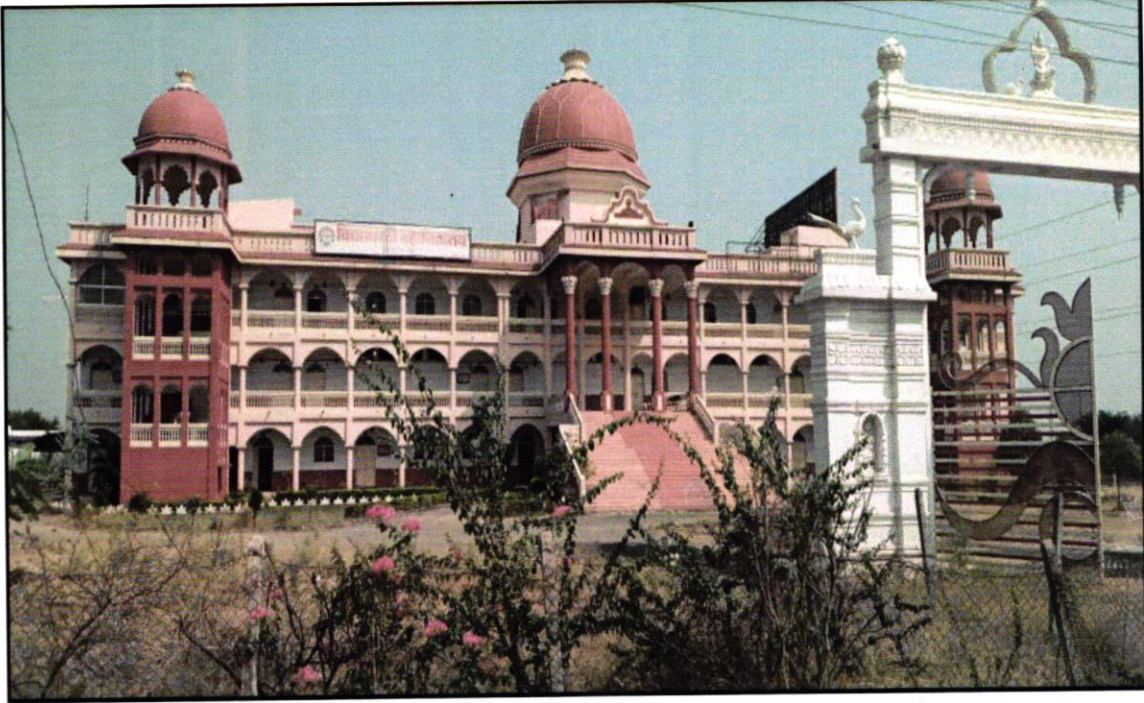




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Dr. R.G. Bhoyar Arts, Commerce and  
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Year 2021-22**



## **ENERGY AUDIT REPORT CONSULTATION REPORT**



**Dr. R.G. Bhoyar Arts, commerce and Science  
College Seloo, Wardha  
Nagpur (M.H)**

PREPARED BY

**EMPIRICAL EXERGY PRIVATE LIMITED**


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(2021-22)



  
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Science College, Seloo, Wardha  
Year 2021-22**



## CONTENTS

Sr. No.	Items	Page No
I	ACKNOWLEDGEMENT	3
II	EXECUTIVE SUMMARY	4
<b>Chapter-1</b>	<b>Introduction</b>	<b>6</b>
1.1	About College	6
1.2	About College Campus	8
1.3	Energy Monitoring Committee	10
1.4	Energy Audit Team	10
1.5	About Energy Audit	11
1.6	Objectives of Energy Auditing	11
1.7	Methodology:	12
<b>Chapter- 2</b>	<b>Power Supply System and Bill analysis</b>	<b>13</b>
2.1	Electrical Bill analysis 2021-22	13
2.2	Connected Load of College	14
2.3	Some photograph of Equipment's	15
<b>Chapter -03</b>	<b>ENERGY CONSERVATION</b>	<b>20</b>
Case Studt-01	Installation 10 kWp grid connected solar roof top system	20



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**Energy Audit Report of  
Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**




## **ACKNOWLEDGEMENT**

**Empirical Exergy Private Limited (EEPL), Indore** takes this opportunity to appreciate & thank the management of **Dr. R. G Bhoyar Arts, Commerce and Science College Seloo Wardha Nagpur (M.H)** for giving us an opportunity to conduct Energy audit for the college.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation the course of study.



  
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**Rajesh Kumar Singadiya**  
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Empanelled Energy Auditor with MPUVN, Bhopal M.P.  
Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi  
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**Energy Audit Report of  
Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



## **EXECUTIVE SUMMARY**

The executive summary of the energy audit report furnished in this section briefly gives the identified energy conservation measures and other recommendation during the project that can be implemented in a phased manner to conserve energy, increase productivity inside the College campus.

### **RECOMMENDATION**

#### **✦ SOLAR SYSTEM: -**

There are good potential of install 10 kWp roof top grid connected system.

