ARYA INSTITUTE OF ENGINEERING & TECHNOLOGY

ENERGY AUDIT REPORT

2021 - 2022

PREPARED BY

EHS ALLIANCE SERVICES

CONTENTS

CERTIFICATE

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PRESENTED TO

ARYA INSTITUTE OF ENGINEERING & TECHNOLOGY

SP-40 , Kukas, RIICO Industrial Area, Delhi Road, Jaipur -302028 , Rajasthan

Has been assessed by EHS Alliance Services for the comprehensive study of Energy Audit on institutional working framework to fulfill the requirement of

ENERGY AUDIT

ACADEMIC YEAR 2021-22

The energy-saving initiatives carried out by the institution have been verified in the report submitted and were found to be satisfactory.

The efforts taken by management and faculty towards all types of energy used in the institution and sustainability are highly appreciated and noteworthy.

EHS ALLIANCE SERVICES GURGAON

SIGNATURE

05.07.2022
DATE OF AUDIT

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ACKNOWLEDGEMENT

EHS Alliance Services would like to thank the management of Arya Institute of Engineering and Technologyfor assigning this important work of Energy Audit. We appreciate the co-operation to the teams for completion of assessment.

We would also like to thank ***Dr. Pramod K. Sharma- Audit Coordinator***, for his continuous support and guidance, without which the completion of the project would not have been possible. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

We are also thankful to

Er. Kshitiz Agarwal- IQAC Director

Er. Sandeep Jhamb - H.O.D. Mechanical Engineering

Mr. Rajesh Jaiswal - Estate Manager

Mr. Devendra Kumar Badiwal - Accountant

Last but not the least, we would like to thank ***Dr. Himanshu Arora- Principal*** and ***Dr. Arvind Agarwal, President of Society***, for giving us an opportunity to evaluate the environmental performance of the campus.

DISCLAIMER

EHS Alliance Services Energy Audit Team has prepared this Energy Audit Report for Arya Institute of Engineering and Technology based on input data submitted by the representatives of college complemented with the best judgment capacity of the expert team.

While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the conclusions are arrived following best estimates and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

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Vijay Singh
Lead Auditor EMS & Energy

Dr. Uday Pratap
Co-Auditor EMS & Energy

ABBREVIATION

A	**Amps**
AC	**Air Conditioner**
AC	**Alternating Current**
AMET	**Academy of Maritime Education and Training**
CFL	**Compact fluorescent lamp**
CIP	**Comprehensive Inspection Programme**
DC	**Direct Current**
HSD	**High Speed Diesel**
Hz	**Hertz**
kg	**Kilogram**
kVA	**kilo-volt-ampere**
kW	**kilo Watts**
kWh	**kilowatt hour**
kWp	**Kilowatt peak**
LED	**Light Emitting Diode**
LPG	**Liquefied Petroleum Gas**
MMS	**Module mounting structure**
MPPT	**Maximum Power Point Tracker**
NAAC	**The National Assessment and Accreditation Council**
SEC	**Specific Energy Consumption**
SPV	**Solar Photovoltaic**
STC	**Standard Test Condition**
TV	**Television**
V	**Volts**
W	**Watts**
W/m2	**watt per square metre**

OVERVIEW OF THE COLLEGE

Arya Institute of Engineering & Technology (AIET) is amongst the foremost of Top Institutes in Rajasthan for Engineering in Higher Technical Education & Research. Established in the year 2005, in the State of Rajasthan, Arya Institute of Engineering & Technology has evolved into the most prominent College in the state as well as the Best Engineering Colleges in Jaipur. Spread over 5 acres of land, its highly skilled faculties are imparting education and guidance to thousands of students in a multi-faceted environment comprising of various Teaching Departments on its Campus. Since its establishment, the Institute has played a vital role in providing the best technical manpower and know-how to the country.

