

# **AJARA MAHAVIDYALAY AJARA**

## **ENERGY AUDIT REPORT**

**2021-22**



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# **ENERGY AUDIT REPORT**

## **1: PREAMBLE:**

Energy sector has played a very important role in development of human race. Various forms of energy are used in industrial as well as domestic sector. Energy resources can be divided mainly into two types i.e., renewable resources and non-renewable resources. The renewable resources of energy mainly include solar energy, wind energy, water energy etc. The non-renewable resources include coal, petroleum, natural gas etc.

Now-a-days, 90 percent of our energy needs are fulfilled by non-renewable resources, which has led to increase in environmental pollution level. The burning of coal leads to release of Sulphur dioxide, which in turn causes acid rain. The carbon dioxide release from various industrial activities has caused significant increase in the level of greenhouse gases, which is main cause of global warming. Along with this, various other major and minor pollutants are environment friendly. More use of renewable energy resources ensures sustainability.

The energy audit mainly focuses on evaluating the use of energy in institutions generated through renewable and non-renewable means of energy and promoting the use of renewable resources for environmental sustainability.

## **Introduction**

Energy audit is an inspection, survey and analysis of energy flows for energy conservation in building or a system to reduce the amount of energy input into the system without adding a negative impact on the output. Energy audits are means to understand the flow of energy starting from the source to its final use.

As per the Energy Conservation Act, 2001, Energy auditing is the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption.

Green audits are assigned to criteria 7 of the National Assessment and Accreditation Council, which is a self-governing organization that provides various institutions with grades based on their criteria for accreditation.

Essentially requirement for an Energy Audit is a part of the criteria 7 and is vital to the accreditation process. This accreditation provides a college with an opportunity to present itself as an esteemed institution without impeccable values, infrastructural advantage and endless opportunities it could provide its students.

## **Need for Energy Audits:**

Energy audits help analyse and determine good institutional practices; whether they are eco-friendly or sustainable. With the world constantly changing, development, unfortunately, results in large-scale utilization of natural resources. Now natural resources are not just used for the supply of products. Energy, water are all basic commodities that are used generously by all. With the threat of depleting resources looming over our heads, it is imperative to determine how much we use and where we waste resources to ensure efficient usage. Energy audits provide opportunities to determine the same and help the organization to reflect, improve and expand their processes and shift to clean green resource utilization. Apart from this, it helps instil consciousness among people as part of the institution towards the environment and sustainable resource utilization.

## **Goals of Energy Auditing:**

- Identification of strengths and weaknesses in green practices.
- Analyze and suggest solutions for problems identified.
- Identify and assess environmental risk.
- Motivate staff for optimal sustainable use of available resources.
- Increase environmental awareness throughout the campus.
- Collect baseline data of environmental parameters and prepare plans for issues before they become problems.

## **Objectives of Energy Audit:**

- Analyze current practices and determine their impact on the environment.
- Identify and analyze significant environmental issues.
- Continuous assessment for better environmental performance.
- Establish and implement a green energy strategy in the campus and sensitize the faculty and students.

## **Benefits to Educational Institutions:**

- Improve the energy utilization within and outside the campus premises.
- Help recognize cost-effective green strategies that enable conservation of energy.
- Empower people linked to the organization to move towards conscious environmental thinking and practice.
- It helps improve the image and builds a positive impression of the institution for its green and clean resource use.

## **2. College Profile**

### **About College:**

#### **Vision:**

To make the institution (Ajara Mahavidyalaya, Ajara) a center of academic excellence with global recognition striving hard for contributing towards the sustainable development of the region, the nation and the humanity at large.

#### **Mission:**

To build the post-independence 'New India', every individual should have knowledge, character and a sense of service and dedication. In the context of the mission of the parent Society (JES), Ajara Mahavidyalaya, Ajara should constantly strive hard to educate and train the generations of the students capable to contribute to the all-sided development of the region, the nation and the humanity at large.

#### **Aims and Objectives:**

1. To propagate the cause of education and to disseminate the knowledge among the students.
2. To train the students in various skills for the all-round development of their personalities.
3. To inculcate moral values and discipline in students.
4. To strive hard for the total Quality Improvement.
5. To educate women for their emancipation and progress.
6. To keep pace with the changing educational, social and global scenario.
7. To make efforts to develop the college as a center for community development.

