ENERGY AUDIT REPORT

2023-24

Shri Swami Vivekanand Shikshan Sanstha ,

Kolhapur Sanchalit,

PADMABHUSHAN DR. VASANTRAODADA PATIL MAHAVIDYALAYA, TASGAON

Prepared by:

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P.D.V.P. MAHAVIDYALAYA TASGAON DIST. SANGLI

ACKNOWLEDGEMENT:

Energy Audit Assessment Team thanks the management of Shri Swami Vivekanand Shikshan Sanstha Kolhapur Sanchalit, Padmabhushan Dr. Vasantraodada Patil Mahavidyalaya, Tasgaon for assigning this important work of Green Audit to DS Energy Consultancy and services, Sangli. We appreciate the cooperation to our Team for completion of study.

Our special thanks are to Principle of college Dr. Milind Hujare, IQAC coordinator Dr. Megha Patil, all head of the departments, teaching and non- teaching staff for giving us necessary inputs to carry out this vital exercise of Energy Audit.

We are also thankful to other staff and office members who were actively involved while collecting the data and conducting field measurements.

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DISCLAIMER

Energy Audit Team has prepared this report for Shri Swami Vivekanand Shikshan Sanstha Kolhapur Sanchalit, Padmabhushan Dr. Vasantraodada Patil Mahavidyalaya, Tasgaon 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 complied in good faith based on information gathered.

It is further informed that the calculations are arrived flowing 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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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. Padmabhushan Dr. Vasantraodada Patil Mahavidyalaya, Tasgaon uses energy in the following forms:

a) Electricity from MSEDCL
b) High Speed Diesel (HSD)
c) Solar wind Hybrid Energy Source

2. Electrical energy is used for various applications, like Computers, Lighting, Air-Conditioning, Fans, Other Lab Equipment
   The average energy consumption is around 2500 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: 0.6 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.
5. Total potential for energy saving within all campus is approximately **Rs. 0.80**+Lakh per annum.

ABBREVIATIONS

AHU	- Air handling unit
APFC	- Automatic Power Factor Controller
DG	-Diesel generator
ECP	-Energy Conservation Proposal
GCV	-Gross Calorific Value
HVAC	- Heating, Ventilation and Air Conditioning
HSD	-High speed diesel
kCal	-Kilo-calories
FO	-Furnace oil
PF	-Power Factor
SEC	- Specific Energy Consumption
TR	-Tons of Refrigeration
UOM	- Unit of Measurement
MAHADISCO	-Maharashtra State Electricity Distribution Company

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

Padmabhushan Dr. Vasantraodada Patil Mahavidyakaya, Tasgaon entrusted the work of conducting a Detailed Energy Audit of campus at Tasgaon 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 Padmabhushan Dr. Vasantraodada Patil Mahavidyakaya, Tasgaon 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 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.

INTRODUCTION OF COLLEGE

Sr No.	Particulars	Details
1	Name of the Institutes	Shri Swami Vivekanad Shikshan Sanstha Kolhapur Sanchit, Padmabhushan Dr. Vasantraodada Patil Mahavidyalaya, Tasgaon
2	Address	Sangli- Tasgaon Road, Tasgaon PIN CODE- 416312 Contact No.02346250665 San_pdvpm.tas@gmail.com
3	Year of Establishment	June 1962
4	Courses offered	a) Bachelor of Science b) Bachelor of commerce c) Bachelor of Arts d) Masters in Science e) Masters in commerce f) Masters in Arts g) Bachelor of Computer Application
5	Affiliation	NAAC (B++ Grade ,2.76) UGC-approved an recognized college affiliated by the Shivaji University

Energy Audit assement team	Designation
Prof.Mrs. D.S.Patil	Certified Energy Auditor
Dr. Milind Hujare	Principal
Dr. Megha Patil	IQAC coordinator

Physical Structure

Total College campus Area	11 acre
Build up Area	40000 Sq.ft or 3716 Sq.m
Projected Area	16000 Sq.ft or 1486 Sq.m

Campus Photographs:

P. D. V. P. MAHAVIDYALAYA TASGAON, DIST. SANGLI

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.

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.

Walk-Through: -

The walk-through process can be start after familiarized with the building, if the building blueprints and other electrical appliance information available describes the building and its operation accurately. In the walk-through audit, the building envelope can be study by a walk around the building. In the model analysis, the building must be divided into zones for analysis. The building survey would include that the air-conditioning system is as indicated on plans. In the building envelope, the type and condition of the windows, effectiveness of window seals will be noted. In the building, typical lighting and power requirements, occupancy and space usage are also noted. This information regarding building could be compared against the recommendations in the relevant Codes of Practices. The survey of mechanical rooms and plant room can give system and plant data. Name plate information could be compared against those in the building's documents, and pumps and chillers room can be visit for estimating the load on the system.

