

# **Vivekananda College, Madhyamgram**

## **Green Audit Report (2021-2022)**



**Prepared by**

**Progyan Foundation for Research and Innovation**

**(An ISO 14001:2015 Certified Organization)**

## Certificate

PROGYAN is an independent policy-science action research organization working as a subsidiary wing of the South Asian Forum for Environment (SAFE), which is a regional CSO and a major stakeholder in the UN Environment towards knowledge economy for all stakeholders to act in this climate milieu. PFRI, SAFE is accredited with ISO 14001:2015 certification and registered as a non-profit Section 8 company in India, committed to advancing scientific knowledge across socio-economies and socio-ecologies in developing adaptive guidelines and operational frameworks, sustainable solutions for resource optimization and climate change, in both rural and urban settings through innovation and research. The major scopes for PFRI include Strategic Environmental Impact Assessment and Institutional Green Audit along with field and analytical research.

This is to certify that the 'Progyan Foundation for Research and Innovation' (PFRI), Kolkata 700099 has conducted a brief and precise 'Green Audit' for the 'Vivekananda college' Madhyamgram, during the assessment year July 2021 to June 2022. The Green Audit was performed in accordance with the applicable standards prescribed by the Central Pollution Control Board and Ministry of Environment, Forests and Climate Change, Government of India, and following NAAC guidelines. The audit involves energy, water, waste, and biological inventories and gives recommendations that the institute can follow to improve the energy, water, waste, and environmental scenarios of the said institute. In an opinion and to the best of our information and according to the information given to us, and also in the midst of the Covid-19 pandemic scenarios, said Green Audit gives a true and fair view in conformity with environmental auditing principles accepted in India.

*Malanicha Dey*

**Dr. Malanicha Dey**  
(Director & Senior Scientist, PFRI)

Date: 20. 12. 2022



*Sumanabonny*  
Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129



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# **SECTION I**

# **INTRODUCTION**

## **1 Introduction**

### **1.1. Basis of Green Audit**

The term 'Green' means eco-friendly or not damaging the environment. This can acronymically be called 'Global Readiness in Ensuring Ecological Neutrality' (GREEN). Green Audit can be defined as the systematic identification, quantification, recording, reporting, and analysis of components of environmental diversity. Green accounting can be defined as the systematic identification quantification, recording, reporting & analysis of components of ecological diversity & expressing the same in financial or social terms. 'Green Auditing', an umbrella term, is known by another name 'Environmental Auditing'. The 'Green Audit' aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco-friendly ambiance. 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. Through Green Audit, one gets a direction as to how to improve the condition of the environment and various factors have determined the growth of carrying out Green Audit.

Educational institutions have broad impacts on the world around them, both negative and positive. The activities pursued by campus can create a variety of adverse environmental impacts. But they are also in a unique position as educational institutions to be leaders in pursuing environmentally sustainable solutions.

Green Audit is a process of systematic identification, quantification, recording, reporting, and analysis of components of environmental diversity of various establishments. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambiance. The Green Audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve the waste minimization plan. It can create health consciousness and promote environmental awareness, values, and ethics. It provides staff and students with a better understanding of the green impact on campus.

## **1.2. Objectives of Green Audit**

Green Audit regulates all such practices and checks whether our processes are consuming more than the required resources and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion, it is necessary to verify the processes and convert them into green and clean ones. The Green Audit provides an approach to it. It also increases overall consciousness among the people working in institutions toward an environment. The various components of the Green Audit such as:

- ✓ To map the geographical location of the college and its surroundings
- ✓ To record the meteorological parameter where the college is situated
- ✓ To document the quality of drinking water
- ✓ To document the waste disposal system
- ✓ To document the quality of wastewater
- ✓ To document the floral and faunal diversity of the college
- ✓ To document the ambient environmental condition of air, water, and noise
- ✓ To estimate the energy requirements of the college
- ✓ Establish and implement environmental management in various departments
- ✓ Setup goal, vision, and mission for green practices on the campus
- ✓ To report the expenditure on green initiatives during the last five years

## **1.3. Benefits of Green Audit**

There are many advantages of a Green Audit for an educational institute

- It would help to defend the environment in and around the campus
- Recognize the cost-saving methods through waste minimization and management
- Point out the prevailing and fourth-coming impacts on the environment
- Improve social and environmental awareness for the institute and students
- Authorize the organization to frame a better environmental performance
- It portrays a good image of the institution through its clean and green campus
- Improvement of environmental ethics and values and stewardship towards responsible environment management
- Finally, it will help to build a positive impression through green initiatives during the upcoming NAAC visit

### 1.4. Methodology of the Green Audit

The audit process was carried out in three phases from July 2021 to June 2022. At first, all the secondary data required for the study was collected from various key information sources and concerned departments. A broad reference work and literature review were carried out to clear the idea of green auditing. Different case studies and methodologies were studied, and the following methodology was adopted for the present audit.

The methodology of the present study is based on onsite visits, personal observations, and questionnaire survey tools. Baseline data for Green Audit report preparation was collected by questionnaire survey method. Questionnaires prepared to conduct the Green Audit on the college campuses are based on the guidelines, rules, acts and, formats prepared by the Ministry of Environment, Forest and Climate Change, New Delhi, Central Pollution Control Board and, other statutory organizations. After the onsite visit and stakeholders' interview, the questionnaires were filled out. The generated data is subsequently gathered and used for further analysis. From the outcome of the overall study, a final report is prepared.

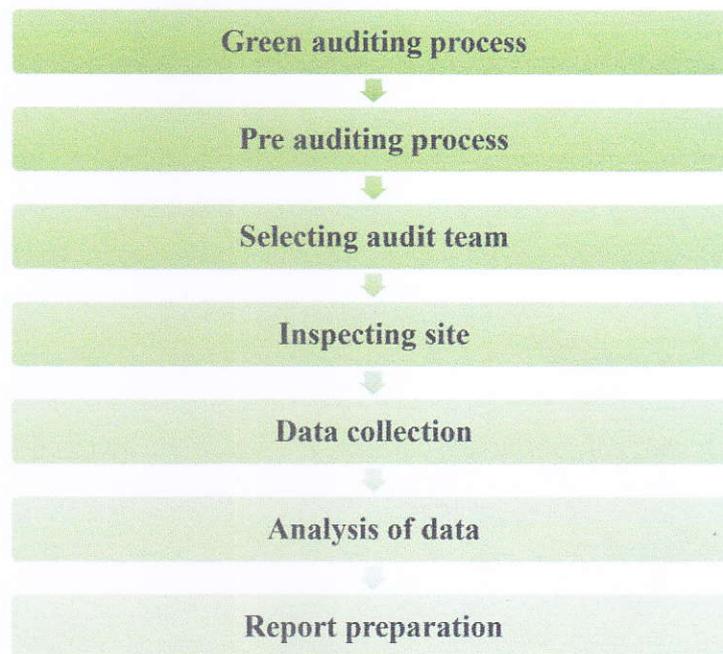


Fig. 1.1. Process of green auditing

## 1.5. About the College

Vivekananda College, Madhyamgram was established in 1986. It is named Vivekananda College to pay our homage to Swami Vivekananda, the great patriot and social reformer, and eternal embodiment of the soul of India and a great inspiring force behind the making of modern India. Our College is a co-educational general degree college affiliated with the West Bengal State University. Distance education is affiliated with Vidyasagar University (PG) – 6 and Rabindra Bharati University (PG) – 4. It is situated in a calm and quiet atmosphere and is far from markets, stations, cinema halls, and other disturbing factors. At the same time, it is within the locality where all modern amenities are available. It stands on the eastern side of Jessore road, National Highway No-34, about 1km from either Madhyamgram or Hridaypur railway station on the Sealdah-Bongaon section. It is about 18 km away from Calcutta and is connected with the city, the capital of West Bengal both by bus routes and train services. The college has now its own building (two-storied) & women's hostel, and a canteen for students & staff surrounded by boundary walls. General courses in Arts and honors courses in English, Bengali, History, Geography, and Education are taught here.

