2022-2023

ENERGY AUDIT REPORT

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Prepared for

K.K.WAGH Arts, Commerce,Science & Computer Science College,KakasahebNagar, Ranwad

2022-2023

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GREENENCON SOLUTIONS

A Complete Solution on Energy Auditing and Consulting

Ref.- EAS/KKWACSC / 2023-24/07

ENERGY AUDIT

CERTIFICATE

This is to certify that **GREENENCON SOLUTION** has successfully completed Energy Audit at **K.K.wagh Arts, Commerce, Science & Computer Science College, KakasahebNagar(Ranwad)**, Nashik. The work of Energy Audit is completed on 20th Jan, 2023 for year 2022-23.

Thanking you and assuring you for our best services.

Audit Report by,

Mr. Santosh D Jadhav

Santosh D. Jadhav
Energy Auditor
BEE Certified
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Date: 25/01/2023
Place: Nashik

For **GREENENCON SOLUTION**

Mr. Santosh D Jadhav

GREEN ENCON SOLUTION GES

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ABBREVIATIONS

ABBREVIATIONS	EXPANSIONS
APFC	Automatic Power Factor Controller
BEE	Bureau of Energy Efficiency
DG	Diesel Generator
EE	Energy Efficiency
MD	Maximum Demand
MT	Metric Ton
MTOE	Metric Ton of Oil Equivalent
No.	Number
PF	Power Factor
SEC	Specific Energy Consumption
A	Ampere
AC	Alternating Current
Avg.	Average
KW	Kilowatts
KWh	Kilowatt hours
GES	GreenEnCon Solution

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GREEN ENCON SOLUTION GES

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PREFACE

K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR is the acknowledged leader in education field. Today K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR has established a strong presence in the education field. This audit was conducted to seek opportunities to improve the energy efficiency of the campus as well as promote the green energy practices in college campus. Reduction of energy consumption while maintaining or improving human comfort, health and safety were of primary concern. Beyond simply identifying the energy consumption pattern, this audit sought to identify the most energy efficient appliances. Moreover, some daily practices relating common appliances have been provided which may help reducing the energy consumption. The report accounts for the energy consumption patterns of the academic area, central facilities based on actual survey and detailed analysis during the audit. The work encompasses the area wise consumption traced using suitable equipments. The report compiles a list of possible actions to conserve and efficiently access the available scarce resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff would follow the recommendations in the best possible way. The report is based on certain generalizations and approximations wherever necessary. The views expressed may not reflect the general opinion. They merely represent the opinion of the team guided by the interviews of consumers.

ACKNOWLEDGEMENTS

GES places on record its sincere thanks to K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR for vesting confidence in GES to carry out the Green Energy Audit. A Green energy audit study is a joint venture exercise of consultant and institute to account and contain energy usage without sacrificing the purpose of energy use. The contribution of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR team is equally important in this venture. Team of technical experts from M/s GreenEnCon Solution, Nasik appreciates the keen interest shown by the management of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR, Nasik for their kind co-operation , furnishing required data and hospitality offered during our visits.

Our special thanks to,

- **Chairman- Mr. Sameer Balasaheb Wagh**
- **Principal – Dr. A.S.Gaware**

We are also thankful to other members of the institute for their diligent involvement and co-operation.

EXECUTIVE SUMMARY

Greenencon Solution has conducted a “Energy Audit” of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE COLLEGE, KAKASAHEBNAGAR for the academic year 2022-23. An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. Its insight to energy efficiency and conservation can lead to significant savings on the utility bill. Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempt to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

Questionnaires prepared to conduct the Energy audit were based on the guidelines, rules, acts and formats set by Government of India, Ministry of Environment and Forest and Bureau of Energy Efficiency. For audit purpose and suitability analysis of data the study area is grouped as administrative buildings, Seminar Hall, Laboratories, class rooms, Common rooms, Sick room, Computer centre & Language Lab. The audit was carried for electricity and energy.

1. PREAMBLE

K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College Kakasahebnagar(Ranwad) Nashik include all Courses in the same building affiliated with Savitribai Phule Pune University.

K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College (Ranwad), Nashik started in 2004 with a current intake of 450 for the Arts, Commerce, Science & Computer Science course. Over the years, K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College (Ranwad), Nashik has grown in leaps and bounds providing a stimulating learning environment in Nasik by providing a sprawling campus and state-of-the-art infrastructure. K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College(Ranwad), Nashik has students from many different areas across the state pursuing their education in Arts, Commerce, Science & Computer Science streams. This Institute is strategically located in the heart of the city and has a campus providing enlightening and inspiring, academic ambience. K.K.wagh Arts, Commerce, Science & Computer Science College Kakasahebnagar(Ranwad) Nashik is spearheaded by well-qualified, experienced, and dedicated staff.

