HINDUSTAN COLLEGE OF SCIENCE AND TECHNOLOGY
FARAH, MATHURA
(affiliated to Dr A.P.J.Abdul Kalam Technical University,Lucknow,U.P)

KEY INDICATOR 7.1.3

7.1.3 (2)

Energy Audit

HINDUSTAN COLLEGE OF SCIENCE AND TECHNOLOGY

Meeting Circular

HCST/IQAC/2017-18/ 11 **Date:-09/02/2018**

All The IQAC members and invitee members are here by informed that IQAC meeting will be held on February 10, 2018 in the Chairman Conference room at 01:30 PM. All committee members are requested to present in meeting.

Agenda of the Meeting

1. Endorsement of previous meeting
2. Environment and energy
3. Clean and Green Campus

Following members are requested to present in the meeting

1	All IQAC committee members	

Dr. Harendra Singh

(Director, IQAC)

Director
Internal Quality Assurance Cell
Hindustan College of Science & Technology
Farah, Mathura

REGISTRAR
HINDUSTAN COLLEGE OF
SCIENCE & TECHNOLOGY
FARAH, MATHURA

Director
Hindustan College of
Science & Technology
FARAH (MATHURA)

HINDUSTAN COLLEGE OF SCIENCE AND TECHNOLOGY

Meeting Notes

HCST/IQAC/2017-18/ 11

Date:- 10/02/2018 **Venue: -** Ground Floor Conference Room, HCST

Agenda of the Meeting

1. Endorsement of previous meeting
2. Environment and energy
3. Clean and Green Campus

Members of Committee present in the meeting

1	Dr. Harendra Singh	(Director, IQAC)
2	Dr. M.S.Gaur	(Member)
3	Dr. Mamta Sharma	(Member)
4	Dr. Sandeep Agarwal	(Member)
5	Mr. Kapil Gupta	(Member)
6	Mr. Vijay Katta	(Member)
7	Dr. Suruchi	(Member)

IQAC meeting was hold at 01:00 PM on 10/02/2018. As discussed in previous meeting feedback form is send to respective coordinators.

Dr. Mamta Sharma has proposed the policy documents for

a. Environment and energy
b. Clean and Green Campus.

IQAC has approved the policy documents proposed by Dr. Mamta Sharma.

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Dr. Harendra Singh

(Director, IQAC)

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College of Science & Technology

POLICY DOCUMENT FOR ENVIRONMENT AND ENERGY

Energy is the most important thing on this earth; next to time and this is the most wasted resource. To see that Energy efficient systems are run in the organization, it becomes the duty of the management committee to come with a clear policy towards its implementation. The following are the points that encompass the environment and energy policy

- To assess our energy usage and measure its impact on environment
- To implement energy efficient lighting (LEDs) and Alternate energy sources (Solar Plant) in the campus.
- To reduce the emission of air pollutants by encouraging bicycles, public transport system, electrical vehicles and use of pedestrian friendly foot paths
- To implement all the points that is mentioned in the Clean & Green Campus Policy and the waste management policy to keep the surroundings and the overall environment pollution free.
- To conduct regular energy audit and take necessary steps in maintenance, wheeling to grid and increasing the energy efficiency
- To create awareness among the employees and students of the organization about the above points by conducting events and encouraging all to be a part of this genuine cause.

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Farah, Mathura

Director
Hindustan College of
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FARAH (MATHURA)

ENERGY AUDIT REPORT

Name of Organization	**Hindustan college of science & technology, Mathura**
Address	**NH#19, Agra-Mathura highway, Farah, Mathura, Pin – 281122**
Contact Person	**Mr. P.K. Soni**
Name of Auditor	**Mrs. Manisha Mohanty, Mr Anshul Chikara**
Audit Date	**04/08/2023**
Report No.	**CIL/20232328**

Energy Policy of The Organization:

Not Available

Non conformity:
Absence of Energy Policy

Energy Management Team:	
Dr. R.k. Upadhyaya	**Director**
Mr. Rajesh kumar Sharma	**Registrar**
Mr. P.K. Soni	**Sr. Engineer, Electrical**
Mr. A. Mukund Lal	**Assistant Professor, ECE**
Mr. Vivek Agrawal	**Assistant Professor, EE**
Mr. Triloki nath Rawat	**Senior Technical Staff, EE**

Building Energy Systems

HVAC systems	
• Are there any leaks or airflow issues in the HVAC system? • How effective is the temperature control in the building? • How much energy does the HVAC system consume?	• During the audit, no leaks or airflow issues were found in the air conditioning system. Reference fig/doc: - Fig1, Fig2, • During the time of the audit, the temperature control of the building was found to be 22^0- 48^0.

• Are there any upgrades or improvements that can be made to the HVAC system for better energy efficiency?	• The air conditioning system of HCST consists of two types of AC units: Portable window and split AC and duct able ac with a total count of 22 and 2 units, respectively. All AC units are rated as 2-star energy-efficient models. See appendix table 1 • The upgrades and the for the HVAC system are available for the in the following table given below.

Idea of upgrades for the AC system: -

Here are some upgrades and improvements that can be considered for the AC units:

1. Inverter Technology: Upgrade the AC units to models with inverter technology. Inverter ACs can adjust the compressor's speed based on the cooling demand, leading to more efficient operation and reduced energy consumption.

2. Energy-Efficient AC Units: Replace the existing AC units with newer, more energy-efficient models. Look for AC units with high SEER (Seasonal Energy Efficiency Ratio) ratings, as they are designed to consume less electricity for the same cooling output.

3. Regular Maintenance: Ensure regular maintenance of the AC units, including cleaning of filters, coils, and condenser units. Dirty components can reduce the system's efficiency and increase energy consumption.

4. Duct Sealing and Insulation: Inspect and seal any leaks in the air ducts to prevent air loss and improve the efficiency of the cooling system. Additionally, proper insulation of ductwork helps in maintaining the cooled air temperature.

5. Smart Thermostats: Install programmable or smart thermostats for better temperature control and energy management. These thermostats can be scheduled to adjust the cooling based on occupancy patterns and reduce cooling during unoccupied hours.

6. Economizers: If feasible, consider adding economizers to the AC system. Economizers allow the AC to use cool outside air during mild weather conditions instead of running the compressor, leading to energy savings.

7. Variable Speed Drives (VSD): Retrofit AC units with VSDs to control the fan and compressor motor speeds. VSDs enable the system to adjust the airflow and cooling capacity according to the cooling demand, improving energy efficiency.

8. Night Cooling: Take advantage of cooler nighttime temperatures by implementing night cooling strategies. Pre-cool the building during off-peak hours and use natural ventilation to maintain comfortable temperatures during early morning hours.

9. Heat Rejection Optimization: Optimize the placement and airflow around the outdoor condenser units to improve heat rejection efficiency, especially in high-temperature environments.

10. Occupancy Sensors: Incorporate occupancy sensors to automatically adjust the AC operation based on room occupancy, ensuring that cooling is only provided when needed.

11. Regular Energy Monitoring: Install energy monitoring systems to track AC energy consumption and identify any unusual patterns or inefficiencies promptly.

Related images/ documents-

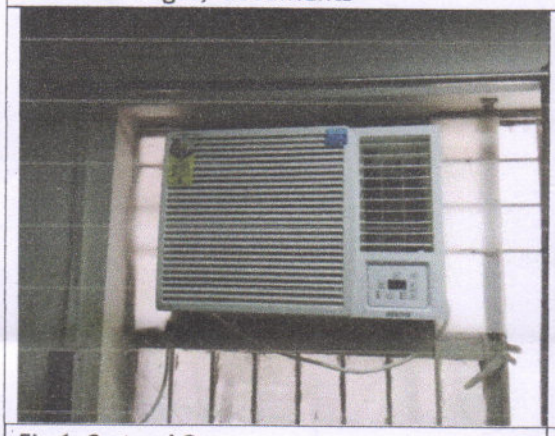


Fig 1. 2-star AC

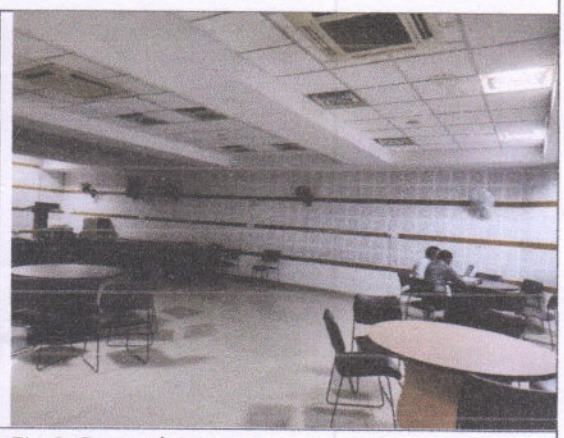


Fig 2. Ducted AC

Lighting systems	
• Are the lighting fixtures and bulbs in use energy-efficient? • How much energy does the lighting system consume? • Are there any areas where lighting can be improved or upgraded for better energy efficiency?	• Yes, the college uses a combination of CFL bulb, LED bulbs, Tube light and LED tube light for energy efficiency. Reference fig/doc: - fig 3 and fig 4 • The lighting system consists of 413 LED bulb, LED tube lights, CFL lights, tube light consuming 216 w/hr, 11-22 w/hr, 13-15 w/hr, 96.4 w/hr respectively resulting in a total electricity consumption of 187 kW. See appendix table: - table 1

	• The following areas are where we can upgrade and improve the lighting for better energy efficiency is given in the below table: -

The areas of energy upgrades are as follow: -
there are several areas where lighting can be improved or upgraded to achieve better energy efficiency in the college. Here are some suggestions:

1. LED Retrofit: Consider replacing the remaining CFL lights with LED lights. LED lights are more energy-efficient, have a longer lifespan, and provide better quality lighting compared to CFLs.

2. Lighting Controls: Install lighting controls such as occupancy sensors, timers, or dimmers to automatically adjust lighting levels based on occupancy and daylight availability. This ensures that lights are only on when needed, reducing unnecessary energy consumption.

3. Daylight Harvesting: Implement daylight harvesting systems that automatically adjust artificial lighting based on natural daylight availability. This helps optimize energy use and maintain consistent lighting levels.

4. Task Lighting: Encourage the use of task lighting in appropriate areas, allowing individuals to control lighting at their workspace without affecting the entire room. This can lead to targeted lighting and energy savings.

5. Efficient Fixtures: Choose energy-efficient light fixtures that distribute light more effectively and minimize wasteful light spillage.

6. Lighting Layout Optimization: Reevaluate the lighting layout to ensure adequate illumination while eliminating over-lighting, which can result in unnecessary energy consumption.

7. Education and Awareness: Promote energy-efficient lighting practices among students and staff to raise awareness about the importance of turning off lights when not in use and using natural light whenever possible.

8. Regular Maintenance: Schedule regular maintenance to clean light fixtures, replace faulty bulbs promptly, and address any lighting issues promptly to ensure optimal performance and energy efficiency.

9. LED Tubes and Bulbs: For spaces that still use traditional fluorescent tubes, consider upgrading to energy-efficient LED tube lights for better efficiency.

Lighting Upgrade Incentives: Check for any energy efficiency incentive programs or rebates offered by utility companies or government agencies that can help offset the cost of upgrading to more energy-efficient lighting.

Related images/ documents-

Fig 3. Lighting in the classroom

Fig 4. Light specification

Plug loads:

- Evaluate the usage of electrical equipment and appliances, such as computers, printers, and vending machines.
- Analyze energy usage and identify areas for improvement.
- Recommend energy-efficient replacements or upgrades.

- The college uses other electrical equipment such as 650 no. of computers and 50 no. of printer. Reference fig/doc: - Table 1
- The proper energy usage detail was not available during the audit.
- The following energy efficient replacement or upgrades are required-

Upgrades for the electrical

Recommendations for energy-efficient replacements or upgrades for the equipment used in the institute:

1. Computers and Laptops: Consider upgrading to energy-efficient computers and laptops that are ENERGY STAR certified. These devices are designed to consume less power during operation and in standby mode.

2. Printers and Photocopiers: Replace older printers and photocopiers with ENERGY STAR certified models, which are more energy-efficient and can save power during standby and sleep modes.

3. Lighting Fixtures: Replace outdated or inefficient lighting fixtures with energy-efficient LED fixtures. LED lights consume significantly less electricity and have a longer lifespan, reducing maintenance costs.

4. Office Appliances: Upgrade office appliances such as microwaves, refrigerators, and water dispensers to ENERGY STAR certified models, which are designed to consume less energy without compromising performance.

5. Vending Machines: If the institute has vending machines, consider replacing them with ENERGY STAR rated vending machines that are designed to use less energy and optimize cooling systems.

6. Classroom Projectors: Upgrade classroom projectors to energy-efficient models that have lower power consumption and offer eco-friendly modes for reduced energy use during periods of inactivity.

7. Charging Stations: If there are charging stations for electronic devices, use smart charging stations that automatically shut off when devices are fully charged, reducing standby power consumption.

8. Server Room Equipment: Ensure the server room is equipped with energy-efficient servers, cooling systems, and UPS (uninterruptible power supply) units to optimize power usage.

9. Appliance Power Management: Consider installing smart power strips or power management systems to control the power supply to appliances when not in use, preventing energy wastage.

10. Energy Management System: Implement an energy management system that monitors and controls energy usage throughout the institute, enabling real-time optimization and identifying areas of improvement.

11. Renewable Energy Integration: If feasible, invest in renewable energy sources like solar panels to partially power the institute and offset electricity consumption.

Before implementing any upgrades or replacements, it's essential to conduct a detailed cost-benefit analysis to determine the potential energy savings and return on investment for each upgrade. These energy-efficient replacements and upgrades can significantly reduce the institute's energy consumption, leading to cost savings and a more sustainable operation.

Nonconformity:

- The proper energy usage detail were not available during the audit.

Water heating systems:	
• Inspect water heating equipment, including boilers and water heaters. • Check for leaks in pipes. • Review temperature setpoints and scheduling. • Analyze energy usage and identify areas for improvement. • Recommend upgrades or replacements as necessary.	• During the time of the audit, the water heating equipment, specifically the immersion rod, was found to be installed inside the water tank and in good condition. Reference fig/doc :- fig 5 • The temperature setpoint for the water heater is set around 50°c for 6-8 hr during the winter season. • There are 30 immersion rods, each with a power rating of 3 kW, installed CONSUMING THE TOTAL OF THE 90KW. • The recommended upgrades or replacements as necessary is given in the following table.

