



Aliah University

(Under the Department of Minority Affairs and Madrasah Education, Govt. of West Bengal)
IIA/27, New Town, Kolkata - 700160, West Bengal


Environmental Consciousness and Sustainability

7.1.6. Quality audits on environment and energy are regularly undertaken by the institution

7.1.6.1. The institutional environment and energy initiatives are confirmed through the following

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

Attached below are Institutional Data in the prescribed format, Green Campus Policy, Scanned copy of Green Audit, Energy Audit, Extracts of Reports of NSS activities of tree plantation, Swach Bharat Abhiyan programs.


02/05/24
Registrar (Officiating)
Aliah University
New Town, Kolkata-700160

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7.1.6.1. The institutional environment and energy initiatives are confirmed through the following

1. Green audit /environment audit	Yes
2. Energy audit	Yes
3. Clean and green campus recognitions/awards	No
4. Beyond the campus environmental promotional activities	Yes

Beyond the campus environmental promotional activities :



OBSERVATION OF SWACHHTA PAKHWARA

- The NSS Volunteers and Programme Officer, NSS on 14th August 2018 organised a programme for cleanliness of the University Campus under SWACHHTA PAKHWADA-2018. The solid waste, unwanted weeds, plastic bags, bottles etc. were removed from the campus. The Programme Officer also motivated the Volunteers and students regarding cleanliness and making the campus clean and green.



Figure 1 Beyond campus cleanliness drive of NSS, Aliah University on Swachhta Pakhwada-2018



Activities of NSS in 2019-20

The NSS unit of the university has done various social activities through different programs under Regular Activity. The following are the brief activities undertaken by the NSS Unit of this university:

OBSERVATION OF SWACHH BHARAT ABHIYAN

- NSS volunteers of Aliah University, Kolkata observed Swachh Bharat Abhiyan on 17th January, 2019 and during Swachh Bharat Abhiyan clean the Park Circus Campus by the participants. The solid waste, unwanted weeds, plastic bags, bottles etc. were removed from the campus. The Programme Officer also motivated the Volunteers and students regarding cleanliness and making the campus clean and green.

PARTICIPATION IN GREEN MARATHON

- NSS Programme Officer, NSS Volunteers and students of Aliah University participated in Green Marathon organised by SBI on 24th February, 2019. The main objective of this programme is to create awareness among the people related green environment.



Figure 2 Participation in Green Marathon, on 24th February 2019



Swachhta Diwas



Swachhta Diwas, or Cleanliness Day, is a significant event aimed at promoting cleanliness and hygiene. Such events involve various activities such as cleaning campaigns, awareness sessions on hygiene practices, waste management workshops, and tree planting drives.

During Swachhta Diwas, cadets, faculty, and staff often come together to clean up the campus or surrounding areas, remove litter, and raise awareness about the importance of maintaining a clean environment for overall well-being.

Figure 3 Beyond campus cleanliness drive of NCC, Aliah University on Swachhta Diwas

Puneet Sagar Abhiyan

Puneet Sagar Abhiyaan of Aliah University on 04 April 2022. It is likely a cleanliness campaign or initiative inspired by the Swachh Bharat Abhiyan (Clean India Mission). Aliah University, typically focus on promoting cleanliness, hygiene, and environmental awareness within the university community and its surrounding areas.



The campaign may involve activities such as campus clean-up drives, waste management initiatives, tree planting programs, awareness workshops on sanitation and hygiene practices, and educational sessions on environmental conservation. Total 10 cadets are participated in this program.

Figure 4. Beyond campus cleanliness drive of NCC, Aliah University under Puneet Sagar Abhiyaan on 4th April 2022

A Detailed Audit for improvement of Energy, Environmental & Green Aspects Of



Aliah University

(for the year 2020-2021)

Action Area IIA/27, New Town, Rajarhat

West Bengal 700 160

Submitted by



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Energy, Environment and Green Audit Report:

(New Town Campus of Aliah University for the year 2020-21)

This is to certify that an audit for the above said campus has been done by us for the year 2020-2021 for all three fronts of 'energy', 'environment' and 'green' quotients. The following observations have been made for the criteria as follows:

A. Energy:

- a. The Power Factor is abnormally low resulting in huge surcharge amounts levied every month.
- b. The Load factor also is quite low, maybe due to futuristic projection of contract demand.
- c. There is very little of renewable energy when a good potential exists.
- d. All the ceiling fans could be converted to BLDC type and that could make a substantial energy savings.
- e. Some good measures have been taken like, use of LED lights, Star rated air-conditioning system etc.
- f. Many of rooms have well daylight accessibility resulting lower use of artificial lighting during day time.

B. Environment:

- a. There are adequate green spaces on mother earth.
- b. There is an arrangement for harvesting rainwater by storing and recharging. It creates a good ambience.
- c. The entire sewage is treated at Central Sewage Treatment Plant of Newtown Kolkata Development Authority.
- d. The plumbing fixtures are of low flow type, resulting in water savings. However, all the cisterns could be replaced with dual flushing type to reduce water consumptions as well as awareness development.

C. Green:

- a. The campus could be rated as per the guidelines of Indian Green Building Council, GRIHA Council or LEED rating system by GBCI.
- b. The campus though could achieve a good credit rating but may fail to pass in many mandatory criteria, resulting in **no rating**.
- c. It is always advisable to go for stringent rating system to bolster the claim of sustainable practice as well as creating responsible citizens of the society, pursuing the motto of the Institution.

Overall, the campus needs to invest much on the above criteria to pass the sustainable practice as per the National Standard.



Acknowledgement

En-Simulated Solutions LLP extends gratitude to Aliah University for extending us the opportunity to conduct the Preliminary Audit for implementation of Energy & Environmental Audit.

We are thankful to the professors & supporting staffs of the college for their transparency & consistent support in sharing relevant information and for providing data about policies and projects along with their other valuable information. This report would have not been possible without their support.

The study team would like to acknowledge the following distinguished personnel of Presidency University in person for the diligent involvement and cooperation.

1. Dr. Mohammad Zakir Hussain, Dept. of Biological Sciences, AU
2. Dr. Indranil Mukherjee, Dept. of Civil Engineering, AU
3. Dr. Aznarul Islam, Dept. of Geography, AU
4. Dr. Jeenat Rehena, Dept. of Computer Science and Engineering, AU
5. Dr. Md. Reyaz, Dept. of Mass Communication and Journalism, AU
6. Dr. Md. Hedayetullah Mir, Dept. of Chemistry, AU
7. Ms. Lipika Mondal, Dept. of Nursing, AU
8. Dr. Sk. Sabir Ali, Sports Section, AU
9. Mr. Shahbaz Afzal, Finance Section, AU

About the Institution

Vision of the University

To become a Centre of Excellence and to contribute to the society through the pursuit of teaching and research in the emerging areas in each branch of modern science, engineering and technology, social studies, and humanities with a deep passion for wisdom, culture, and values.

Mission of the University

To nurture and produce forward-looking students with a focus on their intellectual, moral, and social development enabling them to excel in their chosen field of work in society, industry, business, and academia.

Motto of the University

The motto of the University is “Advancement of Education and Culture” in Arabic, “Taqdeem-ut-Ta’leem wa-as Saqafah.”

Objectives of the University as mentioned in Aliah University Act, 2007:

- i. To create educational opportunities for higher education and studies;
- ii. To encourage study of modern technological and professional courses along with classical languages, oriental studies, religious studies, and Islamic culture;
- iii. To promote higher education amongst the Minorities in the State;
- iv. To disseminate and advance knowledge by providing instructional, educational, research and extension facilities in such branches of learning as it may deem fit;
- v. To provide students and teachers, the conducive atmosphere, and necessary facilities for the promotion of:
 - a. Innovations in education leading to restructuring of courses, new methods of teaching and learning and integral development of personality,
 - b. Studies in various discipline,
 - c. Inter-disciplinary studies,
- vi. To develop centers of excellence for higher studies and research in theology, Islamic jurisprudence and Islamic Culture, comparative religion, science and technology, professional and management education in the State by joint initiative i.e., State-Private partnership, if required;
- vii. National integration, secularism, international understanding, non-violence and humanism;
- viii. To avail better scope and opportunities to serve the societies and the Nation.

As per National Assessment and Accreditation Council (NAAC) guidelines every accredited institution should establish an Internal Quality Assurance Cell (IQAC) as a post-accreditation quality sustenance measure. Accordingly, the University set up its IQAC to develop a system for conscious, consistent, and catalytic improvement in the overall performance of the institution, and to promote measures for institutional functioning towards quality enhancement through internalization of quality culture and institutionalization of best practices.

The built-structure configuration of the project as follows:

- The principal building is 'Basement + Ground + 17 Storied' Administration plus Academic Block;
- 'Ground + 3 Storied' Library Block.

