, when the plants will grow enough, college may explore the potential for biogas generation.

Green Campus Initiative

- There are pedestrian friendly pathways for in-campus movement.
- The college is yet to initiate restriction on single-use plastic in the campus. College may extend it to completely banning plastic usage inside the campus later on.
- The campus is surrounded with greenery, trees, and proper landscaping.
- The bicycles are allowed for in-campus movement as required. Required cycle stands are to be provided inside the campus.
- Institute staff and students may opt for public transport for daily commuting.
- The movement of vehicle inside the campus is not restricted.

Environment & Energy Initiative

- Institute has planted more than 16 varieties of more than 65 trees in its campus.
- Institute may go for replacement of existing fans with energy efficient BLDC fans.

Air Quality & Ventilation

- The classrooms and other area are well ventilated to ensure proper air quality.
- The fans are appropriately installed to ensure proper air circulation

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Lighting System

- The usage of natural light is optimized through well designed structure and windows.
- College has initiated replacement of lighting fixtures with energy efficient LEDs.
- Institute has yet to install sensor based systems (motion sensors/ day-light sensors) to control operations of lights to save energy. It is recommended to install sensor based devices to increase energy conservation.

Water Quality & Conservation

- The water is supplied through bore well.
- The water quality reports are not available. Water analysis is recommended.
- Portable water purifiers are installed for water purification.
- The rainwater harvesting system is not available. It is recommended that Institute should plan for Rain Water Harvesting system.
- The distribution network and piping found satisfactory and adequate.

Waste Management

- The effluent water is discharged in the common drainage system however there is no Sewage Treatment plant.
- The waste is segregated in two type solid and liquid waste.
- E-waste is not collected & disposed of separately.
- For plant waste and dry leaves vermi-composting is being maintained.

Green IT culture

- The electronic communication is encouraged to minimize usage of papers.
- Most of the papers are reused for doubled sided printing to further minimize usage of paper.

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Infrastructure usage

- Ramps and wheelchairs are provided for ease of movements for disabled persons.
- The on-campus movement is distributed with multiple entrances as well as staircases.
- There are no fire extinguishers are located at key areas. The college is required to initiate appropriate measures to meet the safety requirement.
- The draining system for washrooms is efficient and effective.
- No seepages were observed in the building premises.

Auditors:



Mr. Atul Joshi

Accredited Energy Auditor (AEA-0037)
Bureau of Energy Efficiency (BEE, MoP)
Director – Green Done Consultant LLP.



Mr. Alkesh Rajdev

Accredited Professional
Indian Green Building Council
Director – Green Done Consultant LLP

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

2. Acknowledgment:

We wish to express our gratitude towards Management of **Karnpura College, Hazaribagh, Jharkhand** for having given us the opportunity for conducting the study and the support provided during the study.

We are also thankful to the **PRINCIPAL PROF. Kriti Nath Mahto** and **IQAC Coordinators Mr. Niranjan Prasad Neeraj** for extending the necessary help and co-operation from their side.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

3. Audit Team:

From **Green Done Consultants LLP, Mumbai**

1. Mr. Atul Joshi – Accredited Energy Auditor & Director.
2. Mr. Alkesh Rajdev – Accredited Sustainability Consultant, IGBC AP & Director.

From **Karnpura College, Hazaribagh, Jharkhand.**

1. Principal - **PROF. Kriti Nath Mahto** and
2. IQAC Coordinator – **Mr. Niranjana Prasad Neeraj**

4. Introduction:

1.1. About Institute:

Karnpura College, Barkagaon (District – Hazaribagh, Jharkhand) was established in the year 1983, and it is managed by the Pvt. Unaided. The college is situated at Barkagaon Tandwa Road in a rural area surrounded by mountains all around. When there was no system of higher education in any area of Barkagaon and Keredari block and the system of education of girl students was negligible. In such a situation, Karanpura College was established by Shri Ramsevakji with the help of Shri Loknath Mahato (former MLA). Raja Dalel Singh was the king of Karnpura region from 1677 to 1724, whose capital was in Barkagaon (Badam), after this area the college was named Karnpura College. This rural area is a very poor area, situated at a distance of 27 km from the city. Most of the Harijans, Adivasis and backward class people reside in this area. Therefore, the construction of this college was very important for the rural area, which is seen even today and even now only degree college there in both the blocks, Karnpura College.

