



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

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

DVV Requirement: Provide Policy document on environment and energy usage. And provide certificate from the auditing agency for Green audit / Environment audit and Energy audit. Provide Certificates of the awards received from recognized agency (if any). Provide report on environmental promotional activities conducted beyond the campus with geo-tagged photographs with caption and date.

HEI Input: Required documents are attached herewith

Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Policy Document on Environment and Energy Usage

Dronacharya College of Engineering, Gurugram recognize the importance of sustainable development and the protection of the environment for the well-being of the community and future generations. We believe that it is our responsibility to adopt measures that minimize our impact on the environment and promote the efficient use of energy resources. This policy outlines our commitment to environmental sustainability and energy conservation.

Objectives

- To maintain a green campus by regularly conducting 'Green Audit.'
- To spread awareness regarding environmental issues, recycling of resources, energy conservation and tree plantation round the year.
- To undertake measures to protect environment viz: ban on single use plastic, promoting pooling of automobiles, etc.

Practices

Following are the measures of DCE, Gurugram towards protecting environment and its resources:

- i. Environmental Sustainability
- ii. Energy Conservation

Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Environmental Sustainability:

Following shall be the mandates towards maintaining the Environment:

- Complying with all applicable environmental laws and regulations.
- Continually assessing operations and identifying opportunities to reduce our environmental impact.
- Prioritizing the use of environmentally sustainable products, materials, and processes in operations.
- Promoting responsible waste management practices, including reducing, reusing, and recycling waste wherever possible.
- Striving to minimize carbon footprint and reduce greenhouse gas emissions.
- Felicitating the guests in the college by presenting saplings.
- Conducting programs for environment protection and conservation.
- Promoting mandatory ban on plastic items like- plastic carry bags, cups, plates, forks, spoons, bottles, straws, etc., which are thrown after single use.
- Making mandatory for all the students and employees of the institution to avoid the use of non-biodegradable plastic items in the premises.
- Encouraging use of environment- friendly substitutes like cloth bags, paper bag, steel lunch boxes, etc.
- Making PUC check mandatory for all the vehicles.
- Allowing registered vehicles upto the parking area.

Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




Energy Conservation:

- Prioritizing the use of energy-efficient products and technologies in operations.
- Monitoring and measuring energy consumption regularly to identify opportunities for improvement.
- Exploring renewable energy sources, such as solar and wind power, and consider their integration into operations.
- Regularly checking for leak detection and repair of leaks.
- Encouraging employees and stakeholders to conserve energy by implementing energy-saving practices:
 - i. Use of Biogas.
 - ii. Switching-off the lights and fans when not in use
 - iii. Maximum use of natural light.
 - iv. More usage of LED lights.
 - v. Purchasing star rated appliances for energy conservation.
 - vi. Screen time saver for minimizing energy consumption.
 - vii. Minimum use of AC.

Responsibilities:

The management team is responsible for implementing and monitoring this policy.

All employees are responsible for complying with this policy and contributing to the achievement of environmental and energy conservation goals.


Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)


Conclusion:

We are committed to protecting the environment and conserving energy resources in all aspects of our operations. We will continually assess our performance and strive for improvement, ensuring that we meet or exceed our environmental and energy conservation goals.

Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Green Audit

 **GREENOBIN**
"Reuse Whatever is used"

CIN: U74140DL2010PTC2031
GST:06AADCG8609F1Z

To
THE PRINCIPAL
DRONACHARYA COLLEGE OF ENGINEERING
Khentawas, Farrukh Nagar – 123506
Gurgaon, Haryana

DT: 18-2-2021



SUB: OLD RECORDS RECYCLING/PULPING


This is to confirm that we have collected 4349.95 kg of Old practical file, answer sheets etc. (as detailed below) on 18-02-2021 in presence of institution staff at COLLEGE CAMPUS: Khentawas, Farrukh Nagar – 123506, Gurgaon, Haryana

S.No	CATEGORY	Rate/kg (Rs)	DEDUCTION	Final Rate (Rs/kg)	Weight (kg)	TOTAL (Rs.)
1	WHITE PAPER	₹ 12.00	0	₹ 12.00	0	₹ 0.00
2	Old question paper/Answer sheet/record	₹ 11.00	0	₹ 11.00	562.5	₹ 6,187.50
3	Practical books/File[with cover or cardboard with deduction of 20% in weight at Rs 0.00	₹ 10.00	10%	₹ 9.00	3464.3	₹ 31,178.70
4	Chart paper/Newspaper/Magazine/Mix paper	₹ 10.00	0	₹ 10.00	323.15	₹ 3,231.50
TOTAL					4349.95	₹ 40,597.70

We also confirm that all the recyclable waste paper will be channelized for recycling post sorting process.

For Greenobin Recycling Pvt. Ltd.



Signature


Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Certificate of Appreciation Clean Campus Initiative



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Beyond the campus environmental promotion activities

Tree Plantation Drive (23rd December 2022)

Dronacharya College of Engineering, Gurugram conducted “Tree Plantation Drive” on 23rd December 2022 to celebrate national farmer’s day. All the NSS volunteers, faculty members, staff members and students participated in the drive enthusiastically.

The main objective of the drive was to make students aware of their intellectual, social, and emotional responsibility towards environment.

<https://ggnindia.dronacharya.info/events/Tree-Plantation-Drive-DEC-2022.aspx?Month=Dec&Year=2022>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

National Energy Conservation Day (14th December 2022)

Institution's Innovation Council (IIC), Ministry of Education (MoE) **together with** NSS Wing Dronacharya Group of Institutions, Greater Noida **organized** a session on “National Energy Conservation Day” **on** 14th December, 2022. 105 students **attended the session**

<https://ggnindia.dronacharya.info/events/National-Energy-Conservation-Day-DEC-2022.aspx?Month=Dec&Year=2022>



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

National Pollution Control Day (2nd December 2022)

Institution's Innovation Council (IIC), Ministry of Education (MoE) in coordination with NSS Wings, Dronacharya College of Engineering, Gurugram organized a poster making competition on "National Pollution Control Day" on 2nd December 2022. 120 students participated in the competition.

<https://ggnindia.dronacharya.info/events/National-Pollution-Control%20Day-DEC-2022.aspx?Month=Dec&Year=2022>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




NSS Orientation Programme and Tree Plantation (24th August 2022)

The **National Service Scheme (NSS) Orientation Program** was organized on **24th August, 2022** at **Dronacharya College of Engineering, Gurugram**. The main motive of NSS is to develop student's personality through community service.

<https://ggnindia.dronacharya.info/events/Tree-Plantation-Day-24-Aug-2022.aspx?Month=Aug&Year=2022>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Plastic Waste Free Campaign (15th November 2021)

NSS Unit of Dronacharya College of Engineering, Gurugram organized a “Plastic Waste Free Campaign” on 15th November, 2021. 40 students participated in the campaign.

<https://ggnindia.dronacharya.info/events/Plastic-Waste-Free-campaign-15-Nov-2021.aspx?Month=Nov&Year=2021>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



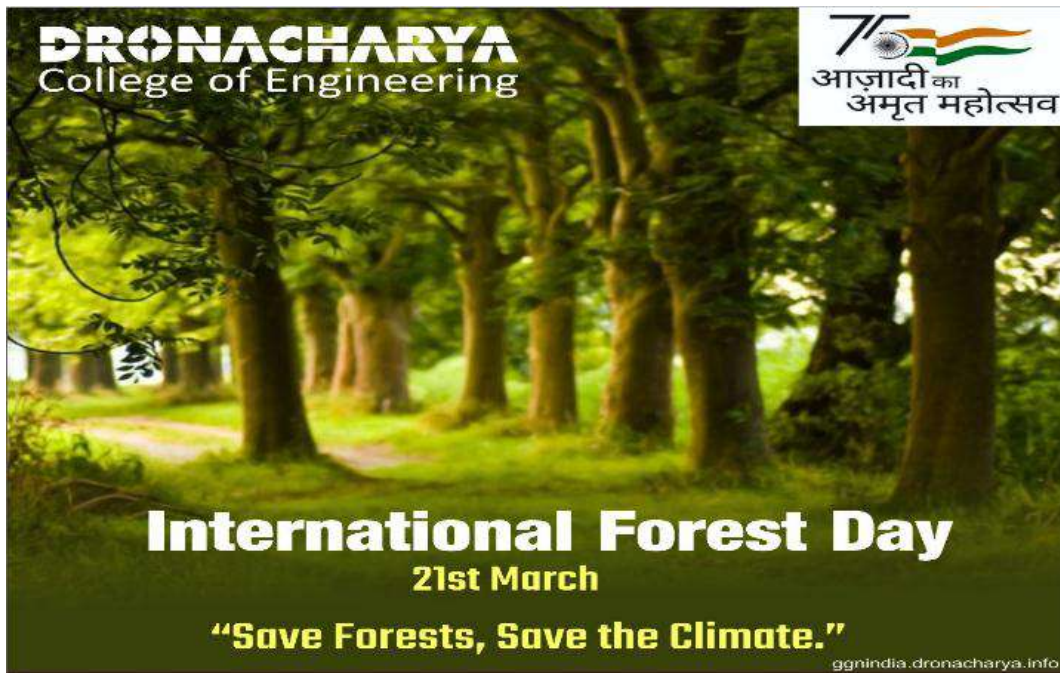
DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)


International Forest Day (21st March 2022)

Dronacharya College of Engineering, Gurugram celebrated International Forest Day 2022 on 21st March 2022.