The detailed area statement of the construction is as follows:

Area Calculation

1. Gross Land Area = 70,373.157 Sqm i.e., 17.389 Acres or 7.037 Hectare;
2. FAR Allowable = 2.092 (For Educational Building);
3. Permissible Gr. Coverage = 41.85% = 29,451.17 Sqm;
4. Proposed Gr. Coverage = 16% of Land Area = 11251.38 Sqm
5. Allowable Built-Up Area = 1,47,220.64 Sqm

Built-Up Area (Admin & Academic):

- Main Building (Academic & Administrative)- B+G+17
- Basement Area = 5000 Sqm;
- Ground Floor = 9300 Sqm;
- First Floor = 8121 Sqm;
- Second Floor = 6191 Sqm;
- Third to Eighth Floor (@ 4358 Sqm/Floor) = 76148 Sqm;
- 9th to 13th Area (3641 Sqm / Floor) = 18205 Sqm;
- 14th to 17th Area (3120 Sqm/ Floor) = 12480 Sqm.
- Gross Total Area (of Admin & Academic Building) = 87,515 Sqm.

Built Up Area (Central Library Building):

- Central Library Building - G+3;
- Ground Floor Area = 956 Sqm
- First Floor Area = 813 Sqm
- Second Floor Area = 813 Sqm
- Third Floor Area = 714 Sqm
- Gross Total Area (of Central Library) = 3156 Sqm

Built-up Area (Entire Project):

- + Proposed Total Built-Up Area = 90,811 Sqm
- + Less Area For 116 No. Covered Car Parking at Basement = 3480 Sqm
- + Actual Proposed Total Built-Up Area = 90,811 - 3480 = 87,331 Sqm
- + FAR Consumed = 87,331 / 70373.15 = 1.24
- + Proposed Ground Coverage = (10,256 / 70373) X 100 = 14.57%

Car-Parking Calculation:

- ❖ Total Built-up area = 87,331 Sqm
- ❖ Car Parking Required = 87,331 / 500 = 175
- ❖ Car: Bus = 95:5
- ❖ Required number of cars = 166
- ❖ Proposed number of cars = 166

Green Area Calculation:

- Green Open Space required (@7.11% of Land Area) = 5003.53 Sqm
- Green Area Provided = 14,192 Sqm = 20%

INTRODUCTION

Energy is critical to any institutions, but often represents a significant cost – both to them and the environment.

ISO 50001:2018, Energy management systems – Requirements with guidance for use, is a strategic tool that helps organizations put in place an energy management system and use their energy more efficiently and effectively.

An energy management system helps organizations better manage their energy use, thus improving productivity. It involves developing and implementing an energy policy, setting achievable targets for energy use, and designing action plans to reach them and measure progress. This might include implementing new energy-efficient technologies, reducing energy waste or improving current processes to cut energy costs. ISO 50001 gives organizations a recognized framework for developing an effective energy management system. Like other ISO management system standards, it follows the “Plan-Do-Check-Act” process for continual improvement.

ISO 50001 provides a set of requirements that enable organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet that policy
- Gather data to better understand and make decisions concerning energy use
- Measure the results obtained
- Review the effectiveness of the policy
- Continually improve energy management

ISO 50001 vs. Other Management System Standards:

As a new member of international standards family, ISO 50001 has been developed based on the common elements shared by other major ISO management system standards, ensuring a high level of compatibility with them. It is notably aligned with ISO 9001 quality management system and ISO 14001 environmental management system standards. The comparison table below provides a quick overview on the comparison between the main clauses of ISO 50001, ISO 9001 and ISO 14001.

Content	ISO 50001	ISO 14001	ISO 9001
Core concept for establishing guidelines	Based on energy consumption of the whole organization, or a particular production process. For compliance with ESOS the ISO 50001 system must cover all the organization or groups energy consumption.	Based on relevant environmental aspects	Based on clients' quality requirements

Policy	Energy policy illustrates the strategy of the organization on energy management. The policy provides the framework for setting up associated objectives and targets to enhance energy performance	Environmental policy illustrates how the organization handles environmental matters, commitment to environmental protection, as well as associated objectives and targets. Typically, the policy will include the organizations commitment to preventing pollution, regulatory compliance and continuous improvement.	Meet the clients' requirements
Strategy	Conducting energy reviews to identify significant energy use activities and set up energy baseline as well as energy performance indicators. Compliance to relevant regulatory requirements and setting up energy objectives, targets and implementation plans.	Compliance to relevant environmental regulatory requirements. Setting up environmental objectives, targets and implementation plans.	Setting up quality objectives, targets and quality management plans.
Baseline	Energy baseline is foundation to establish the system	No such requirement	No such requirement

In summary, the five requirements of ISO 14001 and ISO 50001:

1. Formation of an Environmental Policy and commitment to an EEMS (Energy & Environmental System),
2. Development of a plan for implementation,
3. Implementation and Operation of the EEMS,
4. Monitoring and possible corrective actions,
5. Top management review and continuous improvement.

Basically, the institution must say what the organization is going to do, how they are going to do, who it is going to do and by when it is going to be done.

In the preliminary audit we are supposed to frame the answer of the first question: 'what the organization is going to do'.

ENERGY AUDIT:

Energy Audit is an effective tool in defining and pursuing comprehensive energy management programs. It has positive approach aiming at continuous improvement in energy utilization in contrast to financial audit which stresses to maintain regularity. Energy audit provides answer to the question – what to do, where to start, at what cost and for what benefits.

Energy audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating and maintenance practices of the system. It has been established that energy saving of the order of 15 to 30% is possible by optimizing use of energy by better housekeeping, low cost retrofitting measures and use of energy efficient equipment at the time of replacements. Indian industry consumes more energy as compared to its counter parts in the developed countries.

Need/Purpose:

The energy audit provides the vital information base for overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures.

It aims at:

1. Assessing present pattern of energy consumption in different cost centers of operations.
2. Relating energy inputs and production output.
3. Identifying potential areas of thermal and electrical energy economy.
4. Highlighting wastage in major areas.
5. Fixing of energy saving potential targets for individual cost centers.
6. Implementation of measures of energy conservation and realization of savings.

ENVIRONMENTAL AUDIT

An environmental Audit provides an assessment of the environmental performance of a business or organization. The audit reveals details about the activities of a company and its compliance with environmental regulations. Audit information is presented to the management team and employees.

An environmental audit evaluates and quantifies the environmental performance. It identifies compliance problems or management system implementation issues related to baseline performances of parameters as per the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974. As thermal power is the principal source of energy in our country, The Energy Conservation Act, 2001 is to be an integral part of The Air Act, 1981. Hence energy conservation during functioning of the institute also to be considered during environmental audit.

GREEN AUDIT:

The green audit is a tool that organizations use to identify their environmental impacts and assess their compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. It also serves to identify opportunities to enhance work quality, improves employee health, safety, and morale, reduce liabilities, and achieve other form of business values.

This concept has got its origin in recent past and suddenly got acceleration due to heavy industrial & commercial traffic which ends with unaccountable emission resulting pollution. Due to growth in population, needs has increased.

It is the duty of organizations to carry out the Green Audits of their ongoing processes for various reasons such as; to make sure whether they are performing in accordance with relevant rules and regulations, to improve the procedures and ability of materials, to analyze the potential duties and to determine a way which can lower the cost and add to the revenue. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit.

Green Audit is assigned to the Criterion 7 of NAAC (National Assessment and Accreditation Council) which is a self-governing organization of India that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation.

Need/Purpose:

The intention of organizing Green Audit is to upgrade the environment condition in and around the institutes, colleges, companies and other organizations. It is carried out with the aid of performing tasks like waste management, water conservation, sufficient green cover and proper use of day-lighting in indoor environment. Thus, it's a tool to turn the infrastructure into a better environmentally friendly institute by securing the environment and cut down the threats posed to human health:

7. To make sure that rules and regulations are well taken care of.
8. To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
9. To suggest the best protocols for adding to sustainable development.
10. To suggest improvement in the system to promote safe and clean environment.

In the Energy Audit part, we would be analyzing the current consumption of energy (principally electricity from grid) and possible means to make it smarter. The basic areas of study would be like these:

11. Analysis of electricity bills received from DISCOMs,
12. Analysis of existing lighting system, fans and air conditioning systems. Thereby, searching whether there are scopes of any improvements,
13. Searching options for installation of occupancy sensors, daylight sensors etc.
14. Replacement of old pumps with new ones,
15. Options for putting films over the glazing on the East / West façades,
16. Options for reducing water consumptions and thereby the operation hours of the pumps,
17. Automatic level controller for overhead reservoirs,
18. Options for sub-metering for different uses of electricity like interior lighting, exterior lighting, air-conditioning, pumps and lifts.
19. Searching for tentative potential for renewable energy installation and use.