Recommended upgrades

Upgrading or replacing the water heating system in the existing educational building can lead to improved energy efficiency and reduced operating costs. Here are some recommended upgrades and replacements for the water heating system during the energy audit:

1. High-Efficiency Water Heater: Replace the existing water heater with a high-efficiency model, such as a condensing gas water heater or a heat pump water heater. These units can significantly reduce energy consumption compared to conventional water heaters.

2. Tankless Water Heater: Consider installing tankless or on-demand water heaters, which only heat water when needed. This eliminates standby heat loss, resulting in energy savings.

3. Solar Water Heating System: If feasible, install a solar water heating system to utilize renewable energy from the sun to preheat water, reducing the energy required by the primary water heater.

4. Insulation: Insulate the water heater and hot water pipes to minimize heat loss. Proper insulation helps maintain water temperatures and reduces the need for the water heater to reheat water frequently.

5. Temperature Control: Install programmable or smart thermostats for the water heater to control water temperature based on usage patterns, reducing energy wastage.

6. Recirculation Pump Timer: If the building has a recirculation pump for hot water, consider adding a timer to regulate its operation. This ensures hot water is available when needed while avoiding constant circulation and energy waste.

7. Point-of-Use Water Heaters: In areas where hot water demand is low, consider using point-of-use water heaters to avoid heating large volumes of water unnecessarily.

8. Regular Maintenance: Schedule regular maintenance for the water heating system to ensure optimal performance, prevent inefficiencies, and extend the system's lifespan.

9. Energy Management System: Implement an energy management system that controls and monitors water heating operations, optimizing energy usage based on demand and occupancy.

10. Energy-Efficient Fixtures: Install low-flow faucets and showerheads to reduce hot water consumption, leading to lower energy requirements for heating.

11. Behavioral Practices: Promote water-saving behaviors among building occupants, such as taking shorter showers and fixing leaks promptly.

12. Audit for Hot Water Demand: Conduct an audit to assess the actual hot water demand in the building. Based on the audit results, adjust the water heating system's capacity to match the building's needs.

By implementing these upgrades and replacements, the educational building can achieve better energy efficiency, reduce water heating costs, and contribute to a more sustainable operation. The specific solutions selected should be based on the building's unique characteristics, available budget, and long-term energy-saving goals.

Related images/ documents-

Fig.5 Water tank attach with immersion rod

Other energy-consuming equipment:

• Evaluate other energy-consuming equipment, such as elevators, escalators, and data centers. • Analyze energy usage and identify areas for improvement. • Recommend energy-efficient replacements or upgrades.	• There are 7 elevators installed inside the campus, but the proper energy consumption details were not available during the audit. • During the time of the audit, the energy usage data was not provided. • Recommended energy efficient replacement or upgrades are given below.

Recommended energy efficient replacement or upgrades

1. Lighting:
   Replace traditional incandescent bulbs with LED or CFL bulbs. LEDs are highly efficient and have a longer lifespan.
2. Appliances:
   Look for appliances with the ENERGY STAR label. These appliances meet strict energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA).
   Opt for energy-efficient refrigerators, washing machines, dishwashers, and air conditioners.
3. Windows:
   Upgrade to energy-efficient windows with double or triple panes, low-emissivity coatings, and insulated frames to reduce heat transfer.
4. Thermostat:

Install a programmable or smart thermostat to control your heating and cooling system more efficiently.

5. Water Heating:
   Replace traditional water heaters with energy-efficient tankless or heat pump water heaters.
6. Insulation:
   Improve insulation in your home, including walls, attic, and floors, to reduce the need for heating and cooling.
7. Roofing:
   Choose cool roofing materials that reflect more sunlight and absorb less heat, keeping your home cooler.
8. Electronics:
   Select electronics with energy-saving features, such as power-saving modes and automatic shut-off.
9. Transportation:
   Consider electric or hybrid vehicles to reduce your carbon footprint and dependency on fossil fuels.
10. Power Strips:
    Use smart power strips to prevent standby power consumption by automatically turning off electronics when they're not in use.
11. Landscaping:
    Plant shade trees around your home to reduce the amount of direct sunlight hitting your house.
12. Solar Panels:
    If feasible, install solar panels to generate your own renewable energy.
13. Water Fixtures:
    Replace older faucets, showerheads, and toilets with WaterSense-labeled fixtures that use less water.
14. Cooking Appliances:
    Use induction cooktops, which are more energy-efficient than traditional electric or gas stoves.
15. Curtains and Blinds:
    Use energy-efficient curtains or blinds to better insulate your windows and control heat gain/loss.

Nonconformity:

- During the time of the audit, the energy usage data was not provided.

Building Envelope

Walls, roof, and foundation:	
• Inspect walls, roof, and foundation for air leaks, cracks, and damage.	• During the time of the audit, the condition of the walls, roof was

• Check for insulation and evaluate its R-value. • Review construction materials and building design. • Analyze energy usage and identify areas for improvement. • Recommend upgrades or replacements as necessary.	found to be free of any air leaks, cracks, and damage. See reference fig/doc: - fig 6 • During the time of the audit, the insulation was found to be OK, but its R-value documentation was not provided. • The construction materials used building was ok according to the building design. • The energy usage of the building was found to be 637032.67 KwH/month. See the reference table below: - Table 2 • The upgrades or the replacement as necessary for the walls, roof, and foundation is provided in the table given below.

Upgrades table: -

For an existing educational building, there are several recommended upgrades for the walls, roof, and foundation that can significantly improve energy efficiency and reduce overall energy consumption. These upgrades focus on enhancing insulation, sealing air leaks, and optimizing thermal performance. Here are some specific recommendations:

1. Walls:

   a. Exterior Insulation: Consider adding exterior insulation to the walls. This can be achieved through the installation of insulated panels or adding a layer of foam or mineral wool insulation to the outer surface of the walls. Exterior insulation helps prevent heat transfer through the walls and improves the building's overall thermal performance.

   b. Insulation Retrofit: If possible, assess the current wall insulation and, if inadequate, retrofit it with additional insulation. This can be done by injecting insulation material into the wall cavities or adding insulated panels to the interior walls.

   c. Air Sealing: Seal any gaps, cracks, or openings in the walls that could lead to air leakage. Air sealing ensures that conditioned air stays inside the building, reducing the need for constant heating or cooling.

2. Roof:

a. Reflective Roof Coatings: Apply reflective coatings to the roof surface. These coatings help to reflect sunlight, reducing heat absorption and keeping the building cooler during hot weather.

b. Cool Roofs: If possible, consider installing cool roofs, which are designed to have higher solar reflectance and thermal emittance, minimizing heat transfer into the building.

c. Roof Insulation: Ensure that the roof is well-insulated to prevent heat loss during colder months and reduce the need for heating.

d. Roof Ventilation: Improve roof ventilation to reduce heat buildup in the attic or roof space. Proper ventilation can help maintain a cooler indoor environment, especially during hot weather.

3. Foundation:

a. Foundation Insulation: Insulate the foundation walls to prevent heat loss through the ground. This can be done by adding insulation to the exterior or interior surfaces of the foundation walls.

b. Crawl Space Sealing: If the building has a crawl space, ensure it is properly sealed and insulated to prevent moisture intrusion and reduce heat loss.

c. Perimeter Insulation: Install perimeter insulation around the foundation to reduce heat transfer between the ground and the building.

These upgrades collectively create a more energy-efficient building envelope, reducing the building's reliance on heating and cooling systems.

Related images/ documents-

Fig 6: the fig shows building's roof and wall

Nonconformity: -
The R-value documentation for the existing educational building's roof, walls, and foundation was not available during the audit, indicating a lack of proper documentation and potentially hindering the accurate assessment of the building's thermal insulation and energy efficiency performance.

Insulation:

• Evaluate the type and condition of insulation. • Check for gaps or damaged areas. • Evaluate insulation's R-value and its effectiveness. • Analyze energy usage and identify areas for improvement. • Recommend upgrades or replacements as necessary.	• During the time of the audit, the condition of the insulation was found to be satisfactory. See reference fig/doc: - fig 7 • During the time of the audit, no gaps or damaged areas were found in the case of wires. See the reference fig/doc: - fig 7 • The insulation R-value is not evaluated by the institute. The areas of upgrades or the replacement is given below in the table below.

Upgrades:
For the case of insulation of the wiring in an existing educational building, the following recommended upgrades can enhance energy efficiency, electrical safety, and reduce energy losses:

1. Electrical Insulation Material: Ensure that appropriate electrical insulation materials are used for all wiring in the building. High-quality insulation materials such as PVC (Polyvinyl Chloride) or XLPE (Cross-linked Polyethylene) help minimize energy losses and reduce the risk of electrical faults.

2. Insulation Thickness: Verify that the insulation thickness of the wiring meets or exceeds the required standards and local electrical codes. Adequate insulation thickness prevents energy losses due to heat dissipation and minimizes the risk of short circuits.

3. Insulation Integrity: Check the integrity of existing wiring insulation throughout the building. Any damaged or deteriorated insulation should be promptly repaired or replaced to maintain electrical safety and prevent energy wastage.

4. Efficient Lighting and Wiring Design: Ensure that the lighting and wiring design follow efficient routing and use proper cable sizing. Proper design minimizes unnecessary wiring length and reduces energy losses during transmission.

5. Energy-Efficient Lighting Fixtures: Consider using energy-efficient lighting fixtures to reduce electricity consumption. LED lights, for example, consume less energy compared to traditional incandescent or fluorescent bulbs.

6. Power Factor Correction: Implement power factor correction techniques to optimize electrical system efficiency. Power factor correction reduces reactive power consumption, resulting in improved energy utilization.

7. Smart Wiring Solutions: Implement smart wiring solutions that enable efficient control and monitoring of lighting and electrical devices. Smart systems can help optimize energy usage based on occupancy and time schedules.

8. Use of Circuit Breakers: Install circuit breakers or fuses to protect the electrical wiring from overload and short circuits. Proper circuit protection prevents energy wastage and enhances safety.

9. Proper Cable Management: Organize and manage the wiring system to reduce the risk of tangled or damaged wires. Proper cable management ensures efficient transmission of electricity and reduces energy losses.

10. Energy Monitoring: Consider installing energy monitoring systems to track and analyze electricity consumption. Real-time data can help identify areas of high energy usage and guide energy-saving efforts.

11. Regular Maintenance: Conduct regular inspections and maintenance of the electrical wiring system. This includes checking for insulation damage, loose connections, and any signs of wear and tear.

By implementing these upgrades and ensuring proper insulation of the electrical wiring, the educational building can achieve better energy efficiency, reduce electricity consumption, and enhance electrical safety. Regular monitoring and maintenance will further support a sustainable and safe electrical infrastructure. As always, it's essential to work with qualified electricians and adhere to local electrical codes and regulations during any electrical system modifications.

Related images/ documents-

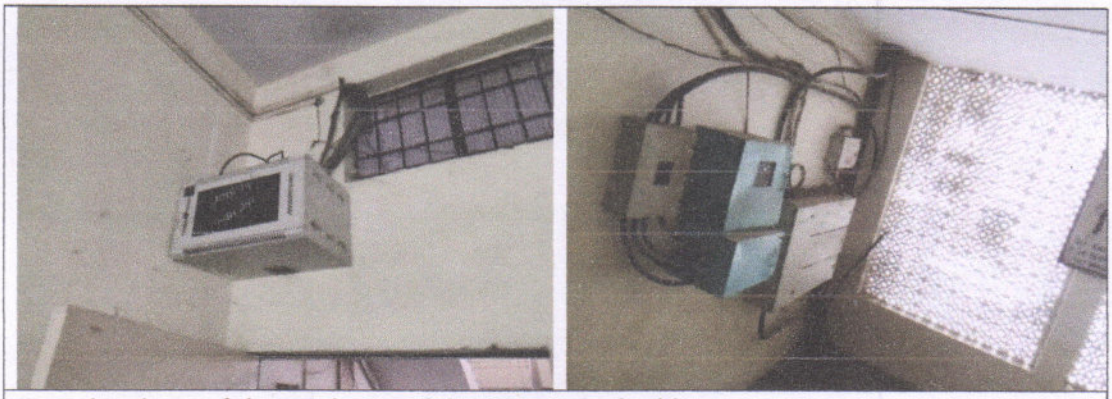


Fig 7 the photo of the insulation of the wire in the building

Nonconformity: -

The R-value documentation for insulation's was not available during the audit.

Doors and windows:	
• Inspect doors and windows for air leaks, damage, or gaps. • Evaluate the type and condition of windows and doors. • Review the window-to-wall ratio and the orientation of windows. • Analyze energy usage and identify areas for improvement. • Recommend upgrades or replacements as necessary.	• The condition of the doors was deemed satisfactory, as no signs of air leaks, damage, or gaps were observed. However, the windows were found to be in poor condition. Reference fig/doc: -9 • The windows and doors are made of wood, steel, and glass. Reference fig/doc: - 9 • The window to wall ratio for the buildings data are not available. • The recommended upgrades or replacement as necessary is given below table.

Upgrades:

For the existing educational structure, upgrading doors and windows can have a significant impact on energy efficiency and comfort. Here are some upgrades and changes to consider for doors and windows during an energy audit:

1. Energy-Efficient Windows:
   a. Replace single-pane windows with double or triple-pane windows that have low-emissivity (low-E) coatings. Low-E windows reduce heat transfer, keeping indoor spaces cooler in summer and warmer in winter.
   b. opt for windows with gas-filled panes (e.g., argon or krypton gas) between the layers to enhance insulation properties.

c. Consider windows with thermal breaks or insulating spacers to minimize heat conduction through the window frames.

2. Window Frame Materials:
   Replace old or poorly insulated window frames with energy-efficient materials such as vinyl, fiberglass, or insulated aluminum frames.
   Timber frames can also be a good option if sourced from sustainable forestry practices.

3. Weatherstripping and Caulking:
   Add weatherstripping around doors and windows to seal any gaps and prevent drafts.
   Apply caulking to seal any cracks or openings between the window frame and the building structure.

4. Window Treatments:
   Install energy-efficient window treatments like cellular shades, thermal curtains, or window films. These can help regulate indoor temperatures and reduce the need for heating or cooling.

5. Sun Shading Devices:
   Consider adding external shading devices like awnings, overhangs, or louvers to block direct sunlight during hot periods, reducing cooling loads.

6. Insulated Doors:
   Upgrade exterior doors with insulated models to minimize heat transfer between indoor and outdoor spaces.

7. Airlocks:
   Install airlocks at building entrances to minimize outdoor air infiltration and reduce the loss of conditioned air.