1.1 ABOUT ENERGY AUDIT

Energy auditing is the process of identifying and determining whether institutions practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. But over the period of time excess use of resources like energy, water, chemicals are become habitual for everyone especially, in common areas. Now, it is necessary to check whether our processes are consuming more than required resources? Whether we are handling waste carefully? Energy audit regulates all such practices and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion it is necessary to verify the processes and convert it in to Energy and clean one. Energy audit provides an approach for it. It also increases overall consciousness among the people working in institution towards an environment.

1.2 OBJECTIVES

The objective of Energy Audit is to promote the idea of Energy Conservation in the Campus of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College(Ranwad), Nashik The purpose of the energy audit is to identify, quantify, describe and prioritize cost saving measures relating to energy use in the Departments and Institute Central Facilities.

The work eligible for Energy Audit Study should be directed towards Identification of areas of energy wastage and estimation of energy saving potential in Departments and Institute Central Facilities. Suggesting cost-effective measures to improve the efficiency of energy use. Estimation of implementation costs and payback periods for each recommended action. Documenting results & vital information generated through these activities. •Identification of possible usages of co-generation, renewable sources of energy (say Solar Energy) and recommendations for implementation, wherever possible, with cost benefit analysis.

1.3 GOALS OF GREEN & ENERGY AUDIT

K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College(Ranwad) has conducted a green audit with specific goals as:

1. Identification and documentation of green practices.
2. Identify strength and weakness in green practices.
3. Conduct a survey to know the ground reality about green practices.
4. Analyze and suggest solution for problems identified from survey.
5. Assess facility of different types of waste management.
6. Increase environmental awareness throughout campus.
7. Identify and assess environmental risk.
8. Motivates staff for optimized sustainable use of available resources.
9. The long term goal of the environmental audit program is to collect baseline data of environmental parameters and resolve environmental issue before they become problem.

1.4 SCOPE OF WORK

- To study electrical energy metering, Green practices, monitoring and control system existing at site and to recommend a suitable system for future monitoring.
- To study monthly power factor, maximum demand, working hours, load factor etc. for the reference period along with monthly electricity Consumption and establish scope for MD control through load optimization of load factor and through detailed load management study.
- To recommend a specific rationalization/ optimization program based on measurement of DB power factors, existing capacitor system and its maintenance, automatic / manual controls required etc.
- To study water distribution system for improving efficiency of water use. The water used at bathrooms, toilets, laboratory, kitchen, garden, shower and other uses as well as leakages and over flow of water from overhead tanks is also been evaluated.
- To undertake detailed lighting study on all buildings with the help of Lux meter to identify lux level for each application.
- Based on the above to evaluate the possibility of replacing inefficient light with Energy efficient lighting system.

2. METHODOLOGY

The methodology adopted for this audit was a three step process comprising of:

1. Data Collection– In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, interviewing key persons, and measurements.

2. Data Analysis- Detailed analysis of data collected was done using Elektra. The database generated by Elektra was used for producing graphical representations.

3. Recommendation– On the basis of results of data analysis and observations, some steps for reducing power consumption without affecting the comfort and satisfaction were recommended along with their cost analysis.

2.1 Data Collection

The first module is related to the general information of the concerned department, which broadly includes name of the department, month and year, total number of students and employees, visitors of the department, average working days and office timings etc. The next module is related to the present consumption of resources like water, energy, or the

handling of solid and hazardous waste. Maintaining records of the handling of solid and hazardous waste is much important in green audit.

For suggesting any corrective measures to reduce power consumption, it is first necessary to know the power consumption pattern in detail. For this, the exhaustive data collection exercise was performed at all the departments, academic centers, and other supporting entities such as library, institute hospital, computer centre etc.

Following steps were taken for data collection:

- The team went to each department, centre, etc.
- Information about the general electrical appliances was collected by observation and interviewing.
- The power consumption of appliances was measured using power analyzer in some cases

(such as fans) while in other cases, rated power was used (CFL for example).

- The details of usage of the appliances were collected by interviewing key persons e.g. Warden (in case of hostels), caretaker (in case of departments) etc.
- Light intensity was measured using lux meters at the places where light intensity was either very low or very high.
- In case of Air Conditioning, insulation was checked by visual inspection.

