



Ph. Office : 2464-1312
Principal : 2464-4371

Muralidhar Girls' College

P-411/14, GARIAHAT ROAD, BALLYGUNGE, KOLKATA - 700 029
(NAAC ACCREDITED - B+ +)

Ref No 130/NAAC/DVV

Date 10/7/2023

With reference to DVV query regarding criteria 7.1.3. this is to state that the clarification is as follows:

BEFORE DVV

7.1.3. Quality audits on environment and energy regularly undertaken by the Institution. The institutional environment and energy initiatives are confirmed through the following

1. Green audit/Environment audit
2. Energy audit
3. Clean and green campus initiatives
4. Beyond the campus environmental promotional activities.

HEI Input	A. All of the above
-----------	---------------------

DVV suggested Input

B. Any three of the above

DVV comments:

The energy AUDIT REPORT provided by the HEI has been conducted in February 2023. Hence it has not been considered.

ANSWER to DVV

It is to be noted that the Energy Audit Report was conducted over the periods 2020-2021 and 2021-2022. Due to lock down (COVID Pandemic) the energy audit report on 2020-2021 could not be conducted and later on the Energy Audit was conducted for both the years 2020-2021 and 2021-2022 together. Some observations till March 2023 have also been included and the report was submitted by the auditor on 25.03.2023.

Kunjalin Bhowmik
10-7-23

Principal
Muralidhar Girls' College

**7.1.3 A. Report on environmental promotional
activities conducted beyond the campus with Geotag
photographs with caption and date**



Muralidhar Girls' College

P-411/14, GARIAHAT ROAD, BALLYGUNGE, KOLKATA - 700 029
(NAAC ACCREDITED - B+ +)

Ph. Office : 2464-1312
Principal : 2464-4371

Ref. No.....

Date.....

'POSTER CAMPAIGNING AGAINST THE USE OF PLASTICS'
"PLASTIC IS THE MOST DESTRUCTIVE WEAPON THAN A NUCLEAR BOMB OR AN ATOM BOMB, IT'S IMPACT SHALL REMAIN FOR CENTURIES ON THE FUTURE GENERATION." Sir P.S. Jagadeesh Kumar

OBJECTIVES

Muralidhar Girls' College has organized *Poster Campaigning against the use of plastics* on 27.03.2022 for the following reasons:

- Plastics are non-biodegradable.
- Plastics pollute the environment.
- It harms human health as well as animals.
- It is not always possible to recycle them.
- There's better alternative way to minimize the use of plastics such as we can use paper bag or bag made with clothes as an alternative way to plastic bags.

PREPARATION

Few posters were prepared in Bengali and in English. Then students were divided into few groups to execute the work accordingly.

ACTIONS

Students in teams went for a special awareness campaign for minimising the use of plastics in Gariahat Market. They explained the people about the disadvantages of plastics and suggested them some alternative ways such as the use of paper bag or bag made with clothes instead of plastic bags.

Kingalini Bhowmik

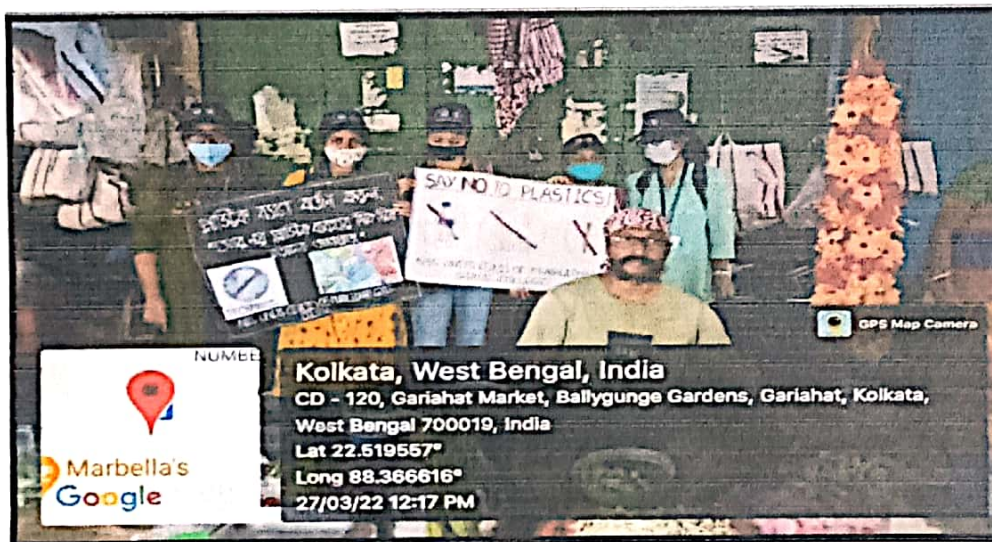
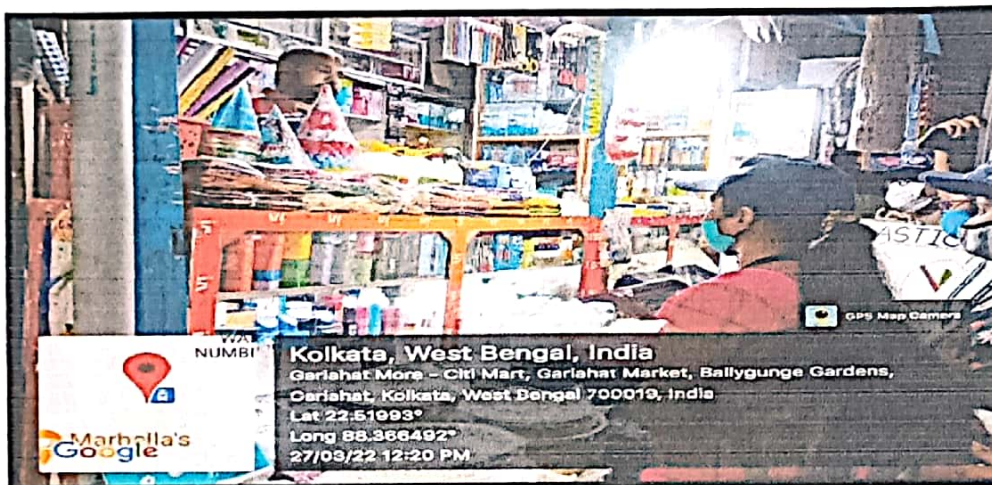
Principal
Muralidhar Girls' College

ACHIEVEMENTS

The shopkeepers were patient and they tried to understand objective of the campaign. They gave different opinions in this regard.

- The shopkeepers told that if they stop using plastics and start using the paper bags or cloth bag then it will be expensive for them. And the customers would not buy their product if it becomes expensive.
- They also told us that the Government should take some steps for minimising the use of plastics.

So, the students concluded that the first and foremost requirement is to develop awareness among general population to achieve any success in this regard.



Kinjalini Biswas

DR. KINJALKINI BISWAS
Principal
Muralidhar Girls' College
Kolkata-700029

7.1.3. B ENERGY AUDIT 2021-2022



Ph. Office : 2464-1312
Principal : 2464-4371

Muralidhar Girls' College

P-411/14, GARIAHAT ROAD, BALLYGUNGE, KOLKATA - 700 029
(NAAC ACCREDITED - B+ +)

Ref. No. 72/A/MISC/Auditor

Date...10/03/2020

To
NU Energy India
Anjan Majumdar
Certified & Accredited Energy Auditor
Bureau of Energy Efficiency
Ministry of Power, Govt. of India
Reg. No. CEA0167/AEA-0193

Sub: Conduction of Energy Audit

Dear Sir,

This is for your kind information you are requested to conduct an Energy Audit in Muralidhar Girls' College for the period of 2020-21.

Please issue a letter of confirmation in this regard as soon as possible.

Thanking you

Kinjalkini Biswas 10.3.2020

Dr. Kinjalkini Biswas
Principal
Muralidhar Girls' College

Declaration from HEI

Major source of electricity usage in the college campus include electric kettle, induction oven, electric bulb of 10 units (9 watt X 6 hours per day x 2 days per month), 250 ceiling fans (320 watt per month), 17 wall fans(1200 watt per month), 89 computers (720 watt x 2 days per month), 12 split AC and one window AC, 2 photocopy machine (1 hour per day x2 days) etc. Machineries like computer, AC and printer are kept in stand-by mode when not in use for only 2 hours. Annual electric bill come around 18,520. The college has adapted some energy conservation methods such as installation of solar panel of 25 KWP capacity to reduce impact of non-renewable energy and 465 LED lights (run approximately 6 hours per day x 2 days per month). The college runs switch off drills at the premise. Not much energy consumption occurs from air conditioner. refrigerator, incubator, digital balance (2), spectrophotometer, autoclave and pH meter, heater, television etc. this year. Approximately 1.5 kilowatt energy gets used up from solar panel this year.

Kinjalkini Biswas
10.3.20

Dr. Kinjalkini Biswas *Principal*
Principal Muralidhar Girls' College
Muralidhar Girls' College, Bhubaneswar - 750029



Muralidhar Girls' College

P-411/14, GARIAHAT ROAD, BALLYGUNGE, KOLKATA - 700 029
(NAAC ACCREDITED - B+ +)

Ph. Office : 2464-1312
Principal : 2464-4371

Ref. No. 115A/Misc/Auditor

Date. 19/11/2021

To,
NU Energy India
Anjan Majumdar
Certified & Accredited Energy Auditor
Bureau of Energy Efficiency
Ministry of Power, Govt. of India
Reg. No. CEA0167/AEA-0193

Sub: Conduction of Energy Audit
with reference to letter Memo no.72/A/MISC/Auditor dated 10.03.20

Dear Sir,

This is for your kind information that due to COVID pandemic, as the Energy Audit could not be conducted, I am requesting you to conduct the Energy Audit of Muralidhar Girls' College for the period of 2020-21 now. I am further requesting you to conduct the Energy Audit of Muralidhar Girls' College for the current year 2021-22 also.

Please issue a letter of confirmation in this regard at the earliest.

Thanking you

Kinjalkini Biswas 19.11.2021
Dr. Kinjalkini Biswas
Principal
Muralidhar Girls' College

Declaration from HEI

Major source of electricity usage in the college campus include electric kettle, induction oven, electric bulb of 10 units (9 watt X 6 hours per day x 2 days per month), 250 ceiling fans (320 watt per month), 17 wall fans (1200 watt per month), 89 computers (720 watt x 2 days per month), 12 split AC and one window AC, 2 photocopy machine (1 hour per day x 2 days) etc. Machineries like computer, AC and printer are kept in stand-by mode when not in use for only 2 hours. Annual electric bill come around 18,520. The college has adapted some energy conservation methods such as installation of solar panel of 25 KWP capacity to reduce impact of non-renewable energy and 465 LED lights (run approximately 6 hours per day x 2 days per month). The college runs switch off drills at the premise. Not much energy consumption occurs from air conditioner, refrigerator, incubator, digital balance (2), spectrophotometer, autoclave and pH meter, heater, television etc. this year. Approximately 1.5 kilowatt energy gets used up from solar panel this year.

Kinjalkini Biswas

19.11.23

Dr. Kinjalkini Biswas

Principal

Muralidhar Girls' College

Principal

Muralidhar Girls' College

Kolkata - 700029

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Principal : 2464-4371



Muralidhar Girls' College

P-411/14, GARIAHAT ROAD, BALLYGUNGE, KOLKATA - 700 029

(NAAC ACCREDITED - B+ +)

Date 3/12/2021

Ref. No. 126/1/Misc.

To
Nu Energy India
Certified & Accredited Energy Auditor BEE
47/4, Shyamnager Road,
Kolkata – 700055.

Sir,

As per discussion with you regarding the Energy Audit of this college this work order is issued to you for the said audit work as a negotiable fees Rs. 15000/-(Plus – GST) for the years 2020-2021 & 2021-2022.

I would request you to take necessary steps in this regard.

Thanking you,

Yours sincerely,

Kupalkini Bhowmik
Principal 3.12.21
Muralidhar Girls' College

Energy Audit Report of Muralidhar Girls' College

P-411/14, Gariahat Road, Ballygunge,
Kolkata-700 029, West Bengal

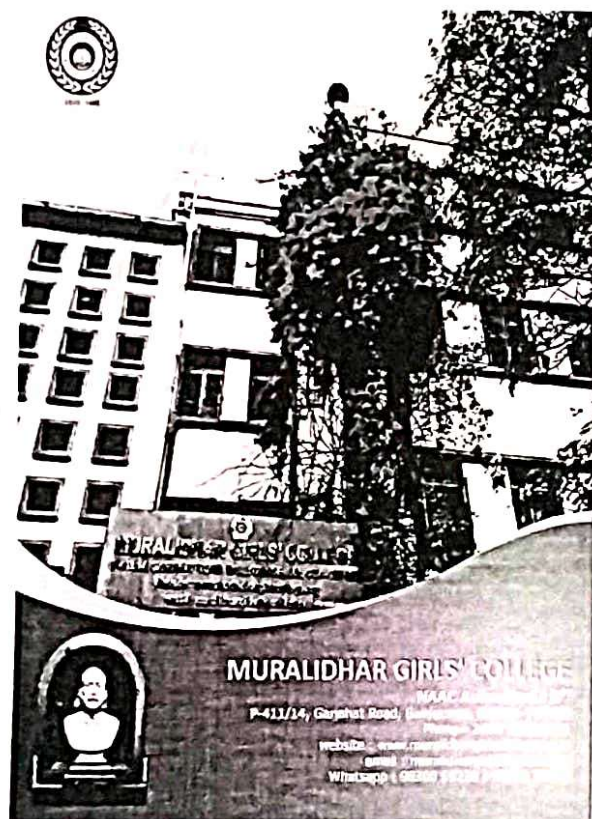
Prepared By

Nu Energy India

Mekhala Apartment, 47/4, Shyamnagar
Road, Kolkata-700055, West Bengal

Mob: +91 9432121623

Email: nuenergyindia2005@gmail.com



Attested

K. B. Bhowmik
Principal

Muralidhar Girls' College



INDEX

1.0 Acknowledgement	4
2.0 Executive Summary	6
3.0 Summary of Recommendation:	8
4.0 Introduction	9
5.0 Scope of Work	9
6.0 Approach & Methodology	9
7.0 Instrument used in Energy Audit:.....	10
8.0 Energy Audit Team:	10
9.0 College Profile:	11
10.0 Energy Conservation Measures Taken by Muralidhar Girls' College	11
11.0 Barriers towards Energy Conservation.....	11
12.0 Base Line Data & Energy Scenario:.....	13
12.1 Summary of Energy Consumption Profile:.....	13
12.2 Estimation of Energy Performance Index (EPI):.....	14
12.2.1 Comments on EPI:	15
13.0 Details of Major Energy Consuming Machinery.....	16
14.0 Electrical Load Measurements on CESC Incomer.....	17
14.1 Measured Electrical Parameters at LT PCC Panel.....	17
14.2 Curves for Measured Power & Harmonics at LT PCC of Main Panel	19
15.0 Measured Solar Power Generation at 4 th Floor Solar PV Inverter Panel	20
15.1 Measured Electrical Parameters at 10 KVA Solar PV Panel-1 (West Side) 20	
15.2 Measured Electrical Parameters at 10 KVA Solar PV Panel-2 (North Side) 24	
16.0 Illumination & Lighting System.....	28
16.1 Introduction:	28
16.2 Salient Observations:	29
16.3 Recommended Illumination [Source: IS 3646 (Part 1): 1992]	30
17.0 Energy Conservation Proposal.....	32
18.0 Annexure	36
19.0 Details of Vendors & Service Providers.....	39



Table 1 Summary of Energy Consumption Profile	13
Table 2 Building Energy Star Rating less than 50% Air-conditioned built-up Area at Warm & Humid Climate.....	14
Table 3 Details of Energy Consuming Equipments of Muralidhar Girls' College	16
Table 4 Measured Electrical Parameters for LT PCC Panel	17
Table 5 Measured Electrical Parameters for 10 kVA Solar PV Panel-1 (West Side)	20
Table 6 Measured Electrical Parameters for 10 kVA Solar PV Panel-2 (North Side)	24
Table 7 Measured Illumination & Power Consumption Profile in Lighting System	31

Figure 1 A Comparison of Annual Electricity Consumption & Cost of Electricity	13
Figure 2 A Comparison of EPI for FY 2020-21 & FY 2021-22	15
Figure 3 Electrical Measurement by Power Analyzer at LT PCC Main Panel	18
Figure 4 Curves for Measured Powers	19
Figure 5 Curves for Harmonic Measurements	19
Figure 6 Curve for Measured Power Generation by 10 kVA Solar PV under Inverter LT Panel-122	
Figure 7 Curve for Measured Harmonic Distortion by 10 kVA Solar PV under Inverter LT Panel-1.....	23
Figure 8 Measurement of Solar PV Generation at 10 kVA Inverter LT Panel-1 (West Side) ...	24
Figure 9 Curve for Measured Power Generation by 10 kVA Solar PV under Inverter LT Panel-226	
Figure 10 Curve for Measured Harmonic Distortion by 10 kVA Solar PV under Inverter LT Panel-2.....	26
Figure 11 Measurement of Solar PV Generation at 10 kVA Inverter LT Panel-2 (North Side) .	27
Figure 12 Population of Different Kinds of Lighting System	28
Figure 13 Energy Consumption (kWh) Pattern of Different Lighting System	29
Figure 14 LUX Measurement at different Room	30
Figure 15 BLDC Smart Ceiling Fan	35

Annexure 1 Saving Potential by Load Current Balancing at load centres	36
Annexure 2 Techno-Economic Analysis for Replacement of Existing 36W Conventional Fluorescent Tube Light (FTL) with Energy Efficient 20W LED Tube Light	37
Annexure 3 Analysis of Energy Saving for the Replacement of Conventional Ceiling Fan with Most Energy Efficient Smart Ceiling Fan	38



Nu Energy India expresses sincere thanks to the management of Muralidhar Girls' College for awarding Nu Energy India to conduct 'Energy Audit, FY 2021-22 at College Campus Building' Premises vide WO Ref. No.- 53, dated 10.03.2023. The field study of this audit was carried out on 25.03.2023.

The following officials of Muralidhar Girls' College, Kolkata have coordinated and helped the audit team during the site visits:

Dr. Kinjalkini Biswas (Principal)
& Co-ordinating Team

We extend our sincere gratitude to Dr. Kinjalkini Biswas and all other Teachers, officers, technicians and staffs for their keen interest shown in the study and the courtesy extended.

We are thankful to the management for giving us the opportunity to involve in this very interesting and challenging project of energy audit at their college premises.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

Anjan Majumdar.

ANJAN MAJUMDAR
Certified & Accredited Energy Auditor
Bureau of Energy Efficiency
Ministry of Power, Govt. of India
Ref. No. - CEA/193/AEA-0123

Attested

Kinjalini Biswas
Principal

Muralidhar Girls' College

**BUREAU OF ENERGY EFFICIENCY**

Examination Registration No. : EA-0167

Accreditation Registration No. : AEA-0193

Certificate of Accreditation

This is to certify that Mr./Ms. Anjan Majumdar having its trade/registered office at Kolkata has been given accreditation as accredited energy auditor. The certificate shall be effective from 2th day of October, 2014.

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 193 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 16th day of January 2015

Secretary,
Bureau of Energy Efficiency
New Delhi

Principal
Muralidhar Girls' College



Muralidhar Girls' College, located at south Kolkata, West Bengal is very energy conscious institution & belief of continuous improvement in their establishment. The working staffs & officers are co-operative and extend their hands to conduct the field trial & testing during field audit. Management of this college has taken many energy saving measures from 2017. Still, some of lacunas were identified by energy audit team during study.

This section presents a brief summary of the results of the Energy Audit carried out last week of March 2023, when ambient condition was favorable for human comfort & working comfort. The study covers mainly the weaknesses of electrical energy aspects at college premises with a focus mainly on proposals and recommendations on energy & cost savings.

A team of two specialist consultants of Certified & Accredited Energy Auditor, BEE, Ministry of Power, Govt. of India were involved in this energy audit. The energy audit was mainly targeted at identifying practical, sustainable and economically viable ENCON measures in all sections of this Warehouse, resulting from a detailed study and analysis of technical parameters. The energy audit involved using a wide range of sophisticated, portable, diagnostic and measuring instruments to generate the data and facilitated in analysis to understand the condition of energy aspects in the Warehouse premises. Following are the observations on field energy audit.

- 1.0 Electricity is the main source of energy in Muralidhar Girls' College. The electrical energy Consumption of this College from CESC for the FY 2021-22 works out to 262 Lakh kWh (@ Rs.8.53/kWh).
- 2.0 Muralidhar Girls' College has already adopted & harnessed roof top 25 kWp, 415 volt rated renewable clean & green Solar Photo voltaic power since 2017, which facilitates college to consume electricity fully in daytime without incurring any cost and also injects & export power to CESC grid partly through bi-directional digital communicable energy meter and saves considerable amount of energy & money per month.
- 3.0 Muralidhar Girls' College has replaced all old non-star air-conditioners with energy efficient 3-STAR rated Split Air-conditioners for 17 nos. of office rooms & saves considerable amount of money per month.
- 4.0 Muralidhar Girls' College is started to adopt most energy efficient & long-lasting LED based lighting system in selected indoor application & saves considerable amount of electrical energy.



- 5.0 At present this girl's college uses large number of 36 Watt conventional & inefficient fluorescent tube lights (FTL) with copper ballast, whose efficacy is found to be very poor & consume excess amount of electrical energy compared to new generation long last 20-Watt LED tube light (TL). Audit addresses that if college is replaced all such 36-Watt fluorescent tube lights (FTL) & their copper ballast with new 20-watt LED tube lights, considerable amount (> 50%) of electrical energy in lighting system can be saved.
- 6.0 Presently this girl's college uses large number of 70 Watt rated conventional & inefficient ceiling fans of 1200 mm sweep, which are consumed excess amount of electrical energy compared to new generation most energy efficient 28-Watt smart BLDC ceiling fan. Audit addresses that if college is replaced all such 70-Watt conventional ceiling fans with new 28-watt rated smart BLDC fan of 1200 mm sweep, considerable amount (> 60%) of electrical energy in room ventilation system can be saved.
- 7.0 At present college is not monitored the energy generation in existing Solar PV systems, wherein the digital true r.m.s energy meters are existed & connected to three existing Inverter Panels. Audit addresses to monitor monthly energy generation mandatorily & maintain the records in a log book, which will facilitate to find out the monthly energy consumption of college building from Solar PV alone by subtracting the energy injected from energy generation.
- 8.0 Measured average & maximum current unbalance in full load condition at CESC LT incomer is found to be significantly high (22.63% & 55.40% respectively), leading to increase line loss further.
- 9.0 Measured average & maximum Total current harmonic distortion (%THDi) at CESC LT incomer is found to be very high (20.8% & 44.9% respectively) at full load, wherein 3rd order of harmonic dominates greatly & leads to increase line loss further due to effect of skin & proximate effect of wiring cables. Audit addresses to install one small "Advance Static Var Generator" (ASVG) to mitigate evil & odd harmonics.
- 10.0 The energy saving & cost saving potential are identified as 61.94% & 62.03% respectively over the existing conditions after considering uncertainty margins for Siliguri Warehouse. Proposals thereof appear to be quite attractive since some cases payback period is less than 2 years & Return on Investment is very high.
- 11.0 For analysis purpose present electricity cost is considered as 14.22 ₹/kWh.



Proposal No.	Proposal	Annual Energy Saving		Annual Energy Cost Saving	Investment Required	Payback Period
		kWh	TOE	₹ Lakh	₹ Lakh	Month
1.	On Current Unbalancing: Balancing the load current in between phases at main CESC fed incomer main panel by Shifting Single Phase Loads (lights, ceiling fans & split air-conditioners) from higher to lower mutually at different class room, laboratories, teacher room, office room, accounts office room etc & also checking of tightness for feeder cable terminals at MCCB, Bus-bar, MCB, etc. and reduction of Line Losses	1153	0.10	0.16	0.14	9.9
2.	On Energy Efficient Lighting System Replacement of all 36W Conventional Fluorescent Tube Lights (FTL) in indoor application step by step with new generation energy efficient & Long Lasting 1 x 20W LED Tube Lights and saving of substantial amount of electrical energy and reduction of maintenance cost	23120	1.99	3.29	3.93	14.3
3.	On Energy Efficient Smart BLDC Ceiling Fan: Replacement of 217 nos. of 70-Watt 48" Conventional Ceiling Fans with new 18 nos. of 28 Watt 48" (Ø 1200 mm Sweep) most Energy Efficient BEE 5-Star Rated Smart Ceiling Fans and save substantial amount of electrical energy.	10937	0.94	1.56	6.18	47.7
	GRAND TOTAL (ELECTRICAL)	35210	3.03	5.01	10.25	24.52



Energy Audit is an effective means of establishment present efficiency levels and identifying potential areas of improvement in energy consumption. Energy audit of utility systems largely helps in reducing the energy consumption with resultant reduction in electricity bills. Audit involves data collection, data verification and detailed analysis of the data. The analysis leads to focus recommendations, which are short term (with minimum investment), medium term (with moderate investment) and long term (with capital expenditure). The cost benefit analysis of various energy conservation proposals enables managements to take decisions regarding implementation schedules.