#### **✦ LIGHTING SYSTEM**

Replacement of “conventional T-12 (40 Watt) and T-8 (36 Watt)” tube light by energy efficient LED lighting fixture was taken up phased manner.

#### **✦ TIMER CONTROLLED STREET LIGHTS**

Installation of “Timer control on Focus Light and street lighting” in college campus is recommended.

#### **✦ CEILING FAN AND EXHAUST FAN:**

Replacement of “conventional ceiling fan (60 Watt to 80 Watt)” by energy efficient star rated fan or BLDC based energy efficient fan (20 to 25 Watt) in “admin building, class rooms, laboratories and faculties cabin” have great potential for energy saving.

Replacement of “conventional exhaust fan (90 Watt to 125Watt)” by energy efficient star rated fan or BLDC based energy efficient Fan (20 to 40 Watt) in old building class rooms, laboratories and faculties cabin have great potential for energy saving.

#### **✦ IOT BASED ENERGY MONITORING SYSTEM AT MAIN FEEDER**

- Installation of “Cloud based (IoT based) energy monitoring system” including harmonic measurement (total voltage and current harmonic distortion %) in power house will be good initiate for energy monitoring as well as student demo project for management. Expected energy saving potential about 2 to 4%.
- Installation of energy meters on PCC panel with IOT system will monitor line losses of the system. It will give real time measurement of power factor and line losses from the cable.





**Energy Audit Report of  
Dr. R.G. Bhojar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**




✦ **SYNCHRONIZATION OF DG SET WITH SOLAR SYSTEM**

- Installation of “Cloud based fuel and unit generation monitoring system” in DG set will help to monitor specific unit generation by DG set failure of the grid power.
- It was observed that during the power failure of the grid, solar unit generations also stop. Synchronization of the solar system with DG set increases the utilization capacity of the solar system.

✦ **Energy Management Workshop and Training:**

- Develop energy management policies for college. Establish a procurement policy that is energy saving and eco-friendly.
- Conduct awareness and training programs for faculty, student and non-teaching staffs. Conduct seminars, workshops and exhibitions on energy management education.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in energy management system.



  
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**




**CHAPTER-1  
INTRODUCTION**

**1.1 About College**

Dr. R. G. Bhoyar Arts, Commerce & Science College (Vidyabharti College) has inspired by Hon'ble Dr. Rajesh G. Bhoyar with their innovative vision and Noble mission "Gun: Sarvatra Pujyate" which established in 2008. The college is recognized under section 2(f) & 12 (b) of the UGC Act 1956, is affiliated to Rashtrasant Tukadoji Maharaj Nagpur University and accredited with B+ by NAAC in 2017. Our institute is only in Seloo taluka, Dist-Wardha (Maharashtra), which gives service to rural flock to spread knowledge and provide quality education. This college in committed to impart quality education and to improve overall personality of the rural youths and make them to face the challenges of the competitive modern world. The College has Under Graduate courses in all discipline and post-graduation in Botany, Zoology, Physics and Commerce as well as research center in Commerce. The college has received Green Championship award. The institute has the Best Rural College and succeeded in caring a niche for itself in the field of education and has earned the trust and confidence of the society mainly because of its quality and value-based education. The institute is located at rural area in Seloo and caters to need of 135 villages. The campus sprawling six acres with natural environment.



  
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



## Vision

The women students through learners can contribute a lot towards National reconstruction and development, which shall finally lead us towards the balance between not only in body and spirit but also in the intellect and emotion.

## Mission

To serve selflessly towards the cause of human excellence especially in character building, personality development and empowerment of women through knowledge and higher education

## Goals

### Academic Goals:

- ✦ To work towards the growth of institution into a centre of excellence.
- ✦ To provide the standard education in the field of Science, Home Science and Social Science to women.
- ✦ To encourage students and teachers in the pursuit of knowledge and in setting high standard of academic achievements.
- ✦ To bring women to the higher level for facing modern science age and to develop scientific and rational attitude.
- ✦ To develop free and fearless thinking leading to intellectual and moral maturity.
- ✦ To bridge the gap between educational and social needs.

### Social Goals:

- ✦ To enable the women to come out from the stagnant pool of orthodoxy into the clear stream of reason, perfection, tolerance and dynamism.
- ✦ To make women aware of their social responsibilities and important role in nation building.
- ✦ To make the student aware of environmental issues and to hand over the moral responsibilities to the coming generation an eco-friendly lifestyle and earth free from pollution.
- ✦ To empower the girl students by helping them to become strong, self-reliant, socially motivated, responsible and dedicated women and better citizen of tomorrow, so as to equip them to meet the challenges in life positively.



  
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Dr. R.G. Bhojar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



### 1.2 About College Campus:

The College is built up area 3547 sq/m with plenty of open space and sports area interspersed within academic buildings. The details of various department and building are given below:

Total Build up area		
Sr.no	Area Name	Total Area (Sqm.)
1	Main Building (Administrative building)	2049.50
2	Building second (Wing A)	626.04
3	Building third (Wing B)	871.56

### Name of Teaching Department and Courses

#### Three Year Degree Courses

- ✚ B.A.
- ✚ B.Com. (English / Marathi Medium)
- ✚ B.Sc.