Operator's Input The auditor may discuss with the building maintenance staff further on the operating schedules and seek clarification on any unusual pattern in the trend of the utility bills. Unusual patterns such as sudden increase or decrease in utility bills could be caused by changes in occupancy in the building, or change in use by existing tenants. It is not uncommon for tenants to expand their computing operations that may increase the energy use significantly

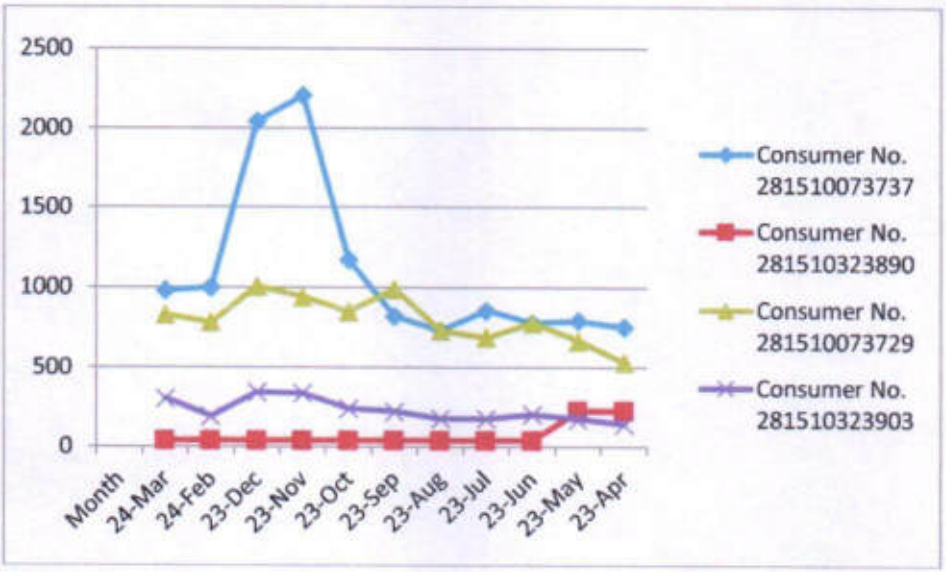
A| HISTORICAL DATA ANALYSIS

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

		Consumer No. 281510073737		Consumer No. 281510323890		Consumer No. 281510073729		Consumer No.281510323903			
		Meter No 41103997870		Meter No. 04103997868		Meter No. 09849981633		Meter No. 09849981633			
Sr. No	Month	Energy consumption units kWh	Bill in Rs	Energy consumption units kWh	Bill in Rs	Energy consumption units kWh	Bill in Rs	Energy consumption units kWh	Bill in Rs	Total Energy consumption	Total Bill in
1	24-Mar	845	7730	40	910	828	6600	305	3680	2153	12170
2	24-Feb	1001	7980	40	920	782	6330	192	2520	2615	17750
3	24-Jan	920	6460	40	800	730	5330	142	1890	1832	14480
4	23-Dec	2046	16420	40	950	1006	8280	344	4250	3436	29900
5	23-Nov	2208	17800	40	930	940	7850	337	4170	3525	30750
6	23-Oct	1170	9660	40	980	849	7150	242	3140	2301	20930
7	23-Sep	820	6910	40	920	989	8230	222	2900	2071	18960
8	23-Aug	732	6220	40	930	730	6200	178	2440	1680	15790
9	23-Jul	858	7200	40	930	688	5740	177	2370	1763	16240
10	23-Jun	780	6600	40	1500	780	6590	205	3290	1805	17980
11	23-May	794	2100	225	3510	666	10350	176	2970	1861	18930
12	23-Apr	755	6400	225	3510	532	4650	143	2630	1655	17190

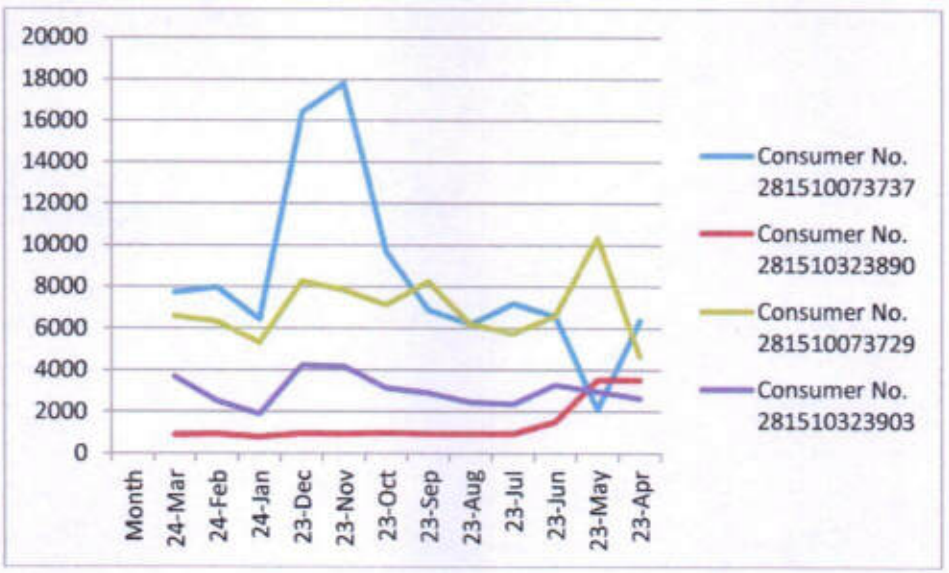
A] Energy Consumption in units or kWh

Month	Consumer No. 281510073737	Consumer No. 281510323890	Consumer No. 281510073729	Consumer No. 281510323903
24-Mar	980	40	828	305
24-Feb	1001	40	782	192
24-Jan	920	40	730	142
23-Dec	2046	40	1006	344
23-Nov	2208	40	940	337
23-Oct	1170	40	849	242
23-Sep	820	40	989	222
23-Aug	732	40	730	178
23-Jul	858	40	688	177
23-Jun	780	40	780	205
23-May	794	225	666	176
23-Apr	755	225	532	143



