GREEN AUDIT REPORT 2018-19

OF

Acharya Jagadish Chandra Bose College

KOLKATA

GREEN AUDIT REPORT

ACKNOWLEDGEMENT

The green audit conducted by AJC Bose College,Kolkata is an internal audit that aims towards looking after a healthy environment. Though nascent, the initiative is taken up to foster the concept of environmental sustainability.

Sincere thanks to all for providing us necessary amenities and co-operation during the audit that helped in making the audit, a success.

TABLE OF CONTENTS

nOBJECTIVE AND SCOPE

Although there is no universal definition of Green Audit, we may define **it as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity.** The "Green Audit" aims to analyze environmental practices within and outside (not in our purview) the college campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment. Later on, it is implemented as a measure to enhance a healthy environment to almost all the organizations. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit. Green audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self governing organization of India which declares the institutions as Grade A, B or C according to the scores assigned during the accreditation.

The main objectives of Green Audit are as follows:

- To ensure development along with safeguarding the environment.
- To reduce energy consumption to foster environment.
- To access weather the measures implemented by the AJC Bose College,Kolkata have helped to reduce the Carbon Footprint.
- To assess whether investments made in increasing awareness among students regarding electricity, biodiversity and environment have helped the Institution achieve the required carbon dioxide emission and absorption in the campus.
- To assess whether non-academic activities of the Institution support the collection, recovery, reuse and recycling of solid wastes that harm the environment.
- To identify gaps and suggest recommendations to improve the Green

Campus status of the institution.

The present Audit is conducted in view of assessing all necessary environmental components of A.J.C Bose College,Kolkata.

EXECUTIVE SUMMERY

In accordance with the Green Campus Evaluation Plan, as suggested by the A.J.C Bose College, Kolkata, planned for conducting a green audit of the college in November, 2018. After the field work and other formalities, the report was finally send for approval to the authority (principal and IQAC) in November 2019.

The purpose of the audit was to make sure that the practices followed in the campus are healthy and environment friendly. With this in mind, the specific objectives of the audit were to evaluate the degree to which the Departments are in compliance with the applicable regulations, policies and standards and to ensure that the development of the college aims at sustainable development and green campus.

The methodology used included physical inspection of the campus and review of the relevant documentation.

Audit Key Steps

Planning completed	November 2018
Field work completed	March 2019
Draft report completed and sent for management response	May 2019
Management response received	June2019
Final report completed	July 2019
Report presented to the Management	July2019

MEMBERS OF THE INTERNAL GREEN AUDIT TEAM OF AJC BOSE

COLLEGE,KOLKATA

The Principal of A.J.C Bose College formed a Green Audit Assessment Team consisting of five members. All members were selected from among the faculty of the college and Dr Arunachal Chatterjee, assistant professor, Zoology Department coordinated the Green audit team.

The following are the members of the Green Audit Team.

	Name	Designation
1	Dr Arunachal Chatterjee, Coordinator Green Audit Team	Assistant professor
2	Dr. Shampa Khasnobis, Coordinator, IQAC	Associate Professor
3	Dr. Taradas Sarkar, Member IQAC	Associate Professor
4	Rabab Abedin	Student (3rd yr B.Sc)
5	Rohit Sharma	Student (3rd yr B.Sc)

STATEMENT OF ASSURANCE

This audit is been conducted for the first time in the college. The audit procedure tried to meet the terms of International Standards of Internal Auditing.

In our decision, sufficient and appropriate audit procedures were completed and evidence gathered to support the precision of the conclusions reached and contained in this report. The conclusions are based on a comparison of the situations as they existed at the time of the audit.

A.J.C Bose COLLEGE, KOLKATA- A BRIEF PROFILE

Formerly known as Birla College of Science and Education, the College was established in 1968. It was renamed Acharya Jagadish Chandra Bose College, when it came under the aegis of the University of Calcutta from 1981.

The college is co-educational and provides inclusive education encompassing students from all section of the society regardless of their caste, creed, religion gender and socio-economic background. And appreciable number of the students are from the minority section including girls, apart from the undergraduate sections in science, arts, commerce streams, the college also offers a teachers education course (B. Ed.)

Since its inception, the AJC Bose COLLEGE group has surpassed innumerable benchmarks of achievements and accreditations. Today AJC BOSE COLLEGE flaunts a colossal network of expansive operations led by an awe-inspiring student force who are the torchbearers of a better tomorrow.