## **3. Energy Policy:**

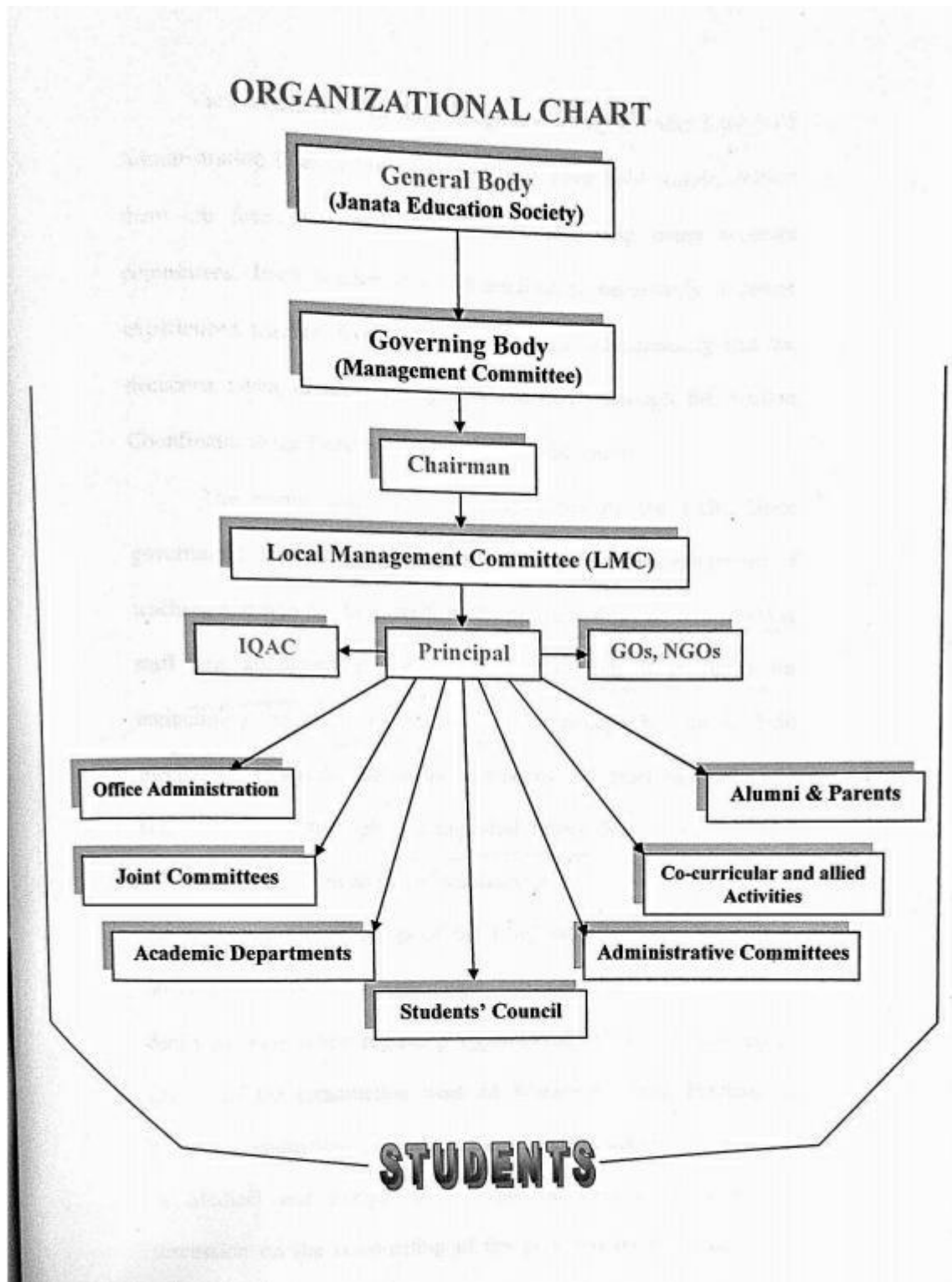
A key component of the College Sustainability Program is energy conservation. Listed below are several guidelines that are intended to manage and reduce energy consumption on all college campus. These guidelines should be followed by all faculty, staff, administration, and students. The Energy usage Policy of college is to manage energy in such a systematic way to minimize its impact on the environment. It will help us to embed efficiency and environmental awareness into our everyday activities, thus helping us to realize our responsibilities and commitment to conservation of natural resources and to limit its usage.

**Policies:**

- To assess source energy usage and measure its impact on the environment.
- To install photovoltaic solar panels for the generation of alternate energy.
- To install LED bulbs in the whole campus to save energy.
- To develop systematic waste management mechanism.
- To develop rainwater harvesting unit.
- To undertake tree plantation drive.
- To monitor and respond to emerging environmental and energy issues. To strengthen our employees' and students' environmental knowledge and skills to improve our own environmental performance.