In the environmental front, we may look after the following:

20. Options for reducing Heat-Island Effect (both roof and non-roof),
21. Options for electric charging facilities for both the 2 & 4 wheelers,
22. Universal design options,
23. Water efficiency in flow & flush fixtures,
24. Rain Water Harvesting systems,
25. Water metering,
26. Waste management system and provision for organic waste composter,

As per the five requirements of ISO 14001 and ISO 50001:

1. As of now there is no such Environmental policy. However, formulation of the same is currently underway.
2. Development of a plan for implementation is to be done.
3. Implementation and Operation of the EEMS is to be done
4. Monitoring and possible corrective actions – Not applicable at present
5. Top management review and continuous improvement would be done once above actions are completed.

Site Photographs

Rainwater harvesting related pictures:



Mitigation of Heat Island Effect:



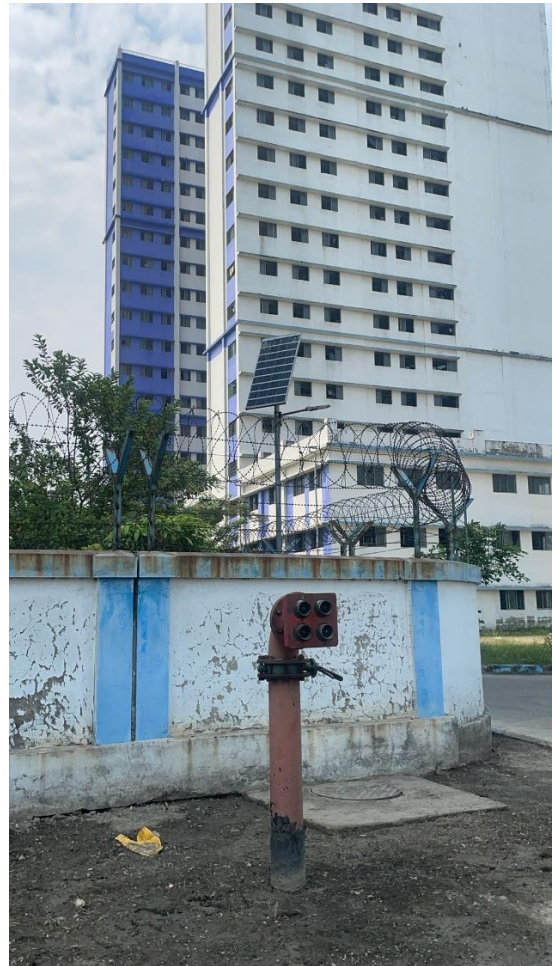




Harvesting of Daylight:



Solar Street Lighting:



Low Flow Fixtures for Water Conservation:



Central Solid Waste Dispatch Area:



Universal Design Aspects:



Analysis of electricity bills received from DISCOM:

Electricity Bill Analysis for the period of April 2020 to March 2021 for Aliah University Rajarhat Campus:

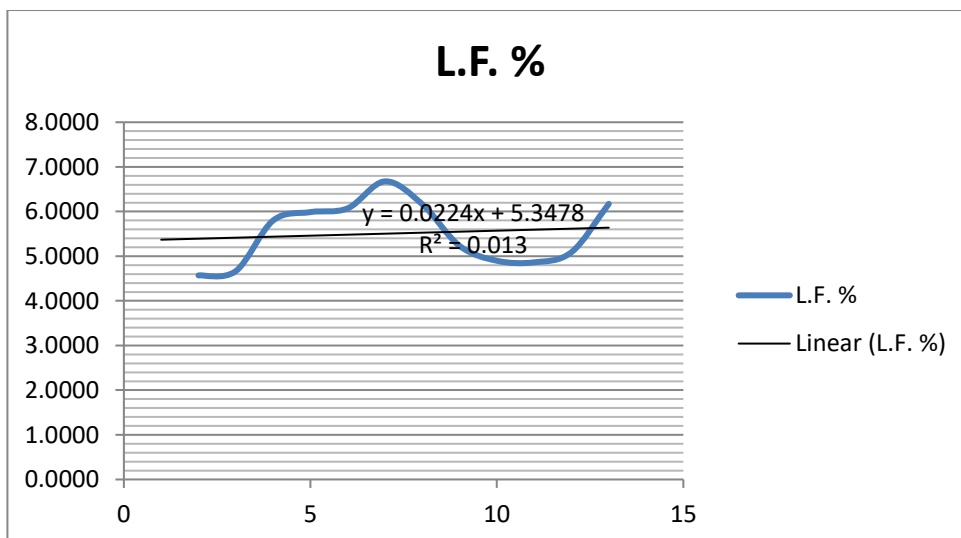
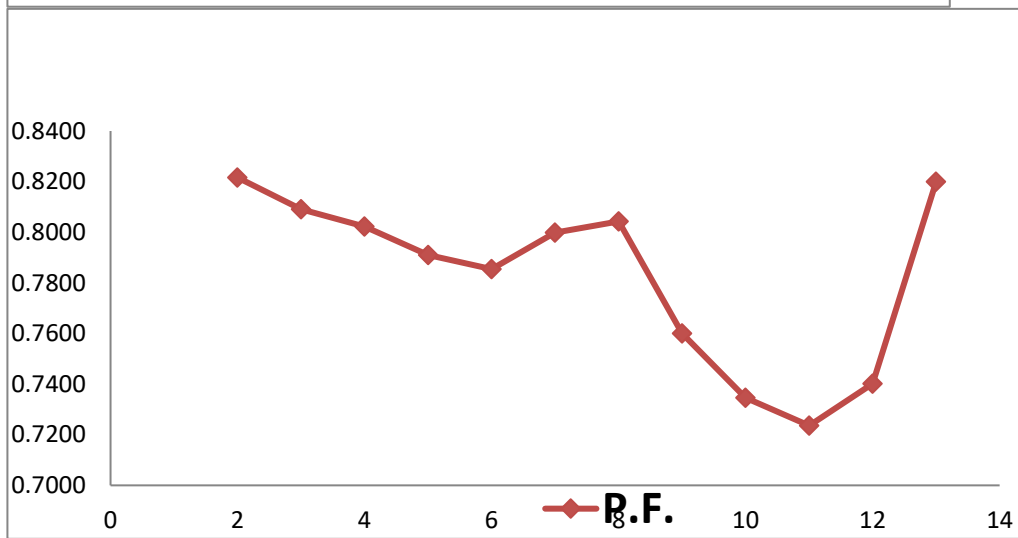
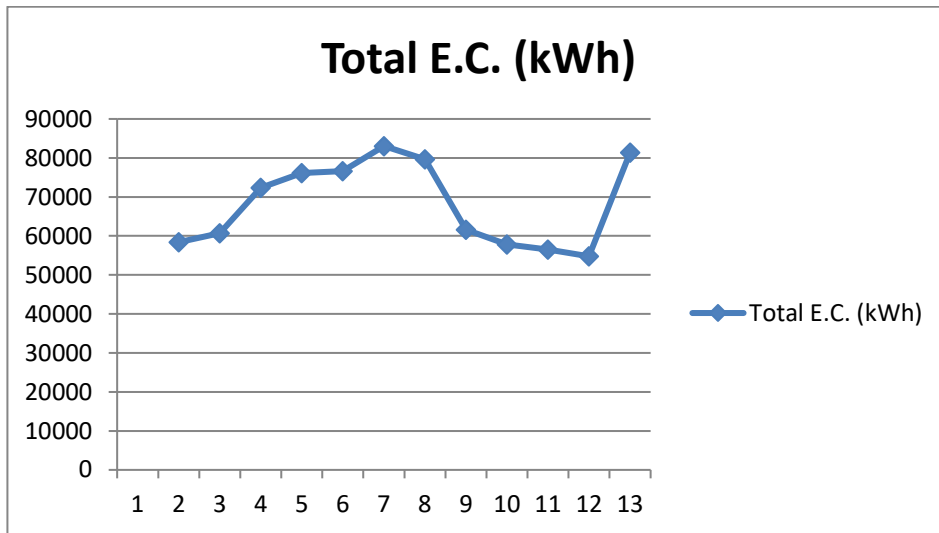
DISCOM: WBSEDCL