The AJC BOSE COLLEGE has also 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 CO_2 emission, energy and water use, while creating an atmosphere where students can learn and be healthy. The 'Green Campus' has been active since last 3 years both as an assembly group of sub committees that actively promote the various projects. The college administration works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity.

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

Sl. No.	Department	[illegible]	[illegible]
1	Physics	121	5+1
2	Chemistry	92	(4+1)+1
3	Mathematics	140	5
4	Bengali	30	2+2
5	English	219	(1+1)+2

6	Hindi	85	1+1
7	Commerce	1945	26**
8	BioScience	170	(1+3) +2
9	B.Sc. Gen	141	15+2
10	B. A. Gen	460	5+5
11	B.Ed	94	8+2

Physical Structure

The built-up area of the college is 1.4 acres.

Sl. No	Type of room	No.
1	Class rooms	15
2	Tutorial rooms	-
3	Laboratories	10
4	PG- Research Lab	NA
5	Language Laboratory	1
6	Workshops	-
7	Computer Centre	1
8	Drawing hall	–
9	Library & Reading hall	2
10	Seminar halls	1
11	Admin and Faculty Offices	4

Office/Building Survey

Information on office-based environmental impacts like built-up area, utility bills, energy-saving devices and IT equipment's was collected. This information was added to

the carbon footprint data, generating a fairly clearer picture of the Institution's annual greenhouse gas emissions and impact of the reduction measures undertaken.

[redacted]

Fifty-two questions related to the environment had been fielded to the Focus Group members to assess their understanding of environment-related issues.

The questions focused on four concerns:

i. Whether they consider themselves eco-conscious?

ii. Do they consider the Institution to be eco-friendly?

iii. What do they think are the top priorities that should be tackled to improve the green campus status of the Institution?

iv. Whether the students and teachers who own vehicles are aware of the quantity of CO_2 emissions by their vehicles?

Of the 300 respondents, almost 80% were eco-conscious. But they were ignorant of the quantum of carbon emission at the national, state or at campus level. About 60% of them were not well informed of the simple carbon emission mitigation measures to be carried out in their homes.

Students who owned two wheelers were sensitized of the carbon emission by their vehicles and educated on this regard. They were also motivated to share their vehicles on alternative days with their peers. For example, 50% of the students who own two wheelers were advised to share their ride with their fellow students/neighbours. Thus the carbon emission by 79 two wheelers will be reduced by 50% in the coming years.

All the respondents considered their Institution to be eco-friendly and were very conscious of the proactive role of the flora in their campus towards carbon absorption. They feel very much honored that their Campus contributes, though very marginally, to the reduction of global warming.

However, they do not have skills to green audit the campus by themselves.

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

a) **The Pre Audit Stage:**

In the pre-audit stage, meetings provided opportunities to discuss the feasibility of such an audit. It also provided the team with basic data required to start the process, prior to the on site inspection by the team. The audit procedure and audit plan was handed over at this meeting and discussed in advance of the audit itself. The Audit team was also approved at this meeting. The audit protocol and audit plan were handed over at this meeting and discussed in advance of the audit itself.

The Management of the college showed commitment towards the green audit and its outcome, during the pre-audit meeting. They were ready to encourage all green activities were willing to formulate policies based on green auditing report.

b) **The Audit Stage:**

The Audit Stage encompasses of the team selection and the field works performed. Looking after the unique structure, location and ambiance of the college, the Green Audit Team focused on Material Issues pertaining to college which have the highest influence on the Green Attributes of the College. The Audit stage also focused on the Methodology adopted. Checklist approach is adopted for transparent evaluation of the topics and increase readability for independent reader.

c) **The Post Audit Stage:**

The post-audit stage ensures formulation of Draft findings and sent to management. Since the audit is done internally, it was important to ensure management approval for the draft. After getting draft approval, the audit team went for final report formulation.

AUDIT FRAMEWORK AND DETAILED FINDINGS

The following audit framework is used for conducting Green Audit in 2018-19. The framework also lists the findings and observations for every criterion.

