7.1.3 Green Audit / Environment Audit report from recognized bodies

Director
R.D. Engineering College
Duhai, Ghaziabad

GREEN AUDIT REPORT

Dec 2023

R.D. Engineering College

PFPM+57W, 8 th KM Mile Stone from Ghaziabad National Highway (NH) No.58, Delhi - Meerut Expy, Duhai, Ghaziabad, Uttar Pradesh 201206

Audit Conducted by:

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Energy Service Companies empaneled with Bureau of Energy Efficiency (BEE)

Table of Contents

1. ACKNOWLEDGEMENT

EFS, Engineering Facility Services acknowledges the cooperation and support of the management and staff of R.D. Engineering College**,** in particular, the support and disposition of the **Mr. Ghanshyam (Registrar), Mr. Brahma Swaroop (State Manager) & Mr. D. N. Sharma (Manager Admin)** Teaching/Supporting Staff of institute has been invaluable to the success of this report. Engineering Facility Services wishes to stress that in line with its policy, all information obtained in the course of this Audit exercise, as well as those contained in this report, will be accorded the strictest confidentiality.

2. Executive Summary:

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crisis. On this background it becomes essential to adopt the system of the green campus for the institute which will lead to sustainable development. RD Engineering College deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends. Being a premier institution of higher studies, the college has initiated **'' The Green Campus''**programme few years back that actively promote the various projects for the environment protection and sustainability.

The purpose of this audit is to ensure that the practices followed in the campuses are in accordance with the green policy adopted by the institution. It works on several facets of Green Campus including water conservation, electricity conservation, tree plantation, waste management, paperless work, mapping of biodiversity. With these issues in mind, the specific objectives ofthe audit are to evaluate the adequacy ofthe management control framework of environment sustainability as well as the degree to which the departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on students' health and learning, college operational costs and the environment. The criteria, methods and recommendation used in the audit were based on the identified risks.

3. Introduction

Green Audit is a systematic, documented, periodic and objective review by regulated entities of facility operations and practices related to meeting environmental requirements (EPA, 2003). In other words, it is a management tool comprising of systematic, documented, periodic and objective evaluation of the organization, which management and equipment are performing with the aim of helping to safeguard the environment by facilitating management control of practices and assessing compliance with company policies which would include regulatory requirements and standards applicable (international Chamber of Commerce, 1989).

Green auditing is essentially an environmental management tool for measuring the effects of certain activities on the environment against set criteria or standards. Depending on the types of standards and the focus of the audit, there are different types of audits. Organizations of all kinds now recognize the importance of environmental matters and accept that their environmental performance will be scrutinized by a wide range of interested parties.

4. Utility of Green Audit

These are used to help improve existing human activities, with the aim of reducing the adverse effects of these activities on the environment. An environmental auditor will study an organization's environmental effects in a systematic and documented manner and will produce a green audit report.

5. Objectives of the Study

The main objectives of the green audit are to promote environmental management and conservation in the institute campus. The purpose of the audit is to identify, quantify, describe and prioritize the framework of environmental stainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out green audit are-

- To introduce and make aware students of real concerns of the environment and its sustainability.
- To secure the environment and cut down the threats posed to human health by analyzing the pattern and extent of resource use on thecampus.
- To establish a baseline data to assess future sustainability by avoiding the interruptions in environment that are more difficult to handle and their corrections requires highcost.
- To bring out a present status report on environmental compliance.

6. Methodology

In order to perform a green audit, the methodology included different techniques such as physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following area to summarize the present status of environmental management in the campus:

- Water consumption and management
- Air quality assessment and management
- Electricity consumption and management
- Sound pollution monitoring
- Waste management
- Biodiversity status of the campus

7. WATER SAVING POTENTIAL & BEST MANAGEMENT PRACTICES

Best management practices (BMPs) are a set of hands-on recommendations that help to identify opportunities and implement programs to save water in college. BMPs are developed for the various water-use categories in the office buildings and for monitoring and operational procedures. They are grouped according to indoor water use, outdoor water use, and monitoring and operational procedures. We can tailor water-saving program by using part or all the BMPs depending on budget and environmental requirements. Tips and information are provided on water-saving amounts and cost recovery to help in prioritizing measures and make the most knock for buck.

Based on the information collected and observations, the following can be recommended to reduce water use and increase its efficiency.

Faucets

Lavatory, bathing and hand wash facilities faucets average water use in the workshop buildings is approximately 28% of the total water received. In some of the faucets water run around 9 litre per minute. Faucets flows can easily be reduced without affecting the comfort of the water user by using appropriate flow regulator technology for these fixtures. This will result in impressive savings of around 50 percent of faucets water use. Flow regulators, especially the aerators are inexpensive and are easy to install and maintain. This is why they are often considered as the low hanging fruits of water saving programs.

Here are the recommended best management practices for achieving water savings for faucets at office building.

- Use pressure compensating and tamper proof aerators that can only be removed

with a 'special' tool to reduce vandalism and theft.

- Regularly clean faucets as sediments may accumulate and reduce the flow.

Recommend flow rate for different type of uses	
Public hand-washing faucet or self-closing faucet	≤ 4.5 litres /min ≤ 1.0 litres /cycle
Restroom faucet	≤ 4.5 litres /min
Kitchen faucet	≤ 8.3 litres/min

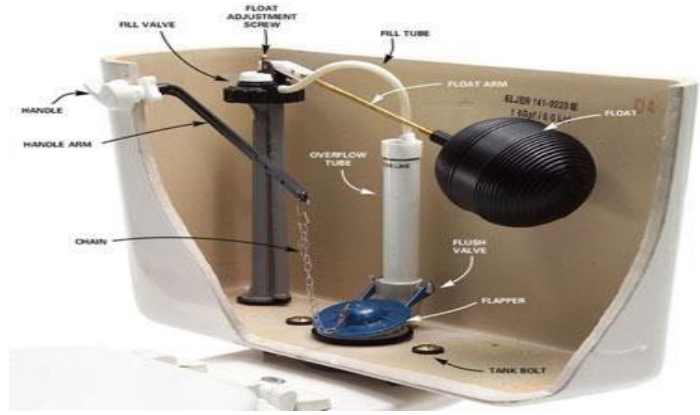
Flow per minutes could be set to 2 or 3 or…6 Litres or more as per the requirement. The Flow Control aerator generates thin streams (like shower aerator) of water to cover wider area for rinse, when compared to conventional aerators. This results in lesser-run time of faucet and easiness for user and ultimately water saving. Flow Control Aerator can easily be installed in existing faucets.

Urinals

Low water use urinals: In some of the standard systems, water is applied automatically through a continuous drip-feeding system or by automated flushing at a set frequency, 24x7, regardless of whether the urinal has been used. Water consumption varies with the system model at an average of 4 litres per flush. Water-efficient urinals use 2.8 litres per flush and in recent times smart flush systems using 0.8 litres per flush have also been launched.

Waterless urinals: There are various technologies available for waterless urinals. In oil barrier technology, the urinals operate using an oil wall between the urine and the atmosphere, preventing odor from escaping. In another technology, the barrier has been replaced by a seal with a collapsible silicone tube that closes after the fluid has passed through it, to prevent gases from flowing into room. A third system uses biological blocks which include microbial spores and surfactants which can be placed into any urinal, thus eliminating water use. By breaking down the urine into components, buildup of sludge and crystals which causes blockages is prevented. Bidets and urinals water use accounts for 3 percent of office buildings water use. These standards shown in the table offer a good water-saving opportunity for water saving in office buildings.

Toilets



A dual-flush toilet is a variation of the flush toilet that uses two buttons or handles to flush different levels of water. A significant way to save water in buildings is to replace single-flush toilets with dual flush toilets. The standard dual- flush toilets use six litres of water on full and three litres on a half-flush.

Replacing old toilets will result to a reduction of 35 percent of toilet water. More cost-effective results can be achieved by replacing only the toilet trim system.

TOILET TANK BANK

With economical, maintenance free 'Green Toilet Bank' it is very easy to save water on toilet flushing, it helps to save 3 liters water on every flushing, with no sacrifice on performance. Toilet Bank filled with water is hanged inside the toilet flushing tank or reservoir. It will displace an amount of water equivalent to 3 Liters in the tank, which means every flush we will save water, thus saving you money. Less the water you use, the less you need to recycle.

8. Saving Water through Monitoring and Operational Procedures

Identifying and Fixing Leaks

The hidden water leaks can cause loss of considerable water and energy without anyone being aware of it. A small leak can amount to large volumes of water loss. Leaks become larger with time, and they can lead to other equipment failure. Fix that leaky pipe, toilet, faucet, or roof top tank to save considerable amount of money and water. The establishment of a leak detection and repair program would be a most cost-effective way to save money and water in the workshop building. Following are some best practices to identify and fixing leaks.

The Management must be committed for providing the staff and resources needed to maintain plumbing fixtures and equipment on a regular basis and assuring prompt identification and repair of leaks.

- Repair staff is given the tools needed and is trained to make leak repair a priority activity.
- Staffs are taught to report leaks and other water-using equipment malfunctions promptly.
- Staffs are rewarded for success.
- Rooftop tank overflow or leakage water should flow to rainwater gutter system not to sewage system to allow detection of rooftop water loss.
- Records of the type, location, number, and repair of leaks are kept in a central location.

Water Metering and Sub-metering

The metering and sub-metering of Main incoming line is essential to understand the water consumption pattern inside the college and hospital building. The accurate measurements enable management to understand maximum and minimum consumption area in the College building and improve water efficiency in the college and hospital building. Monitoring of the water usage allows management to know where and when water is being used and where the best opportunities for water savings exist. Thus, it is recommended to install water meters on each consumption area in the building.

GENERAL RECOMMENDATIONS

Based on the physical inspection and document reviewed on water distribution system of Building, EFS recommends the following recommendations for using water efficiently at College & Hospital Building.

Water tank overflow Alarm system

It is noticed that no alarm as well as level sensor was provided to overhead water tanks. The water alarm system should be installed at all overhead Tank, All PVC rooftop Tanks to avoid over spillage of water. This will help in reduction of wastage of water as well as electricity.

Implementation of water accounting & management system

It was noticed during the audit that water flow meters are nowhere installed at College and Hospital Building. Therefore, it is highly recommended to install digital water flow meters on all the main lines. Digital water meters are also required to install in each section to monitor the section wise water consumption and planning for effective water management. It is also recommended to appoint internal Water Audit team who can inspect water distribution system and for the accounting of water usage in the hospital and college building.

Regular Maintenance of toilet system and use of water efficient fixtures

Regular maintenance of the toilets should be carried out. Test for leaks and make necessary repairs promptly. Keep the toilet in working order by periodically inspecting and replacing flappers and other defective parts. Water efficient fixtures such as aerator and water efficient taps need to be used to reduce water consumption.

Capacity building of Staff Involved in Water Distribution

The Management of RD Engineering College arrange capacity building and awareness programs for the staff engaged in water distribution.

OVERALL AIM FOR WATER CONSERVATION: ON THE WAY FORWARD WITH THE 3-R CONCEPT

“Water conservation is defined as any action that reduces the amount of water withdrawn from water supply sources, reduces consumptive use, reduces the loss or waste of water, improves the efficiency of water use, increases recycling and reuse of water, or prevents the pollution of water”.

Reduce

Reduction at Source

- Better operating controls such as arresting leakages
- Installation of water saving devices such as water tank alarm at all overhead tanks
- Change of device/ equipment such as replacement of water pumps and motor with energy efficient pumps and motors
- Process modification such as use of sprinklers for watering plants and garden

Recycle & Reuse

- Use of treated water in toilets flushing, gardening, fountains, fire fighting equipment's
- Use of storm water as Cooling Tower make-up water after treatment.
- Using storm water & sanitary water as fire water after treatment.
- Reduction of Fresh Water usage supplemented through waste water treatment.
- Direct use of Rain Water Harvesting through storage tanks

Recharge

- Installation of recharge wells / rain water harvesting pits for recharging ground water tables.
- Total recharging capacity (during rain time) to be estimated in 3mm/hr.
- Rain Water Harvesting and conservation.

9. Water consumption (Asset) Management

List of water assets is detailed below.

DETAILS OF TAP			
A- BLOCK			
SR. NO.	LOCATION	UOM	QTY.
1	GROUND FLOOR	Nos	10
2	FIRST FLOOR	Nos	6
3	SECOND FLOOR	Nos	8
4	THIRD FLOOR	Nos	4
B-BLOCK			
1	GROND FLOOR	Nos	10
2	FIRST FLOOR	Nos	10
3	SECOND FLOOR	Nos	0
4	THIRD FLOOR	Nos	9
C-BLOCK			
1	GROUND FLOOR	Nos	6
2	FIRST FLOOR	Nos	7
BOYS HOSTEL			
1	GROUND FLOOR	Nos	10
2	FIRST FLOOR	Nos	18
3	SECOND FLOOR	Nos	26
4	THIRD FLOOR	Nos	26
GIRLS HOSTEL			
1	GROUND FLOOR	Nos	12
2	FIRST FLOOR	Nos	12

10. Electricity consumption (in Units) and management

MONTH	'KWH CONSUMPTION	KVAH CONSUMPTION	NET AMOUNT PAYABLE (INR)
Dec-22	35552	37498	526103
Jan-23	38665	40636.5	554466
Feb-23	44419.5	45961.5	602384
Mar-23	32138	33751	493063
Apr-23	36284.5	38339	533591
May-23	40609.5	42082.5	567630
Jun-23	62664.5	64659	768988
Jul-23	68129	70068	817396
Aug-23	56832	58621	714992
Sep-23	66325	68304.5	776352
Oct-23	67975.5	69894.5	815867
Nov-23	53589.5	55371.5	686659
Max	**68129**	**70068**	**817396**
Min	**32138**	**33751**	**493063**
Avg	**50265**	**52099**	**654791**

11. Sound Pollution Monitoring

The human ear is constantly being assailed by man-made sounds from all sides, and there remain few places in populous areas where relative quiet prevails. There are two basic properties of sound, (1) loudness and (2) frequency. Loudness is the strength of sensation of sound perceived by the individual. It is measured in terms of Decibels. Just audible sound is about 10 dB, a whisper about 20 dB, library place 30 dB, normal conversation about 35-60 dB, heavy street traffic 60-75 dB, boiler factories 120 dB, jet planes during take-off is about 150 dB, rocket engine about 180 dB. The loudest sound a person can stand without much discomfort is about 80 db. Sounds beyond 80 dB can be regarded as pollutant as it harms hearing system. The WHO has fixed 45 dB as the safe noise level for a city to avoid sleep disturbances. For international standards a noise level up to 65 dB is considered tolerable. Frequency is defined as the number of vibrations per second. It is denoted in Hertz (Hz).Sound pollution is another important parameter that is taken into account for green auditing of the College Campus. Different sites were chosen for the monitoring purpose.

Sr.No	Location	Sound DB	
		Min	Max
A Block			
Basement			
1	Basic Electrical Lab	51	56
2	Basic Electronics Lab	44	48
3	Professional Communication Lab	45	48
4	Computer Center	48	54
5	Seminar Hall	47	52
6	Store	46	51
7	Lift	49	55
Ground Floor			
8	Academic Director Office	48	51
9	Dean Technical Office	49	53
10	Head Admin Office	42	47
11	Conference Room	43	51
12	Dean Academic Office	44	53
13	Reception Area	48	54
14	Toilet/Washroom-1	46	52
15	Toilet/Washroom-2	43	50
16	Toilet/Washroom-3	46	52
17	Toilet/Washroom-4	48	54
18	Computer Center	47	51
19	Registrar Office	43	52
First Floor			
20	Faculty Cabins	47	55
21	Gents Washroom	50	57
22	Dean Academic 1st Year	45	51
23	Lecture Hall 1	48	56

Sr.No	Location	Sound DB	
		Min	Max
24	Lecture Hall 2	46	52
25	Lecture Hall 3	43	49
26	Chemistry Lab	49	56
27	Account Office/Chief Finance Office	46	53
28	Physics Lab	48	54
29	Medical Center	46	55
Second Floor			
30	Lecture Hall 1	48	55
31	Lecture Hall 2	47	52
32	Lecture Hall 3	48	54
33	Lecture Hall 4	46	56
34	Lecture Hall 5	46	51
35	Faculty Cabin 1	51	55
36	Faculty Cabin 2	46	54
37	Girls Washroom	49	56
38	Boys Washroom	49	52
39	Faculty Washroom	47	53
40	Seminar Hall	51	57
Third Floor			
41	Faculty Room-MBA Faculty	48	53
42	Innovation Center,Research and Development	48	55
43	Lecture Room	47	52
44	Guest Room	51	55
B Block			
Ground Floor			
1	HOD Cabin/Faculty Room	44	52
2	Exam Cell	46	51
3	Girls Washroom	48	54
4	Boys Washroom	47	52
5	Lab-1	47	52
6	Lab-2	43	49
7	Lab-3	46	51
8	Lab-4	49	54
9	Lab-5	51	57
10	Lab-6	44	53
11	IQAC Office-1	48	55
12	IQAC Office-2	47	56
13	Seminar Hall	44	52
First Floor			
14	Lecture Hall-1	46	52
15	Lecture Hall-2	44	49
16	Lecture Hall-3	42	48
17	Lecture Hall-4	49	57
18	Lecture Hall-5	51	56
19	Lecture Hall-6	50	55
20	Lecture Hall-7	46	53

Sr.No	Location	Sound DB	
		Min	Max
21	HOD Cabins	42	49
22	Faculty Cabin	47	55
23	Girls Washroom	46	52
24	Boys Washroom	43	49
25	Computer Center	44	50
Second Floor			
26	Lecture Hall-1	50	55
27	Lecture Hall-2	49	54
28	Lecture Hall-3	47	52
29	Lecture Hall-4	46	53
30	Faculty Cabin	48	56
31	HOD Room	49	54
32	Library	48	56
Third Floor			
33	Lecture Hall 1	48	55
34	Lecture Hall 2	47	52
35	Lecture Hall 3	48	54
36	Lecture Hall 4	46	56
37	Lab-1	44	49
38	Lab-2	46	53
39	Lab-3	48	55
40	HOD Room	46	51
41	Faculty Cabin	49	55
42	Girls Washroom	48	53
43	Boys Washroom	47	52
C Block			
Ground Floor			
1	Girls Washroom	46	51
2	Boys Washroom	47	56
3	Computer Center-1	44	51
4	Computer Center-2	46	50
5	Computer Center-3	48	53
6	Computer Center-4	43	51
7	Civil Engineering Lab	44	50
8	Mechanical Lab	44	52
9	Welding Shop	43	49
First Floor			
10	Lab-1	44	50
11	Lab-2	43	49
12	Lecture Hall-1	50	56
13	Lecture Hall-2	48	54
14	Lecture Hall-3	43	48
15	Boys Washroom	46	53
16	Girls Washroom	44	49
17	Faculty Room-1	44	48
18	Faculty Room-2	49	56

Sr.No	Location	Sound DB	
		Min	Max
19	Faculty Room-3	48	53
Second Floor			
20	Faculty Cabin	46	53
21	Lecture Hall-1	48	54
22	Lecture Hall-2	49	53
23	Lecture Hall-3	43	50
24	Lecture Hall-4	49	55
25	Lab	44	51
26	Engineering Graphic Lab	43	50
27	Generator/Electrical Panel Room	46	51

- Sound level found satisfactory

Recommended sound level as set in CPCB-Environmental Standards-Noise (ambient standards) dB (A)

SCHEDULE

(see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:- 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

12. Air Quality Monitoring

Since air quality plays a vital role for good health. Air Quality monitoring instrument is used to monitor quarterly the criteria pollutants. The most important air quality parameters, which are measured, are Humidity, PM 2.5 & PM10. The other criteria pollutants such as Ozone, Carbon Monoxide, NO2, SO2 and Lead are not measured because there are no nearby Industries located near the institute, which are emitting these pollutants. Noise equally plays a vital role in the environment; hence noise measurement is also done at the institute quarterly.