2.2 Data Analysis

In data analysis, the data collected is processed to draw significant conclusions to pinpoint loopholes and identify the areas to focus upon. Analysis of the power consumption observations obtained was used to obtain the power consumption pattern and also to get the information about the points where electric power is wasted. Analysis of the water consumption observations obtained was used to obtain the water consumption pattern and also identify the losses. This helped to identify the areas with maximum water and energy saving potential

2.3 Recommendations

Energy as well as cost analysis of different areas were performed and recommendations were made based on the capital cost recovery time.

Following were the steps involved in this process:

- The capital cost involved in replacing an appliance and/or process was estimated.
- The energy saving by the move was calculated in terms of price of energy per year.
- These two costs were compared to calculate the capital cost recovery time which is defined as the total time by which the saving in energy bill balances the capital cost involved.
- If capital cost recovery time is less than the product life, the move can be supported.
- Some other recommendations were also made which are based on lighting intensity, AC insulation, water leakage, solid waste etc.

3. ABOUT THE UNIT

K. K. Wagh Education Society, by making education a tool for the development of rural areas, K. K. Wagh Arts, Commerce, Science and Computer Science College, Kakasahebnagar (Ranwad), at affiliated to Savitribai Phule Pune University started in 2004 having Total Campus Area 26587.84675 Sq.Meters.

In addition to the prevailing university curriculum, the college provides facilities such as guidance for competitive examinations, personality development, and exposure to the professional world, computer training etc. Various student welfare schemes, Nirbhay Kanya Abhiyan, Earn and Learn Scheme, Vidyarthini Manch, Special Mentoring schemes organized by Savitribai Phule Pune University are implemented in the college to develop the personality of the students. Under the Government of India and Savitribai Phule Pune University, the concept of National Service Scheme is implemented in the college and students are encouraged for the benefit of students and society. Students are guided in inter-college level debate competitions, elocution competitions, sports competitions. The library has reference books of all subjects, various newspapers, journals, as well as supplementary CDs of reference books and internet facility, LCD Facilities like projector, smart board are available. Similarly, all the materials required for various competitive exams are available and guidance is provided for the competitive exams from time to time. Lectures are organized by expert lecturers. Also well equipped Training and Placement Department, National Service Scheme, Student Development Board are functioning.

The college has resolved to create a youth generation who can dream of a bright future by combining knowledge, karma, manners and skills and to produce well-rounded students.

4. ENERGY AUDIT

An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. Its insight to energy efficiency and conservation can lead to significant savings on the utility bill. Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempt to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

4.1. ELECTRICITY AUDIT

Energy resources utilized by all the departments, support services and the administrative buildings of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College (Ranwad) campus include electricity. Major use of the energy is at office, class room and laboratories, for lighting and laboratories instruments. K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College (Ranwad) has total sanctioned load of 101KW with 1 commercial Electricity meter. Electricity is supplied to the K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE campus by Maharashtra State Electricity Board.

Table 1: Total Load Consumption of the Unit

Department	Total Load(KW)	Energy Consumed Yearly(KWH)
ADMIN OFFICE	1.87	1846
CLASS ROOMS	39.33	10639.2
LABORATORY	10.5	8159.8
LIBRARY	1.95	2048.8
MEETING HALL	0.13	343.2
LADIESROOM	0.6	806
GENTS/LADIES TOILET	1.3	1638
STAFF ROOM	0.675	572
OTHER ROOMS	7.54	8002.8
PRINCIPAL CABIN	0.565	733.2
HOD CABIN	1.9	1300
GENTS ROOM	0.28	306.8
PASSAGE	4.01	5714.8

