



**Dr. Patangrao Kadam Mahavidyalaya, Sangli**  
Affiliated to Shivaji University

## Energy Audit Report



Prepared by

**DEPARTMENT OF ENVIRONMENTAL SCIENCE,**

**SHIVAJI UNIVERSITY, KOLHAPUR- 416004**

**2022-23**





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## Certificate

This is to certify that the Department of Environmental Science, Shivaji University, Kolhapur has conducted detailed "Energy Audit" of "Bharati Vidyapeeth's Dr.Patangrao Kadam Mahavidyalaya, Sangli." during the academic year 2022-2023. The Energy audit was conducted in accordance with the applicable standards prescribed by 'Bureau of Energy Efficiency, Government of India'. Their audit involve code compliance, operations, maintenance, occupancy, and building systems etc and gives an 'Energy Management Plan', which the institute can follow to minimize impact on the institutional working framework. The analysis was based on a review of the rules governing energy efficiency and conservation, on data analysis, and on the findings of survey with key personnel in the campus's administrative management. The performance of college was found to have good quality even though some important aspects like increasing the use of solar energy and energy efficient equipments are to be considered seriously. In an opinion and to the best of our information and according to the information given to us, said Energy audit gives a true and fair view in conformity with energy auditing principles accepted in India.



*Aasawari Jadhav*  
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Dr. (Mrs.) Aasawari Jadhav  
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"Social Transformation Through Dynamic Education"

Bharati Vidyapeeth's

**Dr. Patangrao Kadam Mahavidyalaya, Sangli**

Founder :  
**Dr. Patangrao Kadam**  
M.A., LL.B., Ph.D.

Principal  
**Dr. D.G. Kanase**  
M.Sc., Ph.D.

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Founding Hon'ble Dr. Patangrao Kadam

Accredited with 'B<sup>++</sup>' Grade  
by NAAC (3<sup>rd</sup> Cycle)

Ref. No. : BV/PKMS/ 346/2022-2023

Date : 07/03/2023

### Principal's Message

In this modern era, environmental sustainability is very important because many environmental problems have been created due to human activities. In such a situation, it is our primary responsibility to preserve the environment by taking certain steps to reduce environmental pollution and develop environmental sustainability. The College, since its inception has taken several efforts to create a green campus through various initiatives such as landscaping, plant plantation, awareness programs etc.

Nature conservation has become very important in recent times. Green, Environmental and Energy audits have become very important in analyzing the institution's environmental performance and possible options to make the institution eco-friendly. These audits aim at improving the environmental conditions inside and outside the institute.

I am very happy that our college has carefully completed these audits under the supervision of the committee of Shivaji University Kolhapur. This will enable us to tolerate environmental issues in the future.

Thank You.



*(Handwritten signature)*

(Dr. D. G. Kanase)

Principal

Bharati Vidyapeeth's

Dr. Patangrao Kadam Mahavidyalaya, Sangli.



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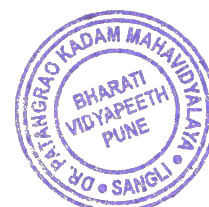
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## Chapter I

### Introduction

#### 1.1 Energy Audit, a Tool for Environmental Protection and Conservation

An energy audit is a survey that looks at how an organization uses its energy and looks for ways to conserve it. It refers to a method or system designed to lower the organization's energy consumption without lowering output. The audit offers recommendations for additional strategies and techniques for maximizing energy savings. Traditionally, fossil fuels, water, and wind have been used to produce electrical energy. The abundance of fossil fuels and their rates of depletion reinforce the need for alternative energy sources and electric energy conservation. Offering goods or services at the lowest cost and with the least degree of environmental damage is often the main goal of an energy audit and the control of energy consumption (Backlund and Thollander, 2015). Energy audits are required to identify areas for improvement, cost-saving opportunities, understand how fuel is used, where waste occurs, and identify potential savings.

The Energy Conservation Building Code (ECBC), introduced in 2017, establishes minimal standards for the design and construction of energy-efficient buildings throughout India. Additionally, it offers two extra sets of incremental specifications that buildings must meet in order to reach higher than necessary levels of energy efficiency (Gnanamangai *et al.*, 2021). In an effort to adopt energy-saving procedures in an organisation; the Bureau of Energy Efficiency (BEE) was established in 2002. Affixed to manufactured goods, energy-efficiency labels provide information on the products' energy efficiency (Ingle, 2014). In order to speed up energy efficiency efforts, BEE has created a system for labelling buildings' energy efficiency that corresponds with their star ratings. The BEE Star Rating Scheme is based on the real performance of the building and equipment in terms of specific energy usage, or "Energy Performance Indicator," by using star ratings to designate products that will be helpful for energy savings in a sustainable manner (Mishra and Patel, 2016).