Respirable Dust Sampler

13. Waste Disposal

Waste disposal include the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.

Waste can be solid, liquid, or gas, each type has different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and household. In some cases, waste can pose a threat to human health. Waste is produced by human activity, for example, the extraction and processing of raw materials. Waste management is intended to reduce adverse effects of waste on human health, the environment or aesthetics.

Waste management practices are not uniform among countries (developed and developing nations) regions (urban and rural areas), and residential and industrial sectors can all take different approaches.

A large portion of waste management practices deal with municipal solid waste which is the bulk of the waste that is created by household, industrial, and commercial activity.

RD Engineering College has employed waste bins for proper segregation of solid wastes in the campus.

Number of dustbins listed below:

Details of dustbin & approx. waste disposal

1. No of dustbin: - 18 approx.
2. Waste disposal quantity 800 KG approx. per month

Dustbin		
LOCATION	**DEGRABLE**	**NON-DEGRABLE**
MAINGATE	1	1
NEAR A-BLOCK	1	1
NEAR RECEPTION	1	1
B-BLOCK	1	1
NEAR CANTEEN	1	1
NEAR C-BLOCK	1	1
NEAR GENERATOR	1	1
BOYS HOSTEL	1	1
GIRLS HOSTEL	1	1
Total	**9**	**9**

14. List of Trees in Campus

Total 282 trees in campus. As listed below.

Plants Details			
S.N.	**Botanical Name**	**Common Plant Name**	**No.of Tree(Approx)**
1	Mnagifera Indica	Mango Tree	5
2	Azadirachta Indica	Neem	2
3	Ocimum Tenuiflorum	Tulsi	50
4	Tinospora Cordifolia	Giloy	20
5	Epipremnum	Money Plant	10
6	Rosa	Rose Tree	25
7	Rosa Rubiginosa	Red Rose	50
8	Psidium Guajava	Guava Tree	25
9	Astoraceae	Marigold	5
10	Helianthus	Sun Flower	5
11	Neolamarckia cadamba	Kadam	15
12	Plumeria Alba	Champa	10
13	Hibiscus Rosa - Sinesis	Gudhal	50
14	Dalbergia Sissoo	Sisam Tree	10
Total			**282**

15. Biodiversity status of the college campus

Introduction

To conserve this biodiversity, our first need is to learn about the existing diversity of the place. Unless we know whom to conserve, we will not be able to plan proper conservation initiatives. Also, it is important to have an understanding of the bio-diversity of an area so that the local people can be aware of the richness of bio-diversity of the place they are living in and their responsibility to maintain that richness.

In today's world, among the popular conservation measures which are taken to spread wildlife and environmental awareness, butterfly gardens can be placed in a significant position. To create butterfly garden, we need to know which associate plants and other fauna are present in the surrounding. This study allows us to understand the faunal and floral diversity of the surrounding areas of the college premises and theirinter-relationship.

Objectives

The main objective of this study is to get a baseline data of bio-diversity of the area which will include:

- Documentation of the floral diversity of the area, its trees, herbs, shrubs and climbers.
- Documentation of the major faunal groups like mammals, reptiles, amphibians, birds and butterflies.
- Documentation of the specific interdependence of floral and faunal life.

Method of Study

A brief methodology for the floral and faunal survey is given below.

1.Sampling was done mostly in a random manner.

2. The total area was surveyed by walking at the daytime.
3. Surveys were conducted for the maximum possible hours in the daytime.
4. Tree species were documented through physical verification on foot.
5. For faunal species, we emphasized mainly on the direct sighting. Also call of various birds and amphibians and nesting of some faunal species were considered as direct evidences.

6. Observing mammals depend critically on the size of the species and its natural history. Diurnal species are common and highly visible. Nocturnal species, however, are rare and difficult to detect. Small mammals like the field rats were found near their burrows, particularly during their entry or exit times in or out from their burrows respectively. In some cases, dung deposits and footprints were also observed that served as a potential clue for the presence and absence of the concerned species. These secondary evidences were all noted with time and spaceco-ordinates.

7. Birds are often brightly colored, highly vocal at certain times of the year and relatively easy to see. Sampling was done on the basis of direct sighting, call determination and from the nests of some bird species.
8. Reptiles were found mostly by looking in potential shelter sites like the under surface of rocks, logs, tree hollow sand leaf litter and also among and under neath the hedges. Sometimes some species, particularly the garden lizards were also observed in open spaces (on twigs and branches and even on brick constructions) while they were basking under direct and brightsunlight.
9. Amphibians act as potential ecological indicators. However, most of them are highly secretive in their habits and may spend the greater part of their lives underground or otherwise inaccessible to biologists. These animals do venture out but typically only at night. They were searched near pond, road beside wetland and in other possible areas. Diurnal search operations are also *success*ful.
10. Active invertebrates like the insects require more active search. For larger winged insects like butterflies, random samplings were carried and point sampling was alsodone.
11. The easiest way to observe many of the invertebrates is simply looking for them in the suitable habitat or micro-habitat. Searching was carried out under stones, logs, bark, in crevices in the walls and rocks and also in leaf litter, dung etc. Slugs and snails are more conspicuous during wet weather and especially at night when they were found using a torch.

Faunal Species

The list of Fauna indicates that the college campus is significantly rich in faunal diversity. We have seen a significant number of bird nests at many places. We have not been able to document other insect groups during this survey. The year long survey will add some more fauna in the checklist for sure after the seasonal survey.

Table 01: Checklist of Faunal groups with species number

1.	Birds	15	Table-2
2.	Reptiles	1	Table-3
3.	Amphibians	2	Table-4
4.	Butterflies	22	Table-5

Table 02: Checklist of Birds

No.	Common Name	Scientific Name	Family
1	Common HawkCuckoo	Hierococcyx varlus	Cuculidae
2	Common Hoopoe	Upupa epops	Upupidae
3	Common Iora	Aegithrna tipsia	Aegithinidae
4	Common Kingfisher	Alcedo atthis	Alcedinidae
5	Common Myna	Acridotheres tristis	Sturnidea
6	Common Pigeon	CoInmba livia	Columbidae
7	Common Sandpiper	Actitis hypoleucos	Scolopacidae
8	Common Tailorbird	Orthotomus sutortus	Cisticolidae
9	Coppersmith Barbet	Megalaima haemacephala	Ramphastidae
10	House Crow	Corvus splendens	Corvidae
11	House Sparrow	Passer domesticus	Passeridae
12	Indian Cormorant	Pholocrocorax fuscicollis	Phalacrocoracidae
13	Pale-billed Elowerpecker	Dicoeum erythrorynchos	Dicaeidae
14	Taiga flycatcher	Ficedula albicilla	Muscicapidae
15	Yellow-footed Green Pigeon	Treron phoen icoptera	Columbibae

Table 03: Checklist of Reptiles

No.	Common Name	Scientific Name	Family
1.	Rat Snake	Zamenis longissimus	Colubridae

Table 04: Checklist of Amphibians

No.	Common Name	Scientific Name	Family
1	Indian Toad	Duttaphrynus melanostictus	Bufonidae
2	Frog	Enphldctis cyanophlyctis	Dicroglossidae

Table 05: Checklist of Butterflies

No.	Common Name	Scientific Name	Family
1	Blue Mormon	Papilio polymnestor	Papilionidae
2	Common Jay	Graphium doson	Papilionidae
3	Common Mime	Papilo clytia	Papilionidae
4	Common Mormon	Papilo polytes	Papilionidae
5	Common Rose	Pachliopta aristolochiae	Papilionidae
6	Lime Butterfly	Papitto demolis	Papilionidae
7	Tailed Jay	Graphium agamemnon	Papilionidae
8	Small Grass Yellow	Furema brigitta	Pieridae
9	Common Grass Yellow	Eurema hecabe	Pieridae
10	Common Gull	Cepora nerissa	Pieridae
11	Indian Jezebel	Delias eucharis	Pieridae
12	Indian Wanderer	Pareronia hippia	Pieridae
13	Lemon Emmigrant	Catopsila Pomona	Pieridae
14	Mottled Eemigrant	Catopsilia pyranthe	Pieridae
15	Psyche	Leptosia nina	Pieridae
16	Common Cerulean	Jamides celeno	Lycaenidae
17	Common Lineblue	Prosotosnora	Lycaenidae
18	Tailless Lineblue	Prosotas dubiosa	Lycaenidae
19	Common Pierrot	Castalius rosimon	Lycaenidae
20	Common Quaker	Neopithecops zalmora	Lycaenidae
21	Dark Grass Blue	Zizeeria karsandra	Lycaenidae
22	Forget-me-not	Catochrysops strabo	Lycaenidae

Floral species:

Number of Floral species observed: 125

The list of FIora indicates a significant diversity of plants which indicates the overall richness of the place. We have classified the overall flora in 8 groups. The most diverse group is the tree whereas there are 1 species of ornamental plant which shows the least diversity.

Table 06: Checklist of Floral groups with species number

1	Trees	14	Table 7
2	Grasses	2	Table 8
3	Herbs	36	Table 9
4	Shrubs	28	Table 10
5	Creepers	24	Table-11
6	Ornamental Plants	1	Table 12
7	Palms	7	Table 13
8	Fern & Season flower	13	Table-14

Table 7: Checklist of Trees

No.	Common Name	Scientific Name	Family
1	Ficus	Ficus Sp.	Moraceae
2	Amla	Emblica officinalis	Euphorbiaceae
3	Guava	Psidiiim guajava	Myrtaceae
4	Rosemallows	Hibiscaceae	Hibiscus
5	Champaca	Magnolia champaca	Magnoliaceae
6	Cycas	Cycas	Cycadaceae
7	Crepe Jasmine	Tabernaemontana Divaricata	Apocynaceae
8	pomegranate	Punica granatum	Punicaceae
9	Ashoka Tree	Saraca asoka	Fabeceae
10	Kadam	Anthocephalus chinen sis	Rubiaceae
11	Indian Almond	Terminalia catappa	Combretaceae
12	Lichi	Litchi chinensis	Sapindaceae
13	Vilayati Babul	Pithecolobium dulce	Mimosaceae
14	Neem Tree	Azadirachta indica	Meliaceae

Table 8: Checklist of Grasses

No.	Common Name	Scientific Name	Family
1	Common Carpetgrass	Axo nopus sp.	Poaceae
2	Durba	Cynodon dcatyl on	Graminae

Table 9: Checklist of Herbs

No.	Common Name	Scientific Name	Family
1	Curry tree	Murraya koenigii	Rutaceae
2	White cedar	Thuja occidentali	Cupressaceae
3	Banyan tree	Ficus benghalensis	Moraceae
4	Yellow oleander	Cascabela thevetia	Apocynaceae
5	Aloe vera	Aloe vera	Asphodelaceae
6	Barberry	Berberis vulgaris L	Berberidaceae
7	Lemon	Citrus Limonum	Rutaceae
8	China rose	Hibiscus rosa-sinensis	Malvaceae
9	Neem	Azardirchata - indica	Mahaceae
10	Tulsi	Ocimum sanctum	Lamiaccac
11	Toon	Toona sinensis	Meliaceae
12	Ashok	Saraca Asoca	Caesalpinanceac
13	Amla	Emblica officinalis	Euphorbiaceac
14	Henna/mehndi	Lawsennia iermis	lytharaceae
15	Marigold	Tagetes erecta	Asteraceae
16	Tej Patta	Cinnamomum tamala	Lauraceae
17	Arjun	Terminalia arjuna	Combretaceae
18	Aswagandha	Withania Somnifera	Solanaceae
19	Jamun	Syzygium cumini	Myrtaceae
20	Candyleaf	Stevia rebaudiana	Asteraceae
21	Tamarind (Imli)	Tamarindus indica	Fabaceae
22	Drumstick-Tree	Moringa oleifera	Moringaceae
23	Kachnar	Bauhinia variegata	Fabaceae
24	Lemon grass	Cymbopogon citratus	Poaceae
25	Safed aak	Calotropis Gigantea	Apocynaceae
26	Datura (Yellow)	Datura stramonium	Solanaceae

27	Datura (Black)	Datura stramonium	Solanaceae
28	Red oleander	Cascabela thevetia	Apocynaceae

29	Sudarshana	Crinum latifolium	Amaryllidaceae
30	Kapur	Cinnamomum camphora	Lauraceae
31	Babri	Eclipta prostrata	Asteraceae
32	Common guava	Psidium guajava	Myrtaceae
33	Rose	Rosa rubiginosa	Rosaceae
34	Bakaian	Melia azedarach	Mahogany
35	Rangoon creeper	Quisqualis indica	Combrataceae
36	Bael (Wood apple)	Aegle marmelos	Rutaceae

Table 10: Checklist of Shrubs

No	Common Name	Scientific Name	Family
1	Giant Milkweed	Calotropis gigantea	Asclepiadaceae
2	Ban jamir	Glycosmis pentophyla	Ruraceae
3	Fever tea	Lippia javanica	Verbenaceae
4	Fever tea	Lippia javanica	Verbenaceae
5	Jasmine	Jusm inum pubescens	Oleaceae
6	Clerodendrum	Clerodendrum viscosum	Verbenaceae
7	Ground Fig	Ficus heterophylla	Moraceae
8	Bleeding Heart	Clerodendrum tiomsoniae	Lamiaceae
9	Stinking Cassia	Cassio tora	Fabaceae
10	Chitrak	Plumbago zeyla nica	Plumbaginaceae
11	Duranta	Duranta repens	Verbenaceae
12	GardenCosmos	Cosmos bipinna tus	Asteraceae
13	Devil's Trumpets	Datura sp.	Solanaceae
14	Dracaena	Pleomele reflea	Asparagaceae
15	Lagerstroemia	Lagerstroemia indica	Lythraceae
16	Citrus/Citron	Citrus medica	Rutaceae
17	Rose	Rosa sp. Var.	Rosaceae
18	Wild Pmumeria	Plumeria pudica	Apocynaceae
19	Wild Eggplant	Solanum Totvum	Solanaceae
20	Indian heliotrope	Heliotropium indiciim	Boraginaceae
21	Heliconia	Strelitzia sp.	Musaceae
22	Common Wireweed	Sida acuta	Malvaceae
23	Thuja	Thuja orientalis	Cupressaceae
24	Chinese Rose	Hibiscus rosa -sinensi's	Malvaceae
25	Lime	Citrus acida	Rutaceae
26	Orange Jasmine	Mn rraya paniculata	Rutaceae