## 1.6. Brief about the College

Name of the college	Vivekananda college, Madhyamgram
Address	East Udayrajpur, Vivekananda Nagar, Madhyamgram, West Bengal, 700129, India
Principal	Dr. Chandan Kumar Chakraborty
Contact details	033 2538 7392
No of department	UG -13; PG - 3
No of students(UG+ PG)	4470
No of distance education students (DDE RBU+VU)	377
No of permanent teacher	28
No of SACT (State aided college teacher) teacher	19
No of visiting teachers for PG	22
No of visiting teachers for UG	5
No of permanent NTS staff	11
No of casual/supportive NTS staff	11
No of security staff	2
No of canteen staff	3
Total campus area	1.81 acres

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 Kolkata - 700 099

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<b>College building spread area:</b>	18563.895 sq. ft.
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**Fig 1.2. Campus area of Vivekananda college, Madhyamgram**

### **1.7. Vision and Mission Statement of the College**

It was primarily due to his active participation in the formulation of Government policy in matters of higher education and the wholehearted support extended by ministers like Sri Sambhu Ghosh and Sri Nirmal Bose that the college was finally established in 1986. Behind the achievement of the college, there is a history - a history of struggle a history of dedication and sacrifice of some good souls of our locality. The college is committed to the highest ideals of collegiate education. It aims at the development of each student and focuses on a comprehensive and balanced education. It is hoped that under the able leadership of Sri Ghosh the college will achieve holistic progress by dint of his administrative acumen and erudite promptness in the execution of all academic activities. The institution aspires to provide a learning environment that integrates body, mind, and spirit by adopting a need-based approach, synthesis of academics and ethics, innovation in learning methods, and a diversified curriculum.

### 1.8. Category of the Green Audit

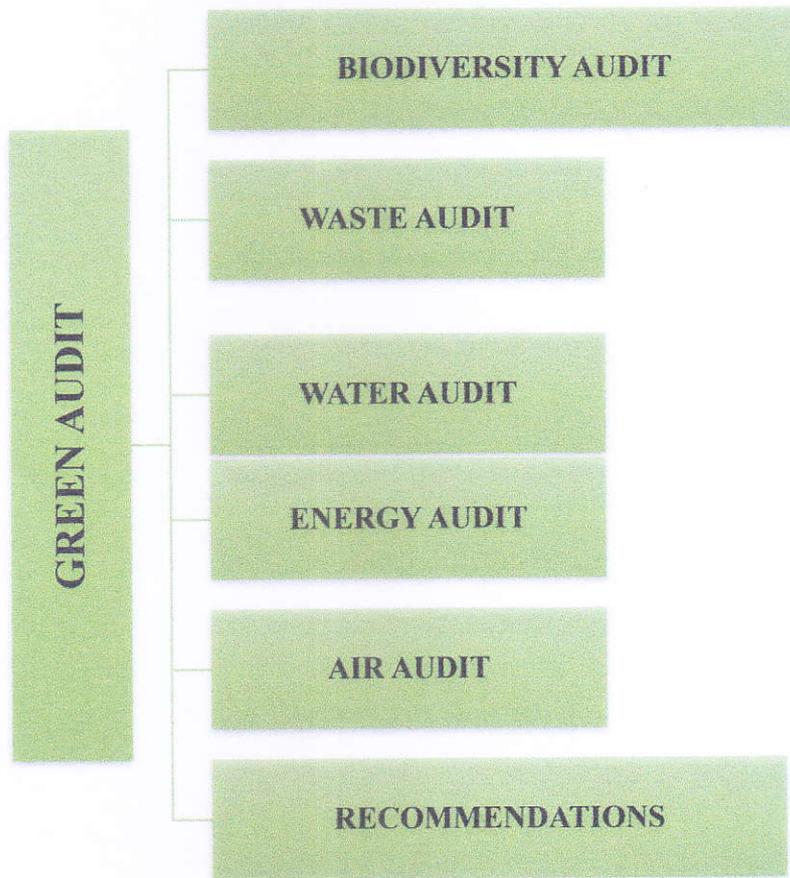


Figure 1.3. Scope of the green audit for 2021-2022

*Malanaha Dey*

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata - 700 099



*Renazabarty*

Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129



# **SECTION 2**

# **WATER AND**

# **WASTEWATER AUDIT**

## **2 Water and Wastewater Audit**

### **2.1. Introduction**

Water is one of the six essential nutrients (along with carbohydrates, protein, fat, vitamins, and minerals). Around 60 % of our body is made up of water and we can only live three to five days without fluids. Water plays many important roles in the body including flushing waste from the body, regulating body temperature, and transporting nutrients, which are necessary for digestion. The need for freshwater is increasing day by day as a result of people's rising standards of living, industrialization, and urbanization. As a result, the Government of India declared the national mission on water conservation as 'Jal Shakti Abhiyan,' appealing to all citizens to work together to address the problem of water scarcity by conserving every drop of water and suggesting that water audits be conducted in all sectors of water use.

A water audit is a systematic process of objectively obtaining a water balance by measuring the flow of water from the site of water withdrawal or treatment, through the distribution system, and into areas where it is used and finally discharged. Water auditing is a cost-effective method for reducing losses, optimizing multiple applications, and enabling significant water saving in the irrigation, home, power, and industrial sectors.

Therefore, an effort is required to reduce water consumption and increase the reuse and recycling of treated wastewater.

### **2.2. Importance of Water Audit**

- i. When problems are identified, it is easier to work on solutions
- ii. The process is more systematic
- iii. It is possible to implement a tracking system

Climate, culture, diet habits, employment and working conditions, degree and type of development, and physiology are all thought to play a role in determining the amount of water required. According to the Southeast Asia Regional Office of the World Health Organization's (WHO) standards Administration requires 50 l per person per day (staff accommodation not included), Staff housing needs 30 l per person per day, and sanitation is

dependent on technology, schools require 2 l per student; 10-15 l per student if water-flushed toilets are used.

### **2.3. Water Consumption in the College**

Considering the COVID pandemic, the college officials started their internal activities from November 2021 onwards but with limited number of staff. From 16<sup>th</sup> November 2021, the college again re-opened with **4847** daily students along with the **101** college staff.

Among them, toilet purposes require approximately 87% water consumption followed by drinking purposes (6%), canteen cooking (3%), washing hands and faces (2.6%), and other purposes (1%). Figure 2.1 and Table 2.1. demonstrated different categories of water usage and their prevalence per annum, whereas Figure 2.2 shows the percentage of wastewater generated per annum. Table 2.2. depicts storage facilities of wastewater, Table 2.3. shows the categories of the water reservoir and its water holding capacity whereas Table 2.4. Amount of wastewater based on various activities.

During the evaluation year, 1254175.2kl of water was used for drinking annually. In that year, of 655610 kl water was utilized for hand and face washing and 178000 kl of water for cleaning purposes of the college buildings. Simultaneously, 530000 kl of water has been required for cooking and washing dishes. The biodiversity garden is watered with 122000 kl annually, of groundwater that year for 3 days per week.

Table 2.5 provided some important water quality parameters based on following standard measurement protocol. All the water quality parameters from different water sources are found to be the below accepted limit as per the Indian standards but the levels of Iron (Fe) are slightly higher in raw water sources.

