GREEN, ENERGY AND ENVIRONMENT AUDIT REPORT OF

CITY ENGINEERING COLLEGE

Bangalore, Karnataka

EXECUTED BY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
&
DEPARTMENT OF MECHANICAL ENGINEERING

INDUSTRY- INSTITUTE PARTNERSHIP CELL

CENTRE OF EXCELLENCE IN ENERGY STUDIES

KONGU ENGINEERING COLLEGE

PERUNDURAI
ERODE – 638 060
TAMILNADU

May 2024

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Acknowledgement

The Industry Institute Partnership Cell (IIPC) of Kongu Engineering College (KEC) expresses the gratitude to the Management of **City Engineering College, Doddakallasandra, Off Kanakapura Road, Next to Gokulam Apartment, Bangalore - 560 062** for providing an opportunity to conduct Environment, Green and Energy audit inside their college premises. The KEC Energy Audit team wishes to thank **City Engineering College,** Bangalore, Karnataka for giving them the opportunity to carry out the energy audit in their institution and for providing all support to the team during the audit. We extend our thanks to **City Engineering College,** Principal, HODs, IQAC team, NAAC coordinators, other Faculty members from various department and the Electrical Maintenance team for their support and for providing various information enabling the successful completion of the audit , which has facilitated the submission of this report.

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CONTENTS

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1.	EXECUTIVE SUMMARY

City Engineering College had agreed to provide access to Kongu Engineering College to undertake Environmental/Green and Energy Audit related measurements at their campus. This Audit has been conducted by a team of faculty members from Mechanical and Electrical Engineering Department of Kongu Engineering College. As there is no standard model for such an audit, the committee brainstormed and evolved a questionnaire. The data was collected, compiled and was finally analyzed by the audit team members. The remaining data which involved measurement using sophisticated instruments were done by the audit team members. By and large, the audit reveals a healthy environment in the campus. The committee has made short term and long-term suggestions to protect environment at higher levels and it is hoped that this will receive due attention of authorities and all stakeholders of the College.

1.1 About the Institution

City Engineering College (CEC), established under Jayanagar Education Society by Dr K.R Paramahamsa, Chairman in the year 2001. CEC is one of the most sought colleges by students from across the country for Engineering and Management Education. The college believe in providing a high-quality education to the prospective professionals of the country for which necessary quality bench marks have been put in place, in the areas of faculty recruitment, training and development, teaching and learning process, student's grooming, external academic audits and feedback system for academic enhancement.

College offers 9 UG courses, 03 PG courses and PhD programmes across various disciplines. In addition to its academic offerings, CEC actively promotes research and innovation through dedicated research centers and initiatives that encourage students and faculty to engage in cutting-edge projects. The college also boasts a strong placement and training cell, providing students with extensive career counseling, industry interactions, internships and job placement opportunities.

2.	OBJECTIVES OF THE AUDIT STUDY

The goals of the present environmental/green and energy audits typically include:

- To recognize, diagnose and resolve the environmental problems.
- To recognize the effects of an organization on the environment and vice versa.
- To suggest the best protocols for sustainable development of organization and environment.
- To assess environmental performance and the effectiveness of the measures to achieve the defined objectives and targets.
- To identify the various pressures and influences on organizations that drive them to improve their environmental performance.
- To ensure that the natural resources are utilized properly as per national policy of environment.
- To establish the parameters for maintaining health and welfare of the community of the organization.
- To set the procedure for disposal of all types of harmful wastes.
- To reduce energy consumption.
- To give preference to the most energy efficient and environmentally sound appliances.
- To minimize the consumption of water and monitor its quality.
- To identify the risks of hazards and implement the policies for safety of stakeholders.
- To facilitate the stakeholders with different aspects of disaster management.
- To train all stakeholders of the organization and empower them to contribute and participate in the environmental protection.

To achieve the mentioned objectives, following stages are implemented. It includes three stages viz. pre-audit stage, audit stage and post-audit stage. Each of these stages comprises a number of clearly defined objectives, with each objective to be achieved through specific actions and these actions yielding results in the form of outputs at the end of each stage.

3.	INTRODUCTION TO ENVIRONMENTAL/GREEN AUDIT

The various activities carried out in the academic institutions affects the environment in which it is situated. To address the issues, the institutions can successfully use auditing strategies to monitor their environmental-energy related activities. An "environmental audit" is a "systematic, documented, periodic and objective review to meet environmental requirements". Although environmental audits may be performed in many ways for different purposes, the reasons for performing an audit and the goals to be achieved will determine the type of environmental audit to be performed. Green audit is the tool of management system used methodologically for protection and conservation of the environment. It is also used for the sustenance of the environment. The audit suggests different standard parameters, methods and projects for environmental protection. The green audit is useful to detect and monitor sources of environment pollution and it emphasizes on management of all types of wastes, monitoring of energy consumption, monitoring of quality and quantity of water, monitoring of hazards, safety of stakeholders and even the management of disasters.

Figure 1. Green Campus

3.1 WATER MANAGEMENT

The college has adequate provisions for water storage. Bore-wells is used as the source of water. Recharging of ground water and rainwater harvesting are implemented by the college thereby conserving the water from its inception. This recharging and harvesting has been very

helpful to augment the ground water. RO is installed in the campus with the capacity of 250 LPH for satisfying the drinking needs. Grey water from the RO plant is used for irrigating the garden. The administration takes much efforts to save water. This can be seen from the slogans placed at most of the places.