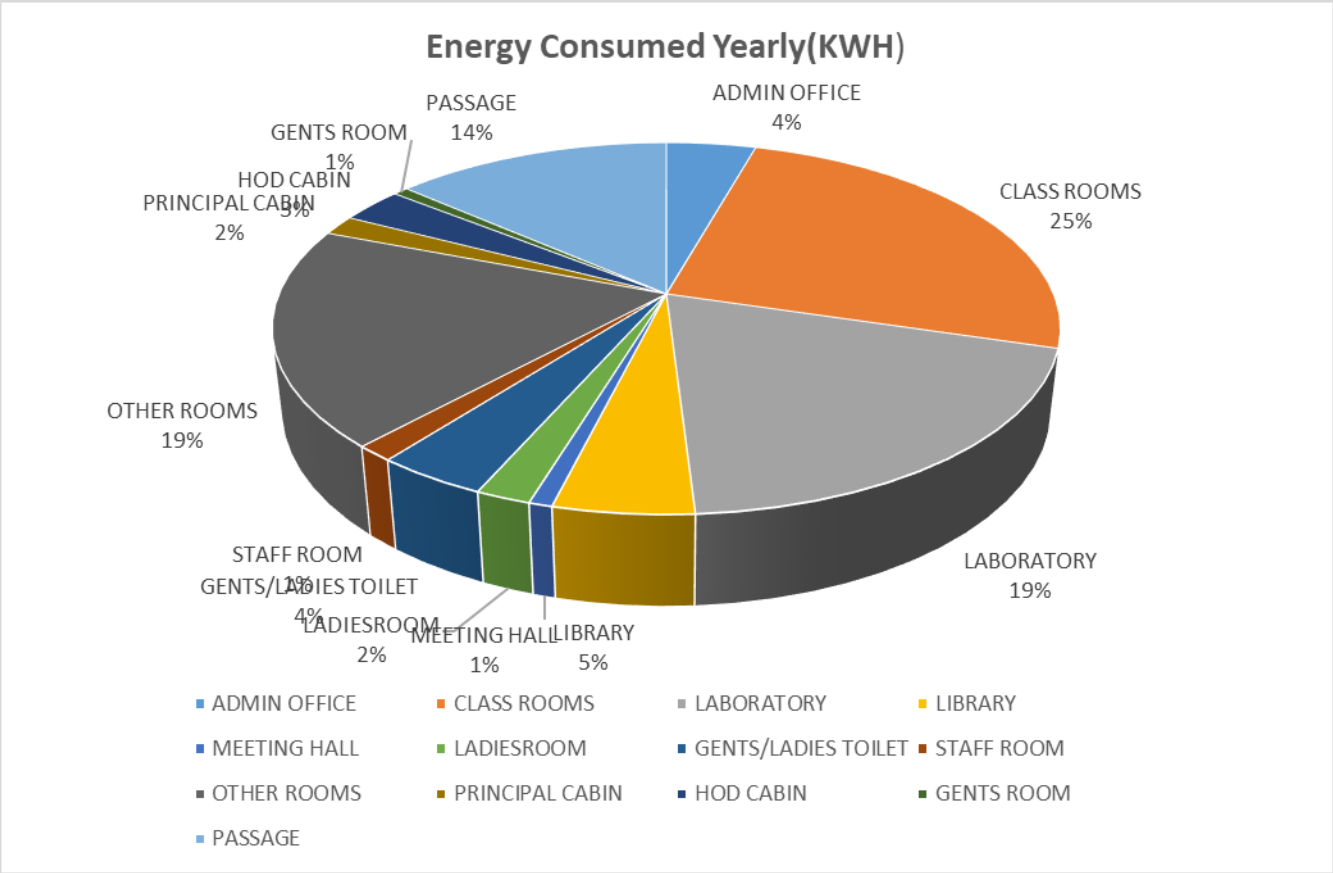

Fig.1: Total Load consumption of the campus

4.2. EQUIPMENT WISE ANALYSIS OF CAMPUS:

Table 2: Equipment wise Load of Campus

SR.No.	Equipment	Energy Consumed Yearly (KWH)
1	**Florescent Tube**	6271
2	**Ceiling Fan**	19344
3	**Exhaust Fan**	208
4	**LCD Projector**	748.8
5	**Computers**	2839.2
6	**Printer**	218.4
7	**Scanner**	208
8	**Lab Equipment**	0
9	**Refrigerator**	780
10	**Hot Plate**	520
11	**Ups**	0
12	**200 W Socket**	208
13	**100 W Socket**	3198
14	**Water Pump**	0
15	**Photocopier**	2184
16	**CCTV Camera**	3182.4
17	**Water Coolar and Filter**	1404
18	**Vending Machine**	78
	Total	**41392**

Equipment wise analysis has been performed in order to identify the equipments, within same application area, which consume more power as compared to others. During equipment wise analysis of the overall campus, the equipments with power consumption less than 1% of total power consumption of the campus were ignored so as to make the analysis results simple and easy to observe. Following chart summarizes the results of equipment wise analysis of power consumption of K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College(Ranwad) campus:

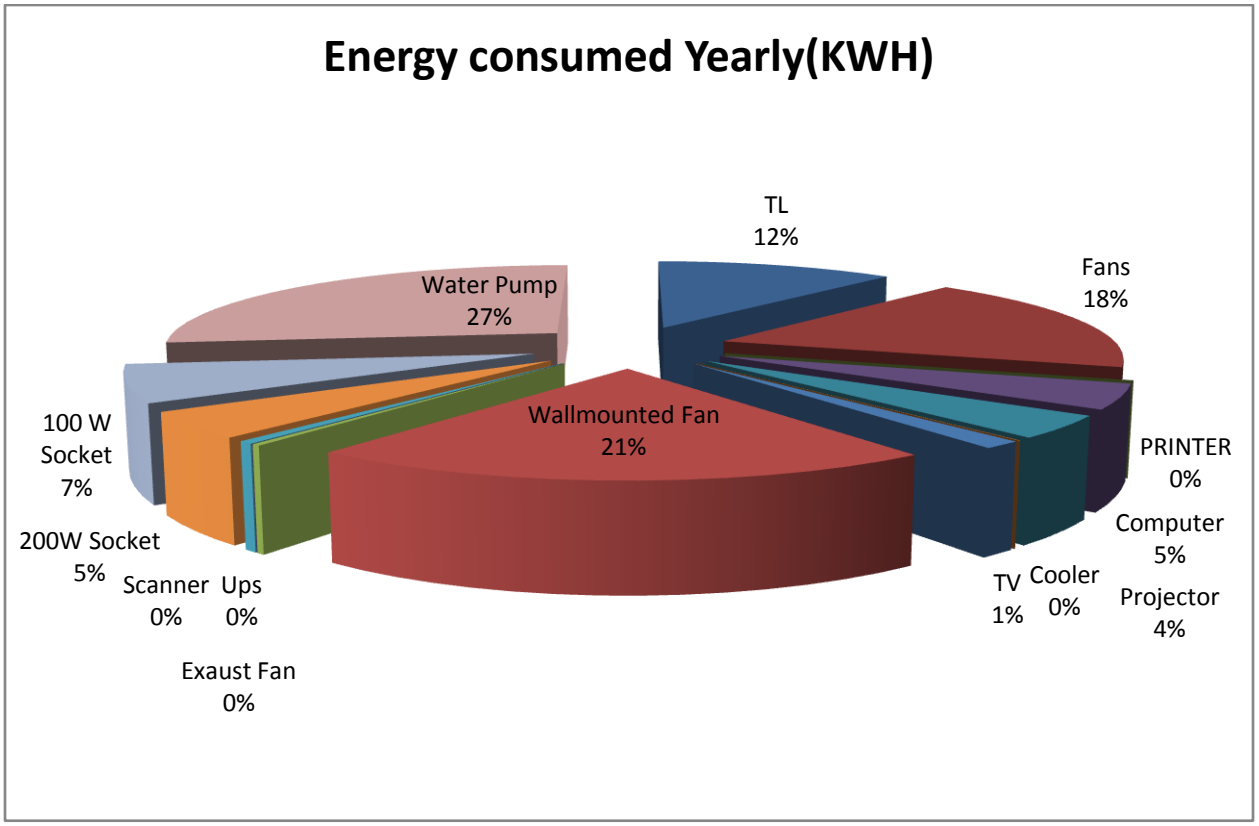

Fig.2.: Equipment wise energy consumed yearly chart

Computer consumes 4% of total power consumed. For lighting, dominant appliance is the conventional Ballast[Choke] tube light with 12% share. Fans have 18% share while wallmounted fans share 21%. Projector has 4% share in total power consumption. Water Pump has 27% share. Power Socket has 10% share of total power consumption.

4.3. LEVEL OF AWARENESS

- The level of awareness for energy conservation in top and middle management is excellent. It is felt necessary to make serious efforts to percolate the same up to the operating staff level and students.
- It is very important to record and monitor energy consumption department wise. Such recording and monitoring of energy consumption help in continuous performance monitoring of the equipments and attending to deviations , if any.
- The electrical personal regularly monitor and record current and power consumption of major equipments to assess their operating performance.

4.4. DETAILED TECHNICAL FEASIBILITY ASSESSMENT OF THE UNIT

4.4.1. ANALYSIS OF ELECTRICITY CONSUMPTION

Identifying where energy is used is useful because it identifies which areas the audit should focus on and raises awareness of energy use and cost. The results of the analysis can be used in the review of management structures and procedures for controlling energy use.

Analysis of energy use can be done by installing sub meters in different plant locations to pinpoint actual energy usage per area. This is a good source data for allocating energy use. The plant manager can also list all equipment used and the corresponding operating hours. With this information, spreadsheet can be created and charts useful for analysis may be generated.

Important Points to Consider When Collecting Load Data:

a. **Usage–** The usage of the equipments in terms of hours per day and days per year can be collected from key persons in s, departments etc. It is important to ensure the accuracy of this data because much of the potential for energy savings lies on wise allocation of the equipment's operating hours.

b. Actual power consumed– Actual power consumption is measured by Wattmeter or Power analyzer.