- **COLLEGE ORGANOGRAM:**

Organogram of the college is given in below : Figure 1





**NAME AND ADDRESS OF COLLEGE:**

Year of establishment of the college	1982
Principal	Dr. Sadale A.N.
Name of college	Ajara Mahavidyalaya, Ajara
Address	Near Bajar Maidan, Ajara, Tal- Ajara, Dist- Kolhapur
City	Ajara
State	Maharashtra
Phone No	(02323)246372
Website	<a href="mailto:ajaracollege@rediffmail.com">ajaracollege@rediffmail.com</a>

**Details of Programmes Offered by the College:**

<b>Programme Level</b>	<b>Name of Programme</b>
UG	B.A.
UG	B.COM
UG	B.Sc.
UG	B.C. A
PG	M.A.
PG	M.COM.

**Table No. 1: Number of students enrolled during 2021-22**

<b>Sr. No.</b>	<b>Class</b>	<b>Male</b>	<b>Female</b>	<b>Total admissions</b>
1	B.A. I	81	62	143
2	B.A. II	55	47	102
3	B.A.III	28	39	67
4	B.COM.I	49	117	166
5	B.COM.II	57	95	152
6	B.COM.III	47	83	130
7	B.Sc. I	60	37	97
8	B.Sc. II	79	61	140
9	B.Sc. III	84	69	153
10	B.C.A. I	21	14	35
11	B.C.A. II	20	16	36
12	B.C.A.III	08	17	25
13	M.A. I	05	02	7
14	M.A. II	00	00	00
15	M.COM.I	18	26	44
16	M.COM.II	12	18	30

**Summary of admission during 2021-2022**

<b>Year</b>	<b>Male</b>	<b>Female</b>	<b>Total Admission</b>
2021-22	624	703	1327

**Table No. 2: Total strength of students and staff on campus during the last year**

<b>Year</b>	<b>Students</b>	<b>Teaching staff</b>	<b>Non – Teaching Staff</b>	<b>Total</b>
2021-2022	1327	19	28	1374

#### **4. Geographical Location:**

##### **Physical Infrastructure:**

###### DETAILS OF AREA:

Location	Rural hilly area
Campus area in square	5 Acres
Built up area in square	2714 Sq. meters

###### **LAND USE PATTERN OF COLLEGE:**

<b>Land use pattern</b>	<b>Area(m<sup>2</sup>)</b>
Total area	5 Acres
Area occupied by buildings	2714 Sq. meters
Ground	4200 Sq. meters
Botanical garden	800 Sq. meters

Geographical details of the college area including, boundary pillar with Global Positioning System Coordinates with elevation of the area is given in table no.3.

**Table No. 3: Geographical details of the college area**

<b>Boundary Pillar (BP) No.</b>	<b>Latitude (N)</b>	<b>Longitude (E)</b>	<b>Elevation (m) MSL</b>
1	16 <sup>0</sup> 06' 50.99"	74 <sup>0</sup> 12' 29.47"	671
2	16 <sup>0</sup> 06' 51.01"	74 <sup>0</sup> 12' 32.08"	668
3	16 <sup>0</sup> 06' 49.46"	74 <sup>0</sup> 12' 30.91"	667
4	16 <sup>0</sup> 06' 49.01"	74 <sup>0</sup> 12' 31.12"	667
5	16 <sup>0</sup> 06' 48.01"	74 <sup>0</sup> 12' 31.00"	666
6	16 <sup>0</sup> 06' 46.38"	74 <sup>0</sup> 12' 30.28"	666
7	16 <sup>0</sup> 06' 50.29"	74 <sup>0</sup> 12' 28.97"	667

Location of the college area is shown on Google Earth map (Figure No. 2)



#### **4.1. ENERGY CONSUMPTION:**

Electricity is used for illuminating the rooms, fans, computers, Laboratory equipment, and pumps and for cooling rooms (AC).

**Number of rooms under use in college: 37**

#### **4.2. ENERGY CONSUMPTION UNITS:**

Details of various sources of energy consumption are given in table No.4.

**Table No.4: Sources of Energy Consumption**

<b>Sr. No.</b>	<b>Energy sources</b>	<b>Electricity/generator/solar lamps</b>
1.	No. of laptops	03
2.	No. of computers	85
3.	No. of CFC bulbs	97
4.	No. of UPS	03
5.	No. of fans	67
6.	No. of fridge	03
7.	No. of generators	03
8.	No. of A.C.	06
9.	No. of LED bulbs	108
10.	Electric pump 1 HP	02
11.	No. of Smart T. V	05
12.	No. of printers and Xerox machines	06