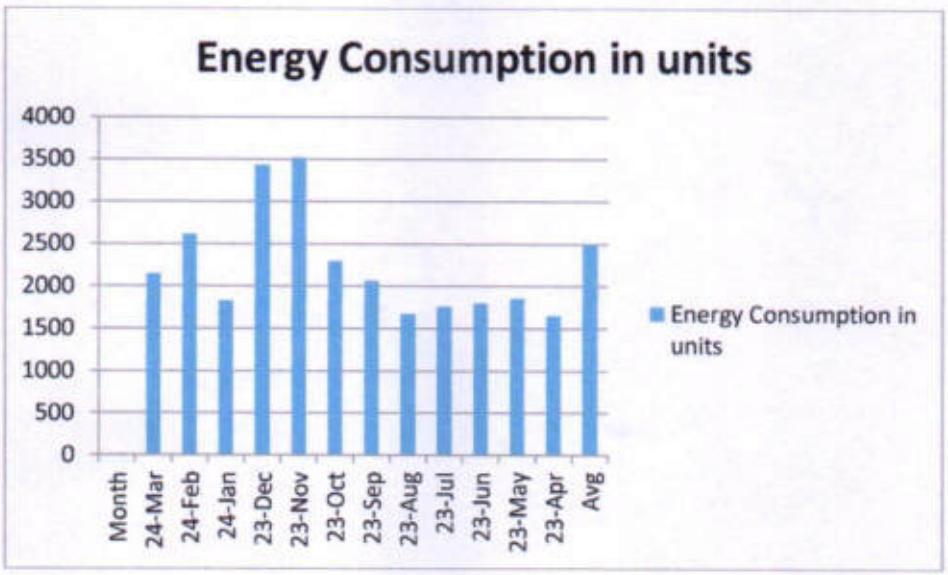
B] Energy Bills in Rupees

Month	Consumer No. 281510073737	Consumer No. 281510323890	Consumer No. 281510073729	Consumer No. 281510323903
24-Mar	7730	910	6600	3680
24-Feb	7980	920	6330	2520
24-Jan	6460	800	5330	1890
23-Dec	16420	950	8280	4250
23-Nov	17800	930	7850	4170
23-Oct	9660	980	7150	3140
23-Sep	6910	920	8230	2900
23-Aug	6220	930	6200	2440
23-Jul	7200	930	5740	2370
23-Jun	6600	1500	6590	3290
23-May	2100	3510	10350	2970
23-Apr	6400	3510	4650	2630



Total Annual Energy Consumption in Units

Month	Energy Consumption in units
24-Mar	2153
24-Feb	2615
24-Jan	1832
23-Dec	3436
23-Nov	3525
23-Oct	2301
23-Sep	2071
23-Aug	1680
23-Jul	1763
23-Jun	1805
23-May	1861
23-Apr	1655
Avg	**2500**



SOURCE OF ENERGY

Padmabhushan Dr. Vasantraodada Patil Mahavidyakaya, Tasgaon uses Energy in following forms:

A] Electricity from MSEDCL

Padmabhushan Dr. Vasantraodada Patil Mahavidyakaya, Tasgaon 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

C] Hybrid (Solar with wind miles) energy generation device

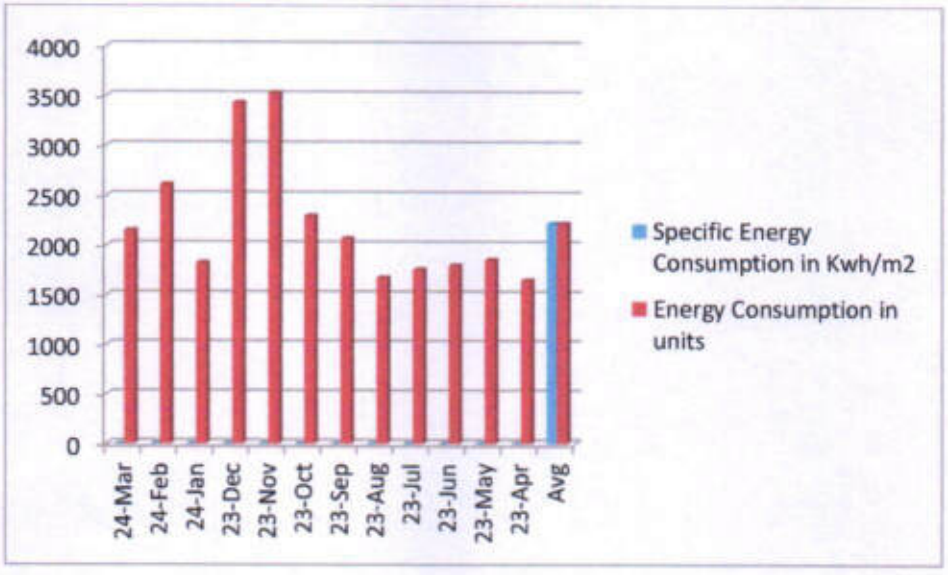
The hybrid energy generation devices contain a solar panel and wind turbine. The hybrid energy generation device has rated power 2 KW.