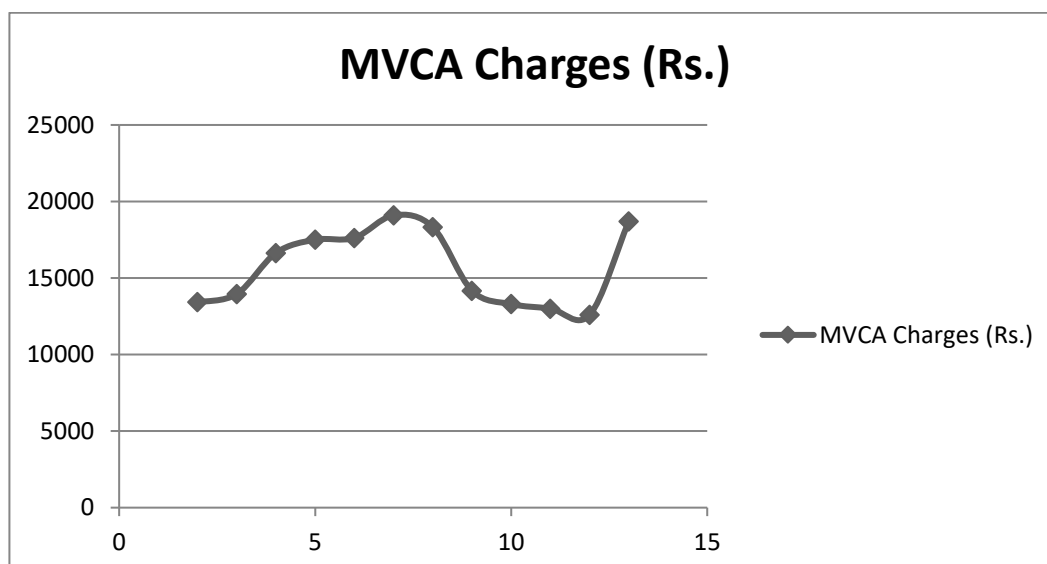
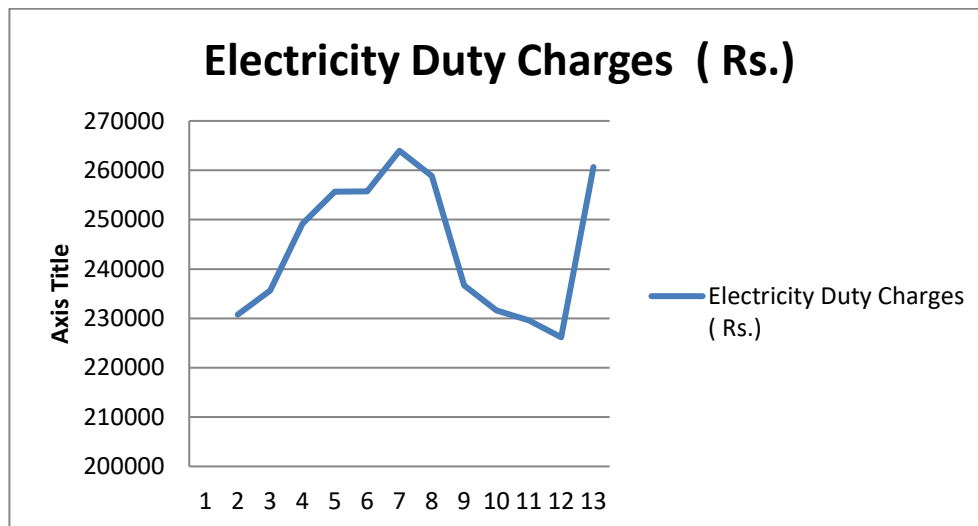
Month	Energy Consumption (kWh)			Inj. RD. Adv. (kWh)	Total E.C. (kWh)	P.F.	L.F. %	Unit/Rate (Rs.)			Energy Charges (Rs.)			Total E.C. (Rs.)	Demand Charges (Rs.)	LF Reb(-)/Sur(+) Charge (Rs.)	PF Reb(-)/Sur(+) Charge (Rs.)	Electricity Duty Charges (Rs.)	MVCA Charges (Rs.)	Rental Charges (Rs.)	TCS Charges (Rs.)	Total Bill Amount (Rs.)
	Normal	Peak	Off-Peak					Normal	Peak	Off-Peak	Normal	Peak	Off-Peak									
	April'20	26000	15480					16910	58390	0.8216	4.5701	6.76	10.14									
May'20	28130	15970	16570	60670	0.8091	4.666	6.76	10.14	3.98	190159	161935.8	65948.6	418043.2	829440	79317.35	19282.3	235626.39	13954.1	2400	-13600.37	1584462.97	
June'20	38060	16950	17340	72350	0.8023	5.799	6.76	10.14	3.98	257286	171873	69013.2	498171.8	829440	71866.94	22334.66	249207.96	16640.5	2400	-14384.3	1675677.56	
July'20	39130	18300	18680	76110	0.791	5.9878	6.76	10.14	3.98	264519	185562	74346.4	524427.2	829440	72498.00	32532.16	255654.90	17505.3	2400	-14756.42	1719701.14	
Aug'20	39650	18180	18800	76630	0.7854	6.0718	6.76	10.14	3.98	268034	184345.2	74824.00	527203.2	829440	71665.3	30839.85	255718.2	17624.9	2400	-14760.07	1720131.38	
Sep'20	46580	18670	17790	83040	0.7998	6.6761	6.76	10.14	3.98	314881	189313.8	70804.2	574998.8	829440	68375.55	32490.97	263959.22	19099.2	2400	-15235.74	1775528	
Oct'21	44070	17880	17720	79670	0.8043	6.1639	6.76	10.14	3.98	538569	181303.2	70525.6	790398.00	829440	73037.9	24471.11	258867.89	18324.1	2400	-14941.87	1981997.13	
Nov'21	32620	14460	14540	61620	0.76	5.2306	6.76	10.14	3.98	416551	146624.4	57869.2	621044.8	829440	70096.54	26445.33	236633.56	14172.6	2400	-13658.5	1786574.33	
Dec'21	28670	14530	14620	57820	0.7346	4.8982	6.76	10.14	3.98	390863	147334.2	58187.6	596385	829440	71187.17	24771.79	231587.93	13298.6	2400	-13367.27	1755703.22	
Jan'21	27500	14320	14720	56540	0.7236	4.8627	6.76	10.14	3.98	382210	145204.8	58585.6	586000.8	829440	70272.76	24169.82	229603.58	13004.2	2400	-13252.73	1741638.43	
Feb'21	27560	13380	13840	54780	0.7402	5.09	6.76	10.14	3.98	370313	135673.2	55083.2	561069.2	829440	64138.29	23357.29	226162.54	12599.4	2400	-13054.11	1706112.61	
Mar'21	46900	17480	16960	81340	0.82	6.1726	6.76	10.14	3.98	549858	177247.2	67500.8	794606.4	829440	74429.19	20163.53	260660.32	18708.2	2400	-15045.33	1985362.31	

The principal findings from the analysis of the electricity bills are as follows:

1. The Power Factor is abnormally low throughout the year resulting in a total surcharge of Rs.3,45,931.45 (rupees three lacs forty-five thousand nine hundred and thirty-one with forty-five paise only). A capacitor bank placed within a APFC panel could improve the PF from 0.78 (average) to 0.95. The approximate payback period is eighteen months only.
2. The Contract Demand of the project is 2541 kVA, whereas the peak demand in twelve months of that year reached maximum 408 kVA, which is 1/6th of the contract demand. This results in abnormally low Load Factor percentage and vis-à-vis a power surcharge of Rs.8,65,191.00 (rupees eight lacs sixty-five thousand and hundred and ninety-one only). Moreover, per month a fixed amount of Rs.8, 29,440.00 (rupees eight lacs twenty-nine thousand four hundred and forty only) is billed for that CD. With revised contract demand, the fixed charges would be reduced and Load Factor would be increased. So, there would be double benefit of reduction of total contract demand. There is no capital investment is required for this.







Analysis of existing lighting system, fans and air conditioning systems. Thereby, searching whether there are scopes of any improvements,

During the walkthrough audit it was observed the existing air-conditioning systems installed in the admin building was already optimal. Hence, very little optimizations is possible here.

Most of the lighting systems have already shifted to LED based luminaires.

However, a large number of conventional (induction motor based) fans still exists in the classrooms. These can be replaced by energy efficient Brushless Direct Current Motor or BLDC fans.

Advantage of BLDC fans over conventional fans :-

- Fewer maintenance costs
- Better performance
- Long lasting due to absence of brushes, thereby eliminating the chances of sparks
- Lesser noise
- Greater torque
- Better energy efficiency (as much as 60% less energy consumption as compared to conventional fans.)
- Lesser heat generation.

Searching options for installation of occupancy sensors, daylight sensors etc.

Occupancy sensors and daylight sensors could be installed in the common areas and classrooms to help reduce the energy consumption.

Replacement of old pumps with new ones,

The existing pumps and associated related plumbing line could be thoroughly checked to determine the present health of the pumps (i.e. the operating parameters such as efficiency, head, discharge) and the plumbing lines. Pressure valves and water meters could be installed to help conserve water and detect losses.

Options for putting films over the glazing on the East / West façades,

For admin buildings or buildings where air conditioning systems are installed, heat reflective films could be placed over the glazing to reduce the cooling load.

Options for reducing water consumptions and thereby the operation hours of the pumps,

Automatic level controller for overhead reservoirs,

It was observed that pumps are operated on a shift basis (3-shift basis). In addition to this, automatic level controller for overhead reservoirs could be installed

Options for sub-metering for different uses of electricity like interior lighting, exterior lighting, air-conditioning, pumps and lifts.

Sub-metering could be done for different uses of electricity such as interior lighting, exterior lighting, air-conditioning systems, pumps and lifts to help identify the energy consumption pattern of the various equipment and appliances.

Searching for tentative potential for renewable energy installation and use.