Energy conservation is a worldwide objective to save the human being from possible disaster. Under the mandate of The Energy Conservation Act 2001, the Bureau of Energy Efficiency (BEE) and Government of India are implementing various programmes to provide momentum of the energy conservation movement in the country. Energy Auditing is most vital part of the conservation of energy. In order to improve the efficiency of the Energy consuming system, energy auditing is the first necessary action to be taken by the concerned firm. Through the energy auditing actual parameters can be detected at each step, which can be compared with the standard achievable parameters. For proper Energy auditing and energy accounting, parameters need to be monitored on regular basis and for any deviation immediate action is needed to rectify and retain the efficiency at the optimum level.

Electrical energy audit reviews the entire distribution of loads with different electrical parameters from sending end to consumption end, which includes grid supply LT incomer, Solar PV Power Generation outgoing feeders, Air Conditioners, Lighting, UPS, Pump, Ceiling Fan & Electricity Bill Analysis etc.

Review of Energy Monitoring & Accounting System; Detail review of present energy monitoring & accounting system in terms of metering, record keeping, data logging, period performance analysis etc.- Recommendations for improvement.

Recording the parameters in the monthly Electricity bills and analyzing the load demand & sanctioned Load, benefits of solar power injection to CESC grid etc.

Energy Audit includes the review of documentation with regard to the scope covered in audit, an on-site visit, and data collection, their review and analysis. This may also require the cross check and verification of data and data which can include industry norms and peer data. Following is that the methodology in detail:

- a. A Pre-Audit Meeting (opening meeting) discussing the main guidelines with the college management team and other concerned departments.
- b. Data collection for monthly electricity bills, unit injected to CESC grid, total built-up area, lighting system, ceiling fan, air conditioners, AC

Attested

Principal

Muralidhar Girls College



- & non-AC Rooms or areas, water pump capacity, capacity of Solar PV System etc.
- Review of existing energy accounting system (Energy Meter) in main grid incomer Panel, Solar PV outgoing feeders etc. & identification any gaps in energy accounting.
 - Measurement of all electrical parameters at main grid incomer Panel & Solar PV outgoing feeders & exploring energy saving opportunities if any.
 - Study of Split Air-conditioners & exploring further energy saving opportunities if any.
 - Check & Measurement of illumination at different office areas & estimation of energy consumption pattern in lighting system.
 - Monthly electricity Bill analysis & exploring further monetary saving.
 - Discussion with members of the house.
 - Review of Documentation/Records (All the relevant maintenance documentation, test records, electrical records etc.

During study several interactions were made to the college personnel and staffs to share the actual operational features of equipments, college maintenance schedule and equipment break down, down time of machineries, safety measures etc. At the same time required drawings, documents, data sheets were collected from the college level and the same was reviewed with the operational actual data.

The study focused on improving energy efficiency and identifying energy saving opportunities at various equipments & systems. The analysis included simple payback period & ROI calculations where investments are required to be made to implement recommendations, to establish their economic viability.

7.0 Instrument used in Energy Audit

The audit study made use of various portable instruments along with plant online instrumentations, for carrying out various measurements and analyses. The specialized instruments that were used during the energy audit include:

- Micro-processor-based Load Manager, KRIKARD ALM 31 with software facility for different electrical parameter measurements
- Digital Smart Hygrometer for dry bulb temperature (DBT), wet bulb temperature (WBT) & relative humidity (RH)
- Digital LUX / Foot Candle Meter

8.0 Energy Audit Team

- A. Majumdar (Accredited Energy Auditor, BEE, Govt. of India)
- S. Hazra (Accredited Energy Auditor, BEE, Govt. of India)
- A. Dutta (Energy Engineer)



Muralidhar Girls' College, established in 1940, is an undergraduate women's college in Kolkata, West Bengal, India. It is affiliated with the University of Calcutta. The mission of the college is to extend educational facilities to all deserving students, including first generation learners.

The college aims towards a greener campus through use of rain water harvesting system and adopts & harnesses grid connected solar photo voltaic (Solar PV) power generation system (both government funded and college purchase) for generation of clean electricity. The college regularly opts for green audits.

- a. Installation of 25 kWp, 415 volt rated Solar Photo voltaic Power Generation System & harnessing clean & green power for college use in daytime & excess power is exported to grid through bi-directional energy meter.
- b. Measured power factor (efficiency of electrical system) is found to be high (avg.-0.975) without using any capacitor banks and saving of some amount line losses & KVA demand.
- c. All old non-star air-conditioners are replaced with energy efficient 3-STAR rated Split Air-conditioners for 17 nos. of office rooms & saves considerable amount of money per month.
- d. College is started to adopt most energy efficient & long-lasting LED based lighting system in selected indoor application & saves some amount of electrical energy.
- e. Some of old wiring cables in ground floor conference room & office room are replaced with new cable with pipe wiring, resulting in lesser conductor resistance & lesser line losses.
- f. Partly natural day light harnesses in the all-class room floors through clear wall glass, resulting in less use of existing lighting system in day time & reduction lighting power consumption further.
- g. Solar PV Inverter Panels are equipped with high accuracy of 0.5 class digital Energy Meter.


The study identified following barriers towards energy conservation & Energy Savings in the Muralidhar Girls College:

- a. Use of large population of 36 Watt conventional & low efficacy fluorescent tube lights (FTL) with copper ballast in all office rooms & class rooms, which consume excess amount of electrical energy compared to new generation long last 20-Watt LED tube light (TL).



- b. Use of large population of 70 Watt rated conventional & inefficient ceiling fans of 1200 mm sweep, which are consumed excess amount of electrical energy compared to new generation most energy efficient 28-Watt smart BLDC ceiling fan.
- c. At present college is not monitored the energy generation in existing Solar PV systems, wherein the digital true r.m.s energy meters are existed & connected to three existing Inverter Panels.
- d. Measured average & maximum current unbalance in full load condition at CESC LT incomer is found to be significantly high, leading to increase line loss further.
- e. Measured average & maximum Total current harmonic distortion (%THDi) at CESC LT incomer is found to be very high at full load, wherein 3rd order of harmonic dominates greatly & leads to increase line loss further due to effect of skin & proximate effect of wiring cables.

Attested


Principal
Muralidhar Girls' College



Main Source of energy in Muralidhar Girls' College is electricity from Grid (CESC) & Solar PV Generation. A summary and comparison of the annual energy consumption & Energy Performance Index (specific energy consumption) is given in tables below:

Table I Summary of Energy Consumption Profile

SUMMARY OF ENERGY CONSUMPTION PROFILE				
Sl. No.	Particulars	Unit	2020-21 (CESC)	2021-22 (CESC)
1.0 Electrical Energy Purchased & Cost Figure:				
1a.	Annual Grid Energy Purchased & Consumed	kWh	9986	15796
1b.	Annual Energy Generation from Solar PV	kWh	9752	8777
1c.	Annual Energy Injected to CESC Grid	kWh	7058	6352
1d.	Annual Solar Energy Consumed by College	kWh	2694	2424
1e.	Ton of Oil Equivalent (TOE)	TOE	0.86	1.36
1f.	Cost of Electricity Purchased & Consumed	₹ Lakh	0.30	0.50
1g.	Unit Rate of Electricity Purchased & Consumed	₹/kWh	2.99	3.15

NOTE: "TOE" stands for Metric Tonne of oil Equivalent Energy
Where, 1 TOE = 10^7 kCal

***Due to COVID situation during above financial years, college was closed most of time and hence energy consumption & cost of electricity are found to be very Less.

A COMPARISON OF ELECTRICITY CONSUMPTION & COST OF ELECTRICITY

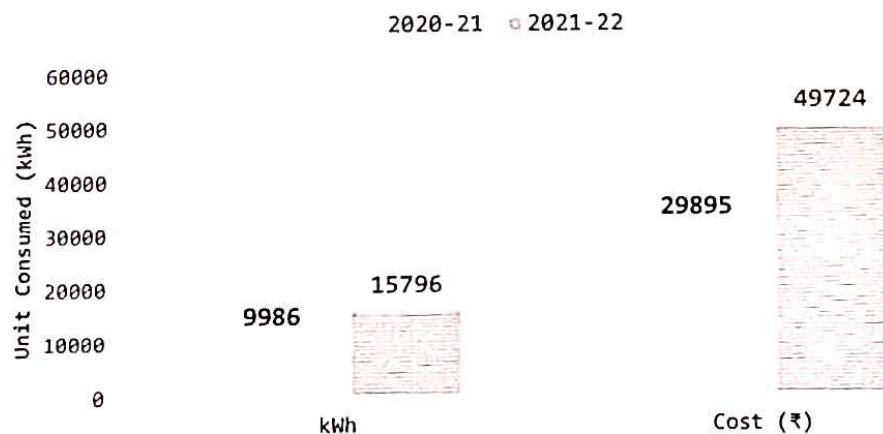


Figure 1 A Comparison of Annual Electricity Consumption & Cost of Electricity

**COMMENTS:**

Energy consumption from grid for the FY 2020-21 & FY 2021-22 is found to be very less due to COVID 19 pandemic, wherein energy consumption for the FY 2020-21 is found to be less by 36.78% compared to the FY 2021-22.

1.1.1. Method of Energy Performance Index (EPI):

As per ECBC 2017, the Energy Performance Index (EPI) of a building is its annual energy consumption in kilowatt-hours per square meter of the building. At present built up area of air-condition areas & non-air conditioning areas college building is found to be 393.54 m² & 2740.96 m² respectively i.e. 12.56% is air-conditioned area & 87.44% is non-airconditioned area. EPI can be determined by:

$$EPI = \frac{\text{Annual energy consumption in kWh}}{\text{Total built-up area (excluding unconditioned basements)}}$$

Energy Performance Index of Muralidhar Girls College for FY 2020-21

- Total Built-up areas Muralidhar Girls' College : 3134.5 m²
- Annual energy consumption of Muralidhar Girls' College : 9986 kWh
- Specific Energy Consumption by Muralidhar Girls' College : 3.18 kWh/m²/year

Energy Performance Index of Muralidhar Girls College for FY 2021-22

- Total Built-up areas Muralidhar Girls' College : 3134.5 m²
- Annual energy consumption of Muralidhar Girls' College : 15796 kWh
- Specific Energy Consumption by Muralidhar Girls' College : 5.04 kWh/m²/year

NOTE: Considering 3134.5 m² total built-up areas for EPI Calculation & there is no basement in this College.

As per ECBC published by BEE, in warm & humid climate "Specific Energy Consumption" as "Energy Performance Index" (EPI) for 5-star rated building having less than 50% Air-conditioned area is below 45 kWh/m²/year with 5-Star Level-*****.

Table 2 Building Energy Star Rating less than 50% Air-conditioned built-up Area at Warm & Humid Climate

Building Energy Star Rating in Less than 50 % air-conditioned built-up area at Climatic Zone - Warm and Humid	
EPI (kWh/sqm/year)	Star Label
85-75	1 Star
75-65	2 Star
65-55	3 Star
55-45	4 Star
Below 45	5 Star



12.2.1 Comments on EPI:

During the FY 2020-21 & FY 2021-22, Energy Performance Index is found to be 3.18 kWh/m²/Year & 5.04 kWh/m²/Year respectively, which are very less & highly satisfactory and belong to 5 Star Category as per ECBC 2017 wherein COVID 19 situation was prevailed. Still, there is further scope for reduction of line losses further in electrical distribution system by the balancing line current, harmonic mitigation at main LT PCC Panel at CESC supply point & replacement of conventional high wattage fluorescent tube lights & ceiling fans and accordingly fix the target for action plan.

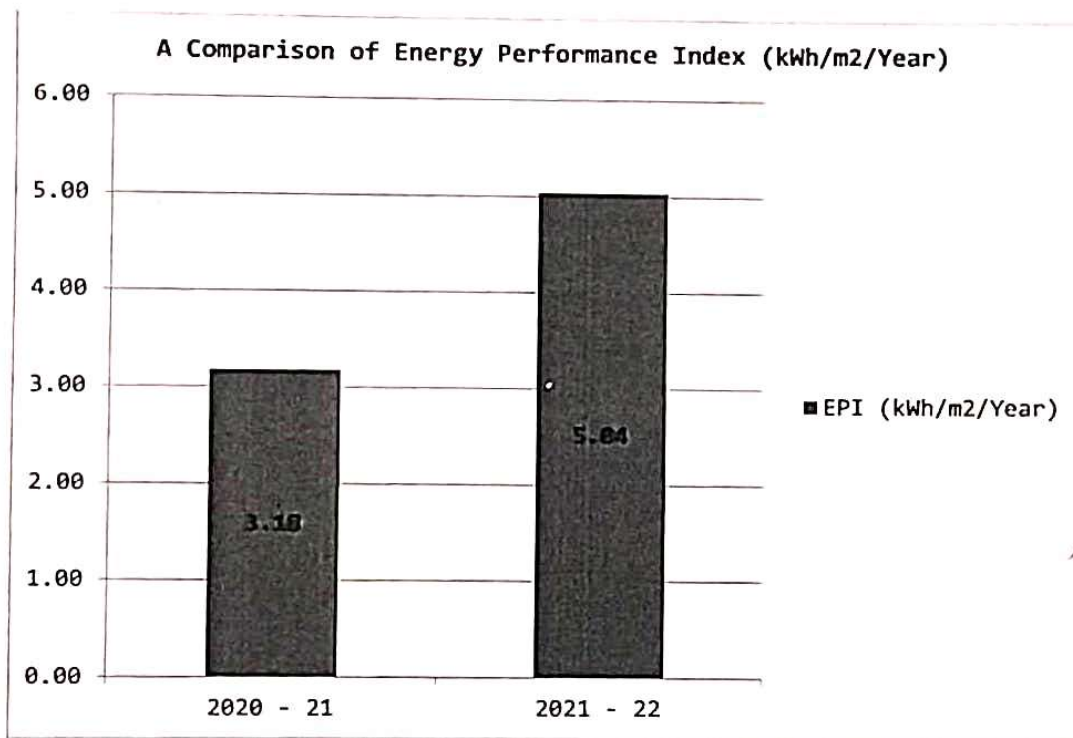


Figure 2 A Comparison of EPI for FY 2020-21 & FY 2021-22

COMMENTS:

Energy Performance Index pattern for FY 2021-22 & FY 2020-21 is found to be similar in nature & no such big gap is found after analysis.





13.0 Details of Major Energy Consuming Machinery

At present there are many major energy consuming machineries like star rated Split Air conditioners, Water Pump, LED based lighting system, Conventional Fluorescent Tube Lighting system, Ceiling fans, Computers, UPS etc. in Muralidhar Girls' College.

Table 3 Details of Energy Consuming Equipments of Muralidhar Girls' College

Type of Equipments	Unit	Number
1.5 TR Split Air-conditioner	Nos.	17
1.5 kW Bore-well Water Pump	Nos.	1
15-Watt LED Light Fixture	Nos.	47
1200 mm Sweep 70-watt Ceiling Fan	Nos.	217
36-watt Fluorescent Tube Light	Nos.	655
20 kWp Solar PV Generator	Nos.	1
5 kWp Solar PV Generator	Nos.	1

Attested

Principal

Muralidhar Girls' College





14.0 Electrical Load Measurements on CESC Incomer

During different electrical parameters were measured & noted at Main Incomer of LT PCC Panel, located at CESC supply Point. During study several electrical parameters, like Voltage, Load Current, Neutral Current, Voltage Unbalance, Current Unbalance, Power factor, Powers, Harmonic Distortions etc. were logged for 20 second time interval and compared with load carrying capability of existing cables of respective feeders.

14.1 Measured Electrical Parameters at LT PCC Panel

Table 4 Measured Electrical Parameters for LT PCC Panel

Line Voltage Measurements at LT PCC of CESC Incomer							
Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
U12 rms	24-03-2023	411.0	407.3	415.1	V	01:00:40	(h:min:s)
U23 rms	24-03-2023	413.0	409.1	417.3	V	01:00:40	(h:min:s)
U31 rms	24-03-2023	408.4	403.8	412.8	V	01:00:40	(h:min:s)
Line Current Measurements at LT PCC of CESC Incomer							
Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 rms	24-03-2023	43.53	18.33	76.87	A	01:00:40	(h:min:s)
A2 rms	24-03-2023	56.51	6.9	94.53	A	01:00:40	(h:min:s)
A3 rms	24-03-2023	54.04	11.2	97.6	A	01:00:40	(h:min:s)
AN rms	24-03-2023	28.29	13.5	36.88	A	01:00:40	(h:min:s)
Power Factor Measurements at LT PCC of CESC Incomer							
Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
PF1	24-03-2023	0.975	0.955	0.988	p.u.	01:00:40	(h:min:s)
PF2	24-03-2023	0.972	0.84	0.992	p.u.	01:00:40	(h:min:s)
PF3	24-03-2023	0.974	0.883	0.993	p.u.	01:00:40	(h:min:s)
PFT	24-03-2023	0.975	0.912	0.99	p.u.	01:00:40	(h:min:s)
Unbalance Measurements at LT PCC of CESC Incomer							
Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
Aunb (IEEE 112)	24-03-2023	22.6	4.6	55.4	%	01:00:40	(h:min:s)
Aunb (u2)	24-03-2023	11.9	2.3	40.0	%	01:00:40	(h:min:s)
Uunb (IEEE 112)	24-03-2023	0.6	0.5	0.7	%	01:00:40	(h:min:s)
Vunb (IEEE 112)	24-03-2023	0.4	0.2	0.6	%	01:00:40	(h:min:s)
Vunb (u2)	24-03-2023	0.6	0.5	0.8	%	01:00:40	(h:min:s)





Measured Power at LT PCC of CESC Incomer

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
D1 (var)	24-03-2023	2.02	1.24	2.49	kvar	01:00:40	(h:min:s)
D2 (var)	24-03-2023	2.29	0.85	2.93	kvar	01:00:40	(h:min:s)
D3 (var)	24-03-2023	1.89	1.10	2.64	kvar	01:00:40	(h:min:s)
DT (var)	24-03-2023	6.38	3.66	8.18	kvar	01:00:40	(h:min:s)
P1 (W)	24-03-2023	9.7	4.6	15.4	kW	01:00	(h:min:s)
P2 (W)	24-03-2023	12.4	1.5	18.8	kW	01:00	(h:min:s)
P3 (W)	24-03-2023	11.8	2.6	17.6	kW	01:00	(h:min:s)
PT (W)	24-03-2023	34.0	8.9	51.6	kW	01:00	(h:min:s)
Q1 (var)	24-03-2023	456.8	-186.4	976.0	var	01:00	(h:min:s)
Q2 (var)	24-03-2023	0.7	-0.4	1.3	kvar	01:00	(h:min:s)
Q3 (var)	24-03-2023	-59.1	-904.9	759.2	var	01:00	(h:min:s)
QT (var)	24-03-2023	1.1	-0.84	2.7	kvar	01:00	(h:min:s)
S1 (VA)	24-03-2023	10.0	4.81	15.6	kVA	01:00	(h:min:s)
S2 (VA)	24-03-2023	12.7	1.80	19.0	kVA	01:00	(h:min:s)
S3 (VA)	24-03-2023	12.0	2.89	17.7	kVA	01:00	(h:min:s)
ST (VA)	24-03-2023	34.6	9.68	52.1	kVA	01:00	(h:min:s)

Harmonic Distortion Measurements at LT PCC of CESC Incomer

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 THDf	24-03-2023	21.6	15.1	30.8	% f	01:00:40	(h:min:s)
A2 THDf	24-03-2023	21.6	12.5	60.9	% f	01:00:40	(h:min:s)
A3 THDf	24-03-2023	19.1	11.2	43.1	% f	01:00:40	(h:min:s)
U12 THDf	24-03-2023	1.3	1.1	1.5	% f	01:00:40	(h:min:s)
U23 THDf	24-03-2023	1.4	1.2	1.6	% f	01:00	(h:min:s)
U31 THDf	24-03-2023	1.6	1.4	1.8	% f	01:00	(h:min:s)
V1 THDf	24-03-2023	1.8	1.5	2.0	% f	01:00	(h:min:s)
V2 THDf	24-03-2023	1.3	1.1	1.5	% f	01:00	(h:min:s)
V3 THDf	24-03-2023	1.8	1.5	2.0	% f	01:00	(h:min:s)

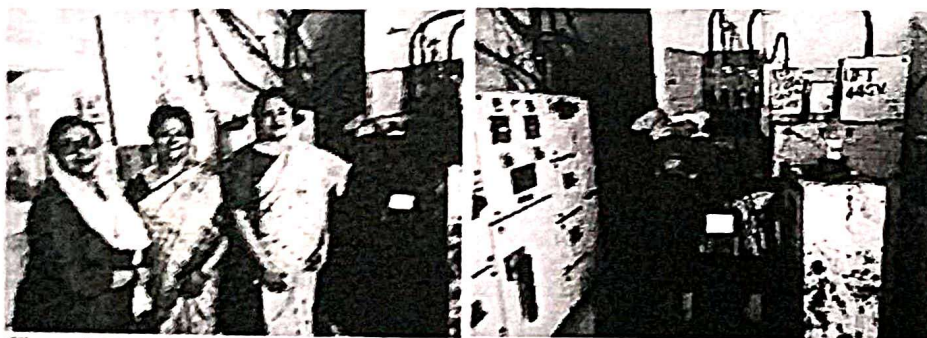


Figure 3 Electrical Measurement by Power Analyzer at LT PCC Main Panel



14.2 Curves for Measured Power & Harmonics at LT PCC of Main Panel

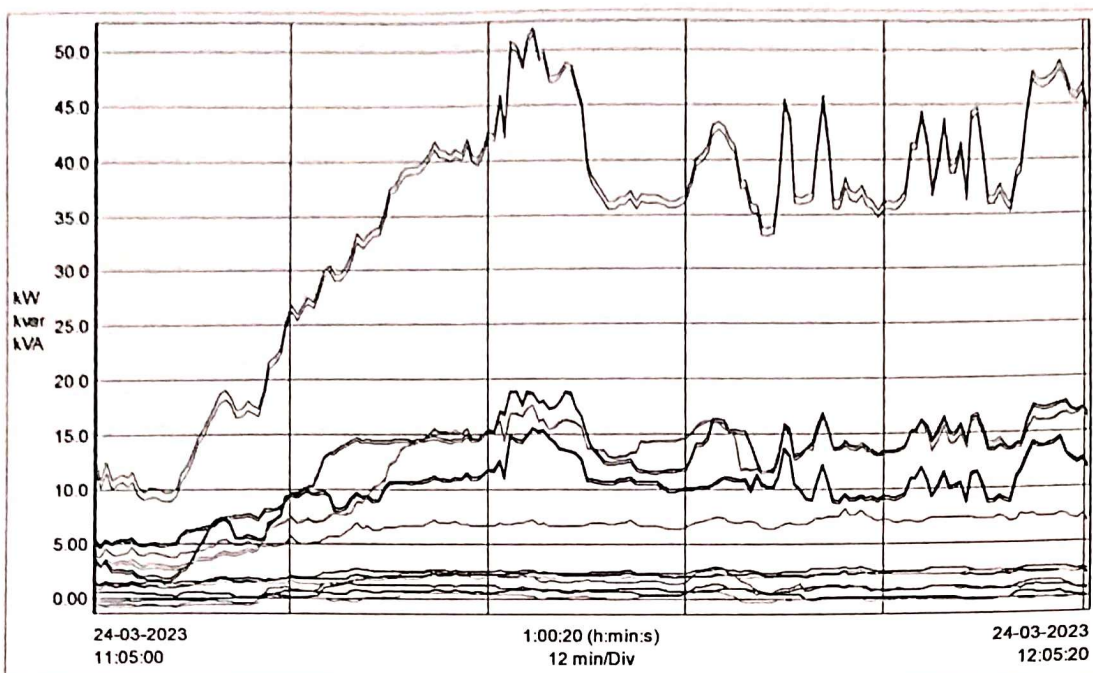


Figure 4 Curves for Measured Powers

COMMENTS:

Maximum measured active power (kW), apparent power & reactive power drawn is found to be 51.6 kW, 52.1 kVA & 2.7 kVAR respectively. Although at low load or partial load condition over Var compensation took place due to leading power factor.

