

ENERGY AUDIT REPORT (2023-2024)

Shri Vasant Rao Banduji Patil Trust's
**Appasaheb Birnale College of
Architecture, Sangli**



Prepared By

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APPASAHEB BIRNALE COLLEGE
OF ARCHITECTURE, SANGLI.**



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1.0 ACKNOWLEDGEMENT

Sahyagiri Enterprises Green Audit Team thanks the management of Appasaheb Birnale College of Education, Sangli for assigning this important work of Energy Audit. We appreciate the co-operation to our team for completion of study.

Our special thanks to:

- ♣ Principal of the college – Dr. Arundhati Pravin Wategave
- ♣ IQAC Head – Er. Abhishek S. Navale
- ♣ IQAC Member – Ar. Pratiksha M. Jadhav
- ♣ Environment Expert at the campus – Ar. Guddidevi Sutar
- ♣ Green Audit coordinator – Ar. Rajesh Sathe
- ♣ Teaching & Supporting Staff of College

For giving us necessary inputs to carry out this very vital exercise of Energy Audit. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

2.0 DISCLAIMER

Sahyagiri Enterprises Green Audit Team has prepared this report for Appasaheb Birnale College of Architecture based on input data submitted by the representatives of College complemented with the best judgment capacity of the expert team.

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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Report by: Mayuri M. Jadhav
EMS Lead Auditor

3.0 SUMMARY

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

The salient observations and recommendations are given below.

1. Appasaheb Birnale College of Architecture, Sangli uses energy in the following forms:
 - a) Electricity from MSEDCL
 - b) High Speed Diesel (HSD)
2. Electrical energy is used for various applications, like Computers, Lighting, Air-Conditioning, Fans, Other Lab Equipment
The average energy consumption is around 1245.5 kWh/Month.
3. The Specific Energy Consumption (SEC) is the ratio of energy required per square meter. In this case the SEC is evaluated as electrical units consumed per square meter of area. It is calculated as under: For Electricity: 0.49 kWh/Sq m
4. It has found that there is wide scope for energy saving and pollution free campus development. Recommendations with cost benefit analysis have given in detail in report.

4.0 INTRODUCTION OF ENERGY AUDIT

An energy audit is a process to study of a building or industry to know the energy consumption of the building and identify methods to reduce the energy consumption for energy savings. In Commercial Building, the present electrical consumption is about 8-10 percent of the total electricity. To meet the international level comfort and facilities the electrical demand is increasingly by 11-12 % annually. This is a challenge for every industry to ensure that energy growth in commercial building does not become unmanageable but also give and presents an opportunity to influence and identifies energy management issues in various commercial buildings and facilities. As the natural resources are limited and energy uses are increasingly very sharply so it is very necessary to save natural resources by reducing energy consumption which can be achieved by using energy efficient equipment's and also by awareness of peoples about energy conservation .Energy audit in industrial and commercial, is the process to identifying opportunities to reduce carbon footprints and energy conservation.

GENERAL

For Appasaheb Birnale College of Architecture, Sangli entrusted the work of conducting a Detailed Energy Audit of campus at Sangli with the main objectives as below:

- To study the present pattern of energy consumption
- To identify potential areas for energy optimization
- To recommend energy conservation proposals with cost benefit analysis.

Case Study in Campus:

We are taking this opportunity to express our heartily gratitude to Appasaheb Birnale College of Architecture, Sangli for giving opportunity for carrying Energy Audit in campus We once again put up our appreciation for full cooperation & valuable guidance for perfect auditing of the Campus to technical as well as commercial persons for providing all the required information & data as well as for providing cooperation with all the departments & extend his best help in our work. We have tried our level best for the work of Energy Audit up to their satisfaction.

The major activities carried out during the audit are as follow:

- Collection of College's records regarding Electricity Power Bills, Power Distribution Diagram, Specifications of major power handling equipment – such as Fans, lighting and pumps.
- Analysis of above calculations, isolating the areas vulnerable to energy consumption not related to production.
- Recommendation of various methods of rectification.
- Making case study of projected saving by following our recommendations; and estimating potential investment & payback period.

✚ Steps in Energy Auditing The energy audit may range from a simple walk – through survey at one extreme to one that may span several phases: -

- 1) The first step is to identify the areas where energy is wasted and reduced energy without affecting the outputs of various functions.
- 2) The second step is to implement energy efficient appliances in place of normal appliances which reduce energy use by proper operations and maintenance. For this reason, it is necessary to reduce the number of operating machines and operating hours according to the demands of the load, and fully optimize equipment operations.