Faculty members and students went to the nearby village to create awareness among the villagers importance of forests and the role they play in our ecology as well as the economy

<https://ggnindia.dronacharya.info/events/Forest-Day-MAR-2022.aspx?Month=Mar&Year=2022>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Swachhta Pakhwada (1st October 2021)

To spread the message of cleanliness and hygiene across the country, NSS unit of Dronacharya College of Engineering, Gurugram observed “Swachhta Pakhwada” on 1st October, 2021. Swachhta Pakhwada is an initiative by the Indian Government to promote cleanliness and sanitation across the country. 146 students participated in the campaign.

<https://ggnindia.dronacharya.info/events/Swachhta-Pakhwada-1st-Oct-2021.aspx?Month=Oct&Year=2021>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.

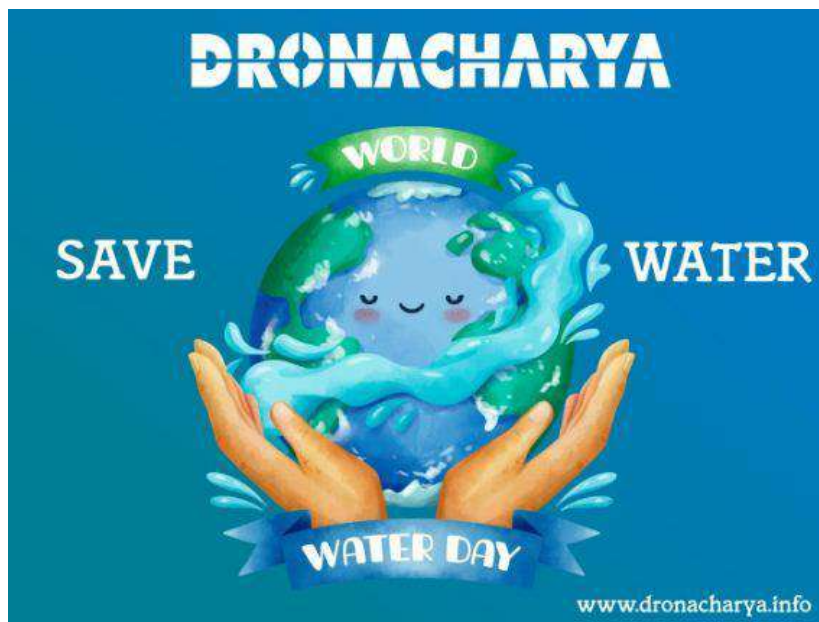



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

World Water Day (22nd March 2021)

NSS Unit of Dronacharya College of Engineering, Gurugram celebrated “World Water Day” on 22nd March, 2021. 85 students participated in the celebration.

<https://ggnindia.dronacharya.info/events/Water-Day-22-March-2021.aspx?Month=Mar&Year=2021>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.

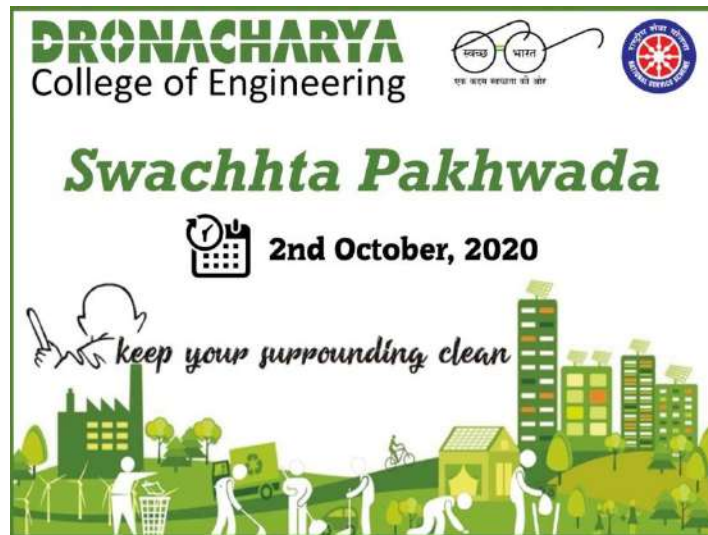


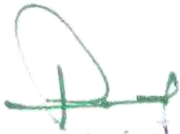
DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Swachhta Pakhwada (2nd October 2020)

NSS Unit of Dronacharya College of Engineering, Gurugram celebrated “Swachhta Pakhwada”; a cleanliness and awareness campaign that aimed to create awareness among people about the importance of cleanliness, hygiene and sanitation. **20 NSS volunteers** along with **2 faculty members** participated in the campaign.

The objective of Swachhta Pakhwada was to instill a sense of responsibility and accountability in people towards maintaining cleanliness and hygiene in their surroundings.




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Plastic Waste Free Campaign (18th August 2020)

NSS Unit of Dronacharya College of Engineering, Gurugram organized “Plastic Waste Free Campaign” on 18th August, 2020. 10 NSS volunteers along with 2 NSS coordinators participated in the campaign.

The main motive behind the conduction of campaign was to spread awareness about the ill effects of using plastic on the environment.




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Swachhta Pakhwada 2020 (16th - 30th January 2020)

As per the direction of the Ministry of Human Resource Development, Govt. of India and Higher Education Department the **Swachhta Pakhwada 2020** was organized from **16th - 30th January 2020** in **Dronacharya College of Engineering, Gurugram**.

NSS Wing, Dronacharya College of Engineering, Gurugram organized various event like Swachhta Pledge, Plogging, Poster making Competition, Cleanliness drive, Rally on Swachhta under this 15 days' swachhta initiative.

<https://ggnindia.dronacharya.info/events/Swachhta-Pakhwada-NSS.aspx?Month=Jan&Year=2020>



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Campaign: One Student One Tree (5th & 11th December 2019)

Dronacharya College of Engineering, Gurugram conducted a campaign "One Student One Tree" on 5th & 11th December 2019 as per the directives of Minister HRD Minister, Govt. of India and AICTE.

The campaign is in line with the Hon'ble Prime Minister **Narendra Modi's** idea of a green and healthy environment.

https://ggnindia.dronacharya.info/events/One-student-one_tree.aspx?Month=Dec&Year=2019



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.




Pot-a-Plant: Go Green Competition (24th October 2019)

Dronacharya College of Engineering, Gurgaon under the flagship of MHRD Innovation Cell, organized a **Pot-a-Plant: Go Green Competition** on **24th October 2019** to spread awareness about the environment and different types of plants among students, at college campus. Students from CSE, IT, ECE and ME Department participated in the competition.

https://ggnindia.dronacharya.info/events/Plant_Go_Green_Competition.aspx?Month=Oct&Year=2019




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Plastic Waste Free Campaign (Swachhata Hi Seva 2019) (11th - 27th September 2019)

Dronacharya College of Engineering, Gurgaon **organized** "Plastic Waste Free Campaign (Swachhata Hi Seva 2019)" as per the guidelines issued by AICTE from 11th - 27th September 2019. Numbers of programs were organized by the college to commemorate the occasion.

https://ggnindia.dronacharya.info/events/Plastic_Waste_14102019.aspx?Month=Sep&Year=2019



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



Plantation Drive (5th June 2019)

In order to sensitize students towards the need to preserve our environment and ecology, NSS Wing, Dronacharya College of Engineering, Gurgaon organized the event of “**Plantation Drive**” at nearby village on **5th June 2019**.

Due to tremendous increase in the pollution level and global warming, a tree plantation drive was organized. The objective of tree plantation is to save the endangered environment and to beautify our life.