#### Post Graduate Courses

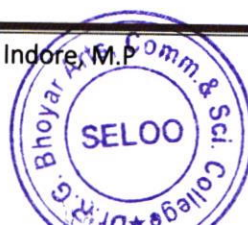
- ✚ M.Com. (English / Marathi Medium)
- ✚ M.Sc. (Botany / Zoology / Physics)

#### Place for Higher Education and research

- ✚ Commerce

#### Departments of the college.

- ✚ Department of Commerce (UG and PG)
- ✚ Department of Botany (UG and PG)
- ✚ Department of Zoology (UG and PG)
- ✚ Department of Physics (UG and PG)
- ✚ Department of Microbiology
- ✚ Department of Biochemistry
- ✚ Department of Chemistry
- ✚ Department of Mathematics
- ✚ Department of Computer Science
- ✚ Department of Electronics
- ✚ Department of Arts
- ✚ Department of N.S.S.
- ✚ Department of Physical Education



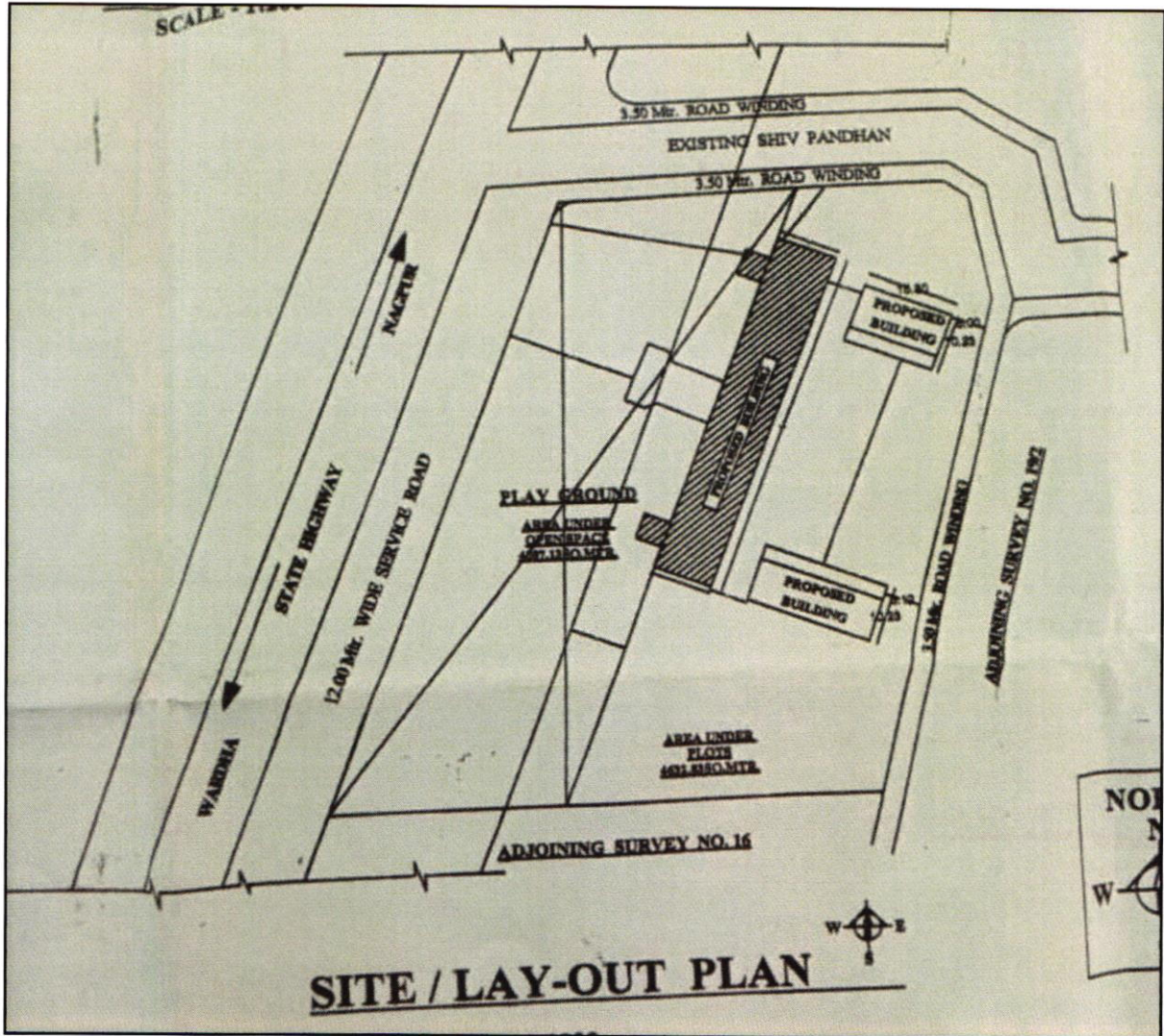




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Science College, Seloo, Wardha  
Year 2021-22



COLLEGE LAYOUT OF VARIOUS FLOORS



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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



### 1.5 About Energy Audit

Energy audit helps to understand more about the ways energy is used in any plant and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to final consumer becomes 50%. Hence one unit saved in the end user is equivalent to two units generated in the power plant.