C.Supplementary Information – Some other supplementary information are also collected such as state of insulation in case of ACs or availability of natural light etc.

4.4.2. IDENTIFIED ENERGY CONSERVATION MEASURES IN THE UNIT

Based on the analysis of the power consumption data, certain steps have been recommended for improving energy efficiency of the campus. Complete cost analysis of implementation of recommended measures has been performed wherever necessary. Also, a number of general measures for energy efficiency have been listed. Described below are some important recommendations for better energy efficiency:

4.4.2.1. Replacing Conventional Ballast[Choke] FTLs with LED TL

Fig. 3. : Conventional Ballast FTL

Dominant light source at most places in the campus is traditional 40W FTLs with conventional Ballast[Choke] which consumes 20W in addition to the 40W. As per our data collection, the campus has in total 202 conventional Ballast[Choke] FTLs and no LED TL[Choke] FTLs. If these conventional Ballast[Choke]s are replaced by LED TL[Choke], 15-20W power can be saved per FTL. Cost Analysis of Replacing Conventional Ballast[Choke] FTL with LED TL[Choke] FTL.

Table 3: Energy Conservation in lighting system

A: Title of Recommendation	**1. Replacement of Conventional ballast with Electronic ballast**
B: Description of Existing System and its operation	The Existing system consist of 202 Fluorescent Tubes with conventional Ballast. The Max. working Hrs. are considered to be 6 Hrs. Total load of the lighting system is 6.34 KW. The total annual Energy consumption of the lighting system is 9887 KWH.
C: Description of Proposed system and its operation	All the Conventional Ballast (202 Nos) are replaced with LED TL. Besides it arrange the Fluorescent TL with proper design as per the working area.
D: Energy Saving Calculations	
1. No of Ballast to be replaced	202
2. Avg power of conventional Ballast	40
3. Avg. power of Electronic Ballast/LED	20
4. Power saved per FTL	(40-20)=20 W
5. Total Power saving	(20*202)/1000= 4.04 KW
6. Avg. use of FTL / year	(270*6)= 1620 Hrs
7. Total Energy saved / year	(4.04*270*6)= 6545 KWH
E: Cost Benefits	
1. Savings in Rs./ Year	**(6545*14.86)= Rs.97,255**
2. Investment	Rs. 60,600/-
3. Payback period in Years	(60,600/ 97,255) =0.62Yrs

Hence, the capital cost recovery time for replacing all conventional Ballast[Choke] FTLs of the campus is around 0.62 years.

4.4.2.2. Revamping of Existing lighting system:

Fig. 4. : Existing Lighting System

Most of the buildings in K.K.WAGH ARTS, COMMERCE, SCIENCE & COMPUTER SCIENCE College(Ranwad) campus are very old and so are the lighting system. According to the data collected, there are a total of 202 TL . Most of the lighting systems are not according to standards. A saving of 1860 units can be obtained by Revamping of existing lighting system.

Cost Analysis of **Revamping of Existing lighting system:**

- Total units consumed by existing lighting system = 9887 kWh
- Average units saved by revamping = 1860 kWh
- Saving in Rs. Per year = 1860*14.86 = Rs.27,640 /-
- Average Cost of Revamping = Rs. 12,000/-
- Capital Cost Recovery time = (12,000)/(27,640) = 0.43 yrs

Hence, the capital cost recovery time for **Revamping of Existing lighting system** of the campus is around 0.43 years.

4.4.2.3 Use of Motion Sensors in Corridors, Classrooms and Toilets:

Corridors, Classrooms and toilets have large potential of saving energy by use of automation tools. Motion sensors can be used there to automatically switch on the light when there is any movement and switch off the light when there is no movement. This can greatly reduce the total load in corridors and toilets.

Cost analysis of Installing Motion Sensors in a Typical Corridor:

- Average number of tube lights in a corridor, Classrooms & Toilet = 202
- Average power of the tube lights = 40W
- Average number of motion sensors required = 48
- Average reduction in usage per day by motion sensor = 1 hrs
- **Total energy saved in corridor per year = (202*40*1*260)/1000 = 2181 kWh**
- **Saving in Rs. Per year = 2181*14.86 = Rs. 32,418/-**
- Cost of installation per motion sensor = Rs. 200
- Total cost of installing motion sensors in a corridor = 48*200 = Rs. 9,600/-
- Capital Cost Recovery Time = (9,600/32,418) = 0.30 yrs

Hence, the capital cost recovery time for installing motion sensors in corridors is 0.30 years.

Toilets are also having comparable capital cost recovery time. Hence, this is a highly recommended step to largely reduce the consumption in corridors and toilets.