Energy audit depends on following factors: -

- Building equipment operation
- Lighting systems.
- Power systems.
- Building envelope
- Air-conditioning and ventilation equipment systems.
- Miscellaneous services.

The first two steps can be implemented without changing buildings and existing appliances.

- 3) The third step would require investment for remodeling, rebuilding, or introducing further control upgrades to the building.

4) The fourth step is to carry out large-scale energy reducing measures when existing facilities have past their useful life, or require extensive repairs or replacement because of obsolescence. In this case higher energy savings may be achieved. For these last two stages, the audit may be more extensive in order to identify more ECOs for evaluation, but at an increased need for heavier capital expenditure to realize these opportunities.

5.0 OVERVIEW OF INSTITUTE

Trust is the outcome of the hard efforts of an eminent social worker of Sangli, Late Shri. Appasaheb Birnale (Ex. MLA and EX. President ZP Sangli) in the year 1971, in the memory of the Shankar Maharshi the Ex. Chief Minister of Maharashtra, Late Padmabhushan Dr. Vasantdada Patil for his contribution as a great freedom fighter and his revolutionary policies of uplifting and widening the field of education and above all for their matchless services to humanity and mankind. The main idea behind his trust was to impart professional, advanced and technical education to the deserving and needy students of rural areas. These Institutes are an important milestone in the progress of their dreams. The trust is highly indebted to sanguine efforts and constant inspiration of Shri. Babanrao Birnale Chairman of The trust to make these dreams come true.

The management started Appasaheb Birnale College of Architecture Sangli in 1993. Institute is approved by AICTE, New Delhi, Government of Maharashtra and affiliated to Shivaji University, Kolhapur. College has 2 Acre campus Area.

College provides instructions to the students for five year degree course Bachelor of Architecture (B. Arch.), 2 year masters course M. Arch. Master of Architecture . The college, right from its inception has shown academic excellence and students have won meritorious awards and have maintained top ranks in the University examinations as well as in extra-curricular activities. Total Student strength of college is 195. College has total 23 teaching staff and 16 non-teaching staff. College has highly qualified staff.

The infrastructure of a college plays a vital role in the development of the college as the students are now focusing on class rooms, studios etc. while selecting a college. It is important that the college has very good infrastructure with spacious Classrooms, studios, seminar Halls, Library, Computer Center & all basic amenities. Various indoor and outdoor games are conducted by college.

The college has also adopted the 'Green Campus' system for environmental conservation and sustainability. The goal is to reduce CO₂ emission, water use while creating an atmosphere where students can learn and be healthy.



6.0 SCOPE OF WORK AND APPROACH

SCOPE:

Scope of work and methodology were as per the proposal. While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility.

Approach to Energy Audit:

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment. The key to such performance evaluation lies in the sound knowledge of performance of equipment and system as a whole. The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream.

Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

7.0 ENERGY AUDIT METHODOLOGY

Energy Audit Study is divided into following three steps

A] Historical Data Analysis

The historical data analysis involves establishment of energy consumption pattern to establish base line data on energy consumption and its variation with change in production volumes.

B] Actual Measurement and Data Analysis

This step involves actual site measurement and field trials using various portable measurement instruments. It also involves input to output analysis to establish actual operating equipment efficiency and finding out losses in the system.

C] Identification and evaluation of Energy Conservation Opportunities

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period. All recommendations for reducing losses in the system are backed with its cost benefit analysis.

Preliminary Survey

In this Preliminary survey, the auditor may need to know the building envelope and its energy consumption. The data of a building can be obtained from: -

- Building Architectural blueprints.
- Building Air-conditioning blueprints.
- Building Electrical lighting and power drawings.
- Electrical bills and operation logs for the year preceding the audit.
- Air-conditioning manuals and system data.
- ECOs for evaluation, but at an increased need for heavier capital expenditure to realize these opportunities.