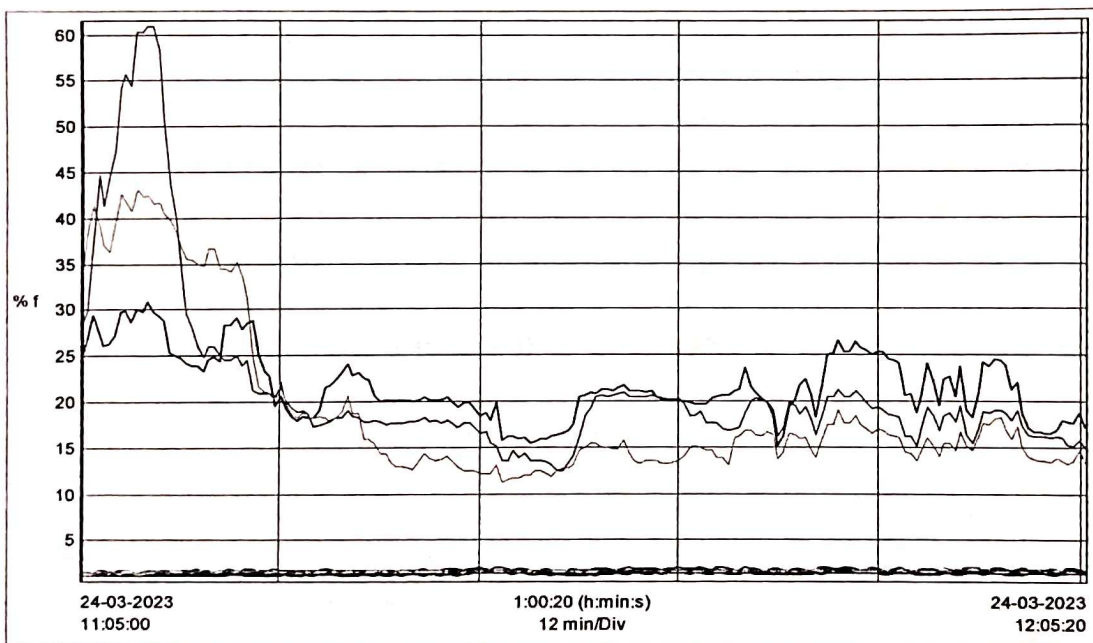


Figure 5 Curves for Harmonic Measurements



**COMMENTS:**

Measured maximum Total Current Harmonic Distortion (%THD1) is found to be 44.9%, which is high and mainly 3rd harmonic & other triple-n order of harmonics are dominating, resulting in increase of line loss. It will reduce after installation of harmonic filter.

15.0 Measured Solar Power Generation at 4th Floor Solar PV Inverter Panel

At present there 100 nos. of 250Wp rated solar modules. Located at 4th floor roof top. During audit, different electrical parameters were measured at AC Outgoing feeder of 10 kVA Inverter LT Panel, located at west side & north side 4th floor stair case and same outgoing feeder of 5 kVA Inverter LT Panel, located at south wall 2nd floor stair case. During study several electrical parameters, like Voltage, Load Current, Neutral Current, Voltage Unbalance, Current Unbalance, Power factor, Powers, Harmonic Distortions etc. were logged for 20 second time interval. Only same was not possible to measure in 2nd floor outgoing 5 kVA Solar PV Inverter Panel due to inaccessibility in inverter panel.

15.1 Measured Electrical Parameters at 10 KVA Solar PV Panel-1 (West Side)**Table 5 Measured Electrical Parameters for 10 kVA Solar PV Panel-1 (West Side)****Line Voltage Measurements at Outgoing Side of 10 kVA Inverter LT Panel-1**

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
U12 rms	24-03-2023	415.3	411.2	419.0	V	05:20:00	(min:s)
U23 rms	24-03-2023	419.0	414.5	422.9	V	05:20:00	(min:s)
U31 rms	24-03-2023	420.3	415.7	424.4	V	05:20:00	(min:s)

Line Current Measurements at Outgoing Side of 10 kVA Inverter LT Panel-1

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 rms	24-03-2023	4.95	1.77	6.77	A	05:20:00	(min:s)
A2 rms	24-03-2023	5.04	1.80	6.91	A	05:20:00	(min:s)
A3 rms	24-03-2023	5.03	1.80	6.86	A	05:20:00	(min:s)
AN rms	24-03-2023	0.00	0.00	0.00	A	05:20:00	(min:s)

Power Factor Measurements at Outgoing Side of 10 kVA Inverter LT Panel-1

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
PF1	24-03-2023	0.993	0.986	0.997	p.u.	05:20:00	(min:s)
PF2	24-03-2023	0.991	0.983	0.997	p.u.	05:20:00	(min:s)
PF3	24-03-2023	0.993	0.985	0.998	p.u.	05:20:00	(min:s)
PFT	24-03-2023	0.992	0.985	0.997	p.u.	05:20:00	(min:s)

Measured Power at Outgoing Side of 10 kVA Inverter LT Panel-1

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
D1 (var)	24-03-2023	109.70	89.15	143.40	var	05:20:00	(min:s)





D2 (var)	24-03-2023	117.90	99.58	151.00	var	05:20:00	(min:s)
D3 (var)	24-03-2023	101.40	88.46	132.60	var	05:20:00	(min:s)
DT (var)	24-03-2023	331.60	281.90	430.40	var	05:20:00	(min:s)
P1 (W)	24-03-2023	1.1	0.6	1.6	kW	05:20	(min:s)
P2 (W)	24-03-2023	1.1	0.6	1.6	kW	05:20	(min:s)
P3 (W)	24-03-2023	1.1	0.6	1.6	kW	05:20	(min:s)
PT (W)	24-03-2023	3.4	1.7	4.8	kW	05:20	(min:s)
Q1 (var)	24-03-2023	7.5	-2.7	14.7	var	05:20	(min:s)
Q2 (var)	24-03-2023	17.2	11.4	19.3	var	05:20	(min:s)
Q3 (var)	24-03-2023	35.4	32.1	39.8	var	05:20	(min:s)
QT (var)	24-03-2023	60.1	41.54	66.8	var	05:20	(min:s)
S1 (VA)	24-03-2023	1.1	0.56	1.6	kVA	05:20	(min:s)
S2 (VA)	24-03-2023	1.1	0.57	1.6	kVA	05:20	(min:s)
S3 (VA)	24-03-2023	1.2	0.58	1.6	kVA	05:20	(min:s)
ST (VA)	24-03-2023	3.4	1.71	4.8	kVA	05:20	(min:s)

Unbalance Measurements at Outgoing Side of 10 kVA Inverter LT Panel-1

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
Aunb (IEEE 112)	24-03-2023	1.3	1.0	1.7	%	05:20:00	(min:s)
Aunb (u2)	24-03-2023	1.3	1.1	1.7	%	05:20:00	(min:s)
Uunb (IEEE 112)	24-03-2023	0.7	0.6	0.7	%	05:20:00	(min:s)
Vunb (IEEE 112)	24-03-2023	0.6	0.5	0.7	%	05:20:00	(min:s)
Vunb (u2)	24-03-2023	0.7	0.6	0.8	%	05:20:00	(min:s)

Harmonic Distortion Measurements at Outgoing Side of 10 kVA Inverter LT Panel-1

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 THDf	24-03-2023	7.4	4.5	11.5	% f	05:20:00	(min:s)
A2 THDf	24-03-2023	8.3	4.8	13.4	% f	05:20:00	(min:s)
A3 THDf	24-03-2023	7.0	4.3	11.4	% f	05:20:00	(min:s)
U12 THDf	24-03-2023	1.6	1.6	1.7	% f	05:20:00	(min:s)
U23 THDf	24-03-2023	1.3	1.3	1.4	% f	05:20	(min:s)
U31 THDf	24-03-2023	1.4	1.4	1.5	% f	05:20	(min:s)
V1 THDf	24-03-2023	1.8	1.7	1.9	% f	05:20	(min:s)
V2 THDf	24-03-2023	1.9	1.8	1.9	% f	05:20	(min:s)
V3 THDf	24-03-2023	1.4	1.3	1.4	% f	05:20	(min:s)

COMMENTS:

- 1) Above measured parameters parameter indicates that hourly average & maximum generation are found to be 3.4 kWh (Unit) & 4.8 kWh (unit) with near to unity power factor & also with pure sine curve, which are highly satisfactory.





- 2) Total voltage harmonic distortion (%A THD) & total current harmonic distortion (%V THD) is found to be satisfactory & complies the harmonic regulation of IEEE 519 2014.

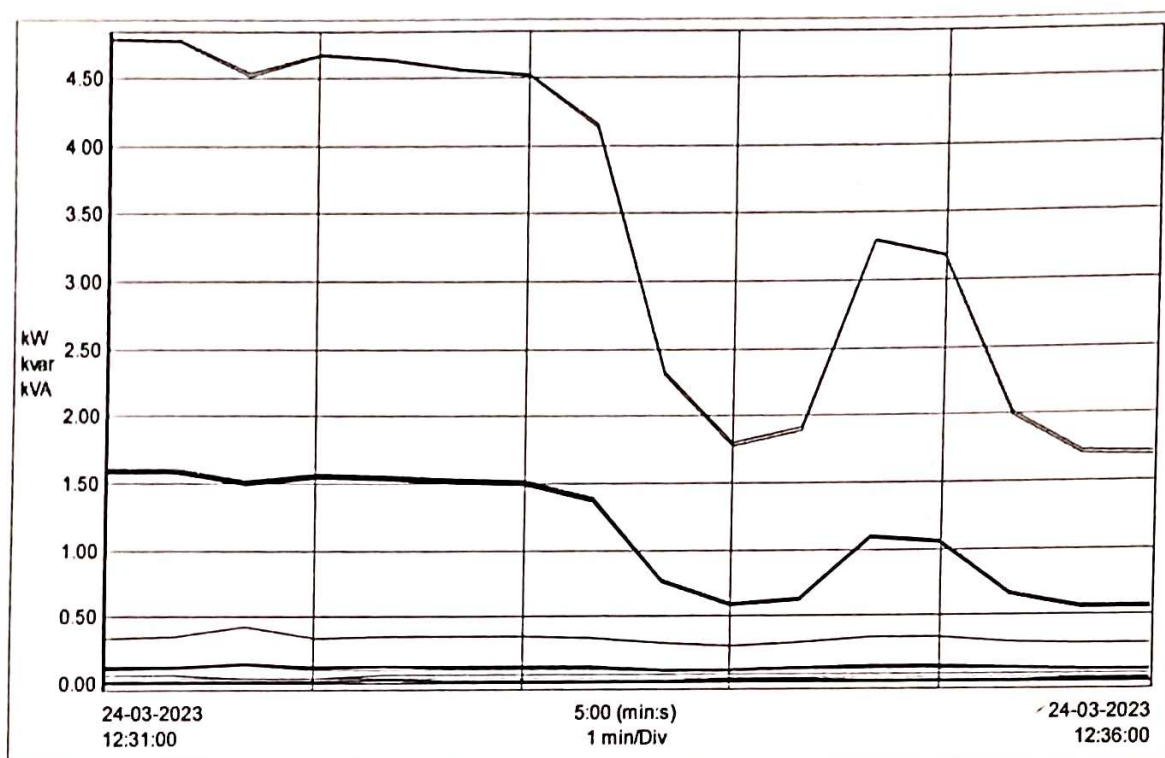


Figure 6 Curve for Measured Power Generation by 10 kVA Solar PV under Inverter LT Panel-1

Attested*

[Signature]

Principal

Muralidhar Girls' College



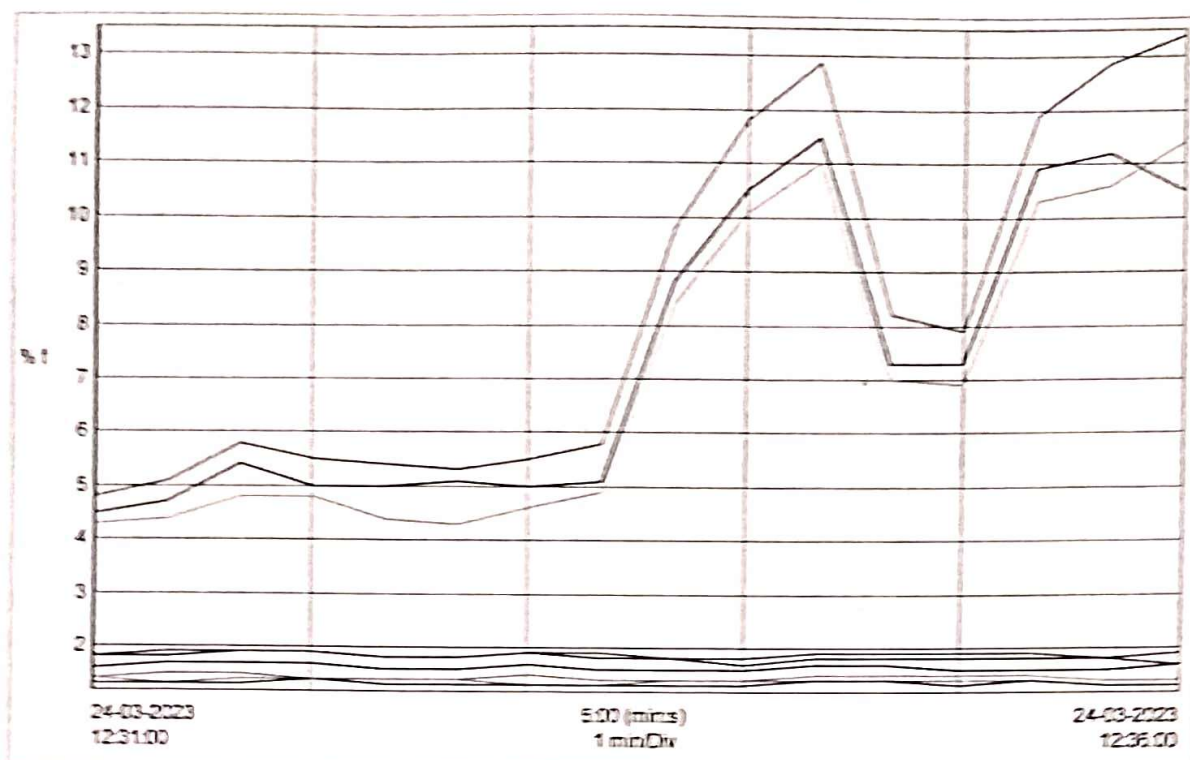
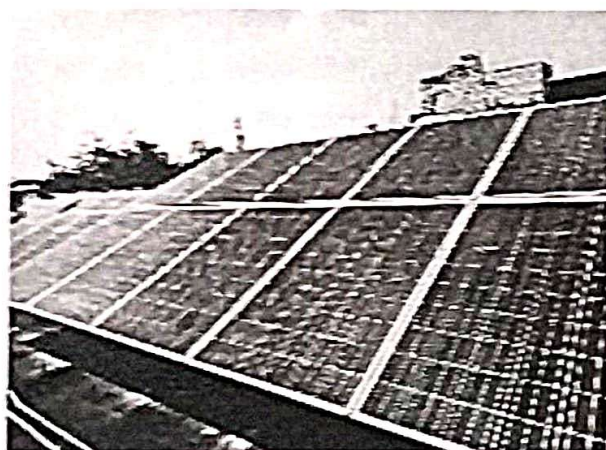


Figure 7 Curve for Measured Harmonic Distortion by 10 kVA Solar PV under Inverter LT Panel-I



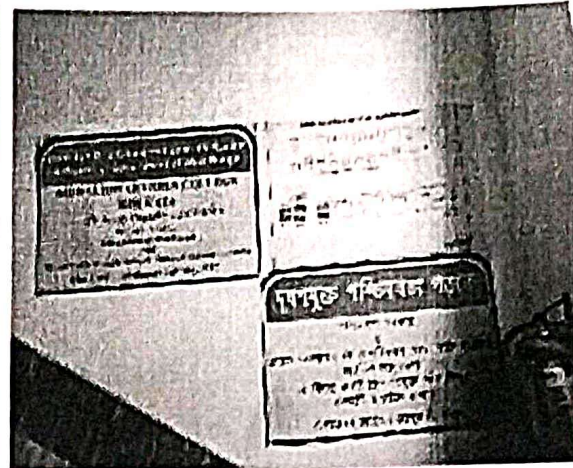
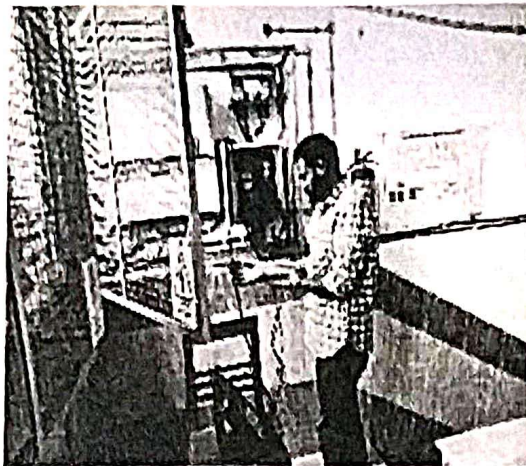


Figure 8 Measurement of Solar PV Generation at 10 kVA Inverter LT Panel-1 (West Side)

15.2 Measured Electrical Parameters at 10 KVA Solar PV Panel-2 (North Side)

Table 6 Measured Electrical Parameters for 10 kVA Solar PV Panel-2 (North Side)

Line Voltage Measurements at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
U12 rms	24-03-2023	420.0	415.6	423.6	V	04:40:00	(min:s)
U23 rms	24-03-2023	423.7	419.6	428	V	04:40:00	(min:s)
U31 rms	24-03-2023	424.9	420.0	429.3	V	04:40:00	(min:s)

Line Current Measurements at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 rms	24-03-2023	6.63	1.62	7.77	A	04:40:00	(min:s)
A2 rms	24-03-2023	6.72	1.69	7.93	A	04:40:00	(min:s)
A3 rms	24-03-2023	6.73	1.67	7.9	A	04:40:00	(min:s)
AN rms	24-03-2023	0.00	0.00	0.00	A	04:40:00	(min:s)

Power Factor Measurements at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
PF1	24-03-2023	0.996	0.990	0.998	p.u.	04:40:00	(min:s)
PF2	24-03-2023	0.996	0.990	0.997	p.u.	04:40:00	(min:s)
PF3	24-03-2023	0.997	0.991	0.998	p.u.	04:40:00	(min:s)
PFT	24-03-2023	0.996	0.991	0.998	p.u.	04:40:00	(min:s)

Measured Power at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
D1 (var)	24-03-2023	123.20	107.20	140.70	var	04:40:00	(min:s)
D2 (var)	24-03-2023	127.90	108.80	142.50	var	04:40:00	(min:s)
D3 (var)	24-03-2023	110.70	98.78	126.50	var	04:40:00	(min:s)



DT (var)	24-03-2023	364.60	316.10	412.40	var	04:40:00	(min:s)
P1 (W)	24-03-2023	1.6	0.8	1.8	kW	04:40	(min:s)
P2 (W)	24-03-2023	1.6	0.8	1.8	kW	04:40	(min:s)
P3 (W)	24-03-2023	1.6	0.8	1.9	kW	04:40	(min:s)
PT (W)	24-03-2023	4.8	2.5	5.6	kW	04:40	(min:s)
Q1 (var)	24-03-2023	1.1	-7.4	11.2	var	04:40	(min:s)
Q2 (var)	24-03-2023	16.0	8.7	18.5	var	04:40	(min:s)
Q3 (var)	24-03-2023	31.9	25.5	35.2	var	04:40	(min:s)
QT (var)	24-03-2023	48.8	26.82	60.3	var	04:40	(min:s)
S1 (VA)	24-03-2023	1.6	0.81	1.8	kVA	04:40	(min:s)
S2 (VA)	24-03-2023	1.6	0.83	1.9	kVA	04:40	(min:s)
S3 (VA)	24-03-2023	1.6	0.83	1.9	kVA	04:40	(min:s)
ST (VA)	24-03-2023	4.8	2.47	5.6	kVA	04:40	(min:s)

Unbalance Measurements at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
Aunb (IEEE 112)	24-03-2023	1.0	0.9	1.4	%	04:40:00	(min:s)
Aunb (u2)	24-03-2023	1.0	0.9	1.4	%	04:40:00	(min:s)
Uunb (IEEE 112)	24-03-2023	0.7	0.6	0.7	%	04:40:00	(min:s)
Vunb (IEEE 112)	24-03-2023	0.5	0.5	0.6	%	04:40:00	(min:s)
Vunb (u2)	24-03-2023	0.7	0.6	0.8	%	04:40:00	(min:s)

Harmonic Distortion Measurements at Outgoing Side of 10 kVA Inverter LT Panel-2

Name	Date	AVG.	MIN.	MAX.	Units	Duration	Units
A1 THDf	24-03-2023	5.1	3.7	9.3	% f	04:40:00	(min:s)
A2 THDf	24-03-2023	5.4	4.3	9.5	% f	04:40:00	(min:s)
A3 THDf	24-03-2023	4.7	3.7	8.7	% f	04:40:00	(min:s)
U12 THDf	24-03-2023	1.8	1.7	1.8	% f	04:40:00	(min:s)
U23 THDf	24-03-2023	1.4	1.3	1.5	% f	04:40	(min:s)
U31 THDf	24-03-2023	1.6	1.4	1.7	% f	04:40	(min:s)
V1 THDf	24-03-2023	2.0	1.8	2.1	% f	04:40	(min:s)
V2 THDf	24-03-2023	1.9	1.8	2.0	% f	04:40	(min:s)
V3 THDf	24-03-2023	1.4	1.3	1.5	% f	04:40	(min:s)

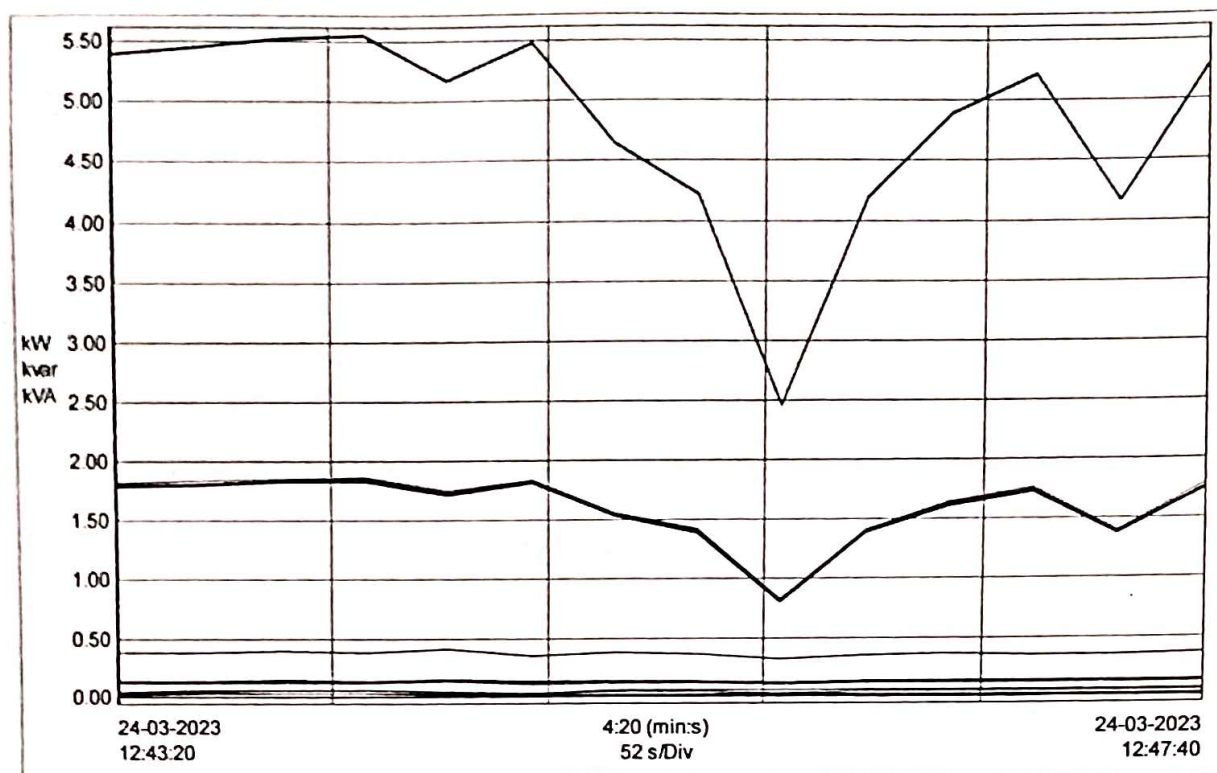


Figure 9 Curve for Measured Power Generation by 10 kVA Solar PV under Inverter LT Panel-2