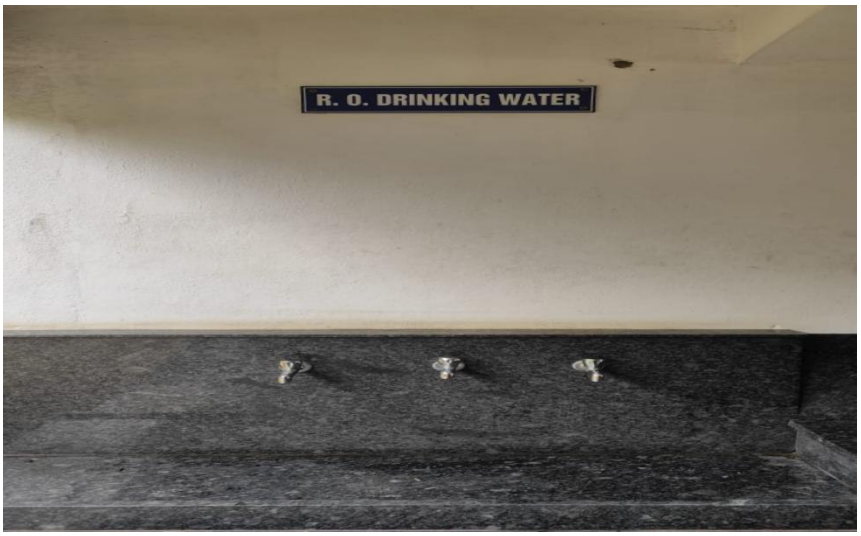

Figure 2. RO Drinking Water

(a) **(b)**

Figure 3. Rainwater Harvesting System

3.2 SOLID WASTE MANAGEMENT

The campus is cleaned on daily basis. Waste bins are placed in corridors, office and staff rooms. The waste generated in the campus includes wrappers, glass, metals, paper, etc. Old newspapers, used papers, files, etc. are given for recycling to external agencies. Glass, metals and other non-biodegradable wastes are given to external agencies where they are segregated and disposed/ recycled according to the nature of the waste. Non-biodegradable and plastic wastes are disposed by Municipal collection centre. Slogans placed at appropriate places help students understand the importance of food and impact of plastics. Bio degradable wastes are decomposed using composite pit and used as manures.

(a) **(b)**

Figure 4. Bio degradable waste collection

3.3 LIQUID WASTE MANAGEMENT

Sewage, Laboratory and canteen effluent waste are the major liquid waste. Effective drainage system is found in all buildings for managing sewages. The laboratory waste water does not contain hazardous chemicals and periodical monitoring is done by the maintenance team. The college will be strict on the source reduction of chemical waste. Laboratories purchase only the chemicals they need, ensuring minimal waste and efficient use of resources.

3.4 E WASTE MANAGEMENT

Electronic goods are put to optimum use; the minor repairs are set right by the Laboratory assistants and teaching staff; and the major repairs are handled by the Technical Assistant and are reused. UPS Batteries are recharged / repaired / exchanged by the suppliers. E-waste like non-functional computers, equipment's and the other metal and wood waste are periodically collected by third party vendor for recycling.

3.5 GREEN COVER

The college is occupied with nearly 128 trees. Apart from that, the college's botanical garden also cultivates a variety of rare and medicinal plants, along with organic vegetation. This green cover helps in reducing CO2 levels in and around the vicinity of the campus.

Figure 5. Green Cover in the campus

3.6 TRANSPORTATION

The college provides four buses for transportation. Most students use public local transportation, such as buses, the metro, auto-rickshaws and cabs, for their commute. Faculty members also use a mix of personal vehicles and public transportation. The widespread use of shared transportation options helps reduce CO_2 emissions associated with fuel usage from individual vehicles.

Figure 6. Shaded Parking

3.7 BASIC AMENITIES

The campus is equipped with essential amenities, including a cafeteria, pedestrian pathways, a bank ATM and sport facilities for students and staff. Additionally, to create a barrier-free environment, the buildings are accessible with ramps, lifts, and PWD toilets, catering to the needs of physically challenged students, the elderly individuals and those with disabilities.

Figure 7. Basic Facilities

3.8 GREEN EDUCATION

Events related to green practices are organized frequently through students and staff associations. National Service Scheme (NSS) unit is actively functioning in the institution and contributes towards inculcating green practices among the students and staff.

4.	INDOOR AIRQUALITY

Indoor air quality (IAQ) refers to the quality of the air inside buildings as represented by concentrations of pollutants and thermal (temperature and relative humidity) conditions that affect the health and performance of occupants. It has become one of the most important issues of environment and health worldwide considering the principle of human rights to health that everyone has the right to breathe healthy indoor air. With the help of Indoor Air Quality meter (Extech EA80), CO_2 level, relative humidity and dry bulb temperatures can be measured. The measurements are carried out based on the protocol given by Central Pollution Control Board, Ministry of Environment and Forests, Govt. of India and the norms are discussed briefly in the subsequent sections. Indoor air quality test was carried out at different locations of the institution. Carbon dioxide levels are within the ASHRAE 55-1992 limit in the outdoor and indoor. The instrument used in the present audit was Extech Make EA80 Model of Indoor air quality meter. The range of the instrument is given below

CO_2 range : 0 to 6,000ppm
Temperature range : -4 to 140°F (-20 to 60°C)
Humidity range : 10 to 95%RH

Figure 8. Indoor air quality meter

4.1 AIR QUALITY MEASUREMENTS

Table 1. Air Quality Measurements

			ASHRAE and OSHA standards: 1000 ppm		
Standard Level of Relative Humidity			**30 – 60 % (ASHRAE)**		
Standard Level of Temperature			**26 - 30°C ±3°C (ASHRAE)**		
S.No.	**Location**	**CO_2 Level (ppm)**	**Relative Humidity (%)**	**Temperature (°C)**	**Comments & Recommendation**
Admin Block					
1.	Chemistry lab	320	83.1	24.1	Within the limits
2.	Sports Room	324	82.9	24.2	Within the limits
3.	1st Floor- Class room	331	82.7	24.6	Within the limits
4.	2nd Floor-ECE Lab	329	83.2	24.1	Within the limits
5.	2nd Floor – Class room	327	82.6	24.2	Within the limits
6.	3rd Floor- Class room	330	83.5	24.5	Within the limits
7.	4th floor- Class Room	329	82.5	24.7	Within the limits
8.	5th Floor -Auditorium	325	82.4	24.5	Within the limits
9.	5th Floor -Library	341	82.7	24.1	Within the limits
C Block					
10.	Staff Room	324	83.4	23.8	Within the limits
11.	Laboratory C008	326	83.2	23.5	Within the limits
12.	1st Floor DAA Lab	325	82.9	23.9	Within the limits
13.	1st Floor Python lab	331	82.8	24.1	Within the limits
14.	1st Floor Faculty room	328	82.7	24.2	Within the limits
15.	2nd Floor Faculty room	327	82.8	24.3	Within the limits
16.	2nd Floor Seminar hall	328	82.6	24.1	Within the limits
17.	4th Floor Class room	326	82.5	24.2	Within the limits
18.	5th Floor Computer science laboratory	325	81.9	24.3	Within the limits

4.2 COMFORT LEVEL

Discomfort can be caused to the occupants due to

- Inadequate ventilation
- High temperature and humidity levels
- High levels of CO_2

Ventilation should be distributed effectively in spaces, and stagnant air zones should be avoided. ASHRAE recommends relative humidity levels between 30 and 60 percent for optimum comfort. Higher humidity may result in microbial growth. A consistently implemented good-housekeeping plan is essential to eliminate or reduce the microbial growth in the building.