Students went to the nearby village and guided people trees are valuable gifts of nature.



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



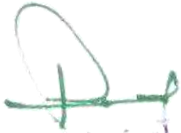
DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Sanitary Napkin Distribution (8th October 2018)

NSS Unit of Dronacharya College of Engineering, Gurugram distributed “Sanitary Napkins” in the nearby locality. 18 NSS Volunteers along with 2 faculty members went to nearby village to spread awareness about the menstrual hygiene and distribute Sanitary Napkins.

<https://ggnindia.dronacharya.info/events/Sanitary-Napkin-Distribution-8-Oct-2018.aspx?Month=Oct&Year=2018>




Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.



DRONACHARYA
College of Engineering
Approved by : All India Council for Technical Education
Permanent Affiliation : M. D. University, Rohtak (Haryana)

Swachhta Pakhwada (1st - 15th August 2018)

NSS Unit of Dronacharya College of Engineering, Gurugram organized “**Swachhta Pakhwada**” from **1st – 15th August, 2018**. The drive was organized within the college premises and in the nearby areas. **40 NSS volunteers** participated in the campaign.

The campaign was observed to promote cleanliness and hygiene. The campaign focuses on creating awareness about the importance of cleanliness and hygiene and to adopt sustainable cleanliness practices.

<https://ggnindia.dronacharya.info/events/Swachhta-Pakhwada-1-15-August-2018.aspx?Month=Aug&Year=2018>

DRONACHARYA
College of Engineering



स्वच्छता पखवाड़ा
Swachhata Pakhwada

1-15th August 2018



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.

DRONACHARYA
www.dronacharya.info

Khentawas, Farrukh Nagar, Gurgaon - 122506 (Hr.)

Energy Audit Report of Dronacharya College of Engineering

KHENTAWAS, FARRUKH NAGAR, Gurugram, Haryana 123506



Conducted by

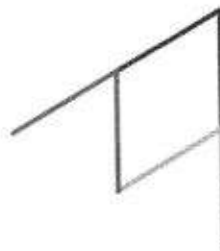
Tetrahedron Manufacturing Services

G-7, near Hindi Khabar, G Block, Sector 63, Noida, Uttar Pradesh 201307

Call: 089841 89814

Email: - tms@tetrahedron.in

<https://www.tetrahedron.in/>



Principal
Dronacharya College of Engineering
Farrukh Nagar, Gurgaon.

Energy Audit Report

DISCLAIMER

This report is based on the information provided by the management of **Dronacharya College of Engineering** & on-site observations on specific dates. We certify that this information and following analysis is correct to the best of our knowledge and ability. The validity of the recommendations is dependent on the accuracy of log books and historical data supplied to us. This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the addressee(s) and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The recommendations and findings are to be used by client at their own accord and Tetrahedron Manufacturing Services or its associates would not be responsible for any material or non-material losses (if any) occurring in any way due to their implementation

Contents

A. Table of content	4
List of tables	4
List Of Figures.....	5
List of Abbreviations.....	6
B. Acknowledgement	7
C. Executive Summary	8
D. Introduction	10
1. Energy and Utility System Description	13
2. Description and Energy Consumption	16
3. Energy Scenario	19
3.1 Electrical Systems	19
3.2 Water Pump	26
3.3) Air Conditioning.....	27
3.4 Lighting System.....	28
4. Energy Conservation Measures.....	29
4.1 Replacing the Conventional fan with energy efficient fan.....	29
4.2 Replacing the Old Tube with LED tube.....	30
4.3 Replacing the old bulb with LED bulb	31
4.4 Water Pumping System.....	32
4.5 Replace LCD monitor with LED monitor	33
5. Annexure	34
.....	34
6. Conclusion.....	41



A. TABLE OF CONTENT

List of tables

Table No.	Description	Page No
Table 01:	Energy Usage Highlights	8
Table 02:	Summary of Energy Conservation Measures	9
Table 03:	College Details	18
Table 04:	Electrical Bill analysis	21
Table 05:	DG Set Details	25
Table 06:	DG Set Dual Fuel System	25
Table 07:	Pump Table	26
Table 08:	AC Details	27
Table 09:	Source Details	28
Table 10:	Fan Details	28
Table 11:	Fan Replacement Savings	29
Table 12:	Current lighting with LED tube	30
Table 13:	Current OLD bulb with LED tube	31
Table 14:	Pump Replacement	32
Table 15:	Replacement of LCD monitor with LED monitor	33

List Of Figures

Figure No.	Figures Description	Page No.
Figure 01:	Energy Audit Flowchart	12
Figure 02:	Energy Audit Instruments	14
Figure 03:	Power Factor	20
Figure 04:	Units and Billed Amount Trends	22
Figure 05:	Billing Distribution	23
Figure 06:	Annual Demand Profile	24

List of Abbreviations

ECM	: Energy Conservation Measures
kWh	: kilo Watt hour
kVAh	: kilo Volt Amp Hour
LT	: Low Tension
HT	: High Tension
MT	: Metric Ton
MTOE	: Metric Ton Oil Equivalent
kW	: Kilo Watt
SEC	: Specific Energy Consumption
SPC	: Specific Power Consumption
TPH	: Tons Per Hour
VFD	: Variable Frequency Drive
DOL	: Direct on Line
Yr.	: Year
Kg	: Kilo Gram
W	: Watt
C	: Celsius
kVA	: kilo volt Amp
V	: Volt
I	: Current
P	: Power

Tetrahedron Manufacturing Services

Energy Audit Report

B. ACKNOWLEDGEMENT

Energy Audit Team of **Tetrahedron Manufacturing Services Pvt Ltd.** Expresses Our Sincere Gratitude to Management of **Dronacharya College of Engineering**, for providing us an opportunity to conduct an energy audit of their organization located In Khentawas, Farrukh Nagar, Gurugram, Haryana 123506. We are grateful to K.K Dahiya, Devendra Kumar, Mr. Sravan and other officials for showing keen interest in the study and for the help and cooperation extended to Energy Audit Team during study. We do hope that you will find the recommendations given in this report useful in helping you save energy. While we have made every attempt to adhere to high quality standards, in both data collection and analysis, as well as in presentation through the report, we should welcome any suggestions from your side as to how we can improve further.

In case of any suggestions or queries:

Tetrahedron Manufacturing Services

Nitin Kumar - Director

Call: 8700454743

Email: - tms@tetrahedron.in

<https://www.tetrahedron.in/>

Energy Audit Report

C. EXECUTIVE SUMMARY

Energy is one of the major inputs in any facility and is the mainstay of the economic development of the country. Rising Electricity & fuel costs coupled with increased global competition is forcing players to slash the energy costs. Energy Audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating & maintenance practices of the system. It is instrumental in coping with the situation of variation in energy cost availability, reliability of energy supply, decision on appropriate energy mix, decision on using improved energy conservation's, equipment's and technology.

Energy conservation is a continuous process and there is always scope for further improvements, with this objective the Energy Audit team with the active involvement of **Dronacharya College of Engineering** have identified the following energy conservation opportunities (ECO's) implementation of ECO's can further help reducing energy consumption.

Highlights

Table01: - Energy Usage Highlights


Description	Units	Values
Annual electricity consumption	Units	251706
Annual electricity cost/annum	INR	2956364

Energy Audit Report

Table02: - Summary of Energy Conservation Measures

Sr. No	Energy Conservation Measures	Annual Saving		Investment	Payback Period
		kWh	INR	INR	Years
1	Replace conventional ceiling fan with energy efficient fan	33089	406996	1285080	3.2
2	Replace conventional tube with energy efficient tube	11373	139889	85050	0.6
3	Replace conventional CFL bulb with energy efficient LED bulb	701	8621	10620	1.2
4	Replace LCD monitor with LED monitor	108900	1339470	3300000	2.5
5	Replacement of old pumps with energy efficient pumps	9900	121770	60000	0.5

Tetrahedron Manufacturing Services


Principal
 Dronacharya College of Engineering
 Farrukh Nagar, Gurgaon.

D. INTRODUCTION

OBJECTIVE OF ENERGY AUDIT:

Energy audit is the key to a systematic approach for decision-making in the area of energy management and gives a positive orientation to the energy resource cost reduction. The primary objective of the energy audit is to determine ways to reduce energy consumption to lower operating costs.

The Energy audit is conducted with the following Objectives:

1. Detailed studies of the intended energy consuming equipment including historical and present energy performance trends
2. Quantification of Energy Losses, and Energy Saving Potential
3. Presentations of Energy Efficiency Measures with cost benefit analysis
4. Identifying potential areas of electrical energy economy.