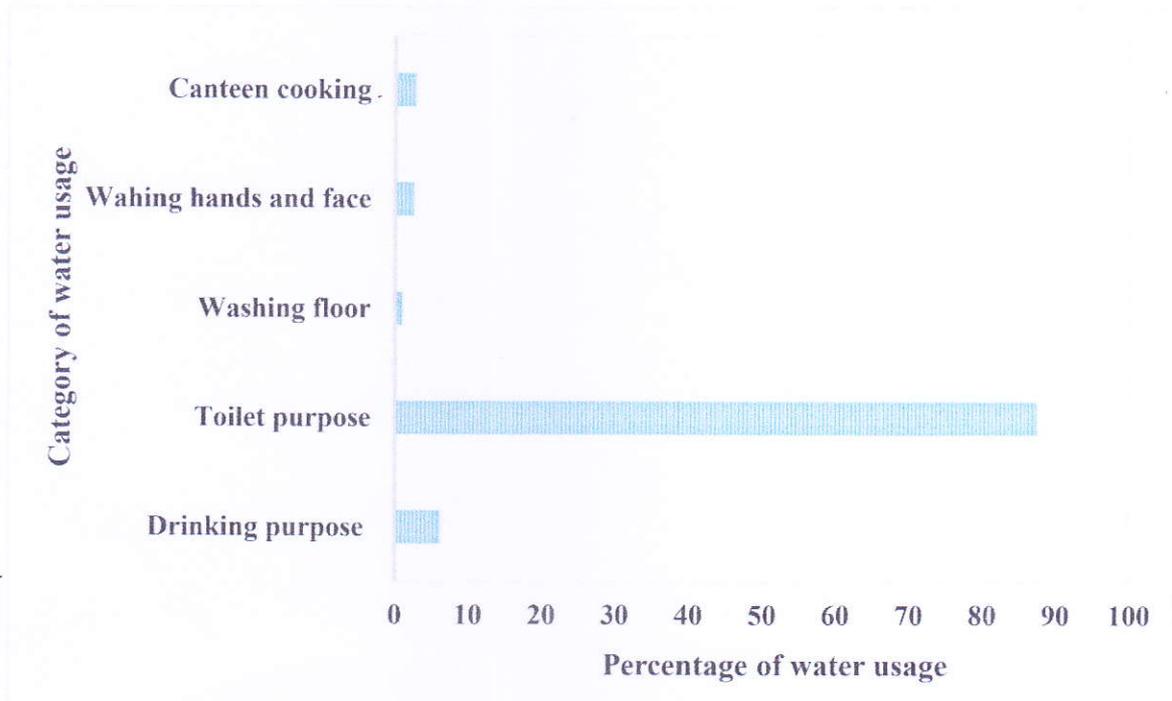


Fig. 2.1. Percentage of different categories of water consumption per annum

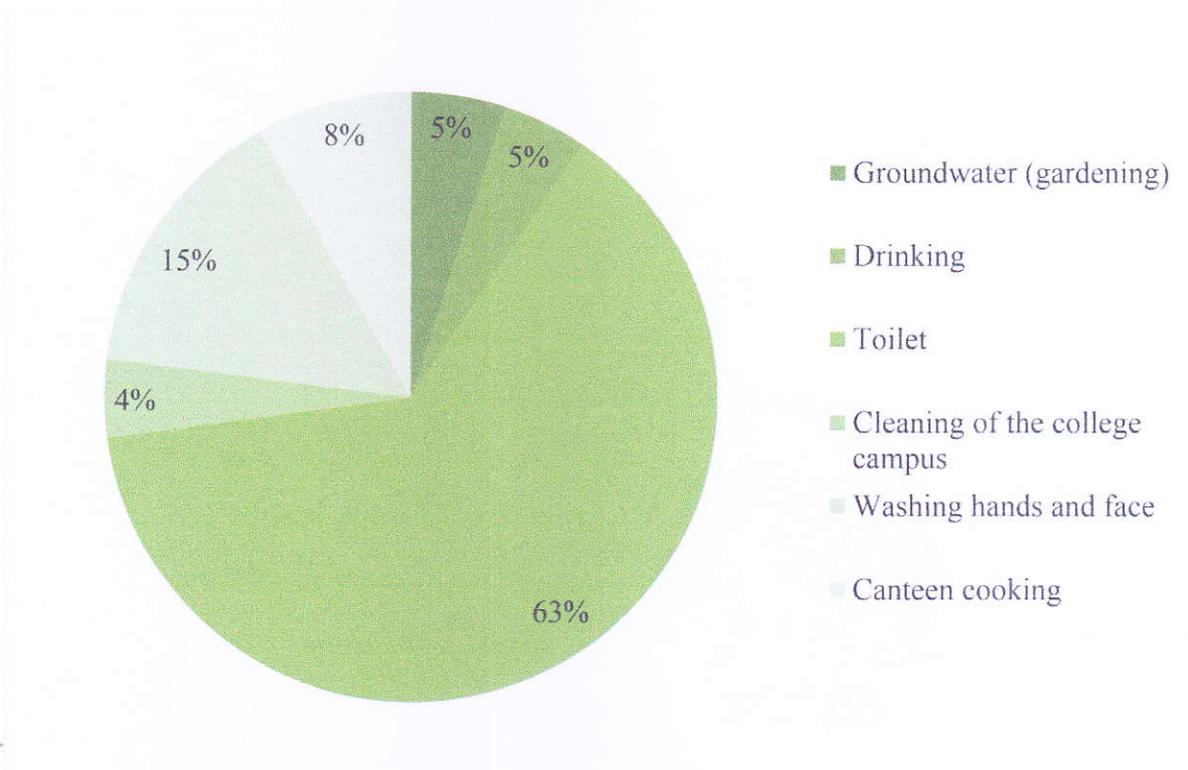


Fig 2.2. Percentage of wastewater generated per annum

Table 2.1. Different categories of water usage

<i>Water source</i>	<i>Activity</i>	<i>Days</i>	<i>No of user</i>	<i>Water usage/day (l/ day)</i>	<i>Activity/day</i>	<i>Water usage/ annum (l/ year)</i>
<i>Groundwater , rainwater</i>	<i>Gardening</i>	122	<i>College campus</i>	1000	3	366000
<i>Groundwater</i>	<i>Drinking purpose (students)</i>	212	4847	1.2	NA	1233076.8
	<i>Drinking purpose (NTS &amp; casual staff)</i>	212	22	1.2	NA	5596.8
	<i>Drinking purpose (Canteen staff)</i>	212	2	1.2	NA	508.8
	<i>Drinking purpose (Security)</i>	212	3	1.2	NA	763.2
	<i>Drinking purpose (Permanent teacher)</i>	212	28	1.2	NA	7123.2
	<i>Drinking purpose (SACT teacher)</i>	178	19	1.2	NA	4058.4
	<i>Drinking purpose (Visting teacher for PG)</i>	75	22	1.2	NA	1980
	<i>Drinking purpose (Visting teacher for UG)</i>	178	5	1.2	NA	1068
						1254175.2
<i>Groundwater</i>	<i>Toilet (Students)</i>	212	4847	8	2	16441024
	<i>Toilet (NTS &amp;</i>	212	22	8	3	111936

	<i>Casual staff</i>					
	<i>Toilet (Canteen staff)</i>	212	2	8	3	10176
	<i>Toilet (Security)</i>	212	3	8	3	15264
	<i>Toilet (Permanent teacher)</i>	212	28	8	3	142464
	<i>Toilet (SACT Teacher)</i>	178	19	8	3	81168
	<i>Toilet (Visting teacher for PG)</i>	75	22	8	3	39600
	<i>Toilet (Visting teacher for UG)</i>	178	5	8	3	21360
						16862992
<i>Groundwater</i>	<i>Washing floor</i>	89		2000		178000
<i>Groundwater</i>	<i>Wahing hands and face</i>	265	4948	0.5		655610
<i>Groundwater</i>	<i>Canteen cooking</i>	212		2500		530000

Table 2.3. Categories of the water reservoir and its water holding capacity

<i>Sl. No</i>	<i>Category of reservoir</i>	<i>No of reservoir</i>	<i>Holding capacity (l)</i>	<i>Total stored water (l)</i>
1	<i>Over headed</i>	1	500	500
2	<i>Over headed</i>	2	1000	2000
3	<i>Over headed</i>	4	2000	8000
4	<i>Underground</i>	1	2000	2000
5	<i>Underground (Rainwater)</i>	1	12000	12000

Table 2.4. Amount of wastewater based on various activities

<i>Activity</i>	<i>Wastewater generated (l/ annum)</i>
<i>Groundwater (gardening)</i>	73200
<i>Drinking</i>	125417.52
<i>Toilet</i>	1686299.2

<i>Cleaning of the college campus</i>	106800
<i>Washing hands and face</i>	524488
<i>Canteen cooking</i>	212000
<i>Total</i>	2728204.72

Table 2.5. Water quality assessment

<i>Parameters</i>	<i>Raw water</i>	<i>Treated water</i>	<i>Standard value (BIS)</i>
<i>Odor</i>	<i>Agreeable</i>	<i>Agreeable</i>	
<i>Taste</i>	<i>Agreeable</i>	<i>Agreeable</i>	
<i>pH</i>	7.12	7.10	6.5-8.5
<i>Fe(mg/l)</i>	2.157	0.068	0.30
<i>Total hardness as CaCO<sub>3</sub>(ppm)</i>	280	240	200
<i>Arsenic (mg/l)</i>	0.010	0.007	0.01
<i>Chloride (mg/l)</i>	14.2	14.2	250
<i>Turbidity(NTU)</i>	1.0	0.3	1
<i>Mn (mg/l)</i>	0	0	0.10
<i>TDS(mg/l)</i>	370	110	500
<i>Total coliform (cfu/100ml)</i>	0	0	0
<i>Faecal coliform (cfu/100ml)</i>	0	0	0

## 2.4. Water Management Methods of the Campus

- ❖ The college has rainwater harvesting system for a few years. A rainwater harvesting system of 12 kl capacity has been installed. One underground reservoir (having 2 kl capacity) and 7 overhead reservoirs of which one having 0.5 kl capacity, two having 1 kl capacity, and 4 having 2 kl capacity have been installed for this purpose.
- ❖ Rainwater collection reservoirs are processed in order to recharge groundwater.
- ❖ More greenery has been added and consistently modified to improve groundwater resources.



Fig 2.3. Water filter in the college campus



Fig 2.4. Rainwater reservoir in the college campus to store excess rainwater

## 2.5. Recommendations

- ✓ Water management can be ensured by using sprinklers for gardening purposes
- ✓ Monthly check-ups for pipe leakage or tap leakage must be done
- ✓ Water management systems are to be introduced in the urinals. Some alternatives include spray taps, which can save about 80% of the water and energy used for hand washing
- ✓ Phytoremediation for wastewater

- ✓ Awareness programs for the management of sustainable water use will be highly efficient in this college for the proper water usage
- ✓ More area on the rooftop or overhead rainwater harvesting should be installed

*Malameha Dey*

*Chandrabanti*  
Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata - 700 099



**SECTION 3**

**WASTE MANAGEMENT**

**AUDIT**

### **3 Waste Management Audit**

#### **3.1. Introduction**

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. Pollution from waste is aesthetically displeasing and results in large amounts of litter in our communities which can cause health problems. Wastes may be classified into different categories depending on their source, structure, adverse effect, etc. In the educational institute, different kinds of waste like E-waste, plastic waste, chemical waste, solid waste, liquid waste, biodegradable waste, etc. are produced which are intended to be disposed of or are required to be disposed of. An increasing number of students in colleges generate large volumes of waste. It has been reported earlier that most of the colleges effectively function as small municipalities, with their own canteen, gyms, laboratory, etc. to generate lots of waste. Educational institutes differ widely in their sizes, student body compositions, and administrative approaches, causing widely varied waste management approaches. Some campuses boast extensive recycling and composting programs, while others are still beginning to implement waste management strategies.