Damp indoor environments have been associated with many serious health effects, including asthma, hypersensitivity, and sinusitis. Moisture incursion leading to dampness can result from water leaks and/or by condensation due to high humidity. Common sources of moisture in buildings include: plumbing; roof and window leaks; flooding; condensation on cold surfaces, e.g., pipe sweating; poorly-maintained drain pans; and wet foundations due to landscaping or gutters that direct water into or under the building. Well-designed, well-constructed and well–maintained building envelopes are critical to the prevention and control of excess moisture and microbial growth by avoiding thermal bridges and preventing intrusion by liquid or vapor-phase water. Management of moisture requires proper control of temperatures and ventilation to avoid high humidity, condensation on surfaces, and excess moisture in materials.

CO_2 is a colourless, odourless, and tasteless gas. It is a product of completed carbon combustion and the by-product of biological respiration. ASHRAE states that CO_2 concentrations in acceptable outdoor air typically range from 300-500 ppm. Adverse health effects from CO_2 may occur since it is an asphyxiate gas. The CO_2 levels can be used as a rough indicator of the effectiveness of ventilation, and excessive population density in a structure. CO_2 increases in buildings with higher occupant densities, and is diluted and removed from buildings based on outdoor air ventilation rates. Therefore, examining levels of CO_2 in indoor air can reveal information regarding occupant densities and outdoor air ventilation rates. High CO_2 levels may indicate a problem with overcrowding or inadequate

outdoor air ventilation rates.CO_2, a by-product of normal cell function, is removed from the body via the lungs in the exhaled air. Exposure to high levels of CO_2 can increase the amount of this gas in the blood, which is referred to as *Hypercapnia* or *Hypercarbia*. As the severity of hypercapnia increases, more symptoms ranging from headache to unconsciousness appear, and it can also lead to death.

The traditional means of dealing with IAQ is through ventilation with outdoor air, but this approach assumes that the outdoor air is cleaner than the indoor air. In many locations and for many contaminants, this is not the case, and insufficiently treated ventilation air can actually make IAQ worse. Poor outdoor air quality includes regionally elevated outdoor contaminant levels, as well as local sources such as motor vehicle exhaust from nearby roadways and contaminants generated by activities in adjacent buildings. Some green building programs recommend across-the-board increases in ventilation rates, but such recommendations may be counterproductive in areas with poor outdoor air quality unless accompanied by appropriate and effective increases in filtration and air cleaning.

4.3 INFERENCES

- Carbon-di-oxide levels are within the ASHRAE 55-1992 limit in the outdoor and indoor. For indoor condition, CO_2 level should be less than 1000 ppm. CO_2 levels are well within the limits in all places.
- ASHRAE recommends relative humidity levels between 30 and 60 percent for optimum comfort. The humidity is within the limit in most of the places. The buildings are well planned and natural circulation of air is felt in all places.
- The average ambient temperature in the campus is found to be 32°C.
- Tree plantation is highly promoted and it is evidenced through the presence of trees in many areas where buildings have not been constructed.
- Awareness programmes on environmental consciousness are organized and it is evidenced through the student participation in the respective activities.

5.	LIQUID AND GASEOUS FUEL CONSUMPTION

The "City Engineering College" in Bangalore minimizes liquid and gaseous fuel consumption by operating only four college buses and not having a hostel. This results in significantly lower usage of diesel and LPG, reducing carbon emissions and fostering a more eco-friendly environment. The limited reliance on fuel-driven transportation and cooking aligns with sustainable practices, promoting the use of public transport and local amenities. This approach reflects the college's dedication to environmental responsibility and operational efficiency.

The table 2 displays Diesel Consumption and expenditure on diesel for transport during the academic year 2023-2024.

Table 2. Diesel Consumption details for generator

S.NO	Month	Total Diesel Consumption by Generator in Litres	Total Expenditure on Diesel for Generator in Rupees
1	June 2023	74	6,502.38
2	July 2023	12	1,054.44
3	August 2023	32.5	2,855.775
4	September 2023	41.5	3,646.605
5	October 2023	134.5	11,818.515
6	November 2023	-	-
7	December 2023	45	3,954.15
8	January 2024	2.5	219.725
9	February 2024	5.3	465.817
10	March 2024	24.5	2,154.285
11	April 2024	6.5	571.545
12	May 2024	4.5	386.685

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Diesel Consumption by generator for the academic year 2023-2024 is depicted in the figure 9.