4.4.2.4 Minimizing Repair Works in Fans:

During data collection, the repaired fans have been found to be consuming very high power as compared to the rated power. Fans repaired once and twice were consuming 16W and 43W more than the average consumption of new fans respectively. Thus, effort should be made to minimize the repairing of fans and also repair work should be supervised properly.

4.4.2.5. Use of Master Switch outside each Room:

Installation of a master switch outside a room can make it easy for a person to switch off all the appliances of a room in case someone forgets to switch off while leaving the room. This can help improving energy efficiency.

4.4.2.6 Reduce Contract Demand (CD) to 101 kVA from existing level of 40 kVA Install MD Controller so as to restrict MD Level at less than 101 kVA

Table 4: Reduced Contract Demand

Solution Description –

The working is done with existing values applied with HT VIII B Tariff for Y 2022-23.

Month	CD	65% CD	MD [kVA]	BD [kVA]	BD - MD [kVA]	Demand Rate	Add. BD Charges
Apr-22	101	65.65	16	66	50	454	22700
May-22	101	65.65	14	66	52	454	23608
Jun-22	101	65.65	18	66	48	454	21792
Jul-22	101	65.65	17	66	49	454	22246
Aug-22	101	65.65	16	66	50	454	22700
Sep-22	101	65.65	18	66	48	454	21792
Oct-22	101	65.65	20	66	46	454	20884
Nov-22	101	65.65	16	66	50	454	22700
Dec-22	101	65.65	16	66	50	454	22700
Jan-23	101	65.65	20	66	46	454	20884
Feb-23	101	65.65	20	66	46	454	20884
Mar-23	101	65.65	14	66	52	454	23608
Summation	NAP	NAP	NAP	NAP	NAP	NAP	235626
Minimum	101	65.65	14	66	46	454	0
Average	101	65.65	17.1	217.5833333	217.583333	454.0	19635.5
Maximum	101	65.65	20	66	52	454	38590

Month	New CD	65% of CD	New BD	New BD-MD	New Add. BD Charges	Saving in BD Charges
Apr-22	40	26	26	10	4540	18160
May-22	40	26	26	12	5448	18160
Jun-22	40	26	26	8	3632	18160
Jul-22	40	26	26	9	4086	18160
Aug-22	40	26	26	10	4540	18160
Sep-22	40	26	26	8	3632	18160
Oct-22	40	26	26	6	2724	18160
Nov-22	40	26	26	10	4540	18160
Dec-22	40	26	26	10	4540	18160
Jan-23	40	26	26	6	2724	18160
Feb-23	40	26	26	6	2724	18160
Mar-23	40	26	26	12	5448	18160
Summation	NAP	NAP	NAP	NAP	48578	217920
Minimum	40	26	26	10	0	0
Average	40	26	26	9	4048	18160
Maximum	40	26	26	33	14982	23608

Saving - kWh/Year	Saving - Rs. Lacs/Year	Investment - Rs. Lacs	Simple Payback-Months
NAP	**2.18**	**1**	**6**

4.4.2.6 Improve the performance of APFC and maintain Unit PF (0.999 Lag) resulting into kVAh consumption almost equal to kWh

Table 5: Improve APFC panel

MONTH	KWH	KVAH	(KVAH-KWH)	Rs./KVAH	EXTRA CHARGES	PRESENT PF
Apr-22	2674	3393	719	8.96	6442.24	0.788
May-22	1987	2493	506	8.96	4533.76	0.797
Jun-22	2875	3625	750	8.96	6720	0.793
Jul-22	3201	3779	578	8.96	5178.88	0.847
Aug-22	2690	3060	370	8.96	3315.2	0.879
Sep-22	3356	3750	394	8.96	3530.24	0.895
Oct-22	2909	3348	439	8.96	3933.44	0.869
Nov-22	2658	3488	830	8.96	7436.8	0.762
Dec-22	3061	3821	760	8.96	6809.6	0.801
Jan-23	3629	4762	1133	8.96	10151.68	0.762
Feb-23	1879	2314	435	8.96	3897.6	0.812
Mar-23	2519	3259	740	8.96	6630.4	0.773

Summation	33438	41092	7654	NAP	68579.84	NAP
Minimum	1879	2314	370		3315.2	0.762
Average	2786.5	3424.333	637.8333333		5714.986667	0.8148333
Maximum	3629	4762	1133		10151.68	0.895