A waste management audit is a total and clear representation for identifying all waste streams that an agency is responsible for producing, or for managing on behalf of others. The type and amount of waste generated by an institute are explained by a waste management audit. A waste management audit can evoke current waste performance and offers potential missing controls and improvements that could be made to the systems in place through scientific and sustainable approaches. The type and amount of waste generated by an institute are explained by a waste management audit.

#### **3.2. Importance of Waste Management Audit**

A waste audit can tell what is working or not working with your current waste and recycling management program. It can uncover breakdowns, expose wasteful problems or confirm successes. This enables make necessary adjustments to improve and maximize our operational efficiency. The importance of waste management audit is as follows:

- ❖ A waste management audit helps one educational institute to be better prepared to efficiently and responsibly dispose of the waste that it generates every day

- ❖ By designing a more efficient waste disposal program through a waste audit, we can enhance recycling practices
- ❖ Deterioration of environmental status can be occurred due to the unavailability of proper waste management practices
- ❖ On-going cost savings
- ❖ Identification of new sources of revenue
- ❖ Improved environmental performance
- ❖ Improved resource efficiency

### **3.3. Waste Management Audit of the College**

Considering the COVID pandemic, the college officials started their internal activities from November 2021 onwards but with limited number of staff. From 16<sup>th</sup> November 2021, the college again re-opened with 4847 daily students along with the 101 college staff.

Different kinds of waste are generated from the different structures of the college. The quality and quantity of the waste are primarily controlled by the source of their generation. Wastes generated by this college with a huge number of students along with a significant number of teaching and non-teaching staff are required to manage with proper strategies.

The amount of E-waste, plastic waste, solid waste, chemical waste, paper waste, and garden waste was found to be generated more than 5000 kg per year. The plastic and solid waste generated by the college campus is collected by the municipality every week. The chemical waste generated in the campus through science laboratories, both solid and liquid is disposed in an acid soak pit situated in the college campus. There is a practice in the laboratories to store these hazardous chemicals in containers and cans for safe disposal. E-waste generated from the college is recycled and disposed scientifically. Paper waste is dumped in a particular place and recycled properly. The waste collected from the college garden is cleaned by incineration three days a week. The E-waste materials (306.60kgs) are channelized for recycling under standards set down in the e-waste management rules 2016.

Table 3.1. Different types of waste generated in the college campus and their disposal

Sl. No.	Types of waste	Disposal method	Amount (kg/year)
1	E-Waste	Repair, Recycling	306.6
2	Plastic waste	Collected by municipality	1325
3	Solid waste	Collected by municipality	1500
4	Chemical waste	Reserved soak pit	114
5	Paper waste	Dumped, Recycling	1855
6	Garden waste	Incineration	510
<b>Total</b>			<b>5610.6</b>

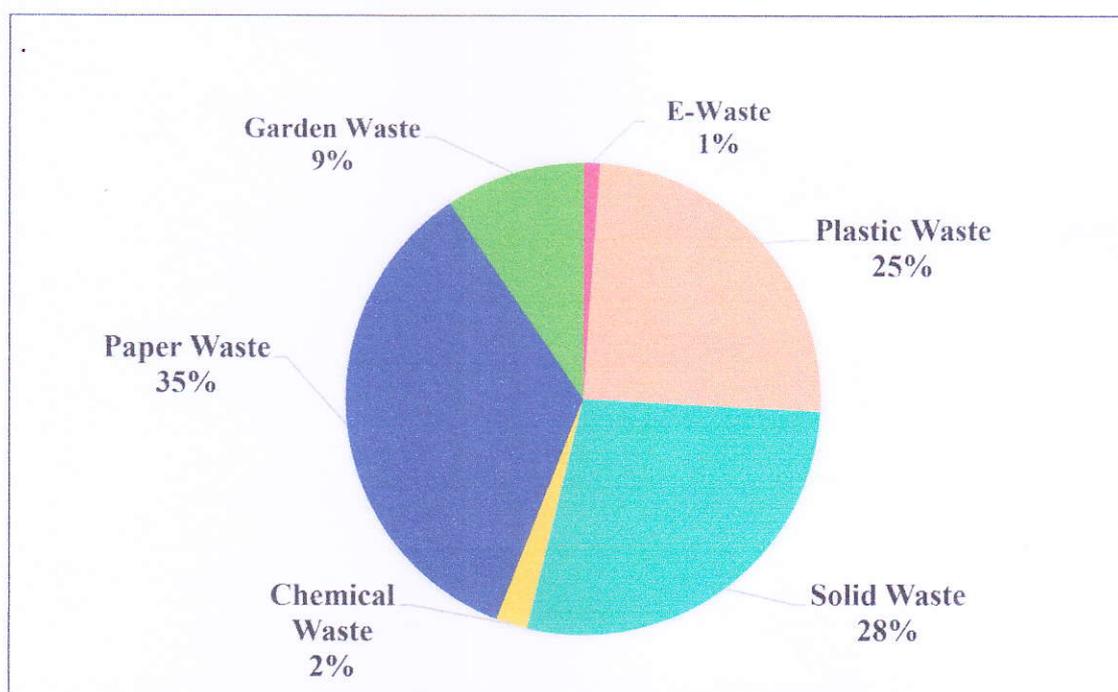


Fig 3.1. Percentage of different types of waste generated in college campuses per annum



Fig 3.2. Waste found somewhere in the college campus



Fig 3.3. Plastic wastes were present in college



Fig 3.4. Open pit in campus



Fig 3.5. Glass pellets were seen lying behind the chemistry laboratory storeroom



**Fig.3.6. Certificate of E-waste recycling by college**

### 3.4. Recommendations

- ✓ An open pit has been found in the college campus which can be used for gardening or vermicomposting. No areas should be left open which may later become a waterlogged breeding ground for disease-causing vector
- ✓ Waste minimization should be introduced within the college campus
- ✓ The solid waste of the chemistry laboratory should be disposed of in a proper way, pieces of glass were seen lying outside the storeroom of the lab
- ✓ The amount of paper waste should be reduced a little, old records should be dumped in a proper way, and waste paper should be recycled
- ✓ Plastic waste was seen behind the toilet, which should be disposed of properly
- ✓ Waste material recycling can be implemented for the biodegradable substances mainly found beside the toilet to produce bio compost to use in the gardens in the college
- ✓ Waste processing for resource recovery is recommended

- ✓ By planting more trees in the garden, the butterfly park can be made which will lead to biodiversity enrichment
- ✓ Provision of installation of garbage units should be introduced where the multilevel segregation of various wastes such as paper, construction, glass, metal scrap, and food waste should be done. Further various waste recycling plans for different types of waste should be introduced
- ✓ Finally, the college campus should be made a green campus

*Malameha Dey*

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata - 700 099



*Behanachandly*  
Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129



# **SECTION 4**

# **ELECTRICITY AND**

# **ENERGY AUDIT**

## 4 Electricity and Energy Audit

### 4.1. Introduction

Energy conservation is an important aspect of campus sustainability which is also linked to the carbon footprint of the campus. Energy auditing deals with the conservation and methods to reduce consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examines its energy use practices. This is a key to a systematic approach to decision-making in the area of energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility.

### 4.2. Importance of the Electricity and Energy Audit

From a general point of view, an energy audit provides enormous benefits in different areas

- ❖ An energy audit will identify energy-saving opportunities
- ❖ It helps reduce environmental damage and pollution
- ❖ It can increase the security of the energy supply
- ❖ It can reduce the consumption of natural resources
- ❖ It can reduce damage to the environment associated with the exploitation of resources.