8. Double Doors:
   Consider using double doors at main entrances to improve energy efficiency. Double doors create an air buffer zone that helps insulate the interior space.

9. Glass Selection:
   opt for energy-efficient glazing with a suitable Solar Heat Gain Coefficient (SHGC) and U-value to balance daylighting and energy performance.

10. Operable Windows:
    If possible, incorporate operable windows to allow for natural ventilation when outdoor conditions are favorable, reducing reliance on mechanical cooling.

11. Window Orientation:

During new construction or renovations, consider window orientation to optimize natural daylighting while minimizing excessive solar heat gain.

12. Regular Maintenance:
    Ensure regular maintenance of doors and windows to repair any seals, weatherstripping, or faulty hardware.

By implementing these upgrades and changes, the educational structure can achieve improved energy efficiency, better indoor comfort, and reduced energy consumption, leading to long-term cost savings and a more sustainable building. The selection of specific upgrades should be based on the building's unique characteristics.

Related images/ documents-

Fig 9 Doors and windows

Nonconformity: -

- The window to wall ratio for the buildings data are not available at the time of audit.

Air leaks:	
• Identify areas of air leakage in the building envelope. • Evaluate the effectiveness of weatherstripping and caulking. • Recommend upgrades or replacements as necessary.	Not applicable

Occupant Behavior

Temperature setpoints:	
• Evaluate temperature setpoints for different areas of the building. • Review thermostat settings and schedules. • Identify opportunities to adjust temperature setpoints to optimize energy efficiency while maintaining occupant comfort.	• No written document found at the time of the audit. • No written document found at the time of the audit. • The opportunities to adjust temperature setpoint to optimize energy efficiency while maintaining occupant comfort is given in the below table.

Identifying opportunities to adjust temperature setpoints can lead to optimized energy efficiency while maintaining occupant comfort in an existing educational institute. Here are some opportunities to achieve this for the AC system:

1. Occupancy Schedule: Adjust temperature setpoints based on the building's occupancy schedule. During periods of low occupancy, such as evenings and weekends, set the AC to a higher temperature or use setback temperatures to reduce cooling demand.

2. Zoning: Implement zoning in the AC system to divide the building into different areas with separate temperature controls. This allows for more precise temperature settings based on the cooling requirements of each zone.

3. Seasonal Adjustments: Set higher temperature setpoints during summer months when outdoor temperatures are warmer. This helps reduce the temperature differential between indoor and outdoor spaces, leading to energy savings.

4. Night Cooling: Utilize night cooling strategies by setting the AC to a higher temperature during the night when outdoor temperatures are cooler. This pre-cool the building and reduces the need for cooling during the hotter daytime hours.

5. Thermostat Setbacks: Use programmable or smart thermostats to automatically adjust temperature setpoints based on occupancy patterns. For example, raise the temperature when the building is unoccupied or during non-business hours.

6. Humidity Control: Ensure that the AC system also addresses humidity control. Higher humidity levels can make occupants feel less comfortable, leading to a higher demand for cooling.

7. Occupant Comfort Surveys: Conduct surveys to understand occupants' comfort preferences regarding temperature settings. Use this feedback to optimize temperature setpoints that align with occupant comfort while minimizing energy consumption.

8. Shade and Sun Control: Utilize shading devices or window treatments to reduce direct sunlight and heat gain, which can lower the cooling demand and enable higher temperature setpoints.

9. Smart HVAC Scheduling: Use smart building automation systems to optimize the AC schedule based on weather forecasts, occupancy patterns, and other factors.

10. Education and Awareness: Educate building occupants, staff, and students about the importance of energy efficiency and comfort trade-offs. Encourage them to dress appropriately for the season to reduce reliance on air conditioning.

11. Monitoring and Fine-Tuning: Regularly monitor the AC system's performance and fine-tune temperature setpoints based on actual building conditions and energy consumption data.

12. Maintenance and Filters: Ensure regular maintenance of the AC system, including cleaning or replacing air filters, to maintain optimal performance and energy efficiency.

By implementing these opportunities, the educational institute can achieve better energy efficiency, reduce operating costs, and maintain a comfortable indoor environment for occupants. It's essential to strike a balance between energy savings and occupant comfort to ensure a successful and sustainable cooling strategy.

Nonconformity: -

1. During the evaluation of temperature setpoints for different areas of the building, it was observed that the AC temperature setpoints were not properly optimized. Some areas had excessively low or high AC setpoints, leading to inefficient energy usage and potential discomfort for occupants. Proper optimization and standardization of AC temperature setpoints are recommended to improve energy efficiency and occupant comfort.
2. During the review of thermostat settings and schedules, the AC system's specific settings and schedules were not available or known. The lack of this crucial information hinders the ability to assess the AC system's efficiency and potential energy-saving opportunities. To optimize energy usage and improve control over indoor climate, it is essential to obtain and document the thermostat settings and schedules for the AC system.

Lighting usage:

• Evaluate lighting usage and habits. • Review the availability of natural lighting and its use. • Identify opportunities to optimize lighting usage to reduce energy consumption.	• The lighting usage of the building is provided in the table below. It indicates that the maximum lighting usage occurs in the building between 9:00 AM- 5:00 PM in the evening, accounting for approximately 80% of the total energy consumption for the academic and 6:00 PM-11:00PM at hostel building. See reference table fig.10 • During the time of the audit the natural light usage was found to be minimal. Reference fig/doc: - 10 • The opportunities for the energy usage is given below in the table

Related images/ documents-

Fig 10 the light in the classroom

Upgrades :-

1. Conduct a Lighting Audit: Begin by conducting a comprehensive audit of your college's lighting systems. This involves gathering data about the types of lighting fixtures, their locations, wattages, and operating hours. This audit will provide a baseline understanding of the current lighting setup.

2. Assess Lighting Needs: Evaluate the lighting needs of different areas within the college. Consider factors such as the purpose of the space, the required illumination levels, and the occupancy patterns. Some areas might require brighter lighting, while others could function effectively with lower lighting levels.

3. Consider Natural Light: Maximize the use of natural daylight where possible. Identify spaces where daylight can be effectively utilized to reduce the need for

artificial lighting during daytime hours. This could involve rearranging furniture or using lighter window treatments.

4. Upgrade to Energy-Efficient Lighting: If your college is still using traditional incandescent or fluorescent lighting, consider upgrading to more energy-efficient options like LED (light-emitting diode) lighting. LED lights use significantly less energy, have a longer lifespan, and produce less heat.

5. Implement Lighting Controls: Install lighting controls such as occupancy sensors and timers. These sensors can detect movement and automatically turn lights on when someone enters a room and turn them off when the room is vacant. Timers can be used to schedule lights to turn off during non-operational hours.

6. Group Lighting Zones: Organize lighting fixtures into zones based on usage patterns. This allows you to control different areas separately, turning off or dimming lights in sections that are not currently in use.

7. Adjust Lighting Intensity: Set lighting systems to operate at the appropriate intensity level. Overlit areas waste energy and can cause discomfort, while underlit areas can compromise safety and productivity.

8. Educate Occupants: Raise awareness among students, staff, and faculty about the importance of turning off lights when they leave a room. Encourage energy-saving behaviors and create signage reminding people to conserve energy.

9. Regular Maintenance: Implement a maintenance schedule to ensure that lighting fixtures are cleaned, and faulty or dimming lights are promptly replaced. Well-maintained fixtures perform more efficiently.

10. Monitor and Analyze Usage: Use energy monitoring systems to track lighting energy consumption over time. Analyze the data to identify trends and areas where further optimization is needed.

11. Set Energy Reduction Goals: Establish clear energy reduction goals for lighting usage. Regularly review progress toward these goals and adjust strategies as needed.

12. Engage in Retrofit Projects: Consider larger retrofit projects that involve redesigning lighting layouts, installing more advanced controls, or using daylight harvesting systems to further optimize energy usage.

By following these steps and tailoring them to your college's specific circumstances, you can identify and implement effective strategies to optimize lighting usage and reduce energy consumption.

Equipment usage:	
• Evaluate the usage of electrical equipment and appliances, such as computers, printers, and vending machines. • Review the availability of energy-efficient equipment. • Identify opportunities to optimize equipment usage to reduce energy consumption.	No records provided by the institute during the time of audit.
Nonconformity: - No written documents are maintain of equipment usage by the institute.	

Education and awareness:	
• Evaluate educational programs for building occupants regarding energy efficiency and sustainability. • Review the availability of resources to educate occupants on energy-saving practices. • Identify opportunities to promote awareness and encourage energy-efficient behaviors among building occupants.	• No records provided by the institute during the time of audit. • There opportunities to promote awareness and encourage energy-efficient behaviour among building occupants is given below:

Opportunities to promote the energy efficient behaviour: -

1. Promoting awareness and encouraging energy-efficient behaviours among building occupants in an educational institute can lead to significant energy savings and foster a culture of sustainability. Here are some opportunities to achieve this:

2. Energy Awareness Campaigns: Launch energy awareness campaigns to educate students, staff, and faculty about the importance of energy conservation. Use posters, banners, and digital displays to provide energy-saving tips and information about the institute's energy consumption.

3. Student Engagement: Involve students in energy-saving initiatives and encourage them to take an active role in promoting energy-efficient practices. Organize workshops, seminars, or competitions focused on energy conservation.

4. Energy Saving Contests: Conduct energy-saving contests among classrooms, dormitories, or departments to encourage healthy competition and motivate occupants to reduce their energy usage.

5. Energy Dashboards: Install energy dashboards or displays in prominent areas to show real-time energy consumption data. Visualizing energy usage can create awareness and encourage occupants to make conscious choices.

6. Green Ambassadors: Appoint green ambassadors from among students and staff to lead and promote energy-efficient initiatives. These ambassadors can serve as role models and advocates for sustainability practices.

7. Energy-Efficient Behaviors Pledges: Encourage occupants to sign energy-saving pledges, committing to specific actions such as turning off lights and electronics when not in use, using natural daylight when possible, and setting air conditioning at optimal temperatures.

8. Incorporate Energy Topics in Curriculum: Integrate energy-related topics into the curriculum, providing students with a deeper understanding of energy conservation and sustainable practices.

9. Energy-Saving Tips and Reminders: Display energy-saving tips and reminders near light switches, thermostats, and appliances to prompt occupants to adopt energy-efficient habits.

10. Sustainability Workshops: Organize workshops or seminars focused on sustainability, energy efficiency, and renewable energy. Invite guest speakers and experts to share insights and experiences.

11. Green Campus Events: Host green campus events or sustainability fairs, showcasing energy-efficient technologies and products to engage and inspire building occupants.

12. Energy-Related Clubs and Organizations: Encourage the formation of energy-related clubs or organizations, providing a platform for like-minded individuals to collaborate on sustainability projects.

13. Online Resources: Create a dedicated section on the institute's website or intranet for energy conservation resources, tips, and success stories to reinforce the importance of energy-efficient practices.

14. Reward and Recognition: Recognize individuals, departments, or dormitories that consistently demonstrate outstanding energy-saving efforts. Offer incentives or rewards to further motivate participation.

15. Collaborative Initiatives: Partner with local utilities or energy organizations to offer workshops, energy assessments, or other resources that promote energy-efficient practices. By implementing these opportunities, the educational institute can foster a culture of energy efficiency and sustainability, empowering occupants to make a positive impact on the environment and reduce overall energy consumption
Nonconformity: - The institute does not provide Education and awareness

Energy Bills & Utility Data

Energy bills:	
• Collect energy bills for the past 12 months. • Review energy bills to identify usage patterns and trends. • Analyze energy bills to identify peak usage periods and potential areas for improvement.	• The energy bills for the past 12 months are given in the table below. Reference fig/doc: - Appendix table 2, fig 13 • Based on the energy bills and the energy audit report, it is evident that the peak periods of higher electricity consumption occur during the months of January, June-August, and October. This may be due to the building experiencing higher occupancy levels during these time periods and also because of the seasonal characteristics of these months.

Utility data: (for the gas the organization uses the gas cylinder, but there is no water meter)	
• Collect utility data, including gas, water, and electricity usage. • Review utility data to identify usage patterns and trends. • Analyze utility data to identify peak usage periods and potential areas for improvement.	• The data collected from the organization shows that they use 5 cylinders in a month. One of these cylinders weighs 15 kg, and the other four cylinders contain commercial gas, and each have a weight of 19 kg. The energy usage of the building was found to be 637032.67 KwH/month. • The water bill not available. See reference appendix table 6

	• There pattern for the case remain same. • The utility data analyses show that the college needs to do

Upgrades: -

To analyze utility data for gas and water consumption and identify peak usage periods and potential areas for improvement in an energy audit, follow these steps:

1. Gather Utility Data:
   Obtain historical gas and water consumption data for the building, preferably covering the past 12 months. This data should include monthly or daily records of gas and water usage.

2. Identify Peak Usage Periods:
   Analyze the gas and water consumption data to identify peak usage periods. Peaks may be related to specific months, seasons, or days of the week when gas and water usage are significantly higher.

3. Investigate Fluctuations:
   Examine the data for any unusual fluctuations in gas and water consumption. Sudden spikes or drops in usage could indicate issues that need further investigation.

4. Review Building Occupancy and Activities:
   Correlate the gas and water consumption data with the building's occupancy and activities during the identified peak usage periods. Consider whether certain events, increased occupancy, or specific activities contribute to higher utility usage.

5. Check Gas Appliances and Equipment:
   Inspect gas-fired appliances and equipment in the building, such as boilers, water heaters, and stoves, for efficiency and proper functioning. Inefficient or malfunctioning equipment can lead to higher gas consumption.

6. Evaluate Water Fixtures:
   Assess water fixtures like faucets, toilets, and showers for leaks and inefficiencies that may contribute to excessive water usage.

7. Implement Water-Saving Measures:
   Consider installing water-saving fixtures, such as low-flow faucets and toilets, to reduce water consumption.

8. Monitor Utility Usage Regularly:
   After implementing improvements, continue monitoring gas and water consumption regularly to track the effectiveness of the measures taken.

9. Financial Analysis:
   Calculate the potential cost savings from implementing energy-efficient measures or water-saving measures to compare with the initial investment required.

10. Set Goals and Targets:
    Set specific energy efficiency and water conservation goals and targets, and regularly review progress toward achieving those goals.

11. Conduct Staff Training:
    Ensure that staff members and occupants are educated about energy and water conservation practices and their role in maintaining the building's efficiency.

12. Regular Maintenance:
    Schedule regular maintenance for gas appliances and water fixtures to ensure they operate at their peak efficiency.