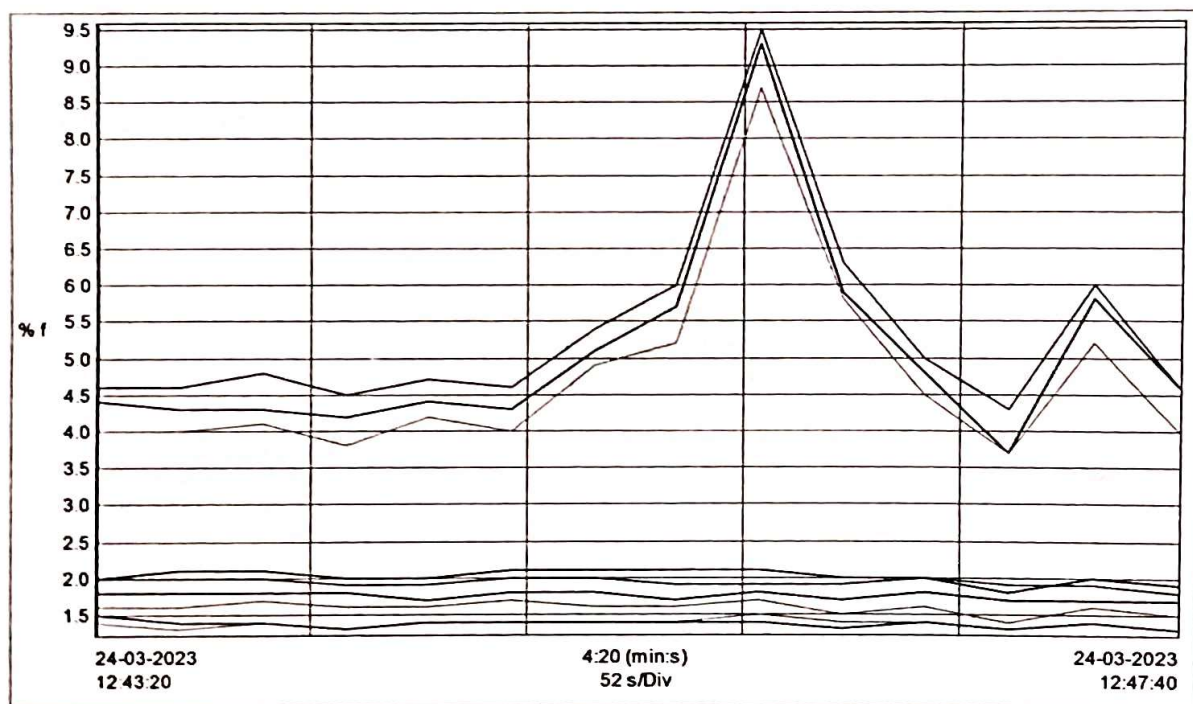


Figure 10 Curve for Measured Harmonic Distortion by 10 kVA Solar PV under Inverter LT Panel-2



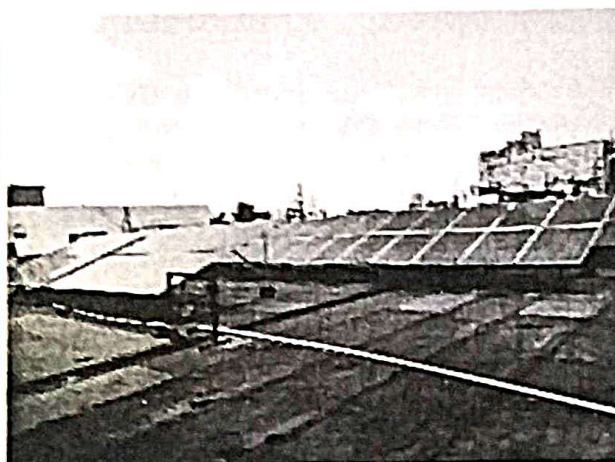
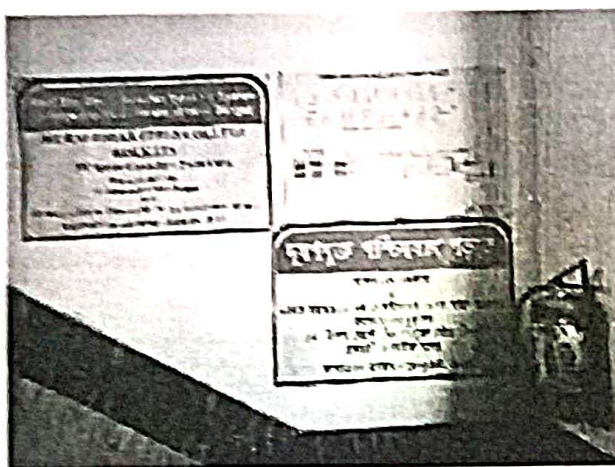
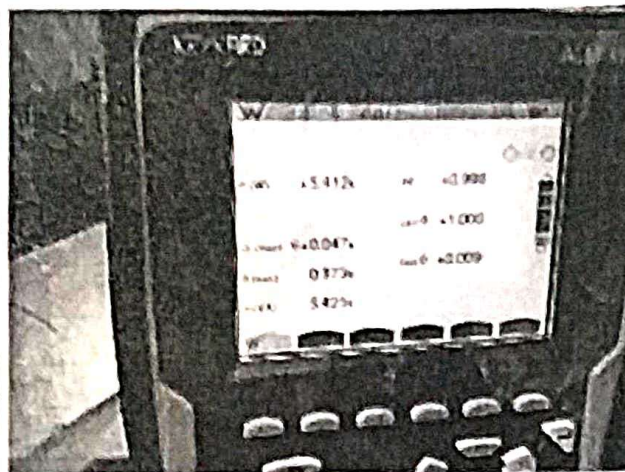


Figure 11 Measurement of Solar PV Generation at 10 kVA Inverter LT Panel-2 (North Side)

COMMENTS:

- 1) Above measured parameters parameter indicates that hourly average & maximum generation are found to be 4.8 kWh (Unit) & 5.6 kWh (unit) with near to unity power factor & also with pure sine curve, which are highly satisfactory.
- 2) Total voltage harmonic distortion (%A THD) & total current harmonic distortion (%V THD) is found to be satisfactory & complies the harmonic regulation of IEEE 519 2014.



16.0 Illumination & Lighting System

16.1 Introduction:

Lighting energy contributes to around **43.65%** of power in Muralidhar Girls' College, which is found to be very high, wherein only few areas use small number of energy efficient & long-lasting LED Lighting Fixtures 15-Watt LED Fixture areas compared to conventional fluorescent tube light (FTL). Hence, there is a further scope for cutting down the lighting power consumption by the adoption of energy efficient LED based lighting system.

Part 8 of National Building Code of India enlisting standards for Building services (Illumination) are the set of standards required to be implemented across all warehousing structures. (IS 3646 Part 1) of BIS.

The field study was included the LUX measurements randomly in class room, office rooms, laboratory and teachers room etc. & estimation of lighting power consumption and comparison with IS standard, condition of lamp/luminaries' survey.

Details of LUX measurements in all floors of college building room and electrical measurements on lighting feeder are given in tables below.

A Comparison of Different Types of Lighting Fixtures

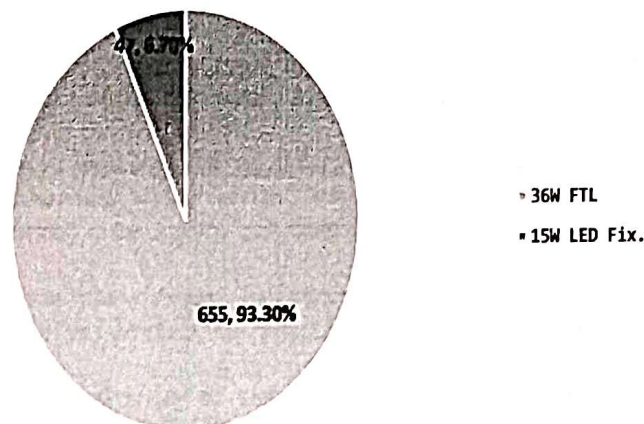


Figure 12 Population of Different Kinds of Lighting System

COMMENTS:

College management should focus mainly to use energy efficient & high efficacy LED Fixture than conventional & high wattage fluorescent tube lights, which will bring down the overall energy consumption of college substantially.



A Comparison of Energy Consumption Pattern of Different Lighting System

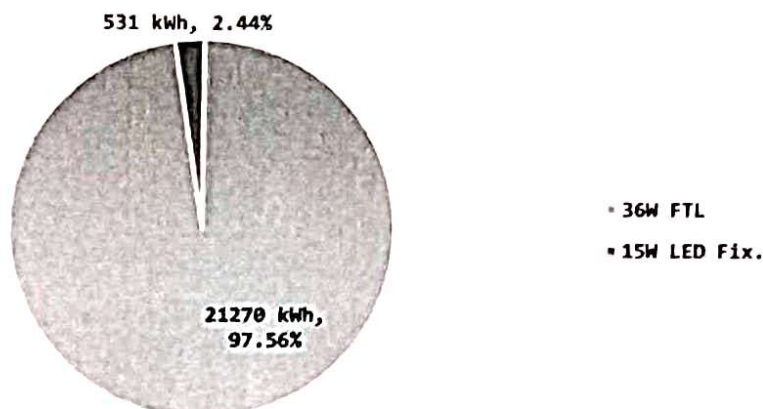


Figure 13 Energy Consumption (kWh) Pattern of Different Lighting System

COMMENTS:

College management should focus mainly to use energy efficient & high efficacy LED Fixture than conventional & high wattage fluorescent tube lights, which will bring down the overall energy consumption of college substantially.

16.2 Salient Observations:

- ⇒ Most cases college is using extensively high wattage conventional fluorescent tube light, which increases lighting power consumption substantially.
- ⇒ Most cases measured LUX in office space areas was found to be poor as compared to recommended value of IS 3646 (Part-1)-1992 as most cases low efficacy fluorescent tube lights are used.
- ⇒ Most cases class rooms, laboratories are harnessed Natural Day light through glass window, leading to reduction of necessity of additional lighting loads.
- ⇒ At present switching of indoor lighting system is done manually and no sensor based automatic switching is available after completion of classes. Hence, there is a uncertainty in switching of circuit in correct time, which may lead to loss of power unnecessarily.
- ⇒ At present there is no cloud (IoT) based lighting control system, wherein today switching of lighting system can be easily controlled efficiently by Smart Mobile or Laptop or Desktop through Internet based Router. Connection from any single location.





16.3 Recommended Illumination [Source: IS 3646 (Part 1): 1992]

L - R - H (L- Lower Value of illuminance, H- Higher Value of illuminance, R- Recommended illuminance).

	L	R	H
Office Room	200	300	500
Class Room	200	300	500
Laboratory	300	500	750
Library	200	300	500
Conference Hall	100	200	300

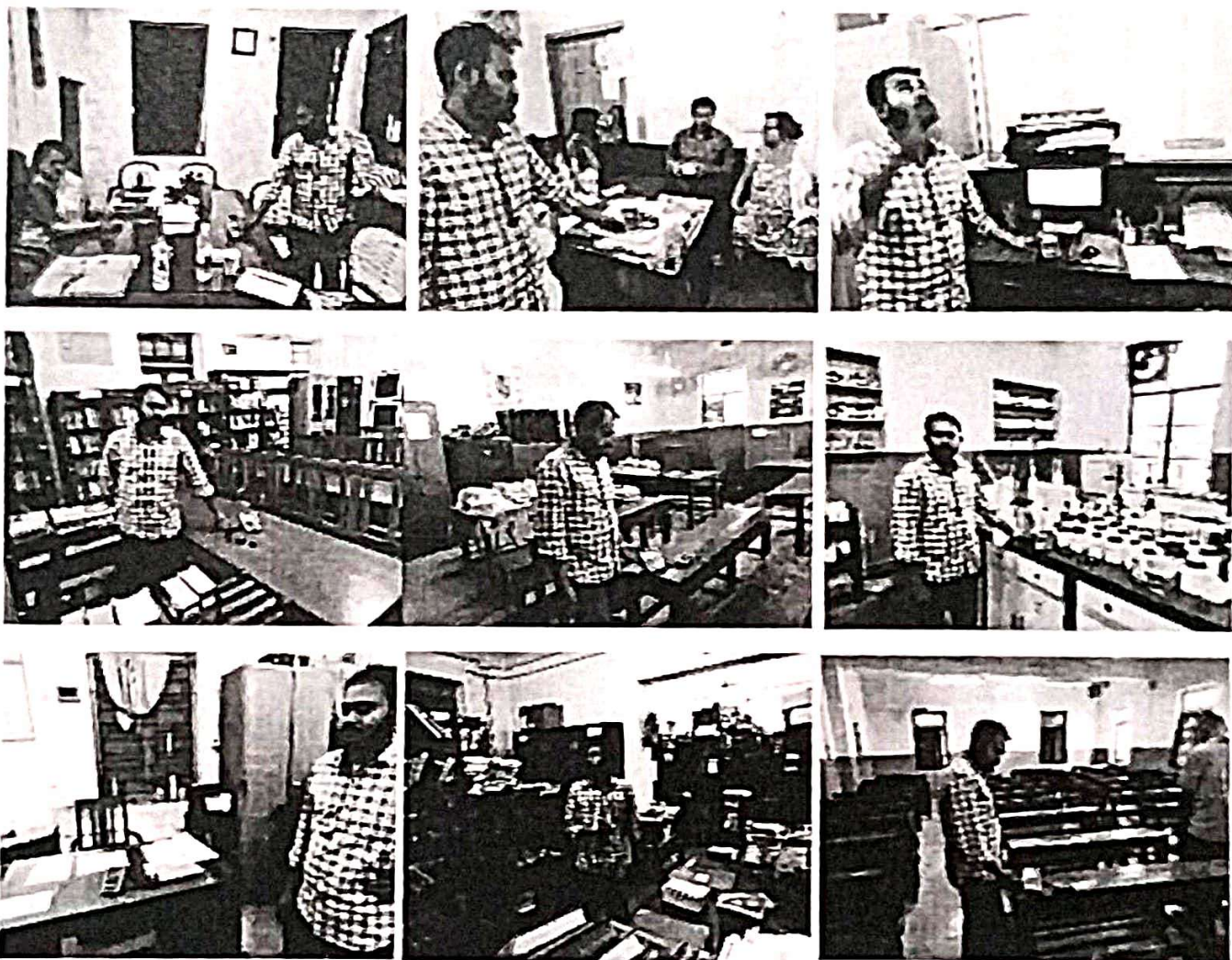


Figure 14 LUX Measurement at different Room





Table 7 Measured Illumination & Power Consumption Profile in Lighting System

Measured illumination & Energy Consumption for Muralidhar Girls College										
Sl. No.	Location/Room	Type of Lamp & Fittings	No. of Glowing Lamp	Watt / Lamp	Watt / ballast	Total Power (kW)	Annual Running Hours	Annual Energy Consumed (kWh)	Avg. LUX Level	LUX As per IS 3646 (Part-1)-1992 (L-R-H)
1.	Gr. Fl. Accounts Room	2 x 36W FTL	8	36	10	0.368	882	325	89.3	200-300-500
2.	Gr. Fl. Office Room	2 x 36W FTL	20	36	10	0.920	882	812	120.3	200-300-500
3.	Gr. Fl. Principal Room	15W LED Fix. (R)	8	15	1	0.128	882	113	206.3	200-300-500
4.	Gr. Fl. Library	2 x 36W FTL	40	36	10	1.840	882	1624	127.1	200-300-500
5.	3rd. Fl. Room-29	2 x 36W FTL	14	36	10	0.644	882	568	129.3	200-300-500
6.	3rd. Fl. Psychology Laboratory	2 x 36W FTL	20	36	10	0.920	882	812	136.7	200-300-500
7.	2nd Fl. Class Room-27 (Projection Room)	2 x 36W FTL	20	36	10	0.920	882	812	196.0	200-300-500
8.	2nd Fl. Chemistry LAB	2 x 36W FTL	16	36	10	0.736	882	649	204.9	200-300-500
9.	1st Fl. Auditorium	1 x 36W FTL	14	36	10	0.644	300	193	233.0	200-300-500
10.	9/Bengali Seminar	2 x 36W FTL	6	36	10	0.276	200	55	99.0	200-300-500
11.	Gr. Fl. Teachers Room	2 x 36W FTL	16	36	10	0.736	919	677	130.9	200-300-500
Total			182	-	-	8.13	-	6639	152	



17.0 Energy Conservation Proposal

Proposal-17.1 (On Current Unbalancing)

Balancing the load current in between phases at main CESC fed incomer main panel by Shifting Single Phase Loads (lights, ceiling fans & split air-conditioners) from higher to lower mutually at different class room, laboratories, teacher room, office room, accounts office room etc & also checking of tightness for feeder cable terminals at MCCB, Bus-bar, MCB, etc. and reduction of Line Losses

17.1.1 Background:

Three-phase unbalance is a familiar issue for power system engineering. This can introduce additional power losses in distribution network in steady states due to both negative and zero sequence components.

From the measurements at CESC fed ground floor incomer main panel, it is seen that large amount of current unbalancing exists in between three phases & considerable amount of unbalance current flows through neutral, which leads to increase line losses (I^2R). It is also noticed that considerable amount of unbalance current flow through neutral conductor, which also heats up neutral conductor & increase losses.

Any large single-phase load or a number of small loads connected to only one phase cause more current to flow from that particular phase causing voltage drop on line. Switching of three phase heavy loads results in current and voltage surges which cause unbalance in the system.

17.1.2 Causes of Unbalance:

Practical imperfections which can result in unbalances are: -

1. Any large single-phase load like fan load, lighting load, computers, Printers, Xerox Machines, UPS, single phase split air-conditioners etc. or a number of small loads connected to only one phase cause more current to flow from that particular phase causing voltage drop on line.
2. Switching of three phase heavy loads results in current and voltage surges which cause unbalance in the system.
3. Flow of triple-n order of harmonics through neutral conductor.
4. Besides, an unbalance can also be quantified by comparing the intensity of negative sequence currents in comparison to the positive sequence currents. The permissible limit in terms of percentage of negative phase sequence current over positive sequence current is 1.3% ideally but acceptable up to 1%.



17.1.3 Summary of Techno-economic Analysis:

SUMMARY OF TECHNO ECONOMICS FOR CURRENT BALANCING IN ELECTRICAL SYSTEM

➤ Annual Energy Saving Potential	: 1153 kWh
➤ Annual Cost Saving Potential	: ₹0.164 Lakh
➤ Investment Required	: ₹0.135 Lakh
➤ Payback Period	: 9.9 Months

Details of techno-economic analysis are given in annexure-1.

Proposal-17.2 (On Energy Efficient Lighting System)

Replacement of all 36W Conventional Fluorescent Tube Lights (FTL) in indoor application step by step with new generation energy efficient & Long Lasting 1 x 20W LED Tube Lights and saving of substantial amount of electrical energy and reduction of maintenance cost

17.2.1 Background:

Presently Muralidhar Girls College uses 655 nos. of conventional 36W Conventional Fluorescent Tube Light with copper ballast, located mainly at all class rooms, laboratory, office room, accounts room, conference hall, auditorium etc, which consume excess power than new generation energy efficient & long-lasting LED lighting fixture. It is well proven that LED Light Fixture is very efficient, which consumes less power corresponding to lumen output.

Power LED Round Fixture for indoor application is designed with high-illumination Power LEDs having a life of 30,000 hours to 50,000 hours. This light has light output similar to fluorescent, and involves a much lower initial investment. The light output is more homogenized then in the existing model, and it provides flicker-free operation from 110V-260VAC.

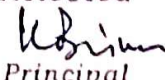
17.2.2 Features of PowerLED Tube Light Indoor Fixture:

- Light emission divided over a greater number of LEDs (for same wattage and total light output), hence more homogenous light and less 'spotty'
- Light output similar to that of standard FTL
- Simplified passive control circuitry provides high reliability of driver; no active SMPS circuitry involved
- Contributes to Power Factor improvement
- Large-chip power LED construction for efficient thermal management of the LED chip, thus providing high reliability and long life

17.2.3 Technical Specifications for 20-watt LED Tube Light (indoor):

- Equivalent to about 36-watt FTL
- Working Voltage- 110 - 260 V AC
- LED lamp Efficacy- Minimum 100 lumens/watt
- Rated system Wattage- 18W \pm 3%

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- Frequency- 50 \pm 1 Hz
- Colour Rendering Index (CRI)- > 80
- Total harmonic distortion (THD)- Should not be more than 20%
- Corrected Colour Temperature (CCT)- 5700 \pm 300 K
- Average Lighting Angle- 160°
- System lumen efficacy- Should be min. 100 lumens / watt
- Power factor- > 0.95
- LED / Type- High Power LEDs should be used
- Life Expectancy (Design life)- Min. 30,000 burning hours
- Ingress Protection- IP20 (Indoor)
- Driver efficiency- More than 85 %

17.2.4 Summary of Techno-economic Analysis:

SUMMARY OF TECHNO ECONOMICS FOR REPLACEMENT OF FLUORESCENT TUBE LIGHT

➤ Annual Energy Saving Potential	: 23120 kwh
➤ Annual Cost Saving Potential	: ₹3.29 Lakh
➤ Investment Required	: ₹3.93 Lakh
➤ Payback Period	: 14.3 Months

Details of techno-economic analysis are given in annexure-2.

Proposal-17.3 (On Energy Efficient Smart BLDC Ceiling Fan)

Replacement of 217 nos. of 70-Watt 48" Conventional Ceiling Fans with new 18 nos. of 28 Watt 48" (ϕ 1200 mm Sweep) most Energy Efficient BEE 5-Star Rated Smart Ceiling Fans and save substantial amount of electrical energy.

17.3.1 Background:

At present Muralidhar Girls' College uses 217 nos. of 70 watt Conventional 48" Ceiling Fans at all class rooms, office rooms, laboratory rooms, conference hall, auditorium etc. During study it was observed that such conventional ceiling fan consumes excess power than new generation low wattage (28 Watt) smart (sensor based) ceiling fan, which saves considerable amount of electrical energy. Hence, it is suggested to replace all conventional ceiling fans with new generation smart energy efficient fans and save considerable amount of electrical energy.

17.3.2 Features of Smart Ceiling Fan:

- a.> Super energy efficient (Brushless Direct Current Motor, BLDC)
- b.> High service value (air delivery/watt)
- c.> Runs 3 times longer on inverter resulting
- d.> No humming noise
- e.> No heating of fan even after long hours of runtime resulting in extra-long life
- f.> Easy speed control using smart remote
- g.> Consistent performance even at low voltage and power fluctuation



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- h.> Timer features to auto switch off the fan
- i.> Sleep mode that reduces the speed after set hours and saves energy

17.3.3 Technical Specifications:

1.> Blade Span (mm/inch)	: 1200/48
2.> RPM	: 380
3.> Service Value	: > 8
4.> Input Voltage (V)	: 140 - 285
5.> Power Consumption (W)	: 28
6.> Frequency (Hz)	: 48 - 52
7.> Air Delivery (CMM)	: 230
8.> Power Factor	: > 0.98
9.> No. of Blades	: 3
10.> Voltage THD	: < 10%
11.> Current THD	: < 2%
12.> Bearing (Double)	: Deep Groove Double Sided Steel Shielding
13.> Remote Control (12 Keys)	: Speed Control, Timer and Sleep Mode

17.3.4 Summary of Techno-economic Analysis:

SUMMARY OF TECHNO ECONOMICS FOR ENERGY EFFICIENT SMART BLDC CEILING FAN

➤ Annual Energy Saving Potential	: 10937 kWh
➤ Annual Cost Saving Potential	: ₹1.56Lakh
➤ Investment Required	: ₹6.18 Lakh
➤ Payback Period	: 47.7 Months

Details of techno commercial analysis are shown in Annexure-3.