There is a good potential of rooftop solar installation for the project and if the power could be arranged with net-metering system, then a good savings is possible at the common area load arisen due to lighting, air-conditioning. Lifts and plumbing pumps.

Environmental measures:

- **Options for reducing Heat-Island Effect (both roof and non-roof).**

Cool roof paints could be applied roofs and cool paints could be applied to exterior wall as well.

External driveways could be painted with low SRI paints.

Parking spaces could have grass pavers

- **Options for electric charging facilities for both the 2 & 4 wheelers.**

People should be encouraged to use non-fossil fuel-based transportation. As such electric charging facilities should be available for both two-wheelers and four-wheelers.

- **Universal design options.**

Disabled friendly environment should be provided as follows-

Use of ramps, disable friendly washrooms, easy access to lifts, provision for braille facility in lifts etc.

- **Water efficiency in flow & flush fixtures.**

The existing plumbing fixtures could be exchanged with low-flow fixtures (even if the faucets are introduced with aerators); this has a potential for reduction of atleast 30-40% daily water consummations. This will ultimately result in lower pumping requirements and thereby conserve energy.

- **Rain Water Harvesting systems.**

Rainwater harvesting system is present in the campus. Three number of rainwater storage tanks of capacity 2000 liters each is present. Two number of filter tank is present.

- **Water metering.**

Water metering could be done to identify the water consumption patterns at various

levels and help take necessary measures.

- **Waste management system and provision for organic waste composter.**

Handling of waste in campuses is extremely difficult as most of the waste generated is not segregated at source and has a high probability of going to land-fills. So a proper solid waste management should be present whereby the wastes could be segregated in three types: Solid Waste, Liquid Waste & E- Waste.

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

Any type of **biomedical wastes** if generated have to be handled with proper safety procedures and are to be disposed of safely as well.

Organic waste should be segregated and Organic waste composter system should be installed.



Saibal Saha

BCE (J.U.)

Certified Energy Auditor – BEE & Certified Water Auditor – NPC

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A Detailed Audit for improvement of Energy, Environmental & Green Aspects Of



Aliah University

(for the year 2021-2022)

Action Area IIA/27, New Town, Rajarhat

West Bengal 700 160

Submitted by



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Ensimulated Solutions LLP

Energy, Environment and Green Audit Report: (New Town Campus of Aliah University for the year 2021-22)

This is to certify that an audit for the above said campus has been done by us for the year 2021-2022 for all three fronts of 'energy', 'environment' and 'green' quotients. The observations of the earlier year would remain same for this year also.

A. Energy:

- a. The Power Factor is abnormally low resulting in huge surcharge amounts levied every month.
- b. The Load factor also is quite low, maybe due to futuristic projection of contract demand.
- c. There is very little of renewable energy when a good potential exists.
- d. All the ceiling fans could be converted to BLDC type and that could make a substantial energy savings.
- e. Some good measures have been taken like, use of LED lights, Star rated air-conditioning system etc.
- f. Many of rooms have well daylight accessibility resulting lower use of artificial lighting during day time.

B. Environment:

- a. There are adequate green spaces on mother earth.
- b. There is an arrangement for harvesting rainwater by storing and recharging. It creates a good ambience.
- c. The entire sewage is treated at Central Sewage Treatment Plant of Newtown Kolkata Development Authority.
- d. The plumbing fixtures are of low flow type, resulting in water savings. However, all the cisterns could be replaced with dual flushing type to reduce water consumptions as well as awareness development.

C. Green:

- a. The campus could be rated as per the guidelines of Indian Green Building Council, GRIHA Council or LEED rating system by GBCI.
- b. The campus though could achieve a good credit rating but may fail to pass in many mandatory criteria, resulting in **no rating**.
- c. It is always advisable to go for stringent rating system to bolster the claim of sustainable practice as well as creating responsible citizens of the society, pursuing the motto of the Institution.

Overall, the campus needs to invest much on the above criteria to pass the sustainable practice as per the National Standard.



Acknowledgement

En-Simulated Solutions LLP extends gratitude to Aliah University for extending us the opportunity to conduct the Preliminary Audit for implementation of Energy & Environmental Audit.

We are thankful to the professors & supporting staffs of the college for their transparency & consistent support in sharing relevant information and for providing data about policies and projects along with their other valuable information. This report would have not been possible without their support.

The study team would like to acknowledge the following distinguished personnel of Presidency University in person for the diligent involvement and cooperation.

1. Dr. Mohammad Zakir Hussain, Dept. of Biological Sciences, AU
2. Dr. Indranil Mukherjee, Dept. of Civil Engineering, AU
3. Dr. Aznarul Islam, Dept. of Geography, AU
4. Dr. Jeenat Rehena, Dept. of Computer Science and Engineering, AU
5. Dr. Md. Reyaz, Dept. of Mass Communication and Journalism, AU
6. Dr. Md. Hedayetullah Mir, Dept. of Chemistry, AU
7. Ms. Lipika Mondal, Dept. of Nursing, AU
8. Dr. Sk. Sabir Ali, Sports Section, AU
9. Mr. Shahbaz Afzal, Finance Section, AU

About the Institution

Vision of the University

To become a Centre of Excellence and to contribute to the society through the pursuit of teaching and research in the emerging areas in each branch of modern science, engineering and technology, social studies, and humanities with a deep passion for wisdom, culture, and values.

Mission of the University

To nurture and produce forward-looking students with a focus on their intellectual, moral, and social development enabling them to excel in their chosen field of work in society, industry, business, and academia.

Motto of the University

The motto of the University is “Advancement of Education and Culture” in Arabic, “Taqdeem-ut-Ta’leem wa-as Saqafah.”

Objectives of the University as mentioned in Aliah University Act, 2007:

- i. To create educational opportunities for higher education and studies;
- ii. To encourage study of modern technological and professional courses along with classical languages, oriental studies, religious studies, and Islamic culture;
- iii. To promote higher education amongst the Minorities in the State;
- iv. To disseminate and advance knowledge by providing instructional, educational, research and extension facilities in such branches of learning as it may deem fit;
- v. To provide students and teachers, the conducive atmosphere, and necessary facilities for the promotion of:
 - a. Innovations in education leading to restructuring of courses, new methods of teaching and learning and integral development of personality,
 - b. Studies in various discipline,
 - c. Inter-disciplinary studies,
- vi. To develop centers of excellence for higher studies and research in theology, Islamic jurisprudence and Islamic Culture, comparative religion, science and technology, professional and management education in the State by joint initiative i.e., State-Private partnership, if required;
- vii. National integration, secularism, international understanding, non-violence and humanism;
- viii. To avail better scope and opportunities to serve the societies and the Nation.

As per National Assessment and Accreditation Council (NAAC) guidelines every accredited institution should establish an Internal Quality Assurance Cell (IQAC) as a post-accreditation quality sustenance measure. Accordingly, the University set up its IQAC to develop a system for conscious, consistent, and catalytic improvement in the overall performance of the institution, and to promote measures for institutional functioning towards quality enhancement through internalization of quality culture and institutionalization of best practices.

The built-structure configuration of the project as follows:

- The principal building is 'Basement + Ground + 17 Storied' Administration plus Academic Block;
- 'Ground + 3 Storied' Library Block.

The detailed area statement of the construction is as follows:

Area Calculation

1. Gross Land Area = 70,373.157 Sqm i.e., 17.389 Acres or 7.037 Hectare;
2. FAR Allowable = 2.092 (For Educational Building);
3. Permissible Gr. Coverage = 41.85% = 29,451.17 Sqm;
4. Proposed Gr. Coverage = 16% of Land Area = 11251.38 Sqm
5. Allowable Built-Up Area = 1,47,220.64 Sqm

Built-Up Area (Admin & Academic):

- Main Building (Academic & Administrative)- B+G+17
- Basement Area = 5000 Sqm;
- Ground Floor = 9300 Sqm;
- First Floor = 8121 Sqm;
- Second Floor = 6191 Sqm;
- Third to Eighth Floor (@ 4358 Sqm/Floor) = 76148 Sqm;
- 9th to 13th Area (3641 Sqm / Floor) = 18205 Sqm;
- 14th to 17th Area (3120 Sqm/ Floor) = 12480 Sqm.
- Gross Total Area (of Admin & Academic Building) = 87,515 Sqm.

Built Up Area (Central Library Building):

- Central Library Building - G+3;
- Ground Floor Area = 956 Sqm
- First Floor Area = 813 Sqm
- Second Floor Area = 813 Sqm
- Third Floor Area = 714 Sqm
- Gross Total Area (of Central Library) = 3156 Sqm

Built-up Area (Entire Project):

- ✚ Proposed Total Built-Up Area = 90,811 Sqm
- ✚ Less Area For 116 No. Covered Car Parking at Basement = 3480 Sqm
- ✚ Actual Proposed Total Built-Up Area = 90,811 - 3480 = 87,331 Sqm
- ✚ FAR Consumed = 87,331 / 70373.15 = 1.24
- ✚ Proposed Ground Coverage = (10,256 / 70373) X 100 = 14.57%

Car-Parking Calculation:

- ❖ Total Built-up area = 87,331 Sqm
- ❖ Car Parking Required = 87,331 / 500 = 175
- ❖ Car: Bus = 95:5
- ❖ Required number of cars = 166
- ❖ Proposed number of cars = 166

Green Area Calculation:

- Green Open Space required (@7.11% of Land Area) = 5003.53 Sqm
- Green Area Provided = 14,192 Sqm = 20%

INTRODUCTION

Energy is critical to any institutions, but often represents a significant cost – both to them and the environment.