Energy audit is the most efficient way to identify the strength and weakness of energy management practices and to find a way to solve problems. Energy audit is a professional approach in utilizing economic, financial, and social and natural resources responsibility. Energy audits “adds value” to management control and is a way of evaluating the system.

Empirical Exergy Private Limited (EEPL), Indore M.P. carried out the “Energy Audit” at the site to find gaps in the energy consumption pattern for Arts, Commerce and Science College. A technical report is prepared as per the need and the requirement of the project.

### 1.6 Objectives of Energy Auditing

An energy audit provides vital information base for overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures. It aims at:

- Identifying the quality and cost of various energy inputs.
- Assessing present pattern of energy consumption in different cost centers of operations.
- Relating energy inputs and production output.
- Identifying potential areas of thermal and electrical energy economy.
- Highlighting wastage in major areas.
- Fixing of energy saving potential targets for individual cost centers.
- Implementation of measures for energy conservation & realization of savings.



  
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**




**1.7 Methodology:**

Methodology adopted for achieving the desired objectives viz.: Assessment of the current operational status and energy savings include the following:

- ✦ Discussions with the concerned officials for identification of major areas of focus and other related systems.
- ✦ Team of engineers visited the site and had discussions with the concerned officials / supervisors to collect data / information on the operations and load distribution within the plant and same for the overall premises. The data was analyzed to arrive at a base line energy consumption pattern.
- ✦ Measurements and monitoring with the help of appropriate instruments including continuous and / or time-lapse recording, as appropriate and visual observations were made to identify the energy usage pattern and losses in the system.
- ✦ Trend analysis of costs and consumptions.
- ✦ Capacity and efficiency test of major utility equipment's, wherever applicable.
- ✦ Estimation of various losses
- ✦ Computation and **in-depth analysis** of the collected data, including utilization of computerized analysis and other techniques as appropriate were done to draw inferences and to evolve suitable energy conservation plan/s for improvements/ reduction in specific energy consumption.



  
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



**CHAPTER- 2**

**POWER SUPPLY SYSTEM AND BILL ANALYSIS**

**2.1 Power Station and Bill analysis 2021-22**

- ✚ Power Supply From: - MSEDCL
- ✚ Customer Number: - 390750000927
- ✚ Sectioned Load: - 7.54 KW
- ✚ Overall Unit charged: - 9.14

Sr No.	Month & Year	Unit consumption (KWH)	Amount (Rs/-)	Unit (Rs/kWh)
1	Apr-21	721	5,407	7.50
2	May-21	463	3,509	7.58
3	Jun-21	443	3,554	8.02
4	Jul-21	499	11,190	22.42
5	Aug-21	630	4,990	7.92
6	Sep-21	493	3,990	8.09
7	Oct-21	553	4,420	7.99
8	Nov-21	598	4,750	7.94
9	Dec-21	526	4,230	8.04
10	Jan-22	567	4,560	8.04
11	Feb-22	481	3,910	8.13
12	Mar-22	563	4,500	7.99
	Total	6,537	59,010	9.14