SPECIFIC ENERGY CONSUMPTION (SEC)

Specific Energy Consumption (SEC) is defined as energy usage per Square meter of area. it is calculated 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	11 acre
Build up Area	40000 Sq.ft or 3716 Sq.m
Projected Area	16000 Sq.ft or 1486 Sq.m
Specific Energy Consumption	0.6 Units/Sq.m

Month	Specific Energy Consumption in Kwh/m2	Energy Consumption in units
24-Mar	0.58	2153
24-Feb	0.70	2615
24-Jan	0.49	1832
23-Dec	0.92	3436
23-Nov	0.95	3525
23-Oct	0.62	2301
23-Sep	0.56	2071
23-Aug	0.45	1680
23-Jul	0.47	1763
23-Jun	0.48	1805
23-May	0.50	1861
23-Apr	0.445	1655



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

	Equipment	Quantity	Actual load in Watt	Total consumption in Watt
Department of Mathematics	Fan	2	78	156
	Tube light	2	40	80
	computers	16	520	8320
	printer	2	200	400
	LED	1	10	10
Department of Computer Science	Fans	4	78	312
	Tube light	3	40	120
	Air conditioners (1.5 Tonne)	1	5500	5500
	LED	1	10	10
	computers	38	520	19760
	Printer	1	200	200
Department of Physics	Fans	9	78	702
	Tube light	6	40	240
	LED	2	20	40
	computers	4	520	2080
	Printer	2	200	400
	LED Projector	1	200	200
Department of Botany	Fans	7	78	546
	tube light	3	40	120
	LED	1	10	10
	wall Fan	1	100	100

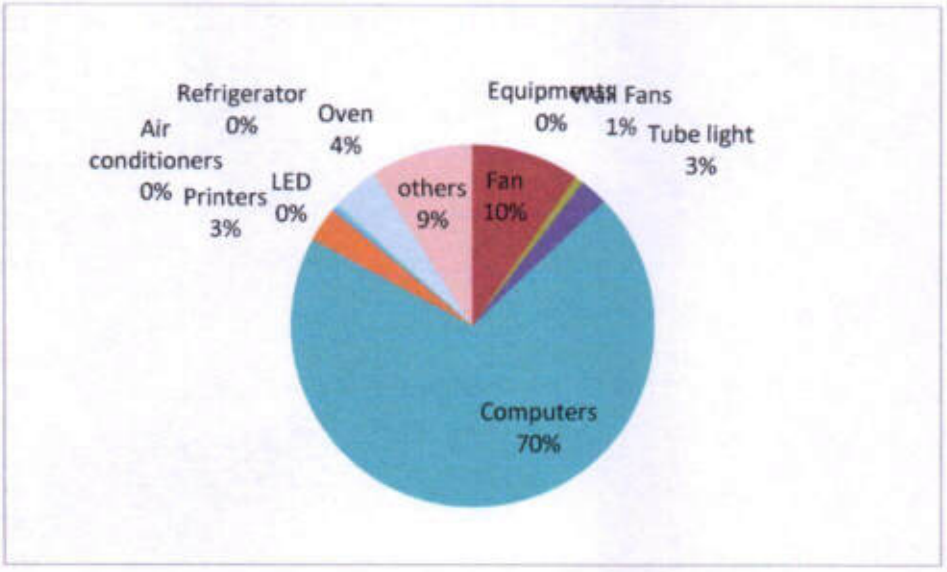
	Refrigerator	1	180	180
	computers	1	520	520
	printer	1	200	200
Zoology Department	Fan	9	78	702
	Tube light	5	40	200
	LED	3	10	30
	wall Fan	1	100	100
	Projector	1	200	200
	Oven I	2	1000	2000
	Oven II	1	2000	2000
	outdoor light	2	40	80
	computers	2	520	1040
	Printer	1	200	200
Statastics Department	Fan	12	78	936
	Tube light	5	40	200
	LED	3	10	30
	wall Fan	3	100	300
	outdoor light LED	2	10	20
	computers	39	520	20280
	Air conditioners (2 Tonne)	1	7050	7050
chemistry Department	Fan	15	78	1170
	Tube light	15	40	600
	LED	6	10	60
	computers	12	520	6240
	wall Fan	1	100	100
	TV LED	1	100	100
	oven	2	1500	3000
	Refrigerator (253 units per year saving	1	180	180
	Air conditioners(1.5 Tonne)	1	5275	5275
Class rooms (No.22)	Fans	1	78	78
	Tube light	1	40	40
Library	Fan	18	78	1404
	18 tube light	1	18	18
	Tube light	20	40	800
	CFL (18W)	1	18	18

	outdoor light	2	40	80
	Printer	1	200	200
	computers	7	520	3640
Staff room for Arts and Commerce	Fan	4	78	312
	Tube light	4	40	160
	computers	1	520	520
Office	Fan	8	78	624
	Tube light	5	40	200
	LED	4	10	40
	wall Fan	1	100	100
	Xerox machine	1	500	500
	computers	7	200	1400
	Printer	6	200	1200
Principle Office	Fan	5	78	390
	Tube light	1	40	40
	LED light	17	10	170
	CFL (18W)	1	18	18
	Air conditioners	2	7050	14100
	LED TV	2	100	200
	computers	1	520	520
	Printer	1	200	200
Hostel	Fan	21	78	1638
	Tube light	15	40	600
	Bulb	8	15	120
	LED	5	`10	50
	Motor	1	746	746
	Water purifier	1	100	100
Jimkhana	Fan	2	78	156
	Tube light	8	40	320
	street light	2	25	50
	bulb CFL (18 W)	1	18	18
	Total			120012

Total Energy Consumption: 120012 Watt or 120.012 kW

B] Major electricity consuming equipment and respective total load

Equipments	Quantity	Actual load in Watt	Total Load in Watt
Fan	117	78	9126
Wall Fans	7	100	700
Tube light	60	40	2400
Computers	128	520	66560
Printers	15	200	3000
LED	26	10	260
Air conditioners	2 (1.5 Tonne) + 3(2 Tonne)		26650
Refrigerator	2	180	360
Oven	2(1kW) + 1 (2kW)		4000
others			6956
Total			**120012**



II) RENEWABLE ENERGY SOURCE:

Hybrid (Solar with wind miles) energy generation system is available in college campus. The device has rated power 2KW.