ISO 50001:2018, Energy management systems – Requirements with guidance for use, is a strategic tool that helps organizations put in place an energy management system and use their energy more efficiently and effectively.

An energy management system helps organizations better manage their energy use, thus improving productivity. It involves developing and implementing an energy policy, setting achievable targets for energy use, and designing action plans to reach them and measure progress. This might include implementing new energy-efficient technologies, reducing energy waste or improving current processes to cut energy costs. ISO 50001 gives organizations a recognized framework for developing an effective energy management system. Like other ISO management system standards, it follows the “Plan-Do-Check-Act” process for continual improvement.

ISO 50001 provides a set of requirements that enable organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet that policy
- Gather data to better understand and make decisions concerning energy use
- Measure the results obtained
- Review the effectiveness of the policy
- Continually improve energy management

ISO 50001 vs. Other Management System Standards:

As a new member of international standards family, ISO 50001 has been developed based on the common elements shared by other major ISO management system standards, ensuring a high level of compatibility with them. It is notably aligned with ISO 9001 quality management system and ISO 14001 environmental management system standards. The comparison table below provides a quick overview on the comparison between the main clauses of ISO 50001, ISO 9001 and ISO 14001.

Content	ISO 50001	ISO 14001	ISO 9001
Core concept for establishing guidelines	Based on energy consumption of the whole organization, or a particular production process. For compliance with ESOS the ISO 50001 system must cover all the organization or groups energy consumption.	Based on relevant environmental aspects	Based on clients' quality requirements

Policy	Energy policy illustrates the strategy of the organization on energy management. The policy provides the framework for setting up associated objectives and targets to enhance energy performance	Environmental policy illustrates how the organization handles environmental matters, commitment to environmental protection, as well as associated objectives and targets. Typically, the policy will include the organizations commitment to preventing pollution, regulatory compliance and continuous improvement.	Meet the clients' requirements
Strategy	Conducting energy reviews to identify significant energy use activities and set up energy baseline as well as energy performance indicators. Compliance to relevant regulatory requirements and setting up energy objectives, targets and implementation plans.	Compliance to relevant environmental regulatory requirements. Setting up environmental objectives, targets and implementation plans.	Setting up quality objectives, targets and quality management plans.
Baseline	Energy baseline is foundation to establish the system	No such requirement	No such requirement

In summary, the five requirements of ISO 14001 and ISO 50001:

1. Formation of an Environmental Policy and commitment to an EEMS (Energy & Environmental System),
2. Development of a plan for implementation,
3. Implementation and Operation of the EEMS,
4. Monitoring and possible corrective actions,
5. Top management review and continuous improvement.

Basically, the institution must say what the organization is going to do, how they are going to do, who it is going to do and by when it is going to be done.

In the preliminary audit we are supposed to frame the answer of the first question: 'what the organization is going to do'.

ENERGY AUDIT:

Energy Audit is an effective tool in defining and pursuing comprehensive energy management programs. It has positive approach aiming at continuous improvement in energy utilization in contrast to financial audit which stresses to maintain regularity. Energy audit provides answer to the question – what to do, where to start, at what cost and for what benefits.

Energy audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating and maintenance practices of the system. It has been established that energy saving of the order of 15 to 30% is possible by optimizing use of energy by better housekeeping, low cost retrofitting measures and use of energy efficient equipment at the time of replacements. Indian industry consumes more energy as compared to its counter parts in the developed countries.

Need/Purpose:

The energy audit provides the vital information base for overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures.

It aims at:

1. Assessing present pattern of energy consumption in different cost centers of operations.
2. Relating energy inputs and production output.
3. Identifying potential areas of thermal and electrical energy economy.
4. Highlighting wastage in major areas.
5. Fixing of energy saving potential targets for individual cost centers.
6. Implementation of measures of energy conservation and realization of savings.

ENVIRONMENTAL AUDIT

An environmental Audit provides an assessment of the environmental performance of a business or organization. The audit reveals details about the activities of a company and its compliance with environmental regulations. Audit information is presented to the management team and employees.

An environmental audit evaluates and quantifies the environmental performance. It identifies compliance problems or management system implementation issues related to baseline performances of parameters as per the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974. As thermal power is the principal source of energy in our country, The Energy Conservation Act, 2001 is to be an integral part of The Air Act, 1981. Hence energy conservation during functioning of the institute also to be considered during environmental audit.

GREEN AUDIT:

The green audit is a tool that organizations use to identify their environmental impacts and assess their compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. It also serves to identify opportunities to enhance work quality, improves employee health, safety, and morale, reduce liabilities, and achieve other form of business values.

This concept has got its origin in recent past and suddenly got acceleration due to heavy industrial & commercial traffic which ends with unaccountable emission resulting pollution. Due to growth in population, needs has increased.

It is the duty of organizations to carry out the Green Audits of their ongoing processes for various reasons such as; to make sure whether they are performing in accordance with relevant rules and regulations, to improve the procedures and ability of materials, to analyze the potential duties and to determine a way which can lower the cost and add to the revenue. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit.

Green Audit is assigned to the Criterion 7 of NAAC (National Assessment and Accreditation Council) which is a self-governing organization of India that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation.

Need/Purpose:

The intention of organizing Green Audit is to upgrade the environment condition in and around the institutes, colleges, companies and other organizations. It is carried out with the aid of performing tasks like waste management, water conservation, sufficient green cover and proper use of day-lighting in indoor environment. Thus, it's a tool to turn the infrastructure into a better environmentally friendly institute by securing the environment and cut down the threats posed to human health:

7. To make sure that rules and regulations are well taken care of.
8. To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
9. To suggest the best protocols for adding to sustainable development.
10. To suggest improvement in the system to promote safe and clean environment.

In the Energy Audit part, we would be analyzing the current consumption of energy (principally electricity from grid) and possible means to make it smarter. The basic areas of study would be like these:

11. Analysis of electricity bills received from DISCOMs,
12. Analysis of existing lighting system, fans and air conditioning systems. Thereby, searching whether there are scopes of any improvements,
13. Searching options for installation of occupancy sensors, daylight sensors etc.
14. Replacement of old pumps with new ones,
15. Options for putting films over the glazing on the East / West façades,
16. Options for reducing water consumptions and thereby the operation hours of the pumps,
17. Automatic level controller for overhead reservoirs,
18. Options for sub-metering for different uses of electricity like interior lighting, exterior lighting, air-conditioning, pumps and lifts.
19. Searching for tentative potential for renewable energy installation and use.

In the environmental front, we may look after the following:

20. Options for reducing Heat-Island Effect (both roof and non-roof),
21. Options for electric charging facilities for both the 2 & 4 wheelers,
22. Universal design options,
23. Water efficiency in flow & flush fixtures,
24. Rain Water Harvesting systems,
25. Water metering,
26. Waste management system and provision for organic waste composter,

As per the five requirements of ISO 14001 and ISO 50001:

1. As of now there is no such Environmental policy. However, formulation of the same is currently underway.
2. Development of a plan for implementation is to be done.
3. Implementation and Operation of the EEMS is to be done
4. Monitoring and possible corrective actions – Not applicable at present
5. Top management review and continuous improvement would be done once above actions are completed.