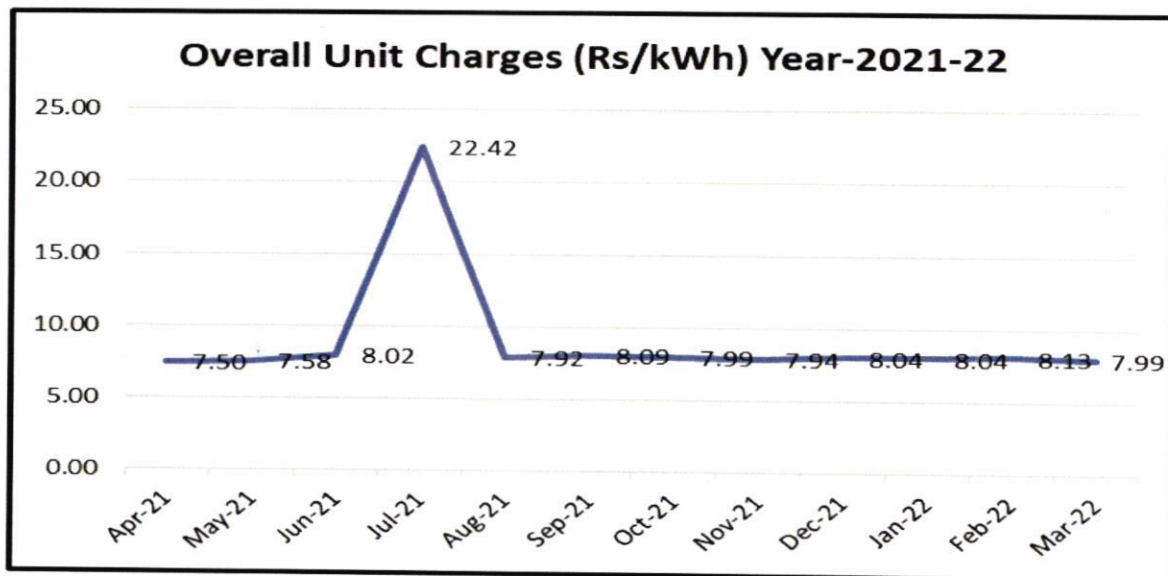


Figure: - Graphical Presentation of Overall unit charges Year-2021-22



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Year 2021-22**



**Monthly unit (kWh) Year-2021-22**

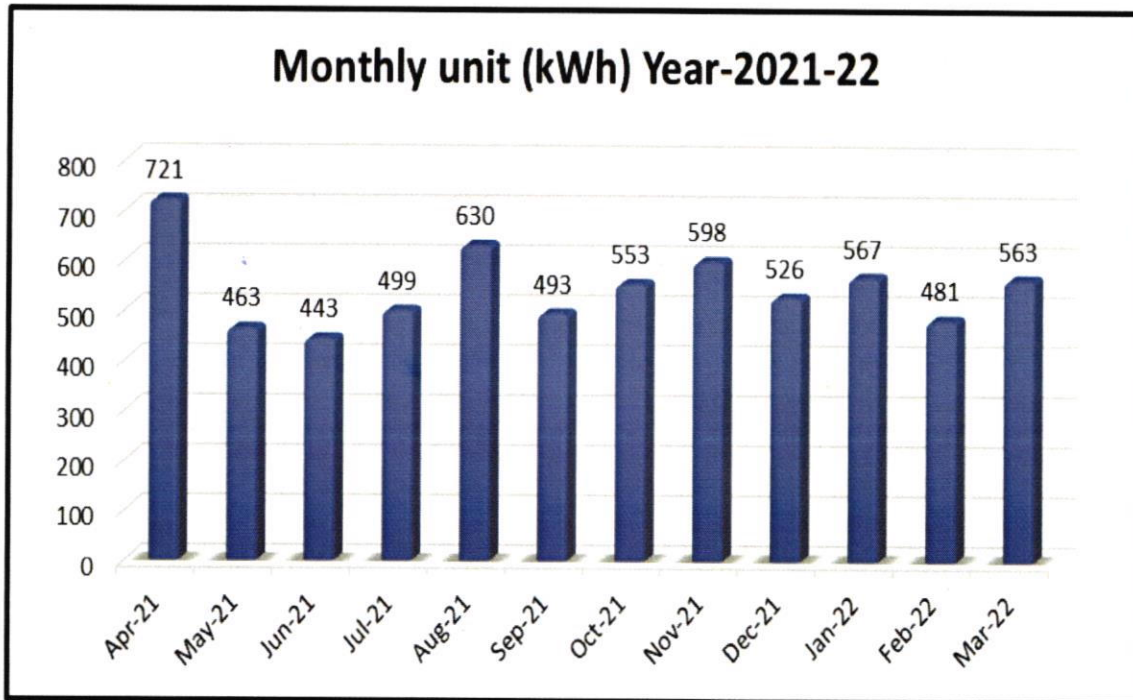


Figure 2.1: - Graphical presentation of monthly unit kWh Year-2021-22

**Monthly electricity amount year-2021-22**

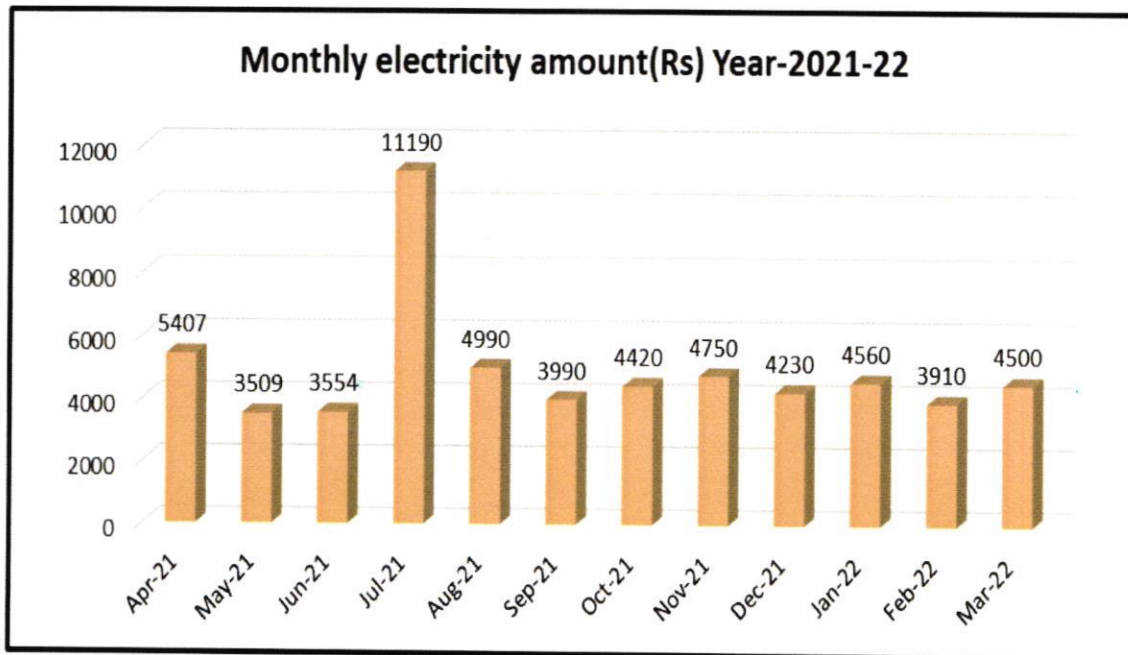


Figure 2.2: - Graphical presentation of Electrical amount year-2021-22



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Year 2021-22**



**2.2 Connected Load of College:**

Sr. No	Location/ Name of Building	Type of Electrical Equipment	Rated (watt)	Quantity (Nos)
1	Admin Building	Computer	85	4
2		Celling fan	80	4
3		Exhaust fan	100	1
4		Tube light	40	2
5		Printer	150	2
6		Cooler	75	1
7	Principal Office	Computer	85	1
8		Celling fan	80	4
9		Exhaust fan	100	1
10		Tube light	20	2
11		Printer	75	1
12		Split AC	1500	1
13	Library	Bulb	20	1
14		Computer	85	5
15		Printer	75	1
16		Celling fan	80	9
17	Seminar Hall	Tube light	40	3
18		Split AC	1500	2
19		Projector	320	1
20		Celling fan	80	6
21	Chemistry lab	Tube light	40	2
22		LED light	20	3
23		Celling fan	80	7
24	Language Department	Tube light	40	2
25		Exhaust fan	150	1
26		Fan	80	1
27	Botany Department	Light	60	1
28		Ceiling Fan	80	10
29		Tube light	40	4
30		Computer	40	1
31		Printer	75	1
32		Laptop	35	2
33		Autoclave	2000	1
34		Incubator	1000	1
35	IQAC Department	Centrifuge	115	1
36		Water bath	150	1
37				
38	IQAC Department	Ceiling fan	80	2
39		Computer	40	1



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Year 2021-22**



40		Printer	75	1
41		Tube-light	40	1
42	Biochemistry Department	Ceiling fan	80	3
43		Tube-light	40	1
44	Zoology Department	Ceiling fan	80	10