This energy audit assumes significance due to the fact that the Dronacharya College of Engineering, total *electricity bill crossed INR. 29 Lakhs from Apr,22 to Mar,23* and it was aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities.

ABOUT AUDIT TEAM MEMBERS:

We have dedicated an expert team for services. Your first point of contact with Tetrahedron Manufacturing Service will be with our dedicated customer services team. We are highly skilled, motivated and fully trained to assist you. Our services team includes our expert, highly experienced advisors for power factor correction systems, harmonic filter and others Energy and Power Quality problems who have over 40 years combined experience for the same. Each team member is dedicated to offering a high level of customer care and also strives for excellence to ensure that you receive the perfect service

METHODOLOGY OF WORK:

The methodology adopted for this audit was

- A preliminary energy audit has been conducted to establish the energy consumption of the organization by analysing the available past energy consumption data, identification of the areas requiring more detailed study and measurements.
- Visual inspection and data collection.
- Identification/verification of energy consumption and other parameters by measurements.
- Computation and in-depth analysis of the collected data, including utilization of computerized analysis and other techniques as appropriate were done to draw inferences and to evolve suitable energy conservation plan/s for improvements/ reduction in specific energy consumption.
- Potential energy saving opportunities
- Flow Chart for Methodology for report preparation

Energy Audit Report

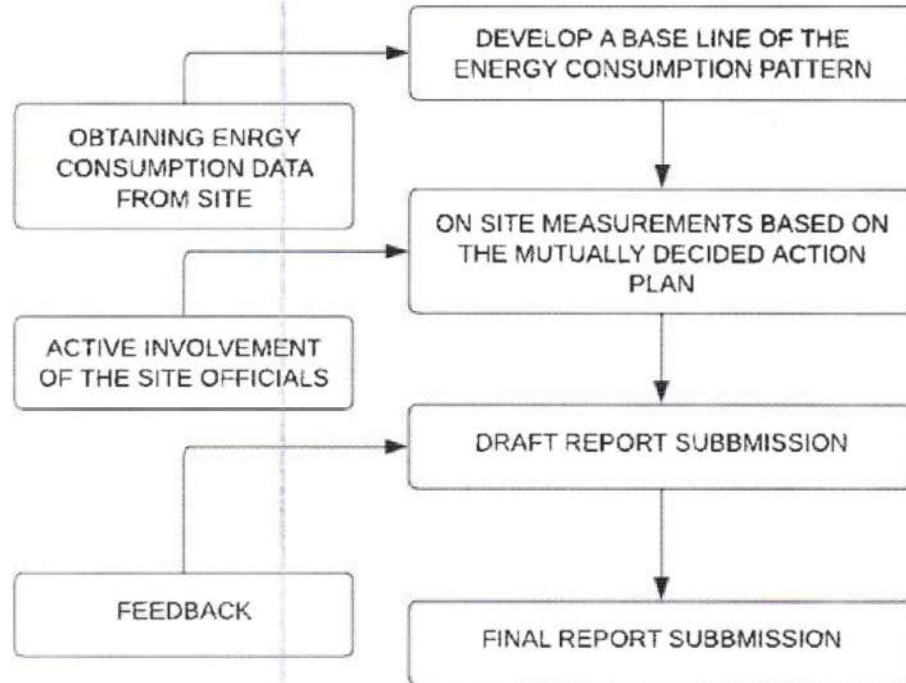


Figure 1 Energy Audit Flowchart

This report is just first step, a mere mile marker towards our destination of achieving energy efficiency and we would like to emphasize that an energy audit is a continuous process. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential.

Energy Audit Report

1. Energy and Utility System Description

Major utilities in the campus are

- 1.General
- 2.Electrical

1.1 Brief Description of each Facility

This study is being done under the indicative scope of work for conduct of Energy Audit specified by Dronacharya College of Engineering. This study is mainly carried out to identify saving areas in Dronacharya College of Engineering with short term, medium term & long-term investments, yielding significant savings. The study can be mainly divided into following groups.

2.1.1 General

Energy Audit focuses on study of correlation of electricity consumption on production. Opportunities for load factor improvement, power factor improvements, etc.

b. Electrical

It includes motor load study of 1 HP & above by measuring input parameters (Voltage, Current, P.F., & kW), performance analysis of water pumps having capacities above 1 HP, performance analysis and identification of energy efficiency opportunities in motors, pumps, air compressors, lighting, etc.

1.2 Instrument Used

Following instruments are used for the study:

- a. 3 Phase Power Analyzer-Fluke 1736
- b. Lux Meter
- c. Measuring tape
- d. Thermal imager
- e. Ultrasonic Water flow meter
- f. Power Clamp
- g. Distance Meter
- h. Hygrometer
- i. Others as required

Energy Audit Report



Power Quality Analyzer



Thermal Imager



UE System (Leak Detect System)



Anemometer



Ultrasonic
Flow Meter



LUX System



Pressure Gauge



Hygrometer



Distance Meter

Energy Audit Report

A



TDS Meter



Flu Gas Analyzer



Clamp Meter

Figure 2 Energy Audit Equipment

1.3 Energy Audit Team

- Pratosh Saxena – Energy Auditor TMS
- Nayan Kumar – Senior Energy Consultant TMS
- Sushanta Bhattaray – Energy Consultant TMS

Tetrahedron Manufacturing

2. Description and Energy Consumption

2.1 About Dronacharya College of Engineering:

Dronacharya College of Engineering, Best Engineering College in Delhi NCR are absolutely committed to serve the society and improve the mode of life by imparting high quality education in the field of Engineering and Management catering to the explicit and implicit needs of the students, society, humanity and industry. 'Shiksha evam Sahayata' i.e. Education and Help are the two words etched on our banner soaring higher year after year.

The Dronacharya College of Engineering in Gurugram, Delhi NCR was established in the year 1998. It has been accredited by AICTE and affiliated with Maharshi Dayanand University and is NAAC-accredited, which is ranked 91 in India. It is a premier institute for engineering, technology, and management education. The campus is spread over 10 acres, located near the Gurugram metro station, the Dronacharya College of Engineering Gurugram is one of the best colleges in the city.

Faculty and Facilities of Dronacharya College of Engineering: -

The faculty and facilities of Dronacharya College of Engineering Gurugram are excellent. The infrastructure here is world-class, resulting in an ideal academic environment. The college is equipped with a well-equipped auditorium with a seating capacity for 450+ students. The facility also features an audio-visual room with an LCD projector, a computer lab, internet connectivity, and air-conditioned classrooms. It has been authorized as a test centre by various firms to help its graduates land jobs. It has a large library and a cafeteria for students to dine in.

Energy Audit Report

The institute also has an air-conditioned auditorium. In addition, the campus is beautifully landscaped, with many trees and open spaces for recreational activities. The college offers various scholarship schemes. The Robotics and Automation lab provides an environment where students can explore autonomy in manufacturing systems.

The campus is equipped with a computer lab for students and teachers, and sports facilities for sports, cultural events, and community service. The campus has modern teaching facilities and large playgrounds for the students. It also provides excellent technical education. The college has a great atmosphere.

Campus and Hostel Life in Dronacharya College of Engineering: -

The college provides hostel accommodation for both male and female students. Its hostel is spacious and equipped with all the facilities. It also has free Wi-Fi connectivity for students and teachers. The hostel has good food and proper cleaning facilities.

Students from different parts of the country live in college hostels. The students are provided with hygienic food, a recreation room, indoor games, and the Internet. The girl's hostel mimics an academic environment and is free from ragging. The campus is beautifully landscaped and provides ample green space for a healthy environment. The college has separate wardens for boys and girls.

Vision: -

To impart Quality Education, to give an enviable growth to seekers of learning, to groom them as World Class Engineers and Managers competent to match the expanding expectations of the Corporate World has been our ever-enlarging vision

Energy Audit Report

extending to new horizons since the inception of Dronacharya College of Engineering.

Campus Life: -

"A thriving residential campus and community of creative and accomplished people from around the world". Life at DCE blends research and reflection, the scientific with the artistic, and the scholarly with the athletic. Our students come from different places and backgrounds, but together they create a diverse and kinetic community that seeks to create a better world.