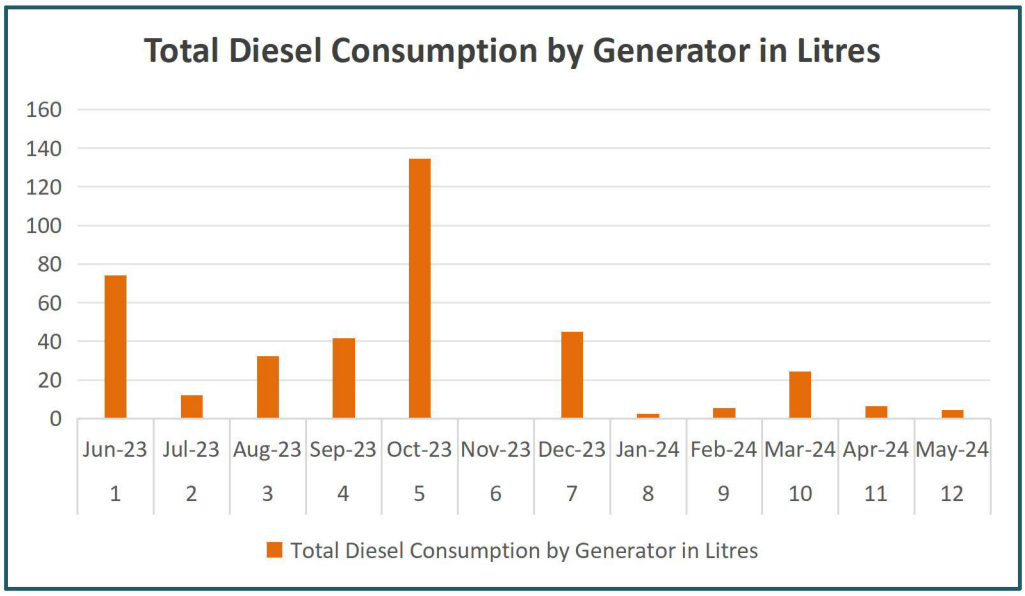

Figure 9. Total Diesel Consumption by Generator in Litres

Figure 10 illustrates the expenditure on Diesel Consumption by the generator for the academic year 2022-2023

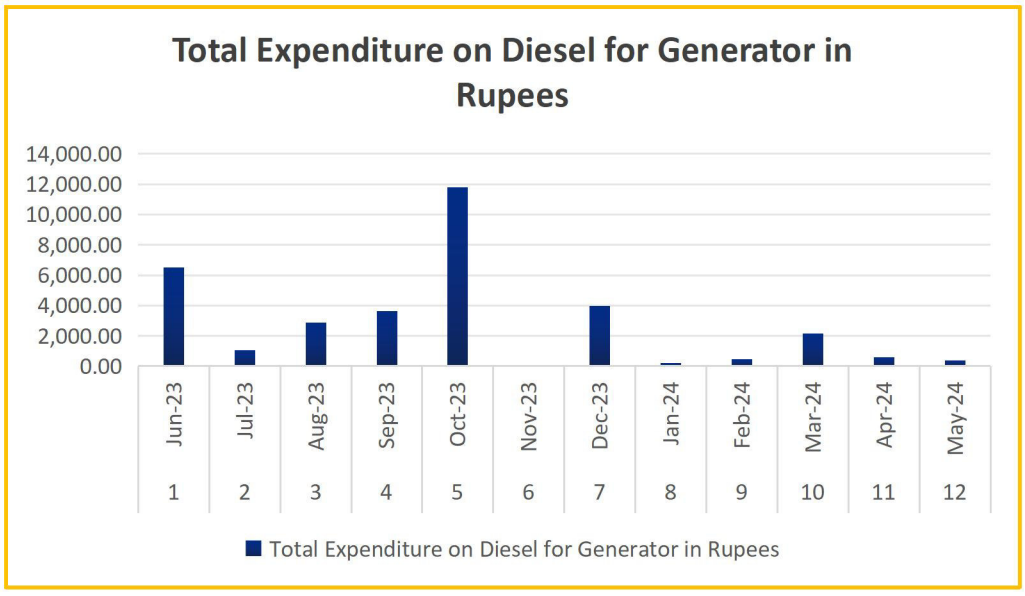

Figure 10. Amount Spent in Rupees on Diesel for Generator

The table 3 provides data on Diesel Consumption and expenditure for transport during the academic year 2023-2024

Table 3. Total Diesel Consumption details for Transportation

S.NO	Month	Total Diesel Usage for Transportation (in Litres)	Total Cost of Diesel for Transportation in rupees
1	June 2023	307.24	27,000
2	July 2023	448.78	39,439
3	August 2023	338.50	29,747
4	September 2023	385.30	33,860
5	October 2023	299.40	26,311
6	November 2023	182.07	16,000
7	December 2023	266.49	23,419
8	January 2024	206.76	18,170.38
9	February 2024	233.46	20,516.09
10	March 2024	289.13	25,066.70
11	April 2024	54.71	4,701.23
12	May 2024	157.66	13,547.64

Diesel Consumption for transport for the academic year 2023-2024 is depicted in the figure11.

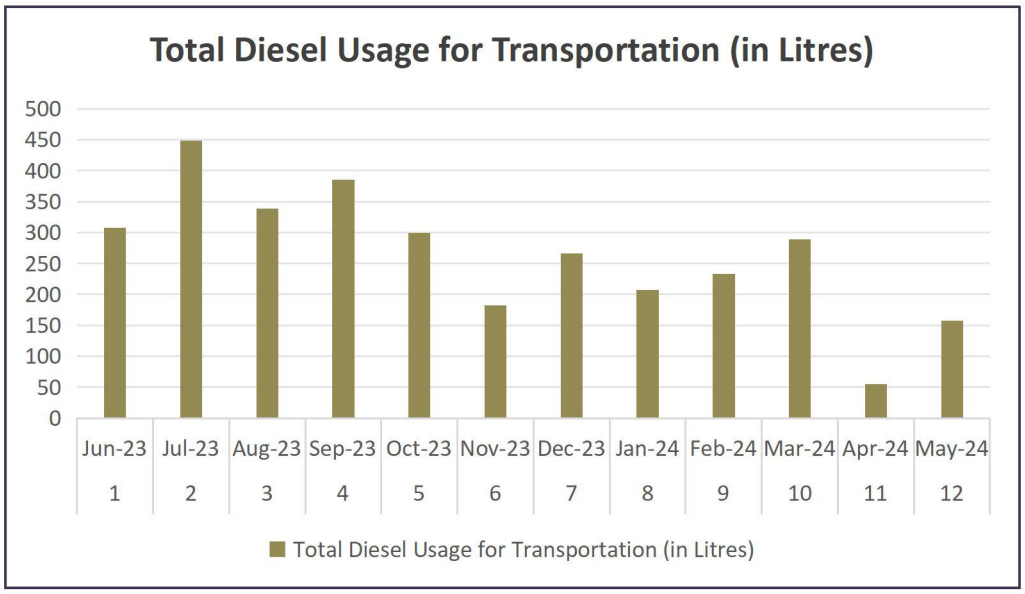

Figure 11. Total Diesel Usage for Transportation

Amount spent on Diesel Consumption for transport for the academic year 2023-2024 is depicted in the figure 12.