## Chapter II Methodology

### 2.1 Background of Bharati Vidyapeeth's Dr. Patangrao Kadam Mahavidyalaya, Sangli:



**Satellite image of Bharati Vidyapeeth's Dr. Patangrao Kadam Mahavidyalaya, Sangli (Source: Google Earth)**

Considering all this situation and adding national holidays in the total days, the audit process was carried out in three phases. For preparation of audit, the earlier data was compared with the present. At first, all the secondary data required for the study was collected from various sources, like concerned departments. A broad reference work was carried out to clear the idea of Energy Auditing. Different case studies and methodologies were studied and the following methodology was adopted for present audit. The methodology of present study is based on onsite visits, the personal observations and questionnaires survey tool. Initially, based on data requirement, sets of questionnaires were prepared. The surveyors then visited all the departments of the college and the questionnaires were filled. The generated data is subsequently gathered through various sections of college and used for further analysis. From the outcome of the overall study, a final report is prepared.

- Energy Auditing Process
- Planning
- Choosing audit team
- Inspecting site/ Collection of data
- Analysing results of audit



➤ Evaluating audit

### 2.2 Survey by Questionnaire:

Baseline data for Energy Audit report preparation was collected by questionnaire survey method. Questionnaires prepared to conduct the Energy Audit in the college campus is based on the guidelines, rules, acts and formats prepared by Ministry of Environment, Forest and Climate Change, New Delhi, Central Pollution Control Board and other statutory organizations. Most of the guidelines and formats are based on broad aspects and some of the issues or formats were not applicable for college campus. Therefore, using these guidelines and formats, combinations, modifications and restructuring was done and sets of questionnaires were prepared for energy audit. All the questionnaires comprise of group of modules. 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 energy. There are possibilities of loss of resources like water, energy due to improper maintenances and assessment of this kind of probability is necessary in Energy Audit. One separate module is based on the questions related to this aspect. Another module is related to maintaining records, like records energy bill, equipment warranty specification, etc. For better convenience of the surveyor, some statistics like, basic energy consumption characteristics for electrical equipment etc. was provided with the questionnaires itself.





## Chapter III

### Observation and Result

#### 3. Electricity and energy audit:

Energy auditing is a tool for identifying energy efficiency potential and measures. Proper management of energy efficient systems can lead to significant cost savings and energy savings as well as increased comfort, lower repair costs, and extended machine life. An effective energy management program begins with a thorough energy audit. Energy audit evaluates the efficiency of all building and process systems that use energy. The auditor of the power starts at the meter used, finding all the energy sources that go into space. The auditor then identifies the streams of energy in each fuel, balances the distribution of energy into different functions, evaluates the efficiency of each of those functions, and identifies energy efficiency and cost-effectiveness.

❖ Audit activities, in general order, include:

- Identify all energy systems
- Check system status
- Analyse the impact of improvements to those systems
- Write up an energy audit report

The report documents the use and occupancy of the building and building systems equipment. The report also recommends ways to improve efficiency through improvements in operation and maintenance items, and through installation of energy conservation measures.

An energy source utilized by all the departments, support services of *Bharati Vidyapeeth's Dr.Patangrao Kadam Mahavidyalaya, Sangli* campus includes use of electricity and liquid petroleum. Major use of the energy is at office, laboratories, ICT enabled classrooms, auditorium and support services for lighting, transportation, and instruments. Electricity is supplied to the college campus by Maharashtra State Electricity Board.