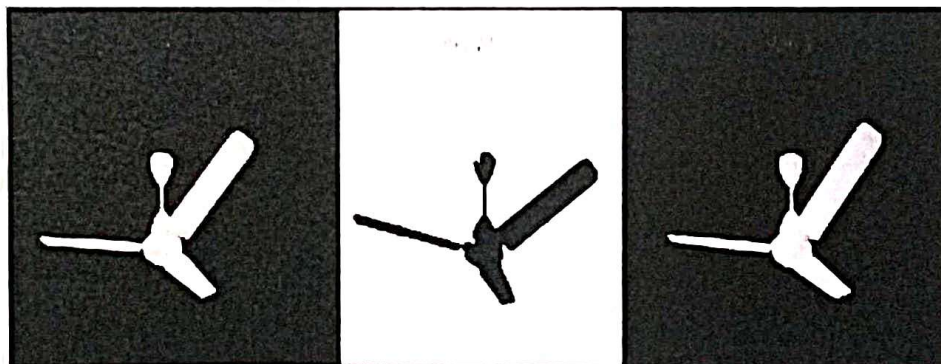


Figure 15 BLDC Smart Ceiling Fan



18.0 Annexure

Annexure 1 Saving Potential by Load Current Balancing at load centres

Analysis for Energy Saving Potential due to Balancing of Load Currents at Load Centres & Reduction of Neutral Current			
Sl. No.	Particulars	Unit	Analysis & Result
1.	Avg. Measured "R" phase Load Current, I_R	Amp.	76.9
2.	Avg. Measured "Y" phase Load Current, I_Y	Amp.	94.5
3.	Avg. Measured "B" phase Load Current, I_B	Amp.	97.6
4.	Mean Load Current, $I_M = (I_R + I_Y + I_B)/3$	Amp.	89.7
5.	Avg. Neutral Current, I_N	Amp.	36.9
6.	Percentage Unbalancing, $((\text{MAX}(I_R : I_B) - I_M) * 100 / I_M)$	%	8.85
8.	Copper Losses in "R" phase, I_R^2	Amp. ²	5909
9.	Copper Losses in "Y" phase, I_Y^2	Amp. ²	8936
10.	Copper Losses in "B" phase, I_B^2	Amp. ²	9526
11.	Copper Losses in "Neutral", I_N^2	Amp. ²	1360
12a.	Overall Cable Resistance of upstream to downstream for phases	Ohm	0.25
12b.	Overall Cable Resistance of upstream to downstream for Neutral	Ohm	0.50
13.	Total Copper Losses due to unbalance currents, $I_{\text{unb}}^2 = I_R^2 * R_R + I_Y^2 * R_Y + I_B^2 * R_B + I_N^2 * R_N$	Watt	6773
14.	For balanced load condition, Current per phase (I)	Amp.	89.7
15.	Total Copper Losses in balance current condition, $3 * I_M^2 * R_{ph} + I_N^2 * R_N$	Watt	6030
16.	Net CU loss due to unbalanced load	Watt	743
17.	Allowable targeted current unbalancing (Max.)	kW	0.743
18.	Power Saving Potential due to balancing of load currents	%	10.0
19.	Annual Load running time of plant	Hour	0.67
20.	Load Factor, LF	p.u.	3600
21.	Loss Load Factor, LLF = $0.2 \text{ LF} + 0.8 \text{ LF}^2$	p.u.	0.659
22.	Annual energy saving due to balancing of load currents	kWh	0.479
23.	Cost of Electricity	₹/kWh	1153
24.	Annual cost of energy saving potential	₹/kWh	14.22
25.	Tentative Investment required for deployment of additional man power for shifting & balancing of single-phase unbalance light & fan loads, AC Load & any other single-phase loads, checking of tightness for all MCCB & MCB cable terminals etc.	₹ Lakh	0.164
26.	Payback Period	Month	0.135
			9.9

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Annexure 2 Techno-Economic Analysis for Replacement of Existing 36W Conventional Fluorescent Tube Light (FTL) with Energy Efficient 20W LED Tube Light

Techno-Economic Analysis for Replacement of Existing 36W Conventional Fluorescent Tube Light (FTL) with 20W LED Tube Light			
Particulars	Unit	Existing	Proposed
Fixture		36W FTL	20W LED TL
Power consumed per Lamp	W	36	20
Power consumed by Ballast	W	10	1
Total power consumed by fixture	W	46	21
Operating Hours/day	Hr	3.7	3.7
Annual days of operation	Day	240	240
Energy Used per year/fixture	kWh	65	30
Energy Rate	₹/kWh	14.22	14.22
Lamp life	hrs	5000	30000
Project Life of Lighting system	Yrs	34.0	34.0
Average Project Life	Yrs	34.0	
Replacement frequency during project lifetime	No.	5.00	0
Replacement frequency/year	No.	0.15	0
Initial Cost/unit	₹	250	550
Annual R & M cost	₹	6936	0
No. of Fixture	Unit	655	
Annual Saving Calculation			
Energy Saving	kWh	23120	
Energy Cost Saving	₹	328760	
Saving in R & M Cost	₹	6936	
Total Annual Saving	₹	335695	
Cost Benefit Calculation			
Capital cost of LED	₹	360250	
Labour & Other Cost	₹/Fixture	50	
Implementation Cost	₹	32750	
TOTAL INVESTMENT	₹	393000	
Annual M & V cost	₹	6550	
Net Annual Monetary Saving	₹	329145	
Simple payback	Month	14.3	



Annexure 3 Analysis of Energy Saving for the Replacement of Conventional Ceiling Fan with Most Energy Efficient Smart Ceiling Fan

Analysis of Energy Saving for the Replacement of Conventional Ceiling Fan with Most Energy Efficient Smart Ceiling Fan

Sl. No.	Particulars	Unit	Analysis & Result
1.	Avg. Power Consumed by 48" Conventional each Ceiling Fan	Watt	70
2.	Number Ceiling Fan exist	Nos.	217
3.	Avg. Running hour per day	hour	6
4.	Running hours per annum	hour	1200
5.	Annual energy consumed by 48" Conventional all Ceiling Fans	kWh	18228
6.	Avg. Power Consumed by each 48" Energy Efficient Smart Ceiling Fan	Watt	28
7.	Power Consumed by all 48" Energy Efficient Smart Ceiling Fans	Watt	6076
8.	Annual energy consumed by 48" Energy Efficient Smart Ceiling Fans	kWh	7291
9.	Annual energy saving potential	kWh	10937
10.	Cost of Electricity	₹/kWh	14.22
11.	Net annual energy cost savings	₹ Lakh	1.56
12.	Net Cost of 48" Energy Efficient Smart Fans	₹ Lakh	6.18
13.	Payback period	Month	47.7



19.0 Details of Vendors & Service Providers

Sl. No.	NAME OF THE PROPOSED SYSTEM	NAME OF THE PROBABLE SUPPLIERS & IMPLEMENTORS
1.	Supplier of 5-Star Rated BLDC Smart Ceiling Fan	S.K. Enterprise 95, Dum Dum Parl, Tank No.-1, Kolkata- 700 055 Tel: 033 2590 5011, Mob: +91 9432674011, 9830472960, Email: skroy09@gmail.com
2.	Supplier of 20-Watt Rate LED Tube Light	S.K. Enterprise 95, Dum Dum Parl, Tank No.-1, Kolkata- 700 055 Tel: 033 2590 5011, Mob: +91 9432674011, 9830472960, Email: skroy09@gmail.com



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7.1.3 D GREEN AUDIT REPORTS

2019-2020 GREEN AUDIT

2020-2021 GREEN AUDIT

2021-2022 GREEN AUDIT

Green Audit Report for 2019-2020

MURALIDHAR GIRLS' COLLEGE

Affiliated to Calcutta University (Re-Accredited by NAAC Grade B++)
P-411/14, Gariahat Road, Ballygunge, Kolkata-700019



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ACKNOWLEDGEMENT

We would like to express a deep sense of gratitude to the authorities of Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 for giving us opportunity to carry out the Green Audit of the college campus. We also acknowledge with much appreciation the crucial role of faculty members and Principal of this college during the preparation of audit report.

The green audit aims to analyze environmental practices within Muralidhar Girls' College, West Bengal campus which will have an impact on the eco-friendly atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of college environment. It was initiated with the motive of inspecting the effort within the institutions whose exercises can cause threat to the health of inhabitants and the environment. Through the green audit, a direction is provided as how to improve the structure of environment and there are several factors that have determined the growth of the green audit.

Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 has assigned Global EHS Consultant, Kolkata to conduct green audit as per the Criteria 7 of NAAC. Global EHS Consultant (GEHSC), Kolkata is the foremost provider of country-specific and industry-academic specific EHS (environment, health, and safety) regulatory analysis. GEHSC, Kolkata is a research and advisory firm with country experts and partners over outside India. GEHSC, Kolkata has delivered critical business and regulatory intelligence to corporate managers and decision-makers around India.

Dr. Susanta Podder (Grad IOSH, PhD, M. Tech, Lead Auditor of ISO 14001, ISO 45001, and ISO 9001) Chief advisor of Global EHS Consultant, Kolkata and Adjunct Associate Professor, Lincoln University, Malaysia along with Ms. Lopamudra Das (Associate Environmental Auditor) visited Muralidhar Girls' College campus on 26.08.2020 and carried out the assessment.

The aim of the Green Audit is to survey the existing environmental practices and to assess the significance of the features found to facilitate the development of Environment Action Plan (EAP) with clear, long-term objectives and the program for implementation.

The overall environment of the college campus is being safe guarded with various activities. The utilization of the renewable resources is being observed through rainwater harvesting unit, reuse of wastewater and green coverage across the college campus.

Waste Management is also effectively managed through safe disposal systems of wet and dry waste. Apart from the implementation of the above, the college management has also been very keen on involving students continuously in creating awareness through several activities.

SPOD
26.08.2020

Introduction

Name Muralidhar Girls' College

Address :P-411/14, Gariahat Road,Ballygunge,Kolkata-700029

Mail Id :

Website : www.muralidhargirlscollege.ac.in

Phone Number : +91 33 2464-1312/4371

Latitude and Longitude : 22°31'03.52" N & 88°21' 55.31" E

Available area of the recreation facility (Green Canopy): 255.488 square meters

Population:

Teaching and non-teaching staff : **117**

Students : **1686**

Facilities

a. Total built-up area around **1021.9526** square meters and the total constructed area is about **3134.5** square meters.

b. Numerous classrooms (**37**) and office rooms (**2**) are available for variety of the classes.

c. Adequate number of sanitary facilities (**17**) separate for male candidates and female candidates, staff-members, students are available.

d. Numerous staff-rooms (**3**), **One** auditorium, **One** conference room are available in the campus.

e. **One** library is available with lots of books, story books and popular magazines.

f. **Two** water-coolers of **500 L** capacity, **3** water purifiers and **3** overhead water tanks of **1500 L** each are available.

g. Solar panel of **5KWP** capacity and **2 LED** street lights are available in the campus.

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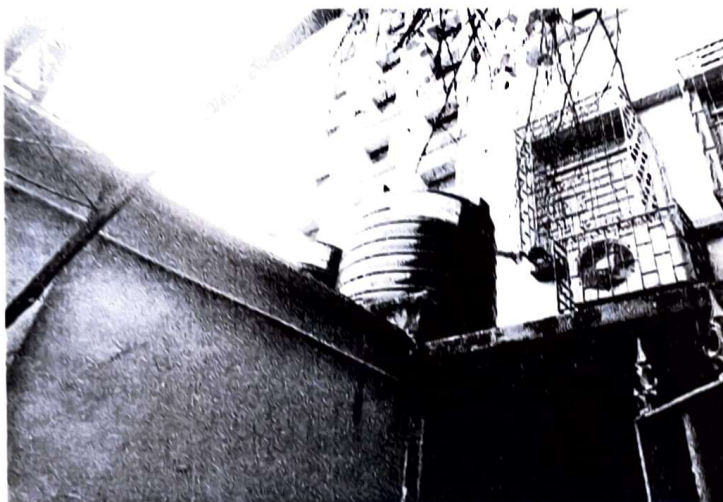

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Muralidhar Girls' College Solar Panel An Initiative to save Energy

ii. 2000 L storage capacity of 2 rainwater harvesting system are available in the campus.



i. One bio-safety cabinet in microbiology lab is available within the campus.


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j. The college campus area, including the canteen is regarded as “plastic free zone.”

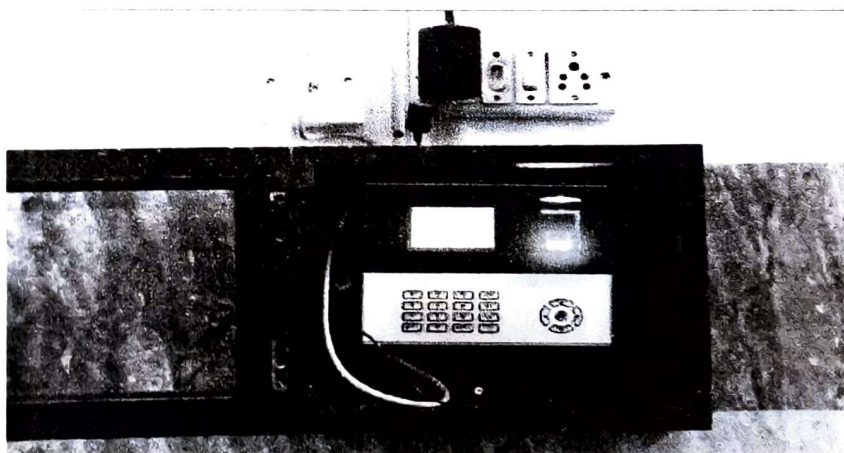


k. Two waste segregation bins are available in the campus for proper waste disposal.

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l. The college campus has installed **one** computerized staff attendance system i.e. biometric machine system.



m. The college has an electronic data processing (**EDP**) unit which provides curricular facilities to the students of the different departments.

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Principal
Muralidhar Girls' College

Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029, West Bengal shows its sensitivity towards the environment by establishing its environmental policy.

The aims of the policy

The policy aims to eliminate or reduce all forms of environmental pollution and encourages all faculty members, staff, students and other stakeholders to do the same. The college always raises awareness of environmental issues among its staff/ students/ stakeholders, especially plastic pollution and encourages initiatives leading towards a clean environment. Its academic departments, NSS and NCC unit, Union Cell works towards this aim collectively.

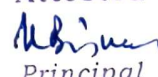
The policy promotes the 3R's for waste in the following order: Reduce, Reuse and Recycle and provide convenient waste collection points and guidance for the disposal of ----

- a. Paper
- b. Cardboard
- c. Glass
- d. Plastic
- e. Electrical items and white goods
- f. Hazardous waste
- g. E-waste.

The college aims to minimize the consumption of water and electricity and mainly solid waste disposal and thereby contribute to the proper use of the natural resource by the following ways:

- a. Encourage reporting leaks and rectifying them promptly.
- b. Progressively replacing/supplementing water-taps in staffroom, washroom etc. if needed.
- c. Establishing rainwater harvesting schemes in the buildings of the campus.
- d. Progressive replacement of light bulbs with energy efficient ones.
- e. Encouraging staff, mainly students to turn off electrical appliances when not in use.
- f. Conserving energy by promoting the use of daylight.
- g. Conducting frequent preventive and corrective maintenance.

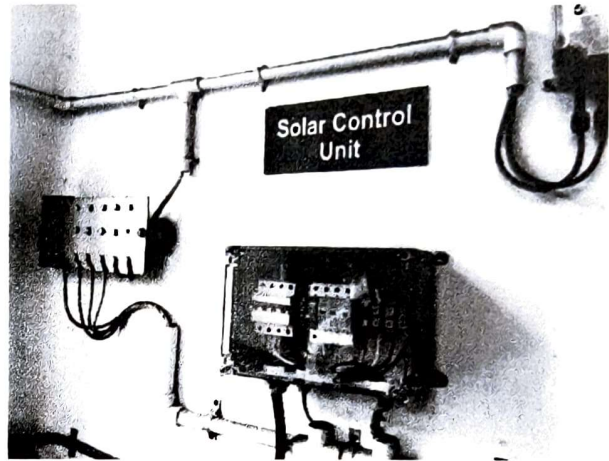
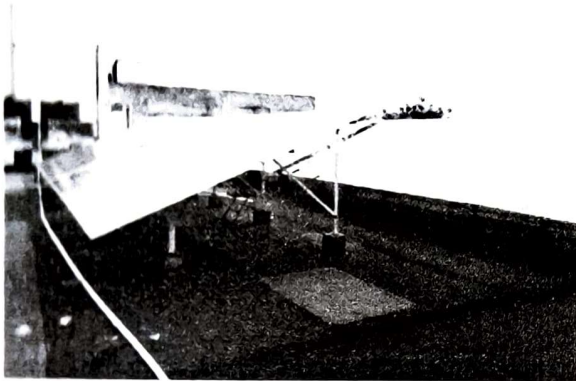
Attested


Principal

Muralidhar Girls' College

a. The college adapts health, safety, and environment-based codes of practice and relevant guidance and complies with legislation.

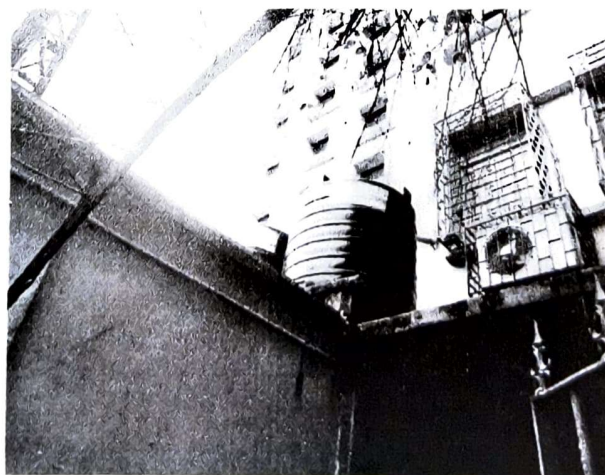
b. The college has planned for Solar panel systems on the campus.



c. The college campus maintained completely free from plastic bags and cups.

d. Waste bins are placed at appropriate sites to maintain a clean and tidy campus.

e. The college has adopted "Roof Top Rain Water "harvesting system to reuse and recycle water.



Attested

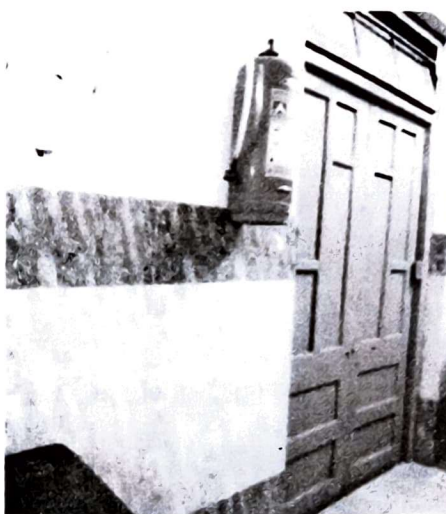
U. Srinivas
Principal

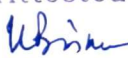
Muralidhar Girls' College

e. Green initiatives are taken by developing medicinal plantation through adequate plantation by the college (N's, NCC Unit and the maintenance cell).



f. The arrangement to set off the fire causing environmental damage by setting the fire extinguishers at different places on the premises.



Attested

Principal
Muralidhar Girls' College


The audit is carried out for the activities at Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata - 700029, West Bengal.



- a. Applicable guidelines of NAAC
- b. Applicable Environmental Legislation
- c. Best environmental practices

In line with the audit definition, the objective of the audit is to have systematic, periodic, planned evaluation against objective evidence and reporting the results to the management as per the focus of the audit. Green Audit focus on the environmental sustainability in terms of applicable environmental elements like Air, Water, Land, Flora, Fauna, Natural resources, and Human being. The very objective of this audit is to evaluate the institutes green performance based on the focus indicators as stated above in view of the goal towards environmental sustainability, applicable legislation, environmental policies and standards. The green audit objectives can be stated as follows.

- a. To review the knowledge and awareness concerns of the institute for the journey of sustainability.
- b. To review the efforts made to protect the environment by preventing pollution and conserving the natural resources being used in the campus.
- c. To establish a baseline data to assess future sustainability and avoid heavy environmental tolls.
- d. To bring out a status report on environmental compliance.
- e. To assess the environmental performance and report it to management/authorities.

Attested

Principal
Muralidhar Girls' College

The scope of the audit is divided into various environmental areas like Land use, water, effluent, sewage, energy etc. Each such area is analyzed based on the evidence produced by the institute. The evidence is collected in form of discussions or interactions, documents and records, practical site conditions and photographs of it.

6. Observation and Recommendation

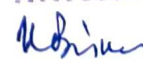
6.1 Land Use

6.1.1 Available Land

Available land in the whole campus is with a limit of 255.488 square meters of which 61.5 ft by 8.5 ft occupies the garden area. 41 is the total number of plants in the garden area. Due to high crowds and shortage of enough space as the college is situated in residential area, it is very difficult to have proper green belt development for noise and pollution reduction within the campus. However, the college has few trees with large canopy cover like Mango, Bakul, Chhatim and Peepal which enhance green cover. In addition, Go Green Club of the college procures and maintains medicinal plants and some ornamentals pots for rich green effect. The garden area is devoid of any threatened plant species. Approximately, 500 litres of water is used in the garden area of the campus whose source is the rainwater harvesting tanks.

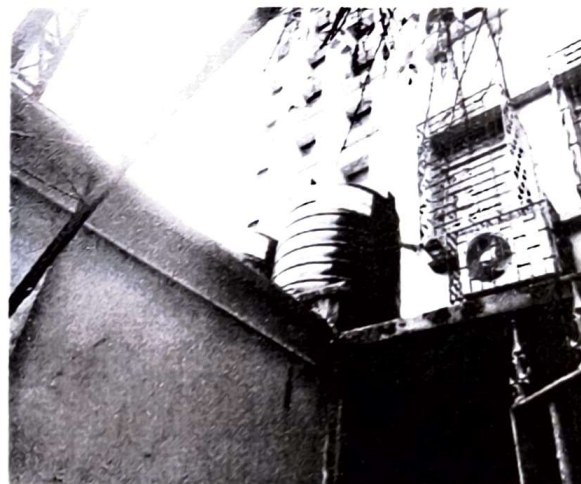
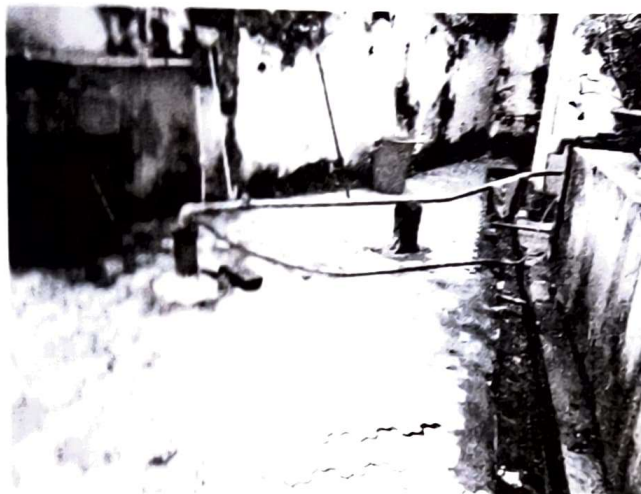
Medicinal plants should be planted in increase number for its value. Common species can be used for plantation since they are more suitable to the local environment and habitat, thus it will become a habitat of the native birds, animals and insects and will help in biodiversity conservation and reclamation. It can be treated as a structural biodiversity creation effort for achieving substantial positive results. Plantation of trees, shrubs and herbs in best possible way according to available space. Indoor plants like snake plant, money plant etc. should be placed at the corner of each corridor of the campus to reduce indoor air pollution and to enhance beautification also.