1.2. Vision Statement of the College

Our vision is to pay special attention to the educational needs of people in these rural areas, especially women and to equip them to participate in nation building activity with a view to promote their individual, social and national growth.

1.3. Mission Statement of the College

To offer excellent education to the poor and the backward class students of the rural area. To aim at the overall personality development of the students through extra and co-curricular activities, social and cultural organizations. To provide an opportunity to rural area students to face all the challenges of a competitive world, with the utmost utilization of their potential in sports, athletics and other events. Enhance the commitment of faculty staff and students to the centrality of diversity, social justice and democratic citizenship.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

The student and faculty strength of the college is listed below:

Physical Structure:

Physical Structure	
Total Campus Area	10 Acre
Built-up Area	3000 sq Mtr
No. of Departments	10
Conference Halls	2
Class Rooms	12
Office Rooms	1
Libraries	1
Auditorium	1
Canteen	1
Other	stadium

Total Strength of Students, Teachers & Non-teaching Staff:

Staff Details	Male	Female	Total
No. of Students	642	824	1466
No. of Teaching Staff	14	4	18
No. of Non-Teaching Staff	10	4	14

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

1. Objectives of Green Audit:

The main aim objectives of this green audit is to assess the environmental quality and the management practice and strategies being implemented in Karnpura College, Hazaribagh, Jharkhand.

The specific objectives are:

1. To monitor the energy consumption pattern of the college.
2. To assess the quality of the water in the campus.
3. To quantify the liquid and solid waste generation and management plans in the campus.
4. To assess the carbon foot print of the college.
5. To assess whether the measures implemented by the College have helped to reduce the Carbon Footprint.
6. To impart environment management plans of the college.
7. Providing a database for corrective actions and future plans.
8. To assess whether extracurricular activities of the Institution support the collection, recovery, reuse and recycling of waste generated within the campus.
9. To identify the gap areas and suggest recommendations to improve the Green Campus status of the Karnpura College, Hazaribagh, Jharkhand.

2. Target Areas of Green Audit:

Green audit forms part of a resource management process. Although they are individual events, the real value of green audit is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water; Minimize waste generation or pollution and also efficiency in resource utilization. All these indicators are assessed in the process of “Green Auditing of this educational institute”.

Eco-campus focuses on the reduction of contribution to emissions, procure a cost effective and secure supply of energy, encourage and enhance energy use conservation, promotes personal action, reduce the institute’s energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. **Target areas included in this green auditing are water, energy, waste, green campus and carbon footprint.**

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

2.1. Auditing for Water Management

Water is a natural resource; All living organisms depend on water. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. Groundwater depletion and water contamination are taking place at an alarming rate. Hence it is essential to examine the quality and usage of water in the college. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water.

2.2. Auditing for Energy Management

Energy conservation is an important aspect of campus sustainability which is also linked with carbon foot print of the campus. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices.

2.3. Auditing for Waste Management:

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health.

Solid waste can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste.

1. Bio-degradable wastes includes food wastes, canteen waste, wastes from toilets etc.
2. Non-biodegradable wastes include what is usually thrown away in homes and schools such as plastic, tins and glass bottles etc.
3. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol.

Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the college.

Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

utilized through recycling and reuse. Thus the minimization of solid waste is essential to a sustainable college. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

2.4. Auditing for Green Campus Management:

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen released by the trees of the campus is good for the people in the campus. So while you are busy studying and working on earning those good grades, all the trees in campus are also working hard to make the air cleaner for you.