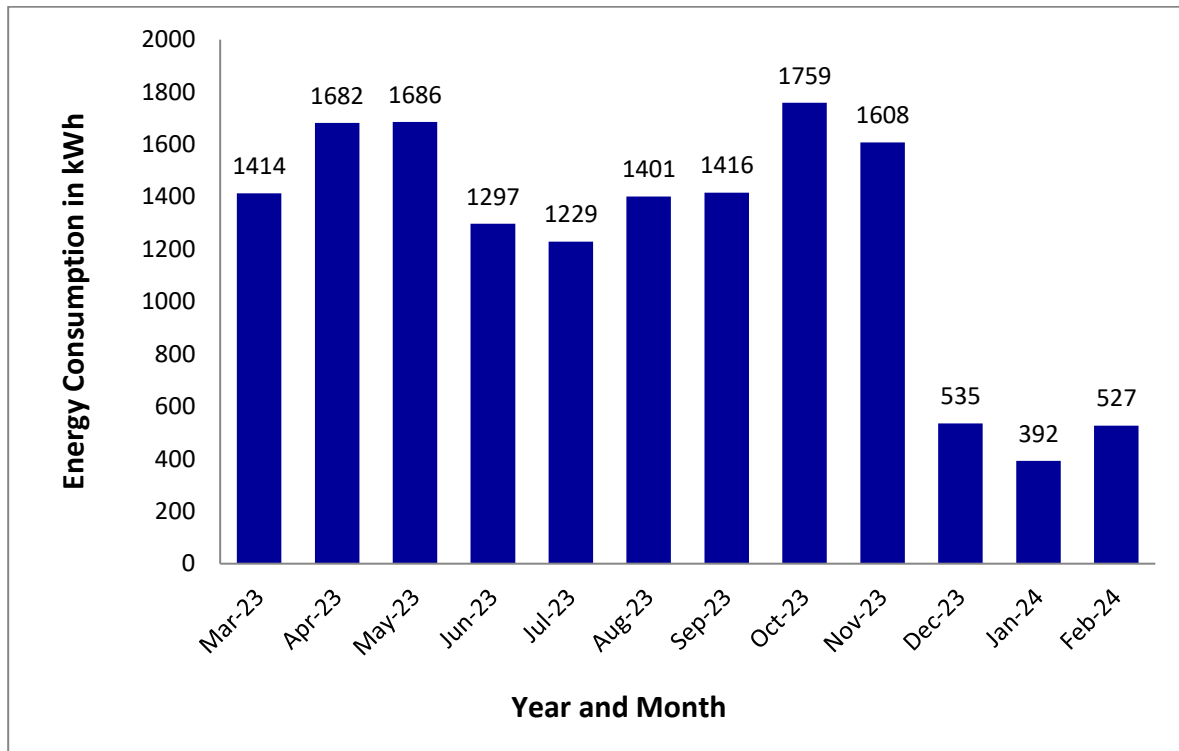
A] HISTORICAL DATA ANALYSIS

Record of monthly energy consumption of individual meter in Kwh (units) and respective Energy bill in Rupees is given below

Month	Energy Consumption in units	Bill in Rs
March -2023	1414	22921.61
April -2023	1682	27856.31
May -2023	1686	27898.41
June -2023	1297	22915.62
July -2023	1229	21995.27
August -2023	1401	24207.58
September -2023	1416	24838.30
October -2023	1759	29334.01
November -2023	1608	27816.50
December -2023	535	13482.59
January -2024	392	11406.27
February -2024	527	13306.21
Avg.	1245.5	22331.56

A] Monthly Energy Consumption in units or kWh

Month	Energy Consumption in units
March -2023	1414
April -2023	1682
May -2023	1686
June -2023	1297
July -2023	1229
August -2023	1401
September -2023	1416
October -2023	1759
November -2023	1608
December -2023	535
January -2024	392
February -2024	527
Avg.	1245.5



SOURCE OF ENERGY

Appasaheb Birnale College of Architecture, Sangli uses Energy in following forms:

A] Electricity from MSEDCL

Appasaheb Birnale College of Architecture, Sangli receives Electricity from MSEBE

B] High Speed Diesel (HSD)

HSD is used as a fuel for Diesel Generator which is run whenever power supply from MSEDCL is not available.