### 4.3. Energy Audit Report

The sustainability of the campus community depends in large part on an evaluation of energy use, energy sources, energy management, lighting systems, and other appliances. Hence this is a relevant aspect of the assessment. The major use of energy is at the office, canteen, and laboratory for different purposes. Table 4.1 shows the energy consumption pattern of the college for one year. The energy consumption was calculated by employing the standard method:  $(\text{kWh/year}) = P(W) \times \text{Hrs} \times \text{Number} \times \text{Days}$ . The total energy consumption by the college is 184187.851kW per year. From Figure 4.1. it is concluded that the major electrical energy consumed by Fans (39%) followed by Split AC (25%), Refrigerators (10%), Exhausted fans (4%), 2-ton Carrier window AC, and Water coolers (4%). Different electrical equipment and their electricity consumption during the assessment years were depicted in Table 4.1. Different kinds of electrical appliances are there in college campuses. The rate of electric energy consumed also varied depending on the number and nature of the electrical

equipment. It was found that Fan consumed 352 kW of electrical energy per day during the reporting period which was responsible for 39% of total consumption. Simultaneously, AC, Refrigerator, Exhaust fan, and Water cooler consumed respectively 204 kW, 76 kW, 35.2 kW, and 32 kW of electrical energy during the reporting period which was cumulatively responsible for 54% of total consumption. Computers, Xerox machines, and Printers are responsible for 3% of total consumption. From Table 4.3., we concluded that some instruments are also responsible for energy consumption in laboratories during working days in college. The amount of total energy consumed by this equipment is 105060 kW every year, besides Figure 4.3., it concluded that the Electric heater, Hg vapour lamp, and Lamp for light practical are responsible for 64% of total consumption.

**Table 4.1. Electrical equipment and their electricity consumption in college per year**

<i>Sl No</i>	<i>Appliances</i>	<i>No of appliances</i>	<i>Power used (kW)</i>	<i>No of days</i>	<i>Usage per day (h)</i>	<i>Average of energy usage per year (kWh/year) [kW× hrs.× Number × days]</i>
1	Fan	176	0.25	212	8	74624
2	Tube light	223	0.02	265	8	9455.2
3	Bulb	88	0.006	265	8	1119.36
4	Vapour LED light (Outside)	19	0.011	265	3	166.155
5	2 Ton carrier window AC	6	1	212	8	10176
6	2 Ton carrier window AC	1	1.5	212	8	2544
7	Split AC	17	1.5	212	8	43248
8	CCTV	33	0.002	212	8	111.936
9	Computer (Working in office)	9	0.2	212	7	2671.2
10	Computer (Working in other room)	51	0.2	212	1	2162.4
11	TV	6	0.08	212	8	814.08

12	Laptop	4	0.06	212	8	407.04
13	Exhaust fan	22	0.2	212	8	7462.4
14	Refrigerator	4	0.8	212	24	16281.6
15	Mixer grinder	1	0.25	212	2	106
16	Xerox machine	2	1	212	4	1696
17	Submersible water pump	2	1.5	212	2	1272
18	Tullu water pump	2	0.5	212	2	424
19	Water cooler	5	0.8	212	8	6784
20	Aqua guard	5	0.05	212	8	424
21	Printer	10	0.15	212	5	1590
22	Biometric machine	1	0.005	212	8	8.48
23	Stand fan	4	0.8	20	7	448
24	Sound system	3	0.25	80	3	180
25	Sound system	1	0.05	80	3	12

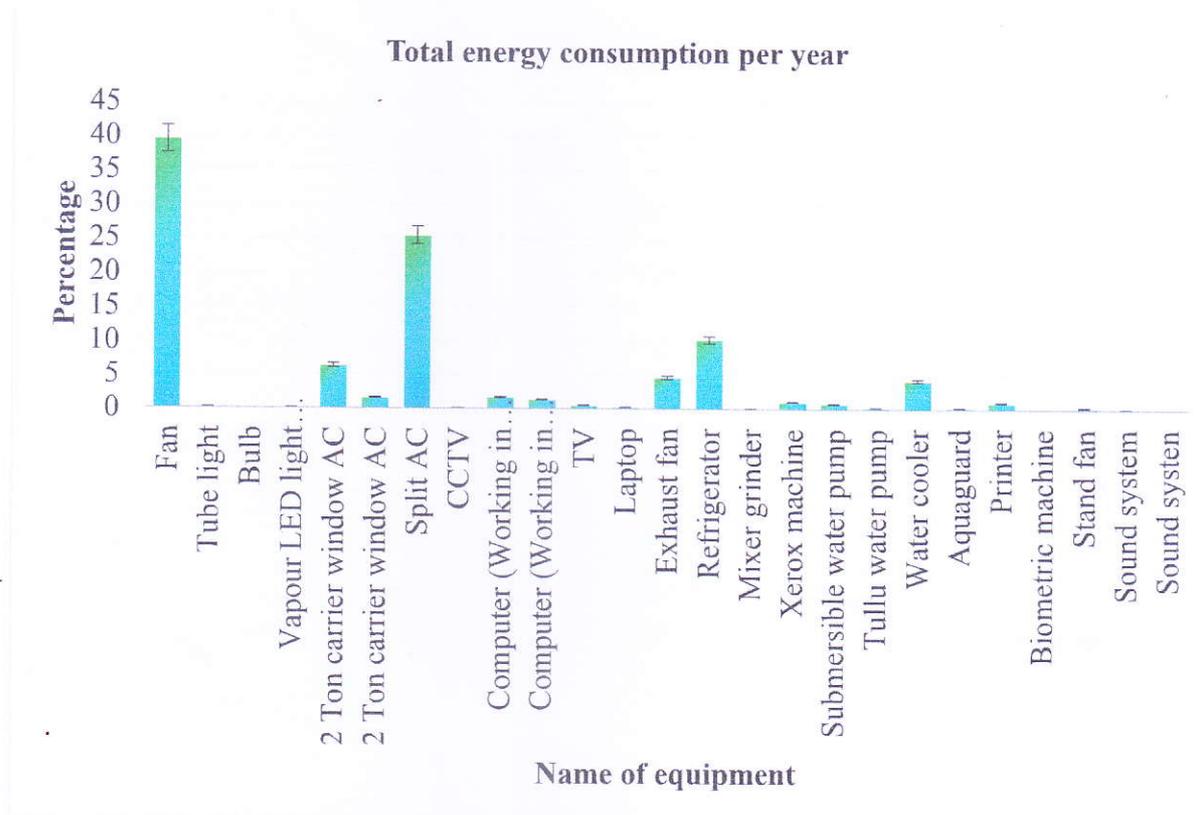


Figure 4.1. Consumption of energy by different electrical equipment

#### 4.4. Fuel Energy (LPG)

LPG is one of the major important sources of fuel energy used in college for various purposes. It is mostly required for laboratory work in science departments and support services canteens of the college. From Table 4.2 it is concluded that the total energy consumed by generators and gas cylinders is 102570 kW per year. Figure 4.2 shows that the major energy consumed by gas cylinders is 90% and by generators only 10%.

Table 4.2. Energy consumption from fuel in college per year

Sl No	Appliances	No of appliances	Energy used	No of days	Usage per day (hr)	Average energy usage per day	Average of energy usage per year
1	Generator	1	25.6	265	1	25.6	6784

2	Generator	1	20	265	1	20	5300
3	Generator	1	2.4	265	1	2.4	636
4	Gas cylinder	6	19	270	3	342	92340
<b>Total</b>							<b>105060</b>

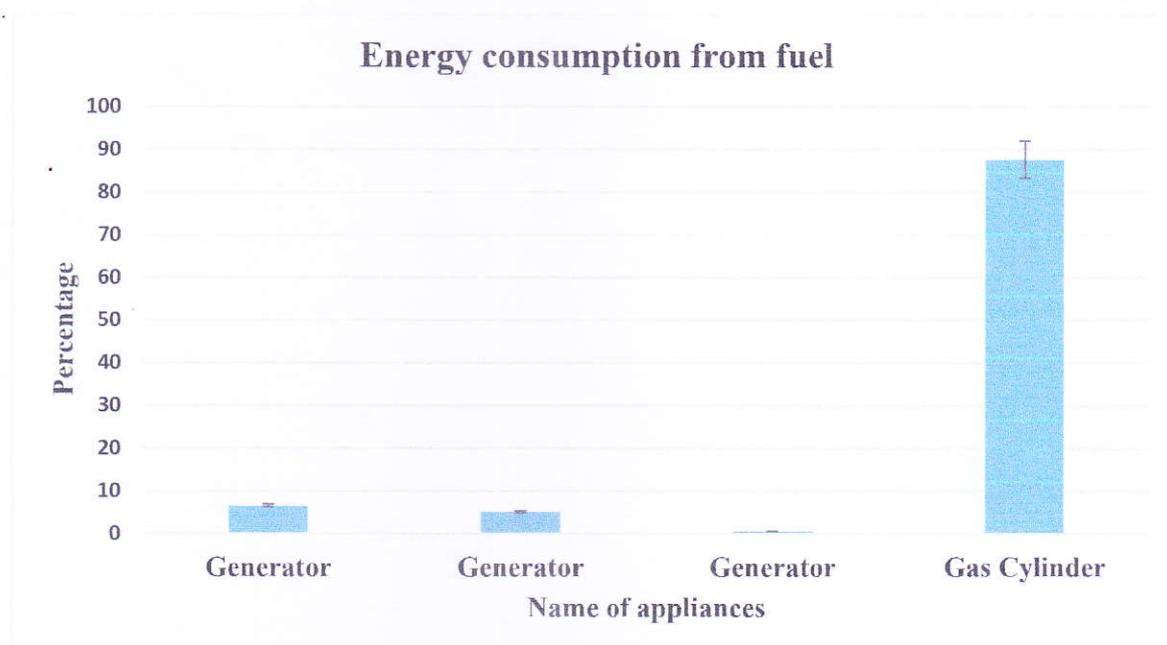


Figure 4.2. Consumption of energy from fuel by different equipment

Table 4.3. Energy consumption in laboratories

Sl No	Appliances	Power used (kW)	No of days	Usage per day (h)	Average of energy usage per year (kWh/ Year)
1	DC voltage source	25	212	5	26500
2	DC source in setup	100	212	5	106000
3	Laser source	100	212	4	84800
4	Hg vapour lamp	200	212	5	212000