45		Tube light	40	3
46		Laptop	35	3
47		Computer	40	1
48		Printer	75	1
49	Microbiology Department	Ceiling fan	80	5
50		Tube light	20	2
51		Laptop	35	2
52	Physics Department	Ceiling fan	80	10
53		Tube light	20	4
54		Laptop	35	2
55	Computer lab	Ceiling Fan	80	2
56		Tube light	20	2
57		Computer	35	10
58	Class room 202	Ceiling fan	80	5
59		Light (LED)	20	2
60	Class room 203	Ceiling fan	80	2
61		Light (LED)	20	2
62	Class room 204	Ceiling fan	80	3
63		Light (LED)	20	2
64	C 101 1 <sup>st</sup> floor	Ceiling fan	80	2
65		Light (LED)	20	1
66	C 102/1	Ceiling fan	80	4
67		Light (LED)	20	1
68	C 102/ 2	Ceiling fan	80	4
69		Light (LED)	20	1
70	2 <sup>nd</sup> floor 01	Ceiling fan	80	4
71		Light (LED)	20	1
72	2 <sup>nd</sup> floor 02	Ceiling fan	80	4
73		Light (LED)	20	1
74	2 <sup>nd</sup> floor 03	Ceiling fan	80	4
75		Light (LED)	20	1
76	3 <sup>rd</sup> floor 01	Ceiling fan	80	6
77		Light (LED)	20	2
78	3 <sup>rd</sup> floor 02	Ceiling fan	80	6
79		Light (LED)	20	2
80	1 <sup>st</sup> floor 01	Ceiling fan	80	8
81		Light (LED)	60	2
82	1 <sup>st</sup> floor 02	Ceiling fan	80	4



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Dr. R.G. Bhojar Arts, Commerce and  
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Year 2021-22**



83		Light (LED)	60	1
84	2 <sup>nd</sup> floor 02	Ceiling fan	80	6
85		Light (LED)	40	1
86	2 <sup>nd</sup> floor 03	Ceiling fan	80	4
87		Light (LED)	40	1
88	3 <sup>rd</sup> floor 01	Ceiling fan	80	4
89		Light (LED)	40	1
90	2	Ceiling fan	80	4
91		Light (LED)	40	1
92	3	Ceiling fan	80	2
93		Light (LED)	40	1
94	Main building ground floor Corridor	Tube light	20	3
95	Main building 1 <sup>st</sup> floor Corridor	Tube light	20	3
96	Main building 2 <sup>nd</sup> floor Corridor	Tube light	20	3