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MISSION, VISION & VALUES

MISSION

- ✓ To create a Progressive Academic Environment by nurturing the Creativity, Ideas, Innovation and Skills in Students in order to achieve Qualitative Techno-Managerial Skills.
- ✓ To provide Excellent Ambience to enhance the Teaching-Learning processes amongst Students and Faculty members by building a determined team who are committed to the ideas of Integrity, Positive Thinking and Social Development to meet industry expectations and requirements.
- ✓ To make Students Globally Competitive by providing suitable Training, Value Added Certification Courses and Beyond Syllabus Academics in order to generate capacity to face competitions and placements and become imaginative mastermind and inventive issue solver while providing them safe and challenging environment.

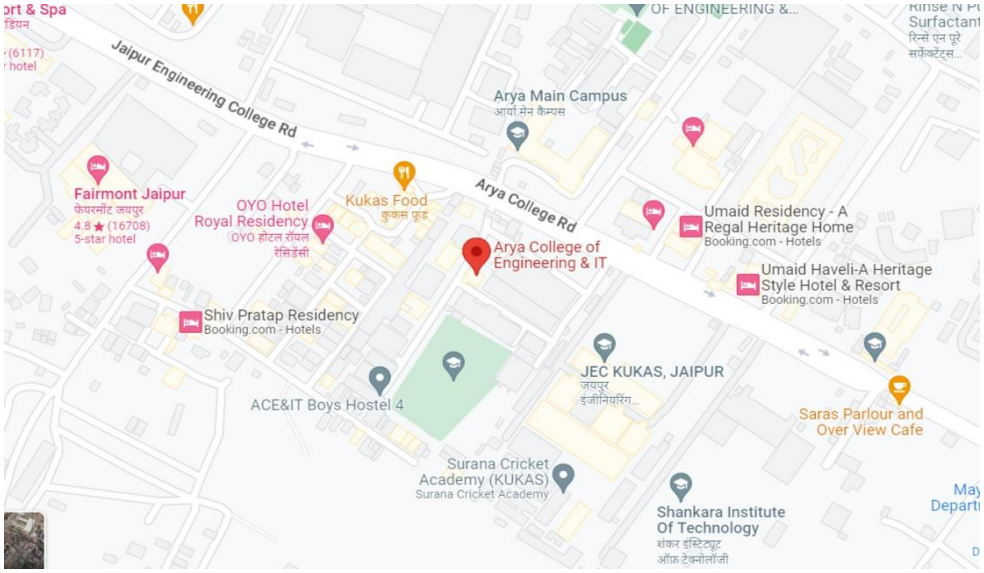
VISION

To emerge as the best educational institute and Work for Excellence in imparting quality education to the students to nurture their inherent talent as Innovative Professional in technical and managerial field there by making them competitive to meet all the future challenge of global economy..

VALUES

Create an environment that instills professionalism, integrity, and the highest professional commitment to the students

Geo Location
Geo Coordinates from Google maps:
27.0299119, 75.8913942



AUDIT PARTICIPANTS

On behalf of College

Name	Designation
Dr. Arvind Agarwal	*President of Society*
Dr. Himanshu Arora	*Principal*
Dr. Pramod K. Sharma	*Audit Coordinator*
Er. Kshitiz Agarwal	*IQAC Director*
Er. Sandeep Jhamb	*H.O.D. Mechanical Engineering*
Mr. Rajesh Jaiswal	*Estate Manager*
Mr. Devendra Kumar Badiwal	*Accountant*

On behalf of EHS Alliance Services

Name	Position	Qualifications
Mr. Vijay Singh	Lead Auditor	*M.Sc. M. Tech (Environment Science & Engineering), Energy Auditor, Post Diploma in Industrial Safety Management*
Dr. Uday Pratap	Co-Auditor	*Ph.D., EMS: Lead Auditor ISO14001:2015, QCI–WASH*

EXECUTIVE SUMMARY

The purpose of this Energy Audit was to seek opportunities to improve the energy efficiency of the Arya Institute of Engineering and Technology. Reducing the energy consumption despite improving the human comfort, health and safety were of primary concern.

Beyond just identifying the energy consumption pattern, this audit sought to detect and categorize the most energy efficient appliances. Additionally, some daily practices relating common appliances have been shared which may help reducing the energy consumption. Data collection for energy audit of the campus was carried out by the EHS Alliance Team. The Energy Audit Report accounts for the energy consumption patterns of the institution on actual survey and detailed analysis during the audit.