The following are the major consumers of electricity in the facility

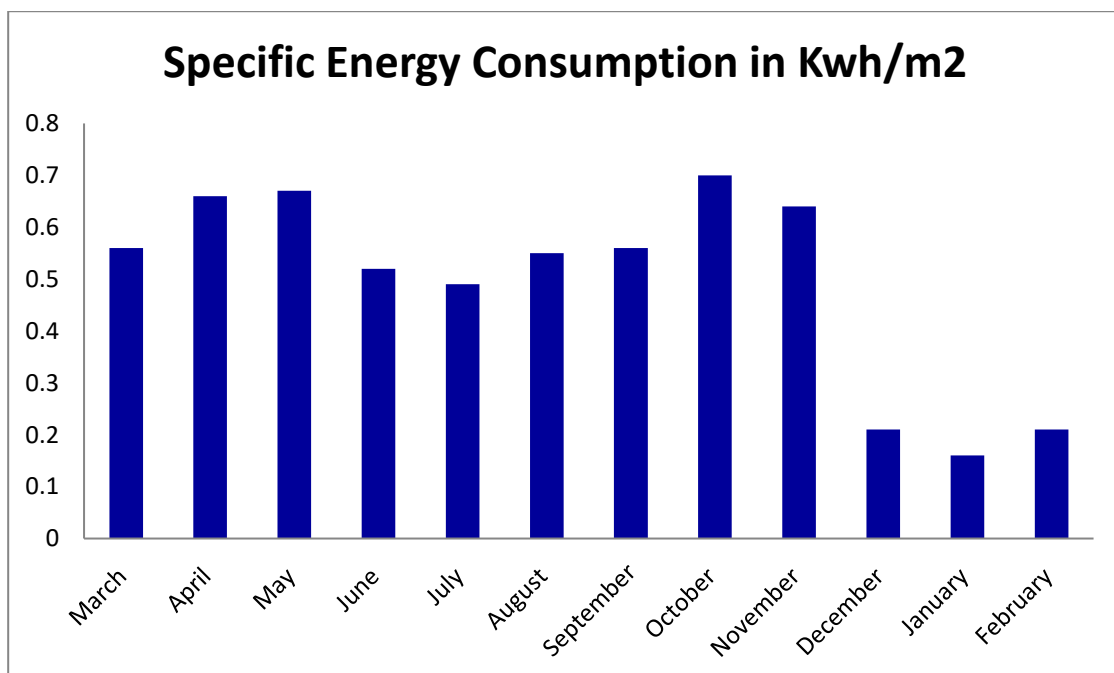
- Computers
- Lighting
- Air-Conditioning
- Fans
- Other Lab Equipment

SPECIFIC ENERGY CONSUMPTION (SEC)

Specific Energy Consumption (SEC) is defined as energy usage per Square meter of area. It is calculated as total electrical kWh/total area of the campus. By calculating SEC, we can crudely target the factors of energy efficiency or inefficiency. SEC for last twelve months was calculated and is as shown in the chart below:

Total College campus Area	2 acre
Build up Area	27191.36 Sq.ft or 2526.16 Sq.m
Specific Energy Consumption	Units/Sq.m

Month	Specific Energy Consumption in Kwh/m ²	Energy Consumption in units
March	0.56	1414
April	0.66	1682
May	0.67	1686
June	0.52	1297
July	0.49	1229
August	0.55	1401
September	0.56	1416
October	0.70	1759
November	0.64	1608
December	0.21	535
January	0.16	392
February	0.21	527



B] STUDY OF ACTUAL MEASUREMENT AND ITS ANALYSIS**I] ACTUAL MEASUREMENT OF EXISITING EQUIPMENTS:**

All required data is collected by Energy Audit Team. In this data, different classifications are done and made survey of the college. In this survey, in every room, how much fans, tubes, fans, computer, instrument AC, etc. will these is measured. According to survey following data is collected

A] All Electricity consuming equipment and respective energy consumption in kW

Floor	Name of Department	Equipment	Quantity	Actual load in Watt	Total consumption in Watt
Ground Floor	Office 1	Fan	01	45	45
		Computer	03	300	900
		Printer	01	750	750
		Fridge	01	800	800
	Principal Cabin	Fan	01	45	45
		Computer	01	300	300
		AC	01	2000	2000
		LED Bulb	04	03	12
	Director Cabin	Fan	01	45	45
		AC	01	2000	2000
		LED Bulb	04	03	12
	Seminar Hall	Fan	04	45	180
		Computer	01	300	300
		Projector	01	900	900
	Classroom -1	Fan	03	45	135
		Computer	01	300	300
		Projector	01	900	900
		LED Bulb	05	03	15
	Classroom -2	LED Tube	05	40	200
	Ladies Common Room	Fan	01	45	45
		LED Tube	01	40	40
	Gents Common Room	Fan	01	45	45
		LED Tube	01	40	40
	Office 2	Fan	03	45	135
		Computer	04	300	1200
		Printers	02	750	1500