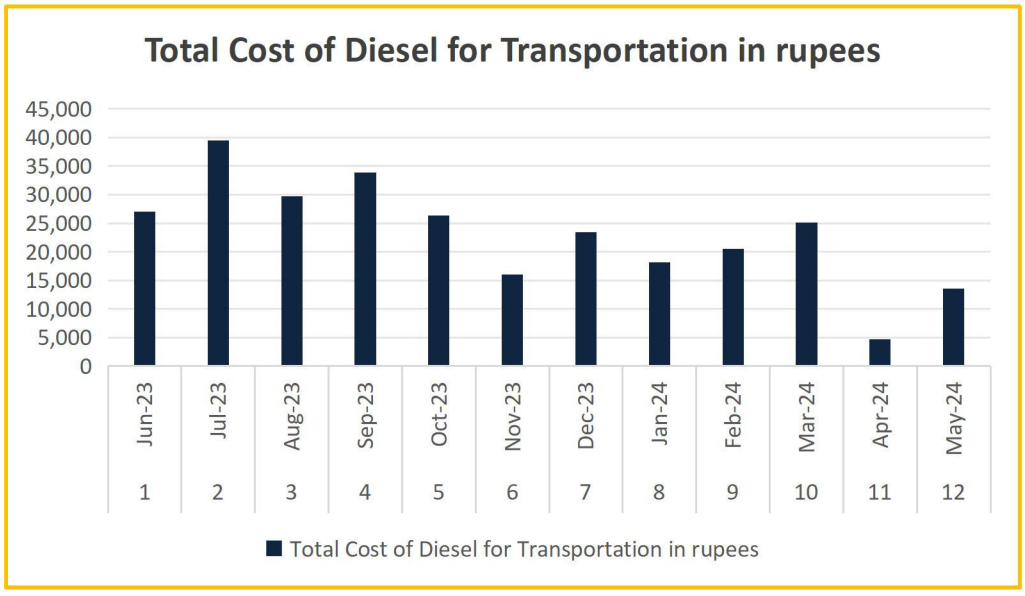

Figure 12. Total Cost of Diesel for Transportation in Rupees

6.	ENERGY AUDIT

6.1 INTRODUCTION

An energy audit is an examination of the total energy used in a particular building or industry. The analysis is designed to provide a relatively quick and simple method of determining not only how much energy is being consumed but where and when. The energy audit will identify deficiencies in operating procedures and in physical facilities. Once these deficiencies have been identified, it will be apparent where to concentrate efforts in order to save energy. The energy audit is the beginning of and the basis for an effective energy-management programme. Human settlements encompass a variety of buildings. Regardless of the building involved, the audit procedure is basically the same. No two buildings are identical regarding energy usage. This is due to the possible variables affecting the buildings, e.g., occupancy rates, the building's size and orientation, its geographic location, the type of heating and cooling systems, the amount and types of equipment in use, the type of construction, the level of insulation and so on. Because each building is unique, it is difficult to generalize about energy-consumption patterns, and so it is necessary to conduct an energy audit for each building. This energy audit is aimed at obtaining a detailed idea about the various end use energy consumption activities and identification, enumerating and evaluating the possible energy saving opportunities.

6.2 ELECTRICITY CONSUMPTION

The energy audit is aimed at obtaining a detailed idea about the various end use energy consumption activities and identification, enumerating and evaluating the possible energy saving opportunities. It is a customary practice to conduct Energy audit every year in the Institute in order to estimate the energy consumption pattern. The present level of energy consumption of the institution has been analyzed, averaged by collecting utility bills from june 2023 to May 2024. The same is detailed in this report.

Table 4 presents a comprehensive breakdown of electric energy consumption over the period from June 2023 to May 2024. The table details the monthly usage in kilowatt-hours (kWh), highlighting any fluctuations or trends that occurred throughout the academic year. This data serves as a vital reference for understanding the consumption patterns and guiding future energy management strategies. By analyzing this information, stakeholders can identify areas for potential efficiency improvements and implement measures to optimize electric energy usage in the future.*

Table 4: Electric Energy Consumption details from June 2023 to May 2024

Academic Blocks			
S.NO	**Month**	**Total Electrical Units Consumed (kWh)**	**Amount Spent on Electricity in Rupees**
1	June 2023	11,124	1,38,785.00
2	July 2023	10,976.5	1,34,472.00
3	August 2023	10,691.5	1,22,031.00
4	September 2023	9,783.98	1,12,031.00
5	October 2023	10,660.9	1,13,104.00
6	November 2023	11,091.5	1,15,140.00
7	December 2023	11,257.03	1,08,261.00
8	January 2024	10,791.99	1,11,118.00
9	February 2024	10,956.54	1,11,663.00
10	March 2024	22,920.44	2,20,988.00
11	April 2024	11,634.00	2,34,925.00 *
12	May 2024	12,629.00	1,10,749.00
* Include arrears			

The Figure 13 illustrates the overall electric energy consumption, measured in kilowatt-hours (kWh), over a specified period. By depicting the total units consumed, this graph provides a clear visual representation of the energy usage trends and patterns.

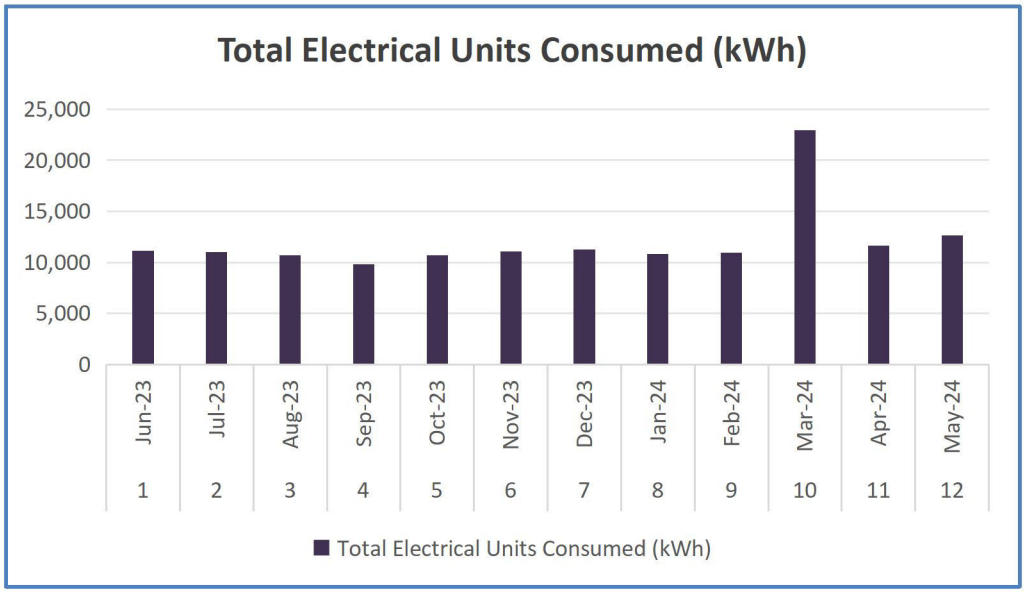

Figure 13. Total Electrical Units Consumed (kWh)