Assuming total working hours -4 hours

Total kWh or units energy obtained from renewable source is 8 kWh

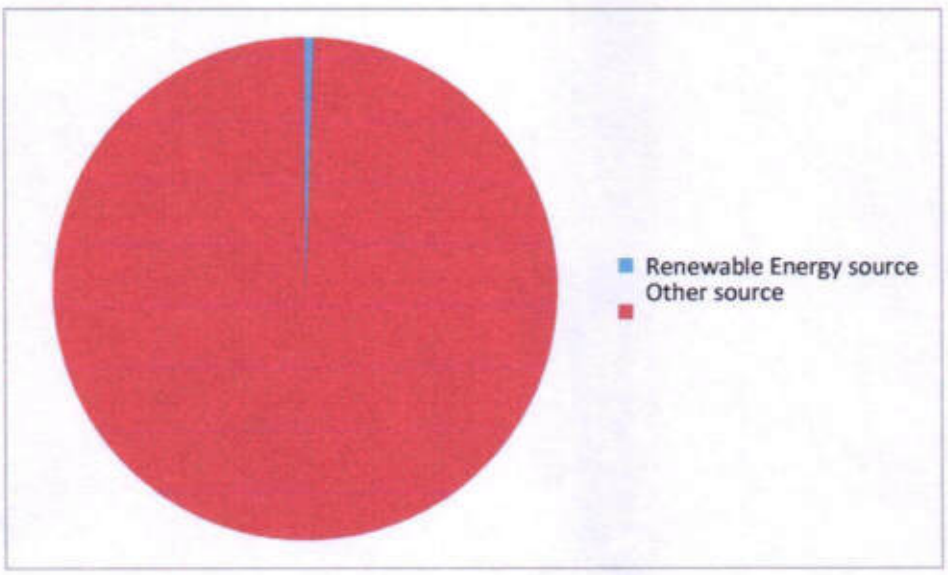
Equipment working on renewable energy

Sr. No	Equipment	Quantity	Actual consumption by equipment	Total Energy consumption in kWh or units
1.	Computer	1	520 W	520W x 4 = 2080Wh 2.08kWh
2.	Printer	1	200 W	200W x 4 = 800Wh 0.8 kWh
3.	Tube light	2	40 W	80W x 4 = 320Wh 0.32 kWh
4.	Fan	2	78 W	156W x 4 = 624Wh 0.624 kWh
			Total	5.736 kWh

Total daily energy consumption by Renewable Energy source = 3.824 kWh

Therefore monthly energy consumption by Renewable Energy source = 21.92 kWh

Monthly Average energy consumption by Electricity board = 2224.25 kWh

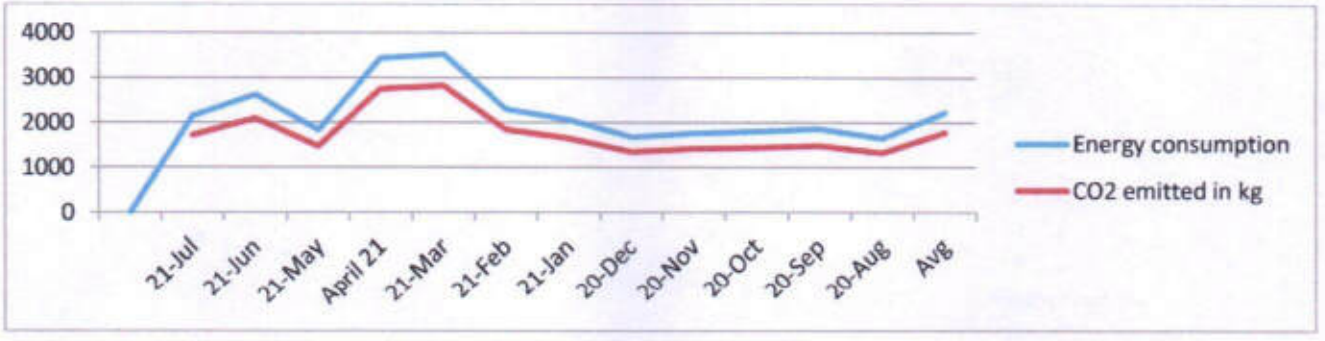


III) CARBON- DIOXIDE EMISSION

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	24-Mar	2153	1722.4
2	24-Feb	2615	2092
3	24-Jan	1832	1465.6
4	23-Dec	3436	2748.8
5	23-Nov	3525	2820
6	23-Oct	2301	1840.8
7	23-Sep	2071	1656.8
8	23-Aug	1680	1344
9	23-Jul	1763	1410.4
10	23-Jun	1805	1444
11	23-May	1861	1488.8
12	23-Apr	1655	1324
	Avg	2500	2000

Chart: Monthly CO_2 Variation



IV) RERQUIREMENT OF NAAC

A) Alternative Energy Initiative

Percentage of power requirement met by renewable energy sources

= (Power requirement met by renewable energy sources / Total power requirement) X 100 We have,

Power requirement met by renewable energy sources - 21.92 kWh Monthly Average energy consumption by Electricity board – 2500 kWh Total Power requirement: 21.92 + 2224.75 = 2246.67 kWh

Therefore,

= (21.92/2500) X 100

= 0.8%

B) Percentage of lighting power requirement met through LED bulbs

Percentage of lighting power requirement met through LED bulbs

= (Lighting power requirement met through LED bulbs / Total lighting power requirement) X 100

= (260/650) X 100

= 40.06%

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 Tasgaon college campus. Now a day's low wattage appliances are used in building. They are helpful in

; saving electricity.