Cost analysis:

• Evaluate the cost of energy consumption. • Review the cost of energy bills and utility data. • Analyze the cost of energy consumption and identify potential areas for improvement.	• The cost of electricity consumption varies from month to month, and the pattern remains consistent year by year. See reference - table 2 • The cost of energy bills is represented through the bar chart shown below. The total annual cost amounted to Rs 7644392.86 paid during the last fiscal period. • The cost of energy consumption and identify potential areas for improvement

For the improvement
To analyze the cost of energy consumption and identify potential areas for improvement in an existing educational building for an energy audit, the following steps can be taken:

1. Gather Energy Consumption Data:
   Obtain historical energy consumption data for the building, preferably covering the past 12 months. This data may include electricity, heating, cooling, and water consumption.

2. Benchmarking:
   Compare the building's energy consumption with similar educational buildings in the region. This benchmarking will help determine if the building's energy usage is higher or lower than average.

3. Energy Audit and Building Inspection:
   Conduct a comprehensive energy audit and inspection of the building to identify energy-consuming systems and equipment. This may include lighting, HVAC (heating, ventilation, and air conditioning), insulation, windows, doors, appliances, and water fixtures.

4. Identify Energy Inefficiencies:
   During the audit, identify areas where energy inefficiencies are evident. This can be through equipment malfunctions, outdated technology, or inefficient building design.

5. Analyze Lighting:
   Check the lighting systems in the building. Replacing traditional bulbs with energy-efficient LED lights can significantly reduce energy consumption.

6. HVAC System Analysis:
   Analyze the HVAC system's performance and efficiency. Inefficiencies in heating and cooling systems can lead to high energy usage. Consider installing programmable thermostats and regular maintenance to improve efficiency.

7. Insulation and Weatherization:
   Check the insulation levels in the building. Proper insulation and weather sealing can prevent energy losses and reduce the load on heating and cooling systems.

8. Renewable Energy Sources:
   Evaluate the feasibility of integrating renewable energy sources such as solar panels or wind turbines to supplement the building's energy needs.

9. Water Consumption:
   Analyze water consumption patterns and consider implementing water-saving fixtures and practices.

10. Behavioral Changes:
    Educate building occupants about energy conservation practices, such as turning off lights and electronic devices when not in use, and promoting a culture of energy consciousness.

11. Financial Analysis:

Calculate the potential cost savings from implementing energy-efficient measures to compare with the initial investment required.

12. Prioritize Improvements:
    Prioritize the identified areas for improvement based on their potential energy and cost savings.

13. Implement and Monitor:
    Implement the energy-efficient measures and regularly monitor energy consumption to track progress and ensure the effectiveness of the improvements.

14. Train Staff:
    Educate facility management and building occupants about the newly implemented energy-efficient measures and their role in maintaining the building's energy efficiency.

15. Continuous Improvement:
    Energy audits should be conducted periodically to assess the impact of the implemented measures and identify further opportunities for improvement.

Benchmarking:	
• Compare energy consumption and cost to industry benchmarks and best practices. • Identify areas where energy consumption and cost are above industry benchmarks. • Recommend solutions to bring energy consumption and cost in line with industry benchmarks.	• Energy consumption comparisons are available; however, industry benchmarking regarding costs has not been performed. • No written record found at the time of the audit. • The following solution can help in bringing energy consumption and cost in line with industrial benchmark as given in the table

Recommended solution for the benchmarking:
To bring energy consumption and cost in line with industry benchmarks for an existing educational building, several solutions can be implemented. These solutions focus on improving energy efficiency, optimizing energy use, and reducing operational costs. Here are some recommended solutions:

1. Energy Audit and Benchmarking:
   Conduct a comprehensive energy audit to identify areas of high energy consumption and compare the building's performance with industry benchmarks. Use this data to set specific energy reduction targets.

2. Building Envelope Upgrades:
   Improve insulation in walls, roofs, and foundations to reduce heat transfer and improve thermal efficiency.
   Seal air leaks and upgrade windows and doors to minimize drafts and improve energy conservation.

3. Efficient Lighting:
   Replace traditional lighting with energy-efficient LED lighting. Use motion sensors and timers to control lighting usage in unoccupied areas.

4. HVAC Optimization:
   Upgrade HVAC systems to more energy-efficient models with inverter technology and higher SEER ratings.
   Implement zoning and programmable thermostats to regulate temperature in different areas based on occupancy patterns.

5. Renewable Energy Integration:
   Install solar panels or other renewable energy systems to offset electricity consumption and reduce reliance on the grid.

6. Occupant Awareness and Education:
   Conduct energy conservation awareness campaigns to encourage students, faculty, and staff to adopt energy-saving behaviors.
   Provide energy-saving tips and reminders throughout the building.

7. Power Management:
   Implement power management systems for electronic devices to reduce standby power consumption.
   Use smart power strips to prevent phantom loads from electronics and appliances.

8. Water Conservation Measures:
   Install low-flow fixtures and water-efficient appliances to reduce water consumption and associated energy costs.

9. Operational Improvements:
   Schedule regular maintenance for HVAC systems, lighting, and other equipment to ensure optimal performance and energy efficiency.
   Monitor and analyze energy consumption data to identify anomalies and areas for improvement.

10. Energy-Efficient Appliances and Equipment:
    Replace outdated or inefficient appliances and equipment with energy-efficient models.
    Consider ENERGY STAR certified devices for improved energy performance.

11. Financial Incentives and Rebates:
    Research available energy efficiency incentives and rebates from local utilities or government programs to offset the cost of upgrades.

12. Collaborate with Energy Experts:
    Seek guidance from energy consultants or specialists to develop a tailored energy-saving plan and implement effective measures.

Implementing these solutions will help the educational building align its energy consumption and costs with industry benchmarks, reducing its environmental impact and operating expenses over time. Regular monitoring and performance evaluation are essential to ensure continuous improvement and long-term sustainability.

Nonconformity: -

During the energy audit of the educational institute, it was observed that the energy consumption and cost were not compared to industry benchmarks and best practices. The absence of such comparisons hinders the institute's ability to identify potential areas of improvement and implement energy-efficient measures in line with industry standards. It is recommended to conduct a thorough benchmarking analysis to gauge the institute's energy performance relative to similar educational facilities and adopt best practices to optimize energy consumption and reduce operating costs.

Financial incentives:	
• Review available financial incentives for energy efficiency improvements. • Identify potential incentives for energy efficiency improvements. • Recommend solutions to take advantage of available financial incentives.	Not available

Nonconformity: -

No detailed energy audit was conducted for financial incentives by the institute at the time of the audit.

Building automation system

HVAC control:	
• Evaluate the HVAC control system and its programming. • Review the performance of the HVAC control system. • Identify opportunities to optimize HVAC performance and reduce energy consumption.	Not applicable

Lighting control:	
• Evaluate the lighting control system and its programming. • Review the performance of the lighting control system. • Identify opportunities to optimize lighting performance and reduce energy consumption.	Not applicable

Energy monitoring:	
• Evaluate the building's energy monitoring systems. • Review the accuracy and effectiveness of energy monitoring systems. • Identify opportunities to improve energy monitoring and identify energy-saving opportunities.	Not applicable

Equipment control:	
• Evaluate the building's equipment control systems. • Review the performance of equipment control systems. • Identify opportunities to optimize equipment performance and reduce energy consumption.	Not applicable

Optimization Strategies:	
• Evaluate the building's optimization strategies, such as occupancy	Not applicable

sensors, demand response, and night setbacks. • Review the effectiveness of optimization strategies. • Identify opportunities to optimize optimization strategies and reduce energy consumption.	

Building Design

Orientation and layout:	
• Evaluate the building's orientation and layout. • Review the building's exposure to sunlight and wind. • Identify opportunities to optimize orientation and layout to reduce energy consumption.	• The building orientation and layout plan of the building are provided in the following references: Fig 11 • During the time of the audit, the building's exposure to sunlight and wind was found to be inadequate. The major source of light was artificial lighting, as indicated in the data provided by the college. • The opportunities to optimizes orientation and layout to reduce energy consumption

To identify opportunities to optimize orientation and layout and reduce energy consumption in an existing educational building for the energy audit, follow these steps:

1. Site Analysis:
   Conduct a thorough site analysis to understand the building's location, surrounding environment, and climatic conditions. This includes considering factors such as sun path, prevailing winds, and shading from nearby structures or trees.

2. Solar Orientation:
   Determine the building's solar orientation, aiming to maximize the use of natural sunlight for daylighting. Orienting the building's main windows and openings towards the south (in the Northern Hemisphere) or north (in the Southern Hemisphere) can optimize natural lighting and reduce the need for artificial lighting during the day.

3. Shading and Glazing:
   Evaluate the use of shading elements, such as overhangs, awnings, or external louvers, to control solar heat gain and prevent excessive heating during hot

months. Select energy-efficient glazing materials that balance natural light transmission and thermal insulation.

4. Ventilation and Airflow:
   Consider the building's layout to facilitate natural ventilation and airflow. Properly placed windows and vents can allow for cross-ventilation, reducing the reliance on mechanical ventilation systems.

5. Zoning and Functional Layout:
   Optimize the building's layout by zoning spaces according to their energy needs and occupancy patterns. Place high-energy-consuming areas, such as computer labs or kitchens, in areas with minimal solar exposure to avoid overheating.

6. Use of Atriums and Courtyards:
   Atriums and courtyards can serve as central gathering spaces and help distribute natural light throughout the building's interior, reducing the need for artificial lighting in common areas.

7. Green Spaces and Landscaping:
   Utilize landscaping strategically to provide shade for the building and outdoor areas. Trees and green spaces can help reduce the heat island effect and contribute to overall energy efficiency.

8. Building Envelope Upgrades:
   Consider improving the building envelope by adding insulation to walls, roof, and foundation to reduce heat transfer and optimize thermal comfort.

9. Energy-Efficient Lighting Design:
   Implement energy-efficient lighting design strategies, such as using LED bulbs and installing motion sensors or timers to control lighting based on occupancy.

10. Energy Modeling and Simulation:
    Utilize energy modeling and simulation software to evaluate different layout and orientation options to predict potential energy savings before implementation.

11. Occupant Behavior:
    Educate building occupants about the importance of energy conservation and encourage energy-conscious behavior, such as turning off lights and electronics when not in use.

Related images/ documents-

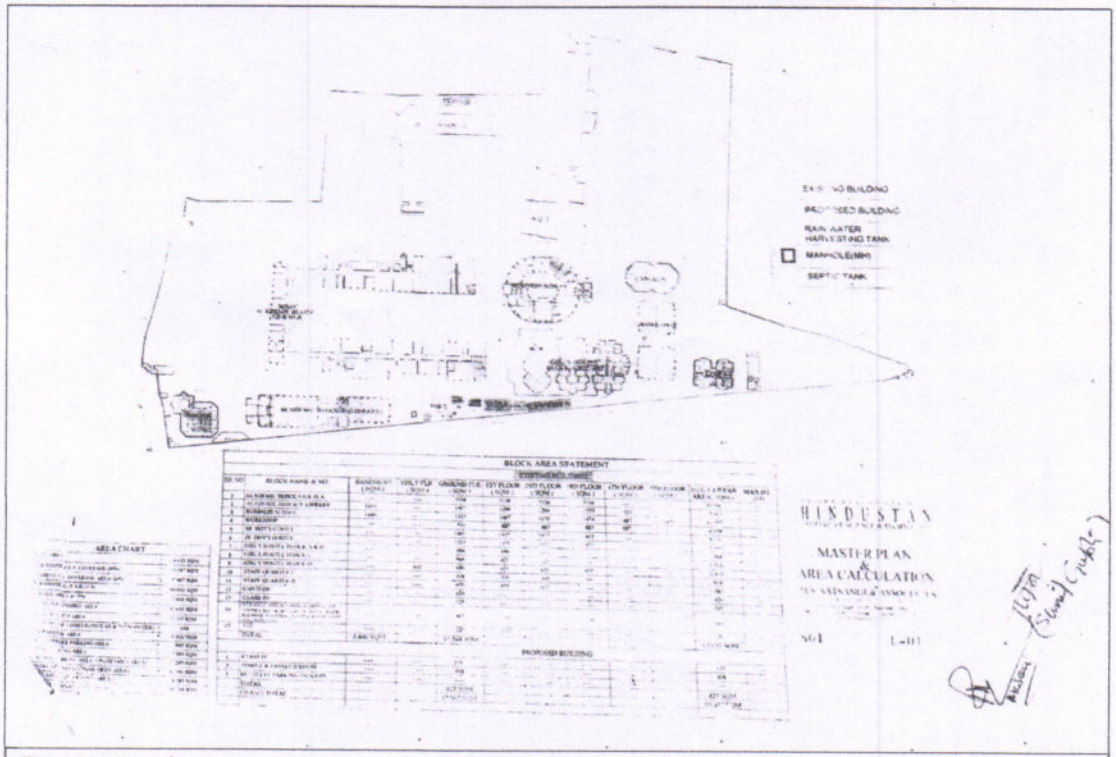


Fig 11: site plan

Insulation:	
• Evaluate the building's insulation and weatherization. • Review the building's insulation materials and installation. • Identify opportunities to optimize insulation and weatherization to reduce energy consumption.	No records provided by the institute during the time of audit.
Nonconformity: - The institution does not maintain any records of building's insulation and weatherization.	

Glazing:	
• Evaluate the building's glazing, including windows and skylights. • Review the glazing materials and their performance.	• Indeed, the building's glazing, encompassing windows and skylights, has been constructed correctly. Each classroom, laboratory, library, and hostel room have ample windows and

• Identify opportunities to optimize glazing to reduce energy consumption.	skylights made from glazing materials. Regrettably, because of the building's antiquated construction, there is inadequate passage of light indoors. Following reference: F12

Related images/ documents-

Fig 12: Glass windows and skylight

Renewable energy:	
• Evaluate the potential for renewable energy sources, such as solar or wind power. • Review the feasibility and cost-effectiveness of renewable energy options. • Identify opportunities to implement renewable energy solutions to reduce energy consumption and lower carbon emissions.	• Yes the institute uses the solar energy for the generation of electricity. They have 450KW solar panel installed in the institute but currently they 270KW in operational. Reference Pic/doc:- Fig 13 • Electricity generated by solar panels is used to decrease the cost of electricity consumption. • Opportunities to implement solar energy solution to reduce energy consumption and low carbon emission is given in the table below.

Opportunities

Implementing solar energy solutions in an existing educational building can be an effective way to reduce energy consumption and lower carbon emissions. Here are some opportunities to consider for the energy audit:

1. Solar Photovoltaic (PV) Panels: Install solar PV panels on the roof or available open spaces to generate clean electricity from sunlight. The generated electricity can offset a portion of the building's energy consumption, reducing dependence on grid power.