5	Na vapour lamp	100	212	4	84800
6	Electric heater	1000	212	3	636000
7	Computer	50	212	5	53000
8	Polari meter lamp	60	212	5	63600
9	Lamp for light practical	100	212	5	106000
10	Source (DC) for free-falling body	100	212	5	106000
<b>Total</b>					<b>1478700</b>

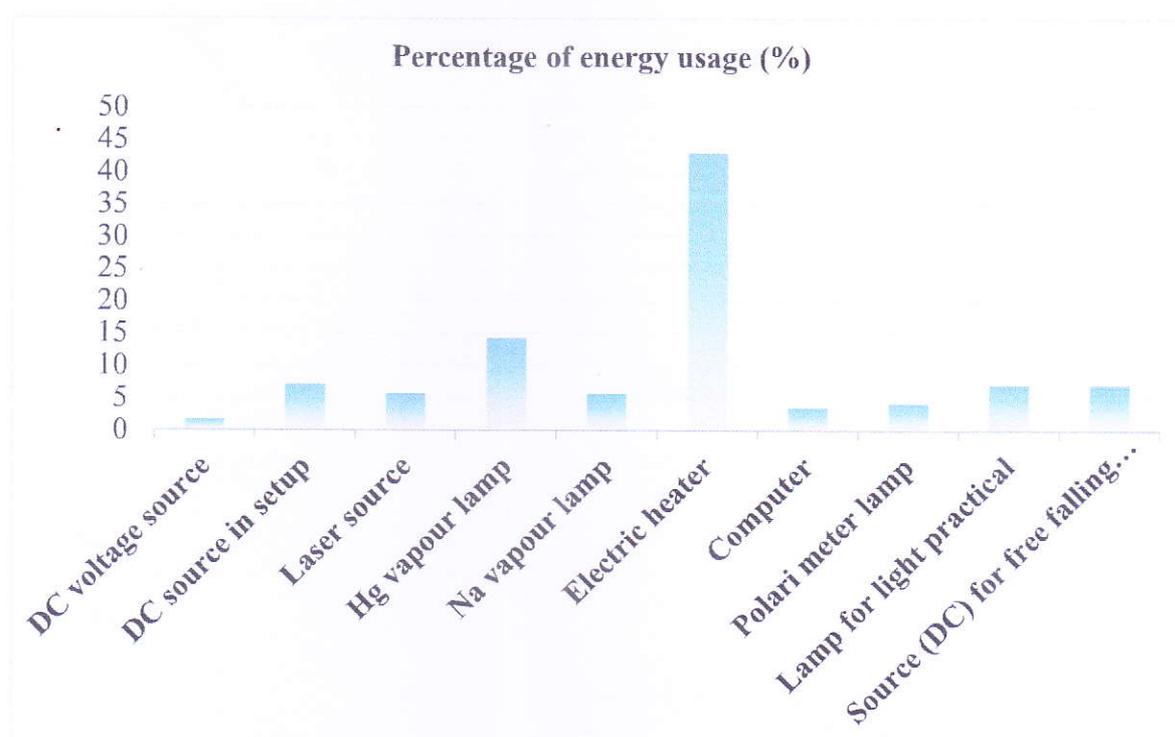


Figure 4.3. Consumption of energy in laboratories by different equipment

#### 4.5. Renewable Energy

The college takes some serious initiatives for moving towards renewable energy sources considering recent carbon emissions and climate change. Solar panels are installed in the parking area of the college campus. Solar panel cleaning is done by College's maintenance team and the system is maintained by Power Solar Systems Limited.



**Figure 4.4. Solar panels are in the college campus**

#### **4.6. Recommendations**

- To avoid the use of more energy-consuming electrical appliances and to replace them with more environment-friendly and energy-efficient appliances in the college
- Moving towards solar and other non-conventional energy can reduce the burden of heavy electric energy consumption
- Installing a sensor-based lighting system can be introduced to sustainably manage the electrical resources
- Old laboratory equipment and other power-consumed old technology can be replaced by energy savings systems and green technology
- A huge amount of energy is wasted because no one really cares about switching off the fans and lights when not required in the classroom. Hence, planning workshops on energy conservation to educate students, faculty and staff can generate huge results
- The college should take initiative for solar powered water heater and cooker in the college canteen

- Students, faculty, and staff should unplug overhead projectors, computers, and smart boards when not in use. This simple way to conserve energy can help save a large amount of power and money in the long run
- Every classroom and laboratory with a central switchboard can have a diagram linking the location of a tube light, fan, etc. with the corresponding switch. This will ensure that the correct fitting is switched on/ off and can save time & unnecessary operation. The awareness regarding energy management could be improved by encouraging students to help in monitoring energy consumption and by integrating energy education into classroom learning

*Malanika Dey*

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata-700 099



*Debasmita Dasgupta*  
Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129



# **SECTION 5**

# **AIR AUDIT**

## 5 Air Audit

### 5.1. Indoor Air Quality

Indoor Air Quality (IAQ) refers to the air quality within & around buildings and structures, it relates to the health and comfort of building occupants. Common indoor pollutants are listed below:

- Carbon monoxide – Sources of carbon monoxide are incomplete combustion of fossil fuels
- Volatile organic compounds (VOCs) – VOCs are emitted by paints and lacquers, paint strippers, pesticides, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions, etc.
- Carbon dioxide – Due to human respiration
- Particulate matter – Due to construction and maintenance activities, vehicular pollution
- Nitrogen oxides- Due to vehicular pollution

Every day there are 90 two-wheelers and 10 four-wheelers are coming to the college premises but there is no system observed to check for PUC certificates like vehicle exhaust gas analysis, vehicular movement noise, and vibration pollution. The air pollution at the time of ignition off and on is more than it is in riding mode.

### 5.2. Recommendations

The college may consider these on top priority: -

1. World Environment Day is to be celebrated in college premises every year on 5th June and whole college students and staff shall get involved and take oath for environment conservation not only in college but also in every span of life.
2. Chemistry department shall monitor the Ambient Air Quality as per the guidelines of the Air (Prevention and Control of Pollution) Act 1981
3. Exhaust gases shall be monitored, analyzed, and check regularly

4. Parking zone of the college shall be neat & clean.
5. Use of bicycles in campus to be promoted

*Mahamehra Dey*

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata - 700 099



*Ramanath*  
Principal,  
VIVEKANANDA COLLEGE  
Madhyamgram, Kolkata - 129



**SECTION 6**  
**BIOLOGICAL DIVERSITY**  
**AUDIT**

## **6 Biological Diversity Audit**

### **6.1. Introduction**

Biodiversity or biological diversity is the variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic, species, and ecosystem levels. Human activities are the main cause of biodiversity loss. Habitat fragmentation, caused by urbanization and agriculture and the overexploitation of resources, leads to the depletion of species. Biodiversity is crucial for the well-being of people and the Earth. Ecological communities maintain the ecological and evolutionary processes that sustain life. These are necessary to help maintain the planet's chemical balance, moderate climate, renew soil, and conserve species diversity. Plants, animals, and other species have intrinsic worth. They are also the source of all biological wealth—supplying food, raw materials, medicines, recreational resources, and a store of other goods and services. The biodiversity audit approach is an innovative, landscape-scale, and evidence-based approach to the delivery of biodiversity. It provides a working example of the implementation of an integrated approach to biodiversity delivery in a region. The rapid biodiversity inventory may include documentation of existing flora and fauna, their current status, threats, etc. to formulate a biodiversity-specific management plan.