Attested


Principal

Muralidhar Girls' College

The main source of water supply in the institute are three well built, overhead tanks of each 1500 L capacity i.e. 4500 litres in total. The water supplied from Kolkata Municipal Corporation is stored in underground reservoir for supply in the college campus. Institute has installed two rainwater harvesting system for about 2000 litres capacity. The drinking water of approximately 1000 liters/day is provided through water treatment facility and thereafter to the dispensers at various locations for the ease of access to the students and staff. The non-toxic water gets discharged into underground water. Total quantity of water pumped every day is around 2000 litres. 200 litres and 500 litres of water are used respectively from water-tap for human use and for garden use.



Water conservation

Specific efforts for conservation of fresh water through installing of push taps, auto water taps based on occupancy sensing mechanism. Periodic water audits can be planned and initiated in regular intervals

Electric Energy

Equipment

Major source of electricity in the college campus include electric stove, kettle, microwave, LPG cylinder at canteen, refrigerator, incubator, digital balance(2 in number), centrifuge, autoclave, spectrophotometer, pH meter, 2 LED bulbs of 10 units(9 watt each), 12 AC, 89 computers, 2 Xerox machines, 2 cooling apparatus, 250 ceiling fans and 17 wall fans etc. Machineries like computer, AC and printer are kept in stand by mode when not in use for only 2 hours. Annual electric bill come around 2 lakh 50 thousand. The college adapted some energy conservation methods such as installation of solar light (panel) of 5 KWP capacity to reduce impact of non-renewable energy on light and LED lights. The college runs switch off drills at the premise. One generator is available in the college campus.

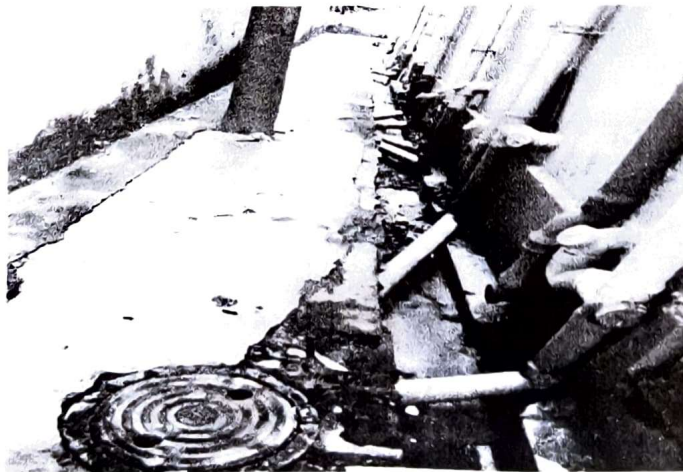
Attested

Principal
Muralidhar Ghosh College



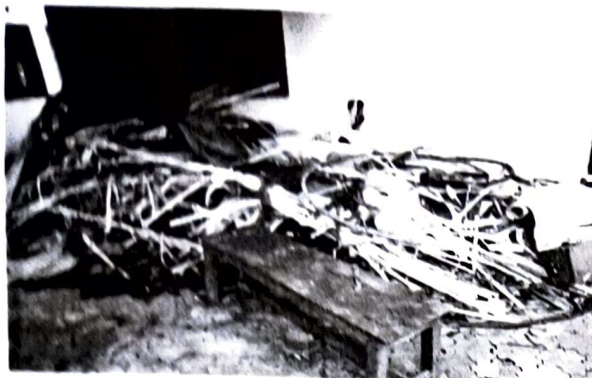
Periodic energy audits can be planned and initiated in regular intervals.

Sewage is generated by the use of water for sanitary (2000 litres/day) from 17 washrooms and canteen (200 litres/day) from 2 water taps. The sewage generated after the use is connected to the municipal sewer lines through the underground tanks and some get mixed with underground water table.



Specific water audit can be conducted to know the water inflow and out flow along with the losses, leakages, wastages etc. to plan actions for water conservation.

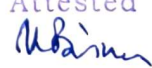
Attested
U. Srinivas
Principal
Muralidhar Girls' College



Institute has started measuring GHG(Green House Gas) emission in terms of considering fuel consumption per students or staff of college. Carbon footprint is the total amount of Green House Gases (GHGs) emitted in terms of carbon dioxide by a person, institute. Carbon Footprint is typically given in tons of CO₂ equivalent per year. Maximum students use public transport system (50 in number), 15 cars by teachers, and 2 times parent-teachers' meeting held in a year. Annual carbon footprint of the college is near about 228105 (Co₂) equivalents.

Good number of visitors visits the campus every year. Institute offer warm and green welcome to them and describes the green initiatives as a part of the induction to them on their visit. Institute has Go Green Club and NSS group which mainly take part in **"Biodiversity and its Conservation"** programme by UGC.

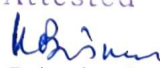
1. Field visit are organized for students and staff members for acquaintance with biodiversity.
2. Introduction of medicinal plants with students.
3. Encourage students to save and plant trees by poster presentation, quiz competition and drawing competition.
4. Nature tours are also conducted for the students.
5. Every year, tree plantation program is organized on World Environment Day.
6. Promote sapling plantation.
7. Regular environmental awareness campaign.
8. Monitoring the amount of water collected from rainwater harvesting and watching the use of this water by the gardener for watering plants.
9. Arrange exhibition and seminar, frequently.
10. Arrange class for fresher's students to make them aware about environment.
11. Distribution of saplings among students and staff members by NSS team to increase awareness and importance of plant kingdom.

Attested

 Principal
 Muralidhar Girls' College


12. Green club and NSS team plant neem sapling (medicinal plant) at the front garden of the college.



The institute thrives hard and sincere efforts are taken towards conservation of environment. Starting with the environmental awareness programs and implementing the practical changes like solar panel installation to conserve energy and use of alternative energy resource. The institute has put effort in the water management system also by installing rainwater harvesting system in the campus. It is noteworthy that the college premise is kept free from plastic pollution within the premise. It shows commitment and responsibility towards the Mother Nature. Institute takes care of the students and staffs as well. The rooms are well ventilated, and premise has enough space and well-equipped.

Attested

Principal
Muralidhar Girls' College

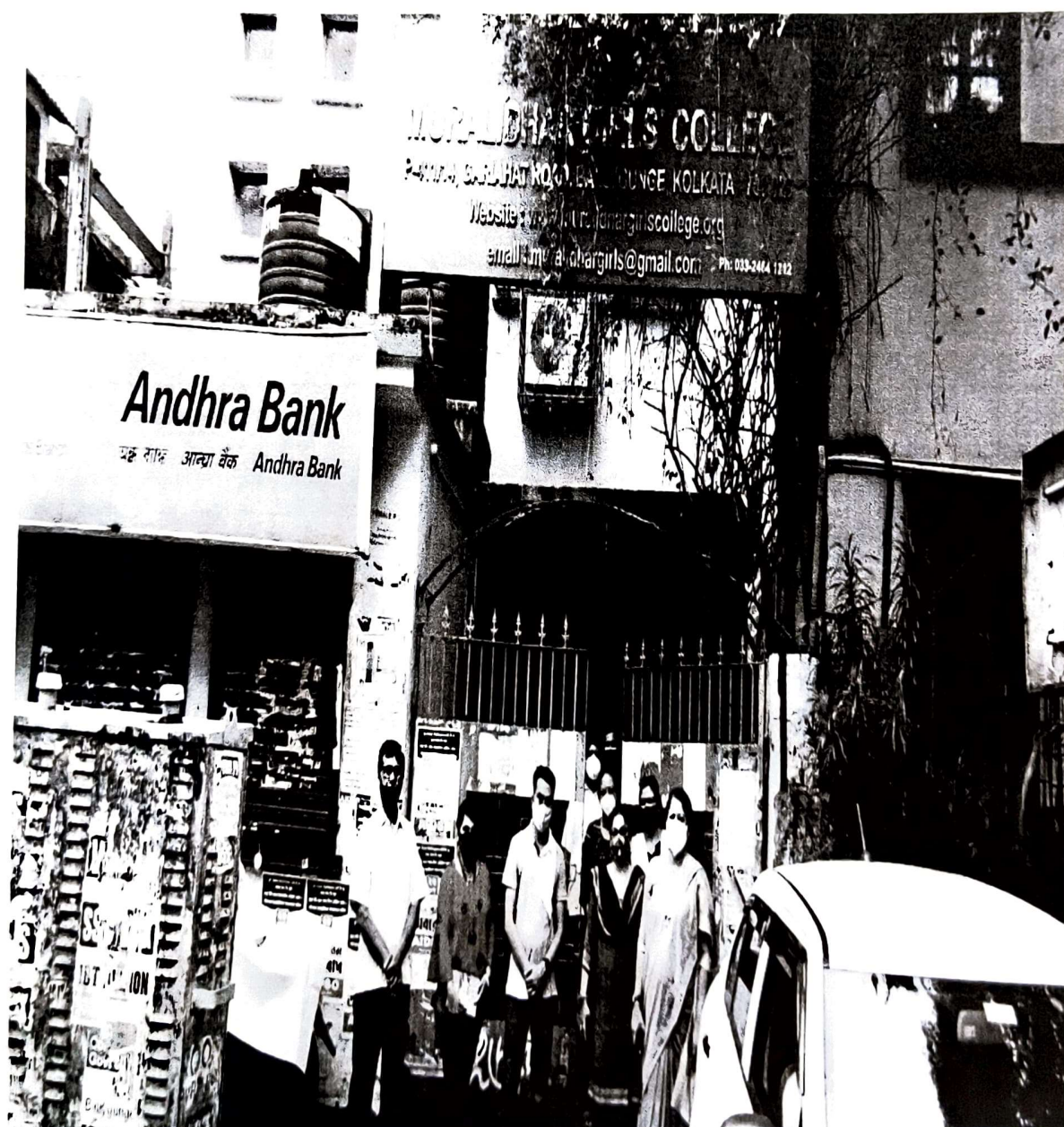
There are always opportunities for improvements which are noted in the different sections for making the activities robust. These would help in the journey of sustainable development which already have been started and reached at a remarkable height.

Attested

Principal
Muralidhar Girls' College

Green Audit Report for 2020-2021

MURALIDHAR GIRLS' COLLEGE

Affiliated to Calcutta University (Re-Accredited by NAAC Grade B++)
P-411/14, Gariahat Road, Ballygunge, Kolkata-700019



Attested

K. B. S. S.
Principal

Muralidhar Girls' College

ACKNOWLEDGEMENT

We would like to express a deep sense of gratitude to the authorities of Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 for giving us opportunity to carry out the Green Audit of the college campus. We also acknowledge with much appreciation the crucial role of faculty members and Principal of this college during the preparation of audit report.

The green audit aims to analyze environmental practices within Muralidhar Girls' College, West Bengal campus which will have an impact on the eco-friendly atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of college environment. It was initiated with the motive of inspecting the effort within the institutions whose exercises can cause threat to the health of inhabitants and the environment. Through the green audit, a direction is provided as how to improve the structure of environment and there are several factors that have determined the growth of the green audit.

Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 has assigned Global EHS Consultant, Kolkata to conduct green audit as per the Criteria 7 of NAAC. Global EHS Consultant (GEHSC), Kolkata is the foremost provider of country-specific and industry-academic specific EHS (environment, health, and safety) regulatory analysis. GEHSC, Kolkata is a research and advisory firm with country experts and partners over outside India. GEHSC, Kolkata has delivered critical business and regulatory intelligence to corporate managers and decision-makers around India.

Dr. Susanta Podder (Grad IOSH, PhD, M. Tech, Lead Auditor of ISO 14001, ISO 45001, and ISO 9001) Chief advisor of Global EHS Consultant, Kolkata and Adjunct Associate Professor, Lincoln University, Malaysia visited Muralidhar Girls' College campus on 7th August 2021 and carried out the assessment.

The aim of the Green Audit is to survey the existing environmental practices and to assess the significance of the features found to facilitate the development of Environment Action Plan (EAP) with clear, long-term objectives and the program for implementation.

The overall environment of the college campus is being safe guarded with various activities. The utilization of the renewable resources is being observed through rainwater harvesting unit, reuse of waste water and green coverage across the college campus.

Waste Management is also effectively managed through safe disposal systems of wet and dry waste. Apart from the implementation of the above, the college management has also been very keen on involving students continuously in creating awareness through several activities.

Introduction

1. General

Name : Muralidhar Girls' College

Address : P-411/14, Gariahat Road, Ballygunge, Kolkata-700029

Mail ID : muralidhargirls@gmail.com **Website :** www.muralidhargirlscollege.ac.in

Phone Number : +91 33 2464-1312/4371

Latitude and Longitude : 22°31'03.52" N & 88°21' 55.31" E

Available area of the recreation facility (Green Canopy) : 255.488 square meters

Population:

Teaching and non-teaching staff : **116**

Students : **1384**

Facilities

a. Total built-up area around **1021.9526** square meters and the total constructed area is about **3134.5** square meters.

b. Numerous classrooms(**37**) are available for variety of the classes.

c. Adequate number of sanitary facilities(**17**) separate each for male and female students, staff-members(**3**) are available.

d. Numerous staff-rooms (**3**), **One** auditorium, **One** conference room are available in the campus.

e. **One** library is available with lots of books, story books and popular magazines.

f. **Two** water-coolers of **500 L** capacity, **3** water purifiers and **3** overhead water tanks of **1500 L** capacity each are available.

g. Solar panel of **5KWP** capacity and **465 LED** lights are available in the campus.

Attested


Principal

Muralidhar Girls' College

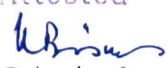


h. 2000 L storage capacity of 2 rainwater harvesting system are available in the campus.



i. One bio-safety cabinet in microbiology lab is available.



Attested

 Principal
 Muralidhar Girls' College

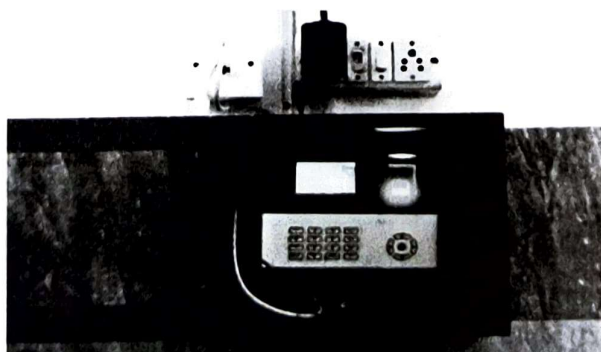
j. The college campus area, including the canteen is regarded as “**plastic free zone.**”



k. **Two** waste segregation bins are available in the campus for proper waste disposal.



l. The college campus has installed **one** computerized staff attendance system i.e. biometric machine system.



Attested
U. Binu
Principal
Muralidhar Girls' College

m. The college has an electronic data processing (EDP) unit which provides curricular facilities to the students of the different departments.

n. **Two** office rooms, **one** browsing centre and **one** sick room are available within the campus.

1.2. Environmental Policy

Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029, West Bengal shows its sensitivity towards the environment by establishing its environmental policy.

The aims of the policy

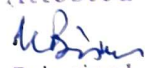
The policy aims to eliminate or reduce all forms of environmental pollution and encourages all faculty members, staff, students and other stakeholders to do the same. The college always raises awareness of environmental issues among its staff/ students/ stakeholders, especially plastic pollution and encourages initiatives leading towards a clean environment. Its academic departments, NSS and NCC unit, Union Cell works towards this aim collectively.

The policy promotes the 3R's for waste in the following order: Reduce, Reuse and Recycle and provide convenient waste collection points and guidance for the disposal of ----

- a. Paper
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The college aims to minimize the consumption of water and electricity and mainly solid waste disposal and thereby contribute to the proper use of the natural resource by the following ways:

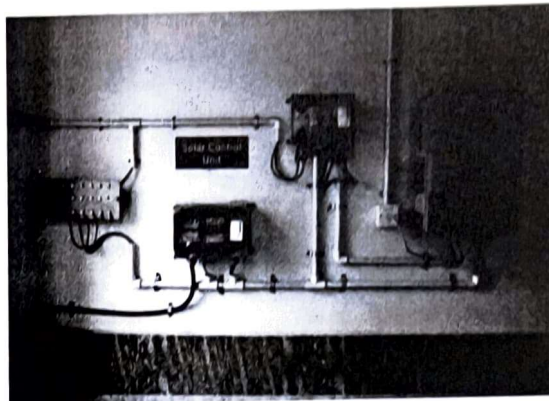
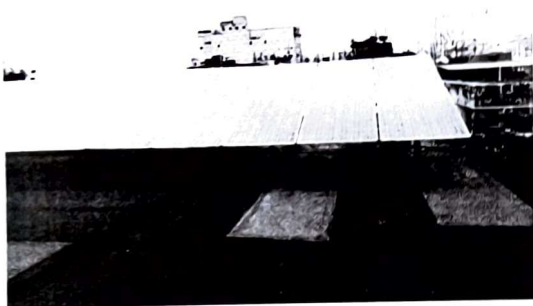
- a. Encouraging to report leaks and rectifying them promptly.
- b. Progressively replacing/supplementing water-taps in staffroom, washroom etc. if needed.
- c. Establishing rainwater harvesting schemes in the buildings of the campus.
- d. Progressive replacement of light bulbs with energy efficient ones.
- e. Encouraging staff, mainly students to turn off electrical appliances when not in use.
- f. Conserving energy by promoting the use of daylight.
- g. Conducting frequent preventive and corrective maintenance.

Attested

Principal
Muralidhar Girls' College

1.3.Steps Taken and Mechanism

a.The college adapts health, safety, and environment-based codes of practice and relevant guidance and complies with legislation.

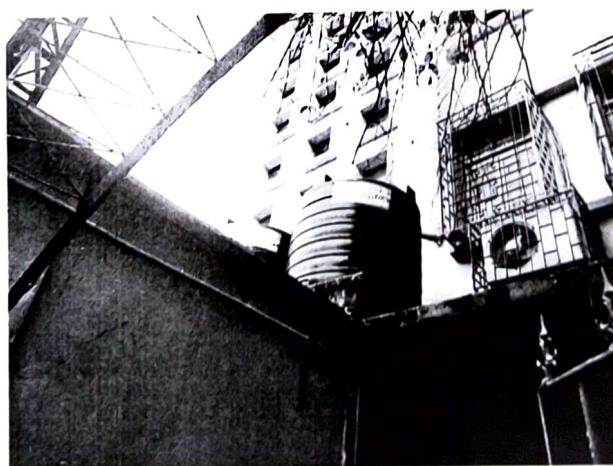
b.The college has planned for Solar panel systems on the campus.



c. The college campus maintained completely free from plastic bags and cups.

d.Waste bins are placed at appropriate sites to maintain a clean and tidy campus.

e. The college has adopted "Roof Top Rain Water"harvesting system to reuse and recycle water.

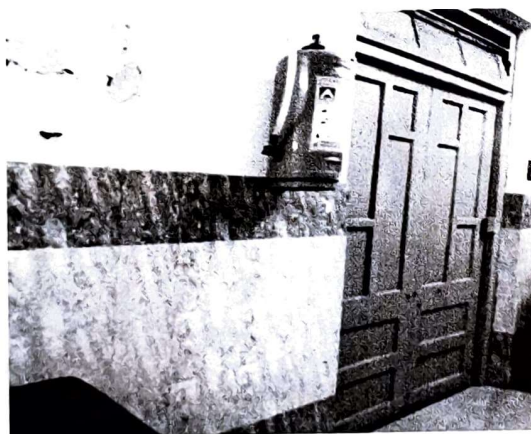


Attested
Ubrin
Principal
Muralidhar Girls' College

e.Green initiatives are taken by developing medicinal plants through adequate plantation by the college(NSS, NCC Unit and the maintenance cell).



f.Arrangement to set off the fire that may cause accident and environmental damage by setting fire extinguishers at different places of the college premises.



g.Social work like distribution of masks and sanitizer by the NSS Team of the college during Covid-19 pandemic scenario.



Muralidhar Girls' College National Service Scheme Wing: An Initiative to fight against Covid-19

Attested
U. B. Kumar
Principal
Muralidhar Girls' College

h. Swachh Bharat Abhiyaan initiatives are taken by NCC Cadets as well as by the college students to keep the college campus clean and tidy.



2. Audit Scope

The audit is carried out for the activities at Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029, West Bengal.



3. Audit Criteria

- a. Applicable guidelines of NAAC
- b. Applicable Environmental Legislation
- c. Best environmental practices

Attested
U. Biswas
Principal
Muralidhar Girls' College

4. Audit Objective

In line with the audit definition, the objective of the audit is to have systematic, periodic, planned evaluation against objective evidence and reporting the results to the management as per the focus of the audit. Green Audit focus on the environmental sustainability in terms of applicable environmental elements like Air, Water, Land, Flora, Fauna, Natural resources, and Human being. The very objective of this audit is to evaluate the institutes green performance based on the focus indicators as stated above in view of the goal towards environmental sustainability, applicable legislation, environmental policies and standards. The green audit objectives can be stated as follows.

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- b. To establish a baseline data to assess future sustainability and avoid heavy environmental tolls.
- c. To bring out a status report on environmental compliance.
- d. To assess the environmental performance and report it to management/authorities.

5. Audit Methodology

The scope of the audit is divided into various environmental areas like Land use, water, effluent, sewage, energy etc. Each such area is analyzed based on the evidence produced by the institute. The evidence is collected in form of discussions or interactions, documents and records, practical site conditions and photographs of it.

6. Observations and Recommendations

6.1. Water Supply

Attested

Principal
Muralidhar Girls' College

Water Sources

The main source of water to the institute are three well-built overhead tanks, each 1500 L capacity i.e. 4500 litres in total and the water supplied from Kolkata Municipal Corporation (KMC) stored in underground reservoir. Water charge is paid along with KMC tax. 500 L of water is pumped once a week and 200 L of water get used from washroom per day by the staff members of the college. Whole college campus has 35 water-taps of which only 100 L water get used and 2 water-taps in canteen of which 200 L of water get used up per day. From rainwater harvesting tanks, 100 L of water get used from April to December month in the year 2020 and only 10 L water during rainy season (June to September) of the same year. 20 L per day water get used from two water-coolers by the teachers and staff-members of the college. No waste water is generated from labs and canteen, only waste water from toilets go to underground sewage. The college has practiced green chemistry i.e. toxic water disposal mechanism within the premise.

Recommendations

Installation of sensor, push taps should be given more importance for sufficient water conservation. Periodic water audits can be planned and initiated at regular intervals.

6.2. Land Cover and Green-Belt Development

Land Use

Available land in the whole campus is with a limit of 255.488 square meters of which 61.5 ft by 8.5 ft occupies the garden area. Due to high crowds and shortage of enough space as the college is situated in residential area, it is very difficult to have proper green-belt for noise and pollution reduction within the campus. However, the college has total 41 plants and few trees with large canopy cover like Mango, Peepal, Simul and Bakul which enhance green cover. In addition, Go Green Club of the college maintains some medicinal plants like Tulsi, Krishna Tulsi, Babui Tulsi, Kalmegh, Vasaka, Sarpagandha, Curry pata, Hadjora, Pudina, Ghritakumari etc and 25 ornamental pots for rich green effect. The garden area is devoid of any threatened plant species. Approximately, 100 litres of water get used every day in the garden area of the campus whose source are the rainwater harvesting tanks. The college has planned to implant neem, turmeric, some vegetable plants and herbs in the campus within next three years.

Attested


Principal

Muralidhar Girls' College

Recommendations

Indoor plants like snake plant, money plant, spider plant, African violet etc. can be placed at the corner of each corridor of the campus to reduce indoor air pollution and to enhance beautification also. Medicinal plants to be maintained properly for their appropriate growth and vigor.

6.3. Sewage Management

Sewage

Sewage is generated by the use of water for sanitary (200 litres per day) from 14 common washrooms and 3 washrooms from staff-room. The sewage generated after the use is connected to the municipal sewer lines through the underground tanks and some get mixed with underground water table.

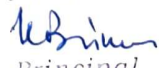
Recommendations

Specific water audit can be conducted to know the water inflow and out flow along with the losses, leakages, wastages etc. to plan actions for water conservation.