The figure 14 provides a visual representation of the expenditure on electricity, denoted in Indian Rupees (Rs.), over a specific period.

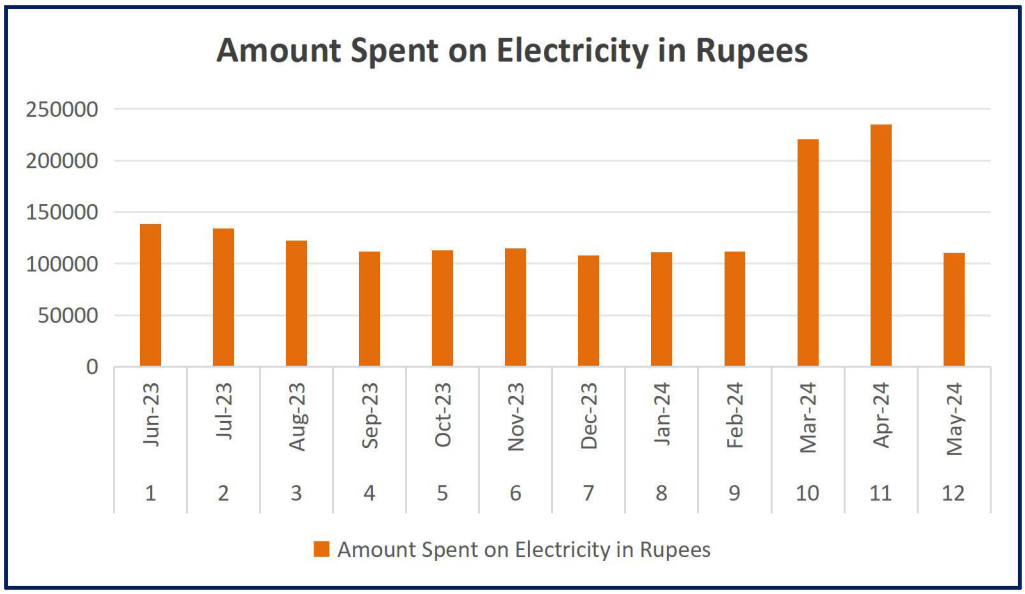

Figure 14. Amount Spent on Electricity in Rupees

7.	CARBON FOOTPRINT AND TOTAL ENERGY CONSUMPTION

Carbon footprint Carbon foot print is the total amount of Green House Gases (GHGs) emitted in terms of carbon dioxide by a person, institute, company, state or country. Carbon footprint is typically given in tons of CO_2 equivalent per year. For calculation of carbon foot print the basic data regarding direct and indirect sources of emission of Green House Gases is needed. How we get around and commute to and from college each day has an impact on the environment through the emission of greenhouse gases into the atmosphere by the burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions. A matured tree absorbs about 22 to 40 kg of CO_2 per year.

Table 5: CO_2 Emissions and Total Energy Consumption

S.No.	Description	Type of fuel and their conversion process	
		Electrical energy consumed	Diesel
1	Annual Energy Consumption	144517.38 kWh	3552.3 lit
2	CO_2 Emission standards	0.95 kg/kWh	2.68 kg/lit
3	Total CO_2 emission(tonne/Annum)	146.812 tonnes	
4	Total No. of students and staff	1334	
5	Per capita CO_2 emission per year	0.11 tonne (+)	
6	No. of Matured Trees	116	
7	CO_2 neutralised due to matured trees (tonne/Annum)	2.55 tonnes	
8	CO_2 to be neutralised per capita per	0.108 tonnes(-)	

8.	ENERGY SAVING OPPORTUNITIES

8.1 Lighting:

Table 6: Sample calculation for energy saving

DESCRIPTION	FTL FITTINGS	LED FITTINGS
	40W	**18W**
No. OF FITTINGS	100	**100**
WATTS	40	**18**
TOTAL WATTS	4000	1800
CONSUMPTION UNITS PER DAY	40.000	**18.000**
RUNNING COST PER DAY	272.00	**122.40**
SAVINGS LED INSTEAD OF FTL IN WATTS	2200	
UNITS SAVINGS PER DAY	22.000	
UNITS SAVINGS PER MONTH	**550.000**	
RUNNING HOURS PER DAY	10	
PRESENT KSEB UNITS COST Rs.	6.80	
COST SAVINGS PER DAY Rs.	149.60	
COST SAVINGS PER MONTH Rs.	**3740.00**	
LED LIGHT FITTING TOTAL EXPENSES Rs. (100*Rs.650)	**65000.00**	
COST RETURN PERIOD IN DAYS	434	
COST RETURN PERIOD IN MONTHS	14.48	
COST RETURN PERIOD IN YEARS	**1.19**	

8.2 Fan:

Table 7.Sample calculation for energy saving

DESCRIPTION	NORMAL FAN	**BLDC FAN**
	80W	**30W**
No. OF FITTINGS	100	**100**
TOTAL WATTS	8000	**3000**
CONSUMPTION UNITS PER DAY	80.000	**30.000**
RUNNING COST PER DAY	544.00	**204.00**
SAVINGS BLDC INSTEAD OF NORMAL FAN IN WATTS	5000	
UNITS SAVINGS PER DAY	50.000	
UNITS SAVINGS PER MONTH	**1250.000**	
RUNNING HOURS PER DAY	10	
PRESENT KSEB UNITS COST Rs.	6.80	
COST SAVINGS PER DAY Rs.	340.00	
COST SAVINGS PER MONTH Rs.	**8500.00**	
BLDC FAN TOTAL EXPENSES Rs. (100*Rs.3250)	**325000.00**	
COST RETURN PERIOD IN DAYS	956	
COST RETURN PERIOD IN MONTHS	31.86	
COST RETURN PERIOD IN YEARS	**2.62**	