Table Energy Efficient Electrical Equipment

Sr.No	Equipment	Make	Rating	Specification	Cost INR
1	20 W LED Tube light	Wipro	18 W	LED	300*
\2	Fan (1200 mm)	Usha	50 W	BEE 4 star	1255*
3\\\\	Fan (700mm)	Usha	43 W	BEE 4 star	1135*
4\	Exhaust fan	Usha	50 W	BEE 4 star 486 m3/min	1650*
5	Tube light	Philips	36 W	Lumen	250*

*Price is based on market rates

1) Tubes and CFL are replaced by LEDs.
2) Replacing the CRT Monitors with LCD Monitors:
3) Replacing regular fans by BEE 4 star fan

ENERGY SAVING CALCULATIONS:

1) Cost Analysis of LED light with Conventional tube light.

total No. of conventional Tubelights in campus	130
Conventional tubelight average power	40 W
LED Average Power	10 W
Difference in power saved per tube light	(40-10)= 30 W
% saving After replacement	75%
Average use of Tube light per year	1935kWh
Energy saved per year	75% of 1935= 1451.25
Electricity bill saving per year	1451*8=Rs. 11610
LED Average cost	Rs. 300
Total LED used	26
Total cost of replacement of tube light	Rs.7800

Current status:

Conventional light: 60 tubes instead of 131 quantities

LED: 26 with cost of replacing Rs. 7800.

Recommendation:

Replace all 60 Tube lights by LED

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2) Replacing the CRT Monitors with LCD Monitors:

In the college campus computers with CRT monitors are 128 numbers and the power consumption of CRT monitor is 520 W which is very large. The power consumption of LCD monitor is 250 Watts so the difference between CRT monitors and LCD monitor is large but the LCD monitor are costlier than CRT monitors. This saving of 270W per monitor is very large. LCD monitor cost analysis with CRT monitors.

total No. of computers with CRT Monitor in campus	128
Conventional CRT Monitor average power	520 W
LED monitor Average Power	250W
Difference in power saved per new computer	(520-250)= 270 W
% saving After replacement	52%
Average use of computer per year	24573kWh
Energy saved per year	52% of 24573= 12778kWh
Electricity bill saving per year	12778*8=Rs. 102224
LED monitor Average cost	Rs. 4500
Total LED monitor used	128
Total cost of replacement of CRT monitor	Rs.576000

3) Replacing regular fans by BEE 4 star fans

total No. of conventional Fans in campus	117
Conventional Fan average power	78 W
BEE 4 star Average Power	50W
Difference in power saved per new Fan	(78-50)= 28 W
% saving After replacement	36%
Average use of Fan per year	3370kWh
Energy saved per year	36% of 3370= 1213kWh
Electricity bill saving per year	1213*8=Rs. 9704
BEE 4 star rated fan-Average cost	Rs. 4500
Total Fans used	117
Total cost of replacement of CRT monitor	Rs.146835
Payback period	15 years

. Hence, the payback time for replacing all conventional fans of the campus with BEE 4 star rated fan is around 15 yrs year.

*Payback period is more than average life of equipment so not recommended.

RECOMMENDATIONS

General Energy Audit Observations & Recommendations

Fans

➢ Use aero foil shaped fan blades.

➢ Use energy efficient motor for continuous or near continuous operations.

➢ Turn fans off when not needed.

Lighting

➢ Reduce excessive illumination levels to standard levels using switching, decamping etc. (Know the electrical effects before doing decamping.)

➢ aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.

➢ Install efficient alternatives to incandescent lightings, etc. Efficient (lumens/watt) of various technologies range from best to worst approximately as follows: - low pressure sodium, high pressure sodium, metal halide, fluorescent, mercury vapour, incandescent.

➢ Consider lowering the fixtures to enable using less of them.

➢ Consider day lighting, sky lightings etc.

➢ Use task lighting and reduce background illumination.

➢ Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.

Buildings

➢ Seal exterior cracks/openings/gaps with caulk, casketing, weather stripping, etc.

➢ Consider new thermal doors, thermal windows, roofing insulation etc.

➢ Install windbreaks near exterior doors.

➢ Consider covering some window and skylight areas with insulated wall panels inside the building.

➢ If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.

➢ Consider tinted glass, reflective glass, coatings, awnings, overheads, draperies, blinds and shades for

sunlit exterior windows.

- Note: Remote control operated appliance use about 5% of the normal use electricity on Standby mode, therefore switching off the appliances from the mains can save avoidable waste of energy. While buying new appliances attention should be paid to standby energy usage and equipment with lower energy consumption and BEE star labelled product must be procured.

Man-made energy wastage

Ways energy is wasted in the College- Please control.

➢ Computer wastage: Computer should be switched off when it is not being used it should be in Standby mode to save energy.

Off the lights: Switching off bathroom or Labs lights when they are not in use is an easy option to save energy and costs. Using automatic switches that turn on and off depending on movement is an efficient way to ensure that the costs are kept to a minimum.