6.4. Energy

Energy Source

Maximum energy consumption occurs from principal's room and staff-rooms of the college. Major source of electricity usage in the college campus include electric kettle, electric bulb of 10 units (9 watt \times 6 hours per day \times 2 days per month), 250 ceiling fans (320 watt per month), 17 wall fans (1200 watt per month), 89 computers (720 watt \times 2 days per month), 12 split AC and one window AC, 2 photocopy machine (1 hour per day \times 2 days) etc. Machineries like computer, AC and printer are kept in stand-by mode when not in use for only 2 hours. Annual electric bill come around 18,520. The college has adapted some energy conservation methods such as installation of solar panel of 5 KWP capacity to reduce impact of non-renewable energy and 465 LED lights (run approximately 6 hours per day \times 2 days per month). The college runs switch off drills at the premise. One generator is available in the college campus. Not much energy consumption occurs from air conditioner, refrigerator, incubator, digital balance (2), spectrophotometer, autoclave and pH meter, heater, television etc. this year. Approximately 1.5 kilowatt energy gets used up from solar panel this year.

Attested

Principal
Muralidhar Girls' College

Recommendations

More LED and halogen (eco-incandescent) bulbs should be placed in the college campus for sufficient energy conservation. Periodic energy audits can be planned and initiated in regular intervals.

6.5. Solid Waste Management

Solid Waste

No specific amount of solid waste is being generated from the college as the college canteen has been shut down due to lockdown and unavailable of student strength. Minimum amount of solid waste was generated from staff-rooms only which get disposed off smoothly to the KMC (Kolkata Municipal Corporation).

Recommendations

Besides dumping of solid wastes in landfill, it can be treated through biodegradable fertilizer pit.

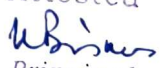
6.6. E-Waste Management

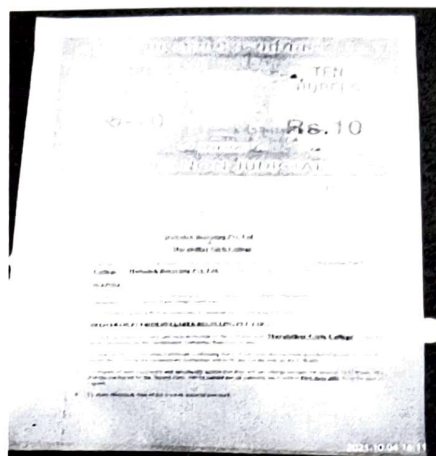
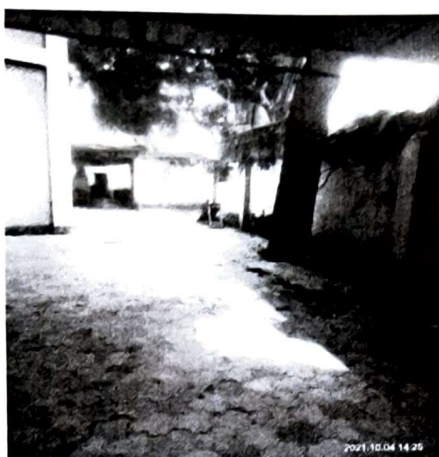
E-Waste

Since the organization is well established and equipped with the necessary and up-to-date electronic infrastructure, the e-waste generation like scraped computers, laptops, xerox machines are produced in a minimal amount. However, as a proactive initiative, an authorized vendor is identified for disposal of e-waste in case it is generated i.e. the college has tie-up with renowned E-waste company, Hulladek Recycling Pvt.Ltd and also signed with "MOU" (Memorandum of Understanding) this year to provide management of electronic waste.

Recommendations

Immediate transfer of e-wastes to the authorized recycler should be ensured.

Attested

Principal
Muralidhar Girls' College



6.7. Carbon Footprint

Institute has started measuring GHG (Green House Gas) emission in terms of considering fuel consumption per students or staff of college. Carbon footprint is the total amount of Green House Gases (GHGs) emitted in terms of carbon dioxide by a person, institute. Carbon Footprint is typically given in tons of CO₂ equivalent per year. Maximum students use public transport system (10 in number), 1 car by principal and 2 times parent-teachers' meeting held in a year. Annual carbon footprint of the college is near about 23,310 (CO₂) equivalents.

6.8. Other Environmental Initiatives

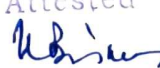
Go Green Club and NSS group of the college have taken initiatives for "**Biodiversity Conservation**" in the pandemic year.

To commemorate World Environment Day

1. Students are encouraged to participate in online poster presentation, quiz competition and drawing competition on different topics related to environment.
2. They also undertook sapling or tree plantation in and around their houses.

Additional activities include:

3. Online environmental awareness campaign.
4. Monitoring the amount of water collected from rainwater harvesting tanks and watching the use of this water by the gardener for watering plants.

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 Principal
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5. Arranged webinars maximum on environmental topics.
6. Arrange online class for fresher students to make them aware about environment.
7. Distribution of saplings among students and staff members by NSS team to increase awareness and understand the importance of plant kingdom.
8. Green Club and NSS team plant neem-sapling (medicinal plant) at the front garden of the college.



7. Conclusion

The institute thrives hard and sincere efforts are taken towards conservation of environment. Starting with the environmental awareness programs and implementing the practical changes like solar panel installation to conserve energy and use of alternative energy resource. The institute has put effort in the water management system also by installing rainwater harvesting system in the campus. It is noteworthy that the college premise is kept free from plastic pollution within the premise. It shows commitment and responsibility towards the Mother Nature. Institute takes care of the students and staffs as well. The rooms are well ventilated, and premise has enough space and well-equipped.

There are always opportunities for improvements which are noted in the different sections for making the activities robust and the institute might try to achieve the proposed recommendations or suggestions more effectively after post-pandemic scenario. These would help in the journey towards a sustainable future which already have been started and reached at a remarkable height.

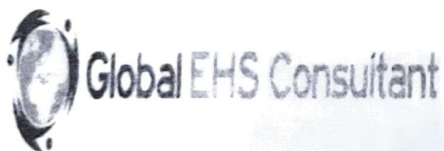
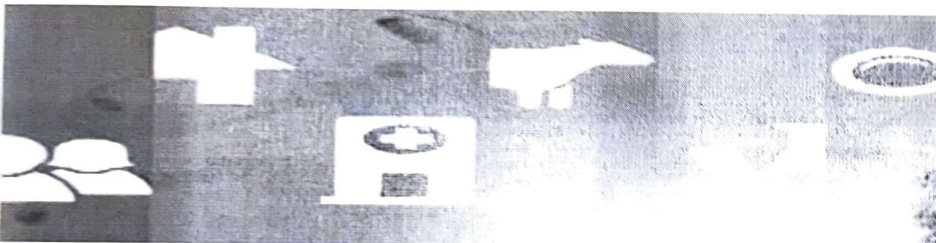
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 Principal
 Muralidhar Girls' College

GREEN AUDIT REPORT

MURALIDHAR GIRLS' COLLEGE

College Address: 45, Ghat Road, Ballingrue, Kall - 700029

As part of NAAC Assessment Compliance**Global EHS Consultant**

Add: Kolkata-700119, West Bengal, India

Phone: +91-9831590983

Email: globalehsc@gmail.com, www.globalehsc.com

Final Green Audit Report

Attested

Principal

Muralidhar Girls' College

16-12-2022

CONTENT

- Certificate 3
- Acknowledgement 4
- Concept and Context 5-6
- Introduction 7
- Overview of the College 8-9
- Facilities of College 10-12
- Courses Offered by College 13
- Google Map View of the College 13
- Vision, Mission and Objective of College 14
- Green Audit Cell 15
- Executive Summary 16
- Environment & Green Audit Analysis 17
- Environmental Policy 18-20
- Green Audit Analysis & Recommendations
 - 1) General Information 22
 - 2) Water Consumption and Management 23
 - 3) Biodiversity Observation and Management 24
 - 4) Sewage Observation and Management 25
 - 5) Solid Waste Observation and Management 26
 - 6) E-Waste Observation and Management 26
 - 7) Energy Observation and Management 27
 - 8) Carbon Footprint Observation and Management 27
 - 9) Other Environmental Initiative 28
- Conclusion 29



Global EHS Consultant

CERTIFICATE

PRESENTED TO

Muralidhar Girls' College

Affiliated to Calcutta University

P-411/14 Gariahat Road Ballygunge Kolkata-700029

Has been assessed FY 2021-22 by Global EHS Consultant Pvt.Ltd for the comprehensive study of environmental impacts on institutional working framework to fulfill the requirement of

GREEN AUDIT

The green initiatives carried out by the institution have been verified on the report

Submitted and was found to be satisfactory.

The efforts taken by the management and the faculty towards environment and sustainability are appreciated and noteworthy.

Date: 16th Dec 2022

Global EHS consultant, Kolkata, West Bengal, India

Attested


Principal

Muralidhar Girls' College

ACKNOWLEDGEMENT

We would like to express a deep sense of gratitude to the authorities of Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 for giving us opportunity to carry out the Green Audit of the college campus. We also acknowledge with much appreciation the crucial role of faculty members and Principal of this college during the preparation of audit report.

The green audit aims to analyze environmental practices within Muralidhar Girls' College, West Bengal campus which will have an impact on the eco-friendly atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of college environment. It was initiated with the motive of inspecting the effort within the institutions whose exercises can cause threat to the health of inhabitants and the environment. Through the green audit, a direction is provided as how to improve the structure of environment and there are several factors that have determined the growth of the green audit.

Muralidhar Girls' College, P-411/14, Gariahat Road, Ballygunge, Kolkata-700029 has assigned Global EHS Consultant, Kolkata to conduct green audit as per the Criteria 7 of NAAC. Global EHS Consultant (GEHSC), Kolkata is the foremost provider of country-specific and industry-academic specific EHS (environment, health, and safety) regulatory analysis. GEHSC, Kolkata is a research and advisory firm with country experts and partners over outside India. GEHSC, Kolkata has delivered critical business and regulatory intelligence to corporate managers and decision-makers around India.

Dr. Susanta Podder (Grad IOSH, PhD, M. Tech, Lead Auditor of ISO 14001, ISO 45001, and ISO 9001) Chief advisor of Global EHS Consultant, Kolkata and Adjunct Associate Professor, Lincoln University, Malaysia along with Ms. Lopamudra Das (Associate Environmental Auditor) visited Muralidhar Girls' College campus on 16.12.2022 and carried out the assessment FY – 2021-22.

The aim of the Green Audit is to survey the existing environmental practices and to assess the significance of the features found to facilitate the development of Environment Action Plan (EAP) with clear, long-term objectives and the program for implementation.

The overall environment of the college campus is being safe guarded with various activities. The utilization of the renewable resources is being observed through rainwater harvesting unit, reuse of wastewater and green coverage across the college campus.

Waste Management is also effectively managed through safe disposal systems of wet and dry waste. Apart from the implementation of the above, the college management has also been very keen on involving students continuously in creating awareness through several activities.

For Global EHS Consultant, Kolkata



(Dr. Susanta Podder)

Grad IOSH, PhD, M. Tech,

Lead Auditor of ISO 14001, ISO 45001, and ISO 9001

Chief advisor of Global EHS Consultant, Kolkata

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Principal
Muralidhar Girls' College

CONCEPT AND CONTEXT

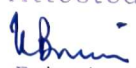
CONCEPT

The National Assessment and Accreditation Council, New Delhi (NAAC) has made mandatory from the academic year 2016 onwards that all Higher Educational Institutions should submit an Annual Green or Environment Report. Green Audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation. Moreover, it is part of Corporate Social Responsibility (CSR) of the Higher Educational Institutions to ensure that they contribute towards the reduction of global warming through Carbon Footprint reduction measures.

In view of the NAAC circular regarding Green auditing, the college management decided to conduct an internal environment assessment study by a competent internal professional auditor. The green audit aims to examine environmental practices within and outside Muralidhar Girls' College campus which impact directly or indirectly on the atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of college environment. It was initiated with the intention of reviewing the efforts within the college whose exercises can cause risk to the health of inhabitants and the environment.

Through the green audit, a direction as how to improve the structure of environment and inclusion of several factors that can protect the environment can be commenced.



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Principal
Muralidhar Girls' College

CONTEXT

In India, the process for environmental audit was first mentioned under the Environment Protection Act, 1986 by the Ministry of Environment of Forest and Climate Change (MOEFCC) on 13th March, 1992. As per this act, every person owning an industry or performing an operation or process needs a legal consent and must submit an environmental report or statement.

In view of the NAAC circular regarding environment auditing, the College Management decided to conduct an internal environment assessment study by a competent internal professional auditor headed by Prof.(Dr)Kinjalkini Biswas, Principal of Muralidhar Girls' College. The college first started green audit in the year 2016 and accredited with grade 'B++'.

The term 'Environmental Audit' or 'Green Audit' means differently to different people. Terms like 'assessment', 'survey' and 'review' are also used to describe similar activities. Furthermore, some organizations believe that an 'environmental audit' addresses only environmental matters whereas others use the term to mean an audit of health, safety and environment-related matters. Although there is no universal definition of Green Audit, many leading companies/institutions follow the basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication of Environmental Auditing (1989).

The **ICC defines Environmental Auditing** as:

"A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects."

The outcome of audit should be established with concrete evidence that the measures undertaken and facilities in the college under green auditing. This audit focuses on the Green Campus, Waste Management, Water Management, Air Pollution, Energy Management & Carbon Footprint etc. being implemented by the college.

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Muralidhar Girls' College

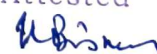
INTRODUCTION

Now days, the educational institutions are becoming more thoughtful towards the environmental aspects and as a result new and innovative concepts are being introduced to make them sustainable and eco-friendly. To preserve the environment within the institution, a number of viewpoints are applied by the several educational institutes to solve their environmental problems such as promotion of saving the energy, waste recycle, water consumption reduction, water harvesting and many more.

The activities carried out by the institution can also create adverse environmental impacts. Green audit is defined as an official inspection of the effects an institution has on the environment. Green Audit is conducted to evaluate the actual scenario at the institution campus. Green audit can be a useful tool for a college to determine how and where they are using the most of the energy or water or resources; the college can then decide how to implement changes and make savings. It can also be used to determine the nature and volume of waste, which can be used for a recycling project or to improve waste minimization plan.

Green auditing and the application of mitigation measures is a win-win situation for all the institutions, the learners and the mother earth. It can also result in health awareness and can promote the environmental awareness, values and beliefs. It provides a better understanding to staff and students about the Green impact on institution. Green auditing also upholds financial savings through reduction of resource usage. It gives an opportunity to the students and teachers for the development of ownership of the personal and social responsibility. The audit process involves primary data collection, site walk with the team of College including the assessment of policies, activities, documents and records.

Attested



Principal

Muralidhar Girls' College

Overview of the College

History

Muralidhar Girls' College began as a girls' school with a small number of students in 1919. The founder was Sri Muralidhar Bandhopadhyay, Principal of Sanskrit College, a well-known scholar and educationist, whose dream was to inspire young women as ideals of national tradition and culture. His dream was fulfilled later on July 8th, 1940 when the school developed into Ballygunge Girls College with the distinguished educationist Sri Nalini Mohan Shastri as Principal. In 1945, the college was permanently affiliated to the University of Calcutta and a year later it was renamed Muralidhar Girls' College as a mark of respect to the founder's memory. His worthy son, Sri Hironmoy Bandhopadhyay, IAS, Ex Vice-Chancellor, Rabindra Bharathi University became Vice President of the College Governing Body and arranged a grant of 3 lakh from the Government of India for the construction of a 3 storied building on Gariahat Road where the college has since been housed. The college is at present enlisted in the UGC panel of recognized colleges in West Bengal under section 2(f) & 12(B) of the UGC Act. It is also registered under West Bengal Societies Registration Act, 1961. The total land area of the college is 0.25253 acre over which it has undisputed ownership. The total constructed area is 3134.5 square meters.

Overview

Muralidhar Girls' College situated at the heart of the city is one of the premier institutes of women's education in Kolkata, West Bengal. The college started with a humble beginning in 1940, soaring high steadily through a span of 80 years in academics as well as in NCC and NSS establishing itself as a heritage institution. The college received B++ grade by UGC-NAAC in September 2016. As a significant mark of achievement, 2016 marks the receipt of the prestigious RUSA grant of 2 crores for the development and betterment of the college. This reputed college in Kolkata provides various Arts and Science courses affiliated under the University of Calcutta and is particularly attentive towards the empowerment of girl students. A 3 year (job-oriented) degree course under the University of Calcutta, Tourism and Travel Management (TTMV) caters for jobs in all government and non-government sectors. CBCS system which is currently followed in the college is a modern, well-structured and efficiency building method of learning. It is systematically distributed over six semesters. Students get the opportunity to have higher skills specific to their chosen subject which will make them more

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Principal

Muralidhar Girls' College

suitable to fit better in this competitive market. The college has opened honours in core science subjects like Chemistry and Mathematics from academic session 2017-18. Physics and Microbiology have received affiliation from the University of Calcutta from 2017-18 as general subjects thus strengthening the science wing of the college. College sponsored career and market oriented add on courses that have utility for job, self-employment and empowerment of the students are conducted for their benefit. Last year, 95% students benefitted from the Kanyashree Prakalpa. Apart from this, numerous other scholarships like Minority, SC/ST/OBC, Udayan etc are catered to. Abiding by the CU rules, there is a sports quota for national, state or district level performers who are provided with various facilities. The college organizes conferences, workshops, and placement training sessions for the betterment of the students. The NCC and NSS units are active at local, state and national levels. College sports, functions and prize distribution ceremonies are organized every year. Committees such as the Discipline Committee, Anti-Ragging Committee, Internal Complaints Committee, Grievance Redressal Cell etc address the concerns of the students. IGNOU (Indira Gandhi Open University) study centre in this college fulfills the higher educational aspirations of our students and paves the way for an inclusive knowledge society for all. The motto of the college 'Atmadeepa Bhava' is the guiding principle of self enlightenment and journey of search of oneself that the college stands for. Sincerity and honesty when coupled with the right amount of tenacity always ends with something good for an individual, for the college and for the country, as our students are the future citizens who will mark the world with their footsteps. The motto teaches them to introspect their actions both past and present- introspection of what they are, what their wrong doings are so that they can watch, analyze and come out with a solution of making better decisions in the future. So introspection, diagnosis and action taken are the keywords emphasized in their steps for a successful forward march.

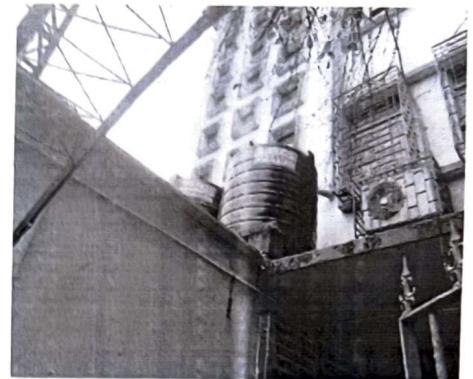


Attested
M. B. S.
Principal
Muralidhar Girls' College

FACILITIES

Harvested Rainwater

The college has established two rainwater harvesting tanks of approx. 1000 L each which is a good initiative facilitating reuse and recycle water in the campus.



Solar Energy

The college has established renewable panel of 5 KWP which is a great initiative for generation of clean electricity during energy shortage smoothly in the campus.



Muralidhar Girls' College Solar Panel - An Initiative to save Energy

Waste Segregation Bin

The college has kept separate waste bins both for hazardous and organic waste inside campus thus educating students for proper waste management.



Attested
K. B. Srinivas
Principal
Muralidhar Girls' College

Plastic-Free Campus

The canteen which provides students with hygienic and healthy food and also the college campus is totally maintained free from single-use plastic which is another good initiative by the college.



Vending Machine

The college has implemented sanitary vending machine this year which is a great initiative for the female population of the college.



Gym

The college has well equipped gym for fitness both for girls and boys. NCC students use gym corner the most.



Medical Unit

The college has a medical facility for students as well as for teachers and staffs attended by Dr. Suchandra Das (M.B.B.S-Cal) for emergency purposes equipped with first-aid box and a proper sick room.



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Principal
Muratidhar Girls' College

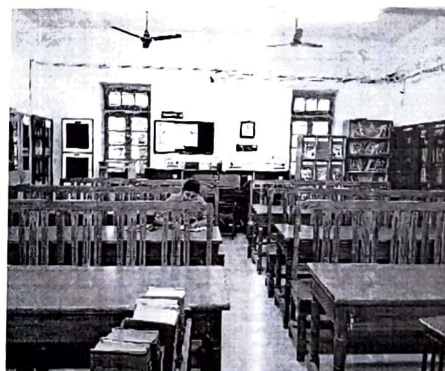
Labs

The science building of the college has well-equipped labs of department such as chemistry, physics, geography, computer science etc with facilities of computers, equipment and instruments as well. Students get good exposure of practical knowledge of their subject in perspective of theoretical aspects as well.



Library

The college library has almost 43,000 books on all subjects taught in the college where 60 students can accommodate at a time. The stock of books has undergone considerable expansion and exhaustive collection adequately which meets the varied requirements of all students and teachers. Great care is taken to create quiet and tranquil atmosphere inside the room. Every department has a separate seminar library.



BioSafety Cabinet

The microbiology department of the college has arranged a biosafety cabinet to prevent contamination during laboratory work.



Nature Club

“Go Green’ is the nature club of the college which considers care for nature as a co-curricular activities of the students with mission to nurture environment regenerate, maintain and preserve lands and water through single, self-reliant, low impact lifestyle through sustained contribution and conservation effort.

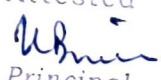
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Principal
Muralidhar Girls' College

COURSES OFFERED

ENGLISH	BENGALI	SANSKRIT	EDUCATION	HISTORY
PHILOSOPHY	POLITICAL Sc	SOCIOLOGY	JOURNALISM & MASS COMM.	BOTANY
CHEMISTRY	ECONOMICS	GEOGRAPHY	MATHEMATICS	PSYCOLOGY
FILM STUDIES	TOURISM & TRAVEL MANAGEMENT	MICROBIOLOGY	STATISTICS	SKILL ENHANCEMENT COURSE

Google Map View of the College



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 Principal
 Muralidhar Girls' College

Vision Mission & Objectives of College

VISION

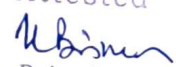
The vision of the college is the empowerment and enlightenment of women through value-based and quality education so as to foster informed global minds. The institution also has a proactive role in enabling the girl student for income generation and sensitizing them to international issues, so that they become truly equipped global citizens.

MISSION

The mission of the college is succinctly expressed through motto "ATMADIPO BHABO". The institution aims at holistic development of unexplored potential of students. The mission of the institution is consonant with the Millenium Development Goal (MSD)-"Promote gender equity and empower women" (UNDP, Human Development Report 2002) and the National Education Policy to extend equal socio-technological opportunities to all students of the college.

OBJECTIVES

- To empower the students to know and ask for their rights to education, health, shelter, food and clothing.
- To empower the students to fight against every form of indiscrimination.
- To enable students to take decisions and accept responsibilities.
- To cater to the needs of the society through capacity building of the students.
- To empower the students scientifically through Information and Communication Technology (ICT) enabled education to face global challenges.
- To empower the students with necessary socio-political awareness so that they become effective members of the civil society.
- To inculcate in the students moral, social, secular and ethical values.
- To sensitize and educate the students about environment and sustainable development.
- To create a healthy, competitive academic environment by continuous upgradation of teaching-learning process through research and ICT advancements.