Control Objective	Control(S)	Audit Observation
WATER MANAGEMENT	Repair sources of water leakage, such as dripping taps.	Regular checking and maintenance of pipelines are done to control water wastage.
	Minimize wastage of water and use of electricity during water filtration process, if used, such as Aquaguard filter.	Yes, the college has aquaguard filters installed in collage corridors, canteen and also in all the departments.
	Use an efficient and hygienic water storage mechanism to minimize the loss of water during storage.	The institute has 39000 Lit water storage capacities to ensure water use. Moreover, the water of the tanks is released and cleaned at regular intervals i.e. in each 15 days to maintain water hygiene of the tank.
	Install water recycling mechanism.	Yet, no such mechanism is adopted.
ENERGY MANAGEMENT	Appreciate that it is preferable to purchase electricity from a company that invests in new sources of renewable and carbon-neutral electricity	The college does not have any choice other than CESC for electric supply. The college also has one eco-friendly generator for the supply of emergency electricity to save our ecosystem.

	Look into the possibility of on-site micro-generation of renewable electricity.	There is one solar gate light
	Give preference to the most energy efficient and environmentally sound appliances available, this includes energy-saving light bulbs, refrigerator, A.C machine, water cooler, monitors, printers, zerox machine etc.	The college is using a few CFL and more LED lights as much as practicable. Institute purchases "Star Rated" electrical appliances (Refer to such as refrigerator, A.C machine, water cooler etc., to minimize the energy consumption and maintain carbon neutrality of the environment. Institute has proposed to replace most of the resistance regulator, CRT monitors and DOT matrix printers by electronic regulators, LCD monitors and Deskjet/Laser printers, respectively. Institute has already installed 560 LCD- computers (i.e. 90% of CRT monitors are replaced by LCD/ LED monitors). Moreover, in this academic year two zerox machines (Canon, Image Runner Advance, Model No. 4525, and Power Consumption 1.5 kWh) that are operated on low power consumption are installed. The details of electrical appliance i.e. AC, *Fridge*, and *Water Cooler* are given in kwt.

	Encourage staff, students and conference guests to save energy through visible reminders, incentives and information to increase awareness. This particularly concerns turning off electrical appliances when not in use	Yes, the college has put several posters and reminder notes in classrooms and other relevant places to turn off electric appliances when not in use.
	Ensures that all electronic and electrical equipments, such as computers, are switched off when not in use and is generally configured in power saving mode when such option is available	It is practiced.
	Ensure that all cleaning products used by college staff have a minimal detrimental impact on the environment, i.e. are biodegradable and non-toxic	Negligible amounts of washing liquids are used in the college and all the toilet cleaners are eco-friendly.
	Dispose the glassware waste and chemical waste generated from the laboratories in a scientific manner	It is to be noted that there is no harmful waste water/ Non toxic chemicals from chemistry lab is emitted during the experimentation. Most of the waste generated is water-soluble and ultimately disposed through normal sewage system, diluted largely so biomagnifications is negligent. However, the ceramic materials like Glass which are broken during the experimentation are stored in a

		bucked and are sold to vendors for recycling.
WASTE MANAGEMENT	Make full use of all recycling facilities from students canteen and private suppliers, including glass, cans, white coloured and brown paper, batteries, print cartridges, cardboard and furniture.	No, the college does not have any such recycling device to carry on the procedure. However, glass, cans, white coloured and brown paper, batteries, print cartridges, cardboard and furniture are sold to vendors for recycling.
	Compost or cause to be composted, all organic waste, green waste and non-recycled collected from kitchens, gardens, offices and rooms.	No, the college does not have any such mechanism.
	Recycle or safely dispose of dry wastes, computers and electrical appliances.	All dry wastes (paper, metal, glass, other dry waste, e-waste, etc.) are separated in different bins in the college and resell to the local vendor. Moreover, a few out dated computers are gifted to local NGOs.
	Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated	The college has set up separate bins to ensure proper segregation and collection of the various wastes. Those are (a) biodegradable (b) non-bio degradable (c) hazarders. The responsibility of recyclable waste is however still not taken up.