2.5. Auditing for Carbon Footprint:

Burning of fossil fuels (such as petrol) has an impact on the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions. Vehicular emission is the main source of carbon emission in the campus, hence to assess the method of transportation that is practiced in the college is important.

3. METHODOLOGY ADOPTED:

The methodology adopted to conduct the Green Audit of the Institution had the following components.

Onsite Data Collection:

Due to Covid restrictions, virtual tour of the college campus was organized by the Green Audit Team. The data samples and relevant photographs were collected through geo-tagged photographs. The key focus of the audit was on assessing the status of the green cover of the Institution, their waste management practices and energy conservation strategies etc.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

Focus Group Discussion:

The Focus Group discussions were held with the staff members and the management focusing various aspects of Green Audit. The discussion was focused on identifying the attitudes and awareness towards environmental issues at the institutional and local level.

Energy, Waste Management and Carbon Foot Print Analysis Survey:

With the help of teachers and staff, the audit team has assessed the energy consumption pattern and waste generation, disposal and treatment facilities of the college. The monitoring was conducted with a detailed questionnaire survey method.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

4. AUDIT STAGE:

Green auditing in **Karnpura College, Hazaribagh, Jharkhand** began with the assessment of the status of the green cover of the Institution followed by waste management practices and energy conservation strategies etc. The team monitored different facilities at the college, determined different types of appliances and utilities (lights, taps, toilets, air conditioners, etc.) as well as measuring the usage per item (Watts indicated on the appliance, etc.) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and learners were interviewed to get details of usage, frequency or general characteristics of certain appliances. Data collection was done in the sectors such as Energy, Waste, Greening, Carbon footprint and Water use. College records and documents were verified several times to clarify the data received through survey and discussions.

5. GREEN AUDIT REPORT

5.1. Water Quality Assessment:

Water is provided through a bore well. Institute has installed portable a R.O. unit to treat the water before sending it for drinking purpose. The bore well water is being used for flushing and gardening.



Institute has not carried out lab testing of bore well water sample. Hence current water analysis report was not available at the time of audit.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.2. Water Management:

The source for the water used in the College is bore well water. One bore well is present in the campus. Institute has installed two overhead tanks with a capacity of 1 KL each.



- Water availability is good throughout the year & institute do not need tanker water to meet its demand during peak summer.
- Water meter is not installed on the bore-well and hence, no record is maintained for daily water consumption.
- College is required to display signboards for spreading awareness of its water saving initiatives.
- There were 10 leaking taps reported during the audit phase. Institute needs to repair it immediately to avoid water loss.
- There is no formal water management plan available with the institute.
- The institute has not installed **Rain Water Harvesting** system yet for recharging the bore well with rainwater from the roof and for gardening purpose.
- The catchment area of roof of institute building is available for Rain Water Harvesting Institute may install a proper rain water harvesting system and collect the rain water and divert it to a common channel and store it in an underground storage tank or use it for bore well recharge.
- There is no **Sewage Water Treatment** plant in the campus to recycle the waste water for the use of flushing and gardening. The waste water is being drained to main drainage system of the city.
- There is very minimal effluent generation from the laboratory which is being discharged in to the common.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.3. Energy Audit Report:

5.3.1. Electrical Bill Analysis:

Electricity is supplied by JHARKHAND BIJLI VITRAN NIGAM LIMITED (JBVNL). The institute falls under Non-Domestic Service (NDS) tariff category.

Consumer Name:	Karnpura College
Consumer No.	BGK01361
Meter No.:	708593
Electricity Supply Company	Jharkhand Vitran Nigam Limited
Tariff Category:	NDS-2 1kw
Connected Load (kW):	1 kw
Sanctioned load (KW) :	1 kw

Non - Domestic Service (NDS-2) (Demand based) is applicable to contracted load of more than 5 kW.