Month	New Expected PF	New Expected kVAh	New (kVAh - kWh)	Saving in Extra kVAh	Saving in Rs.
Apr-22	0.999	2676.68	2.68	716.32	6418.26
May-22	0.999	1988.99	1.99	504.01	4515.94
Jun-22	0.999	2877.88	2.88	747.12	6694.21
Jul-22	0.999	3204.20	3.20	574.80	5150.17
Aug-22	0.999	2692.69	2.69	367.31	3291.07
Sep-22	0.999	3359.36	3.36	390.64	3500.14
Oct-22	0.999	2911.91	2.91	436.09	3907.35
Nov-22	0.999	2660.66	2.66	827.34	7412.96
Dec-22	0.999	3064.06	3.06	756.94	6782.15
Jan-23	0.999	3632.63	3.63	1129.37	10119.13
Feb-23	0.999	1880.88	1.88	433.12	3880.75
Mar-23	0.999	2521.52	2.52	737.48	6607.81

Summation	NAP	33471.47	33.47	7620.53	**68279.94**
Minimum	0.999	1880.88	1.88	367.31	3291.07
Average	0.999	2789.29	2.79	635.04	5689.99
Maximum	0.999	3632.63	3.63	1129.37	10119.13

Saving - kWh/Year	Saving - Rs. Lacs/Year	Investment - Rs. Lacs	Simple Payback- Months
NAP	**0.68**	**1.2**	**21.18**

4.7. SUMMARY OF ENERGY CONSERVATION OPTIONS & RECOMMENDATIONS:

Table64: Summary of Energy Conservation Measures

Sr. No	Energy Saving Recommendations	Annual Energy Savings(KWH)	Annual Cost Savings(Rs.)	Capital Investment(Rs.)	Simple Payback Period(Yrs.)
1	LED TL	6545	Rs.97,255	Rs. 60,600	0.62
2	Revamping	1860	Rs. 27,640	Rs. 12,000.00	0.43
3	Automation	2181	Rs. 32,418	Rs. 9,600	0.30
4	MD controller	-	Rs.2,17,920	Rs. 1,00,000	0.5
5	APFC	7620	Rs. 68,279	Rs.1,20,000	1.8
Total		**18,206**	**Rs. 4,43,512**	**Rs. 3,02,200**	**0.68**

GREEN ENCON SOLUTION GES

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5.SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary :

Green Audit is one of the important tools to check the balance of natural resources and its judicial use. Green auditing is the process of identifying and determining whether institutional practices are eco-friendly and sustainable. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area. The main objective to carry out green audit is to check the green practices followed by institute and to conduct a well defined audit report to understand whether the institute is on the track of sustainable development. This is the first time to conduct green audit of college campus. After completing the audit procedure of College campus for green practices, there are following conclusions, recommendations which can be followed by college in future for keeping campus environment friendly.

5.2. **Conclusion:**

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial. Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. There are some best Practices followed on Energy Audit in the Organization like Transformers, Generators and UPS are protected properly with fencing and kept awareness boards on ‘Dangers’ and ‘Warnings’. It is observed that the most of places, sign board of ‘Switch ON’ and ‘Switch OFF’ are kept towards saving energy measures to the stakeholders. Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members. Adaptation of sprinkler irrigation in the campus to minimize the energy potential is well appreciated. Few recommendations, in addition, can further improve the energy savings of the Organization. This may lead to the prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.

5.3. Recommendations:

- The energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for utility operation in the audit sites.
- Procurement of equipment with energy efficiency (4-5 star rated equipment) during replacement may be considered.
- Sub meters in all the buildings for energy monitoring are recommended so that energy load required and energy consumption in each building may be noted.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- Turn off electrical equipment when not in use
- Maintain appliances and replace old appliances in all laboratories.
- Use computers and electronic equipment in power saving mode.
- Monthly use of electricity in the College is very high which may be reduce to a greater extent by means of undertaking a periodical energy audit.
- Regular monitoring of equipment in all laboratories and immediate rectification of any problems.

6.INSTRUMENT USED BY AUDIT TEAM

Table 8: Instruments used by Audit Team

SR.NO.	INSTRUMENT NAME	SPECIFICATIONS
1	Clamp-on Power meter	0-1200KW 0-600 V AC 0-600 V DC 0-400 A AC/DC
2	Power Analyzer	3 phase 4 wire Recording parameters- voltage current, frequency, Harmonics/ Inter harmonics up to 49^{th} , THD of voltage, current with crest factor, Transients, voltage sag – swells, all power measurements, Inrush current, monitoring of events,etc.
3	Lux Meter	0-2,00,000 lux level
4	Infrared Thermometer	Non contact type Temp.= -30 to 550®C RH= 10 to 95 %