	Make specific arrangements for events, such as community events, seminars and conferences in order to both arise consciousness among students and others and also to minimize the waste produced and maximize what is recycled/reused.	The college organized community program by the NSS unit to ensure both consciousness and awareness among students and community members. Moreover, faculty members are sent to various Seminars related to environmental awareness.
	Dispose all waste, whether solid or otherwise, in a scientific manner and ensure that it is not released directly to the environment.	Yes, the college disposes all wastes, whether solid or otherwise, in a scientific manner and ensure that it is not released directly to the environment.
	To recycle and reuse of kitchen wastes (from canteen and hostels) and garden waste.	Kitchen wastes and garden wastes commonly are recycled to form nutrient rich quality organic manure for agricultural purpose.
CARBON FOOTPRINT	Ensure use of eco friendly transport option	About 90% of the students and teaching and non-teaching staffs of the college use public transport as the main mode of transport.
	Promote environmental awareness as a part of course work in various curricular areas, independent research projects, and community service.	Compulsory Environment & Ecology (CH 101) paper of 100 marks in the University Syllabus for all the students of all streams to develop Environmental Awareness.
	Reduce the rate at which the College contributes to the depletion and degradation of	College does not directly or indirectly participate in depletion and degradation of natural resources.

	natural resources	
	Review architecture of existing buildings and reviews ways, in consultation with experts, to reduce usage of energy for such buildings, offering greatest efficiency for energy and water usage.	New constructions are in compliance with green standard.
	Conduct environmental awareness posters and seminars as a part of the programme.	Yes, the college places several posters and placards in the campus to ensure that environmental awareness is conducted. Also, seminars are organized on environmental theme in the college.
	Carbon footprint or emissions of the campus.	Calculating carbon footprint or the carbon emissions to determine how best to approach minimizing impact on global warming.

Ex Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

RECOMMENDATIONS

Criteria	Recommendation
Maximize the renewable flow energy to initiate healthy and continuous flow of energy	To set up solar panel in the college to ensure continuous renewable energy flow.
To channelize flow resource	To initiate rainwater harvesting by digging wells to accommodate rainwater flowing through the roof tops.
Maximize the proportion of waste that recycle & minimize the quantity of non- recyclable refuse	1) College campus is totally plastic free zone. 2) To set up more separate bins to ensure proper segregation and collection of the various wastes.
Reduce energy consumption, especially of energy derived from fossil fuels	All the areas of the campus should be under the preview of solar renewable power control. Also, switch off drills are to be set up in the campus to ensure all the electric devices to be in power off measure.
Minimize the use of chemical pollutants Software and Hard ware Lab	The chemical pollutants from the science laboratories are water soluble. So, it is recommended that this water is recycled properly for effective use in the garden area. E-waste other than batteries which are not returned to the vendors, should be disposed off at collection centres authorized by Pollution Control Board.

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

Sr Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

Carbon Footprint

Carbon footprint is historically defined as *the total set of greenhouse gas emissions caused by an individual, event, organization or product, expressed as* ***carbon dioxide equivalent.***

Data collected from the following sources were taken into consideration to calculate carbon footprint emission and reduction. The floristic richness of the campus – total number of plants, trees, shrubs – was estimated. The impact of alternate green energy production and consumption to reduce fossil fuel-based energy was assessed, e.g. the number of CFL, LED, tube lights (FTL) and electronic chokes was counted. The Carbon Footprint Calculator was used to arrive at conclusions. Carbon Footprint Calculator enables the measurement of carbon emission by the Institution. Besides, by breaking down the value to key 'carbon drivers', the Institution can know how much of carbon footprint comes from which type of behavior (high power-consuming incandescent bulbs vs. LED lights, solid waste management, etc.).

Carbon Audit Tools and Analysis

The Carbon Audit tools and analysis methodology were developed collectively by the Green Audit Team and based on that the audit was conducted in three major thematic areas.

Floristic status of the institution

The AJC Bose College, Kolkata is located in about 40 cottahs of land in the city of Kolkata, West Bengal. After deducting the built-up area 22000sq ft., the projected area available to develop various types of flora is 0.1 **acres**.

There are **following types** of trees, shrubs, herbs (including potted plants) in the campus.

- 9 full grown trees
- 20 semi grown trees
- 136 Bushes (including floriculture plants)

Members of the College Green Audit Team counted the number of plants: full-grown trees (above 10 years), semi-grown trees (below 10 years), shrubs and lawn (0-sq.ft. area).