27	Oleander	Nerium oleander	Apocynaceae
28	Karipata	Murraya Koenigii	Rutaceae

Table 11: Checklist of Creepers

No.	Common Name	Scientific Name	Family
1	Aparajita	Clitoria ternatea	Fabaceae
2	Birdfoot Grape-Vine	Cayratia pedata	Vitaceae
3	Passion Flower	Passiftora suberosa	Passifloraceae
4	Cayratia	Coratia trifolia	Vitaceae
5	Corkystem Passionflower	Passiflora suberosa	Passiflozaceae
6	Birdfoot Grape-Vine	Cayratia sp.	Vitaceae
7	Gulanchalata	Tinospora cordifolia	Menispermaceae
8	Titakunja	Wattakaka votubillis	Asclepiaceae
9	Bengal Trumpet Vine	Thunbergia grandiflora	Acanthaceae
10	Lpomoea	lpomoea aquatic	Convolvulaceae
11	I ndian Stinging Nettle	Tragia in volucrato	Euphorbiaceae
12	Money Plant, Ivy Arum	Epipremn um aureum	Areceae
13	Snake Vine	Stephania japonica	Menispermaceae
14	Philodendron	Philodendron sp.	Areceae
15	Chinese creeper	Micania micrantha	Asteraceae
16	White Morning Glory	lpomoea obscura	Convolvulaceae
17	Telakuchu	Coccinia grand is	Cucurbitaceae
18	Tiliacora	Tiliacora racemosa	Menispermaceae
19	Roundleaf Bindweed	Evolvulus Nummularius	Convolvulaceae
20	Justicia	Justicia simplex	Acanthaceae
21	Hemigraphis	Hemigraphis hirta	Acanthaceae
22	Climbing Mallotus	Nlallotus repandus	Euphorbiaceae
23	Bougainvillea	Bougainviflea sp.	Nyc‹aginaceae
24	Allamanda	Allamanda sp.	Apocynaceae

Table 12: Checklist of Ornamental Plant

No.	Common Name	Scientific Name	Family
1	Dracena (Red)	Dracenarnahatma	Liliaceae

Table 13: Checklist of Palms

No.	Common Name	Scientific Name	Family
1	Areca Palm	Dypsis Intescens	Arecaceae
2	Bottle Palm	Hyoyhorbe lagenicaulis	Arecaceae
3	Indian Datepalm	Phoenix sylvestris	Palmae
4	Coconut	Cocos nucifera	Arecaaceae
5	Palmyra Palm	Borassusflabe Hifer	Palmae
6	Areca	Areca catechu	Arecaceae
7	Palmyra Palm	Borassusflabellifer	Arecaceae

Table 14: Checklist of Ferns and Seasonal Flowers

No.	Common Name	Scientific Name	Family	Type
1	Bircl- nest Fern	Asplenium Sp.	Aspleniaceae	Fern
2	Fishtail Fern	Microsorum punctatum	Polypodiaceae	Fern
3	Oakleaf Ferm	Drynoriaquercifolia	Polyqodiaceae	Fern
4	Snapdragon	Antirrhinum majus	Scrophulariaceae	Season
5	Garden stock	Matthiola incana	Brassicaceae	Season
6	Gazania	Gazania sp.	Asteraceae	Season
7	Gladiolus	Gladiolus sp.	Iridaceae	Season
8	Flaming Kaaty	Kalanchoeblossfeldiana	Crassulaceae	Season
9	Miaden Pink	Dianthus deltoids	Carryophyllaceae	Season
10	Amaryllis	Hippeastrum Sp	Amaryllideceae	Season
11	Pansy	Viola tricolor var.	Violaceae	Season
12	Petunin	Petunia hybrida	Solanaceae	Season
13	Verbena	Vei-hena sp.	Verbenaceae	Season

Conclusion:

Biodiversity status of college campus found satisfactory.

16. Suggestions and Recommendations

- Sustainable use of resource and ecology balance of the college campus must be maintained through the year.
- The prolific use of insecticides/pesticides should be checked as these harmful chemicals are detrimental and instrumental for killing of insects/butterflies which are natural prey for the birds.
- There is urgent need to form a Green Monitoring Team.The priority ofthis body is to maintain the greenry of the College campuses.
- The Green Monitoring Team should consist of members from teaching staffs, non teaching staffs, students and if possible try to include some local interested people.
- Vermicompost facility may be practiced, the product of which can be used as manure or fertilizer for plantation purpose.

Drinking Water Quality Standard as per Bureau of Indian Standards IS 10500

SN	Substance Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permisible Limit in the Absence of Alternate Source	Method of Test (Ref. to IS)	Remarks
1	2	3	4	5	6	7
Essential Characteristics						
i	Colour, Hazen units, Max.	5	Above 5. consumer acceptance desreases	25	3025(Part-4): 1983	Extended to 25 only if toxic substances are not suspected in absenceof alternate sources.
ii	Odour	Unobjectionable	-	-	3025 (Part-5): 1983	a) Test cold and when heated b) Test at several dilutions
iii	Taste	Aggreable	-	-	3025 (Part 7&8):1984	Test to be conducted only after safety has been established.
iv	Turbidity NTU, Max.	5	Above5, consumer acceptance decreases.	10	3025 (Part 10): 1984	
v	pH Value	6.5 to 8.5	Beyond this range the water will affect the mucous membrane and/or water supply system	No relaxation	3025 (Part 11): 1984	

SN	Substance Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permisible Limit in the Absence of Alternate Source	Method of Test (Ref. to IS)	Remarks
1	2	3	4	5	6	7
vi	Total Hardness (as CaCO3) mg/l, Max.	300	Encrustation in water supply structure and adverse effects on domestic use.	600	3025 (Part 21): 1983	
vii	Iron (as Fe) mg/l, Max.	0.3	Beyond this limit taste/ appearance are affected , has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.	1.0	32 of 3025 : 1964	
viii	Chloride (as Cl) mg/l, Max.0.3	250	Beyond this limit, test, corrosion and palatability are affected.	1000	3025 (Part 32): 1988	
ix	Residual free chlorine mg/l, Min	0.2	-	-	3025 (Part 26)1986	To be applicable only when water is chlorinated. Tested at consumer end. When protection is required, it should be Min 0.5mg/l

S N	Substance Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permisible Limit in the Absence of Alternate Source	Method of Test (Ref. to IS)	Remarks
1	2	3	4	5	6	7
x	Fluoride (as F) mg/l, Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025 1964	
	Desirable Characteristics					
xi	Dissolved solid mg/l, Max.	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2000	3025 (Part 16) 1984	
xii	Calcium (as Ca) mg/l, Max.	75	Encrustation in water supply structure and adverse effect on domestic use	200	3025 (Part 40) 1991	
xiii	Magnesium (as Mg) mg/l, Max.	30	Encrustation to water supply structure and adverse effect on	100	16.33.34 of IS 3025 1964	
xiv	Copper (as Cu) mg/l, Max.	0.05	domestic use Astringent taste, will be caused beyond this discoloration and corrosion of pipes, fitting and utensils	1.5	36 of 3025 1964	

S N	Substance Characteristics	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permisible Limit in the Absence of Alternate Source	Method of Test (Ref. to IS)	Remarks
1	2	3	4	5	6	7
xv	Sulphate (as SO4)	200	Beyond this causes gas-tro intenstinal irritation when magnesium or sodium are present.	400 (sec. col. 7)	3025 (Part 24) 1986	May be extended up 400 provided Magnesium (as Mg) does not exceed 30
xvi	Nitrate (as NO_2) Mg/l, Max.	45	Beyond this methaemo-globinemia takes place	No relaxation	3025 (Part 34) 1988	
xvii	Cadmium (as Cd) Mg/l, Max.	0.01	Beyond this, the water becomes toxic	No relaxation	See Note 1	To be tested when pollution is suspected
xviii	Arsenic (as As) Mg/l, Max.	0.01	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37) 1988	To be tested when pollution is suspected
xix	Lead (as Pb) Mg/l, Max.	0.05	Beyond this limit, the water becomes toxic	No relaxation	See Note 1	To be tested when pollution is suspected
xx	Zinc (as Zn) Mg/l, Max.	5	Beyond this limit it can cause astringent taste & an opalescence in water	15	39 of 3925 1964	To be tested when pollution is suspected
xxi	Mineral Oil Mg/l, Max.	0.01	Beyond this limit undesi-rable taste and odour after chlorination take place	0.03	Gas chromat-ographic method	To be tested when pollution is suspected

Source: Indian Railways Institute of Civil Engineering, Pune

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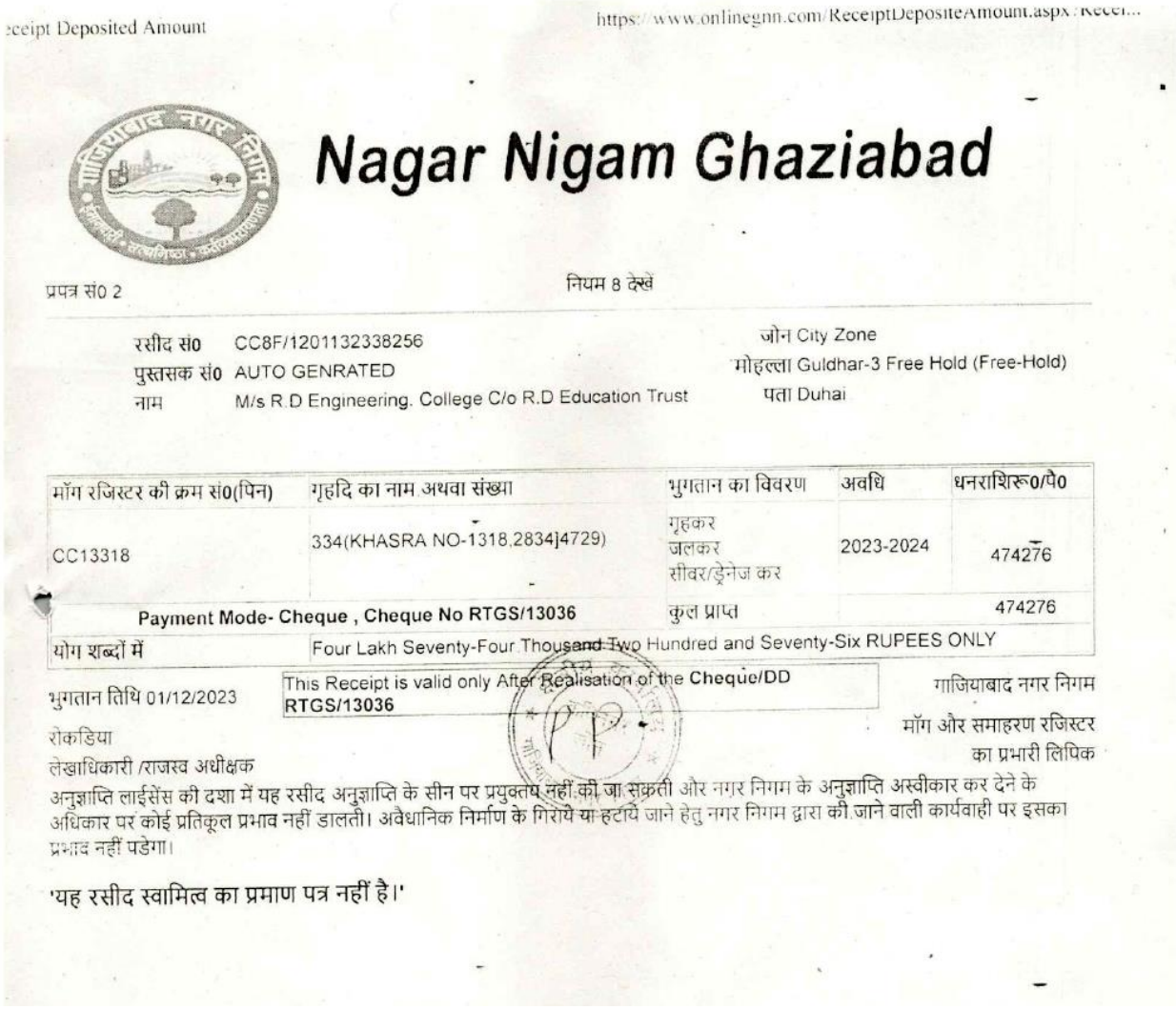
18. Waste disposal Report



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Nagar Nigam Ghaziabad

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रसीद सं0 CC8F/1201132338256
पुस्तसक सं0 AUTO GENRATED
नाम M/s R.D Engineering. College C/o R.D Education Trust

जोन City Zone
मोहल्ला Guldhar-3 Free Hold (Free-Hold)
पता Duhai

मॉग रजिस्टर की क्रम सं0(पिन)	गृहदि का नाम अथवा संख्या	भुगतान का विवरण	अवधि	धनराशिरू0/पै0
CC13318	334(KHASRA NO-1318,2834]4729)	गृहकर जलकर सीवर/ड्रेनेज कर	2023-2024	474276
Payment Mode- Cheque , Cheque No RTGS/13036		कुल प्राप्त		474276
योग शब्दों में	Four Lakh Seventy-Four Thousand Two Hundred and Seventy-Six RUPEES ONLY			

भुगतान तिथि 01/12/2023

This Receipt is valid only After Realisation of the Cheque/DD RTGS/13036

गाजियाबाद नगर निगम
मॉग और समाहरण रजिस्टर
का प्रभारी लिपिक

रोकडिया
लेखाधिकारी /राजस्व अधीक्षक

अनुज्ञाप्ति लाईसेंस की दशा में यह रसीद अनुज्ञाप्ति के सीन पर प्रयुक्तय नहीं की जा सकती और नगर निगम के अनुज्ञाप्ति अस्वीकार कर देने के अधिकार पर कोई प्रतिकूल प्रभाव नहीं डालती। अवैधानिक निर्माण के गिरोये या हटाये जाने हेतु नगर निगम द्वारा की जाने वाली कार्यवाही पर इसका प्रभाव नहीं पडेगा।

'यह रसीद स्वामित्व का प्रमाण पत्र नहीं है।'

19. Drinking Water Test Report

Office of The Chief Medical Officer, Ghaziabad

Ref.No. DSO/IDSP/2023/ 1157 Dated 25/02/2023

PORTABLE WATER TEST REPORT

ADDRESS:- R D ENGINEERING COLLEGE, 9TH KM MILE STONE ON NH-58, DELHI MEERUT ROAD, DUHAI, GHAZIABAD.

No of sample collected : 01

Date of sample collected : 21-02-2023

Sample collection area

Sample collection area	Sample ID	Result
R D ENGINEERING COLLEGE, 9TH KM MILE STONE ON NH-58, DELHI MEERUT ROAD, DUHAI, GHAZIABAD	136	Satisfactory

Test Result

H_2S Water test kit : Negative (-Ve) after 24-48 hrs incubation

Comments:-

H_2S water test kit report - ve reflects that water is free from Coliforms Organism.

Recommendation:

Given water sample safe for drinking purpose.

Lab Technician
IDSP Lab
Ghaziabad

(Dr. Suruchi Saini)
Microbiologist IDSP Lab
Ghaziabad

(Dr R K Gupta)
District Public Health Expert
& Surveillance Officer
District Public Health E...

Office of The Chief Medical Officer, Ghaziabad

Ref.No: DSO/IDSP/2023/ 1457 Dated 25-02-2023

Safe Drinking Water, Health & Hygiene Certificate

It is certified that a combined inspection team headed by Mr. Sujit Kumar Rai from IDSP UNIT, Ghaziabad and Nagar Nigam Ghaziabad inspected the premises R D ENGINEERING COLLEGE, 9TH KM MILE STONE ON NH-58, DELHI MEERUT ROAD, DUHAI, GHAZIABAD on 21-02-2023 and found R D ENGINEERING COLLEGE, 9TH KM MILE STONE ON NH-58, DELHI MEERUT ROAD, DUHAI, GHAZIABAD has safe Drinking water facilities for the person is maintaining hygienic sanitation conditions in the water as per the norms. This certificate is issued with the condition that the water quality will be maintained in future otherwise, it will automatically stand canceled on proof.

Based on Ref: DSO/IDSP/2023/ 1457

(Dr. R K Gupta)
District Public Health Expert
District Surveillance Officer
Ghaziabad
District Public Health Expert

To

R D ENGINEERING COLLEGE,
9TH KM MILE STONE ON NH-58, DELHI MEERUT ROAD, DUHAI,
GHAZIABAD

THANKS

ENVIRONMENT AUDIT REPORT

Dec 2023

R.D.Engineering College

PFPM+57W, 8 th KM Mile Stone from Ghaziabad National Highway(NH) No.58, Delhi - Meerut Expy, Duhai, Ghaziabad, Uttar Pradesh 201206

Audit Conducted by:

ENGINEERING FACILITY SERVICES
Office No.778-779, Gaur City Mall, Sector-04, Greater Noida (Uttar Pradesh) India, 201318; E-mail.; efs_info@yahoo.com; Mo: 8826682703
Energy Service Companies empaneled with Bureau of Energy Efficiency (BEE)

1 Contents

2 ACKNOWLEDGEMENT

Engineering Facility Services acknowledges the cooperation and support of the management and staff of **R D Engineering College,** in particular, the support and disposition of the **Mr. D. N. Sharma (Manager Admin,), Mr. Brahma Swaroop (State Manager) & Mr. Ghanshyam (Registrar)** Teaching/Supporting Staff of institute has been invaluable to the success of this report. EFS Engineering Facility Services wishes to stress that in line with its policy, all information obtained in the course of this Audit exercise, as well as those contained in this report, will be accorded the strictest confidentiality.

3 DISCLAIMER

This Environment audit report of **R D Engineering College** is prepared by Engineering Facility Services, Noida on interest of the organization.

This report need not necessarily represent the views of building management and its employees. The building management, any employee of **R D Engineering College** or any person acting on behalf of any of them makes no warranty or representation whatsoever express or implied with respect to use of any information, process, method or similar item disclosed in this report and assumes no legal liability for the information in this report, nor does any party represent that the use of this information will not infringe upon privately owned rights.

All calculations in this report are done based on the data provided by plant administration, the necessary measurements taken during the study, and the operating conditions prevailing during the study period. The accuracy of the report is subject to these limitations.