  
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Year 2021-22**



Sr. No	Equipment's	Rated Power (Watt)	Quantity (Nos)	Total Power (Watt)	Load Share %
1	Computer System / Laptop	85	32	2720	9.20
2	Celling Fan	80	142	11360	38.44
3	Exhaust Fan	150	4	600	2.03
4	Tube light	40	20	800	2.71
5	Tube light	20	41	820	2.77
6	Printer	150	7	1050	3.55
7	AC	1500	3	4500	15.23
8	Streat Light	50	4	200	0.68
9	Water Cooler	1500	1	1500	5.08
10	Borewells	3000	2	6000	20.30
<b>Total Connected Load KW</b>				<b>29.550</b>	<b>100.00</b>

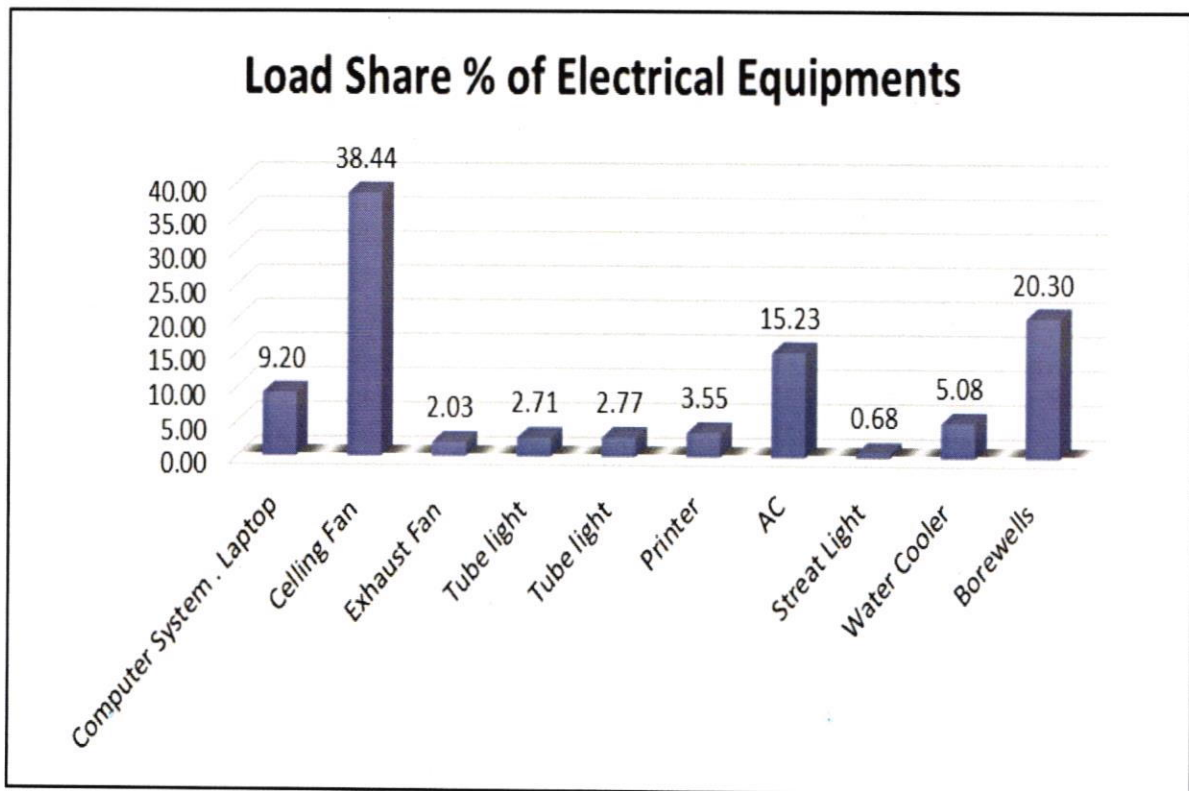


Figure 2.3: - Graphical Presentation of connected load Year-2021-22



  
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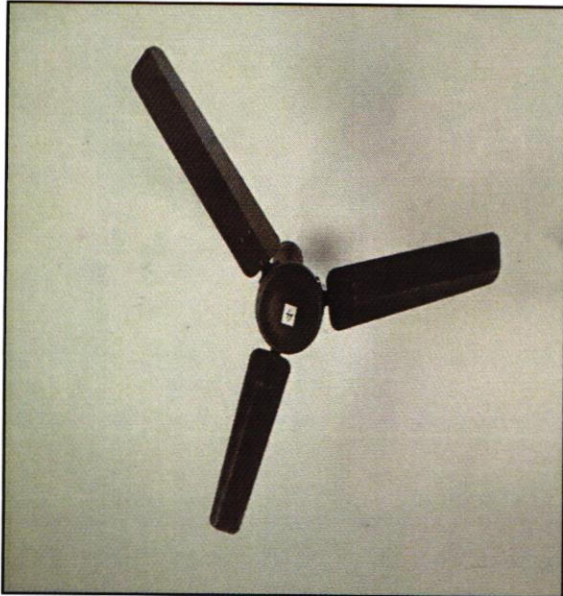