	Staff Room	Fan	04	45	180
		Computer	05	300	1500
		Xerox machine	01	1500	1500
	Staff Room No. 1	Fan	03	45	135
		Computer	03	300	900
	Examination Cell	Fan	02	45	90
		Computer	01	300	300
		Xerox machine	01	1500	1500
		LED Tube	05	40	200
	Surveying Cell	Fan	02	45	90
		LED Tube	04	40	160
	Climatology Services Building Material	Fan	02	45	90
	Kitchen	Wall Fan	01	40	40
		Induction	01	2000	2000
	Passage (Near Staircase)	LED Tube	04	40	160
	Courtyard	LED Tube	15	40	600
LED Bulb		20	03	60	
Reception Area	LED Tube	03	40	120	
First Floor	Staff Room	Fan	02	45	90
		Computer	01	300	300
	Studio 10	Fan	04	45	45
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	05	40	200
	Studio 11	Fan	04	45	45
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	05	40	200
	Studio 1	Fan	06	45	270
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	11	40	440
	Studio 2	Fan	06	45	270
		Computer	01	300	300
Projector		01	900	900	
LED Tube		10	40	40	

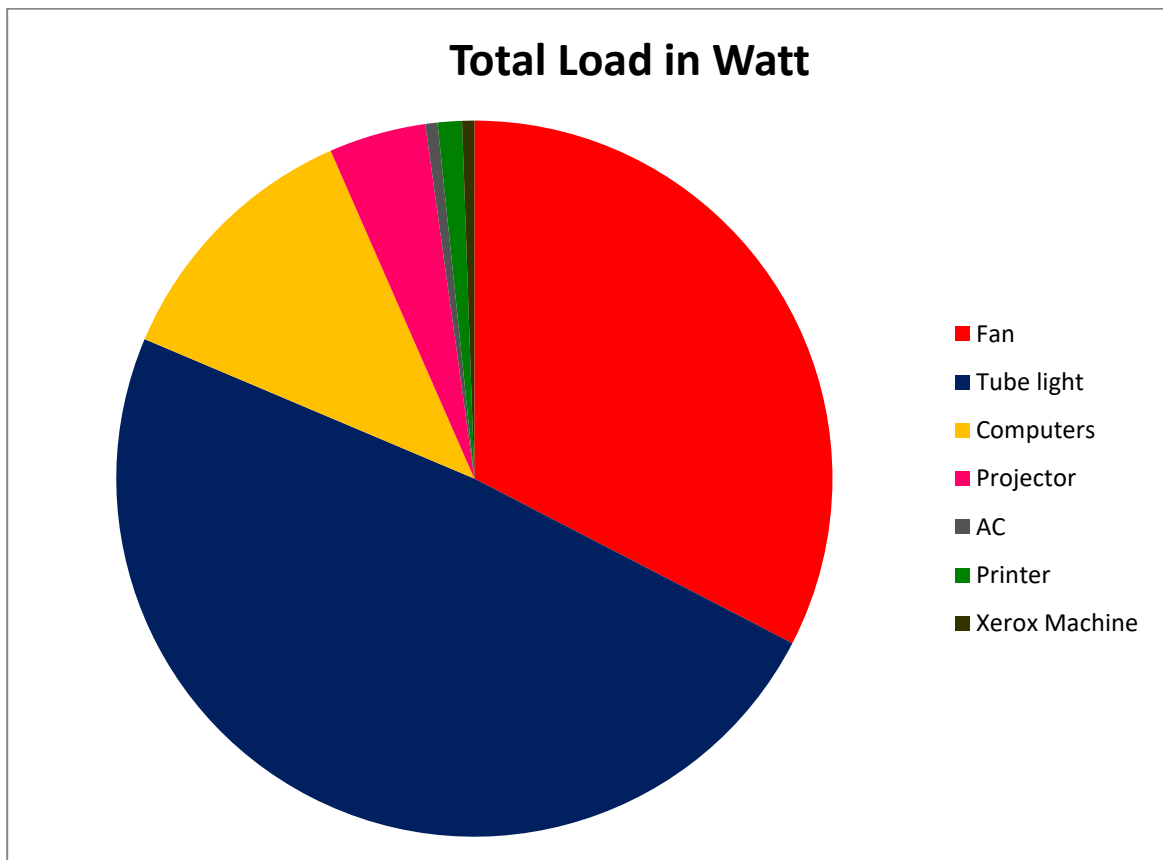
	Library	Fan	07	45	315
		Computer	06	300	1800
		Printer	01	750	750
		LED Tube	12	40	480
	Staff Room 2	Fan	03	45	135
		Computer	03	300	900
	Passage (Near Staircase)	LED Tube	04	40	160
Passage	LED Tube	04	40	160	
Classroom -3	LED Tube	21	40	840	
Second Floor	Classroom -2	Fan	03	45	135
		Computer	01	300	300
		Projector	01	900	900
	Classroom -3	Fan	04	45	180
		Computer	01	300	300
		Projector	01	900	900
	Classroom -4	Fan	04	45	180
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	10	40	400
	Studio 3	Fan	06	45	270
		Computer	01	300	300
		Projector	01	900	900
	Studio 4	Fan	06	45	270
		Computer	01	300	300
		Projector	01	900	900
	Staff Room	Wall Fan	03	40	120
		Computer	02	300	600
	Studio 9	Fan	08	45	360
		Computer	01	300	300
		Projector	01	900	900
	Passage Near Staircase	LED Tube	04	40	160
	Studio 5	Fan	03	45	135
		Wall Fan	04	40	160
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	10	40	400
	Fan	03	45	135	