The following table will illustrate these figures

Sl. No.	Details of flora	Number of
1	Full-grown trees	09
2	Semi-grown trees	20
3	Bushes (including floriculture plants)	136

CALCULATION OF CARBON ABSORPTION

Assumptions

i. Number of mature trees in 1 acre = 700

ii. Carbon absorption capacity of 700 trees is equivalent to carbon emitted by a speeding car for 26,000 miles

iii. 26,000 miles = 41,843 km

iv. Average kilometers covered by a car per litre of petrol is 20 km

v. Total quantity of petrol consumed by the car (41,843/20) = 2092 litres

The carbon emitted by a car due to consumption of 1 litre of petrol is 2.3 kg CO_2. At this rate the total quantity of carbon emitted by 2092 litres of petrol (2092 ×2.3 kg) =4812 kg CO_2 or 4.8 tonnes of CO_2. Therefore, the carbon absorption of one full-grown tree is 4812/700 = 6.8 kg CO_2.

The footprint calculation is based on the standard unit of 1 litre petrol = 2.3 kg CO_2

Carbon absorption by flora in the Institution

Carbon absorption capacity of one full-grown tree = 6.8 kg CO_2.

(a) Therefore the carbon absorption capacity of 09 full-grown trees in the campus of the Institution (09 × 6.8 kg CO_2) = **61.2 kg or 0.**061 tonnes of CO2.

(b) The carbon absorption capacity of 20 semi-grown trees is 50% of that of full- grown trees. Hence, the carbon absorption (20 × 3.4 kg CO2) = 68 kg or 0.068 tonnes of CO2.

(c) There are 136 bushes of various species being raised in the gardens of the Institution. Carbon absorption of bush plants varies widely according to the species. Certain bushes absorb as high as 49,000 g CO2 per plant, whereas some others absorb as low as 150 g CO2 per plant. In the absence of a detailed scientific study and botanical survey, the per-plant carbon absorption was assumed to be 200 g (in consultation with environment scientists). Based on this, the total carbon absorption of 3864 plants was calculated to be 136 × 200 g = 27200g or 27.2 kg or 0.027 tonnes of CO2.

(e) The grand total of carbon absorption by the flora in the campus of The AJC Bose College is (0.061+0.0681+0.027= 0.1561 **tonnes.**

The grand total of carbon absorption by the flora in the campus is (a+ b+ c) = 0.1561 **tonnes.**

This is the sink effect of the flora in the campus.

TOOL TO MEASURE OXYGEN EMISSION BY FLORA IN THE CAMPUS

According to the Arbor Day Foundation, 'a mature leafy tree produces as much oxygen in a season as 10 people inhale in a year'

A person breathes 7 or 8 litres of air per minute. Air is about 20% oxygen. But the exhaled air has about 15% oxygen, and hence the net consumption is about 5%. Therefore, a person uses about 550 litres of pure oxygen each day.

Calculation of oxygen emission by flora

The number of litres in 1 kilogram depends on the density of the substance being measured. Litre is a unit of volume, and kilogram a unit of mass. Litres and kilograms are approximately equivalent when the substance measured has a density of close to 1 kilogram per litre.

On average, one full-grown tree produces nearly 260 pounds or 117 kg of oxygen each year. Two mature trees can provide enough oxygen for a family of four.

i. Total oxygen emitted by 9 full-grown trees per year (117.6 kg × 9) = 1058.4 kg or

1.05 tonnes.

ii. Total oxygen emitted by semi-grown trees (58.8 kg × 20) = 1176 kg or **1.17 tonnes** (oxygen emission is 50% of that of the full-grown tree).

iii. Total oxygen emitted by 136 bushes is calculated based on the following oxygen-inhaling requirement per person per day. A normal human being requires 550 litres of oxygen per day. 400 bushes produce enough oxygen per day to enable a person to breathe adequate quantity of oxygen of 550 litres. Total quantum of oxygen produced by 400 plants per day is 550 litres of oxygen.

Taking 400 plants as one unit, the number of units of bushes in the campus (136/400) = 0.34 .

Total quantity of oxygen produced by 9.66 units is (0.34 × 550 litres) = 187 litres of oxygen per day.