Table03: - College Details

College Details		
No	Particulars	Details
1	Name of the College	Dronacharya College of Engg.
2	Address	Vill: - Khantawas, Farukhnagar, Haryana
3	Contact Person	Mr. Hansraj Yadav
4	Contact Phone number	9910380110
5	E-mail	registrar@ggnindia.dronacharya.info
6	Web site	https://ggnindia.dronacharya.info/
7	Type of Building	Educational Institute
8	Annual Working Days	Approx 275
9	No: of Shifts	1
10	No: of students enrolled	1600
11	No: of teaching staff	130
12	No: of non-teaching staff	90
13	No: of departments	12
14	No of UG courses	8
15	No: of PG courses	4
16	Total campus area	10.4 acre
17	Total Built Up area	28465 m ²
18	No: of hostel students	1
19	No: of plants in college	More than 5000
20	Grounds and stadiums	1

2.2 Annual Energy Consumption

Electricity

Dronacharya College of Engineering is receiving electricity from DHBVN (Dakshin Haryana Bijli Vitran Nigam) Contract demand with DHBVN is 400 KW.

3. Energy Scenario

3.1 Electrical Systems

3.1.1 Electrical bill analysis

Dronacharya College of Engineering is getting electricity supply from DHBVN (Dakshin Haryana Bijli Vitran Nigam) Major portion of the energy consumption is used for academics and hostel.

The observations made during the study are given in the following sections.

The Tariff Structure at the college

Tariff structure of the facility is given below

•Tariff Category	HTS-NDS
•Supply voltage	11 kV
•Contracted demand	400 kW
•Demand charges	165 per kW
•TOD	Not Opted
•Unit charge	6.65/kVAh

Energy Audit Report

7

1. Power factor (PF)

It shall be the responsibility of the HT Consumer to determine the capacity of PF correction apparatus and maintain an average PF of not less than 0.76.

Maximum power factor = 0.89

Minimum power factor = 0.62

Average power factor = 0.76

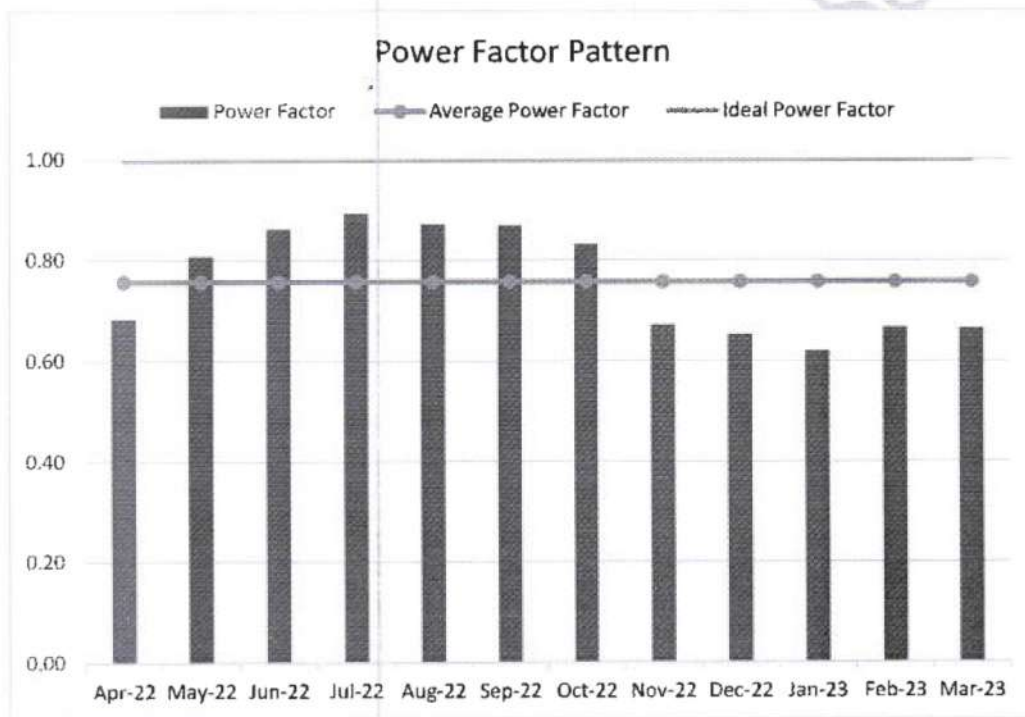


Figure 3 Power Factor

2. Time of Day Tariff: - Not opted

Energy Audit Report

TABLE 04: - Electrical Bill analysis

Month	Contract Demand (kVA)	Billed Demand (kVA)	Units(kWh)	Units (kVAh)	Power Factor	Nominal Unit Rate (INR)	Fixed Charges	Energy Charges	Municipal Tax	Electricity Duty	Surcharge	Billed Amount (INR in Lakhs)
Apr-22	400	407.7	10122	14810	0.68	6.65	67266	98487	3315	1012	2486	173175
May-22	400	394.5	17430	21586	0.81	6.65	65096	143547	4173	1743	2741	193605
Jun-22	400	407.7	23710	27524	0.86	6.65	67266	183034	5006	2371	3726	265429
Jul-22	400	394.5	24088	26990	0.89	6.65	65096	179484	4892	2409	3640	256110
Aug-22	400	407.7	24918	28582	0.87	6.65	67266	190070	5146	2492	3831	269415
Sep-22	400	407.7	23328	26862	0.87	6.65	67266	178633	4918	2333	3660	257419
Oct-22	400	394.5	20090	24160	0.83	6.65	65096	160654	4515	2009	3357	236231
Nov-22	400	407.7	13104	19482	0.67	6.65	67266	129555	3936	1310	6173	425496
Dec-22	400	394.5	10422	15962	0.65	6.65	65096	106147	3424	1042	1042	176300
Jan-23	400	407.7	9522	15376	0.62	6.65	67266	102250	3390	952	5168	358515
Feb-23	400	407.7	11268	16910	0.67	6.65	67266	112452	3594	1127	2667	187715
Mar-23	400	368.2	8950	13462	0.66	6.65	60756	89522	3006	895	2225	158954
Average	400	400	16413	20975	0.76	6.65	66000	139487	4110	1641	3393	246364

Observation:

- 1) Maximum consumption 28582 kVAh in month of August-2022 and minimum 13461.92 kVAh in month of March-2023.
- 2) The average energy consumption is 20975 kVAh.

Energy Audit Report

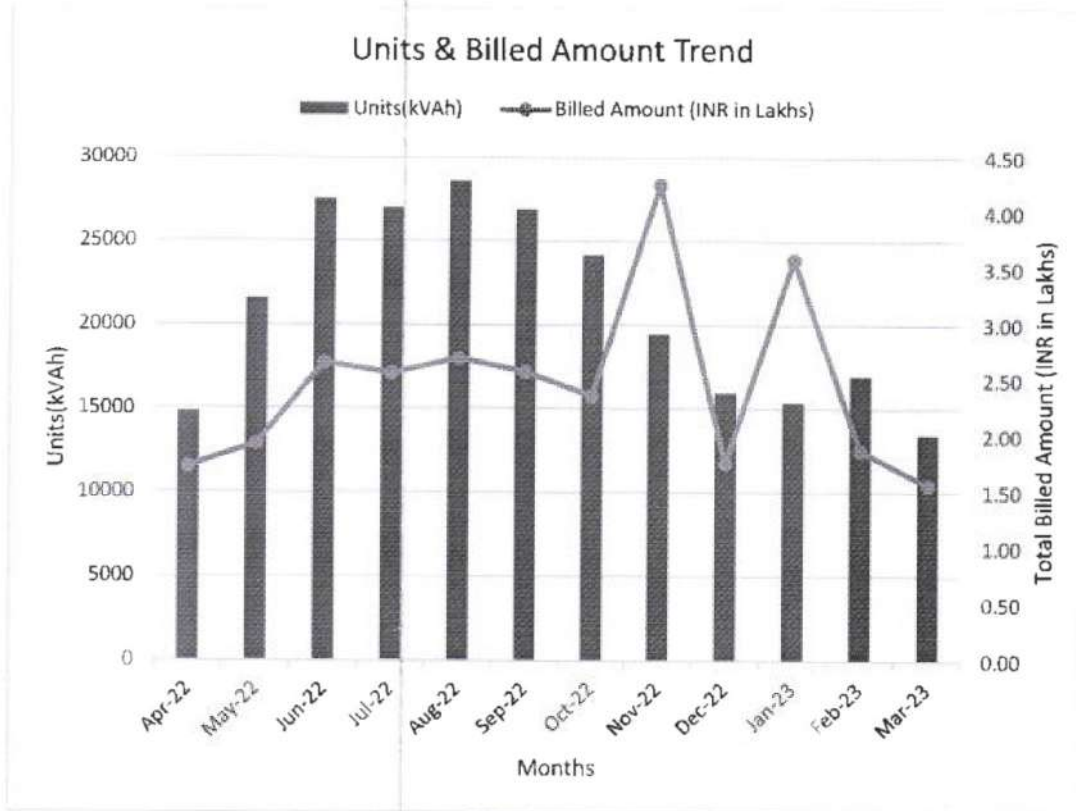


Figure 4 Units & Billed Amount Trend

Observation:

- 1) In Aug-22 Billed amount is maximum.
- 2) In Mar-23 Billed amount is minimum.