2. Solar Water Heating: Implement solar water heating systems to use solar energy for heating water. Solar water heaters can cater to the hot water demand of the building, reducing the energy required by conventional water heaters.

3. Solar Daylighting: Incorporate solar daylighting solutions, such as solar tubes or light shelves, to harness natural sunlight and reduce the need for artificial lighting during the daytime.

4. Solar Carports: If the building has parking lots, consider installing solar carports with integrated solar panels. These structures not only provide shade for parked vehicles but also generate solar energy.

5. Energy Storage Solutions: Integrate energy storage solutions, such as batteries, to store excess solar energy generated during sunny periods for use during cloudy days or at night, maximizing solar energy utilization.

6. Net Metering or Feed-in Tariffs: Explore net metering or feed-in tariff programs offered by utility companies. Excess solar energy generated can be fed back to the grid, potentially earning credits or financial incentives.

7. Solar Energy Awareness: Promote solar energy awareness among students, faculty, and staff through educational programs and campaigns. Encourage understanding and appreciation of the benefits of solar energy.

8. Solar-powered Outdoor Lighting: Install solar-powered outdoor lighting for pathways, parking lots, and other areas to reduce energy consumption and improve safety.

9. Energy Audits for Solar Sizing: Conduct energy audits to assess the building's energy needs accurately. The audit results can help determine the appropriate solar energy system size and optimize solar energy usage.

10. Financial Incentives: Research available financial incentives, grants, or rebates offered by government agencies or utility companies to offset the initial investment cost of solar installations.

11. Solar-powered Ventilation: Consider solar-powered ventilation systems for areas like attics or storerooms, helping to reduce the need for mechanical ventilation and cooling.

12. Integrated Design: When planning building renovations or expansions, incorporate solar energy solutions into the design phase to maximize energy efficiency and sustainability.

Fig 13: Solar panel installed on the above building

Energy-Efficient Equipment

Energy Efficient Equipment:	
• Check the energy efficiency of all the equipment viz: lighting equipment, including bulbs and fixtures, HVAC equipment, including boilers, chillers, and air handlers. water heaters, including boilers and hot water tanks. office equipment, including computers, printers, and copiers, etc. kitchen equipment, including refrigerators, dishwashers, and ovens. laundry equipment,	No records provided by the institute during the time of audit.

including washers and dryers, any other equipment.	
Nonconformity: Energy Efficient Equipment's details are not available.	

Renewable Energy Sources

Solar energy:	
• Evaluate the potential for solar energy, including photovoltaic (PV) panels and solar thermal systems. • Review the feasibility and cost-effectiveness of solar energy options. • Identify opportunities to implement solar energy solutions to reduce energy consumption and lower carbon emissions.	• A total of 405 kWp of solar panels have been installed on both the college building and hostel. Among them, the solar panels with a capacity of 270 kWp installed on the college's academic block are currently operational. Following reference: F14. • the feasibility and cost-effectiveness of solar energy options review at table no- 5 • Opportunities to implement solar energy solution to reduce energy consumption and low carbon emission is given in the table below.

Opportunities
Implementing solar energy solutions in an existing educational building can be an effective way to reduce energy consumption and lower carbon emissions. Here are some opportunities to consider for the energy audit:

1. Solar Photovoltaic (PV) Panels: Install solar PV panels on the roof or available open spaces to generate clean electricity from sunlight. The generated electricity can offset a portion of the building's energy consumption, reducing dependence on grid power.

2. Solar Water Heating: Implement solar water heating systems to use solar energy for heating water. Solar water heaters can cater to the hot water demand of the building, reducing the energy required by conventional water heaters.

3. Solar Daylighting: Incorporate solar daylighting solutions, such as solar tubes or light shelves, to harness natural sunlight and reduce the need for artificial lighting during the daytime.

4. Solar Carports: If the building has parking lots, consider installing solar carports with integrated solar panels. These structures not only provide shade for parked vehicles but also generate solar energy.

5. Energy Storage Solutions: Integrate energy storage solutions, such as batteries, to store excess solar energy generated during sunny periods for use during cloudy days or at night, maximizing solar energy utilization.

6. Net Metering or Feed-in Tariffs: Explore net metering or feed-in tariff programs offered by utility companies. Excess solar energy generated can be fed back to the grid, potentially earning credits or financial incentives.

7. Solar Energy Awareness: Promote solar energy awareness among students, faculty, and staff through educational programs and campaigns. Encourage understanding and appreciation of the benefits of solar energy.

8. Solar-powered Outdoor Lighting: Install solar-powered outdoor lighting for pathways, parking lots, and other areas to reduce energy consumption and improve safety.

9. Energy Audits for Solar Sizing: Conduct energy audits to assess the building's energy needs accurately. The audit results can help determine the appropriate solar energy system size and optimize solar energy usage.

10. Financial Incentives: Research available financial incentives, grants, or rebates offered by government agencies or utility companies to offset the initial investment cost of solar installations.

11. Solar-powered Ventilation: Consider solar-powered ventilation systems for areas like attics or storerooms, helping to reduce the need for mechanical ventilation and cooling.

12. Integrated Design: When planning building renovations or expansions, incorporate solar energy solutions into the design phase to maximize energy efficiency and sustainability.

Related images/ documents-

F14. Solar panel

Nonconformity:

The photovoltaic (PV) panels and solar thermal systems data was not available at the time of audit.

Biomass energy:	
• Evaluate the potential for biomass energy, including wood chips, agricultural waste, and other organic materials. • Review the feasibility and cost-effectiveness of biomass energy options. • Identify opportunities to implement biomass energy solutions to reduce energy consumption and lower carbon emissions.	Not Applicable

Water Usage

Plumbing fixtures:

• Evaluate the efficiency of plumbing fixtures, including faucets, toilets, and showers. • Review the performance of plumbing fixtures and their water consumption. • Identify opportunities to optimize plumbing fixtures and reduce water consumption.	• At the time of the audit, the plumbing fixtures, such as faucets, toilets, and showers, were discovered to be in a severely deteriorated state. Most of the restroom taps were non-functional, and multiple leaks were identified during the audit. Following reference: F15 • The opportunities to optimizes plumbing fixtures and reduce water consumption is given below.

Upgrades

To optimize plumbing fixtures and reduce water consumption in the case of an educational building for an energy audit, consider the following opportunities:

1. Faucets:
   Install low-flow or aerated faucets that maintain water pressure while reducing water usage.
   Implement sensor-activated faucets that only dispense water when needed, preventing wastage due to forgetfulness or accidental running.
   Repair any leaky faucets promptly to prevent unnecessary water loss.

2. Toilets:
   Replace old and inefficient toilets with high-efficiency toilets (HETs) or dual-flush toilets, which use less water per flush.
   Conduct a water audit to check for hidden leaks in toilet tanks and flappers, as they can lead to significant water wastage.

3. Showers:
   Install low-flow showerheads that maintain satisfactory water pressure while reducing water consumption during showers.
   Encourage shorter shower times through awareness campaigns to promote water conservation.

4. Greywater Recycling:
   Consider implementing a greywater recycling system, which can reuse water from sinks, showers, and laundry for non-potable purposes like irrigation or flushing toilets.

5. Educational Campaigns:

Raise awareness among building occupants, students, and staff about the importance of water conservation and provide tips on how to save water in daily activities.

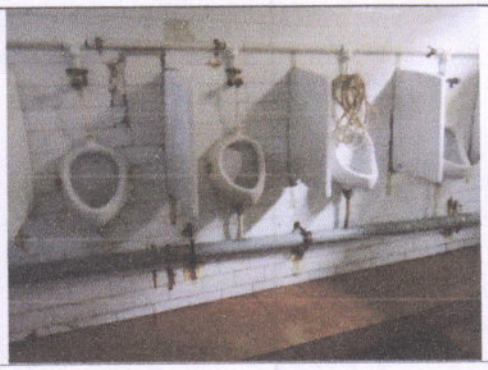
6. Water Monitoring and Data Analysis:
   Install water meters at critical points to monitor water usage and identify patterns of high consumption or leaks.
   Analyze water usage data to spot trends and make informed decisions on optimizing water consumption.

7. Rainwater Harvesting:
   If feasible, consider installing a rainwater harvesting system to collect and store rainwater for non-potable purposes, such as irrigation or flushing toilets.

8. Plumbing Maintenance:
   Regularly inspect and maintain the plumbing system to detect and fix leaks promptly.

9. Water-Conserving Landscaping:
   Use native and drought-resistant plants for landscaping to reduce outdoor water usage.

Related images/ documents-



F15. Poor plumbing fixtures of washbasin and toilets

Nonconformity: -
Evaluating and optimizing the performance of plumbing fixtures will contribute to reducing water wastage and promoting water conservation in the building. Conducting a detailed review of plumbing fixtures and their water consumption is recommended to enhance the building's overall water efficiency and sustainability.

Irrigation systems:

• Evaluate the efficiency of irrigation systems, including sprinklers and drip systems. • Review the performance of irrigation systems and their water consumption. • Identify opportunities to optimize irrigation systems and reduce water consumption.	No records provided by the institute during the time of audit.
Nonconformity: The institute lacks a proper irrigation system .	

Water reuse:	
• Evaluate the potential for water reuse, including greywater and rainwater harvesting. • Review the feasibility and cost-effectiveness of water reuse options. • Identify opportunities to implement water reuse solutions to reduce water consumption.	• The institute engages in the reuse of wastewater generated from the R.O. water purification unit and has also implemented a Sludge treatment plant with a capacity of 400KLD for treating greywater. Institute reuse the rainwater by installing ground recharge method of rainwater harvesting system. Reference fig/doc: - fig 16, Fig17 • No written document was found at the time of the audit. • The opportunities to implement water reuse solution to reduce water consumption can be done using the following information of the table

To implement water reuse solutions and reduce water consumption in the existing building during an energy audit, consider the following opportunities, including rainwater harvesting and greywater reuse:

1. Rainwater Harvesting:
   Install rainwater harvesting systems to collect and store rainwater from rooftops and other impervious surfaces.
   Use collected rainwater for non-potable purposes such as landscape irrigation, toilet flushing, and cooling systems.

2. Greywater Recycling:
   Implement a greywater recycling system to treat and reuse water from sinks, showers, and laundry for non-potable purposes like toilet flushing or irrigation.
   Ensure proper filtration and treatment processes to maintain water quality and safety.

3. Dual Plumbing System:
   Consider installing a dual plumbing system that segregates potable water from recycled water, allowing the latter to be used for specific purposes without mixing with drinking water.

4. Educational Initiatives:
   Conduct awareness campaigns to educate building occupants and users about the benefits of water reuse and how to participate in water conservation efforts.

5. Water Use Assessments:
   Conduct a comprehensive water audit to identify areas with the highest water consumption and potential opportunities for water reuse.

6. Water Reuse Policy and Guidelines:
   Develop and implement a water reuse policy that outlines the acceptable uses of rainwater and greywater in the building.
   Provide guidelines for maintenance and regular monitoring of the water reuse systems.

7. Building System Integration:
   Integrate water reuse systems with the building's plumbing and irrigation systems to facilitate efficient water distribution and utilization.

8. Water Quality Monitoring:
   Regularly test the quality of recycled water to ensure it meets safety and regulatory standards.
   Implement automatic shut-off mechanisms if water quality falls below acceptable levels.

9. Regulatory Compliance:
   Ensure compliance with local regulations and building codes related to water reuse and greywater recycling.

10. Professional Consultation:
    Seek advice from water management experts or consultants to design and optimize water reuse systems for the specific needs of the building.

Related images/ documents-

Fig 16. RO water plant

Fig 17. Rainwater harvesting recharge pit

Nonconformity: -

The institute does not review the feasibility and cost-effectiveness of water reuse options.

Leak detection:

- Conduct a leak detection survey to identify potential leaks in the plumbing system.
- Review the performance of the plumbing system and identify opportunities to fix leaks and reduce water consumption.

- During the time of the audit, leaks were found in the plumbing system. Reference fig/doc: fig 18
- The performance of the plumbing system was found very poor, and it can be improved using the following ways and documenting them also. Reference fig/doc: - fig 18

To review the performance of the plumbing system and identify opportunities to fix leaks and reduce water consumption in the existing educational building, follow these steps:

1. Plumbing Inspection:
   Conduct a comprehensive inspection of the entire plumbing system, including pipes, fixtures, faucets, toilets, showers, and any other water-related equipment. Look for visible leaks, water stains, or signs of water damage.

2. Water Meter Monitoring:
   Monitor the water meter regularly to track water consumption patterns and detect any sudden increases in usage, which could indicate leaks.

3. Leak Detection Survey:
   Perform a leak detection survey to systematically check for hidden leaks in the plumbing system.
   Utilize advanced leak detection tools, such as acoustic leak detectors or thermal imaging cameras, to identify leaks in pipes.

4. Repair Promptly:
   Address any identified leaks or plumbing issues promptly to prevent water wastage and potential damage to the building structure.

5. Faucet Upgrades:
   Replace old and inefficient faucets with low-flow or aerated faucets that reduce water consumption while maintaining satisfactory water pressure.

6. Toilet Upgrades:
   Install high-efficiency toilets (HETs) or dual-flush toilets to minimize water usage per flush.
   Check and repair toilet flappers regularly to prevent water leaks in the toilet tanks.

7. Showerhead Upgrades:
   Replace standard showerheads with low-flow showerheads to reduce water consumption during showers.

8. Greywater Recycling:
   Implement a greywater recycling system to capture and treat wastewater from sinks, showers, and laundry for reuse in non-potable applications, such as toilet flushing or irrigation.

9. Rainwater Harvesting:
   Install rainwater harvesting systems to collect and store rainwater for landscape irrigation or other non-potable uses.

10. Education and Awareness:
    Educate building occupants, students, and staff about the importance of water conservation and how to report water leaks or wastage.

11. Regular Maintenance:
    Establish a scheduled maintenance plan to check and maintain plumbing fixtures, pipes, and equipment.
    This includes repairing or replacing any deteriorated or malfunctioning components.

12. Water Use Monitoring:
    Implement a water usage monitoring system to continuously track water consumption trends and identify opportunities for improvement.