- A biodiversity audit may deliver a current understanding of prevailing biotic resources of the surroundings
- Updated information on the flora and faunal diversity
- To identify possible threats and hazards to the existing diversity
- Formulate conservation measures on the existing biotic resources and increase carbon stocks

### **6.2. Faunal Diversity in College**

The college sustains a good diversity of fauna due to its healthy and green vegetation in the vicinity of the college. 15 species of faunal species have been recorded belonging to 11 families (Table 6.1.). Spotted doves and Common pigeons (3 species) of the Columbidae family have been observed there. House crows (3 species) and House sparrows of Corvidae and Passeridae family have been seen there. Along with Red-vented Bulbul and Jungle babbler with families, Oriolidae and Timallidae, respectively has been spotted there.

Therefore, it can be noticed that the avian community is quite common in the case of faunal diversity rather than faunal other communities.

**Table 6.1. List of avifaunal diversity of the college campus**

<i>Sl no.</i>	<i>Family</i>	<i>Common name</i>	<i>Scientific name</i>
1	Passeridae	House sparrow	<i>Passer domesticus</i>
2	Corvidae	House crow	<i>Corvus splendens</i>
3	Pycnonotidae	Black drongo	<i>Dicrurus macrocercus</i>
4	Oriolidae	Red-vented bulbul	<i>Pycnonotus cafer</i>
5	Sturnidae	Common myna	<i>Acridotheres tristis</i>
6	Timaliidae	Jungle babbler	<i>Turdoides striata</i>
7	Columbidae	Spotted dove	<i>Stigmatopelia chinensis</i>
8	Columbidae	Common pigeon	<i>Columba livia</i>
9	Cuculidae	Common hawk cuckoo	<i>Hierococcyx varius</i>
10	Ardeidae	Indian pond heron	<i>Ardeola grayii</i>
11	Strigidae	Spotted owlet	<i>Athene brama</i>

### 6.3. Floral Diversity in College

The rapid biodiversity assessment depicted a healthy green environment of the college campus. It is pertinent to note that the college authority research team is already instrumental in recording the biodiversity of the college surroundings and has already taken some conservation and awareness education among the college students. The college sustains a luxuriant plant along with medicinal plant diversity ranging from trees, grasses, herbs, shrubs, ornamental plants, and seasonal flowers. More than 50 varieties of floral species were observed in the college campus. Some of the plants are massively destroyed by the recent cyclonic events. Table 6.2. depicted some examples of commonly occurring plant species.

**Table 6.2. List of major tree species observed in the college campus**

<i>Sl No.</i>	<i>Family</i>	<i>Common name</i>	<i>Scientific name</i>
1	Anacardiaceae	Aam	<i>Mangifera indica</i>
2	Meliaceae	Mahogany	<i>Swietenia mehogani</i>
3	Myrtaceae	Eucalyptus	<i>Eucalyptus globulus</i>

4	Annonaceae	Debdaru	<i>Polyalthia longifolia</i>
5	Combretaceae	Hartuki	<i>Terminalia chebula</i>
6	Moraceae	Dumur	<i>Ficus hispida</i>
7	Leguminosae	Palas	<i>Butea monosperma</i>
8	Moraceae	Kathal	<i>Artocarpus heterophyllus</i>
9	Compositae	Rabonlata	<i>Mikania scandens</i>
10	Cesalpiniaceae	Ashok	<i>Saraca asoca</i>
11	Apocynaceae	Karabi	<i>Nerium indicum</i>
12	Combretaceae	Arjun	<i>Terminalia arjuna</i>
13	Palmae	Supari	<i>Areca catechu</i>
14	Caricaceae	Papeya	<i>Carica papaya</i>
15	Meliaceae	Neem	<i>Azadirachta indica</i>
16	Rubiaceae	Kadam	<i>Anthocephalus indicus</i>
17	Moringaceae	Sajina	<i>Moringa oleifera</i>
18	Combretaceae	Bohera	<i>Terminalia belerica</i>
19	Rutaceae	Kadi Pata	<i>Murraya koenigii</i>
20	Fabaceae	Tetul	<i>Tamarindus indica</i>

Table 6.3. List of some medicinal plants observed in the college campus

SI No.	Family	Common name	Scientific name
1	Zingiberaceae	Halud	<i>Curcuma longa</i>
2	Labiatae	Krishna Tulsi	<i>Ocimum tenuiflorum</i>
3	Euphorbiaceae	Amlaki	<i>Embllica officinalis</i>
4	Acanthaceae	Basabpata	<i>Justicia adhatoda</i>
5	Fabaceae	Lajjabati	<i>Mimosa pudica</i>
6	Solanaceae	Ashwagandha	<i>Withania somnifera</i>

Table 6.4. List of herbs and shrubs observed in the college campus

SI No.	Family	Common name	Scientific name
1	Rutaceae	Lebu	<i>Citrus acida robb</i>
2	Solanaceae	Ashwagandha	<i>Withania somnifera</i>
3	Solanaceae	Krishna dhutura	<i>Datura innoxia</i>
4	Solanaceae	Lonka morich	<i>Capsicum annum</i>
5	Asclepiadaceae	Ananta mul	<i>Hemidesmus indicus</i>

6	Rutaceae	Kamini	<i>Murraya paniculata</i>
7	Liliaceae	Ghritakumari	<i>Aloe barbadensis</i>
8	Urticaceae	Kaluruki	<i>Pouzolria indica</i>
9	Acanthaceae	Kalmegh	<i>Andrographis paniculata</i>
10	Rosaceae	Golap phul	<i>Rosa damascene</i>
11	Acanthaceae	Patpati	<i>Dipteracanthus prostrathus</i>
12	Oleaceae	Bel phool	<i>Jasminum sambac</i>
13	Mimosaceae	Kuchikata	<i>Mimosa rubicanlis Linn</i>
14	Liliaceae	Pipul	<i>Piper longum Linn</i>
15	Verbenaceae	Jarbas	<i>Stachytarpheta jamaicensis linn</i>
16	Compositae	Bringaraj	<i>Weddelia chinesis merill</i>
17	Poaceae	Harali	<i>Cynodon dactylon</i>
18	Nyctaginaceae	Punornova	<i>Boerhaavia diffusa</i>
19	Apocynaceae	Karabi	<i>Nerium indicum</i>
20	Myrtaceae	Peyara	<i>Psidium guajava</i>
21	Annonaceae	Ata	<i>Annona squamosa</i>
22	Crassulaceae	Patharkuchi	<i>Kalanchoe pinnata</i>
23	Brassicaceae	Kopi gach	<i>Brassica oleracea var. botrytis</i>

#### 6.4. Recommendations

- The college may form a green monitoring team or Eco-club to monitor and assess the floral and faunal diversity periodically
- Proper action and management strategies should be formulated to maintain plant health.
- Urban forestry should be encouraged in the native varieties of plants by replacing invasive plants
- Proper propagation of green diversity is necessary to facilitate carbon sequestration.
- The vermicomposting facility should be practiced, the product of which can be used as manure or fertilizer for plantation purpose
- Community awareness within the local areas by the students of the college to generate interest in urban biodiversity
- Increased student involvement and participation during research and conservation actions in the college



**Fig 6.1. College campus**



**Fig 6.2. Terminalia arjuna**



Fig 5.3. *Azadirachta indica*

*Mahamha Deo*

Director  
**PROGYAN**  
Foundation for Research & Innovation  
Kolkata - 700 099

*Sumanabony*  
Principal,  
**VIVEKANANDA COLLEGE**  
Madhyamgram, Kolkata - 129



# **SECTION 7**

# **CONCLUSION**

## **7 Conclusions**

### **7.1. Overall Upshots of the Green Audit**

The current assessment tried to capture the overall scenarios on water, wastewater, waste management, and biodiversity condition of Vivekananda College. Every section provides a precise methodology applied and findings in a systematic manner. Finally, sets of recommendations were provided for each section to improve the prevailing energy and biotic components of the college campus. The college has already taken a series of initiatives to maintain a healthy and green environment on campus. The situation can be further accelerated by considering suggested recommendations from the study. The major activities, approaches, and innovations undertaken by the college toward transforming a green campus are as follows

- ❖ The college has introduced a rainwater harvesting system of 12 kl capacity
- ❖ The college has introduced solar energy sources to compensate for electric consumption
- ❖ The college has replaced incandescent lamps with LED bulbs for efficient energy savings.
- ❖ In college, there is a dark room for the physics department which is used for different experiments
- ❖ The college has a smart classroom and a big auditorium for educational purposes.
- ❖ Science laboratories are provided with exhaust fans so that the fumes are safely discharged outside the building
- ❖ The college maintains well-documented resources of fauna and flora diversity
- ❖ College involved in yearly plantation activities with all classes of participants including students, teachers, and other staff

### **7.2. Study Team and Acknowledgments**

Progyan Foundation for Research and Innovation (PFRI) is thankful to Vivekananda College for entrusting us. We would also like to thank Honourable Principal Sir **Dr. Chandan Kumar Chakraborty** for his encouragement and guidance in preparing this report. The team is also like to acknowledge other staff members of the college for their unwavering support. The study team is headed by Dr. Malancha Dey (M.Sc.; B.Ed.; M.Phil.; Ph.D.) which is supplemented by Dr. Dipayan Dey (M.Sc.; M.Phil.; Ph.D.; PGDHE), Dr. Shantanu Bhunia (M.Sc.; Ph.D.), Mr. Supriya Maity (M.Sc.) and Mr. Pulak Priti Patra (M.F.Sc.).