Energy Audit Report

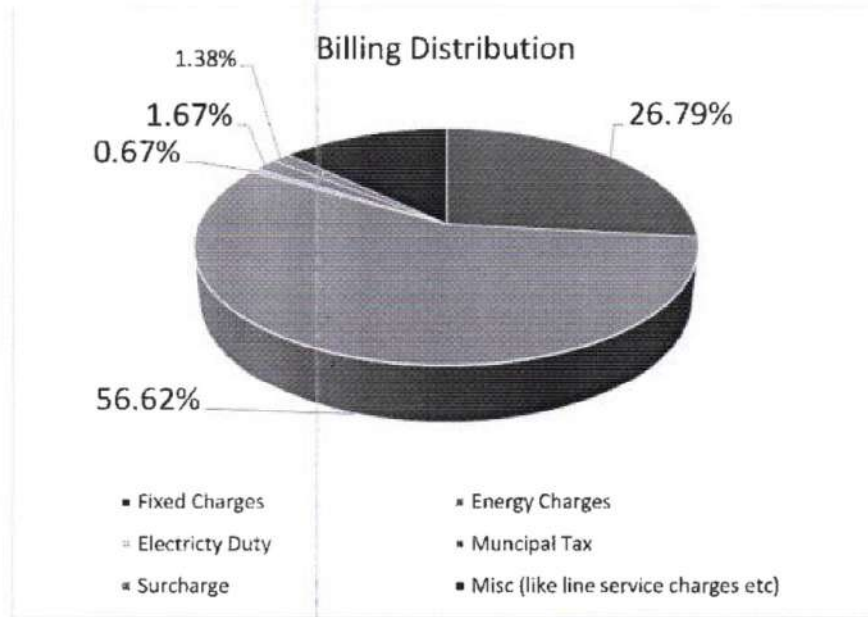


Figure 5 Billing Distribution

Observation:

- 1) Energy Charges are 56.62% of total bill

Energy Audit Report

A

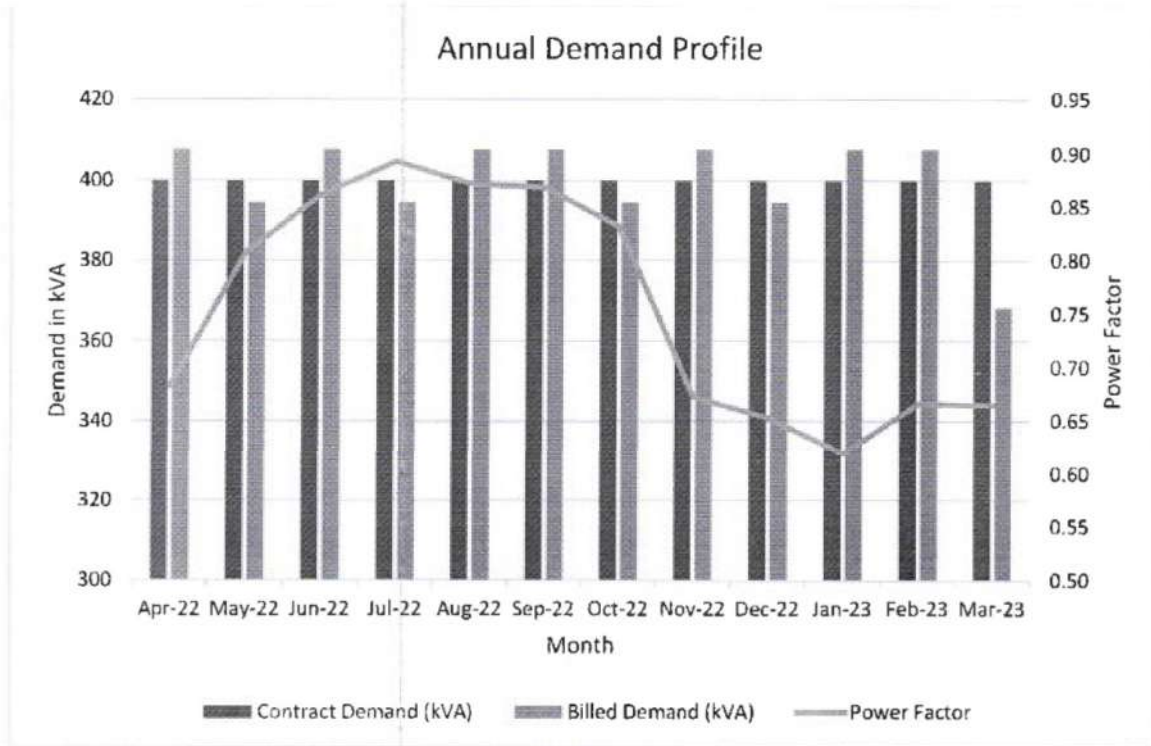


Figure 6 Annual Demand Profile

Observation:

- 1) Power Factor is Minimum for Jan-23.
- 2) Demand is nearly 400 kVA

Energy Audit Report

3.1.2 Diesel Generator

Following table shows the details of DG set.

Table05: - DG Set Details

Sl. No	Make	Capacity in KVA	Avg Running Duration/day in hrs	kW	kWh	Diesel/hr in ltrs	Cost of Diesel/Ltr in Rs	Total Cost/day
1	Kirloskar	500	2	400	800	70	90	12600
2	Kirloskar	250	2	200	400	23	90	4140
3	Kirloskar	62	2	49.6	99.2	12	90	2160

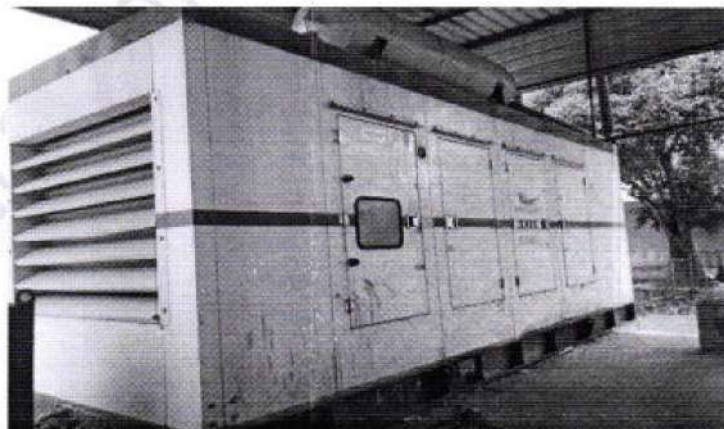
Recommendations:

1. Conversion of DG sets to Dual Fuel System
2. Use of Natural Gas with Diesel will reduce the diesel cost by at least 30%
3. GHG emissions will reduce by a minimum of 20%

After Implementing Dual Fuel System:

Table06: - DG Set Dual Fuel System

Sl. No	Make	Capacity in KVA	Avg Running Duration/day in hrs	kW	kWh	Diesel/hr in ltrs	Cost of Diesel/Ltr in Rs	Total Cost/day
1	Kirloskar	500	2	400	800	49	90	8820
2	Kirloskar	250	2	200	400	16.1	90	2898
3	Kirloskar	62	2	49.6	99.2	8.4	90	1512



Energy Audit Report

3.2 Water Pump

The performance analysis of the pumps used for water required for the institute is done based on the present operating parameters like water flow, head and power. Pumps of different capacities are installed based on the water flow requirement at different sections of the college. The water supply of the institute is met by river and bore well. There are number of pumps are running mainly in the institute campus.

Table07: - Pump Table

Pump Table				
Description	Units	Pump at the back of admin building	Pump at the corner of admin building	Pump at front gate of admin building
Design parameter				
Rated output	hp	7.5	7.5	7.5
	kW	5	5	5
Method of starting		Star-Delta	Star-Delta	DOL
Pump Efficiency	%	65	61	58
Motor Efficiency	%	92	92	86
Measured Parameter				
Voltage	Volts	415	416	412
Current	Amps	8.11	8.18	7.98
Power Factor		0.85	0.86	0.83
Flow Rate	m ³ /hrs	107.6	106.54	78.26
Diff Pressure	kg/cm ²	0.92	0.87	0.65
Calculated Parameter				
Power	kW	4.96	5.07	4.73
System Efficiency	%	54.4	49.8	29.3
Age	Years	2.5	-3	-8

Observation:

- 1) Pump at the front gate of admin building has less efficiency than other pumps, which is about 30%.
- 2) One pump has age of about 8 years while other pump has about 2.5 years. The pump which has more age i.e., 8 years have less efficiency.