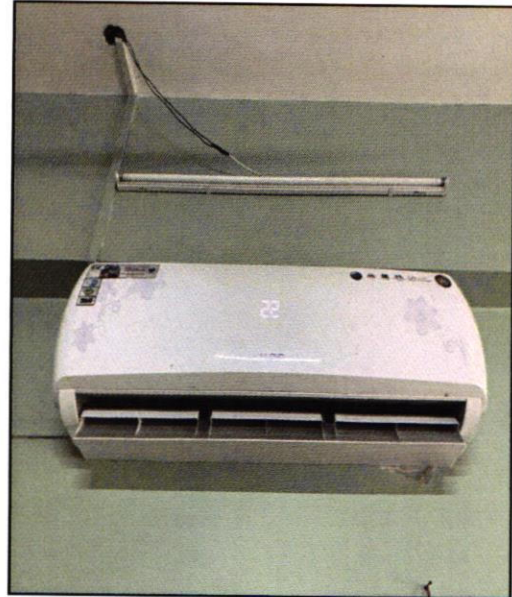
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



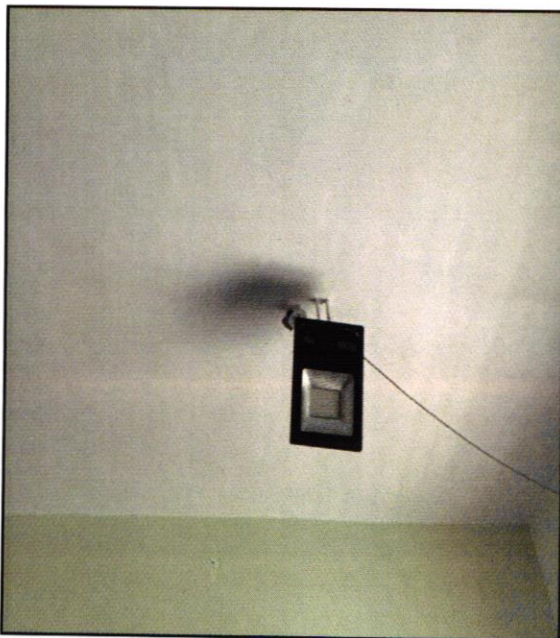
**2.3 Some Photograph of Electrical Equipment's: -**



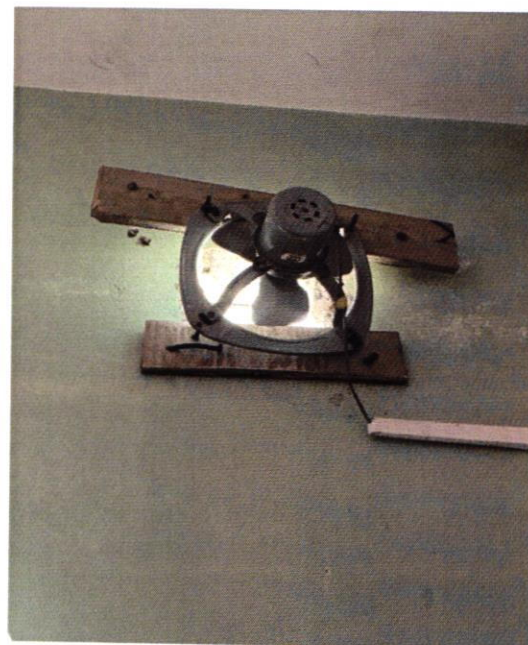
Celling Fan



AC



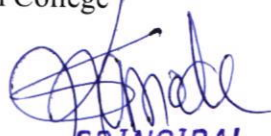
Focus Light





Exhaust Fan

Figure 2.4: - Electrical Equipment in College



  
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& Science College, SELOO

	<b>Energy Audit Report of Dr. R.G. Bhoyar Arts, Commerce and Science College, Seloo, Wardha Year 2021-22</b>	
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### CHAPTER- 3 ENERGY CONSERVATION MEASURES

#### Case Study No. 01: -

#### **Installation 10 kWp grid connected solar roof top system**

#### **Observation: -**

It is observed that there is good potential for installation of solar roof top grid connected and take the advantage of Net Metering Policy of State Government at present college is taking 100 % Energy from grid.

#### **Recommendation:**


Installation 10 kWp Solar Photovoltaic Grid Connected System.

#### **Solar unit (Energy) Generation calculation: -**

Recommended capacity of solar PV system	= 10 kWp
Expected Annual energy generation @ 04 Unit /day /kWp	= 10 kWp x 4 kWh / days x 365 days = 14600 kWh
Total Expected monetary saving potential @ Rs 9.14 per unit (Overall energy charges)	= Rs 1,33,444 /-
Total Expected investment @ Rs.40 /watt	= 4,00,000 /-
*Simple Payback period	= 3.0 year

**Note: - Energy saving depends on the operation hours per day and load factor of the systems.**



  
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Dr. R.G. Bhoyar Arts, Commerce and  
Science College, Seloo, Wardha  
Year 2021-22**



**END OF THE REPORT  
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