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All requests to use or reproduce any part of this report should be directed to:

The Registrar

R D Engineering College

Report by: (Deepak Bajpai) Lead Auditor

(Certified Energy Auditor and Chartered Engineer)

4 INTRODUCTION

Environment Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of various establishments. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambience. Environment audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Green impact on campus. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-enquiry is a natural and necessary outgrowth of a quality educational institution. Thus, it is imperative that the college evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

5 OVERVIEW OF INSTITUTE

R.D. Engineering College is one of the premier institutions in the field of technical education. This self-financing institution is approved by All India Council for Technical Education, New Delhi, recognized by the Government of Uttar Pradesh and affiliated to Uttar Pradesh Technical University, Lucknow. This Institute aims at imparting technical knowledge and broad vision to the budding technocrats of future and relies on dedication, skills and experience of outstanding faculty and staff. All round personality development of students and to impart them meaningful education are the key objectives of this Institute.

The Institute is committed to generating, disseminating, preserving knowledge and to working with others to bring this knowledge to bear on the world's great challenges. R.D.E.C. is dedicated to provide its students with an education that combines rigorous academic study and the excitement of discovery with the support and intellectual stimulation of a diverse campus community. We seek to develop in each member of the R.D.E.C. community the ability and passion to work wisely, creatively and effectively for betterment of the human kind.

6 OBJECTIVES

The Environment Audit of an institution is of paramount importance these days for self-assessment of the institution, reflecting the role of the institution in mitigating the present environmental problems. The college has been putting efforts to keep the environment clean since its inception. But the auditing of this non-scholastic effort of the college has not been documented. Therefore, the purpose of the present environment audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Environment Audit is to:

1. Document the quality drinking water
2. Document the quality of recycled waste water for gardening
3. Document the solid Waste disposal system of medical and non-medical waste
4. To document the ambient environmental condition of air, water and noise in the campus.
5. Benchmarking for environmental protection initiatives
6. Reduction in resource use of water, electricity etc.
7. Financial savings through a reduction in resource use as electricity, water, waste, fuel, etc.

7 AUDIT TEAM

Audit was conducted by the EFS team:

Name	Position	Qualification
Deepak Bajpai	Lead Auditor	B.Tech (Mechanical Engineering) Bureau of Energy Efficiency Certified Energy Auditor, Chartered Engineer
Vikrant Pal	Auditor	B. Tech
Ashwani Kumar	Auditor	B. Tech

8 EXECUTIVE SUMMARY

An environmental audit is a snapshot in time, in which one assesses campus performance in complying with applicable environmental laws and regulations. Though a helpful benchmark, the audit almost immediately becomes outdated unless there is some mechanism in place to continue the effort of monitoring environmental compliance.

This is an environmental audit of the institute for NAAC affiliation; QS Programme and doing their bid towards environmental protection and environmental awareness at the local and global front. The 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 the audit. This audit report contains observations and recommendations for the improvement of environmental consciousness.

9 AREA OF IMPROVEMENTS

- Water meters should be installed and maintain the inventory of water resources.
- The water from the rainwater harvesting pit can be used for the purpose of gardening.
- An internal inspection system should be developed for various equipment available in the campus.
- Environmental drills for response against spillages and leakage of chemicals in the campus.

10 ENVIRONMENTAL AUDIT -QUESTIONNAIRES

The areas of eco/environmental/green auditing to be followed/practiced by participating institutions:

I. Waste Minimization and Recycling
II. Greening
III. Energy Conservation
IV. Water Conservation
V. Clean Air
VI. Animal Welfare
VII. Environmental Legislative
VIII. General Practices

Does any Environmental Audit conduct earlier?

Yes, this is the third time a systematic way of monitoring their environmental eminence initiative taken by R D Engineering College for environment protection.

What is the total permanent population of the Institute?

Particulars	Total
Students	**1600**
Teachers	**150**
Sub Total	**1750**
Approximate Number of Visitors (Per day)	**50**

Where is the campus located?

R D Engineering College is located in 9th KM Stone on NH-58, Delhi – Meerut Road, Duhai, Ghaziabad, Uttar Pradesh 201206

Which of the following are available in your institute?

1	Garden area	Available
2	Playground	Available
3	Kitchen	Available
4	Toilets	Available
5	Garbage Or Waste Store Yard	Available
6	Laboratory	Available
7	Canteen	Available
8	Hostel Facility	Available
9	Guest House	Available

Which of the following are found near your institute?

1	Municipal dump yard	Not in the vicinity of the institute, No No
2	Garbage heap	No Garbage heaps
3	Public convenience	Yes, public convenience is available
4	Sewer Plant	Installed
5	Stagnant water	No stagnant water
6	Open drainage	Yes, properly maintain and sanitized
7	Industry – (Mention the type)	No
8	Bus / Railway station	Nearby from campus
9	Market / Shopping complex / Public halls	Yes, within 500 mtr.

I – WASTE MINIMIZATION AND RECYCLING

1.	**Does your institute generate any waste?** **If so, what are they?**	**Yes, Solid waste, Canteen waste, paper, plastic, E-waste etc.**
2.	What is the approximate amount of waste generated per day?	Wet Waste: 200 kg Dry Waste: 600 KG
3.	How is the waste generated in the institute managed? By 1 Composting 2 Recycling 3 Reusing 4 Others (specify)	Reuse of one side printed Paper for internal communication. Sewage water used for gardening. Two types of Waste bins are provided at campus for biodegradable and non-biodegradable waste. Horticulture waste is also disposed by Solan Authority.
4.	Do you use recycled paper in institute?	Yes
5.	Do you use reused paper in institute?	Yes
6.	How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.	Done in locality for awareness of resource crunches
7.	Can you achieve zero garbage in your institute? If yes, how?	Yes, 50% achieved, Possible through waste management plan

II – GREENING THE CAMPUS

8.	**Is there a garden in your institute?**	**Yes, about Approx. 42% areas are developed as Gardens.**	
9.	Do students spend time in the garden?	2-4 Hour	
10.	Total number of Plants in Campus	Plant type	Approx. number
		Trees	282
		Ornamental	600
11.	Suggest plants for your campus. (Trees, vegetables, herbs, etc.)	Ashoka, Ficus Religeosa, Boganvellia, Bottle palm, Tunn, Jackfruit and many more as per geographical regime.	
12.	Is the university campus have any Horticulture Department	Yes	
	Number of Staff working in Horticulture Department	3 Gardeners, Engg. Deptt. look water pipe line maintenance and Admin officer looking maintenance.	
13.	Number of Tree Plantation Drives organized by college per annum. (If Any)	Yes, Two Tree Plantation Drives are Organized Annually. 35 trees and 140 shrubs planted in this financial year.	
14.	Number of Trees Planted in Last FY.	20	
	Survival Rate	95%	
15.	Plant Distribution Program for Students and Community	Yes, Saplings are distributed to Students and visitors at various Occasions. Besides this landscape of some area in city are developed by Institute.	
16	Plant Ownership Program	Various trees are planted and owned by faculty, staff, visitors and as well as by the students. The name plates are also displayed near the plants.	

III – ENERGY

17.	List ten ways that you use energy in your institute. (Electricity, LPG, firewood, others). Using this list, try to think of ways that you could use less energy every day.	Electricity saving by use of CFL/LED bulbs for illumination, PNG saving by use of Pressure cookers for cooking food.
18.	Are there any energy saving methods employed in your institute? If yes, please specify. If no, suggest some	Yes, energy saving methods like switching off the electrical gadgets, when not in use. Use of Natural Lights and Natural Ventilation is promoted. Messages are displayed at various locations to make aware the Peoples about Energy Savings. Renewable source of energy through limited solar street lighting installed at R D Engineering College.
19.	How many CFL/LED bulbs has your institute Installed?	100 % of Total Conventional bulbs are Replaced by LED Lights.
20.	Are any alternative energy sources employed / installed in your institute? (Photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.	Yes, upgradation work is in progress
21.	Do you run “switch off” drills at institute?	Yes
22.	Are your computers and other equipment’s put On power-saving mode?	Yes, In Practice
23.	Does your machinery (TV, AC, Computer, weighing balance, printers, etc.) run on standby modes most of the time? If yes, how Many hours?	Yes, All machinery is working only when required. Computers & Printer are switched on during the usages only.

IV – WATER CONSERVATION

24.	List four uses of water in your institute	Basic use of water in campus: 1. Drinking –800 KL/month 2. Gardening – 1000 KL/Month 3. Kitchen and Toilets –700 KL/month 4. Others – 150KL/month
25.	How Does your institute store water? Are there any water saving techniques followed in your institute?	22 Nos of Overhead and Underground Water Tanks installed for storage of water. To avoid overflow of water-controlled valves are provided in water supply system. Close supervision for water supply system.
26.	If there is water wastage, specify why and How can the wastage be prevented / stopped?	There is no water wastage methodology used.
27.	Locate the point of entry of water and point of exit of waste water in your institute. Entry- Exit-	Entry- Water comes from borewell Exit- From Water Drainage System to Campus STP
28.	Write down four ways that could reduce the amount of water used in your institute	Basic Four ways: 1. Dripping of water from taps is closely monitored. 2. Maintenance and monitoring of valves in supply system to avoid overflow, leakage and spillage 3. Water Conservation awareness for new Students 4. Reuse of waste water
29.	Record water use from the institute water meter for six months (record at the same time of each day). At the end of the period, compile a table to show how many litres of water have been used.	Water Meters are not available for calculation of usage of total quantity only.
30.	Does your institute harvest rain water?	Yes
31.	Is there any water recycling System.	Upgradation work is in progress

V – CLEAN AIR

32.	**Are the Rooms in Campus are Well Ventilated?**	**Yes**	
33.	Window Floor ratio of the Rooms	**Very Good**	
34.	What is the ownership of the vehicles used by your institute? (Please Tick ✓ only one)		Yes
			Operator-owned vehicles
		✓	Institute-owned vehicles
			A combination of campus-owned and operator-owned vehicles
35.	Provide details of institute-owned motorised vehicles?	**Total**	
	No. of vehicles	**63**	
	PUC done	**Yes**	
36.	Specify the type of fuel used by your institute's vehicles:	**Qty**	
	Diesel	**18**	
	Petrol	**32**	
	CNG	**12**	
	LPG	**0**	
	Petrol	**1**	
	Electrical/Battery	**0**	
37.	Air Quality Monitoring Program (If Any)	Yes, Monitoring is being done by approved Laboratory	
38.	Students suffer from respiratory ailments? (If Any)	There has been no reported case of respiratory ailments due to environment pollution.	
39.	Details of Genset	Silent DG Set installed for backup power	

VI – ANIMAL WELFARE

40	List the animals (wild and domestic) found on the campus (dogs, cats, squirrels, birds, insects, etc.)	Monkey, Birds and Squirrels are commonly found in campus. A variety of birds species and other flora and fauna are available but these are not harmful to humans so institute doing their bit for its conservation.
41.	How many dogs in your area have undergone Animal Birth Control - Anti Rabies (ABC - AR)?	Not required
42.	Does your institute have a Biodiversity Programme or a KARUNA CLUB?	Not Available

VII – ENVIRONMENTAL LEGISLATIVE COMPLIANCE

43.	Are you aware of any environmental Laws? Pertaining to different aspects of environmental management?	Yes
44.	Does your institute have any rules to protect the environment? List possible rules you could include.	Yes (Plantation, Restrictions of vehicles, garbage disposal, etc.)
45.	Does Environmental Ambient Air Quality Monitoring conducted by the Institute?	No
46.	Does stack monitoring of DG sets conducted by the Institute?	No
47.	Is any warning notice, letter issued by state government bodies?	No
48.	Does any Hazardous waste generated by the Institute? If yes explain its category and disposal method	Yes (Disposal of hazardous waste by dilution method)
49.	Does any Biomedical waste generated by the Institute? If yes explain its category and disposal method	No, disposal waste generated by college

VIII –GENERAL

50.	Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
51.	Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
52.	Does housekeeping schedule on your campus?	Yes, the Swachch Bharat movement. Total 50 person employed for this work.
53.	Are students and faculties aware of environmental cleanliness ways? If Yes Explain	Yes, Periodically pollution reduction, plantation, energy conservation awareness campaigns carried out by the institute
54.	Do Important Days Like World Environment Day, Earth Day, and Ozone Day etc. eminent in Campus?	Yes
55.	Does Institute participate in National and Local Environmental Protection Movement?	Yes, Swatch Campus Abhiyaan & tree plantation drives by students at Campus.
56.	Does Institute have any Recognition/certification for the environment's Friendliness?	No
57.	Does Institute use renewable energy?	Yes
58.	Does Institution conducts a Green/environmental audit of its campus?	Yes, this is the first environmental audit done by the institution
59.	Has the institution been audited/accredited by any other agency such as NABL, NABET, TQPM, NAAC etc.?	Yes, Accredited by NAAC

11 BEST PRACTICES/INITIATIVES FOR ENVIRONMENT

A	**Renewable Energy** Yes, renewable energy is used by R D Engineering College .	100 KW solar plant installation is in progress
B	**Biodiversity Conservation** Flora and fauna conservation	It is in the schedule plan of Campus Environment committee
C	**Tree Plantation Drives** Two Drives Annually, as well as Every Guest, is honored by Tree Plantation at Campus.	Yes
D	**Ground Water Recharge** 06 units of Rain Water Harvesting System.	Yes
E	**Pollution Reduction** Personal Vehicles users used the carpool.	Faculty & student used carpool & common bus facility.
F	**E-Waste Management**	Handover to authorized recycler
G	**Solid Waste Management** Lifting of garbage from R D Engineering College campus on an alternate day for landfill.	Yes
H	**Adoption of Village School** CSR	Yes
I	**Water Conservation**	Yes
J	**Corporate Resource Center (CRC)**	R D Engineering College Corporate Resource Center (CRC) is dedicated to nurturing future leaders
K	**Mitigation measures for Air pollution at construction stage and operation stage by developing adequate green belt.**	Yes
L	**Mitigation measures for noise pollution by isolation of noise generation activities**	Yes
M	**Disaster management plan**	Yes
N	**Fire protection system**	Yes
O	**Environment/Green committee**	For regulating eco-friendly initiatives at campus premises.

12 RECOMENDATIONS

- Water Meter should be installed/monitored at institute for monitoring of water consumption per capita.
- Environmental Monitoring i.e. (Ambient Air Quality monitoring, Stack Monitoring of DG sets, Water and wastewater monitoring need to be conducted by Himanchal Pradesh State Pollution Control Board, approved laboratory with frequency of six month.

13 CONCLUSION

This audit involved extensive consultation with all the campus team, interactions with key personnel on wide range of issues related to Environmental aspects. The R D Engineering College has Environmental Committee for sustainable use of resources. The audit has identified several observations for making the campus premise more environmental friendly. The recommendations are also mentioned with observations for college campus team to initiate actions.

The audit team opines that the overall site is maintained well from environmental perspective. There is no major observations but few things are important to initiate urgently are water balance cycle and periodic inspection of buildings and initiation of composting at campus.

14 REFERENCE

- The Environment [Protection] Act – 1986 (Amended 1991) & Rules-1986 (Amended2010)
- The Petroleum Act: 1934 – The Petroleum Rules:2002
- The Central Motor Vehicle Act: 1988 (Amended 2011) and The Central Motor Vehicle
- Rules:1989 (Amended in2005)
- Energy Conservation Act 2010.
- The Water [Prevention & Control Of Pollution] Act – 1974 (Amended 1988) & the Water (Prevention & Control of Pollution) Rules –1975
- The Water [Prevention & Control Of Pollution] Cess Act-1977 (Amended 2003) and Rules-1978
- The Air [Prevention & Control Of Pollution] Act – 1981 (Amended 1987) The Air (Prevention & Control of Pollution) Rules –1982
- The Gas Cylinders Rules – 2016 (Replaces the Gas Cylinder Rules –1981
- E-waste management rules2016
- Electrical Act 2003 (Amended 2001) / Rules 1956 (Amended2006)
- The Hazardous Waste (Management and Handling and Trans-boundary Movement) Rules, 2008 (Amended2016)
- The Noise Pollution Regulation & Control rules, 2000 (Amended2010)
- The Batteries (Management and Handling) rules, 2001 (Amended2010)
- Relevant Indian Standard Code practices

Green and Environment Audit Policy:

A green and environmental policy is thoroughly done in R.D. Engineering College for sustainability, environmental conservation, and responsible resource management. Such policies are crucial for businesses, government entities, and other organizations to demonstrate their dedication to reducing their environmental impact and contributing to a more sustainable future. Below are key components that are typically included in a green and environmental policy:

1. **Scope Definition:** Determine the boundaries and focus areas of the audit.
2. **Data Collection:** Gather information on the organization's environmental aspects, including resource use and emissions.
3. **Regulatory Compliance:** Assess the organization's compliance with environmental laws and regulations.
4. **Identification of Risks and Opportunities:** Identify potential risks to the environment and opportunities for improvement.
5. **Performance Measurement:** Evaluate the organization's environmental performance against established benchmarks or targets.
6. **Stakeholder Engagement:** Involve relevant stakeholders in the audit process, such as employees, customers, and local communities.
7. **Reporting:** Communicate the audit findings, including areas of strength and weakness, and propose recommendations for improvement.
8. **Environment Policy:** An Environmental Policy is a formal statement that outlines an organization's commitment to environmental sustainability and its approach to managing its impact on the environment. This policy sets the overall framework for the organization's environmental objectives and targets.
9. **Commitment:** A clear expression of the organization's commitment to environmental protection and sustainability.
10. **Compliance:** A commitment to comply with relevant environmental laws, regulations, and other requirements.
11. **Continuous Improvement:** A pledge to continually improve environmental performance through the setting of objectives and targets.
12. **Prevention of Pollution:** A commitment to preventing pollution and minimizing adverse environmental impacts.
13. **Resource Conservation:** An acknowledgment of the importance of conserving resources, including energy and water.
14. **Stakeholder Engagement:** Recognition of the importance of engaging with stakeholders on environmental matters.
15. **Communication:** A commitment to communicating the organization's environmental policy to employees, suppliers, customers, and the public.