The work comprehends the area wise consumption traced using suitable equipment. The analysis was carried out by our team with the support of the staff members from Arya Institute of Engineering and Technology. The report provides a list of possible actions to preserve and efficiently access the available source, resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff members would follow the recommendations in the best possible way. The report is based on certain generalizations including the approximations wherever necessary. The views conveyed may not reveal the general opinion. They merely represent the opinion of the team guided by the interviews of clients. We are happy to submit this Energy audit report to the Arya Institute of Engineering and Technology.

ENERGY AUDIT - ANALYSIS

1. ENERGY CONSUMPTION

To understand the Energy Consumption trends and for analyzing the average monthly consumption we have collected electricity energy bills from July 2021 to June 2022

The details of **"Meter Connection"** at **"Arya Institute of Engineering and Technology"** are as follows-

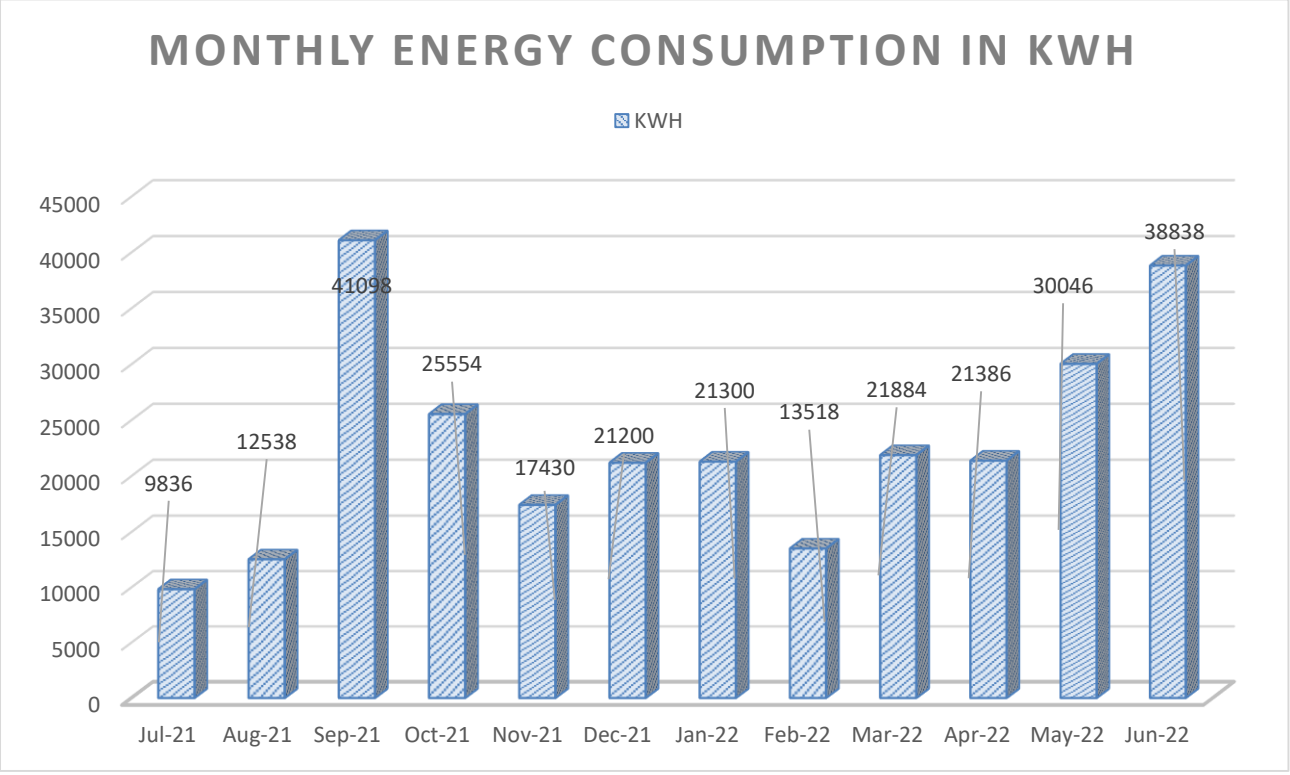
Name - ALL INDIA ARYA SAMAJI SOCIETY FOR HIGHER TECH EDUCATION

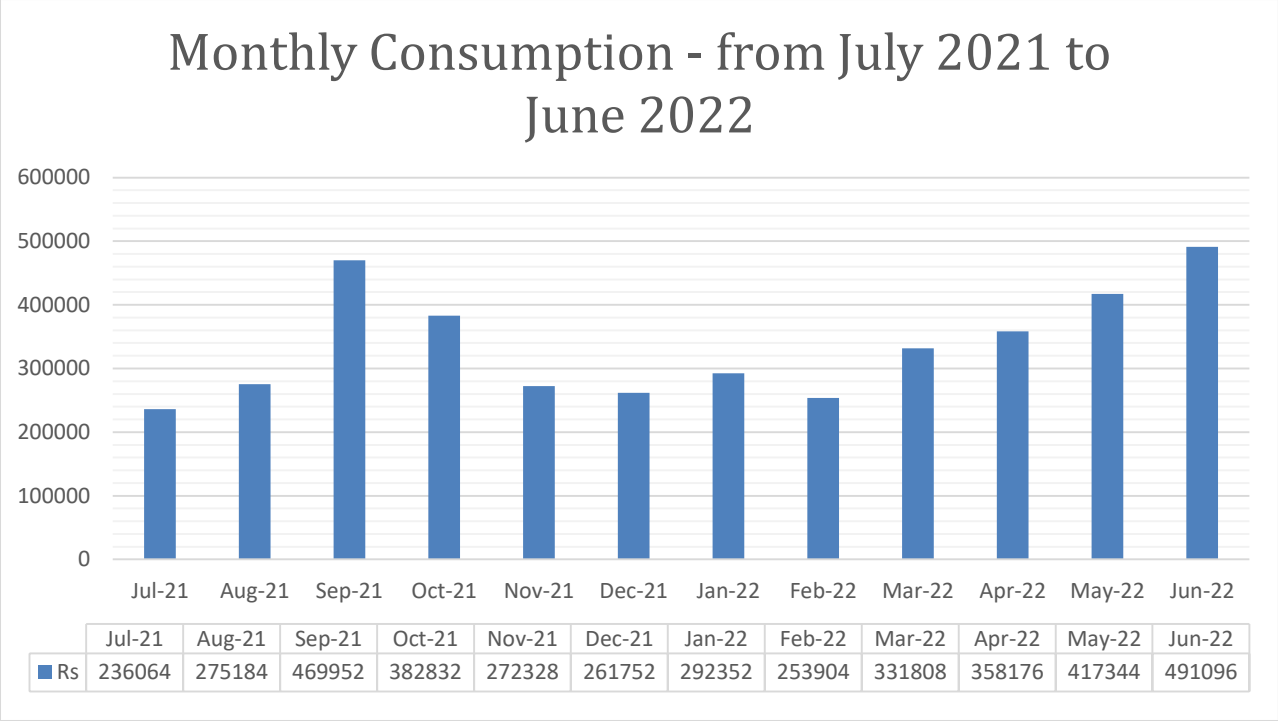
CA No. - 210503027388

1.1 Summary of Monthly Electricity Consumption and Total Bill Amount

To understand the Energy consumption trend and for developing the baseline parameter we have collected monthly energy bill for the 12 months i.e. from July 2021 to June 2022

Month	Grid Billing	Solar PV	Total Readings	Rate INR	Amount in INR
Jul-21	9836	19672	29508	8.00	236064
Aug-21	12538	21860	34398	8.00	275184
Sep-21	41098	17646	58744	8.00	469952
Oct-21	25554	22300	47854	8.00	382832
Nov-21	17430	16611	34041	8.00	272328
Dec-21	21200	11519	32719	8.00	261752
Jan-22	21300	15244	36544	8.00	292352
Feb-22	13518	18220	31738	8.00	253904
Mar-22	21884	19592	41476	8.00	331808
Apr-22	21386	23386	44772	8.00	358176
May-22	30046	22122	52168	8.00	417344
Jun-22	38838	22549	61387	8.00	491096
SUM	274628	**230721.00**	**505349**		**4042792**