The annual production of oxygen at this rate (187× 365) = 68255 litres or kg of oxygen, which is approximately 68.25 **tonnes of oxygen.**

Carbon Footprint Reduction Table

Carbon dioxide absorption

Sl. No.	Flora	Quantity in Tonnes
1	9 full-grown trees	0.061
2.	20 semi-grown trees	0.068
3	136 bushes	0.027
Total		**0.156**

Oxygen emission by flora

Sl. No.	Flora	Quantity in Tonnes
1	9 full-grown trees	1.05
2	20 semi-grown trees	1.17
3	136 bushes	68.25
Total		**70.47**

Energy-saving measures and Carbon Footprint Reduction

The Energy Audit Report of the College during the year 2018-19 revealed that the total consumption of electricity was 68818 units.

One unit equals 1000 watts (1 kW hr). It requires 0.538 kg or approximately ½ kg of coal to produce 1 unit of electricity.

The total quantity of coal required to produce 105672 units of electricity (68818× 0.538 kg coal) = 37024.08 kg or **37.02tonnes.**

CO_2 emission by coal

One kilogram of coal emits 2.86 kg of CO_2, thereby increasing the carbon footprint which in turn contributes to global warming.

Therefore, 37.02 tonnes of coal consumed indirectly by the institution through consumption of 68818 units of electricity led to the emission of (37024.08 kg of coal × 2.86 kg CO_2) 105888.88 kg or **105.88tonnes of CO_2** into the atmosphere.

The management of college is conscious of this damage to the environment and has been implementing various programs/activities to reduce energy consumption on the one hand and increase green energy sources on the other.

They are

- Replacing high energy-consuming lighting system with energy-efficient lighting systems.
- Suitable number of solar panel in the college roof top is required

ANALYSIS OF CO_2 REDUCTION THROUGH THE ABOVE MEASURES

Installing energy-efficient lighting system

Based on the recommendations of the Energy Audit Team, the Institution has reduced CO_2 emissions indirectly by replacing high energy-consuming electric bulbs with energy-efficient LED lighting systems. To understand the carbon emission reduction, it is appropriate to compare the units of electricity consumed between incandescent lamps and LED.

The following table illustrates this

Sl. No.		
1	Total no. of tube light used earlier	488
2	Average energy consumption by an tube light	40 W
3	Energy consumed by 488 FTL for 5 hr/day	97.6 kW hr or 97.6 units
4	Energy consumption of 488 FTL for 300 days/year	29280 kW hr or 29280 units
488 tube light are replaced with 488 LEDs		
5	Energy consumed by 488 LED for 5 hr/day	48.8 kW hr or 48.8 Units
6	Energy consumption of 488 LED for 300 days/year	14640 kW hr or 14640 units
7	Energy saved by LED for 5 hr/day	97.6-48.8 Units=48.8 Units
8	Energy saved by LED for 300 days/year	14640 Units

CARBON FOOTPRINT REDUCTION ANALYSIS

One Fluorescent tube light (FTL) consumes 40W of energy; One LED bulb consumes 18W of energy.

First, it is appropriate to analyses the carbon emission due to consumption of 29280 units of electricity by 488 FTL lamps per year. The standard tool of analysis employed in this Green Audit is coal equivalent of electricity.

0.538 kg of coal is required to produce 1 unit of electricity.

Total units of electricity consumed by 488 FTL lamps = 29280 units

Coal equivalent of 29280 units (29280 × 0.538 kg coal) = 15752.64 kg or 15.75 **tonnes.**

1 kg coal emits 2.86 kg CO_2 into the atmosphere.

At this rate, 15752.64 kg coal emits (15752.64 × 2.86) = 45052.55 kg or 45.02 **tonnes of CO_2.**

The following are the CO_2 reduction measures adopted in the Institution.

LED

488 FTL which consume 29280 units of electricity were replaced with 488 LED lamps. At this rate the coal equivalent (14640 × 0.538 kg) = 7876.32 kg or 7.87 tonnes.

CO2 emission by 7867.32 kg coal (7867.32 kg × 2.86) = 22500.53 kg or **22.5 tonnes**. Carbon emission reduction achieved through use of LED bulbs (45.02 – 22.5) = **22.5 tonnes.**

The positive impact of energy efficiency in this section on Carbon Footprint is **22.5 tonnes** of CO2.

Water Audit

Conservation of rain water through rainwater harvesting system is practised by the college management. The total open terrace area of the buildings amounts to 1,00,000 sq.ft

Solid Waste Management

Management of solid waste is an important driver in Green Audit. Solid waste not properly managed leads to the degradation of the environment which, in turn, affects the flora and fauna. Keeping this in mind, the College has been strictly implementing scientific solid waste management to maintain the green status of the campus.