➢ Utilize your free resources: The biggest and brightest energy resource is outside and is free to use all year round, the sunshine. Instead of turning on all the lights in the office, if there is enough window space, open the curtain and let the sunshine to come in. This will reduce the use of heating and lighting need and hence energy cost.

Climate Control: Using programmable thermostats, office managers can automatically dial down the climate control at night and at other times when the office is unoccupied. Thermostats with zone control can adjust settings room-by-room, turning off, for example, air-conditioning to an unused conference room.The man-made energy wastages pointed in the report are not indented to blame anyone rather to encourage people to save energy and make contribution towards the prosperity of our nation..

Commercial Recommendations

- Installation of solar PV panel system of capacity 5 kWh is highly recommended.
- Replacement of CRT monitors with LED monitors will save Rs **146835**/- per year and payback period is 5 years its highly recommended as it will avoid digital eye strain on users.
- Replacement of remaining all conventional tube lights with LED will give savings up to 75%

INSTALLATION OF SOLAR PV PANEL

A 5kW solar system is the best fit to meet your average daily consumption 20 kWh and offset your heavy electricity bills. With higher efficiency and power potential, this system's capacity is the largest residential solar energy system you can go for.

Small businesses and commercial properties can also benefit from a 10kW solar panel system. Its significant power generation capacity can replace the traditional energy sources you use and help you become self-sufficient.

The Working of a 5 kW Solar System and Its Benefits:

Simply put, solar panels work by capturing sunlight (not heat) and converting this energy into usable electricity. This is called the photovoltaic (or PV) effect which takes place at the individual solar cells arranged together in the panels.

The DC power generated by solar panels is converted to AC electricity when it flows through a solar inverter, an important component in your 5kW solar system cost. An inverter has an in-build transformer to also control the voltage of DC and AC currents.

Being a renewable, sustainable, and plentiful energy source, solar energy has many advantages to offer:

- **Lower Electricity Bill:**

The biggest incentive for switching to solar is the opportunity to cut down your annual electricity expenses. Your bills drop as you start meeting your energy needs with your on-site 5kW solar system. Your savings depend on how much of your power demand is covered by your solar system in comparison to the upfront price of your 5000-watt solar panel system in India. It's safe to conclude that the upfront cost of a 4kW solar power plant is an investment toward securing a much lower long-term energy cost for your home.

- **Earn Solar Credits:**

In addition to savings on utility bills, there is a possibility to sell and monetize the surplus solar energy that you don't use at home. A grid-tied 5kW solar panel system is designed to export unused solar energy

to the grid for solar credits. Households can use these credits to buy grid electricity when required or receive a payment on their credit balance at the year end.

- **Environmental Gains:**

For each kilowatt-hour (kWh) of solar electricity that you use at home, you give up a similar quantity of grid electricity. This lowers your property's environmental footprint. Since solar panels use sunlight to generate power, there is no emission during the process, making solar good for the environment.

10 Kilowatt Solar Panel Price List & Specifications

Solar photovoltaic technology has become more efficient and feasible for both residential and commercial applications. Also, the prices of 5 kW solar systems in India have reduced sharply over the decade with the market becoming more competitive. Selecting the right type and size of solar system is important to ensure maximum returns on your investment. Here is a representation of estimated 5 kW solar system prices for different system types.

Model	5 kW Solar Price
5kW On-grid solar system	Rs. 4,50,000
5kW Off-grid solar system	Rs.3,00,000
5kW Hybrid solar system	Rs. 4,75,000

Key specifications of a 5kW solar system:

Key components	Solar panels (at least 75% performance efficiency), solar mounting structure, solar inverter, solar batteries (optional), the balance of system (cables, fuses, MCBs, and Distribution boxes) **For residential applications, all components should be in compliance with MNRE guidelines and ALMM standards to be eligible under the subsidy scheme.*
Energy output	–20kWh of electricity per day – 600 kWh of electricity per month – 7200kWh of electricity per year
Area required	To install a 10kW solar system, you need a shade-free space of 500 square feet.

Different Types of 5kW Home Solar Systems:

The price of a 10kW solar panel system varies across the different installation options available. Each type of system has a unique combination of solar components to fit a variety of commercial and residential applications. Knowing each system type is important to determine the best way to meet your energy needs.

- On-grid 4kW solar system (with the flexibility and benefits of net metering)
- Off-grid 5kW solar system (with solar batteries)
- Hybrid 5kW solar system (with solar battery storage and grid connection)

A] 5kW On-grid Solar System Specifications:

In a grid-tied solar energy system, electricity flows both to and from the local grid. Aside from solar panels and an inverter, your system is paired with a net meter. The surplus electricity that you don't use is fed to the grid. Through the net metering regulations, you receive solar credits for the electricity exported on your subsequent energy bill. This makes the overall cost of energy for your home even cheaper.

A grid-tied solar system also allows you to draw grid power to meet additional electricity demand beyond what your solar panels are supplying. Solar credits can be used to purchase additional grid power units.

If you are looking for the most affordable option to go solar, a 10kW on-grid solar system price in India with subsidy is worth considering. Since this type of system doesn't include solar batteries, the upfront cost is less than other types of solar installation frameworks. Also, you can avail a fixed subsidy of Rs. 94,822/- on an on-grid solar system.

B] 5kW Off-grid Solar System Specifications:

Many communities that are located far away from power sources (the government grid) have to pay higher electricity tariff rates for grid connection. At the same time, they depend on expensive diesel-fired power generation to fulfil additional electricity needs. For such households and commercial establishments, an off-grid 10kW solar plant cost proves to be more feasible and affordable than traditional energy sources.