Site Photographs

Rainwater harvesting related pictures:



Mitigation of Heat Island Effect:



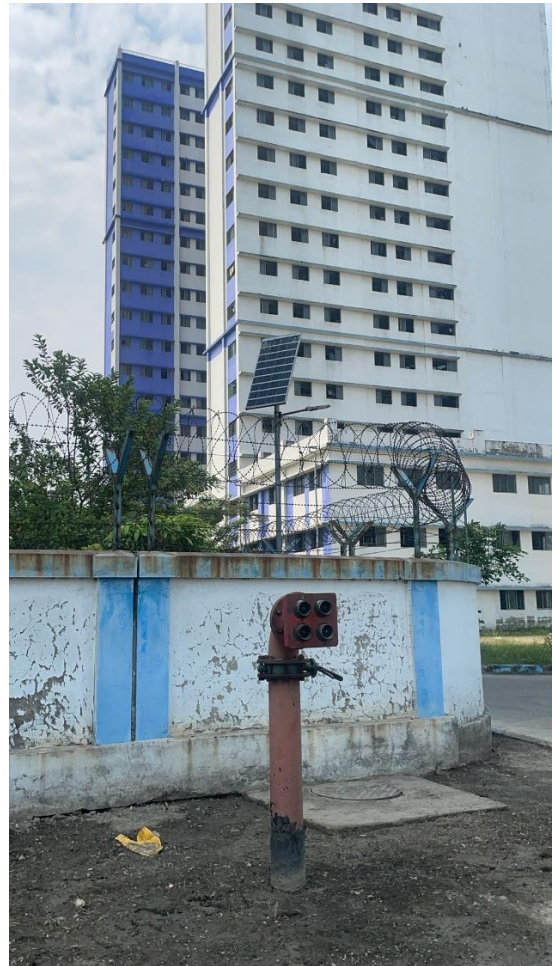




Harvesting of Daylight:



Solar Street Lighting:



Low Flow Fixtures for Water Conservation:



Central Solid Waste Dispatch Area:



Universal Design Aspects:



Analysis of electricity bills received from DISCOM:

Electricity Bill Analysis for the period of April 2021 to March 2022 for Aliah University Rajarhat Campus:

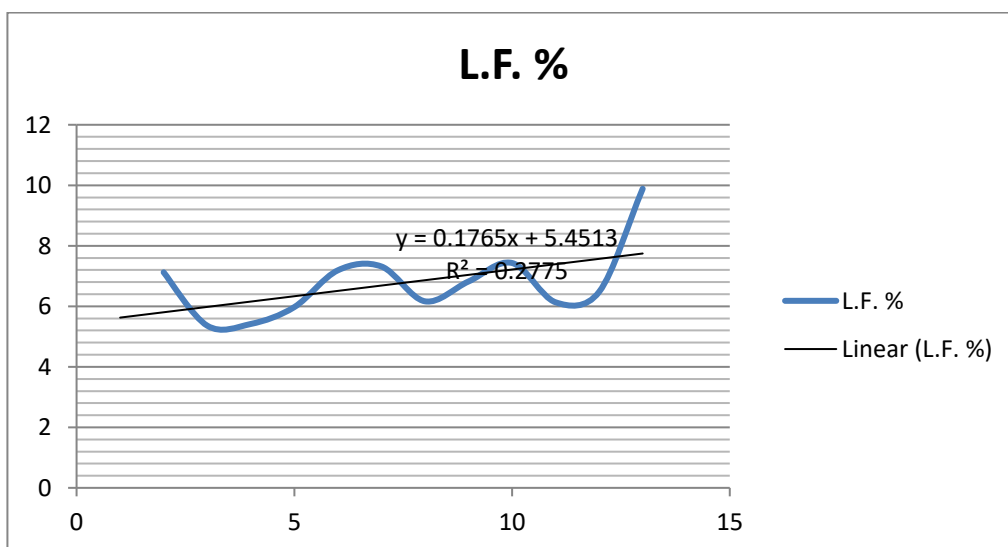
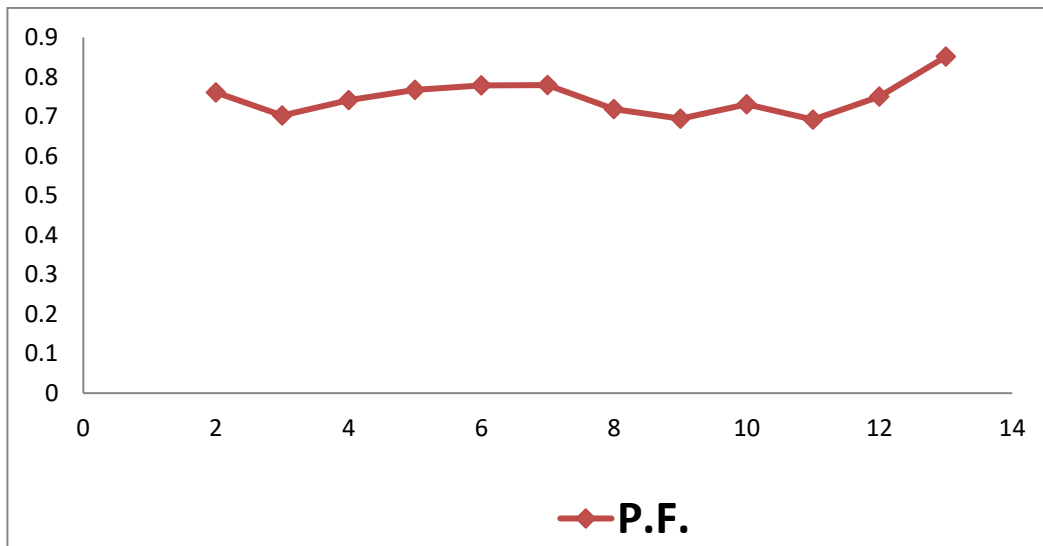
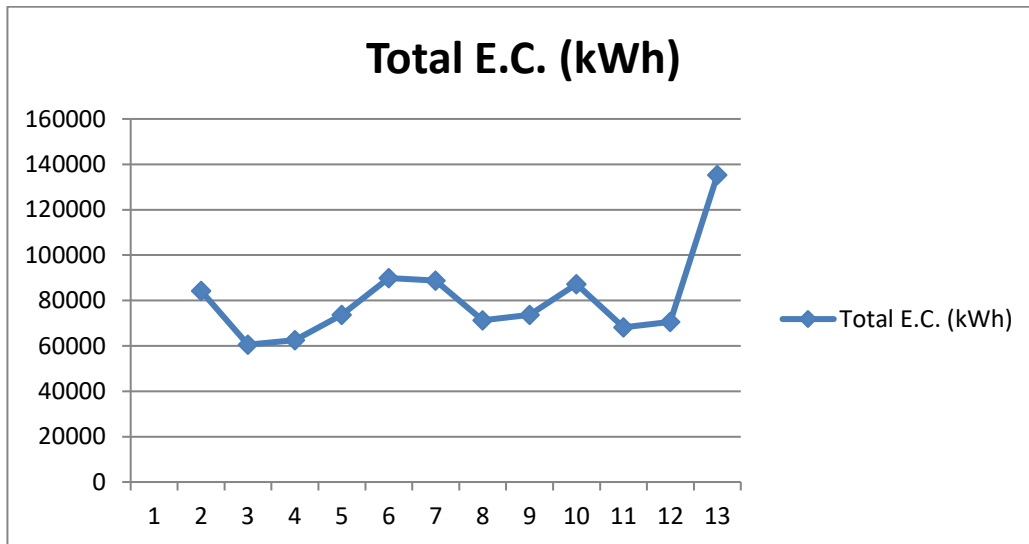
DISCOM: WBSEDCL