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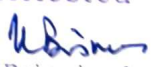
Green Audit Cell

On behalf of Muralidhar Girls' College

NAME	POSITION
Dr. Kinjalkini Biswas	Principal
Dr. Shampriya Chowdhury	Convenor
Dr. Suvasree Dutta (Dasgupta)	IQAC Co-Ordinator
Dr. Sangita Das Chowdhury	State-Aided Teacher
Sri. Sontu Bugh	Assistant Professor(Botany Department)
Dr. Bandana Das	Assistant Professor(Mathematics Department)
Smt. Rita Nag & Kaberi Roy	Graduate Laboratory Instructor & Office Staff

On behalf of Global EHS Consultant Pvt. Ltd

NAME	POSITION	QUALIFICATIONS
Dr. Susanta Podder	Lead Auditor	Ph.D, M.Tech, Lead Auditor ISO 14001, 45001, 9001
Lopamudra Das	Co-Auditor	M.Sc in Environmental Management

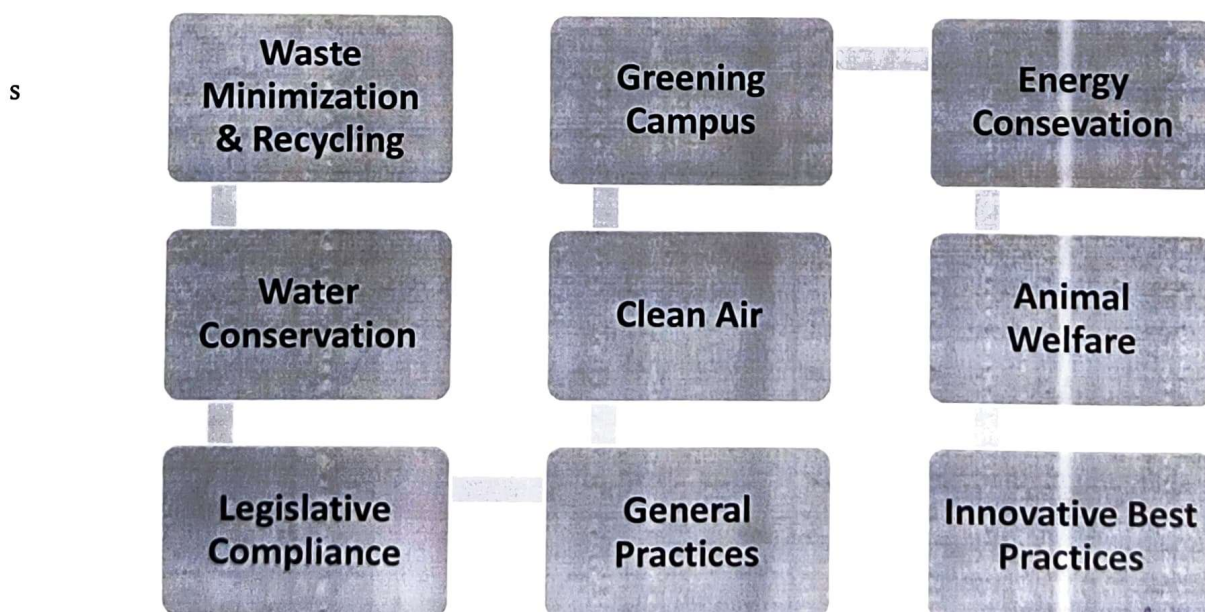
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Principal
Muralidhar Girls' College

Executive Summary

Green auditing is an essential step to identify and determine whether the college practices are sustainable and ecological. It is a snapshot in time in which one assesses campus performance in complying with applicable environmental laws and regulations. But over the period of time, excessive usage of resources like water, electricity, petrol, etc. have become habitual for everyone especially, in urban and semi-urban areas. It is actually the right time to check if we (our process) are consuming more than required resources? Whether we are using resources sensibly?

Green audit standardizes all such practices and provides an efficient way to use natural resources. In the time of climate change and resource exhaustion it is necessary to re-check the processes and convert it in to green and sustainable. Green audit provides an approach for it. It also increases overall awareness among the individuals working in college towards an eco-friendly environment.

This is the second attempt to conduct a green audit of Muralidhar Girls' College campus for fulfillment of NAAC criteria. Audit criterion is environmental cognizance, waste minimization and management, biodiversity conservation, water conservation, energy conservation and environmental legislative compliance by the campus. A questionnaire is used during audit. This audit report contains observations and recommendations for improvement of environmental consciousness.



Attested

[Signature]
Principal

Muralidhar Girls' College

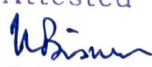
Environment & Green Audit- Analysis

The whole world is on the road to sustainable development. Environment conservation is the top priority among the list as every human activity has its own impact on their surroundings. Hence be it a college or room will disturb the balance the environment. Engineers are increasingly expected to play leadership roles when it comes to sustainable development, working to solve global challenges such as the depletion of resources, pollution, ecosystem damage and the effects of rapid population growth. It is very important to do a detailed study about the effects on the environment. This is conducted under the name of Environment or Green Audit which is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of the college. It aims to analyze environmental practices within and outside of the college which will have an impact on the eco-friendly atmosphere. The objectives of the green audit can be listed as follows:

- Environmental education through systematic environmental management approach
- Improving environmental standards and Enhancement of university profile
- Benchmarking for environmental protection initiatives
- Sustainable use of natural resource in the campus.
- Financial saving through a reduction in resource use
- Curriculum enrichment through practical experience
- Development of ownership, personal and social responsibility for the university campus and its environment
- Developing an environmental ethic and value systems in young people

To conduct a walkthrough audit to check the suggestions implemented by the MOEFCC and suggest for further improvements. To verify all the points with actual measurements and gave suggestions for improvement.

Demands for energy, drinking water, clean air, safe waste disposal facilities and transportation issues are increasing day by day. In this audit report of the year 2021-2022 we aim to identify the areas of positive development done by the college and to point out the suggestions for improvements.

Attested

Principal
Muralidhar Girls' College

Environmental Policy

Muralidhar Girls' College, P-411/14 Gariahat Road, Ballygunge, Kolkata-700029, West Bengal shows its sensitivity towards the environment by establishing its environmental policy.

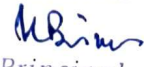
Aims of the Policy

The policy aims to eliminate or reduce all forms of environmental pollution and encourages all faculty members, staff, students and other stakeholders to do the same. The college always raises awareness of environmental issues among its staffs, students or stakeholders, especially plastic pollution and encourages initiatives leading towards a clean environment. Its academic departments, NSS unit, NCC Cell works towards this aim collectively. The policy promotes the 3R's for waste in the following order: Reduce, Reuse and Recycle and provide convenient waste collection points and guidance for the disposal of -----

- Paper
- Cardboard
- Glass
- Plastic
- Electrical items
- Hazardous waste
- E-waste.

The college aims to minimize the consumption of water & electricity and mainly solid waste disposal and thereby contribute to the proper use of the natural resource by the following ways:

- Encourage to report leaks and rectifying them promptly.
- Progressively replacing/supplementing water-taps in staff-room, washroom etc. if needed.
- Exploring options for using waste water by establishing a separate reservoir in science building.
- Established rainwater harvesting schemes in the campus.
- Progressive replacement of light bulbs with energy efficient ones.
- Encouraging staff, mainly students to turn off electrical appliances when not in use.
- Minimizes the consumption of electricity where opportunities arise.
- Conserving energy by promoting the use of daylight.
- Conducting frequent preventive and corrective maintenance.

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Muralidhar Girls' College

Steps Taken and Mechanism


- The college adapts health, safety, and an environment based codes of practice and relevant guidance and complies with legislation.
- The college has planned for Solar panel systems on the campus.
- The college campus is completely free from smoke, plastic bags and cups.
- Waste bins are placed at appropriate locations to maintain a clean and tidy campus.
- Green initiatives are taken by developing medicinal plantation through adequate plantation by the college (NSS Unit and the maintenance cell).
- The arrangement to set off the fire causing environmental damage by setting the fire extinguishers at different places on the premises.

Audit Scope

The audit is carried out for the green activities at Muralidhar Girls' College, P-411/14 Gariahat Road Ballygunge Kolkata-700029, West Bengal.

Audit Criteria

- Applicable guidelines of NAAC criteria
- Applicable Environmental Legislation
- Best Environmental Practices

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Principal
Muralidhar Girls' College

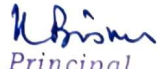
AuditObjective

In line with the audit definition, the objective of the audit is to have systematic, periodic, planned evaluation against objective evidences and reporting the results to the management as per the focus of the audit. Green Audit focuses on the basis of the environmental sustainability in terms of applicable environmental elements like Air, Water, Land, Flora, Fauna, Natural resources and Human being. The very objective of this audit is to evaluate the institutes green performance based on the focus indicators as stated above in view of the goal towards environmental sustainability, applicable legislation, environmental policies and standards. The green audit objectives can be stated as follows.

- To review the knowledge and awareness concerns of the institute for the journey of sustainability.
- To review the efforts made to protect the environment by preventing pollution and conserving the natural resources being used in the campus.
- To establish a baseline data to assess future sustainability and avoid heavy environmental tolls.
- To bring out a status report on environmental compliance.
- To assess the environmental performance and report it to management/authorities.

AuditMethodology

The scope of the audit is divided into various environmental areas like land use, water, effluent, sewage, energy etc. Each such area is analyzed based on the evidences produced by the college. The evidences are collected in form of discussions/interactions, documents and records, practical site conditions and

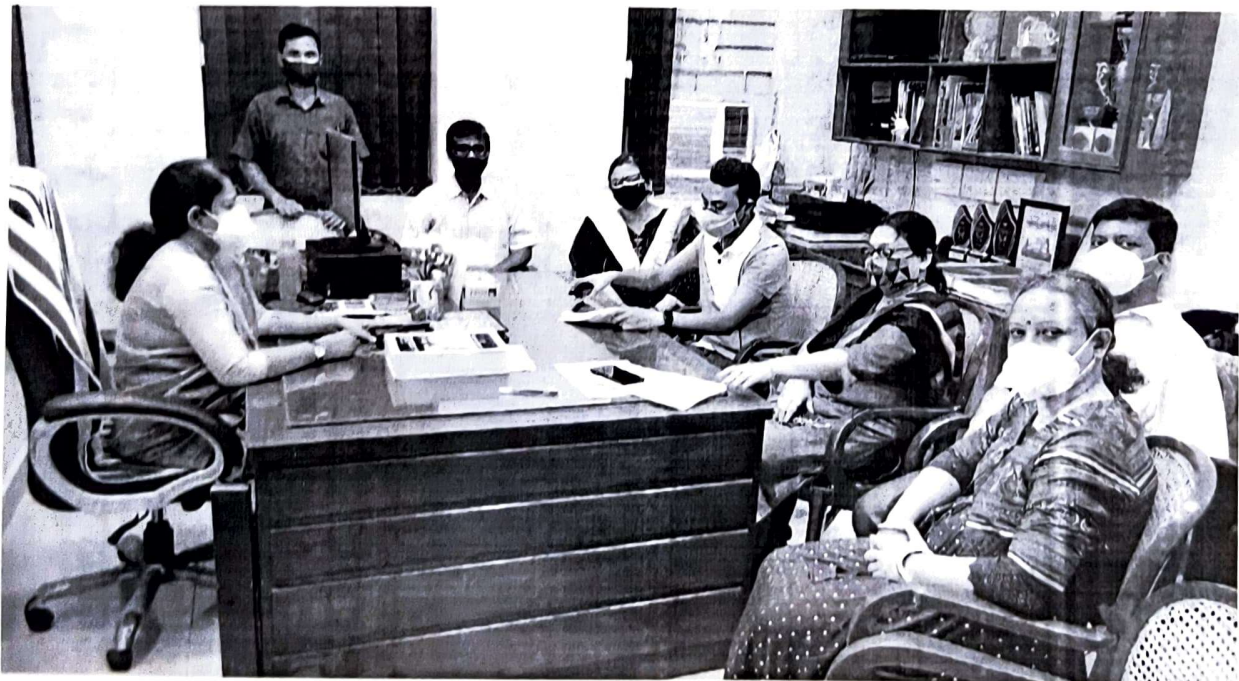
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photographs of it.
Following the above methodology, we have hereby compiled our Audit Report with our observations. However, since this is the 2nd time green audit (first in the year 2016-2017) is being conducted, hence the study become smooth because of previous constraints, but if observations of this report are read and recommendations of this report are followed the benefits of the same shall accrue to the college & it would be much better streamlined to carry out green audit in future.

Audit Observations

The observations have been compiled based upon initial desk review of various communications and documents, and after visiting Muralidhar Girls' College as part of getting an initial idea on the work done, have identified the appropriate methodology and accordingly an initial inception report was prepared and submitted.

The pictures during Audit review meeting is below:



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1.General Information :

This is the 2nd time a systematic way of monitoring the environmental eminence initiative taken by college for environmental protection.

Total permanent population of the college

Population	Total
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Students	1274
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Teachers	82
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Non-Teaching Staff	26
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- Total built-up area of the college is around 1021.9526 square meters and the total constructed area is about 3134.5 square meters.
- 37 classrooms, 3 staff rooms, 2 office rooms, 1 auditorium and 1 conference room are available for study and official activity in the college.
- 17 sanitary facility is present in the college separate for male and female students of which 3 are for staff members.
- One central library is available with a good collection of book and magazines along with seminar library in all department.
- Total area of the college under tree canopy is approximately 255.488 square meter of which 522.75 square meter fall under garden area of which more than 41 number of plants exist and 35 plant species are presently available.
- Two LED street lights is available in the college.
- 1000 L capacity of each two rainwater harvesting tanks are available in the college.
- The college campus is made plastic free zone by educating all college members.
- The college has an electronic data processing (EDP) unit which provides curricular facilities to the students of the different departments.
- The college campus has installed one computerized staff attendance system i.e. biometric machine system.
- Two water-coolers of 500 L capacity, 3 water purifiers and 3 overhead water tanks of 1500 L capacity each are available in the college.
- Arrangement to set off the fire that may cause accident and environmental damage by setting fire extinguishers at different places of the college premises.
- Swachh Bharat Aavahan initiatives are taken by NCC Cadets as well as by the college students to keep the college campus clean and tidy.

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Following things are found near college :

- Municipal Dump Yard- Not in vicinity of the institute
- Garbage Heap- No garbage heaps
- Public Convenience- Yes, transport facility is available like bus, auto, rickshaw, taxi
- Sewer Line- 1 km within campus collecting in reservoir
- Stagnant Water- No stagnant water
- Open Drainage-No
- Industry (Name)- No
- Railway Station- Yes, nearby the college within 2 km
- Market/Shopping Complex- Available

2. Water Consumption & Management

Water is one of the most critical aspect for life and freshwater is a precious natural resource.

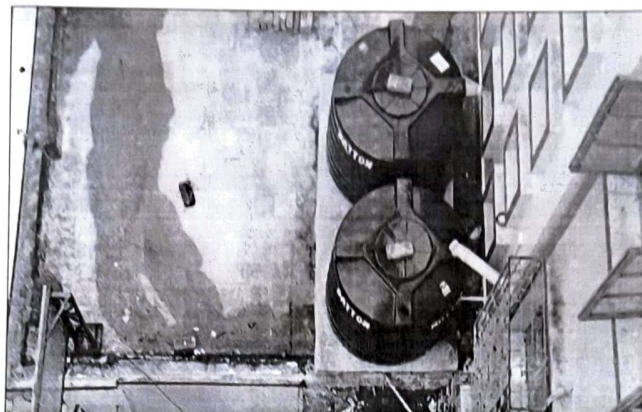
With continuous growth in population, per capita availability of utilizable water is going down, whereas the demand is ever increasing primarily due to life style changes and decreasing awareness on water management. It is clearly visible in the society that due to unsustainable use of water resources there is contamination and depletion of the natural water sources which is an alarming situation. Therefore, it becomes paramount to conserve protect and manage the water resources availability and usage so that it is sustainably used within the college campus.

The main source of water at the institute are three well-built overhead tanks of 1500 L capacity each and the water supplied from Kolkata Municipal Corporation (KMC) stored in underground reservoir. Water charge is paid along with KMC tax. 3000 L of water is pumped every day and heavy amount of water get used from washroom per day by the stakeholders of the college. Whole college campus has 35 water-taps of which only 200 L water used up per day and 2 water-taps in canteen of which 200 L of water used up per day. From rainwater harvesting tanks, approximately 1000 L of water is used for garden purpose. 500 L per day water get used from two water-coolers by the teachers and staff-members of the college. Waste water generate from lab, canteen and toilet go to underground sewage. The college has practiced green chemistry method i.e. toxic water storage in an underground chamber within the premise. The college has taken water saving initiative by creating awareness among students to close taps after use to conserve water.

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Rainwater Harvesting Tanks (1000 L each)

Recommendations

Replace manual taps with auto push taps to reduce water wastage, more installation of rainwater harvesting tanks, maintenance and monitoring of valves to avoid overflow, leakage and spoilage, flow rate of taps should be checked, it should not be more than 2.5 litre/minute, lab grey water reservoir can be neutralised by introduction of bacteria species like *sphingomonas*, plants such as colacassia, *arundo donax*, *typha latifolia* etc. from mix with groundwater. More awareness on water conservation to be made inside campus. Installation of water meter and periodic water audit can be planned and initiated at regular intervals for monitoring of water consumption per capita.

3.Biodiversity Observation & Management

Green-belt observation is undertaken to have a look on how overall ecological environment of the college is maintained. Ideally it should be a periodic yearly activity and efforts of the all stakeholders should be involved. Here a broad definition of biodiversity has been considered, i.e. Biodiversity is all the different kinds of life form available in a given area— all the variety of animals, plants, fungi, microorganisms like bacteria and large flora & fauna that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.

Available land in the whole campus is around 255.488 square meters of which 522.75 square meter occupies the garden area. . Due to high crowds and shortage of enough space as the college is situated in residential area, it is very difficult to have proper green-belt for noise and pollution reduction within the campus.

However, the college has total 41 plants and few trees with large canopy cover like Mango, Peepal, Simul, Bakul, Chhatim, Monkey puzzle tree which enhance maximum green cover. In addition, Nature Club of the college maintains some medicinal plants like Tulsi, Krishna Tulsi, Babui Tulsi, Kalmegh, Vasaka, Sarpagandha, Curry pata, Hadjora, Pudina, Ghritakumari giving rich green effect. The garden area is devoid of any threatened plant species. Approximately, 100 L of water is used every day in the garden area of the campus from rainwater harvesting tanks. Recently, the college has implant 25 ornamental plants and 5 ornamental palm tree for beautification.



Medicinal Plants



Green Cover around college

Recommendations


Localized plant species can be used more for plantation since they are more suitable to the local environment and habitat. Therefore it will become a habitat of the native birds, animals and insects and can help in biodiversity conservation and reclamation. Medicinal plants to be maintained properly for their appropriate growth and vigor.

4.Sewage Observation & Management

Sewage is generated by the use of water from sanitary purpose (200 L per day) from 17 washrooms and 3 washrooms from staff-room. The water usage through toilet get collected in septic tank which further connect to the municipal sewer line through underground & negligibe amount get mix with groundwater.

Recommendations

Specific water audit can be conducted to know the water inflow and out flow along with the losses, leakages, wastages etc. to plan actions for water conservation.

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5.Solid Waste Observation & Management

Approximate 10 kg of solid wastes are produced from office, labs and canteen of the college. Maximum amount of biodegradable and non-biodegradable solid wastes which are generated are segregated and kept in different waste bins and then given to Municipality in weekly basis smoothly. The college authority has banned single use plastic usage since Covid times inside college campus and recycled paper is used in decorative purpose which is a great initiative.

Recommendations

Besides giving of solid wastes to Corporation, organic solid wastes can be treated through vermi-compost especially by earthworm and wax worm thereby reducing cost to Municipal Corporation as well as treated waste is a rich source for garden soil. Data of every day canteen waste can be taken up and can be displayed in the canteen board to educate the students and staff members about the wastage to aware about solid-waste effect in the environment and the human needs.

6.E-Waste Observation & Management

Since the organization is well established and equipped with the necessary and up-to-date electronic infrastructure, the e-waste generation like scraped computers, laptops, xerox machines are produced in a minimal amount. However, as a proactive initiative, an authorized vendor is identified for disposal of unused and expired e-waste i.e. the college has tie-up with renowned E-waste company, Hulladek Recycling Pvt.Ltd and also signed with "MOU" (Memorandum of Understanding) to provide management of electronic waste.

Recommendations

Immediate transfer of e-wastes to the authorized recycler should be ensured. E-waste listing and quantification in detail can be useful to reduce e-waste generation. Some small and usable e-waste can be recycled for decorative purpose of the college.

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7. Energy Observation & Management

Maximum energy consumption occurs from principal's room and staff-rooms of the college. Major source of electricity usage in the college campus include 7200 watt/month from 10 LED bulbs, 6400 watt/month from 250 ceiling fans, 2400 watt/month from 17 wall fans, 3,13,200 watt/month from 87 computers which run 3 hours continuously per day. Machineries like computer, AC and printer are kept in stand-by mode when not in use for only 2 hours. The college has adapted an energy conservation methods such as installation of solar panel of 5 KWP capacity to reduce impact of non-renewable energy and 2 LED Street lights (run approximately 6 hours per day × 2 days per month). One generator is available in the college campus. Not much energy consumption occurs from air conditioner, refrigerator, incubator, two digital balance, spectrophotometer, autoclave, pH meter, heater, television etc.

Recommendations

Maximum awareness by displaying messages about energy savings and use of natural lights and natural ventilation are promoted. More LED and eco-incandescent bulbs should be placed in the college campus for sufficient energy conservation. Periodic energy audits can be planned and initiated in regular intervals.

8. Carbon Footprint Observation and Management

Institute has started measuring GHG (Green House Gas) emission in terms of considering fuel consumption per students or staff of college. Carbon footprint is the total amount of Green House Gases (GHGs) emitted in terms of carbon dioxide by a person, institute. Carbon Footprint is typically given in tons of CO₂ equivalent per year. Maximum students (above 50) use public transportation, Principal use one car, more than 2 two-wheelers use by stakeholder and 1 LPG is used by the college authority.

Recommendations

Solar heater can be used to reduce impact on LPG. More implementation of energy-saving gadgets to reduce CO₂ emission from electricity. Increase in display of environment conscious poster/paintings/ slogans for spreading awareness

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amongst students. Mass awareness by pasting energy-saving sticker, insist to share vehicles & arranging training programmes on environmental management system & nature conservation.

Other Environmental Awareness Initiatives

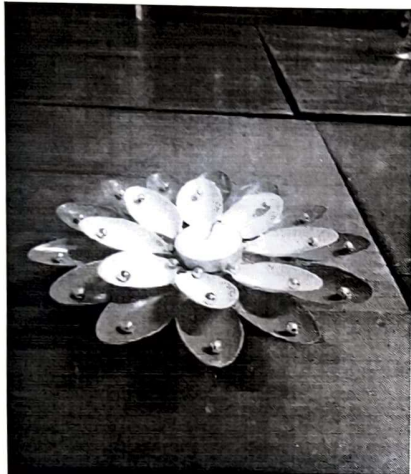
Green committee members of the college and NSS team work jointly together for “Green Cover and its Conservation” every year as well as in pandemic year. The college celebrates World Environment Day every year. The college take initiative on frequent environmental cleanliness and awareness campaign, arrange field visit for students to observe nature closely, distribution of saplings among students and staff members by NSS team to increase awareness and understand the importance of greenery, conduct nature tour for the students, Covid sensitization program from the college, conduct seminar/webinar/conference on environment topics. On the day of green audit inspection, the college arrange an awareness program on importance of environmental audit & role of students in green audit where more than 100 students attend the seminar. The students of Muralidhar Girls’ College are very much aware of environmental activities done by NSS team & college authority and students made things by reusing plastic and waste products which is a good creativity.



Seminar on E-Audit on Green Audit Inspection Day

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Muralidhar Girls' College students has created following materials from waste products which is really appreciable.

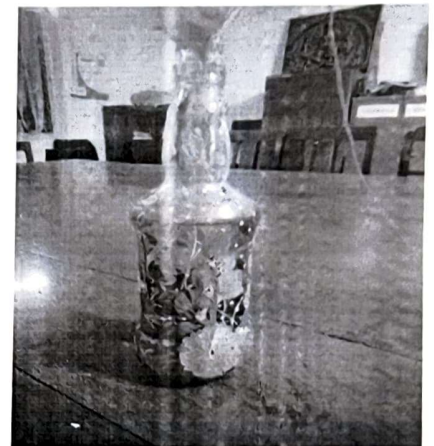


Candle-stand with Basket with used

Used plastic spoon



plastic



Tree Stand With

Used glass bottle

Conclusion

This audit involved extensive consultation with all the members of the campus, interactions with key personnel on wide range of issues related to Environmental aspects. The College has Environmental Committee for sustainable use of resources. The college is considering the environmental impacts of most of its actions and makes an intensive effort to act in an environmentally responsible manner. Even though the college does perform quite well, the recommendations in this report highlight many ways in which the college can work to improve its actions and become a more sustainable institution. The audit team opines that the overall site is good maintained from environmental perspective.

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Green audit report is one of the useful means of demonstrating an organization's commitment to openness and transparency. If an Organization believes it has nothing to hide from its stakeholders, then it should feel confident enough to make its green audit reports freely available to those who request them. As a basic rule, green audit reports should be made available to all stakeholders.