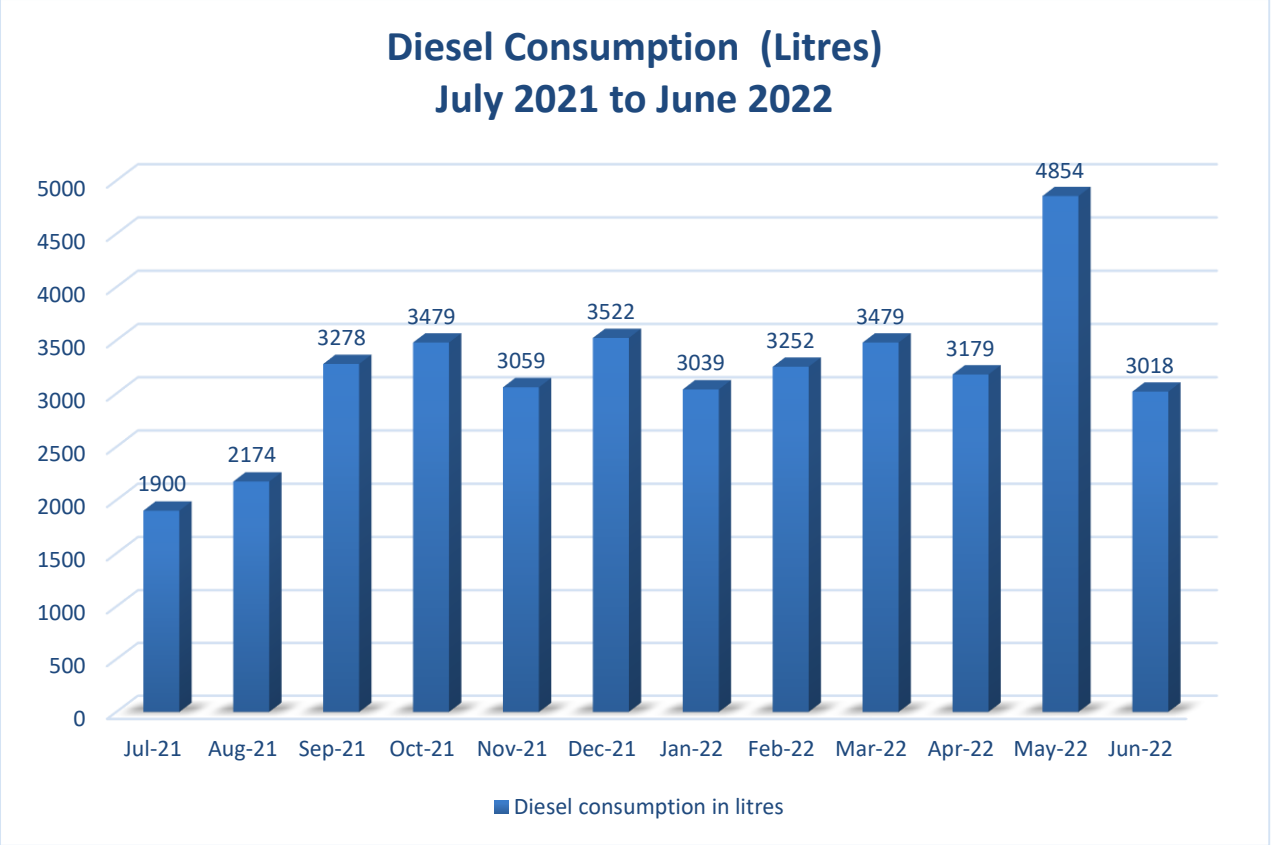




2. DIESEL CONSUMPTION

Below is the diesel consumption details in litres from from July 2021 to June 2022.