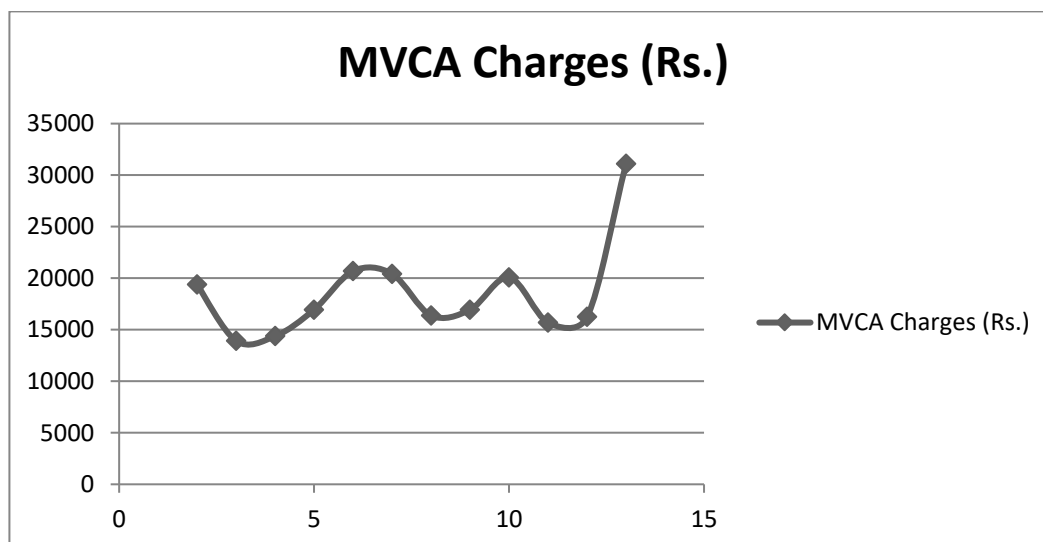
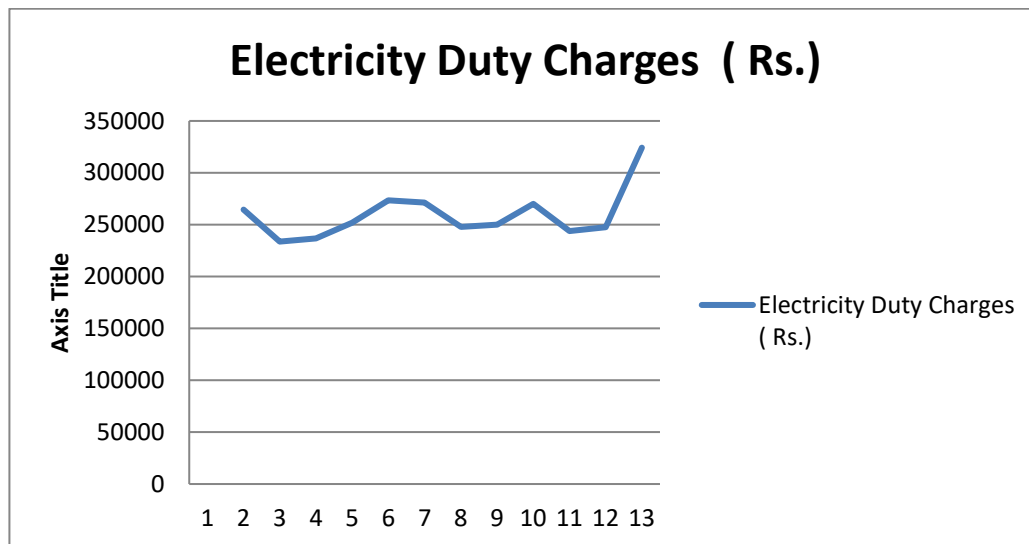
Month	Energy Consumption (kWh)			Inj. RD. Adv. (kWh)	Total E.C. (kWh)	P.F.	L.F. %	Unit/Rate (Rs.)			Energy Charges (Rs.)			Total E.C. (Rs.)	Demand Charges (Rs.)	LF Reb(-)/Sur(+) Charge (Rs.)	PF Reb(-)/Sur(+) Charge (Rs.)	Electricity Duty Charges (Rs.)	MVCA Charges (Rs.)	Rental Charges (Rs.)	TCS Charges (Rs.)	Total Bill Amount (Rs.)
	Normal	Peak	Off-Peak					Normal	Peak	Off-Peak	Normal	Peak	Off-Peak									
	April'21	48930	17400					17970	84300	0.7609	7.1243	6.76	10.14									
May'21	28790	15000	16740	60530	0.7026	5.3612	6.76	10.14	3.98	194620	152100	66625.2	413345.60	829440	25655.48	66519.5	233693.89	13921.9	2400	1582.57	1586559.00	
June'21	31120	15010	16360	62490	0.7419	5.4164	6.76	10.14	3.98	210371	152201.4	65112.8	427685.40	829440	67781.88	26530.77	236623.10	14372.7	2400	0	1604833.85	
July'21	38580	17230	17860	73670	0.7673	5.9748	6.75	10.13	3.97	260415	174539.9	70904.2	505859.10	829440	70375.63	31387.90	251906.67	16944.1	2400	165416.32	1873729.72	
Aug'21	51480	19800	18680	89960	0.7785	7.1907	6.75	10.13	3.97	347490	200574	74159.60	622223.60	829440	66841.04	38597.56	273352.64	20690.8	2400	92557.28	1946102.92	
Sep'21	51850	19000	17890	88740	0.7799	7.3173	6.75	10.13	3.97	349988	192470	71023.3	613480.80	829440	64334.27	38023.32	271255.55	20410.2	2400	91847.21	1931191.35	
Oct'21	37660	16510	17080	71250	0.7191	6.1658	6.75	10.12	3.96	254205	167081.2	67636.8	488923.00	829440	65292.58	30348.17	247868.57	16387.5	2400	83928.37	1764588.19	
Nov'21	38100	17820	17730	73650	0.6944	6.8208	6.74	10.11	3.96	256794	180160.2	70210.8	507165.00	829440	58888.69	31529.39	250166.52	16939.5	2400	84706.46	1781235.56	
Dec'21	42320	23770	21180	87270	0.7307	7.4322	6.74	10.11	3.96	285237	240314.7	83872.8	609424.30	829440	61885.21	38129.88	270088.35	20072.1	2400	91451.99	1922891.83	
Jan'22	31750	18270	18190	68210	0.6921	6.1334	6.74	10.11	3.96	213995	184709.7	72032.4	470737.1	829440	62944.5	29371	243967.34	15688.3	2400	82607.41	1737155.65	
Feb'22	33510	19350	17740	70600	0.7507	6.4792	6.74	10.11	3.96	225857	195628.5	70250.4	491736.3	829440	60543.36	30761.47	247535.52	16238.00	2400	83815.6	1762470.25	
Mar'22	72380	32790	30090	135260	0.8514	9.8859	6.76	10.14	3.98	489289	332490.6	119758.2	941537.6	829440	62037.41	7288.05	324222.28	31109.80	2400	109781.76	2307816.9	

The principal findings from the analysis of the electricity bills are as follows:

1. The Power Factor is abnormally low throughout the year resulting in a total surcharge of Rs.4,04,259.57 (rupees four lacs four thousand two hundred fifty-nine and fifty-seven paise only). A capacitor bank placed within a APFC panel could improve the PF from 0.78 (average) to 0.95. The approximate payback period is eighteen months only. This is an immediate requirement.
2. The Contract Demand of the project is 2541 kVA, whereas the peak demand in twelve months of that year reached maximum 408 kVA, which is 1/6th of the contract demand. This results in abnormally low Load Factor percentage and vis-à-vis a power surcharge of Rs.7,30,035.15 (rupees seven lacs thirty thousand thirty five and fifteen paise only). Moreover, per month a fixed amount of Rs.8, 29,440.00 (rupees eight lacs twenty-nine thousand four hundred and forty only) is billed for that CD. With revised contract demand, the fixed charges would be reduced and Load Factor would be increased. So, there would be double benefit of reduction of total contract demand. There is no capital investment is required for this.







Analysis of existing lighting system, fans and air conditioning systems. Thereby, searching whether there are scopes of any improvements,

During the walkthrough audit it was observed the existing air-conditioning systems installed in the admin building was already optimal. Hence, very little optimizations is possible here.

Most of the lighting systems have already shifted to LED based luminaires.

However, a large number of conventional (induction motor based) fans still exists in the classrooms. These can be replaced by energy efficient Brushless Direct Current Motor or BLDC fans.

Advantage of BLDC fans over conventional fans:-

- Fewer maintenance costs
- Better performance

- Long lasting due to absence of brushes, thereby eliminating the chances of sparks
- Lesser noise
- Greater torque
- Better energy efficiency (as much as 60% less energy consumption as compared to conventional fans.)
- Lesser heat generation.

Searching options for installation of occupancy sensors, daylight sensors etc.

Occupancy sensors and daylight sensors could be installed in the common areas and classrooms to help reduce the energy consumption.

Replacement of old pumps with new ones,

The existing pumps and associated related plumbing line could be thoroughly checked to determine the present health of the pumps (i.e. the operating parameters such as efficiency, head, discharge) and the plumbing lines. Pressure valves and water meters could be installed to help conserve water and detect losses.

Options for putting films over the glazing on the East / West façades,

For admin buildings or buildings where air conditioning systems are installed, heat reflective films could be placed over the glazing to reduce the cooling load.

Options for reducing water consumptions and thereby the operation hours of the pumps, **Automatic level controller for overhead reservoirs,**

It was observed that pumps are operated on a shift basis (3-shift basis). In addition to this, automatic level controller for overhead reservoirs could be installed

Options for sub-metering for different uses of electricity like interior lighting, exterior lighting, air-conditioning, pumps and lifts.

Sub-metering could be done for different uses of electricity such as interior lighting, exterior lighting, air-conditioning systems, pumps and lifts to help identify the energy consumption pattern of the various equipment and appliances.

Searching for tentative potential for renewable energy installation and use.

There is a good potential of rooftop solar installation for the project and if the power could be arranged with net-metering system, then a good savings is possible at the common area load arisen due to lighting, air-conditioning. Lifts and plumbing pumps.

Environmental measures:

- **Options for reducing Heat-Island Effect (both roof and non-roof).**

Cool roof paints could be applied roofs and cool paints could be applied to exterior wall as well.

External driveways could be painted with low SRI paints.

Parking spaces could have grass pavers

- **Options for electric charging facilities for both the 2 & 4 wheelers.**

People should be encouraged to use non-fossil fuel-based transportation. As such electric charging facilities should be available for both two-wheelers and four-wheelers.

- **Universal design options.**

Disabled friendly environment should be provided as follows-

Use of ramps, disable friendly washrooms, easy access to lifts, provision for braille facility in lifts etc.

- **Water efficiency in flow & flush fixtures.**

The existing plumbing fixtures could be exchanged with low-flow fixtures (even if the faucets are introduced with aerators); this has a potential for reduction of atleast 30-40% daily water consumptions. This will ultimately result in lower pumping requirements and thereby conserve energy.

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Rainwater harvesting system is present in the campus. Three number of rainwater storage tanks of capacity 2000 liters each is present. Two number of filter tank is present.

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Water metering could be done to identify the water consumption patterns at various levels and help take necessary measures.

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