#### Energy consumption of building:

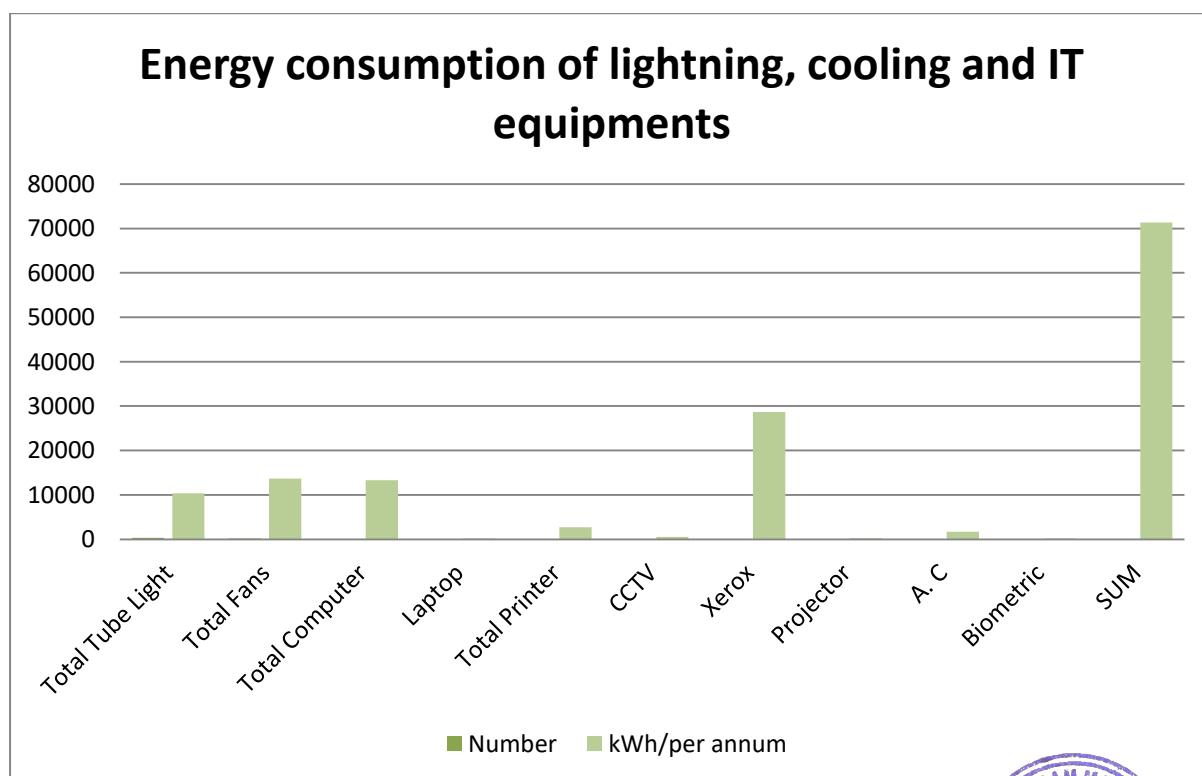
College Building of Dr. Patangrao Kadam Mahavidyalaya, Sangli includes the college has a spacious and beautiful building, with well-equipped laboratories, classrooms, ICT enabled classrooms, auditorium, two open stages, Landscape garden and a playground. The calculations are based on the data provided by the college and actual observations taken at the

site. The collected data shows all departments in the college have maximum number of major energy consuming equipments and energy consumption is 103656.32 kWh/ Annum.

**3.1 Energy consumption of lightning, cooling and IT equipments:**

**Table No.3.1: Energy consumed per annum by equipments in Building**

Sr. No.	Equipments	Number	kWh/per annum
1	Total Tube Light	299	10333.44
2	Total Fans	203	13641.6
3	Total Computer	79	13272
4	Laptop	4	161.28
5	Total Printer	14	2688
6	CCTV	11	554.4
7	Xerox	2	28672
8	Projector	1	272
9	A. C	3	1728
10	Biometric	1	204.8
	<b>SUM</b>		<b>71322.72</b>