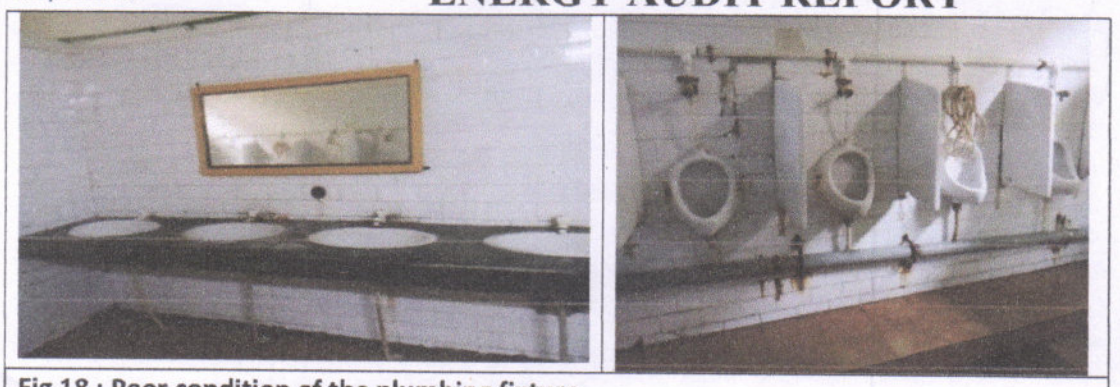


Fig 18 : Poor condition of the plumbing fixture

Education and awareness:	
• Develop education and awareness programs to promote water conservation and encourage sustainable water usage. • Identify opportunities to engage occupants and stakeholders in water conservation efforts.	• No records provided by the institute during the time of audit. • The opportunities to engage occupant and stakeholder in water conservation efforts are given in the following table below

Opportunities for the upgrade:

To engage occupants and stakeholders in water conservation efforts for the existing educational building during an energy audit, consider the following opportunities:

1. Awareness Campaigns:
   Launch awareness campaigns to educate building occupants, students, faculty, and staff about the importance of water conservation and its impact on the environment.
   Use posters, flyers, and digital displays to communicate water-saving tips and information about ongoing water conservation initiatives.

2. Interactive Workshops and Seminars:
   Organize workshops and seminars focused on water conservation techniques and practices.
   Invite experts to share insights and success stories on water-saving initiatives.

3. Student Involvement:
   Involve students in designing and implementing water conservation projects, fostering a sense of ownership and responsibility.
   Create student-led water conservation clubs or committees to promote sustainable practices.

4. Competition and Challenges:
   Organize water-saving competitions among different classrooms, departments, or residential areas within the building.
   Recognize and reward individuals or groups who demonstrate outstanding water conservation efforts.

5. Interactive Displays and Dashboards:
   Install interactive displays or digital dashboards that show real-time water consumption data.
   Encourage occupants to monitor and track their water usage to create a sense of accountability.

6. Regular Communication:
   Send periodic newsletters or emails to occupants, sharing water-saving tips, updates on water conservation projects, and progress reports.

7. Incorporate Water Conservation into Curriculum:
   Integrate water conservation topics into the educational curriculum, incorporating sustainability and environmental awareness across different subjects.

8. Water-Saving Fixtures:
   Label water-saving fixtures and equipment to raise awareness about their role in water conservation.
   Explain the benefits of using such fixtures to the building occupants.

9. Partnerships and Collaborations:
   Collaborate with local environmental organizations or water authorities to organize joint water conservation events and initiatives.

10. Feedback and Suggestion Mechanisms:
    Set up channels for occupants to provide feedback, suggestions, or report water-related issues easily.
    Act promptly on reported water leaks or wastage to show responsiveness to their concerns.

11. Leadership and Role Modeling:
    Encourage building leaders, such as administrators or teachers, to lead by example in practicing water conservation.
    Display water-saving behaviors and practices for others to emulate.

12. Recognition and Certifications:
    Celebrate achievements in water conservation by awarding certificates or plaques to individuals or groups who have made significant contributions.

Non conformity:

The college has not developed and implemented education and awareness programs aimed at promoting water conservation and encouraging sustainable water usage practices among students, staff, and stakeholders.

Energy Audits & Assessments

Energy data collection:	
• Collect data on the building's energy consumption, including electricity, natural gas, and other fuels. • Collect data on the building's operational schedules, occupancy levels, and other factors that may impact energy consumption.	• The building energy consumption data for the 12 month is shown in the fig below. Reference appendix table: Table 2 • The building operates for 300 days per year, while certain areas are operational for 365 days. The occupancy level is higher from January to may and from August to November. Additionally, other factors, such as temperature variations throughout the day and seasonal changes, influence the scheduling and fundamental aspects of the building's operations.

Energy Consumption (Total consumption of last 12 months- 22-23)

Building name	Building size (square mtr.)	Electricity consumption (kWh)	Natural gas consumption (Kg)	Fuel oil consumption (gallons)	Solar Energy (kWh)
Academic block- II, II, III	20760	608261	1092 kg/ year	Not available	467787.6
Academic-5, library	7465				
Business school	10357				
Workshop	4458				
Senior boys' hostel	5710				
Junior boys' hostel	5933				
Girls hostel block- A& B	968				
Girls hostel C	1314				
Girlshostel D	2313				
Staff qtr- 1	918				
Staff qtr- 2	1380				

Canteen	426				
Class IV	125				
Service area	445				
STP	120				
TOTAL	62692				

Energy Consumption ((Average monthly consumption)					
Building name	Building size (square mtr.)	Electricity consumption (kWh)	Natural gas consumption (Kg)	Fuel oil consumption (gallons)	Solar Energy (kWh)
Academic block- II, II, III	20760	50688.42	15+ (19*4) = 91 kg *Commercial cylinder	Not available	38982.3
Academic-5, library	7465				
Business school	10357				
Workshop	4458				
Senior boys' hostel	5710				
Junior boys' hostel	5933				
Girls hostel block- A& B	968				
Girls hostel C	1314				
Girlshostel D	2313				
Staff qtr- 1	918				
Staff qtr- 2	1380				
Canteen	426				
Class IV	125				
Service area	445				
STP	120				
TOTAL	62692				

Metering Information:				
Electricity meter number	**Natural gas meter number:**	**Other Source meter number**		
UPO85156	**NA**	**NA**		

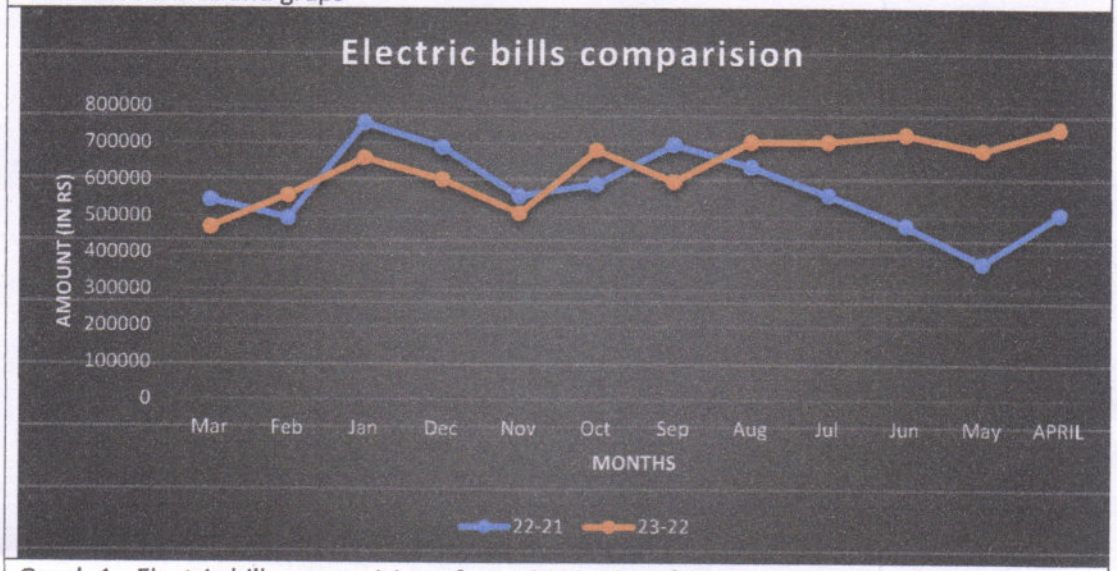
Cost/Billing Information (Data Collection Period Apr-23 To Apr -22)

Electricity billing period (month/year)	Electricity provider:	Electricity account number:	Electricity cost (Rs/kWh)
Mar-23	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	471100.15
Feb-23	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	558259.43
Jan-23	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	660847.11
Dec-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	603113
Nov-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	511043.74
Oct-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	683198.20
Sep-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	597104.39
Aug-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	705374
Jul-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	705373.78
Jun-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	725228.60
May-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	682294.49
Apr-22	Dakhsinanchal Vidyut Bitran Nigam Ltd.	781726695486	741455.97
Total Annual Cost - 7644392.86			
Average Monthly Cost- 637032.67			

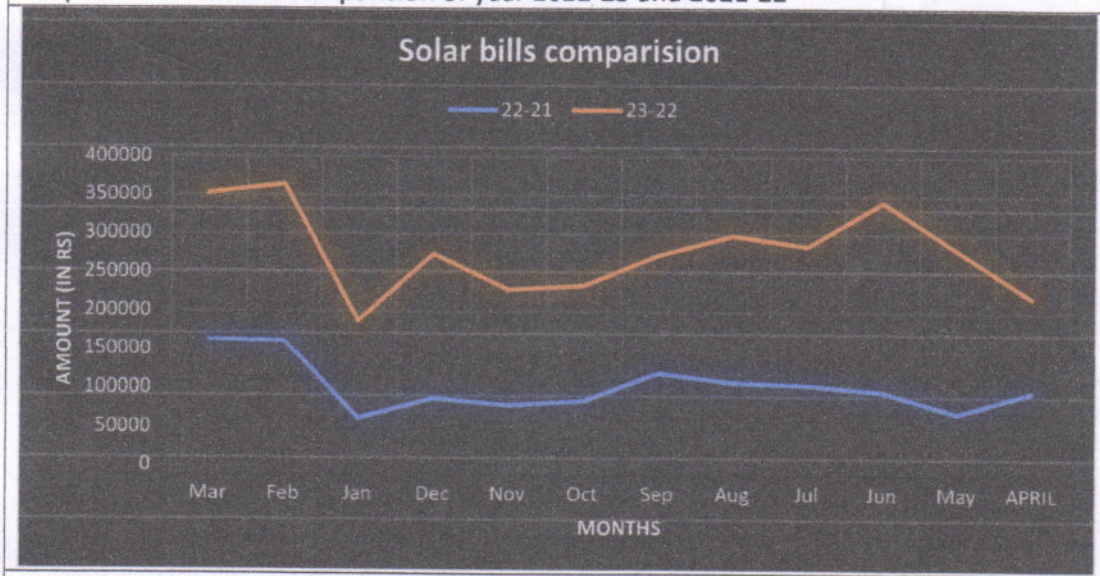
Energy modeling and simulation:	
• Use energy modeling software to simulate the building's energy performance and identify opportunities for energy savings. • Evaluate the performance of various energy-saving measures, such as upgrading HVAC systems, improving insulation, and implementing renewable energy sources.	Not Available

Cost-benefit analysis:	
• Evaluate the cost-effectiveness of potential energy-saving measures. • Consider the upfront costs of implementation, as well as the long-term savings in energy costs and carbon emissions.	According to the cost-benefit analysis, the expenses for electricity and solar bills were higher in the year 2022-2023 compared to 2021-2022. Related documents – Graph 1 & 2, table 5

Reference tables and graps-



Graph 1.- Electric bills comparision of year 2022-23 and 2021-22



Graph 2.- solar bills comparision of year 2022-23 and 2021-22

	Mar 22- April 21	Mar23- April 22

Electricity billing period (month/year)	Electricity bill	Solar bill	Electricity bill	Solar bill
Mar	544722	162918	471100.15	189990
Feb	495454	161325	558259.43	203062.50
Jan	754394	61060.5	660847.11	126112.50
Dec	689539	87061.5	603113	187087.50
Nov	556947	78930	511043.74	149175
Oct	589884	84285	683198.20	148252
Sep	697284	120285	597104.39	152752
Aug	636540	108000	705374	190102.50
Jul	560491	104571	705373.78	180270
Jun	476309	96759	725228.60	245835
May	373032	69232.5	682294.49	210775.50
APRIL	508611	96390	741455.97	121628.70

Table-5, Comparision tables of electric bill and solar bill

Energy conservation related certifications / awards

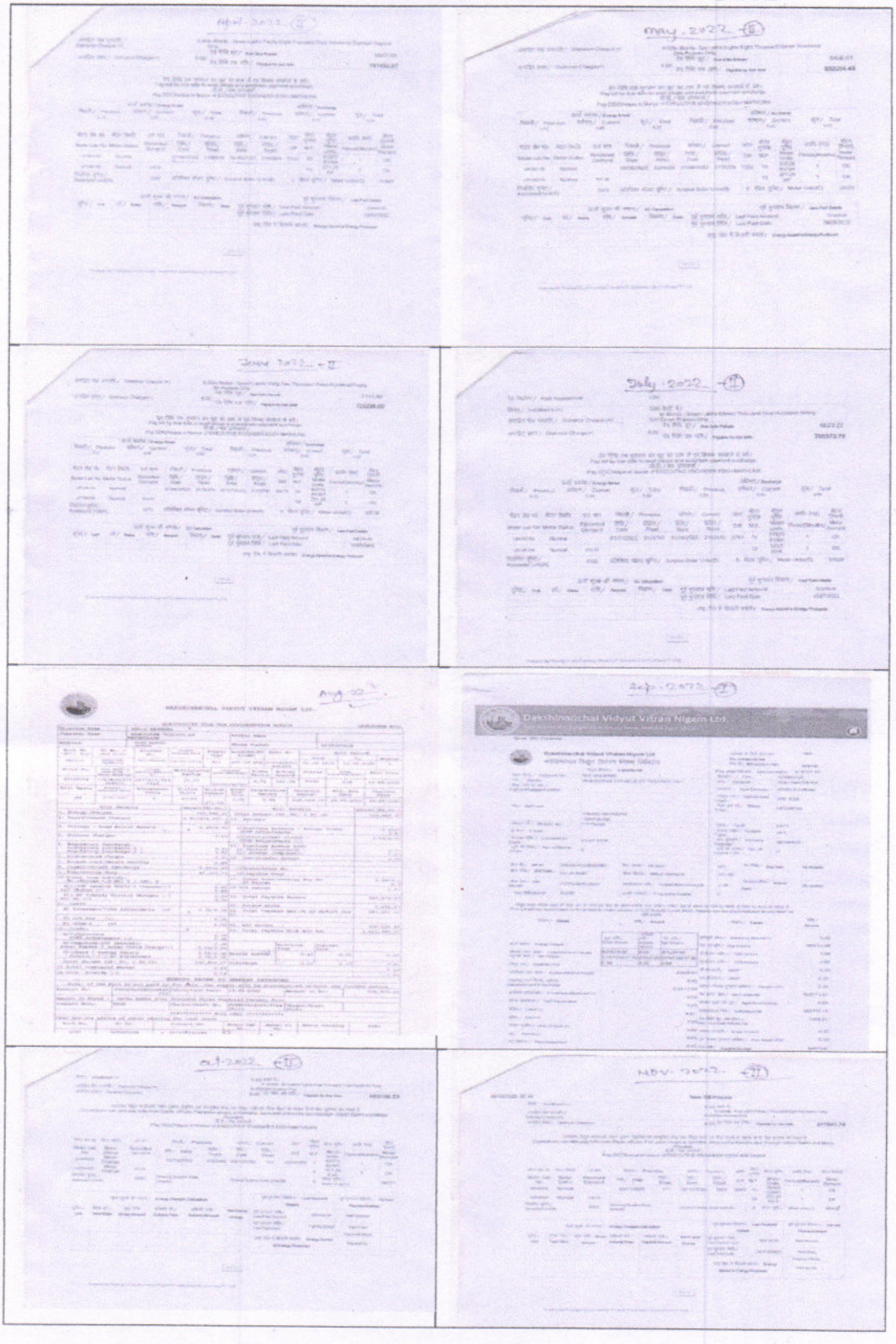
NOT AVAILABLE

Appendix data

Table 1 showing the different equipment in the Building.