Energy Audit Report

3.3) Air Conditioning

Table08: - AC Details

SI NO	Name of Location	1.5 Ton	2 Ton	Star Rating
1	Auditorium		2	****
			2	***
2	Computer Centre		1	*****
			1	****
			2	***
3	Library		1	****
			3	***
4	Seminar Hall	1		*****
		7		****
		4		***
5	Laboratory	17		*****
		43		****
		6		***

ACs Data

Observation:

- 1). 19 ACs are 5 stars rated, 54 ACs are 4 star rated & 17 are 3 stars rated.
- 2). Although many of ACs are 5 stars rated but as per BEE guidelines, 5 Star rated ACs will be considered as 4 stars rated effective from 1st July,2022
- 3). 3 stars rated ACs should be replaced as soon as possible
- 4). ACs set temperature should be 24 degree C for human comfort as well as energy consumption point of view.

3.4 Lighting System

Lighting is provided in commercial buildings, indoor and outdoor for providing comfortable working environment. The primary objective is to provide the required lighting effect for the lowest installed load i.e. highest lighting at lowest power consumption. There are number of buildings in Campus.

Table09: - Source Details

SI NO	Type of Source	No of source	Each Wattage
1	T12	332	28
2	T8	298	40
3	CFL/Incandescent bulb	177	12
Total		807	

3.5 Fan Data

Majority of the fans are traditional type fans that consume more energy. Now in the market advanced BLDC type fans are available which consumes less energy and available advanced feature regulators

Table10: - Fan Details

SI NO	Name of Location	No of Fan
1	Classroom	224
2	Computer Centre	8
3	Laboratory	456
4	Seminar Hall	72
5	Tutorial Room	32
6	Workshop	12
Total		804

Energy Audit Report

4. Energy Conservation Measures

4.1 Replacing the Conventional fan with energy efficient fan

Recommendations:

These fans should be replaced with BLDC type fans, their ROI is around 5 yrs. as for all replacement a huge capital sum is involved so recommendations are to go in a phase wise manner.

Saving Potentials:

Table11: - Fan Replacement Savings

Fan Replacement Savings					
Description	Units	Value	Value	Value	Value
Present system					
Type of fan		Ceiling fan	Wall fan	Pedestal fan	Exhaust fan
Number of existing fans	Nos	647	62	9	86
Wattage /fan	Watt	65	65	65	65
Usage of fan per day	Hrs	8	8	8	8
Working days per annum	Days	275	275	275	275
Annual Energy consumption	kWh	92521	8866	1287	12298
Proposed system					
Recommended for replacement	%	50%	50%	100%	50%
Recommended of EE fan	Nos	324	31	9	43
Wattage of EE fan	watt	28	28	28	28
Annual Energy consumption	kWh	19928	1910	554	2649
Annual Power saving	kWh	26333	2523	733	3500
Energy tariff	INR	12.3	12.3	12.3	12.3
Monitory saving	INR	323895	31038	9011	43052
Investment/fan	INR	2800	5440	5440	3760
Total investment	INR	905800	168640	48960	161680
Simple Payback period	Years	2.8	5.4	5.4	3.8

4.2 Replacing the Old Tube with LED tube

Findings:

Current existing tube light consumes 40 W which is replaced by LED tube.

Recommendations:

Replace the current tube light with LED tube which consumes less energy.

Table12: - Current lighting with LED tube

Current lighting with LED tube			
Description	Units	Value	Value
Present system			
Type of tube		28 w	40 w
Number of existing tube lights(T12/T8)	Nos	332	298
wattage /tube	watt	28	40
Total wattage	Watt	9296	11920
Daily usage	Hrs/day	8	8
Annual working days	days/yr.	275	275
Annual Energy consumption	kWh	20451	26224
Proposed system			
Recommended for replacement	%	60%	60 %
Recommended of LED tube light	Nos	199	179
Wattage of LED tube light	Watt	20	20
Annual Energy consumption	kWh	8764.8	7867
Annual Power saving	kWh	3505.9	7867
Energy tariff	INR	12.3	12.3
Monitory saving	INR	43123	96767
Investment/LED tube light	INR	225	225
Total investment	INR	44820	40230
Simple Payback period	Years	1.04	0.4

A

4.3 Replacing the old bulb with LED bulb

Findings:

Current existing old CFL bulb consumes maximum 12 W which is replaced by LED bulb.

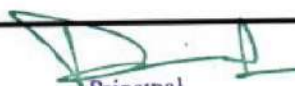
Recommendations:

Replace the current old bulb with LED bulb which consumes less energy.

Table13: - Current OLD bulb with LED tube

Current OLD bulb with LED tube		
Description	Units	Value
Present system		
Number of existing CFL/Incandescent bulb	Nos	177
wattage /tube	watt	12
Total wattage	Watt	2124
Daily usage	Hrs/day	8
Annual working days	days/years	275
Annual Energy consumption	kWh	4672.8
Proposed system		
Recommended for replacement	%	60 %
Recommended of LED tube light	Nos	106
Wattage of LED tube light	Watt	9
Annual Energy consumption	kWh	2103
Annual Power saving	kWh	701
Energy tariff	INR	12.3*
Monitory saving	INR	8621
Investment/LED tube light	INR	100
Total investment	INR	10620
Simple Payback period	Years	1.2

* Although base price is INR 6.65/unit but after considering all charges, average unit cost for the last 1 year was found to be INR 12.29/unit



Principal
Dronacharya College of Engineering
Fartukh Nagar, Gurgaon.

.4 Water Pumping System

Findings:

The submersible pump is use to supply the water for institute are more than 5 years old & power consumption of the pump is more than rated.

Recommendations:

Replace the existing pump with Energy Efficient water pump.

Table14: - Pump Replacement

Pump Replacement		
Description	Units	Pump at front gate of admin building
Design parameter		
Rated output	hp	7.5
	kW	5
Method of starting		DOL
Pump Efficiency	%	58
Type		Submersible
Measured Parameter		
Proposed Power	kW	4.5
Daily Usage	Hrs/day	8
Annual Working Days		275
Annual Power Savings	kWh	9900
Energy Tarif	INR/kWh	12.3
Monetary Savings	INR	121770
Total Investment	INR	60000
Simple Payback Period	Years	0.5



4.5 Replace LCD monitor with LED monitor

Screen Monitors:

Existing Scenarios

Type of monitor (LCD/LED)	Total No of monitors	Avg Running hrs. annually
LCD type	660	1440

Recommendation:

Replace LCD monitor with LED monitor, although a capital sum is involved in but ROI is less than 3 years and product life cycle is much more than that.

Table15: - Replacement of LCD monitor with LED monitor

Replacement of LCD monitor with LED monitor		
Total no. LCD monitors	Nos	660
Avg. running hours per day	Hrs	6
Avg. working days per year	Nos	275
Avg. Power consumption of LCD monitor	W	150
Total electricity consumed by LCD monitor	kWh	163350
Avg. Power consumption of LED monitor	W	50
Total electricity consumed by LED monitor	kWh	54450
Total electricity saving per year	kWh	108900
Rate of electricity	INR	12.3
Total monetary saving per year	INR	1339470
Investment	INR	3300000
Simple payback period	Years	2.5
Simple payback period	Months	29.6

Annexure



Observation:

- 1) Leaving the door open when entering and exiting the room when air conditioner is on so solution is put a notice on the front and back of the door as a reminder.
- 2) Here we can use the PVC strip curtains at the door even though when the door is open there is no wastage of ac breeze.

Energy Audit Report

A



Observation:

- 1) Replacing the T12 tube lights by LED which leads to reducing the total annual energy cost and also energy is used effectively.
- 2) Motion sensors can be used there to automatically switch on the light when there is movement in corridor and switch off when there is no movement in corridor.