# Annexure I.

## 1. Water Quality Assessment Report

**PUBLIC HEALTH ENGINEERING DTE.  
NORTH 24 PGS DISTRICT LABORATORY  
(LABORATORY TEST REPORT)**

Agency Name: Vivekananda College  
 Receipt No: 3078      Work Order No: \_\_\_\_\_  
 Water sample collected by: Party      Receipt Date: 26-08-2022      Date of collection: 29-08-2022

SL NO	Municipality/Block Name	G.P Name / Mouza Name	Habitation & Landmark	Type Of Source	Depth of tubewell in mtr	CHEMICAL TEST RESULTS							BACTERIOLOGICAL TEST RESULTS			Remarks		
						Date of Testing	As mg/ltr	Fe mg/ltr	pH	Total Hardness as (CaCO <sub>3</sub> )	Turbidity (NTU)	Cl mg / ltr	Mn mg / ltr	TDS mg / ltr	Date of Testing		Date of Completion	CFU of Total Coliforms at 37°C per 100 ml
1	Madhyamgram Ward no-06		Vivekananda College Near Sarangtha Bhowan	River water		30-08-2022	0.010	2.150	7.12	280	1.0	14.2	x	170				
	Dc		Vivekananda College Near Sarangtha Bhowan	Treated water		30-08-2022	0.007	0.002	7.10	240	0.3	14.2	x	170	29-08-22	30-08-2022	0	0

Signature of Chemist / Bacteriologist: \_\_\_\_\_  
 Barasat Division, P.H.E.D.

Signature of Asstt Engineer: \_\_\_\_\_  
 R.W.S. Barasat Sub Division, PHED

Signature of Executive Engineer: \_\_\_\_\_  
 Barasat Division, PHED

Drinking water specification - IS-10500, 2012

Sl. No.	Parameter	Acceptable limit	Permissible limit in absence of alternate
1	As	0.01 mg/l	No relaxation
2	Fe	0.30 mg/l	1.0 mg/l
3	Cl	250 mg/l	1000 mg/l
4	pH	6.5 - 8.5	No relaxation
5	TDS	500 mg/l	2000 mg/l
6	Mn	0.10 mg/l	0.30 mg/l
7	Turbidity (NTU) Max	1	5
8	Total Hardness (as CaCO <sub>3</sub> )	200 mg/l	600 mg/l

Note - Water sample is collected by the party. Laid BDL - Below Detection Limit.

Bacteriological Drinking Water Specification, BIS: 10500, 2012

Note: Minimum limits as per CL 3.2.1 of IS-10500	
a)	Throughout any year, 95% of samples should not contain any coliform organisms in 100 ml.
b)	No sample should contain coliform organisms per 100 ml.
c)	Coliform organisms should not be detectable in 100 ml of any two consecutive samples.

2. Document of E-waste Manifest

18 PM HULADEK ERD

Huladek Recycling Pvt. Ltd.  
 Regd. office: 4, D. L. Khan Road, Flat B-401, 4th Floor, Kolkata-700025  
 WRO Collection Centre: 115 Forester Road, Goleen No. 20371, Shyambhangan - 711102

Form B  
 (New Rule 19)  
**E-WASTE MANIFEST**

Copy 1 - Sender's Copy

1	Sender's Name and mailing address (including Phone No.)	Vivekananda College, Madhyamgram, Vivekananda College Rd. E. Udayapur, Vivekananda Nagar, Madhyamgram, Kolkata - 700025
2	Sender's Authorisation No., if applicable	N/A
3	Manifest document No.	100122-3306020
4	Transporter's Name and address (including Phone No.)	4014, D. L. Khan Road, Kolkata - 700025
5	Type of Vehicle	<input checked="" type="checkbox"/> Truck <input type="checkbox"/> Tanker <input type="checkbox"/> Special Vehicle <input type="checkbox"/> Other
6	Transporter's Registration No.	B-2916112 (PROVISED) Division
7	Vehicle Registration No.	WB03D0306
8	Receiver's Name and address (including Phone No.)	Huladek Recycling Private Limited, 4, D. L. Khan Road, Kolkata - 700025, IN
9	Receiver's Authorisation No., if applicable	B-2916112 (PROVISED) Division
10	Description of E-waste (Item Weight Numbers)	IT EWR, 306.6 Kg
11	Description of E-waste (Item Weight Numbers) (Producer or Bulk Consumer or Collection Centre or Producer Responsibility Organization or Dealer or Recycler)	
12	Date	17/08/2022 Signature: <i>Chandrima</i> Principal VIVEKANANDA COLLEGE Madhyamgram, Kolkata - 129
13	Transporter's Acknowledgement of Receipt of E-waste	Date: 17/08/2022 Signature: <i>A. Dabey</i>
14	Name and Stamp of Receiver (Collection Centre of Producer Responsibility Organization or Dealer or Recycler)	Date: 17/08/2022 Signature: <i>A. Dabey</i> Stamp: Huladek Recycling Pvt. Ltd. Authorized Dealer

Huladek SelfPickupSheet\_Form\_ssr136561

*Malameha Dey*  
 Director  
**PROGYAN**  
 Foundation for Research & Innovation  
 Kolkata - 700 099

*Malameha Dey*  
 Director  
**PROGYAN**  
 Foundation for Research & Innovation  
 Kolkata - 700099

*Chandrima*  
 Principal,  
**VIVEKANANDA COLLEGE**  
 Madhyamgram, Kolkata - 129

**VIVEKANANDA COLLEGE**  
 Estd.-1988  
 Aff. Under  
 W.B.S.U.  
 Madhyamgram, Kolkata - 700025

**PROGYAN FOUNDATION FOR RESEARCH & INNOVATION**  
 Kolkata 700099  
 www.progyan.in

PFRI

Hulladek Recycling Private Limited  
S. Deshpande Sashmal Anand  
Kolkata 700013  
1800-212-7880 ||  
hulladek@hulladek.in

② Time  
03:00 Pm

Hulladek

Company Name	Vivekananda College, Madhyamgram	Contact person	Dr.Chandan Kumar Chakraborty	Concerned person	Dr.Chandan Kumar Chakraborty	Date	2022-08-16	Logistics Executive	Aditya Dubey
Pickup Location	Vivekananda College Rd, E Colepukur, Vivekananda Nagar Rd, Vivekananda Nagar, Madhyamgram, West Bengal 700129	Contact no	9830278174	Contact No	9830278174	AM/CM/PE/DM/CF/Other	Shrihar Aditya	Pick Up Request Number	PC/CL/AC/WH/ST/01

Item Code	Item	Description	Quantity	Weight/unit	Net Weight	UDM	HSN Code	Price/UDM (inclusive of applicable taxes)	Total Price (inclusive of applicable taxes)
IT1W2	Monitor	TFT CRT Monitor LED TV, UPS, CPU, Keyboard, Mouse, Printer	1	4000	4000	Kg	84	1056	1056
4421	Rechargeable Battery		1	240	240	Pcs	84	1056	1056
8504	Charger		1	400	400	Pcs	85	1056	1056
IT202	CPU		8		528	Kg	84	20.00	1056
IT152	CRT		9		94.6	kg	84	20.00	1892
IT102	Keyboard		11		7.7	kg	84	20.20	154
IT122	IT7	Monitor	3		9.7	kg	84	20.30	194
IT132	UPS		4		20.1	kg	84	20.00	402
IT186	Printer	Scrap	4		21.1	kg	84	20.20	422
IT177	Yerox		1		43.2	kg	84	20.00	864
IT192	UPS Battery		6		12.2	kg	84	20.00	244
IT209	mixed IT		1		6.4	kg	84	20.00	128
IT205	LED TV		3		388	kg	84	20.00	776
					3066	Kg			6132

I hereby declare that I will receive/have received Rs. 6000 in the form of Cheque/RTGS/BBPS/Cash less than 2022 for the above mentioned items.

How would you like to rate our pick-up service?

Poor
  Bad
  Average
  Good
  Excellent

*Chakraborty* 17/08/2022  
Principal, Vivekananda College, Madhyamgram

*[Signature]*  
Director, PROGYAN

GSTIN: 19AAJCC0001K019  
CPCB REGISTRATION NO: S-2961872/PRO/12/WM/01 Division



Director  
**PROGYAN**  
 Foundation for Research & Innovation  
 Kolkata - 700 099

*Chakraborty*  
 Principal,  
**VIVEKANANDA COLLEGE**  
 Madhyamgram, Kolkata - 129