Both the Green and Environment Audit and the Environmental Policy are essential components of an organization's broader sustainability efforts. The audit helps identify areas for improvement, while the policy provides a strategic framework for environmental management. Together, they contribute to an organization's efforts to operate in an environmentally responsible and sustainable manner.

SOLAR PANEL INSTALLATION IN PROGRESS

VEENA ENTERPRISES

Performa Invoice

Name Of the Buyer :- R. D. Engineering College **Add :-NH-58,Delhi Meerut Road Duhai,Ghaziabad UP-201206** **GST NO- 09AAATR8426MIZX**	**Name of the seller: Veena Enterprises, 3813 David Street Darya Ganj New Delhi 110002** **GST NO:-07ARUPM1247N1Z4**
SR/ EX/ C&P SP	23-12-2023

	Description Of Goods	Quantity	Total Amount
1	Solar Power Plant (On-grid System)	100kw	38,70,000
	GST@13.8%		5,34,060
	Grand Total		44,04,060

Payments Terms:-

10% Advance along with PO on submission of PI

60% Advance before dispatch of materials.

25% before installation.

5% after commissioning

For Veena Enterprises	**Bank Details**
For VEENA ENTERPRISES GST No. 07ARUPM1247N1Z4 Authorized Signatory	Veena Enterprise
	Bank : Axis Bank
	Acc No:916020039483195
	IFSC code: UTIB0000279
	Branch : Darya Ganj
Authorised Signatory	GST No :07ARUPM1247N1Z4

RAIN WATER HARVESTING PIT

THANKS

Energy Audit Report

DECEMBER 2023

RD Engineering College

9th KM Stone on NH-58,
Delhi – Meerut Road, Duhai,
Ghaziabad, Uttar Pradesh 201206

Audit Conducted by:

ENGINEERING FACILITY SERVICES

Office-778,779 Gaur City Mall, Sector-04, Greater Noida West (Uttar Pradesh) India, 201301; E-mail.; efs_info@yahoo.com; Mo: 8826682703

Energy Service Companies empaneled with Bureau of Energy Efficiency (BEE)

Acknowledgement

We take the opportunity to express our deep sense of gratitude towards management and staff of **RD Engineering College, Ghaziabad**, the support and disposition of the Teaching & Supporting Staff of College for awarding the work of executing Energy Audit in RD Engineering College, Ghaziabad. In particular we wish to thank them for their timely initiative, advice and valuable support extended to the project.

We are also grateful for extending all sorts of help while carrying out energy audit and also for their valuable help regarding the data collection and details at various stages of the project. We are also thankful to them for providing support while conducting survey in RD Engineering College, Ghaziabad.

We would be failing in our duty if we do not thank our respondents, who gave their valuable time and answered the survey questions with tremendous patience and understanding.

(Mr. DEEPAK BAJPAI)

CERTIFIED ENERGY AUDITOR & CHARTERED ENGINEER

DISCLAIMER

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TEAM MEMBERS

Project Team	Name
RD Engineering College	Mr. Brahma Swaroop
	Mr. D. N. Sharma
	Mr. Ghanshyam
Engineering Facility Services	Mr. Deepak Bajpai (BEE Certified -Energy Auditor)
	Mr. Vikrant Pal (Engineer-Energy Audit)
	Mr. Ashwani Kumar Anand (Engineer-Energy Audit)

Contents

List of tables

List of Figures

1.0 Introduction

The working details of assignment are as follows:

Project	**Energy Audit**
Client	**RD Engineering College**
Industry	**College**
Site	**RD Engineering College, Ghaziabad**
Consultant	**EFS**
Duration	December 2023
Project Scope	Examination of detail energy audit in the utility and process to assess the loss in the system.
Report	This document gives recommendations, details of findings and the way forward
Consultants involved	Mr. Deepak Bajpai (Certified Energy Auditor EA-19771) Mr. Ashwani Kumar Anand Mr. Vikrant Pal
Notes	- The critical points are marked in red - The assumptions are marked in blue - The suggestions / alternatives in the audit report are based on the present operating conditions of equipment/systems and to the best of our knowledge. - Investment figures are estimated values and recommended to obtain cost from vendors.

1.1 Summary of Energy Conservation Measures

Table 1. Summary of Energy Conservation Measures

S. No	Energy Conservation Measure	Annual Savings Electricity		Investment	Payback
		kWh	INR Lakhs	INR Lakhs	Month
Payback 0-12 months					
1	**Reduction in contact demand** It is recommended to reduce contract demand from 550 KVA to 400 KVA.		0.5	0	0
Payback >24 months					
2	**PF Improvement** It is observed that average power factor 0.963 It is recommended to maintain the power factor up to 0.995 by installing the additional capacitor at power distribution.		2	3	23
3	**Conventional ceiling fan replacement with BLDC fan** It is recommended to replace the Institute ceiling fan with BLDC fan immediately and plan to replace the 100 fans with BLDC fan in first phase.	9600	0.8	3.2	48
Total		**9600**	**3**	**6**	**26**

Sr. No.	Recommended Measure
1	Replace the ceiling fan with BLDC fan
2	Replace the AC with VRV technology
3	It is recommended to install occupancy sensor in office cabins and toilets to save energy
4	It is recommended to install the day light sensor on the outdoor lights for automation and control of the lights and this will also help us reduce the unwanted running hours of the lights

Some Energy Saving measure already taken by Institute as listed below:

- The institute has a very clear environmental vision and trying to reduce the energy
- The institute has planted a lot of trees and has maintained very good greenery.
- The institute generates more than 50 percent of energy through solar power plant for its domestic needs.
- It was observed that the building has opted the Energy efficient lighting system that is LED which was good option to save energy and we personally felt good to observe it.
- Most of the building have sufficient day light which saves the energy in the institutes.

2.0 Institute description and energy sources

2.1 About Institute

R.D. Engineering College is one of the premier institutions in the field of technical education. This self-financing institution is approved by All India Council for Technical Education, New Delhi, recognized by the Government of Uttar Pradesh and affiliated to Uttar Pradesh Technical University, Lucknow. This Institute aims at imparting technical knowledge and broad vision to the budding technocrats of future and relies on dedication, skills and experience of outstanding faculty and staff. All round personality development of students and to impart them meaningful education are the key objectives of this Institute.

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2.2 Energy Sources and Cost

Electricity & Fuel are major energy sources of the plant. Electricity is supplied at 11 kV. There is one 500 KVA, 11/0.44 kV power transformers to cater electricity demand.

The energy cost from various sources of energy is given below:

Table 2. Energy cost component of energy sources

Source of energy	Unit	Cost
Electricity (Grid)	Rs. /kWh	8.32

2.3 Electricity

The energy demand of the plant is fulfilled by the electricity from Grid. The annual energy consumption from electricity grid sources is as follows:

Table 3. Month wise electrical energy consumption

3.0 Electricity consumption

DETAILS OF ELECTRICITY CONSUMPTION FOR THE 2022-2023									
MONTH	**'KWH CONSUMPTION**	**KVAH CONSUMPTION**	**FIXED CHARGE**	**ENERGY CHARGES (INR)**	**PF**	**CONTRACT DEMAND (KVA)**	**BILLING DEMAND (KVA)**	**MDI (KVA)**	**NET AMOUNT PAYABLE (INR)**
Dec-22	35552	37498	177375.00	311983.36	0.948	550	412.50	119	526103
Jan-23	38665	40636.5	177375.00	338095.68	0.951	550	412.50	112	554466
Feb-23	44419.5	45961.5	177375.00	382399.68	0.966	550	412.50	128	602384
Mar-23	32138	33751	177375.00	280808.32	0.952	550	412.50	110	493063
Apr-23	36284.5	38339	177375	318980.48	0.946	550	412.50	120	533591
May-23	40609.5	42082.5	177375	350126.4	0.965	550	412.50	164	567630
Jun-23	62664.5	64659	177375	537962.88	0.97	550	412.50	248	768988
Jul-23	68129	70068	177375.00	582965.76	0.972	550	412.50	262	817396
Aug-23	56832	58621	177375.00	487726.72	0.97	550	412.50	248	714992
Sep-23	66325	68304.5	177375.00	568293.44	0.97	550	412.50	255	776352
Oct-23	67975.5	69894.5	177375.00	581522.24	0.97	550	412.50	266	815867
Nov-23	53589.5	55371.5	177375.00	460690.88	0.97	550	412.50	220	686659
Max	**68129**	**70068**	**177375**	**582966**	**1**	**550**	**413**	**266**	**817396**
Min	**32138**	**33751**	**177375**	**280808**	**1**	**550**	**413**	**110**	**493063**
Avg	**50265**	**52099**	**177375**	**433463**	**1**	**550**	**413**	**188**	**654791**

Observation:

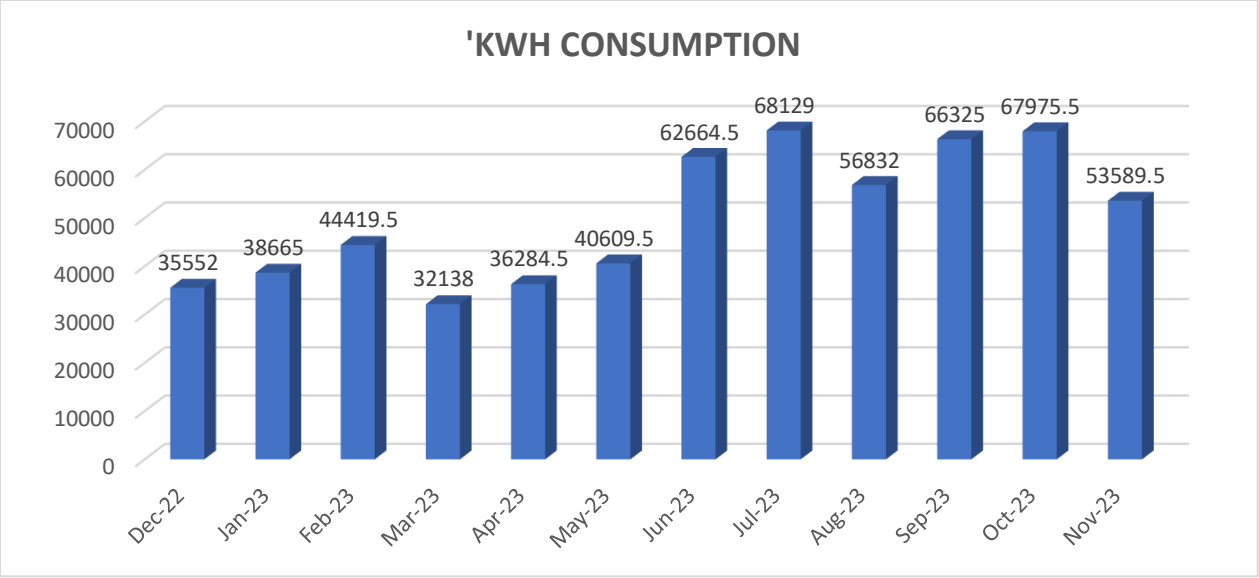
The maximum Energy consumption in July- 23 was 68129 kWh and minimum Energy consumption was 32138 kWh in March-23.

4.0 BASELINE ENERGY DESCRIPTION

Building is consuming different sources of energy - Grid Electricity, Electricity from Diesel Generating Sets. Electricity is generally used for all electrical devices while diesel is used to operate the DG sets.

The building is obtaining the power supply from Pashchimanchal Vidyut Vitran Nigam Limited through 11kV line which directly feeds into transformer which steps down voltage from 11kV to 433V.

Graph shows the total billed amount in KWH



Lighting, pump/ motor load and HVAC are the major energy consuming components in the building, followed by diesel (very less consumption) used in DG sets.

The building utilizes various energy resources to provide best of the amenities in the management, break up of different resources is given below and this consumption of resources forms the baseline/ benchmarking of the energy use.

5.0 Energy Conservation Measures

5.1 Power Factor Improvement

Background

Power factor maintain by RD Engineering College with the help of APFC panel.

Findings

During audit data & electrical bill analysis found the average PF is 0.963

Recommendations

Install additional capacitor bank to maintain the power factor from 0.963 to 0.995

Benefits

After installation capacitor bank billing amount of electricity bill will be reduced.

Table 4. Cost benefit Analysis of by PF improvement

Bill Period	KVAh Consumption at Present	Present Power Factor	KVAh Consumption post improvement of existing power factor to 0.995	Net Reduction in KVAh Consumption	Corresponding reduction in Energy Charges (Rs)	Total Monitory Benefit (Rs)
Dec-22	37498	0.948	35731	1767	14704	14704
Jan-23	40637	0.951	38859	1777	14786	14786
Feb-23	45962	0.966	44643	1319	10972	10972
Mar-23	33751	0.952	32299	1452	12077	12077
Apr-23	38339	0.946	36467	1872	15576	15576
May-23	42083	0.965	40814	1269	10558	10558
Jun-23	64659	0.969	62979	1680	13974	13974
Jul-23	70068	0.972	68471	1597	13284	13284
Aug-23	58621	0.969	57118	1503	12508	12508
Sep-23	68305	0.971	66658	1646	13696	13696
Oct-23	69895	0.973	68317	1577	13124	13124
Nov-23	55372	0.968	53859	1513	12586	12586
Total	**625187**		**606215**	**18972**	**157846**	**157846**

Table 5. Cost benefit Analysis by installing capacitor bank/SVG Generator

Description	UOM	Value
Average PF of the plant		0.963
Improved PF after installing Capacitor bank		0.99
Electricity tariff	Rs./kWh	8.32
Monetary Saving	Lakh INR	2
Investment	Lakh INR	3
payback	Month	22.8

5.2 Reduce Contract Demand

Background

College is getting power from Pashchimanchal Vidyut Vitran Nigam Limited at 11KV and a transformer 500 kVA LT Supply with a contract demand of 550 kVA. Minimum billing demand is 75% of contract demand. Demand charges is paid at rate of 430/kVA.

Findings

College is having contract demand of 550 kVA and minimum billing demand is 75% of contract demand ie.413 kVA.

Recommendation

Reduce the contract demand up to 400 kVA.

Benefit

The cost benefit analysis is as follows.

Table 6. Cost benefit analysis reducing contract demand

MONTH	Present Contract Demand				Proposed Contract Demand				
	Contract Demand (KVA)	Billing Demand (75% of Contract Demand)	Actual Demand (KVA)	Demand Charge (INR)	Contract Demand (KVA)	Min Billing Demand (75% of Contract Demand)	Actual Demand (KVA)	Proposed Demand Charge (INR)	Saving (INR)
Details of Contract Demand for Jun- 2022 to May-2023									
Dec-22	550	413	119	177375	400	300	119	129000	48375
Jan-23	550	413	112	177375	400	300	112	129000	48375
Feb-23	550	413	128	177375	400	300	128	129000	48375
Mar-23	550	413	110	177375	400	300	110	129000	48375
Apr-23	550	413	120	177375	400	300	120	129000	48375
May-23	550	413	164	177375	400	300	164	129000	48375
Jun-23	550	413	248	177375	400	300	248	129000	48375
Jul-23	550	413	262	177375	400	300	262	129000	48375
Aug-23	550	413	248	177375	400	300	248	129000	48375
Sep-23	550	413	255	177375	400	300	255	129000	48375
Oct-23	550	413	266	177375	400	300	266	129000	48375
Nov-23	550	413	220	177375	400	300	220	129000	48375
Average	**550**	**413**	**188**	**177375**	**400**	**300**	**188**	**129000**	**48375**
Total									**580500**

5.3 Replace BLDC fans with ceiling fans

Background

During energy audit we found that the institute uses 60 KW ceiling fans.

Findings

We found that the ceiling fan which is of 60KW consume more power.

Recommendations

It is recommended to replace the Institute ceiling fan with BLDC fan immediately and plan to replace the 100 fans with BLDC fan in first phase.

Benefits

We can replace the existing ceiling fans with the energy efficient BLDC fans. Savings should be taken as when the fan is needed to be changed as when they get faulty. Saving calculation given below.