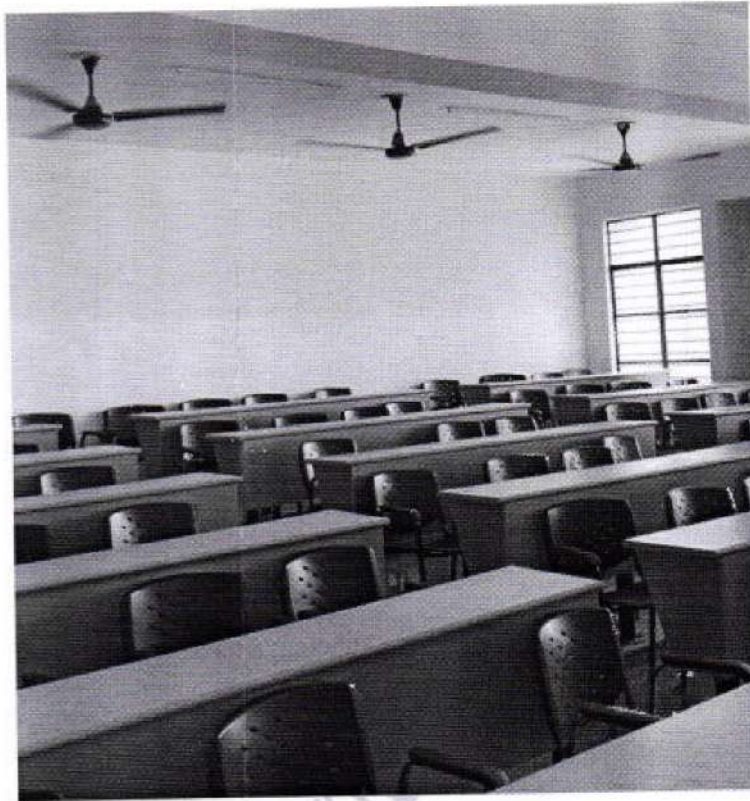


Observation:

- 1) It has been observed that lights are on, even though there is no person in the auditorium. Motion sensors can be used there to automatically switch on the light when there is movement and switch off when there is no movement.

Energy Audit Report

A



Observation:

- 1) Fans should be switched off when no one in the classroom.
- 2) Master switches should be installed outside the classroom

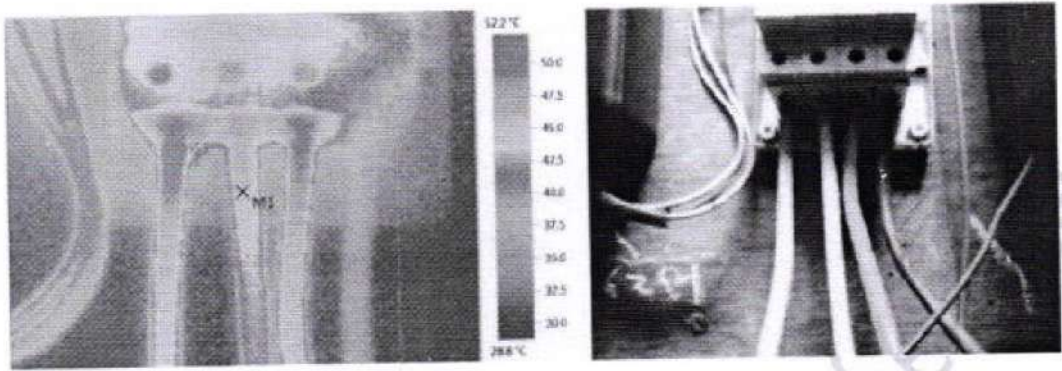
Recommendation: -

Visuals related to energy awareness should be implemented all across the facilities sample are as below: -



Energy Audit Report

A




Picture parameters:

Emissivity: 0.99
Refl. temp. [°C]: 20.0

Picture markings:

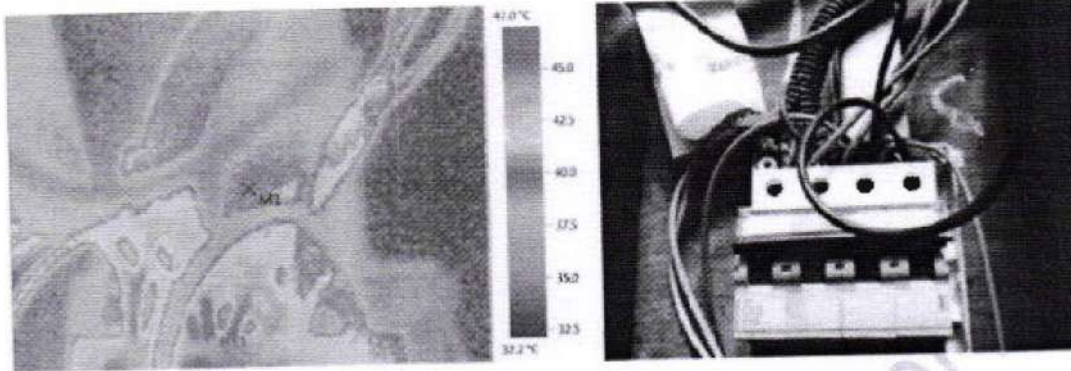
Measurement Objects	Temp. [C]	Emiss.	Refl. Temp. [C]	Remarks
Measure point 1	45.1	0.99	20.0	Center Spot
Hot Spot 1	52.2	0.99	20.0	-

Conducted by – Tetrahedron Manufacturing Services Pvt Ltd.


Principal
Dronacharya College of Engineering
Ferozkh Nagar, Gurgaon.

Energy Audit Report

A



Picture parameters:

Emissivity: 0.99

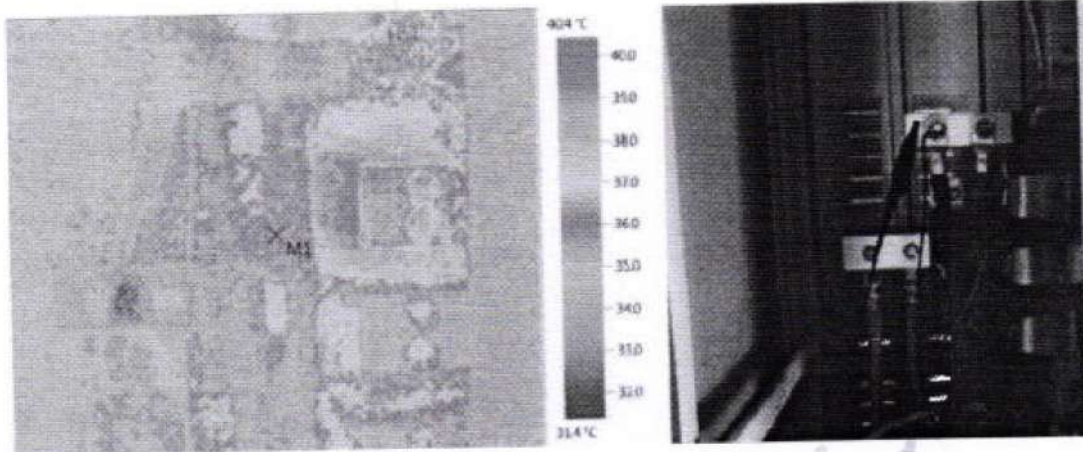
Refl. temp. [°C].20.0

Picture markings:

Measurement Objects	Temp. [C]	Emiss.	Refl. Temp. [C]	Remarks
Measure point 1	39.5	0.99	20.0	Center Spot
Hot Spot 1	47.0	0.99		

Energy Audit Report

4



Picture parameters:

Emissivity: 0.99

Refl. temp. [° C]: 20.0

Picture markings:

Measurement Objects	Temp. [C]	Emiss.	Refl. Temp. [t]	Remarks
Measure point 1	35.7	0.99	20.0	Center Spot
Hot Spot 1	40.4	0.99	20.0	-

6. Conclusion

The college's energy consumption is significantly higher than the industry average for similar facilities, indicating significant opportunities for energy savings.

The lighting and HVAC systems are the two major energy consumers in the college, accounting for more than 70% of the total energy consumption.

The college can achieve significant energy savings by implementing a range of energy conservation measures (ECMs), such as installing LED lighting, upgrading HVAC systems, and improving building insulation.

The recommended ECMs have a high potential for energy savings and are financially viable with a reasonable ROI period.

The implementation of recommended ECMs can help the college to reduce its energy consumption, lower operating costs, and reduce its carbon footprint, contributing to its sustainability goals.

Overall, the energy audit report provides a comprehensive roadmap for the college to improve its energy efficiency and sustainability. The implementation of recommended ECMs can help the college to achieve significant energy savings and reduce its environmental impact while improving the learning and working environment for students, faculty, and staff.

-----X-----