**Graph No.3.1: Energy consumed per annum by equipments in Building**

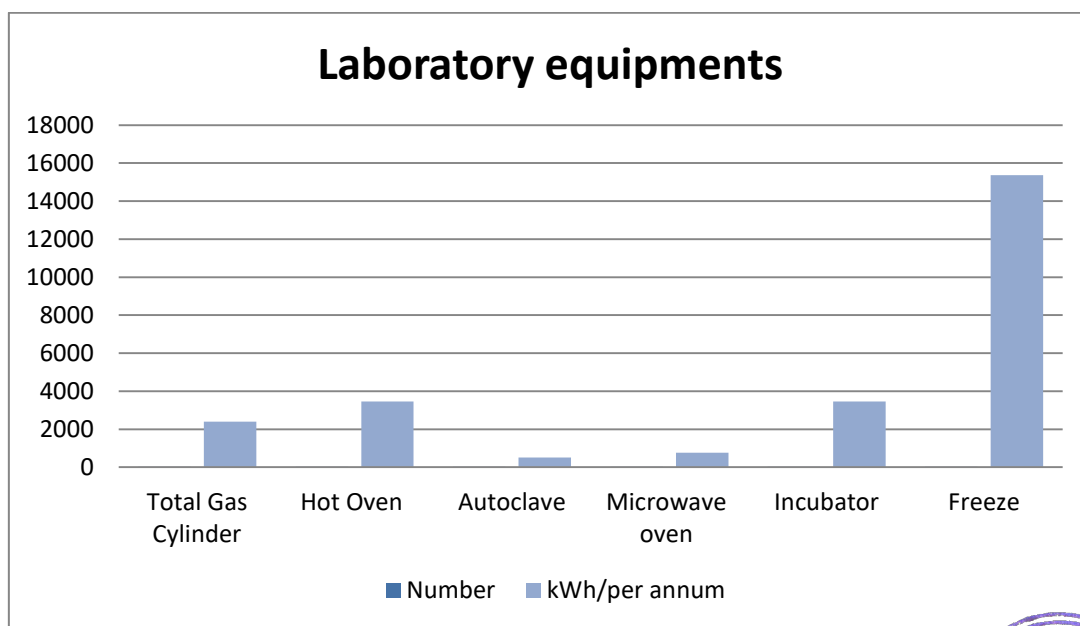


The energy-consuming equipment throughout the building uses 71366.24 kWh/Annum of power annually. Since there was maximum use of energy 28672 kWh/Annum for Xerox machine. Also 14 printers consume 2688 kWh/Annum energy. Moreover, in the assessments it was found that there are 299 LED Tubes, which consumes energy i.e. 10333.44 kWh/Annum. 203 Ceiling Fans use 13641.6 kWh/Annum and 11 CCTV cameras use 554.4 kWh/Annum, 79 computer and 4 laptops consume 13272 kWh/Annum and 161.28 kWh/Annum energy respectively. Also there is 1 biometric machine which uses energy of 204.8 kWh/Annum. (Graph No. 3.1)

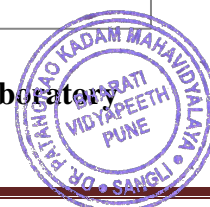
**3.2 Energy consumption of Laboratory equipments:**

**Table No.3.2: Energy consumed per annum by equipments in Laboratory**

Sr. No.	Equipments	Number	kWh/per annum
1	Total Gas Cylinder	11	2393.6
2	Hot Oven	9	3456
3	Autoclave	1	512
4	Microwave oven	1	768
4	Incubator	3	3453
5	Freeze	8	15360
	<b>SUM</b>		<b>25942.6</b>



**Graph No.3.2: Energy consumed per annum by equipments in Laboratory**

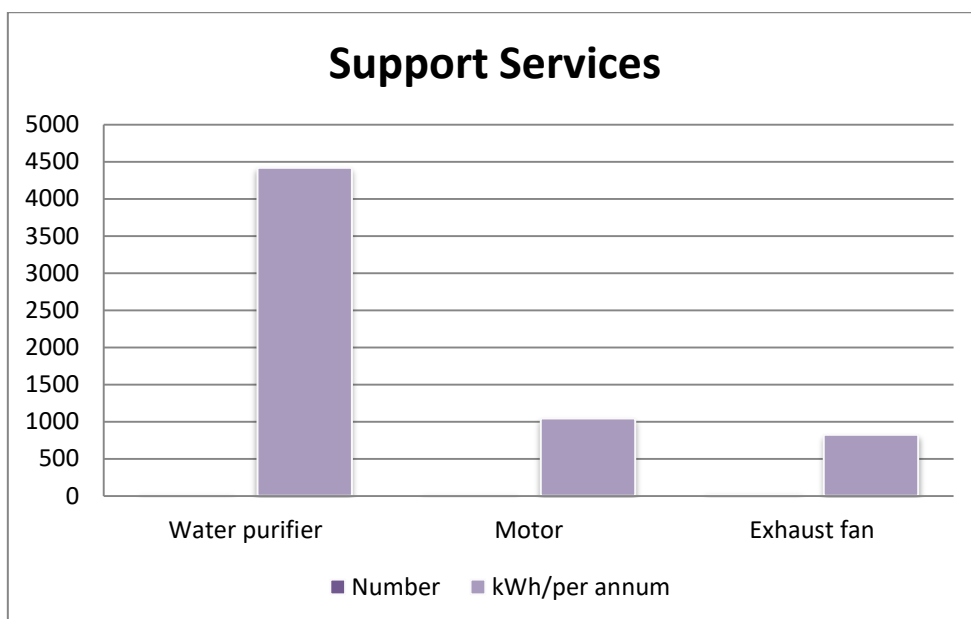


The energy-consuming equipments in laboratory uses 25942.6 kWh/Annum of power annually. Since there was maximum use of energy 15360 kWh/Annum for 8 freeze which are used in laboratory for storage purpose . After that Hot oven consume 3456 kWh/Annum energy and incubatory can consume nearby to that is 3453 kWh/Annum. Microwave has consumed 768 kWh/Annum as well as autoclave has consumed 512 kWh/Annum of energy. Total 11 gas cylinders are used for laboratory which has consumed 2393.6 kWh/Annum. (Graph No. 3.2)