Period	Diesel consumption (in litres)
Jul-21	1900
Aug-21	2174
Sep-21	3278
Oct-21	3479
Nov-21	3059
Dec-21	3522
Jan-22	3039
Feb-22	3252
Mar-22	3479
Apr-22	3179
May-22	4854
Jun-22	3018
Total	**38233**



3. ANALYSIS OF DG SETS

In the campus, there is only one Diesel Generator (DG) set for its electrical power needs in case of Grid power failure. DG sets capacity is 250 kVA.

DG Set Design Details		
Description	***Unit***	***DG at Station 1***
Rated capacity	kVA	250
Hz		50
Sl No.		3.30608E+12
Make		Greaves
Volts	Volts	415
PF		0.8
Phase		3
RPM		1500
Amps	Amps	448
Mfg.		2006

DG Set Operation details		
Operating hours during testing	Hours	0.50
% Loading	%	63.73
Energy Generation	kWh	34.21
Load	kVA	91.73
Fuel consumption during testing	Litre	10
Specific energy generation	kWh/litre	3.21

Observation and Suggestions:-

Soundproof silent generators are an efficient tool to keep both noise and vibration at low levels. For the power backup of the institution, the soundproof model is installed near herbal garden of the institution.

As per the trial taken during the energy audit the percentage loading of DG set is 63.73% which is ok and specific energy consumption of DG Sets 3.21 kWh/Litre which is satisfactory because as per manufacturer recommendation, best practices for SEC in DG sets range from 3.0 to 3.5 kWh/Litre and above.

We recommend college to initiate periodic maintenance schedule and stack monitoring of DG set through authorized lab.

4. AC SYSTEM

Energy Efficiency Ratio (EER): Performance of smaller chillers and rooftop units is frequently measured in EER rather than kW/ton. EER is calculated by dividing a chiller's cooling
Capacity (in Btu/h) by its power input (in watts) at full-load conditions. The higher the EER, the More efficient the unit. The cooling effect produced is quantified as tons of refrigeration (TR). The above TR is also called as air-conditioning tonnage.

There are Split ACs installed in Arya Institute of Engineering and Technology in various areas of various capacity which detail is given below:-

Sl No.	Location /Identification	Type (Window/ Split)	Qty	RR. Tonnage
1	Ground Floor	S	10	2
	Ground Floor	S	1	2
2	Ground Floor	W	13	1.5
3	First Floor	S	7	1.5
4	First Floor	W	8	1.5
5	Second Floor	S	2	1.5
6	Second Floor	W	10	1.5
7	Third Floor	S	4	2
	Third Floor	S	2	2
8	Third Floor	W	12	1.5
9	Robolab	W	2	1.5
10	Library	W	1	1.5

Remarks: - We have checked Energy Efficiency Ratio of AC's and EER of AC's is fairly OK. But in future you should purchase 5-Star rated invertor based split AC's because power consumption of Inverter based BEE 5-Star rated AC's is less than non-star rated AC's.

Also, we recommend Arya Institute of Engineering and Technologyto organize periodic maintenance schedule and take corrective actions for insulating of AC's refrigerant lines in order to protect energy losses.

5. FANS ANALYSIS

In the Arya Institute of Engineering and Technology, there are 1018 fans installed, all ceiling fans are of 60W. The observation and suggestion are given below.

Sl No.	Location/Identification	Ceiling Fan-60W
1	Basement Lab 1	6
2	Basement Lab 2	6
3	Basement Lab-3	6
4	Basement Lab -4	6
5	Basement Lab -5 GSS	6
6	Basement Lab 6 (PE)	6
7	Basement Drive Lab	6
8	Basement Lab -CSE	4
9	Basement - Project Lab	6
10	Basement HVE Lab	6
11	Ground Floor	120
12	First Floor	99
13	Second Floor	120
14	Third Floor	141
15	NBH	253
16	Tej Hostel	178
17	Robo lab	9
18	Library	40

Observation and Suggestions:-

In the college, all the ceiling fans are of 60 W but BEE 5 Star Rated of 30W Ceiling Fans are present in the market. We recommend to replace to BEE 5 Star rated 30W fans.