Third Floor	Studio 6	Wall Fan	05	40	200
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	10	40	400
	Studio 7	Fan	03	45	135
		Wall Fan	05	40	200
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	06	40	240
	Studio 8	Fan	03	45	135
		Wall Fan	05	40	200
		Computer	01	300	300
		Projector	01	900	900
		LED Tube	05	40	200
	Apex Hall	Fan	14	45	630
		Computer	01	300	300
		LED Bulb	24	03	72
		Spot Light	05	20	100
		Projector	01	900	900
	Classroom -5	LED Tube	10	40	400
Passage Near Staircase	LED Tube	04	40	160	
	Total			543486	

Total Energy Consumption: 54486 Watt or 54.486 kW

B) Major electricity consuming equipment and respective total load

Equipments	Quantity	Actual loadin Watt	Total Load in Watt
Fan	119	45	5355
Tube light	178	40	7120
Computers	44	300	13200
Projector	16	900	14400
AC	2	2000	4000
Printer	4	750	3000
Xerox Machine	2	1500	3000
Total			50075



II) RENEWABLE ENERGY SOURCE:

Solar energy generation system is available in college campus. The device has rated power 10 kW.

Assuming total working hours -4 hours

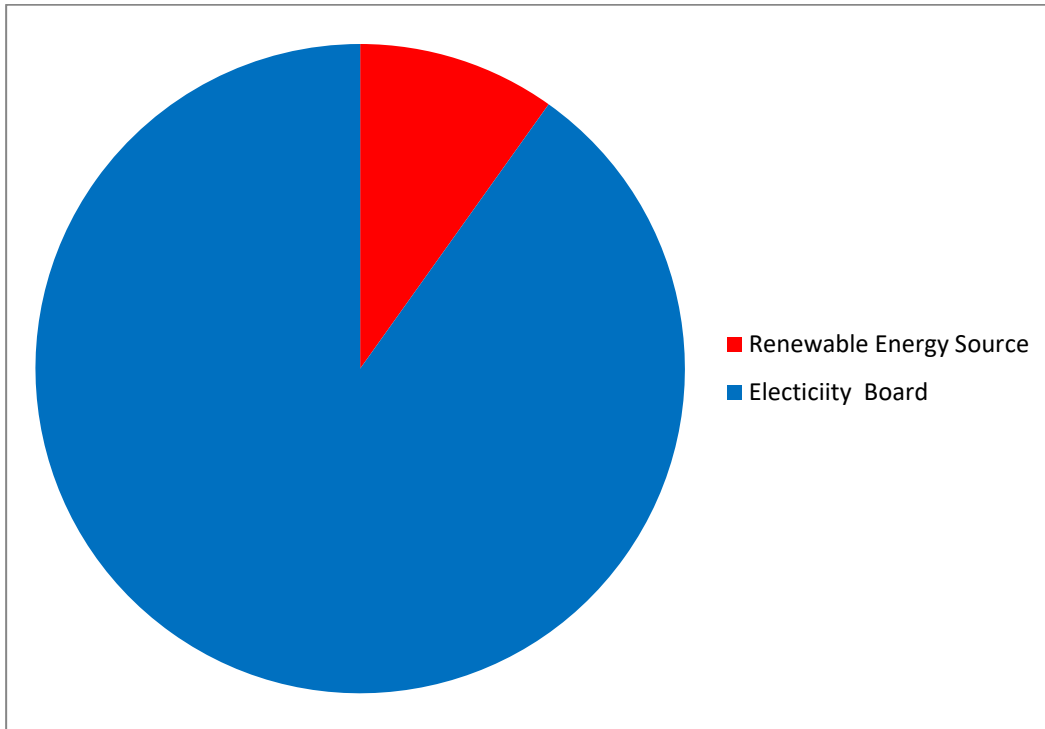
Total kWh or units energy obtained from renewable source is 40 kWh Equipment working on renewable energy.