Table 7. Saving by Ceiling fan replacement with BLDC fan

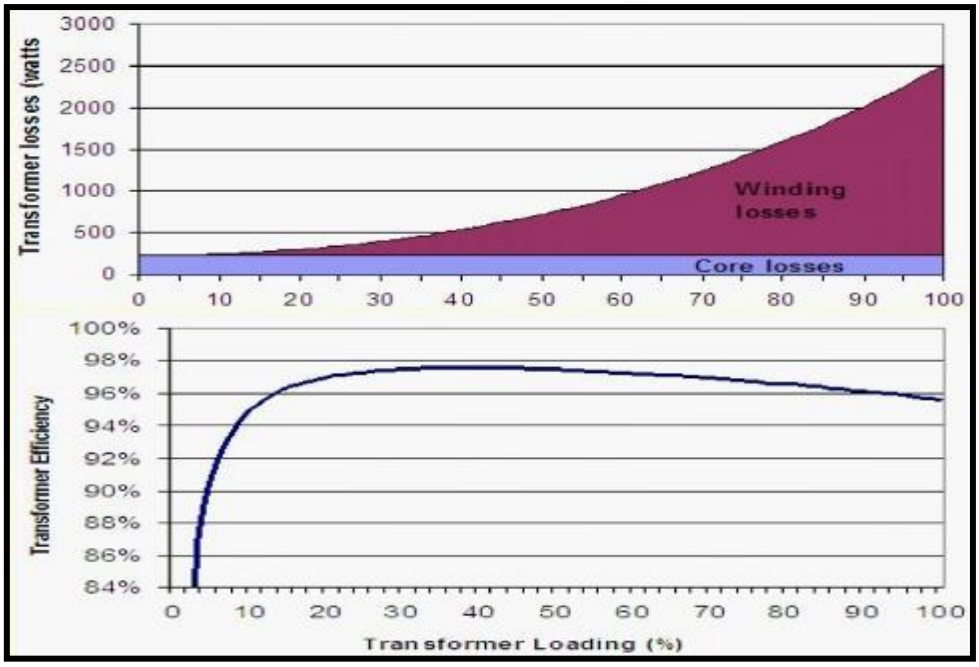
Parameter	Unit	Value
Average power consumption of the ceiling fan at present	Watt	60
Average power consumption of energy efficient star rated (BLDC) fans	Watt	28
Equivalent Power saving per fan	Watt	32
Numbers of fans to be replaced	Nos	100
Working Hours Per annum	Hr	3000
Overall electric Power Cost	Rs/KWH	8.32
Annual Energy Saving	KWH	9600
Monetary saving	Rs/Year	79872
Investment	Rs	320000
Payback	Month	48

6.0 Observation and analysis

6.1 Transformer loading

The efficiency of the transformers not only depends on the design but also, on the effective operating load. The variable losses depend on the effective operating load on the transformer. The maximum efficiency of the transformer occurs at a condition when the constant loss is equal to variable loss. For distribution transformers, the core loss is 15 to 20% of full load copper loss. Hence, the maximum efficiency of the distribution transformers occurs at a loading between 40 – 60%. For power transformers, the core loss is 25 to 30% of full load copper loss. Hence, the maximum efficiency of the power transformers occurs at a loading between 40 – 60%.

Transformer loading Vs Efficiency



All the electrical parameters required evaluating percentage loading & losses of Transformers were recorded for old building transformer.

No load and full load losses of the transformer are obtained from standards to calculate the transformer losses same is as follows.

Table 8. Transformer loading

Description	Transformer Capacity	No-load loss	Full load loss	Power factor	Maximum Apparent power	Average Apparent Power	Max Loading	Average Loading	Total loss
Unit	kVA	kW	kW	PF	kVA	kVA	%	%	kW
Transformer	500	0.9	6.45	0.966	65.13	58.62	13%	12%	1.01

Note: Total loss = No load loss+ Full load loss*(% Loading ^{2})

6.2 Lighting system

Plant already implemented energy efficient measures in lighting area at diffident places. Most of the conventional lamps are replaced by LED Lamps.

6.2.1 AREA WISE LUX LEVEL

Lux is measured during the audit and listed below.

Table 9. Details of measured Lux in college

Sr.No	Location	Lux Levels	
		Min	Max
A Block			
Basement			
1	Basic Electrical Lab	160	180
2	Basic Electronics Lab	175	190

Sr.No	Location	Lux Levels	
		Min	Max
A Block			
3	Professional Communication Lab	165	180
4	Computer Center	155	195
5	Seminar Hall	170	190
6	Store	165	180
7	Lift	175	195
Ground Floor			
8	Academic Director Office	160	175
9	Dean Technical Office	165	178
10	Head Admin Office	155	172
11	Conference Room	170	192
12	Dean Academic Office	182	198
13	Reception Area	164	194
14	Toilet/Washroom-1	160	180
15	Toilet/Washroom-2	175	196
16	Toilet/Washroom-3	172	194
17	Toilet/Washroom-4	163	188
18	Computer Center	168	190
19	Registrar Office	160	180
First Floor			
20	Faculty Cabins	155	175
21	Gents Washroom	162	186
22	Dean Academic 1st Year	156	173
23	Lecture Hall 1	160	190
24	Lecture Hall 2	170	195
25	Lecture Hall 3	180	200
26	Chemistry Lab	160	190
27	Account Office/Chief Finance Office	164	178
28	Physics Lab	175	200
29	Medical Center	180	200
Second Floor			
30	Lecture Hall 1	173	195
31	Lecture Hall 2	165	185
32	Lecture Hall 3	180	198
33	Lecture Hall 4	175	195
34	Lecture Hall 5	182	200
35	Faculty Cabin 1	162	192
36	Faculty Cabin 2	168	186
37	Girls Washroom	172	188
38	Boys Washroom	166	190
39	Faculty Washroom	171	194
40	Seminar Hall	160	186

Sr.No	Location	Lux Levels	
		Min	Max
A Block			
Third Floor			
41	Faculty Room-MBA Faculty	167	198
42	Innovation Center, Research and Development	156	187
43	Lecture Room	150	180
44	Guest Room	160	185

Sr.No	Location	Lux Levels	
		Min	Max
B Block			
Ground Floor			
1	HOD Cabin/Faculty Room	160	189
2	Exam Cell	165	178
3	Girls Washroom	155	175
4	Boys Washroom	150	184
5	Lab-1	175	197
6	Lab-2	176	194
7	Lab-3	162	183
8	Lab-4	172	194
9	Lab-5	184	198
10	Lab-6	167	185
11	IQAC Office-1	156	180
12	IQAC Office-2	175	198
13	Seminar Hall	166	184
First Floor			
14	Lecture Hall-1	162	186
15	Lecture Hall-2	175	200
16	Lecture Hall-3	155	180
17	Lecture Hall-4	164	186
18	Lecture Hall-5	157	178
19	Lecture Hall-6	165	185
20	Lecture Hall-7	164	178
21	HOD Cabins	151	172
22	Faculty Cabin	156	183
23	Girls Washroom	167	190
24	Boys Washroom	163	199
25	Computer Center	178	195
Second Floor			
26	Lecture Hall-1	170	192
27	Lecture Hall-2	182	199
28	Lecture Hall-3	165	186
29	Lecture Hall-4	175	195

Sr.No	Location	Lux Levels	
		Min	Max
B Block			
30	Faculty Cabin	167	189
31	HOD Room	156	178
32	Library	160	190
Third Floor			
33	Lecture Hall 1	163	178
34	Lecture Hall 2	164	189
35	Lecture Hall 3	166	178
36	Lecture Hall 4	156	179
37	Lab-1	180	196
38	Lab-2	163	179
39	Lab-3	153	184
40	HOD Room	164	188
41	Faculty Cabin	175	199
42	Girls Washroom	151	169
43	Boys Washroom	178	200

Sr.No	Location	Lux Levels	
		Min	Max
C Block			
Ground Floor			
1	Girls Washroom	175	195
2	Boys Washroom	160	185
3	Computer Center-1	172	185
4	Computer Center-2	163	186
5	Computer Center-3	171	192
6	Computer Center-4	165	187
7	Civil Engineering Lab	174	194
8	Mechanical Lab	176	188
9	Welding Shop	163	189
First Floor			
10	Lab-1	170	192
11	Lab-2	188	200
12	Lecture Hall-1	175	197
13	Lecture Hall-2	164	189
14	Lecture Hall-3	157	178
15	Boys Washroom	151	176
16	Girls Washroom	165	187
17	Faculty Room-1	156	175
18	Faculty Room-2	158	186
19	Faculty Room-3	159	198
Second Floor			

Sr.No	Location	Lux Levels	
		Min	Max
C Block			
20	Faculty Cabin	178	200
21	Lecture Hall-1	153	189
22	Lecture Hall-2	175	198
23	Lecture Hall-3	164	188
24	Lecture Hall-4	176	197
25	Lab	174	189
26	Engineering Graphic Lab	175	197
27	Generator/Electrical Panel Room	167	190

OBSERVATIONS

It was observed that the building has opted for the Energy-efficient lighting system i.e. LED which a was good option to save energy and we personally felt good to observe it and checked whether the lux level we are getting is sufficient or not and was observed that the lux level was good.

It was observed that the lux level in some of the areas is within limits and in some areas, it is a bit more.

RECOMMENDATION

LED lights are highly recommended as they are the best in technology available in the illumination market and will provide a good amount of energy and monetary savings since major lighting includes halogens which are the most inefficient light in the market. So please go for the led lights for the areas where it is still remaining to go for 100% LED lightings.

LED also helps in heat load reduction since the heat dissipated by the halogens is much higher than the heat dissipated by LED lights thus intangible savings by reduction in cooling can be easily be achieved. Also, we recommend not using GLS Bulbs as they are inefficient lights and also dissipate heat increase HVAC load.

It is recommended to install a photo sensor for all the outdoor light and also in the working floor near to the glasses envelope in the building.

It is recommended to install occupancy sensors in Stores/office cabins and toilets to save energy.

It is recommended to install the daylight sensor on the outdoor lights for automation and control of the lights and this will also help us reduce the unwanted running hours of the lights.

6.3 List of Assets & Electrical Equipment's

Table 10. Electrical Asset List of college

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	All Labs				15					
2	Workshop Lab Ist Year	1			10	1				
Block-B GROUND FLOOR										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	FACULTY ROOM									
2	EXAM CELL	5		1 CFL	3	6				
3	GALLERY	3		2						
4	WASHROOM GENTS	2					1	2		
5	WASHROOM LADIES	1					1	1		
6	SAMINAR HALL			28CFL	18					
7	B-001	4			7			1		
8	B-002	2			2			1 NOT WORKING		
9	INNOVATION LAB	2			2					
10	IOT LAB	3			2					
11	M.TECH LAB	2			3					
12	IQAC LAB	2		5	9			1		
13	STEADMIL LAB	2			2			1 NOT WORKING		
14	SEMINAR SIDE ROOM	5			2					
	TOTAL	**33**		**7+29**	**50**			**5+(2 NW)**		
Block-B IST FLOOR										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	FACULTY ROOM	5		1	7					

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	**Room No./ FLOOR**	**Tube Light/LED**			**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
2	HOD ROOM			2	2			1		
3	GALLERY	1		1+1 CFL						
4	WASHROOM GENTS			1			1		1	
5	WASHROOM LADIES			1			1			
6	B- 101	3		1	7			2		
7	B- 102	2		3	7			2		
8	B- 103	3		1	7			2		
9	B- 104	2		3	7			2		
10	B- 105	2		2	7			2		
11	B- 106	5			9			1		
12	B- 107	2		2	7			2		
13	B- 108	2		2	7			2		
	TOTAL	**26**		**20+1**	**67**		**2**	**16**	**1**	
Block-B 2ND FLOOR										
S.No.	**Room No./ FLOOR**	**Tube Light/LED**			**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
1	HOD ROOM	**1**			**2**			**1**		
2	FACULTY ROOM	2			6	1				
3	LIBRARY	17		1 CFL	26					
4	GALLERY	1								
5	B-201	4			7			2		
6	B-202	4			7			2		
7	B-203	4			7			2		
8	B-204	4			7			2		
	TOTAL	**37**		**1**	**63**	**1**		**9**		
Block-B 3RD FLOOR										

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	HOD ROOM	2			2					
2	FACULTY ROOM			4	6				1	
3	WASHROOM GENTS			1			1			
4	WASHROOM LADIES	1					1			
5	GALLERY	2								
6	B-301	4			7			2		
7	B-302	4			7			2		
8	B-303			2	7					
9	B-304	2			4					
10	B-307	4			7			2		
11	B-308	2			6					
	TOTAL	**21**		**7**	**46**			**6**	**1**	
Block-C GROUND FLOOR										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	Lab -1	4		1	8		1			
2	Lab -2	5		2	12					
3	Lab -3	2		3	4					
4	Server Room	1		1	3					
5	Store Room	2		2	3					
6	Gallery	1		3	1				1	
7	Washroom Gents	1					1			
	TOTAL	**16**		**12**	**31**		**2**		**1**	
Block-C Ist FLOOR										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	C-101	4			7					
4	C-104	4			7					
5	C-105	5			7					
6	ED & IC Lab	2			3					
7	HOD-ECE+CE	3		1	3			1		
8	Faculty Room	2			2	1				
9	HOD ME	2		4		3		1		
10	Gallery	2								
11	Washroom Gents	1					1			
12	Communication Lab	2					2			
	TOTAL	**27**		**5**	**29**	**4**	**3**	**2**		
Block-C 2nd FLOOR										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	C-201	3			7					
2	C-202	3			7					
3	C-203 Lab	2			6					
4	C-204	2			8					
5	C-205	3			7					
6	Faculty Room	4			6					
7	Gallery	2							1	
	TOTAL	**19**			**41**				**1**	
Girls Hostel										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	38 Rooms	31		36	38		6		1	

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	**Room No./ FLOOR**	**Tube Light/LED**			**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
	TOTAL	**31**		**36**	**38**				**1**	
Boys Hostel										
S.No.	**Room No./ FLOOR**	**Tube Light**	**/LED**	**CFL**	**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
1	18 Room, Ground Floor	45		49	46				1	
2	1st Floor, 33 Room	42			72		12			
3	IInd Floor,55 Room	75			65					
4	IIIrd Floor, 55 Room	75			68					
5	Mess	16			24					
6	Gym	5			7					
									1	
	TOTAL=161 Room	**258**		**49**	**282**		**12**		**1**	
A Block Basement										
S.No.	**Room No./ FLOOR**	**Tube Light**	**/LED**	**CFL**	**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
1	PC Lab	8		1	6					
2	AWS Lab	5	7		14					
3	Office Ist	1			1					
4	Office Iind	1		1	1					
5	CS Store	3			2					
6	Store (Mishra Ji)	1			3					
7	Electronics Lab	6			6		1			
8	Store	1								
9	Faculty Room ECE	2			1					
10	Electrical lab	4	4		12		2			
11	Faculty Room Electrical	1			1					

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
12	Pannel Store	1								
	Total	34	**11**	**2**	**47**		**3**			
Ground Floor A Block										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	Google Lab		7	1	2	6 Wall Fan			1	Concelled Light-9
2	Reception		13	1	1	4 Wall Fan				
3	Gallery	1	1	1	1					Concelled Light- 5
4	Registrar Office	3	1	2	6			1		
5	Admin Office					1		1		Concelled Light- 6
6	Nagresh Sir Office				2					Concelled Light- 3
7	Director Office					1		1		Concelled Light- 6
8	Chairmen Sir Office				2			1		Concelled Light- 3
9	D.N. Sharma Office	2			1			1		Concelled Light- 4
10	Kichen	1			1					Concelled Light- 3
11	Dean Office	2			2					Concelled Light- 3
	TOTAL=161 Room	**9**	**22**	**5**	**18**	**12**		**5**	**1**	**41**
A Block Ist Floor										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	P1	6			6		1	2	2	
2	P2	5			7		1	2		
3	P3	4			6		1	2		
4	Physics Lab	5			7					
5	Chemistry Lab	4	2		8			2		
6	Dr. Room	1			2					
7	Account Office	3	2		2		1	1		

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	Room No./ FLOOR	Tube Light/LED			Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
8	Gallery	4	7		1					
9	HOD Office	2			2			1		
10	Washroom Boys		1				1			
11	Washroom Girls									
12	Faculty Room	3			7		2			
13	CFO Office	**1**	**7**		**2**		**1**	**1**		
	Total	**38**	**19**		**50**		**8**	**11**		
A Block IInd Floor										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	P4	4			7			2		
2	C1	4			7			2		
3	C2	4			7			2		
4	C3	4			7			2		
5	C4	4			7			2		
6	Gallery									
7	Washroom Boys	1					1			
8	Washroom Girls	1								
	Faculty Room	3			5					
	PC Lab		18			11				
	Total	**25**	**18**		**40**	**11**		**10**		
A Block IIIrd Floor										
S.No.	Room No./ FLOOR	Tube Light	/LED	CFL	Fan	WAL FAN	Exhaust Fan	A.C	Water Cooler	Other's
1	HOD Office		1	1	3	1		1		
2	Lift Room	2			1					

ASSET LIST OF RD ENGINEERING COLLEGE										
Mechanical Engineering All Labs										
S.No.	**Room No./ FLOOR**	**Tube Light/LED**			**Fan**	**WAL FAN**	**Exhaust Fan**	**A.C**	**Water Cooler**	**Other's**
3	Research Lab		8		12					
4	RoomNo-1	4			4					
5	Solar Pannel Office	2								
6	Gallery	4								
7	Lecture Room-B-302	4			7					
8	Lecture Hall	5			12					
9	Class Room- 2nd Year				3					Concealed Light- 10
10	Class Room- Ist Year	6			7			2		
	Total	**27**	**9**		**49**			**3**		**10**

6.4 List of Genset & Capacity

Table 11. Details of measured Gensets with capacity in college

Genset & Capacity			
S No.	**Location**	**Genset & Capacity**	**Company**
1	RD College	125 KVA	Cummins
2		200 KVA	Kirloskar
3		160 KVA	Sterling
	Genset Total	**3**	

6.5 List of Computers

Table 12. Details of measured computers in college

Sr.No.	LOCATION	COMPUTERS
1	BLOCK-C	532
	TOTAL	**532**

7.0 Appendix: Profile of electrical parameters (including harmonic)

This report presents the results of power quality & harmonic analysis carried at RD Engineering College, Ghaziabad carried out by Engineering Facility Services on 27th December 2023.

The agreed objectives of the assessment are analysis and the finding based on the analysis of parameters like frequency, voltage, current & waveforms, Total Harmonic Distortion (THD) etc.

The audit comprised of Power Quality & Harmonics Audit at Transformer & UPS, Measurements were taken using Calibrated Krykard ALM31 make Digital Power and Harmonic Analyser. This Electrical Power Quality audit report presents the analysis, findings and recommendations for improving the system efficiency.