Note:- Energy saving will increase or decrease if operating hours of machine /equipment will be increased or decreased and payback period will also increase or decrease if cost of investment (Cost of machine/equipment/accessories of machine) will increase or decrease because cost of investment is taken on tentative basis.

6. ANALYSIS OF LIGHTING SYSTEM

6.1 Brief description of existing system

For assessing energy efficiency of lighting system, Inventory of the Lighting System has been noted / collected, with the aid of a lux meter, measurement and documentation of the lux levels at various locations at working level has been done.

6.2 Inventory of Lighting

Sl. No.	Location/ Identification	200W-LED High Mast	10W LED	18W LED Light	12 W LED Round	36W LED	18W LED Flood	20W LED
1	Basement	0	0	18	0	72	0	0
2	Ground Floor	0	0	25	0	56	40	13
3	First Floor	0	0	32	0	47	0	25
4	Second Floor	0	0	23	0	54	0	10
5	Third Floor	0	0	73	0	29	0	0
6	Main Gate	2	0	5	0	0	7	0
7	NBH Hostel	4	131	175	0	207	0	0
8	Tez Hostel	2	69	123	0	59	0	0
9	Robo lab	0	0	0	0	23	0	0
10	Library	0	0	18	96	4	0	0

6.3 Lux Measurement

Description	Lux	Remark
Class Rooms	120 to 235	Acceptable
Offices	130 to 240	Acceptable
Corridors	35 to 90	Acceptable
Washrooms	45 to 76	Acceptable

Outdoor	36 to 95	Acceptable
Computer Lab	150 to 289	Acceptable
Parking area	45 to 94	Acceptable
Canteen	69 to 185	Acceptable

Observation

College has initiated LED based lighting solution, but still there are 551 (36W) tube lights. LEDs save energy, the life span is much greater and emit virtually no heat. We recommend to replace the tube lights with LEDs.

Additionally, we recommend to install motion sensor-based lights in common areas such as library, washrooms, corridors, etc.

We also recommend to use solar lights for open areas like parking, ground, street lights, etc. Table below shows the performance characteristics comparison of all luminaries.

Table - Luminous Performance Characteristics of Commonly Used Luminaries

Type of Lamp	Lumens/Watt		Colour Rendering Index	Typical Application	Typical Life
	Range	Avg.			
Incandescent	8-18	14	Excellent (100)	Homes, restaurants, general lighting emergency lighting	1000
Fluorescent lamps	46-60	50	Good w.r.t coating (67-77)	Offices, shops, hospitals, homes	5000
Compact fluorescent Lamps (CFL)	40-70	60	Very Good (85)	Hotels, shops, homes, offices	8000-10000
High pressure mercury (HPMV)	44-57	50	Fair (45)	General lighting in factories, garages, car parking. flood lighting	5000
Halogen lamps	18-24	22	Excellent (100)	Display, flood lightening, stadium exhibition grounds, construction areas	2000 - 4000
High pressure sodium (HPSV)	67-121	90	Fair (22)	General lighting in ware houses,	6000 - 12000

SON				factories, street lighting	
Low pressure sodium (LPSV) SOX	101-175	150	Poor (10)	Roadways, tunnels, canals, street lighting	6000 - 12000
Metal halide lamps	75-125	100	Good (70)	Industrial bays, spot lighting, flood lighting, retail stores	8000
LED Lamps	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lights, etc.	40000 - 100000

7. OTHER POWER CONSUMPTION

7.1 Inventory of IT Infrastructure

Sl No.	Location/Identification	Desktop	Laptop	Printers	Scanners	Servers	Other
1	Registrar Office	6	2	2	1	0	0
2	Account Office	6	0	2	0	0	0
3	Robotic Lab 1	6	1	1	0	0	0
4	Robotic Lab 2	2	0	0	0	0	0
5	T&P Office	4	1	3	0	0	0
6	Exam Cell	7	1	2	0	0	Photocopy -1
7	Admission Cell	1	0	0	0	0	0
8	Board Room1	1	0	1	0	0	2 TVs
9	Board Room2	2	0	1	0	0	1 TV
10	TV Studio	2	0	0	0	0	1 TV
11	Principal Office	3	1	1	0	0	0
12	Director Room	5	1	2	0	0	1 Photocopy Machine