Sr. No	Equipment	Quantity	Actual consumption by equipment	Total Energy consumption in kWh or units
1.	Computer	1	300 W	300W x 4 = 1200Wh 1.2kWh
2.	Printer	1	750 W	750W x 4 = 3000Wh 3 kWh
3.	Tube light	2	40 W	40W x 4 = 160Wh 0.16 kWh
4.	Fan	2	45 W	45W x 4 = 180Wh 0.18 kWh
Total				4.54 kWh

Total daily energy consumption by Renewable Energy source = 4.54 kWh

Therefore monthly energy consumption by Renewable Energy source =136.2 kWh

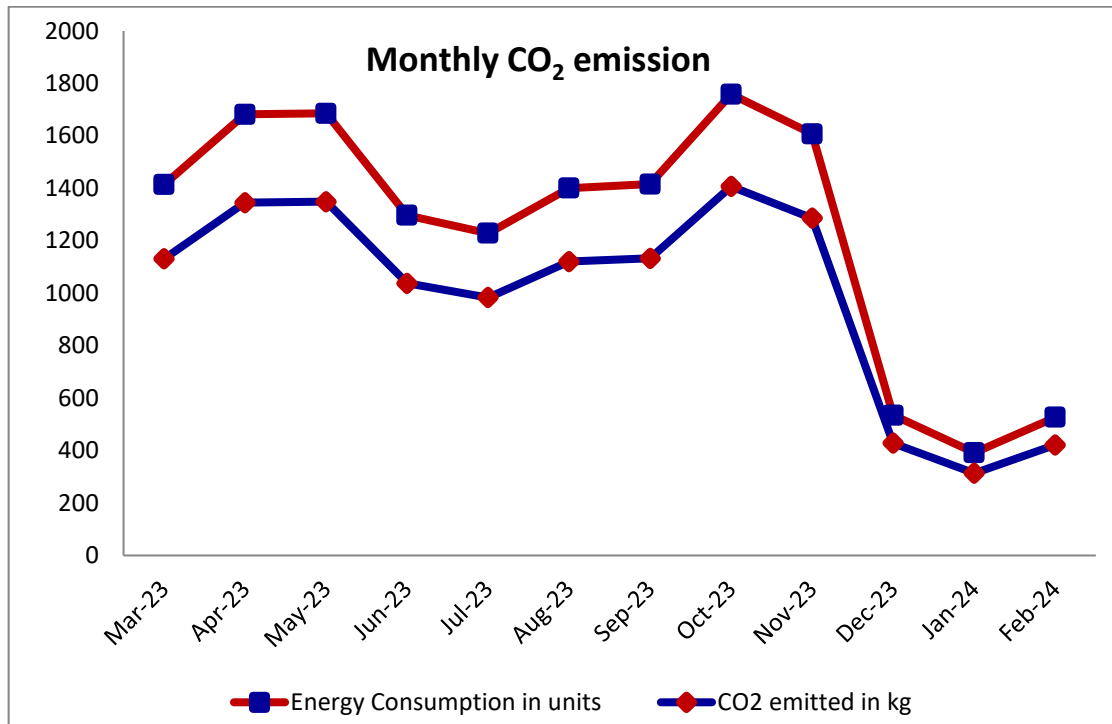
Monthly Average energy consumption by Electricity board = 1245.5 kWh



CARBON- DIOXIDE EMISSION

For consumption of 1 Unit (1 kWh) of Electricity, the CO₂ emitted is 0.8 Kg. OR the Emission is 0.8 Kg/kWh. In the following Table we present the total units consumed and CO₂ emitted as under:

Sr.No.	Month	Energy consumption (kWh)	CO ₂ emitted in kg
1	March -2023	1414	1131.2
2	April -2023	1682	1345.6
3	May -2023	1686	1348.8
4	June -2023	1297	1037.6
5	July -2023	1229	983.2
6	August -2023	1401	1120.8
7	September -2023	1416	1132.8
8	October -2023	1759	1407.2
9	November -2023	1608	1286.4
10	December -2023	535	428
11	January -2024	392	313.6
12	February -2024	527	421.6
13.	Avg.	1245.5	996.4



III) REQUIREMENT OF NAAC

A) Alternative Energy Initiative

Percentage of power requirement met by renewable energy sources

$$= (\text{Power requirement met by renewable energy sources} / \text{Total power requirement}) \times 100$$

We have,

Power requirement met by renewable energy sources - 136.2 kWh

Monthly Average energy consumption by Electricity board – 1245.5 kWh

Total Power requirement: 114.72 + 6339.34 = 1360.22 kWh

Therefore,

$$= (136.2/1360.22) \times 100$$

$$= 10\%$$

B) Percentage of lighting power requirement met through LED Tubes

40 Watts LED

Daily lighting power requirement met through LED Tubes = 178 * 40 = 7120 Wh = 7.12 kWh

Annual lighting power requirement met through LED Tubes = 7.12 * 300 = 2136 kWh

Percentage of lighting power requirement met through LED Tubes = (Lighting power requirement met through LED Tubes / Total lighting power requirement) X 100

$$= (7.12/2136) \times 100$$

$$= 3.33\%$$

C] IDENTIFICATION AND EVALUATION OF DATA

The electrical devices which are connected in college campus are not energy saving devices. These devices can be changed by electrical efficient appliances. The appliances are of high watt equipment so the electrical consumption is high in college campus. Now a day's low wattage appliances are used in building. They are helpful in saving electricity.

ENERGY SAVING CALCULATION



Providing Solar PV system for part load operations during day time

There are mainly Lighting and Computer loads. Since, there is no separate lighting feeder; it becomes necessary to separate out the lighting feeder for those lights where they are used 6 to 8 hours in a day.

A 10 kW Solar PV is proposed for the Lighting load application with minimum Storage batteries.

The power saved considering the 85% loading = 10 kW

Average Daily available hours = 6 h/day

Electricity Saved = $6 \times 10 = 60$ kWh/day

Yearly availability = 300 days/year

Yearly savings in electricity = $300 \times 60 = 18000$ kWh/year

Monetary Savings = $18000 \times 10 = \text{Rs. } 1,80,000$ / year

Approximate cost of the solar system = Rs. 7.2 lac

Payback Period: $720000/180000 = 4$ Yrs.

Average life of project: 25 Yrs.

Net Saving: $20 \text{ yrs} \times 180000/\text{yrs.} = 36,00,000/-$



10 kW solar power plant

8. RECOMMENDATIONS

General Recommendations

- ✚ All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors.
- ✚ All projectors to be kept OFF or in idle mode if there will be no presentation slides. All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- ✚ The comfort air conditioning temperature to be set between 24°C to 26°C.
- ✚ Lights in toilet area may be kept OFF during day time

Commercial Recommendations

- ✚ Replacement of CRT monitors with LED monitors. It's highly recommended as it will avoid digital eye strain on users.
- ✚ Replacement of Conventional tube lights with LED.

9. CONCLUSION

Natural resources on earth are limited and consuming very sharply. It can be saved by employing energy efficiency and it is very necessary to prevent depletion of natural resources. The Electrical audit of college buildings shows that the load of electrical equipment's is significant and should be taken some necessary step for reducing energy conservation. Today energy conservation plays a very important role for energy conserving because energy consumption is increasing day by day but the natural resources are not increasing and also generation is not match with consumption People should aware about energy conservation and reduce energy consumption by adopting modern technologies.



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Date: 09/10/2023

Energy Audit Certificate

This is to certify that the Sahyagiri Enterprises has conducted detailed energy audit report of **Appasaheb Birnale College of Architecture, Sangli** during academic year 2023-2024 to energy conservation activities.

The college has submitted necessary data and credentials for scrutiny. The efforts taken by the management, faculty and students towards energy conservation are highly appreciated.

EMS Lead Auditor

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