Small buckets numbering 120 have been kept in various places of the campus so that students shall deposit the solid waste in the buckets.

The Chemistry lab , Canteen and other labs uses approximately 100 kgs of LPG

Emission of CO_2 through transport system

Both public and private transport system– is very high in India as India is credited with the third rank in carbon emission in this regard. It is estimated that in India, 9% of the total carbon is emitted by the transport system.

The positive factor in this regard is that AJC Bose College does not own any transport vehicles, say four wheelers, to arrange conveyance for students. Taking into consideration that the College is enjoying the availability of adequate public transport system, the College Management has taken a principled stand right from the beginning to encourage students to use the public transport system to reduce carbon emissions.

Impressions

The overall impression one gets while green auditing the campus is that it qualifies to be labelled as a Green Campus. The geographical terrain and the vast area at the disposal of the Institution is a contributing factor to further green the campus.

The College management and the faculty deserve appreciation for their efforts to reduce Carbon Footprint through installation of various energy-efficient measures. One example is replacing incandescent and fluorescent bulbs with less energy- consuming CFL and LED bulbs.

SUMMERY OF FINDINGS

The main findings of the audit show that, in general, all the departments and students are aware about the need for environmental protection at a general level. It was also observed that a number of best practices such as maintaining garden, planting trees in the campus, vemicompost to ensure a proper waste management technique, etc. are followed in the campus.

However, on detailed review, it was observed that, as the institute is implementing Green Campus Policy for the 1st time and only a few practices are still in nascent stage and needs further nurture in order to improve their efficiency, fairness and consistency.

Suggestions and Recommendations

There exists vast scope to improve the green campus status of the College through biodiversity promotion and tapping green energy sources.

i. Compostable solid waste shall be collected and deposited in solid waste collection tanks. These wastes shall be profitably converted into compost and applied to gardens and trees to reduce the application of chemical-based fertilizers and pesticides.

ii. Solar panels shall be installed on top of the buildings to produce 10,000 kW of electricity. To enhance solar power productivity, aluminium foil-based reflectors shall be installed on the eastern and western sides of the solar panel.

iii. Energy-efficient measures such as replacement of all incandescent bulbs/ FTL with LED

lamps, old electrical regulators of fans with energy-efficient electronic regulators, air-conditioning units with all-star rated systems need to be undertaken.

iv. Students from the Computer Science Department shall be trained as e-waste managers to manage e-waste. These e-managers shall be in constant touch with schools, orphanages and parish houses through social media and inform them of the outdated computer systems that shall be used by them. They also shall dispose of the less efficient, damaged and non-functioning e-wastes to the vendors.

v. Water quality testing laboratory will be installed in one part of the laboratory to test the portability of the drinking water to ensure the students are free from water-borne diseases. All the water taps shall be fitted with high-efficiency aerator taps to reduce wastage of water. All toilets shall be fitted with dual- flush water closets, which will reduce water consumption by 40%.

vi. Environment education shall be imparted to all college students through 1-hr life-skill classes once a week. This will create wide-level environment consciousness among the student community. They will be sensitized to encourage pillion riding with their peers or use public transport instead of two wheelers. Moreover, they will also motivate their parents to replace all the incandescent or fluorescent bulbs with energy-efficient LED bulbs

GREEN AUDIT REPORT

Certification by the internal Green Audit team of Acharya Jagadish Chandra Bose College College

Sl. No.	Name	Designation
1	Dr. Arunachal Chatterjee	Assistant professor
2	Dr. Shampa Khasnobis	Associate Professor
3	Dr. Taradas Sarkar	Associate Professor
4	Rabab Abedin	Student
5	Rohit Sharma	Student

DECLARATION

I agree with all the recommendation and observation mentioned in this report.