7.1 Summary of measurements & recommendations

Sl. No.	Location	Category	Observations	Recommendations
1	Main Riser	Power Quality	As per IEEE, the maximum permissible limit for Current Unbalance is 10% and Voltage Unbalance is 3%, but as measured AVG. current unbalance is 46.47%, which is higher than standard. And average voltage unbalance is 0.140 % which is within standard limits.	Load balancing required at the load end.

7.2 Standards for Evaluation

Engineering Facility Services subscribes to the industry wide standards used for the evaluation of the electrical systems for computer installations, which include but are not limited to: Institute of Electrical and Electronic Engineers Standard 1100-2005, “Powering and Grounding Electronic Equipment”, (Emerald Book)

The standards conform to the requirements of the National Electrical Code (NFPA 70). References:

- IEEE 1100 – 1999 & 2005 Emerald Book
- IEEE 446 - 1995 Orange Book
- Particulate and Gaseous Contamination Guidelines for Data Centres (ASHRAE TC 9.9)
- IEEE 142 – 1991 Green Book

7.3 BACKGROUND

Power Quality Analysis Audit carried out by using Krykard make ALM31 Load Manager at Facility. This report presents the analysis and the finding based on the analysis of parameters like frequency,

voltage, current & waveforms, Total Harmonic Distortion (THD) etc. The details of harmonic analysis are given in Appendix.

7.4 PROBLEMS DUE TO HARMONICS

Current harmonics causes increased losses in the power system and the components. The current harmonics also distort the voltage waveform and cause voltage harmonics. Voltage distortion affects not only sensitive electronic loads but also capacitor banks.

Higher frequency harmonic currents generally flow on the outer sides of the conductor due to the "skin effect" thus effectively reducing the cross-sectional area of the Conductor. This effect leads to the heating of the conductors. Overheating of the Neutral wires are also caused by the harmonics produced in any one phase of a balanced three phase system. False tripping of circuit breakers can also happen due to the harmonics which can be many times higher than sinusoidal waveform which can loss data and time.

7.5 EFFECTS DUE TO HARMONICS

- Blinking on Incandescent Lights - Transformer saturation
- Capacitor Failure - Harmonic Resonance
- Circuit Breakers Tripping - Inductive Heating and Overload
- Conductor Failure - Inductive Heating
- Electronic Equipment Shutting down - Voltage Distortion
- Flickering of Fluorescent Lights - Transformer saturation
- Fuses Blowing for no Apparent Reason - Inductive Heating and Overload
- Motor Failures (overheating) - Voltage Drop
- Neutral Conductor and Terminal Failures - Additive Triplen Currents
- Electromagnetic Load Failures - Inductive Heating
- Overheating of Metal Enclosures - Inductive Heating
- Power Interference on Voice Communication – Harmonic Noise
- Transformer Failures - Inductive Heating

7.6 POWER FACTOR

It is suggested to maintain an average power factor close to unity as far as practically possible. This can be achieved by adding additional capacitor banks and ensuring proper functioning of capacitor banks and keeping the system harmonics under check and balances.

7.7 THREE PHASE CURRENT UNBALANCE

As per the standards, the limits of voltage unbalance and current unbalance are specified as a maximum of 3% and 10% respectively. Under unbalanced conditions, the power system will incur more losses and heating effects, and be less stable because when the phases are balanced, the system is in a better position to respond to emergency load transfers.

7.8 SELECTION OF NEW DEVICES/EQUIPMENT

The devices/equipment resulting in generation of harmonics is available with THD rating. Selection of these devices with THD rating less than 5% helps in maintaining good system power quality. It is thus suggested to consider the THD rating of the new equipment/devices like VFDs, UPS, and electronic chokes before installation.

7.9 STANDARDS

As per IEEE 519, the maximum permissible limit for voltage harmonics is 8% (less than 1KV).
As per IEEE, the maximum permissible limit for Current Unbalance is 10% and Voltage Unbalance is 3%.
As per IEEE, the maximum permissible limit for Short Term Flickering is 0.65.
As per IEEE 519-1992, the maximum permissible limit for Harmonics Order 2-10 is 7%, Harmonics Order 11-16 is 3.5%, Harmonics Order 17-22 is 2.5% and Harmonics Order 23-34 is 1%.

Table 13. Standards THD & Unbalancing

Sr. No.	Parameters	Value
1	Voltage THD %	8% (Less than 1KV)
2	Voltage Unbalanced %	3%
3	Current Unbalanced %	10%

Table 14. Current Distortion Limits

7.10 Current distortion limits (120 V to 69kV) – User's responsibility

Isc/IL	h< 11	11<h<17	17<h<23	23<h<35	35<h	TDD
<20*	* 4.0	2	1.5	0.6	0.3	5
20<50	7	3.5	2.5	1	0.5	8
50<100	10	4.5	4	1.5	0.7	12
100<1000	12	5.5	5	2	1	15
>1000	15	7	6	2.5	1.4	20

Note: *All power generation equipment is limited to those values regardless their Isc/IL.

Odd harmonics are represented as % of fundamental at Power Control Centre (PCC). Even v harmonics are limited to 25% of odd harmonic's limits.

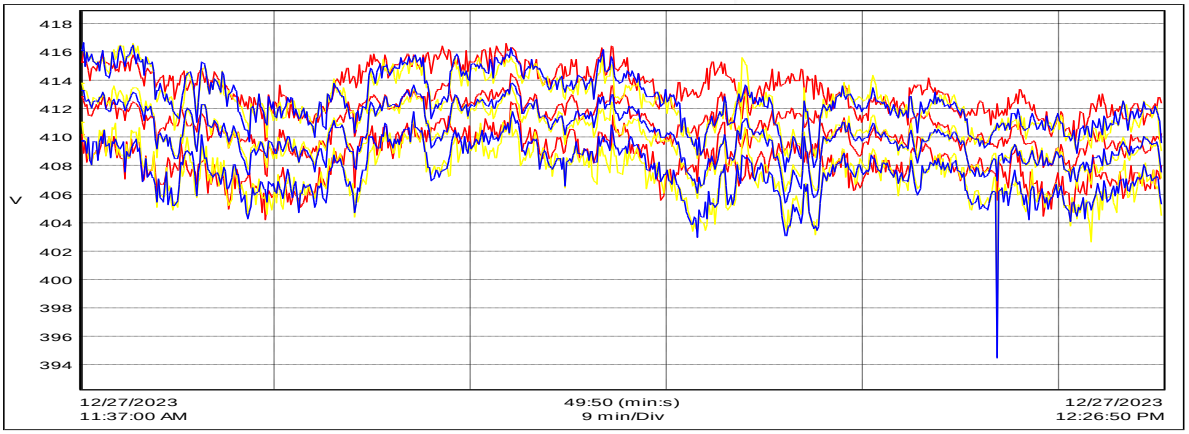
Table 15. Harmonics Limits

Isc	Short Circuit current at the point of common coupling (PCC), corresponding to system MVA level
IL	Fundamental full load current in Amps
H	Harmonic number
11<h<1 7	Limits of individual currents at PCC
THD	Total harmonic distortions

7.11 TRANSFORMER 500KVA

Parameters	Avg.	Min.	Max.
Frequency	50.02	49.94	50.12
Ampere- R phase (A)	65.09	52.00	101.5
Ampere- Y phase (A)	120.9	111.5	138.0
Ampere- B phase (A)	61.99	49.00	95.00
Ampere- Neutral (A)	60.70	42.40	76.40
Voltage- R phase (V)	410.9	404.2	416.6
Voltage- Y phase (V)	410.1	396.8	416.6
Voltage- B phase (V)	410.1	394.5	416.7
P.F. Total	0.966	0.959	0.973
POWER- Total (KW)	56.64	51.13	62.73
V THD % R phase	4.756	4.300	5.300
V THD % Y phase	4.335	3.900	4.900
V THD % B phase	4.453	4.000	5.200
I THD % R phase	25.30	22.40	29.30
I THD %Y phase	12.21	11.10	13.20
I THD % B phase	21.01	16.50	24.50
Voltage Unbalance %	0.194	0.0	0.900
Current Unbalance %	46.47	34.00	58.90

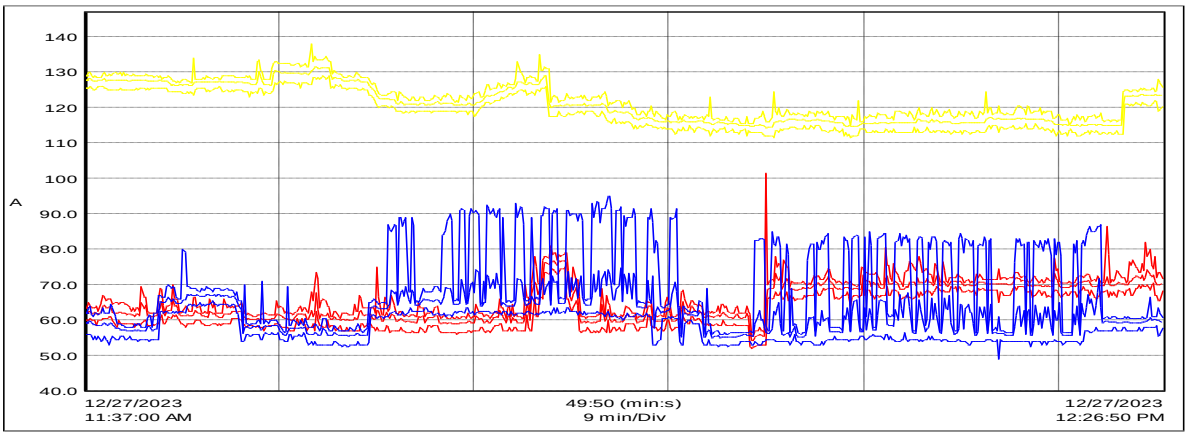
Figure 1. Voltage Profile of TRANSFORMER 500KVA



Observation:

- The average voltage in Red phase is 410.9 V and it varies from 404.2 V to 416.6 V.
- The average voltage in Yellow phase is 410.1 V and it varies from 396.8 V to 416.6 V.
- The average voltage in Blue phase is 410.1 V and it varies from 394.5 V to 416.7 V.

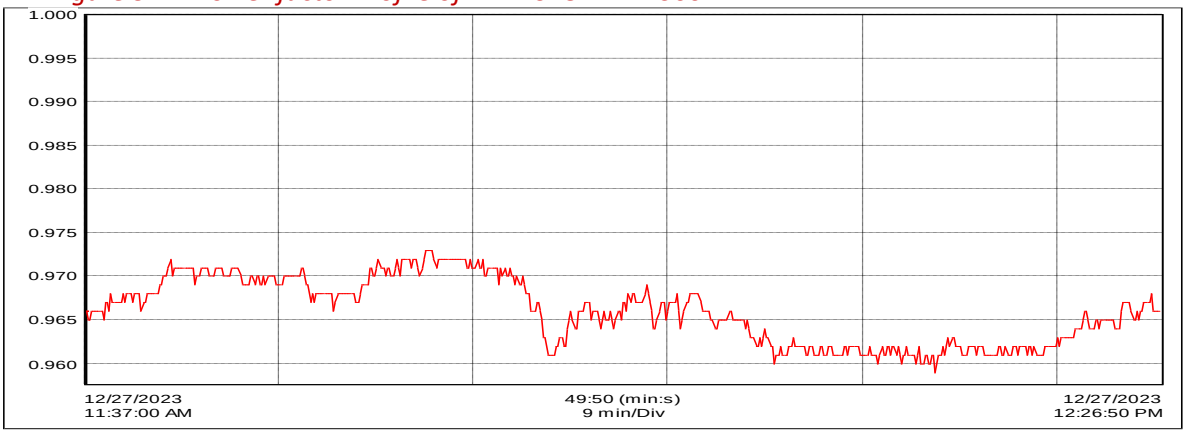
Figure 2. Current Profile of TRANSFORMER 500KVA



Observation:

- The average current in Red phase is 65.09 A and it varies from 52.00 A to 101.5 A.
- The average current in Yellow phase is 120.9 A and it varies from 111.5 A to 138.0 A.
- The average current in Blue phase is 61.99 A and it varies from 49.00 A to 95.00 A.

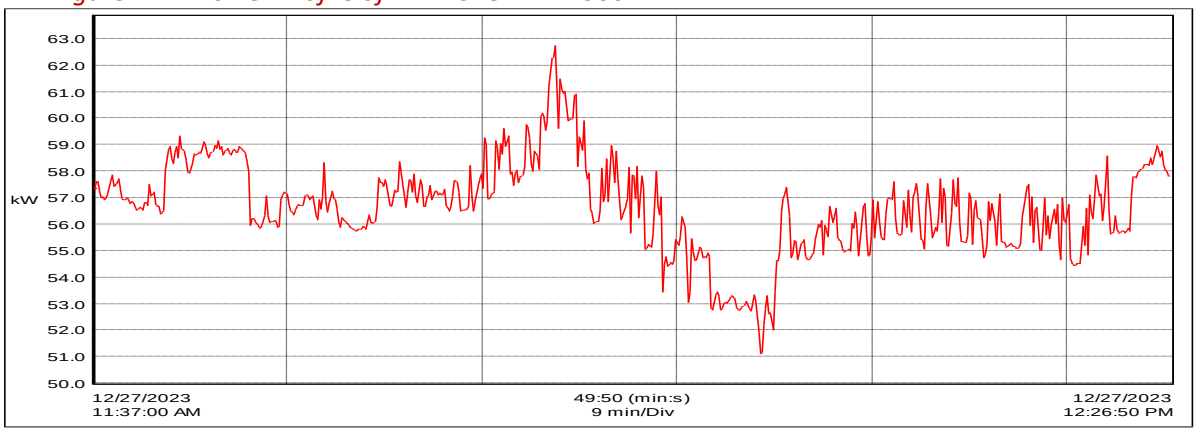
Figure 3. Power factor Profile of TRANSFORMER 500KVA



Observation:

- The average power factor is 0.966 and it varies from 0.959 to 0.973.

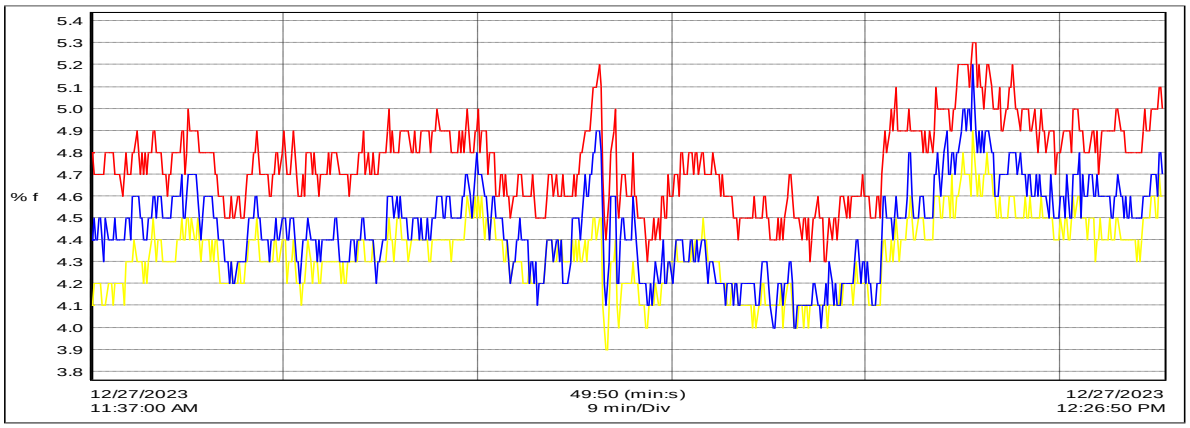
Figure 4. Power Profile of TRANSFORMER 500KVA



Observation:

- The average power is 56.64 KW and it varies from 51.13 KW to 62.73 KW.

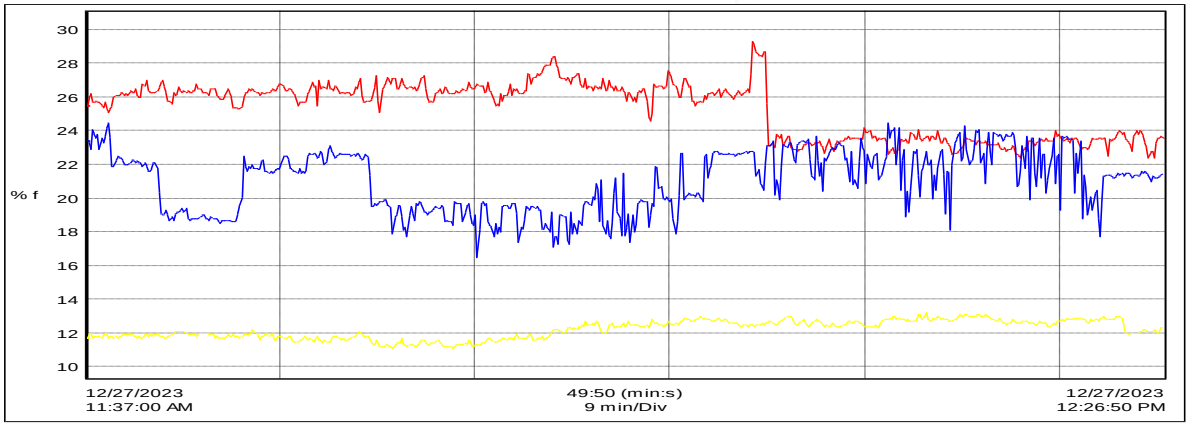
Figure 5. Voltage THD% Profile of TRANSFORMER 500KVA



Observation:

- The average THD% of voltage in Red phase is 4.756 % and it varies from 4.300 % to 5.300 %.
- The average THD% of voltage in Yellow phase is 4.335 % and it varies from 3.900 % to 4.900 %.
- The average THD% of voltage in Blue phase is 4.453 % and it varies from 4.000 % to 5.200 %.