Under the given tariff a fixed charges of Rs. 150/kw is applicable and the Energy Charges are depends on the amount of consumption. The rates are given in the following table.

Category	Fixed Charges		Energy Charges (Rs./kWh)
	Unit	Rate	
Rural	Rs./conn./month	40	6.00
Urban	Rs./conn./month	150	6.25

The college is consuming an average of 1205 kWh/ month of electrical energy based on the four month's data available with institute.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.3.2. Electrical Consumers:

Institute do not have air conditioners. The list of common electrical consumers along with its typical electricity consumption is provided in the table below.

Type of Electrical Device	Quantity
	Nos.
LED Lights	123
FAN	72
COMPUTER	15
INVERTER BATTERY	2 SET
MOTOR 2HP	1
Generator	1
Solar	1

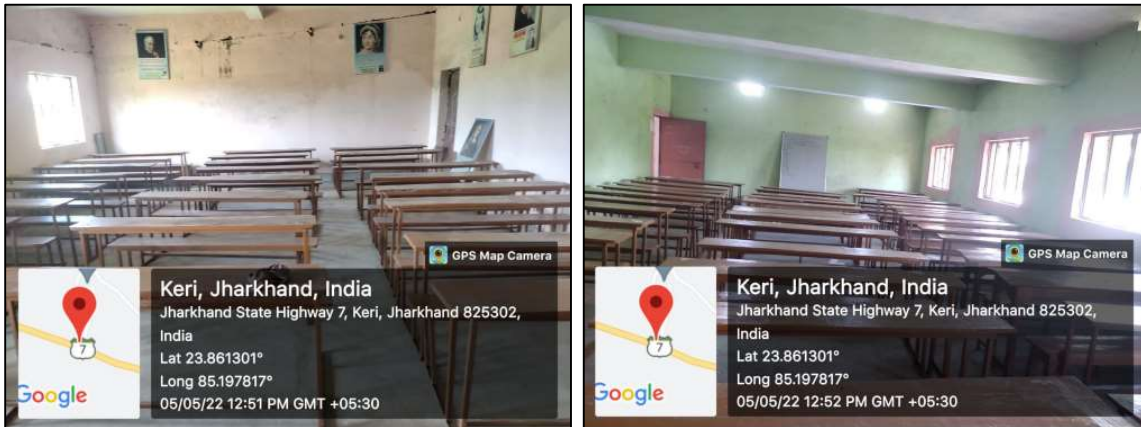
5.4. Alternate Sources of Energy and Energy Conservation Measures

- Institute has recently installed 0.5 kWp Solar PV Rooftop system.



- Since the biodegradable waste generation is very low, there is no Bio-gas plant.
- Institute is using electricity only from grid.
- Institute is has not installed any sensor based energy conservation system yet.
- Institute has started replacing existing lighting fixtures with LEDs and energy efficient lighting.
- Institute do not have air conditioner.
- Institute is utilizing the natural light to its maximum. The classroom and offices are designed in such a way that it allows maximum sun light and reduces requirement of artificial lights.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand



5.5. Waste Management:

Following data provide the details of the waste generated & the disposal method adopted by the college.

Physical Structure	
Total Campus Area	10 Acre
Built-up Area	3000 sq Mtr
No. of Departments	10
Conference Halls	2
Class Rooms	12
Office Rooms	1
Libraries	1
Auditorium	1
Canteen	1
Other	stadium

Total number of rooms (Class rooms, canteen, office, auditorium, library etc.): **18**

Total number of stakeholders in the college: **2996**

Staff Details	Male	Female	Total
No. of Students	403	500	903
No. of Teaching Staff	6	12	18
No. of Non-Teaching Staff	5	2	7

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.5.1. Waste Management Practices Adopted by the College:

Following table shows the quantum of waste generation from office, labs & canteen.