13	Estate Room	1	0	1	0	0	0
14	CSE Dept	10	0	2	0	0	0
15	CSE Staff Room	7	0	0	0	0	0
16	SDC Cell	4	0	1	0	0	0
17	MBA Dept	4	0	1	0	0	0
18	R&D Lab	1	0	0	0	0	0
19	LT-11	1	0	0	0	0	0
20	Civil Dept	3	0	1	0	0	0
21	3rd Floor	1	0	0	0	0	0
22	EE Dept	4	0	1	0	0	0
23	ME Dept	2	0	1	0	0	0
24	CL12	31	0	0	0	0	0
25	CL13	60	0	0	0	0	0
26	CL-14-A	31	0	0	0	0	0
27	CL-14 B	30	0	0	0	0	0
28	CL-15	30	0	0	0	0	0
29	CL-16	30	0	0	0	0	0
30	CL-17	30	0	0	0	0	0
31	CL-18	30	0	0	0	0	0
32	CL-19	30	0	0	0	0	0
33	CL-20	30	0	0	0	0	0
34	TEZ Lab	30	0	0	0	0	0
35	EE CL	24	0	0	0	0	0
36	ME CL	30	0	0	0	0	0
37	CL-26	40	0	0	0	0	0

38	CL-27	40	0	0	0	0	0
39	CL-28	40	0	0	0	0	0
40	CL-29	40	0	0	0	0	0
41	CL-30	40	0	0	0	0	0
42	CL-31	30	0	0	0	0	0
43	CL-32	50	0	0	0	0	0
44	CL-33	30	0	0	0	0	0
45	CL-34	50	0	0	0	0	0
46	CL-35	50	0	0	0	0	0
47	Mechatronics Lab	5	1	4	0	0	0
48	Library	14	0	2	0	0	0
49	President Office	3	1	2	0	0	0
50	Vice President	2	0	2	0	0	0
51	NBH Hostel	3	0	0	0	0	0

7.2 Water pump details

Sr. No.	Description	Unit	Pump No.-1	Pump No.-2	Pump No.-3	Pump No.-4	Pump No.-5	Pump No.-6
1	Rated Power of Motor	KW	7.3x2	2.2	2.2	2.2	1.5	1.5
2	Motor Eff.	%						
3	Discharge Head	m	151	36	50	5	4	4
4	Suction Head	m		10	10	3	3	34
5	Pump Type	Submersible / Monoblok/ Centrifugal Etc.	Submersible	Monoblock	Monoblock	Monoblock	Monoblock	Monoblock

7.3 Exhaust fan details

Sl No.	Location/Identification	60W Exhaust Fan	160W Exhaust Fan
1	Third Floor -Staff Toilet	1	
2	Third Floor CSE Lab	1	
3	Third Floor CSE Lab17	2	
4	Third Floor CSE -18	2	
5	Third Floor CSE-19	1	
6	Third Floor- Dark Room	2	
7	Third Floor Physics Lab	2	
8	Third Floor Chemistry Lab	1	
9	Third Floor Boys Toilet	1	
10	Girls Toilet	1	
11	LT-41	1	
12	LT-42	2	
13	LT-43	1	
14	LT-45	1	
15	LT-46	1	
16	LT-47	2	
17	Second Floor	13	2
18	First Floor	10	1
19	Ground + Basement	7	8

ANALYSIS

There should be regular maintenance schedule of equipment like pumps, exhaust fans and IT equipment. Electronics such as computers, printers, scanners, etc. more than 3 year or 5 years (as per their life) should be replaced with new computers/laptops. Ideal Temperature should be maintained for all electronic appliances.

8. CAPACITOR BANK

S. No	Capacity in KVAR	Quantity
1	1 KVR	1
2	2 KVR	1
3	5 KVR	1
4	10 KVR	2
5	15 KVR	4
6	20 KVR	2

***** **END OF THE REPORT** ******