8.3 Air Conditioner:

Table 8. Sample calculation for energy saving

Model	Star Rating	EER	Cooling Capacity	Power Consumption (Watts/Hr)	No. of Watts saved / Hr to 0 Star Level	No. of Units saved / 8 Hr.	**Savings (Rs / Yr) (300Days)
Split AC	5 Star	3.59	6212	1732	1268	10.1	19240
Split AC	3 Star	3.12	6044	1938	1062	8.5	16192
Split AC	2 Star	3	6610	2210	791	6.3	12001

(Actual may vary)

- **Raising AC setting by 1° can save 6% power**
- **Typically the temperature is set at 20-21 degree Celsius, whereas, the comfort number is 24-28 degree Celsius.**
- **A change from 20 degree Celsius to 24 degree Celsius, has the potential to save about 24 per cent of power.**

9.	BEST PRACTICES

- Energy is conserved by using natural light in the classrooms.
- LED bulbs and CFLs are used in all possible locations as an energy conservation measure.
- A training program on Energy Conservation, Environmental Impacts and Fuel Savings is conducted for students, staff and faculty members by external agencies.
- Solar street lights are installed throughout the campus to reduce energy consumption and promote sustainability.
- A 70 kW solar panel system is installed to generate renewable energy and further reduce the campus's reliance on conventional energy sources.

10	OBSERVATIONS, RECOMMENDATIONS AND GENERAL SUGGESTIONS

10.1 OBSERVATIONS

(i) Water saving plumbing fixtures may be provided in common utility areas

(ii) Energy saving air-conditioners may be purchased for new building expansion.

(iii) Programmes are being regularly conducted for planting saplings and creating awareness about efficient energy usage.

(iv) Water metering facility may be provided for monitoring the water consumption and planning for future.

(v) Natural ventilation and day lighting is used in many places.

(vi) An Internal Audit Team may be formed and an audit may be carried out six months once.

(vii) Grey water is used for gardening purposes. It can be used, but soil testing has to be done where the grey water is used. The grey water from RO plant has high alkalinity and it can reduce the percolation capacity of the soil. This can cause water logging problems in case of rain.

(viii) Diesel consumption in generator need to be recorded for every operation.

(ix) It is good practice of testing the Earth Electrode and maintaining the minimum Earth Electrode resistance at college campus area.

10.2 GENERAL SUGGESTIONS

1. Class rooms and laboratory's to display messages regarding optimum use of electrical appliances like lights, fans, computers in the room
2. All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes / 30 minutes.
3. The comfort air conditioning temperature to be set between 24˚C to 28˚C.
4. It is recommended to replace fluorescent light by LED whenever they get fused.
5. Vehicle pass may be issued as a sticker and that can be pasted in the vehicles belonging to Faculty, Staff and Students. This is to track the number of vehicles commuting inside the campus and to prevent the entry of unauthorized vehicles. This will help to find the percentage of institute population using own vehicles.
6. Safety precautions/ Warning signs need to be displayed near to the chemical storage points such as Chemistry Laboratories.
7. All Faculty and non-teaching staff should be made aware of common safety procedures and location of centralized facility like RO Plant, Rain water harvesting tanks, etc.
8. Responsibility chart (Name and In-charge) may be made available at RO, Gardening and Transport Offices/rooms as like in laboratories. This will be a first level of motivation and bring better attachment to towards institution.
9. Green, Environment and Energy Audits (internal) to be conducted every year, and progress can be analyzed by creating action taken report on the recommendations.
10. Switching to digital forms, electronic means of communication helps in avoiding paper wastage.
11. Eliminate or reduce paper processes by scanning paperwork that you produce or receive from others.
12. Instead of using several paper documents or records, compile important information into a shared, accessible folder in a Google Drive and keep it updated.

11	ANNEXURE

This section will include all the necessary documentation, such as:

1. **Energy Auditor Certificate**
2. **Green Auditor Certificate**
3. **Environmental Auditor Certificate**
4. **Accreditation Bodies Support Document**

Regn. No. EA-13164

Certificate No. 6461

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. Logeswaran T

son / daughter of Mr. Thangamuthu

has passed the National Certification Examination for Energy Auditors held in October - 2011, 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 : 1st February, 2012

Controller of Examination

ATTESTED COPY

PRINCIPAL
CITY ENGINEERING COLLEGE
Kanakapura Main Road, Bangalore-560061

IGBC

Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

Logeswaran T

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairman
Indian Green Building Council

Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

10115

18 December 2021

ATTESTED COPY

PRINCIPAL
CITY ENGINEERING COLLEGE
Kanakapura Main Road, Bangalore-560061

Certificate 73531799 / 159674238

LOGESWARAN T

has been awarded a Certificate of Achievement for

ISO 14001:2015 - Environmental Management Systems Auditor/Lead Auditor Training Course

by passing the written examination and continuous assessment this learner has successfully passed all the course assessment requirements

Held at SGS India Private Limited
Completed on 28 April 2022 - 2 May 2022
Exam taken on 2 May 2022

This course meets the formal training requirements for individuals seeking certification under the CQI and IRCA Auditor Certification Scheme and for this purpose is valid for five years from the date of completion of the exam.