SN	Particulars	Quantity	Load
1.	LED bulb 9w	17	216 w/hr
2.	LED Tube light	38	11-22 w/hr
3.	CFL bulb	68	13-15 w/hr
4.	Tube light	284	96.4 w/hr
5.	Ciling lamp	6	10 w/hr
6.	Fan 100W	291	70-75 w
7.	Wall fan	39	45-55 w
8.	EXUST FAN	17	6 w/hr
9.	Ductable Ac	2	436 KW
10.	Portable AC (Split + window) 1.5 Ton	22	527.53 KW
11.	Computer	650	200-500 w/hr
12.	Printer	50	30-50 w/hr
13.	Cooler	1	1 kwh
14.	Water pump	4	50kw
15.	Water hetar	30	3kw/hr
Set Temperature point=50 ^{0}C for the water heater and solar heater			

Table 2: showing the electricity bills of the college



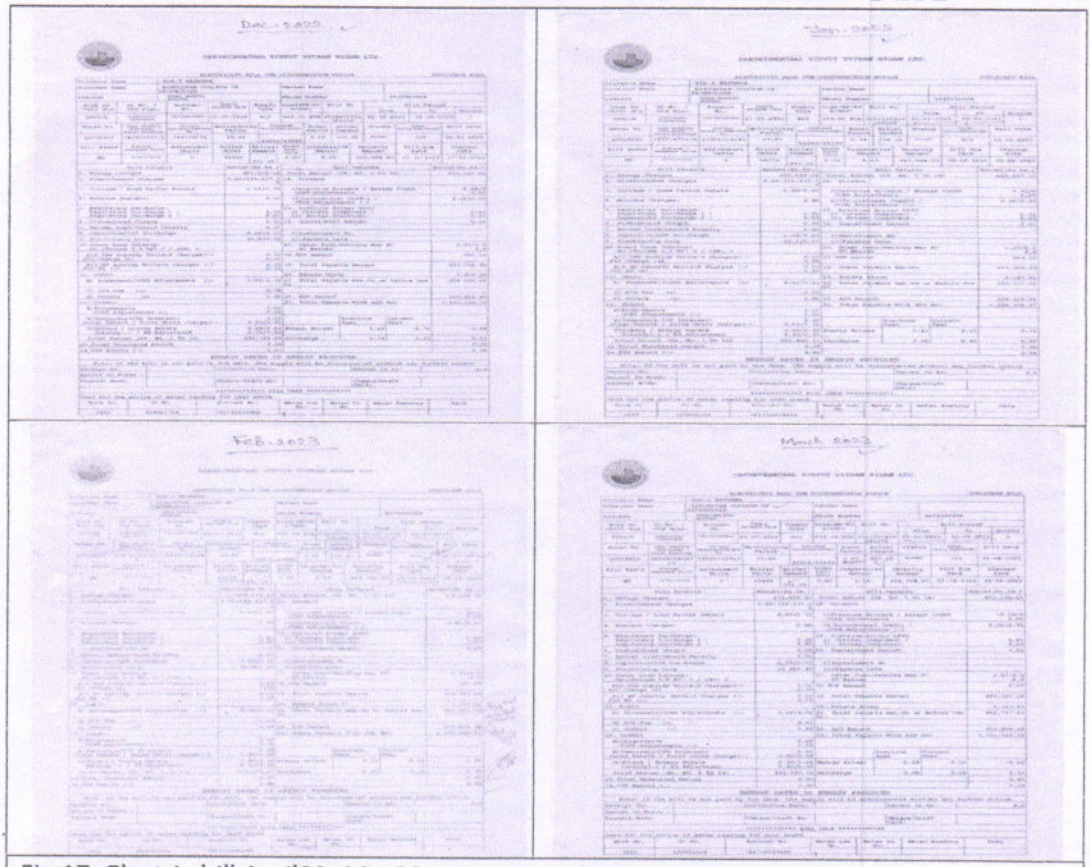


Fig 17- Electric bill April22- Mar23

Appendix 2

General Energy Conservation Tips

1. Electricity
   - 1.1. Schedule your operations to maintain a high load factor
   - 1.2. Minimize maximum demand by tripping loads through a demand controller
   - 1.3. Use standby electric generation equipment for on-peak high load periods.
   - 1.4. Correct power factor to at least 0.99 under rated load conditions.
   - 1.5. Set transformer taps to optimum settings.
   - 1.6. Shut off unnecessary computers, printers, and copiers at night.
2. Motors
   - 2.1. Properly size to the load for optimum efficiency.
   - 2.2. (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)
   - 2.3. Check alignment.
   - 2.4. Provide proper ventilation.
   - 2.5. (For every 10°C increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
   - 2.6. Check for under-voltage and over-voltage conditions.

2.7. Balance the three-phase power supply.
2.8. (An Imbalanced voltage can reduce 3 - 5% in motor input power)
2.9. Demand efficiency restoration after motor rewinding.

3. Fans
   3.1. Use smooth, well-rounded air inlet cones for fan air intakes.
   3.2. Avoid poor flow distribution at the fan inlet.
   3.3. Minimize fan inlet and outlet obstructions.
   3.4. Clean screens, filters, and fan blades regularly.
   3.5. Use aero foil-shaped fan blades.
   3.6. Minimize fan speed.
   3.7. Use low-slip or flat belts.
   3.8. Check belt tension regularly.
   3.9. Eliminate variable pitch pulleys.
   3.10. Use variable speed drives for large variable fan loads.
   3.11. Use energy-efficient motors for continuous or near-continuous operation
   3.12. Eliminate leaks in ductwork.
   3.13. Minimize bends in ductwork
   3.14. Turn fans off when not needed.

4. Pumps
   4.1. Operate pumping near best efficiency point.
   4.2. Modify pumping to minimize throttling.
   4.3. Adapt to wide load variation with variable speed drives or sequenced control of smaller offices.
   4.4. Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
   4.5. Use booster pumps for small loads requiring higher pressures.
   4.6. Increase fluid temperature differentials to reduce pumping rates.
   4.7. Repair seals and packing to minimize water waste.
   4.8. Balance the system to minimize flows and reduce pump power requirements.
   4.9. Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.

5. HVAC (Heating / Ventilation / Air Conditioning)
   5.1. Tune up the HVAC control system.
   5.2. Consider installing a building automation system (BAS) or energy management
   5.3. system (EMS) or restoring an out-of-service one.
   5.4. Balance the system to minimize flows and reduce blower/fan/pump power requirements.
   5.5. Eliminate or reduce reheat whenever possible.
   5.6. Use appropriate HVAC thermostat setback.
   5.7. Use building thermal lag to minimize HVAC equipment operating time.
   5.8. In winter during unoccupied periods, allow temperatures to fall as low as possible without freezing water lines or damaging stored materials.

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

5.10. Improve control and utilization of outside air.

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

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

5.13. Optimize ventilation.

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

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

5.16. Use evaporative cooling in dry climates.

5.17. Clean HVAC office coils periodically and comb mashed fins.

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

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

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

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

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

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

5.24. Consider reducing ceiling heights.

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

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

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

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

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

5.30. Purchase only high-efficiency models for HVAC offices.

5.31. Put HVAC window offices on timer control.

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

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

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

5.35. Minimize HVAC fan speeds.

5.36. Consider desiccant drying of outside air to reduce cooling requirements I humid climates.

5.37. Seal leaky HVAC ductwork.

5.38. Seal all leaks around coils.
5.39. Repair loose or damaged flexible connections (including those under air handling offices).
5.40. Eliminate simultaneous heating and cooling during seasonal transition periods.
5.41. Zone HVAC air and water systems to minimize energy use.
5.42. Inspect, clean, lubricate, and adjust damper blades and linkages.
5.43. Establish an HVAC efficiency-maintenance program. Start with an energy audit and follow-up, then make an HVAC efficiency-maintenance program a part of your continuous energy management program.

6. Lighting
   6.1. Reduce excessive illumination levels to standard levels using switching; decamping, etc. (Know the electrical effects before doing de-lamping.)
   6.2. Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
   6.3. Install efficient alternatives to incandescent lighting, mercury vapour lighting, etc. Efficiency (lumens/watt) of various technologies range from best to worst
   6.4. approximately as follows: low pressure sodium, high-pressure sodium, metal halide, fluorescent, mercury vapour, incandescent.
   6.5. Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
   6.6. Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
   6.7. Consider lowering the fixtures to enable using less of them.
   6.8. Consider day lighting, sky lights, etc.
   6.9. Consider painting the walls a lighter color and using less lighting fixtures o lower wattages.
   6.10. Use task lighting and reduce background illumination.
   6.11. Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.
   6.12. Change exit signs from incandescent to LED.
7. DG sets
   7.1. Optimize loading
   7.2. Use waste heat to generate steam/hot water /power an absorption chiller or
   7.3. preheat process or utility feeds.
   7.4. Use jacket and head cooling water for process needs
   7.5. Clean air filters regularly
   7.6. Insulate exhaust pipes to reduce DG set room temperatures
   7.7. Use cheaper heavy fuel oil for capacities more than 1MW
8. Buildings
   8.1. Seal exterior cracks / openings / gaps with caulk, gasketing, weather stripping, etc.
   8.2. Consider new thermal doors, thermal windows, roofing insulation, etc.
   8.3. Install windbreaks near exterior doors.
   8.4. Replace single-pane glass with insulating glass.

8.5. Consider covering some window and skylight areas with insulated wall panel inside the building.
8.6. If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.
8.7. Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.
8.8. Use landscaping to advantage.
8.9. Add vestibules or revolving doors to primary exterior personnel doors.
8.10. Consider automatic doors, air curtains, strip doors, etc. at high-traffic passages between conditioned and non-conditioned spaces. Use self-closing doors if possible.
8.11. Use intermediate doors in stairways and vertical passages to minimize building stack effect.
8.12. Use dock seals at shipping and receiving doors.
8.13. Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

9. Water & Wastewater
9.1. Recycle water, particularly for uses with less-critical quality requirements.
9.2. Recycle water, especially if sewer costs are based on water consumption.
9.3. Balance closed systems to minimize flows and reduce pump power requirements.
9.4. Eliminate once-through cooling with water.
9.5. Use the least expensive type of water that will satisfy the requirement.
9.6. Fix water leaks.
9.7. Test for underground water leaks. (It's easy to do over a holiday shutdown.)
9.8. Check water overflow pipes for proper operating level.
9.9. Automate blow down to minimize it.
9.10. Provide proper tools for wash down -- especially self-closing nozzles.
9.11. Install efficient irrigation.
9.12. Reduce flows at water sampling stations.
9.13. Eliminate continuous overflow at water tanks.
9.14. Promptly repair leaking toilets and faucets.
9.15. Use water restrictors on faucets, showers, etc.
9.16. Use self-closing type faucets in restrooms.
9.17. Use the lowest possible hot water temperature.
9.18. Do not use a heating system hot water boiler to provide service hot water during the cooling season -- install a smaller, more-efficient system for the cooling season service hot water.
9.19. If water must be heated electrically, consider accumulation in a large insulated storage tank to minimize heating at on-peak electric rates.
9.20. Use multiple, distributed, small water heaters to minimize thermal losses in large piping systems.
9.21. Use freeze protection valves rather than manual bleeding of lines.
9.22. Consider leased and mobile water treatment systems, especially for deionized water.

9.23. Seal sumps to prevent seepage inward from necessitating extra sump pump operation.
9.24. Install pre-treatment to reduce TOC and BOD surcharges.
9.25. Verify the water meter readings. (You'd be amazed how long a meter reading can be estimated after the meter breaks or the meter pit fills with water!)
9.26. Verify the sewer flows if the sewer bills are based on them

10. Miscellaneous
10.1. Meter any unmetered utilities to know what normal efficient use is. Track down causes of deviations.
10.2. Shut down spare, idling, or unneeded equipment.
10.3. Make sure that all of the utilities to redundant areas are turned off – including utilities like compressed air and cooling water.
10.4. Install automatic control to efficiently coordinate multiple air compressors, chillers, cooling tower cells, boilers, etc.
10.5. Renegotiate utilities contracts to reflect current loads and variations.
10.6. Consider buying utilities from neighbors, particularly to handle peaks.
10.7. Leased space often has low-bid inefficient equipment. Consider upgrades if your lease will continue for several more years.
10.8. Adjust fluid temperatures within acceptable limits to minimize undesirable heat transfer in long pipelines.
10.9. Minimize use of flow bypasses and minimize bypass flow rates.
10.10. Provide restriction orifices in purges (nitrogen, steam, etc.).
10.11. Eliminate unnecessary flow measurement orifices.
10.12. Consider alternatives to high-pressure drops across valves.
10.13. Turn off winter heat tracing that is on in summer.