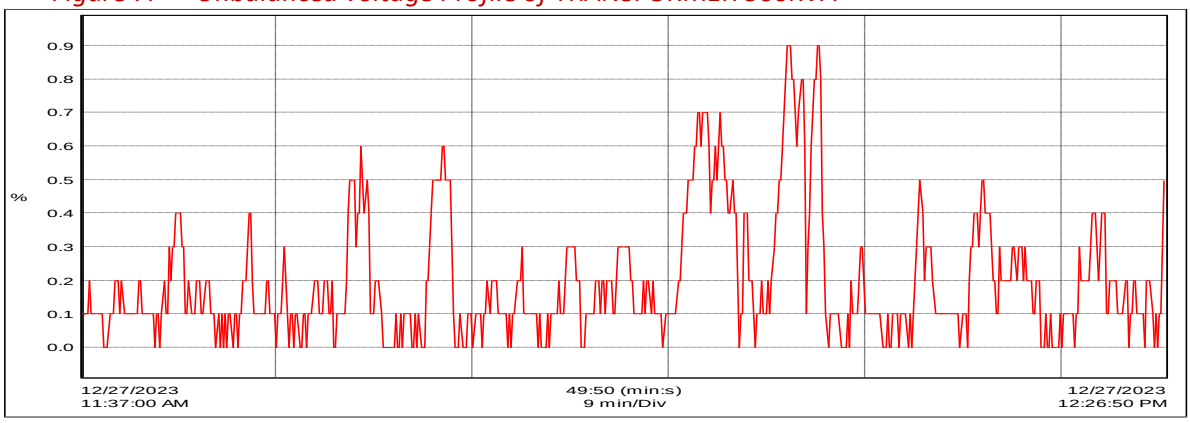
Figure 6. Current THD% Profile of TRANSFORMER 500KVA



Observation:

- The average THD% of current in Red phase is 25.30 % and it varies from 22.40 % to 29.30 %.
- The average THD% current in Yellow phase is 12.21 % and it varies from 11.10 % to 13.20 %.
- The average THD% of in current Blue phase is 21.01 % and it varies from 16.50 % to 24.50 %.

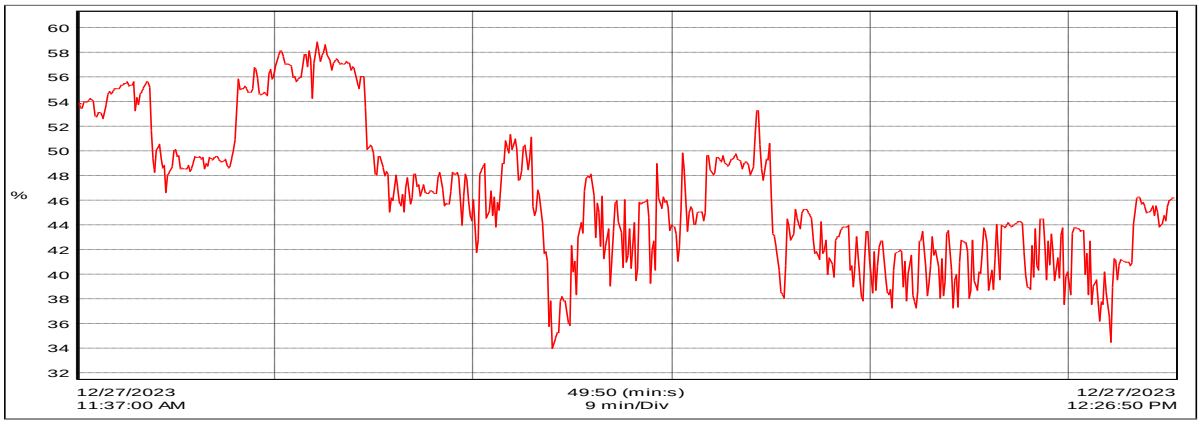
Figure 7. Unbalanced voltage Profile of TRANSFORMER 500KVA



Observation:

- The average unbalanced voltage is 0.194 % and it varies from 0.0 % to 0.900 %.

Figure 8. Unbalanced Current Profile of TRANSFORMER 500KVA



Observation:

- The average unbalanced current is 46.47 % and it varies from 34.00 % to 58.90 %.

8.0 CHECKLIST & TIPS FOR ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

• Optimise the tariff structure with utility supplier

• Schedule your operations to maintain a high load factor

• Shift loads to off-peak times if possible.

• Minimise maximum demand by tripping loads through a demand controller

• Stagger start-up times for equipment with large starting currents to minimize load peaking.

• Use standby electric generation equipment for on-peak high load periods.

• Correct power factor to at least 0.90 under rated load conditions.

• Relocate transformers close to main loads.

• Set transformer taps to optimum settings.

• Disconnect primary power to transformers that do not serve any active loads

• Consider on-site electric generation or cogeneration.

• Export power to grid if you have any surplus in your captive generation

• Check utility electric meter with your own meter.

• Shut off unnecessary computers, printers, and copiers at night

Motors

• Properly size to the load for optimum efficiency. (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)

• Use energy-efficient motors where economical.

• Use synchronous motors to improve power factor.

• Check alignment.

• Provide proper ventilation (For every 10oC increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)

• Check for under-voltage and over-voltage conditions.

• Balance the three-phase power supply. (An Imbalanced voltage can reduce 3 - 5% in motor input power)

• Demand efficiency restoration after motor rewinding. (If rewinding is not done properly, the efficiency can be reduced by 5 - 8%)

Drives

• Use variable-speed drives for large variable loads.

• Use high-efficiency gear sets.

• Use precision alignment.

• Check belt tension regularly.

• Eliminate variable-pitch pulleys.

- Use flat belts as alternatives to v-belts.
- Use synthetic lubricants for large gearboxes.
- Eliminate eddy current couplings.
- Shut them off when not needed

Fans

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters, and fan blades regularly.
- Use aerofoil-shaped fan blades.
- Minimize fan speed.
- Use low-slip or flat belts.
- Check belt tension regularly.
- Eliminate variable pitch pulleys.
- Use variable speed drives for large variable fan loads.
- Use energy-efficient motors for continuous or near-continuous operation
- Eliminate leaks in ductwork.
- Minimise bends in ductwork
- Turn fans off when not needed Blowers
- Use smooth, well-rounded air inlet ducts or cones for air intakes.
- Minimize blower inlet and outlet obstructions.
- Clean screens and filters regularly.
- Minimize blower speed.
- Use low-slip or no-slip belts.
- Check belt tension regularly.
- Eliminate variable pitch pulleys.
- Use variable speed drives for large variable blower loads.
- Use energy-efficient motors for continuous or near-continuous operation.
- Eliminate ductwork leaks.
- Turn blowers off when they are not needed.

Pumps

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller units.

• Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.

• Balance the system to minimize flows and reduce pump power requirements.

• Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) returnmall loads requiring higher pressures.

• Increase fluid temperature differentials to reduce pumping rates.

• Repair seals and packing to minimize water waste.

HVAC (Heating / Ventilation / Air Conditioning)

• Tune up the HVAC control system.

• Consider installing a building automation system (BAS) or energy management system (EMS) or restoring an out-of-service one.

• Balance the system to minimize flows and reduce blower/fan/pump power requirements.

• Eliminate or reduce reheat whenever possible.

• Use appropriate HVAC thermostat setback.

• Use morning pre-cooling in summer and pre-heating in winter (i.e. -- before electrical peak hours).

• Use building thermal lag to minimize HVAC equipment operating time.

• In winter during unoccupied periods, allow temperatures to fall as low as possible without freezing water lines or damaging stored materials.

• In summer during unoccupied periods, allow temperatures to rise as high as possible without damaging stored materials.

• Improve control and utilization of outside air.

• Use air-to-air heat exchangers to reduce energy requirements for heating and cooling of outside air.

• Reduce HVAC system operating hours (e.g. -- night, weekend).

• Optimize ventilation.

• Ventilate only when necessary. To allow some areas to be shut down when unoccupied, install dedicated HVAC systems on continuous loads (e.g. -- computer rooms).

• Provide dedicated outside air supply to kitchens, cleaning rooms, combustion equipment, etc. to avoid excessive exhausting of conditioned air.

• Use evaporative cooling in dry climates.

• Reduce humidification or dehumidification during unoccupied periods.

• Use atomization rather than steam for humidification where possible.

• Clean HVAC unit coils periodically and comb mashed fins.

• Upgrade filter banks to reduce pressure drop and thus lower fan power requirements.

• Check HVAC filters on a schedule (at least monthly) and clean/change if appropriate.

• Check pneumatic controls air compressors for proper operation, cycling, and maintenance.

• Isolate air conditioned loading dock areas and cool storage areas using high-speed doors or clear PVC strip curtains.

• Install ceiling fans to minimize thermal stratification in high-bay areas.

• Relocate air diffusers to optimum heights in areas with high ceilings.

• Consider reducing ceiling heights.

• Eliminate obstructions in front of radiators, baseboard heaters, etc.

• Check reflectors on infrared heaters for cleanliness and proper beam direction.

• Use professionally-designed industrial ventilation hoods for dust and vapor control.

• Use local infrared heat for personnel rather than heating the entire area.

• Use spot cooling and heating (e.g. -- use ceiling fans for personnel rather than cooling the entire area).

• Purchase only high-efficiency models for HVAC window units.

• Put HVAC window units on timer control.

• Don't oversize cooling units. (Oversized units will "short cycle" which results in poor humidity control.)

• Install multi-fueling capability and run with the cheapest fuel available at the time.

• Consider dedicated make-up air for exhaust hoods. (Why exhaust the air conditioning or heat if you don't need to?)

• Minimize HVAC fan speeds.

• Consider desiccant drying of outside air to reduce cooling requirements in humid climates.

• Consider ground source heat pumps.

• Seal leaky HVAC ductwork.

• Seal all leaks around coils.

• Repair loose or damaged flexible connections (including those under air handling units).

• Eliminate simultaneous heating and cooling during seasonal transition periods.

• Zone HVAC air and water systems to minimize energy use.

• Inspect, clean, lubricate, and adjust damper blades and linkages.

• Establish an HVAC efficiency-maintenance program. Start with an energy audit and follow-up, then make an HVAC efficiency-maintenance program a part of your continuous energy management program.

Compressors

• Consider variable speed drive for variable load on positive displacement compressors.

• Use a synthetic lubricant if the compressor manufacturer permits it.

• Be sure lubricating oil temperature is not too high (oil degradation and lowered viscosity) and not too low (condensation contamination).

• Change the oil filter regularly. • Periodically inspect compressor intercoolers for proper functioning.

• Use waste heat from a very large compressor to power an absorption chiller or preheat process or utility feeds.

• Establish a compressor efficiency-maintenance program. Start with an energy audit and follow-up, then make a compressor efficiency-maintenance program a part of your continuous energy management program.

Compressed air

• Install a control system to coordinate multiple air compressors.

• Study part-load characteristics and cycling costs to determine the most-efficient mode for operating multiple air compressors.

• Avoid over sizing -- match the connected load.

• Load up modulation-controlled air compressors. (They use almost as much power at partial load as at full load.)

• Turn off the back-up air compressor until it is needed.

• Reduce air compressor discharge pressure to the lowest acceptable setting. (Reduction of 1 kg/cm2 air pressure (8 kg/cm2 to 7 kg/cm2) would result in 9% input power savings. This will also reduce compressed air leakage rates by 10%)

• Use the highest reasonable dryer dew point settings.

• Turn off refrigerated and heated air dryers when the air compressors are off.

• Use a control system to minimize heatless desiccant dryer purging.

• Minimize purges, leaks, excessive pressure drops, and condensation accumulation. (Compressed air leak from 1 mm hole size at 7 kg/cm2 pressure would mean power loss equivalent to 0.5 kW)

• Use drain controls instead of continuous air bleeds through the drains.

• Consider engine-driven or steam-driven air compression to reduce electrical demand charges.

• Replace standard v-belts with high-efficiency flat belts as the old v-belts wear out.

• Use a small air compressor when major production load is off.

• Take air compressor intake air from the coolest (but not air conditioned) location. (Every 50C reduction in intake air temperature would result in 1% reduction in compressor power consumption) • Use an air-cooled aftercooler to heat building makeup air in winter.

• Be sure that heat exchangers are not fouled (e.g. -- with oil).

• Be sure that air/oil separators are not fouled.

• Monitor pressure drops across suction and discharge filters and clean or replace filters promptly upon alarm.

• Use a properly sized compressed air storage receiver. Minimize disposal costs by using lubricant that is fully demulsible and an effective oil-water separator.

• Consider alternatives to compressed air such as blowers for cooling, hydraulic rather than air cylinders, electric rather than air actuators, and electronic rather than pneumatic controls.

• Use nozzles or venturi-type devices rather than blowing with open compressed air lines.

• Check for leaking drain valves on compressed air filter/regulator sets. Certain rubber-type valves may leak continuously after they age and crack.

• In dusty environments, control packaging lines with high-intensity photocell units instead of standard units with continuous air purging of lenses and reflectors.

• Establish a compressed air efficiency-maintenance program. Start with an energy audit and followup, then make a compressed air efficiency-maintenance program a part of your continuous energy management program.

9.0 Energy Auditor Certificates

Regn No. EA-19771

Certificate No. 8890

National Productivity Council

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Mrs. / Ms. **Deepak**

son / daughter of Mr. **Vineet Kumar**

has passed the National certification Examination for Energy Auditors held in September - 2016, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

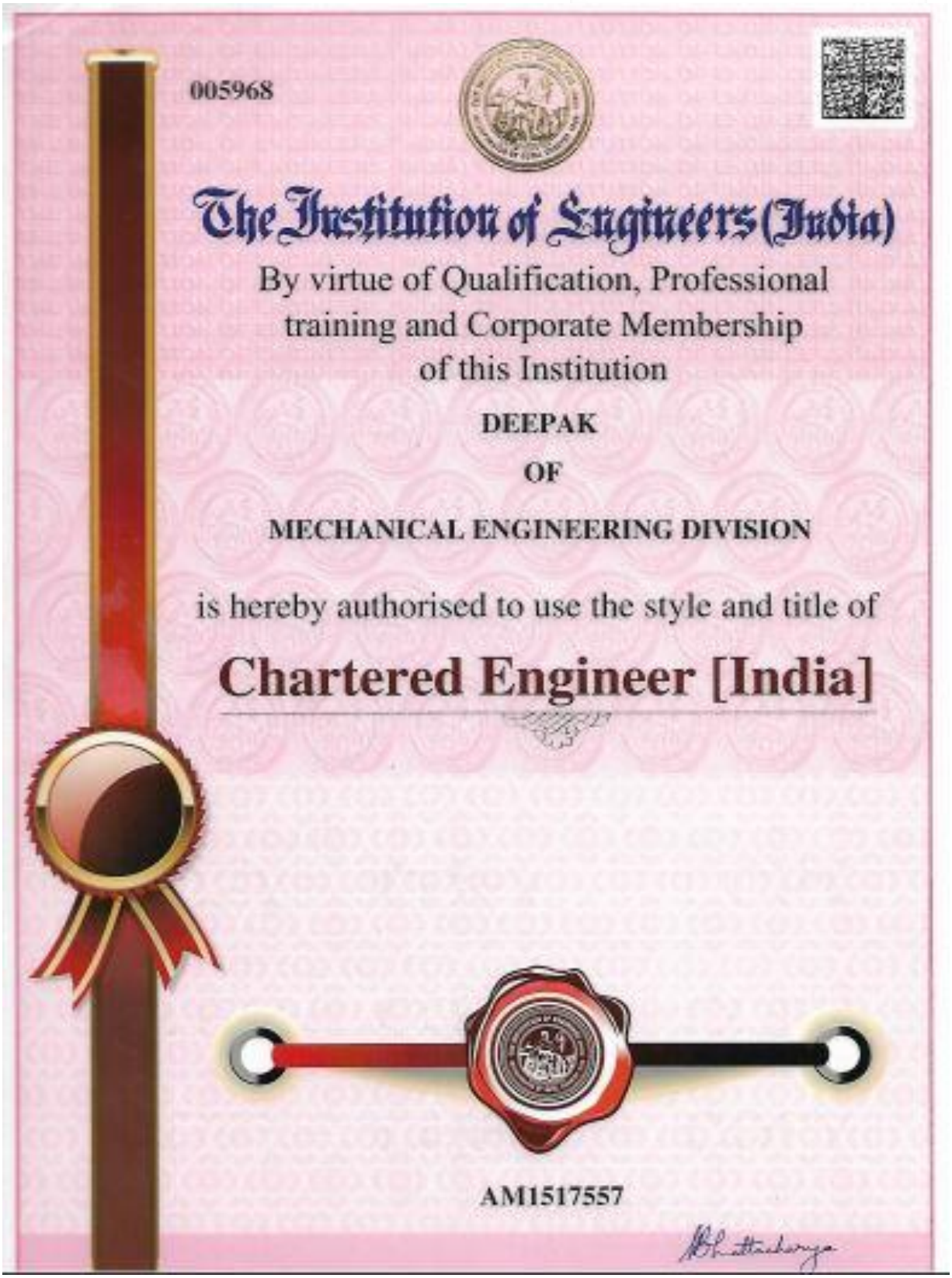
He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 10th March, 2017

Controller of Examination


005968

The Institution of Engineers (India)

By virtue of Qualification, Professional training and Corporate Membership of this Institution

DEEPAK

OF

MECHANICAL ENGINEERING DIVISION

is hereby authorised to use the style and title of

Chartered Engineer [India]

AM1517557

THANKS