Approximate quantity of waste generated per day (in kg)				
Office	Type of Waste			
Quantity	Biodegradable	Non-Biodegradable	Hazardous	Others
< 1kg	Y			
2 - 10 kg				
> 10 kg				
Labs	Type of Waste			
Quantity	Biodegradable	Non-Biodegradable	Hazardous	Others
< 1kg	Y			
2 - 10 kg		Y		
> 10 kg				
Canteen	Type of Waste			
Quantity	Biodegradable	Non-Biodegradable	Hazardous	Others
< 1kg		Y		
2 - 10 kg	Y			
> 10 kg				

- The waste generated is collected and disposed of by Local Municipal Authorities.
- There is no biomedical waste, hazardous chemicals and radioactive waste getting generated.
- The institute is segregating the waste in to dry & wet waste.
- Institute is maintaining a vermi-composting system to dispose the dry leaves in the campus.



Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.6. Green Campus:

Institute has planted more than 100 no. of trees in the campus.



Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

Table 6. List of plants in the campus

Sr. No.	Name of the Plant	Tree / Plant	Quantity
1	Coconut	Tree	3
2	Show-Plant	Tree	10
3	Mango	Tree	8
4	Banyan	Tree	2
5	Mahua	Tree	2
6	Lemon	Tree	2
7	Babul	Tree	5
8	Khajur	Tree	3
9	Pipal	Tree	3
10	Shisam	Tree	3
11	Amrud	Tree	5
12	Gulmohar	Tree	5
13	Jamun	Tree	3
14	Sagwan	Tree	4
15	Bel	Tree	2
16	Neem	Tree	5

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

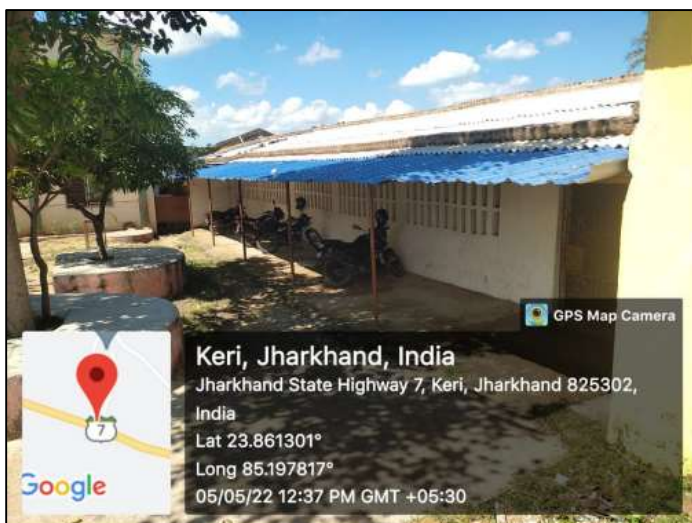
5.6.1. Green Campus Initiatives:

Following are few activities under green campus initiatives.

- Automobile entry is not restricted in the campus.
- Institute is yet to adopt the battery-powered vehicle for transportation. However cycles are being used for internal transport.
- The pathways inside the campus are pedestrian friendly. The campus areas have been designed with the concept of open spaces including roads and lawns.



- The natural landscape has been preserved while accommodating the demand to use these venues actively for gatherings, ceremonies and recreation. There is a clear pedestrian connection through all campus roads and adequate parking facilities.



Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

- Institute has not yet initiated banning of plastic in the campus.
- It is recommended that institute should carry out awareness programmers, recycling plastics into reusable materials that do not harm the planet, alternatives to go plastic free, etc. in College campuses.
- The college campus is landscaped with various trees & plants.
- Tree plantation is the major focus of the management to maintain the pristine purity and beauty of the institute to provide a congenial atmosphere for the academic and non-academic pursuits.

5.6.2. Quality audits on Environment and Energy:

Institutes has initiated carrying out following audit on regular basis.