Signature:

ANAB

ANSI National Accreditation Board

CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

CDG Inspection Limited
002, 4th Floor, Office Block, MGF Metropolis Mall
MG Road, Gurgaon, Haryana, India

Fulfills the requirements of

ISO/IEC 17020:2012

In the field of

INSPECTION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 25 November 2024
Certificate Number: AI-2927

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ilac-MRA

An inspection body's fulfilment of the requirements of ISO/IEC 17020:2012 means the inspection body meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid inspection results (refer to joint ISO-ILAC-IAF Communiqué dated Sept 2013).

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SCOPE OF ACCREDITATION TO ISO/IEC 17020:2012

CDG INSPECTION LIMITED

002, 4th Floor, Office Block, MGF Metropolis Mall
MG Road, Gurgaon, Haryana, India
Shashi Shekhar, Managing Director
info@cdginspection.com, +001 91 95555 777 22

INSPECTION
TYPE A (THIRD-PARTY) BODY

Valid to: **November 25, 2024** Certificate Number: **AI-2927**

Inspection

Items, Materials OR Products Inspected	Type and Range of Inspection	Methods and Procedures
C-TPAT Supply Chain Security **Risk Assessment** for ICD's (Inland container depot), CFS (container freight stations), Terminal Operators, Warehouses, Logistic Providers and Foreign Manufacturers	Security concerns in: - Employees (employees hiring, termination) - Physical Facility (barriers, gates, lightings, alarms and locks) - In-out (employees, visitors and vehicles) - Information Access (computers access, password protection, computers safeguarding) - Containers control (shipping dock, container physical condition, seal and key) - Procedures (documented and instructions are clearly indicated) - Security awareness training	US Custom Border Protection Document C-TPAT Minimum Security Criteria – March 2020 https://www.cbp.gov/border-security/ports-entry/cargo-security/ctpat-customs-trade-partnership-against-terrorism/apply/security-criteria

Fire Safety and Electrical Inspection	Inspection and review of Electrical Safety Processes (Fire Protection, Emergency Lighting) at Construction Site(s), Commercial Establishment(s), residential projects, and Factory Premises. Inspection of firefighting equipment, fire safety provisions & fire safety preparedness. Inspection of fire doors.	Customer Specified Specification, Relevant project Specification in the form of Inspection and Test Witness Plan and Applicable National & International Codes and Standards, Statutory and regulatory requirement, such as below. National Building Code of India 2016 (NBC 2016) IS 1641 `Code of Practice for Fire Safety of Buildings (General): General Principles of Fire Grading and Classification' IS 1642 'Fire Safety of Buildings (General): Details of Construction – Code of Practice' IS 1643 'Fire Safety of Buildings (General): Exposure Hazard - Code of Practice' IS 1644 'Fire Safety of Buildings (General) : Exit Requirements and Personal Hazard - Code of Practice' IS 2189 'Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of Practice' IS 15105 'Design and Installation of Fixed Automatic Sprinkler Fire Extinguishing Systems - Code of Practice' IS:1646 Fire safety of buildings (general) electrical installation IS:1913 General and safety requirements of electric lighting fittings IS:3034 Fire safety of industrial buildings (Electrical generation and distribution stations) IS 3614-1 (Inspection of Fire Door) NFPA 101 - Life Safety Code (for fire safety audit) NFPA 70E - Standard for Electrical Safety in the Workplace (for electrical safety audit)

Inspection

Items, Materials OR Products Inspected	Type and Range of Inspection	Methods and Procedures
		NFPA 70 - National Electrical Code (for electrical safety audit) NFPA 170 - Fire Safety and Emergency Symbols (for fire safety audit)
Pre-shipment (Visual) inspection Inspection of Consumer Goods being manufactured in Factory Premises, Godown and Warehouse	Sample Picking for visual Inspection, ensuring quantity, type, self-declaration of factory for guaranteed particulars as per Purchase Order Specifications of each client	Internal Procedure/checklist- CIL-08,Issue 01,Rev0, 01.07.2019 ANSI/ASQ Z1.4-2003, as per the sampling plan: follow customer's instruction regarding the sampling plan ISO 2859-1:1999 for sampling plan, or as indicated in Purchase Order Specifications of each client
Factory Inspection / **Institutional** Inspection	Walk thru, interview and review of records for compliance to various requirements as stipulated in The Factories Act, 1948, as amended by the Factories Act, 1987, serves to assist in formulating national policies in India with respect to occupational safety and health in factories and docks in India. (Safety, health, efficiency and well-being of the persons at workplaces) Ch III (11-20), Ch IV-IVA, (21-41H)	Internal Procedure-CIL-09, Issue 01, Rev 0 (01.07.2019). to comply to applicable Safety Requirement of Indian Factory Act 1948 and IS 14489
Office Documentation Review/Personnel Interview/Audit Activities Function: Agricultural commodities grains, food grain, animal feeding stuffs, pulses, rice, wheat	Verification of conformity of inspected item by review of documentation	Mandatory verification of conformity requirements (National/International Standards) appropriate to the importing country meeting contract of sale or documentary credit requirements

Inspection

Items, Materials OR Products Inspected	Type and Range of Inspection	Methods and Procedures
Physical Inspection: Agricultural Commodities & By-Products in Bulk & Bags Food Grains, Animal Feeding Stuffs, Oil Seeds, De-oiled Cakes, Pulses, Rice, Milled Products of Oilseeds, Edible Oils and Fats	Pre-Shipment Inspection, Sampling, Quantity & Quality Assessment, Weighing Supervision / Attendance During Loading & Discharging of Cargoes from Vessel, Barge, Container, Railway Wagons & Trucks, Load Compartment Inspection (L C I) Hose Testing, Hold Inspection, Hold Sealing & Draft Survey. Cargo Inspection, Sampling & Weighing, Supervision / Attendance During Loading & Discharging of Cargoes from Vessel, Barge, Flex tank Containers, Railway Wagons & Road Tankers etc. Animal & Vegetable Fats and Oils – Sampling	GAFTA (conform GAFTA rules 124) GAFTA (conform GAFTA rules 123) GAFTA (conform Code of Practice for Approved Superintendents and/or contract of sale, terms, or documentary credit requirements and specific Client's requirements FOSFA International Code of Practice for Member Superintendents Part one. ISO 5555:2001 As per customer's requirements in the form of work order
Physical Inspection: Refined Sugar and Raw Sugar in Bulk & Bags	Pre-Shipment Inspection, Sampling & Weighing, Supervision / Attendance during Loading & Discharging of Cargoes from Vessel, Barge, Containers, Railway Wagons & Trucks.	Refined Sugar Association Rules and Regulations Sugar Association of London Rules and Regulations
Container Seal Inspections / Security seal inspection, including Process Review of engineering and Design features and Method of Construction at Manufacturer's Premises	Container Seal Inspection includes the requirements specified in C-TPAT bulletin for security seal for an audit of manufacturer's security-related business processes to ensure effectiveness of a high-quality security seal according to ISO 17712. ASTM F 1158- Evaluation of Tampering of Security Seals	ISO 17712:2013-Freight Containers-Mechanical Seals, C-TPAT Bulletin ASTM F 1158- Evaluation of Tampering of Security Seals

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Inspection

Items, Materials OR Products Inspected	Type and Range of Inspection	Methods and Procedures
Environmental Inspection/Survey Green Audit/Inspection as per NAAC (National Assessment and Accreditation Council - India) Requirement Energy Audit/Inspection	Walk thru inspection, interview, and review of records / documents. Inspection and review of environment processes and procedures. Inspection of building premises. Evaluation / checking of statutory / regulatory environmental compliances. Evaluation of activities related to pollution control and betterment of environment and surroundings. Spot checking/Testing environmental parameters (air, water, noise, etc.) using handheld equipment. Collecting/sealing samples for various environmental tests. Evaluation of energy conservation activities by reviewing declared and installed system	CDG Inspection Procedure- SP-13, 21 incorporating applicable requirements stipulated in • Environment (Protection) Act, 1986 • The Water (Prevention and Control of Pollution) Act, 1974 • The Air (prevention and control of pollution) act, 1981 • The energy conservation act, 2001 • The Hazardous Waste Management Rules, 2016. • The Biological Diversity Act 2002 • The National Green Tribunal Act, 2010 • The Wildlife Protection Act, 1972 • The Forest (Conservation) Act, 1980 • ASOSAI (The Asian Organization of Supreme Audit Institutions) Guidance on 'environmental audit'

Note:

1. The key activities at the address mentioned above include, but not limited to - quality management functions, administration & accounts, Marketing, contract review, planning for inspection & Inspection personnel authorization, assignment of inspection personnel, conduct of inspection, issuance of inspection report and inspection certificate.
2. Geographic coverage of this Scope is limited to India.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AI-2927.

R. Douglas Leonard Jr., VP, PILR SBU

Techno Commercial Proposal

CDG Inspection

Date: 13_/_12/2022

To

M/S Hindustan College of science & Technology (Farah Mathura-u.p.)

Sub:	Proposal for Energy Audit

Technical Proposal

- CDG is an ISO 17020 accredited inspection agency (through a valid ILAC-approved accreditation board).
- Our environmental inspection/Energy audit checklist is based on different environmental/energy acts of India, ASOSAI environmental/energy audit guidelines & standard environmental/energy practices.
- Our inspector will cover the following areas:

  a. Compliance with applicable environmental/energy legislation.
  b. Environmental/energy impact assessment (impact of organization's activities over its surroundings).
  c. Environmental practices: Land use, plantation, biodiversity, natural forest (if applicable), rainwater harvesting, etc.
  d. Energy - energy conservation, efficient use of energy, use of green energy
  e. Building: sustainable/green building (natural light, air, water management, energy-efficient equipment, etc.)
  f. Awareness & Training – environmental/energy awareness & training program of the organization (for its employees & stakeholders).

CDG Inspection

Commercial Proposal

Nature of building / organization : Hindustan College of science & Technology

Approximate Area: 17 acre

Total Fee: 45,000/-

Note: The above-mentioned fee does not include travelling & stay cost and the same will be charged as actual (if applicable).

Terms & Conditions:

- GST is additional (not included in the above-mentioned fee)
- Fee should be paid in favor of 'CDG Inspection Limited' only. No cash payment should be made in any situation.
- The above fee does not include the cost of any kind of consultancy, training, or clerical work.
- The above-mentioned scope of work does not include any kind of consultancy, training, or clerical work.
- Inspection/ compliance assessment shall be restricted/limited to the scope & location for which the quotation has been issued. If a quote has been generated for inspection, it does not include any testing fee.
- Testing shall be restricted/limited to the product & standard for which the quotation has been issued
- CDG will conduct an unbiased test/inspection/assessment and will record the actual findings. The client cannot force or request CDG for a favorable report (Test report, inspection report, assessment report, etc.).
- The process of inspection / testing / assessment shall be initiated only after receipt of Application form and fee.
- CDG Inspection Limited' can issue non-accredited inspection reports/assessment reports/test reports in the sectors for which CDG is not accredited.
- Above mentioned service completion time is tentative only & may change due to any reason. Though CDG will give maximum effort to complete offered services in time, it cannot be a legally binding condition & the client organization cannot make any kind of claim for the same.
- All due payments (if any) should be made before inspection/testing/assessment (Before completion of the work) and failure to do this can lead to cancellation of the application & in this situation no previous payment will be refunded.
- The fee once paid is not refundable under any circumstances. Above fee is for initial inspection / testing / assessment only & does not cover costs like re-visit, retest, periodic checks etc. CDG will raise additional payment demands for such services (ex; retest, additional visits, periodic checks/inspections, etc.).
- Costs related to travel & stay will be additional (not included in the above-mentioned fee) & charged as actual.
- CDG Inspection Limited reserves rights to outsource any inspection/testing/certification activity to any associated company.

- Though CDG will try to conduct an unbiased and error-free test/inspection/assessment there may be some unintentional errors/mistakes (due to human negligence or technical faults). Upon identification of such errors/mistakes, CDG will try to correct them, but the client cannot make any kind of claim (viz: compensation of loss, damage, etc.). In any case, CDG's gross responsibility is limited to the service fee paid by the client.
- Any dispute is subjected to judiciary of NCT of Delhi only.

CDG Representative:

Signature
Chanda Mishra

CDG Inspection

ORGANISATION'S DETAILS		
Organisation Company name as in official registration (register of companies or other)		
Official Address Complete street address as in official registration): Number and street, place, ZIP/postal code, state/province, country		
GST No. (if GST is not applicable on your organization, please leave this field blank)		
Top management e.g. CEO or Managing Director – **Name, position, telephone, mobile, e-mail**	**Name:**	**Mobile No.**
	Designation:	**Email:**
Responsible / Contact Person e.g. Management Representative – **Name, position, telephone, Mobile, e-mail**	**Name:**	**Mobile No.**
	Designation:	**Email:**

Service (s) Required			
Inspection/Certification	☐	Testing	☐
Service Description:			
Total Fee: Rs.		Amount Paid: Rs.	
In Favour of:		Bank:	
Mode of Payment:	☐ Cheque	☐ Bank Transfer	☐ Payment Gateway
Payment Details (Please mention cheque no. / NEFT/ RTGS/ IMPS / Transaction Reference ID)			

CDG
Inspection

Terms & Conditions

- GST additional, as applicable at the time of billing.
- Boarding, lodging and travel expenses of inspectors / technicians / auditors shall be additional and billed to the client organization (if required)
- Inspection / compliance assessment shall be restricted to the scope & location for which quote is requested by the client organization.
- Fee paid is not refundable under any circumstances. Above fee is for initial inspection / testing / assessment only & does not cover costs like re-visit, periodic checks etc.
- 'CDG Inspection Limited' can issue non-accredited inspection/test reports in the sectors for which CDG is not accredited.
- This quotation is for Compliance testing / inspection / assessment only & does not include any kind of consultancy or training.
- Our product certification schemes are voluntary & we issue compliance certification only.
- The process of inspection / testing / assessment shall be initiated only after receipt of Application form and fee.
- Fee should be paid in favour of 'CDG Inspection Limited' only. No cash payment should be made in any situation.
- All due payments (if any) should be made before inspection / testing /assessment (Before completion of work) and failure to this can lead to cancellation of application & in this situation no previous payment will be refunded.
- CDG Inspection Limited reserves rights to outsource any inspection/testing/certification activity to any associated company.
- Any dispute is subjected to judiciary of NCT of Delhi. In any case CDG's gross responsibility is limited to fee paid only.

Client Declaration

I/We hereby declare that I/we have read above mentioned terms & conditions and I/we undertake to abide by all the terms and conditions of this application form. I/we agree with above mentioned terms & conditions.

Client Representative Name _____

Designation _____

Signature with Company Seal

Date _____

Note: If this application form is electronically filled & sent to our email, it will be considered as signed.