**3.3 Energy consumption of Support services:**

**Table No.3.3: Energy consumed per annum by support services in Building**

Sr. No.	Equipments	Number	kWh/per annum
1	Water purifier	3	4416
2	Motor	1	1040
3	Exhaust fan	16	820
	<b>SUM</b>		<b>6276</b>



**Graph No.3.3: Energy consumed per annum by Support services in Building**

Other facility of college campus includes pure drinking water facility as well motor which is used for water uplifting. Water purifier has been utilized 4416 kWh/Annum energy and motor has been used 1040 kWh/Annum of energy. Exhaust fans used for proper air conditioning consume up to 820 kWh/Annum of energy. Total amount of energy used for other facility is 6276 kWh/Annum.

### Key Observations:

- The total energy consumption of college is 103656.32 kWh/Annum
- Highest consumption of energy is by lightning, cooling and IT equipments i.e. 71322.72 kWh/Annum.
- The energy consumption of Laboratory equipments is also more than support services.
- Installation of sensor based electrification items like fans, lights, etc. can save electricity.
- Solar panels are installed to terrace of building which is useful in conserving the natural resources.
- Unnecessary use of lights, fans and computers at some places when no one is using.



## **Chapter IV**

### **Summary and Conclusion**

#### **Summary:**

Energy Audit is one of the important tools to check the balance of natural resources and its judicious use. Energy auditing is the process of identifying and determining whether institutional practices which 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 Department of Environmental Science, Shivaji University, Kolhapur has conducted an “Energy Audit” of Bharati Vidyapeeth's Dr. Patangrao Kadam Mahavidyalaya, Sangli in the academic year 2022-23. The main objective to carry out energy audit is to check the Energy Audit practices followed by college and to conduct a well-defined audit report to understand whether the college is on the track of sustainable development.

After completing the audit procedure of college for Energy Audit practices, there are following conclusions, recommendations and Energy Management Plan (EMP) which can be followed by college in future for keeping campus environment friendly.

#### **Conclusion:**

From the Energy Audit, following are some of the conclusions which can be taken for improvement in the campus.

1. Installation of solar panels provides ample amount of electricity. Such solar modules are already installed wherever possible in the campus.
2. Use of LED lamps and Tube Lights is maximum.
3. Laboratories equipment is consuming more energy in the departments. The replacement of old equipment can be beneficial for solving this issue.
4. The replacement of florescent tube can be beneficial for solving electricity consumption issue.



### **Recommendations:**

Following are some of the key recommendation for improving campus environment:

1. An environmental policy document has to be prepared with all the recommendations and current practice carried by college.
2. The college should develop internal procedures to ensure its compliances with environmental legislation and responsibility should be fixed to carry out it in practice.
3. Electrification of street lights by solar power should be encouraged.
4. Installation of sensor based electrification items like fans, lights, etc. can save electricity.
5. Regular checkups and maintenance of wire, and Electricity meter system should be done by engineering section to reduce over use, short circuit.
6. Science laboratories and support services using large amount of energy consumption; the system should develop energy conservation practices.



**Chapter V**  
**Energy Management Plan (EMP)**

By understanding the dynamics of present situation of resource utilization and current Energy Audit practices, the Department of Environmental Science has prepared an „Energy Management Plan“ for the Bharati Vidyapeeth's Dr. Patangrao Kadam Mahavidyalaya, Sangli in the academic year 2022-23. This plan will reveal the strengths and weaknesses and suggests remedies to develop Energy Audit campus. The EMP also gives suggestion for the priority of work to carry out.

<b>Energy Management Plan Sector</b>	<b>Strengths</b>	<b>Weakness</b>	<b>Suggestions</b>	<b>Priority</b>
<b>1. Electricity</b>	Different types of the instrument is available	Unnecessary use of lights, fans and computers at some places when no one is using.	Electrification of street lights by solar power.  Installation of sensor based electrification for fans, lights, etc. Use of solar pumps for water tanks.	Medium







**Environmental Audit Team with Principal of Dr. Patangrao Kadam  
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