1. Green Audit
2. Environmental Audit
3. Energy Audit

This is the first audit and institute plans to have such audits at regular frequency. Institute is carrying out many environmental promotion activities in the campus throughout the year. These activities include

- ✓ Cleanliness Drive
- ✓ Plantation Drive

The institute not only organizes such program inside the campus but is also actively doing it outside the campus as well.

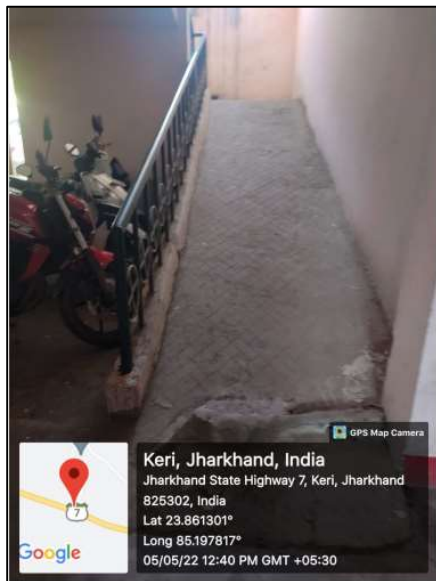
5.6.3. Routine Green Practices:

Every year college celebrates World Environment Day, World Water Day, etc. in the campus. Plantation and cleanliness drives are also organized in the campus. Main focus of these programs is to provide awareness to the students about the importance of the environment, its conservation and sustainable use of environmental resources. The programs are conducted through seminars, poster presentation, quiz competition debates etc.

5.6.4. Disabled-Friendly Environment:

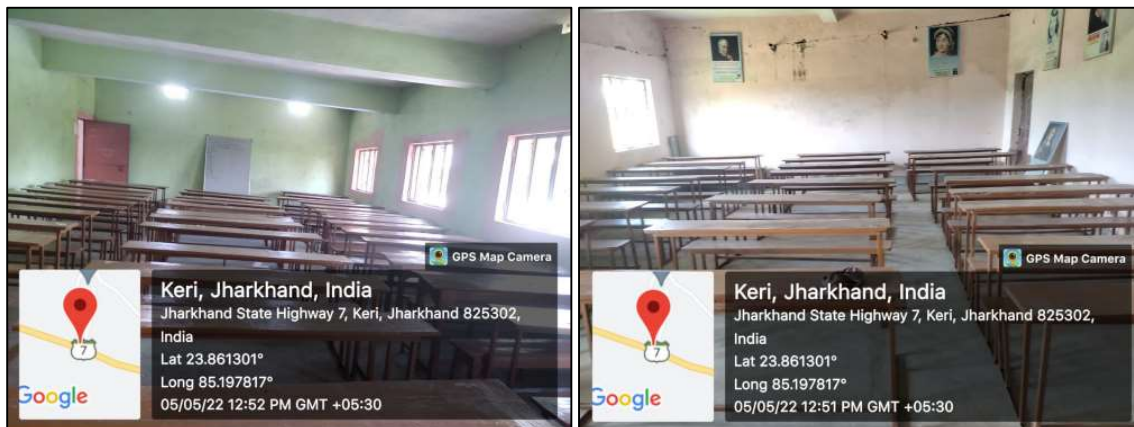
Institute has provided a ramp for easy access to classrooms for disabled students and staff. Wheelchairs are available for disabled students/ staff for movement in the camps. College also provided a separate enquiry counter for assisting disabled students.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand



5.6.5. Air Quality & Ventilation:

The classrooms and offices in the premises are well ventilated. The fans are operational and adequately placed to effect the sufficient air changes. Fans installed are not star-rated.



5.6.6. Infrastructure Usage:

- College premises has multiple entrances and has broad passage ways.
- The campus has proper drainage system and there were no leakages/ seepages from the roof.
- The premises do not have fire extinguishers installed.
- It is recommended to install adequate number of fire extinguishers in the college premises.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

5.6.7. Green IT Culture:

The institute is following a green IT culture.