Course Number 17972 - PR 315
Certificated by the Chartered Quality Institute (CQI) and International Register of Certified Auditors (IRCA)

Authorised by

H Crick
UK Business Manager

A Mangan
Global Training Manager

Issued by SGS United Kingdom Ltd. Registered in England No 1193985
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CQI IRCA APPROVED TRAINING PARTNER

CQI IRCA CERTIFIED COURSE

SGS ATTESTED COPY
PRINCIPAL
CITY ENGINEERING COLLEGE
Kanakapura Main Road, Bangalore-560061

SOLAR ENERGY SOCIETY OF INDIA (SESI)

CBIP Building, Malcha Marg, Chanakyapuri, New Delhi – 110 021

Indian Section of the International Solar Energy Society (ISES)

THIS IS TO CERTIFY THAT

Selvakumar P

Is hereby authorised to use the style and title of

Solar Chartered Engineer

President

Certificate No. : 893388-N
Date of Issue : 24/01/2023

ATTESTED COPY

PRINCIPAL
CITY ENGINEERING COLLEGE
Kanakapura Main Road, Bangalore-560061

MEMORANDUM OF UNDERSTANDING

BETWEEN

BUREAU OF ENERGY EFFICIENCY

AND

NATIONAL ACCREDITATION BOARD FOR CERTIFICATION BODIES

FOR

IMPLEMENTATION OF REGULATORY AND VOLUNTARY FRAMEWORKS BASED ON ACCREDITATION

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding (MoU) entered into on the 28th day of May in the year 2018.

BETWEEN

The **Bureau of Energy Efficiency**, a statutory body under the Ministry of Power, Government of India, formed under Energy Conservation Act, 2001 (52 0f 2001), having its office at 4th Floor, Sewa Bhawan, R K Puram, New Delhi-110066 (hereinafter referred to as "BEE" which expression shall include its successors, administrators, executors and assignees)

AND

The **National Accreditation Board for Certification Bodies** (hereinafter referred to as NABCB), the national accreditation body of India for certification/inspection bodies, with its headquarters in the 2nd Floor, Institution of Engineers Building, 2, Bahadur Shah Zafar Marg, New Delhi 110002. NABCB is a constituent Board of the **Quality Council of India** which has been set up by the Central Government in partnership with CII, FICCI and ASSOCHAM and is an autonomous body with the **Department of Industrial Policy and Promotion**. NABCB, which expression shall, where the context so admits, be deemed to include its successors executors and administrators of the OTHER PART

henceforth be referred to as the 'Parties'.

Accordingly, the Parties have decided to enter into this MoU for the aforesaid objectives on the terms & conditions as mentioned hereunder.

ARTICLE 1

OBJECTIVE

The principal objective of this Memorandum is to establish a mechanism for cooperation between BEE and NABCB wherein NABCB will provide accreditation services to support BEE including accredited certification services through NABCB accredited product certification bodies who will carry out activities as IAME (Independent Agency for Monitoring and Evaluation) to support implementation of BEE's Standards & Labelling (S&L) Program.

ARTICLE 2

SCOPE

2.1 The MOU covers all activities needed to create and implement regulatory and voluntary frameworks based on accreditation with the aim of securing international acceptability, wherever possible.

2.2 Both parties recognize specifically the need for the following activities for the purpose which would be covered under this MoU:

- Implementation of BEE's S&L Programme by using NABCB accredited product Certification Bodies
- Any other activity necessary for the smooth operation of BEE's regulatory regimes and voluntary initiatives

ARTICLE 3

RESPONSIBILITIES

3.1 Responsibilities of BEE

- BEE own the systems for supporting implementation of its regulations and voluntary initiatives.
- BEE will provide inputs with respect to its requirements to NABCB for developing the accreditation frameworks.
- BEE will aim to make available its experts, as and when required by NABCB, to support its accreditation activities.
- BEE, as the regulator, will keep NABCB informed of any changes in the regulations which may affect the accreditation activities.

3.2 Responsibilities of NABCB

- NABCB shall accredit product certification bodies to be empaneled under the BEE's S&L Program for scopes covering the products enlisted in BEE's S&L Program.

- NABCB shall support BEE in development of accreditation framework for international acceptance.

- NABCB shall support BEE in the development of systems for approval of NABCB accredited product certification bodies.

- NABCB shall offer services consistent with the international norms of accreditation activities for BEE's activities.

- NABCB shall give due recognition to international systems of equivalences in its services which support BEE's activities.

- NABCB shall take into account any specific requirements laid down by BEE in its accreditation services in support of BEE's activities.

- NABCB shall undertake any other activity necessary for the development and/or operation of BEE's initiatives consistent with its charter.

- NABCB shall update any changes in accreditation status of Product Certification Bodies (addition/deletion of scopes/suspension/withdrawal) to BEE.

ARTICLE 4

ADMINISTRATION OF MOU

4.1 To achieve the objective of the MOU, BEE and NABCB shall set up a Joint Coordination Committee (JCC) with the following composition:

DG, BEE (Chairman)
CEO, NABCB
One other member each from BEE and NABCB

4.2 The JCC may invite any expert to assist its work, if needed.

ARTICLE 5

CONFIDENTIALITY

Both parties agree that information obtained in carrying out the objectives shall be kept confidential, unless decided otherwise with mutual agreement

ARTICLE 6

DISPUTES

In case any disputes arise in implementing the MoU, these shall be resolved amicably by mutual consultation

ARTICLE 7

VALIDITY

This MoU shall be valid as long as both Parties desire and are meeting their responsibilities mentioned in this MoU.

ARTICLE 8

MISCELLANEOUS

Neither Party shall use or publicize the MoU in such a manner as to cause any disrepute to the other party and shall not make any statement relevant to this MoU which may reasonably be considered to be misleading.

This MOU signed as hereunder shall be effective from the date of signing

For **BEE**

Signature: .....
Name: PANKAJ KUMAR
Address: 4th Floor, Sewa Bhawan
R.K.Puram
New Delhi 110066
Seal:

Witness
Signature: .....
Name: SAMEER PANDITA
Address: BEE

For **NABCB**

Signature: .....
Name: ANIL JAUHRI
Address: 2nd Floor, Institution of Engineers Building, 2, Bahadur Shah Zafar Marg, New Delhi 110002
Seal: N.A.B.C.B. C/o Quality Council of India 2nd Floor, Institution of Engineers Bldg. Bahadur Shah Zafar Marg New Delhi-110002 (INDIA)

Witness
Signature: .....
Name: Ajay Kumar Sharma
Address: NABCB

Dated: 28.05.18

Place: New Delhi

End of the Report

Thank You

CHIEF CO-ORDINATOR

INDUSTRY - INSTITUTE PARTNERSHIP CELL

KONGU ENGINEERING COLLEGE

PERUNDURAI, ERODE - 638 060

PHONE : 04294-226642

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