An off-grid framework uses solar panels, an inverter and a battery bank to ensure a 24-hour power supply. 10kW solar panels can generate enough power to run your home or office and still give a surplus to charge batteries and create an energy reserve. Your property uses the battery reserve during the night hours or on days when solar panels don't produce enough power.

C] 5kW Hybrid Solar System Specifications

The biggest motivation for choosing the hybrid solar framework is to minimize and even eliminate grid dependence and avoid power outages. The price of a 10kW solar system in India installed in a hybrid framework is higher than an on-grid system. And It's reasonably so if you consider the additional advantages.

A hybrid framework offers the flexibility of net metering combined with the reliability of solar batteries. You not only earn solar credits by selling off surplus solar energy to the grid but also maintain an on-site power reserve to prevent sudden outages and ensure a dependable power supply.

5kW Solar Panel System Facts-

- **Number of solar panels:** The exact number of solar panels required to make up a 10kW solar system depends on their output rating. A solar panel's output rating ranges from 200-wattage to

400-wattage. Panels of higher rating can produce more power in less amount of space. On average, it takes 27 to 35 solar panels for your 10kW solar panel system to function at its optimum power generat2ion capacity.

- **Warranty**: Most solar system manufacturers provide lasting warranties on different solar components. You can get up to 25 years of performance warranty on solar panels. Other solar components like solar batteries and inverters come with a product warranty of 5-10 years.
- **Subsidy:** Households in India can reduce their 10kW solar power plant cost in India by availing subsidy. The MNRE has launched the rooftop solar subsidy scheme to encourage the adoption of solar for residential use. To be eligible under the scheme, it's important to buy made-in-India solar components and connect your solar system to the grid.

Also, the system must be installed in compliance with the prescribed technical specifications and standards by a vendor empanelled with your local DISCOM company.

5kW Solar System Installation Cost in India

5kW Solar System Subsidy in India:

For rooftop solar plants installed for residential use all over India, the following Central Financial Assistance (CFA)/ Central Government Subsidy are available.

Rooftop Solar System Capacity	Applicable Subsidy (₹)
1 kw	Rs. 30,000/-
2kW	Rs. 60,000/-
3kW and above	Rs. 78,000/-

5kW Solar Panel System Price in India with Subsidy:

Here is a tabular representation of CFA calculations to understand the estimated price of a 10kw solar panel system in India.

Model	10kW Solar Plant Price	Subsidy Applicable	Prices After Subsidy
5kW On-grid solar system	Rs. 3,55,500 Onwards*	Rs. 78,000	Rs. 2,77,500 Onwards*
5kW Off-grid solar system	Rs. 3,50,000	Not applicable	Rs. 3,50,000
5kW Hybrid solar system	Rs. 7,50,000	Rs. 78,000	Rs. 6,72,000

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.

Mrs. D.S. Patil (EA-31840)
BE(Mech) MTech(Energy)
Bureau of Energy Efficiency (BEE)
Certified Energy Auditor and Manager

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5/22, 'Prashant' ZP Colony,
Near Waransil, Vishrambag,
Sangli, 416415.

DS Energy Consultancy and Services

Certificate of Completion

Energy Audit

This certifies that

A detailed Energy Audit for **Padmabhushan Dr.Vasantraodada Patil Mahavidyalaya, Tasgaon** has been conducted for the year **2023-24** to assess the green initiative planning, efforts, activities implemented in the campus like economical usage of electricity, water and paper resources ,Swach Bharat Abhiyan, plantation Segregation of waste etc.

The activities and measures carried out by the institute have been verified and found to be satisfactory, some recommendations are given in the report. The efforts taken by the institute, faculty and students are highly commendable.

Dhanashri Patil
Certified Energy Auditor and
Manager (EA 31840)
Bureau of Energy Efficiency

Date
July 23,2024

UKcert
Certification & Inspection

Certificate of Compliance

This is to certify that the

Conformity Assessment Certification

of

DS ENERGY CONSULTANCY AND SERVICES

at

5/29, 'PRASHANT', ZP COLONY, NEAR WARNALI, VISHRAMBAG, SANGLI, MAHARASHTRA PIN 416415, INDIA

has been independently assessed and is compliant with the requirements of:

ISO/IEC 17020:2012

For the following scope of activities:

THIRD PARTY INSPECTION SERVICES FOR WALKTHROUGH AND DETAILED ENERGY AUDIT, GREEN AUDIT AND ENVIRONMENTAL AUDIT FOR COMMERCIAL BUILDINGS, INDUSTRIES , EDUCATIONAL INSTITUTES LIKE COLLEGES AND UNIVERSITIES , POWER QUANTITY AUDIT AND HARMONIC STUDIES , ENERGY AND LOAD MONITORING SERVICES , THERMOGRAPHY, ENERGY MANAGEMENT SYSTEM , AIR QUALITY TESTING , DATA WARE HOUSING , WATER AUDIT, RENEWABLE ENERGY ADVISORY, HEALTH CHECK UP OF PLANT EQUIPMENTS.

Certificate Number: UQ - 2024011219

Validity of this certificate can be verified at www.ukcertifications.org.uk

Date of Certification	12th January 20
1st Surveillance Audit Due	11th January 2025
2nd Surveillance Audit Due	11th January 2026
Certificate Expiry	11th January 2027

Authorised Signatory

UKAF

UK Certification & Inspection Ltd