- Email/ electronic communication mode is preferred to save papers.
- Both side printing is being adopted to save paper and trees.
- E-waste is not collected separately.

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

6. Carbon Foot Print Analysis:

6.1. CO₂e Calculation:

Carbon Foot Print Calculation		
A- Scope 1 (Direct Emission)		
Source	Fuel Consumption	CO ₂
DG	NA	NA
Vehicles	NA	NA
Others	NA	NA
B- Scope 2 (Indirect Emission)		
Source	Unit Consumption	CO ₂ (KG)
Electricity Consumption (Annual)	14463	11860
Total A+B	14463	11860
Carbon Offset		
Source	Quantity	CO ₂ (KG)
Solar	400	328
Trees	65	1170
Others	Nil	0
Total		1498

* Solar generation is estimated as 0.5 kW x 4 Units/Day x 200 Days

Sr. No	Description	Remark
1	Direct Emissions	No Data available
2	Indirect Emissions	Calculated as per international standards
3	Reductions	<ul style="list-style-type: none"> Institute may plan to add more capacity in Solar PV Institute may plant more no. of trees. Institute to adopt energy efficient equipment.

7. SUGGESTIONS AND RECOMMENDATIONS:

7.1. Water Management:

- There should be a proper monitoring of water consumption pattern in the campus. The bore well should be installed with water meter to monitor the consumption. The water meter readings to be recorded every day or every week at a fixed time.
- It is recommended to check water quality from bore well and R.O. water quality for dissolved oxygen, acidity, alkalinity, chloride, hardness, pH, and conductivity, total dissolved solids and E-coli/ coliform.
- The wash basin taps may be equipped with water saving fixtures.
- The flush tanks of the toilets may be fitted with dual volume system.
- Institute may install drip irrigation system to water the garden and plants in the campus.
- It is recommended to fix the leaking taps at the earliest.

7.2. Energy Management:

1. Ceiling fans have a very good scope for reducing power consumed using a technology called Brushless DC Motor or simply BLDC motor. BLDC technology, in general, has been in the market for a couple of decades. The traditional fan uses an induction motor and typically consumes 70-90 watts. But BLDC fan, on the other hand, can reduce power consumption up to 65%.
2. Prominent advantages of BLDC motor over induction motor are Lower Electricity Consumption, Longer backup on Inverters (even on Solar), improved reliability, Noise reduction, longer lifetime.
3. Institute may considered replacing existing fan with BLDC fans.

Sr. No.	Parameters	Unit	Value
1	Total No. of Fans	Nos.	72
2	Power Drawn by Regular Fans	Watts	80
3	Power Drawn by BLDC Fans	Watts	35
4	Energy Saving per Fan	Watts	45
5	Operating Hours Per Day	Hrs/Day	8
6	Annual Operating Days	Days/Yr	312
7	Annual Energy Savings Per Fan	kWh	112.32
8	Annual Energy Savings – For 72 Fans	kWh	8087.04
9	Energy Cost	Rs./kWh	6.63
10	Annual Cost Savings	Lacs Rs.	0.54
11	Estimated Investment	Lacs Rs.	1.8
12	Simple Payback	Years	3.4

Green Audit Report – Karnpura College, Hazaribagh, Jharkhand

4. College may adopt for sensor-based (occupancy sensors) energy conservation approach for offices, classrooms and washrooms as well.
5. To offset carbon emissions, Institute may
 - Augment solar rooftop capacity
 - Opt for energy efficient light fixtures, BLDC fans, and star rated equipment.
 - Plant more trees.

7.3. Green Campus:

- Battery powered vehicles may be adopted in future to reduce emissions inside campus.
- Common/ public transport may be adopted.

7.4. Waste Management:

- College may undertake feasibility study to install sewage water treatment in the campus to recycle waste water and use it in flush or for gardening purpose.
- Try to completely ban the use of plastic in the campus, and to encourage the use of biodegradable materials as alternatives. Try to achieve the goal of plastic free campus.