Original signature by the Principal with Seal

Principal
A. J. C. Bose College
1/1B, A. J. C. Bose Road, Kol - 20

CERTIFICATION OF GREEN AUDIT REPORT

Certified that the green audit report of Acharya Jagadish Chandra Bose College, Kolkata has been prepared as per ISO 14001 rules and regulations by a panel of environmental experts mentioned below in association with the internal Green Audit members of Acharya Jagadish Chandra Bose College, Kolkata

Sl. No.	Name and Designations of External audit member	Signature with date
1.	Dr. Anup Kumar Sikdar Former Principal, Ramsaday College, Howrah Member W.B. State Council of Higher Educations	Dr. Anup Kumar Sikdar M.Sc. (Zoology), Ph.D. Ex-Principal, Ramsaday College (Howrah) West Bengal, India
2.	Dr. B. B. Paira Former professor and Head Department of Chemical Engineering, University of Calcutta	Prof. B. B. Paira Former Head Department of Chemical Engineering University of Calcutta
3.	Dr. Samir Kanti Datta Vice-Principal(Science) The Bhawanipur Education Society College, Kolkata	Vice Principal (Science) The Bhawanipur Education Society College Kolkata - 700 020

Declaration:

We, the external members of green audit team verified all green audit related documents and systematically noted observation especially calculate the carbon neutrality and suggest our recommendation for good green campus with eco-friendly setup.

Signature of Dr. A. K. Sikdar

Dr. Anup Sikdar
M.Sc. Ph.D.
Ex-Principal, College (Howrah)
West Bengal, India

Signature of B. B. Paira

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Signature of Dr. S. K. Datta

Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

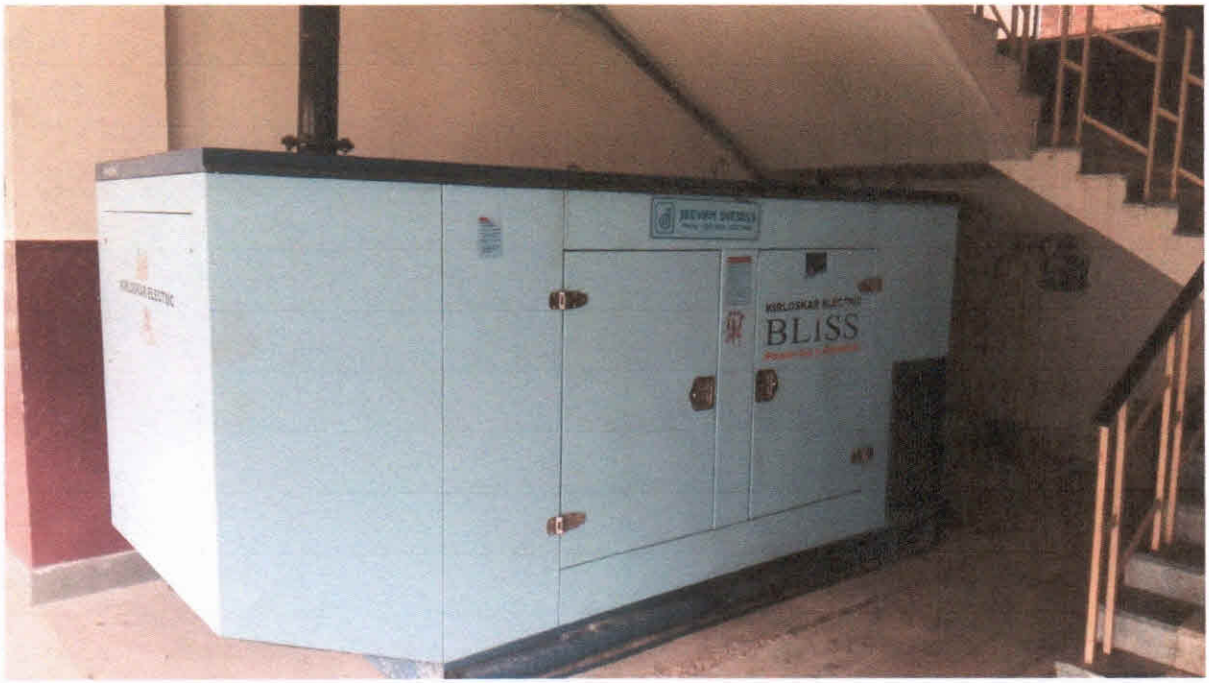
Ex-Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

B. B. Paira

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020



B. B. Paira

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

& Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020

Prof. B. B. Paira
Former Head
Department of Chemical Engineering
University of Calcutta

Dr. Anup Kumar Sikdar
M.Sc. (Zoology), Ph.D.
Ex-Principal, Ramsaday College (Howrah)
West Bengal, India

Ex Vice Principal (Science)
The Bhawanipur Education Society College
Kolkata - 700 020