#### **4.3. ENERGY REQUIREMENT: sanctioned load (17.20 kw)**

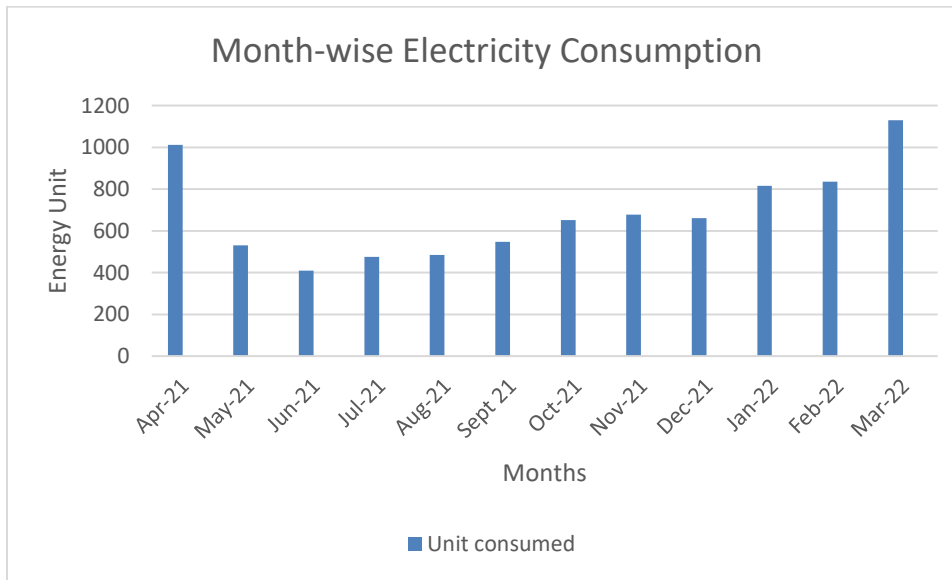
Electricity supplied from the Maharashtra State Electricity Board is the main source energy for the activities on the campus. In addition to the regular supply, energy consumed ( KW) during the last year is shown in tabular as well as graphical form.

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**Table No. 5: Energy consumption during the Year 2021-22  
Consumer No-255010029081**

Sr. No.	Months	Energy Units	Amount
1	Apr 21	1012	8227.86
2	May 21	530	11835.74
3	June 21	410	15422.65
4	July 21	475	4016.61
5	Aug 21	485	8161.8
6	Sept 21	547	12773.71
7	Oct 21	651	5349.29
8	Nov 21	678	5544
9	Dec 21	661	5416.5
10	Jan 22	815	6570.6
11	Feb 22	836	6744.37
12	Mar 22	1130	8940.43
<b>Total</b>		<b>8230</b>	<b>99003.56</b>

**Figure 4 : Graphical representation of energy consumption during 2021-22**



From the energy consumption pattern, it is found that there was increase of energy consumption in month of October to February as compared other months. Thereafter, energy consumption is gradually decreasing in May to August. Maximum energy requirement was 836 Units during

February and minimum 410 units was in June, in energy consumption during the last two years is mainly switching over the use of LED bulbs in place high energy consuming 40-Watt tube lights.

**Energy conservation measures taken up by the College:**

The requirement is met from the Maharashtra Electricity Board. College is aware of environmental impacts of consumption of conventional energy supplied by MSEB. Hence, college has adopted following measures to minimize the energy consumption.

1. Switching over to the use of LED bulbs as a replacement to conventional high energy consumption bulbs
2. College has encouraged use of e-mail instead of sending notices and faxing documents.
3. Most of the fans carry three stars rating of electrical appliances.
4. Increased use of flat-screen LCD monitors rather than CRT monitors
5. Awareness amongst students was carried out and accordingly sign boards are displayed at strategic locations for conservation of energy and students positively responding.

**4.4 USE OF RENEWABLE ENERGY:**

**Use of solar system:** College has installed solar water heater in the ladies hostel.

**Solar Energy:** Percentage of annual power requirement of the Institution met by the renewable energy sources (current year data):

Annual power requirement met by renewable energy sources (in KWH): Presently college has installed solar heater in the lady’s hostel.

Total power requirement	Renewable energy source	Renewable energy generated and used	Percentage
183393.4 KWH/Year	Solar Heater	288 KWH/Year	0.15



**Solar system installed on top of ladies’ hostel**

College should initiate more efforts to use renewable energy for lighting rooms and street.

**Annual power requirement met through LED bulbs (in KWH):**

No. of Bulbs	Watt	Power requirement(KWH)
2	6	12
37	9	333
1	12	12
2	14	28
66	18	1188
<b>108</b>	<b>59</b>	<b>1573</b>

1. Number of LED Tubes: 108 consumes 1573 watts
2. Effective use per day: 8 hrs
3. Energy consumption: 1000 watts if used 8 hrs /day, it consumes 8.0 units of electricity. Therefore, energy consumption of 108LED bulbs = 1573 watts x 8/1000 =12.58 units / day.  
Considering effective working days as 300 days, energy consumed by LED bulbs would be 300 x 12.58=3774 units / year.

**Annual power requirement met through LED bulbs is 20.89% of the total energy requirement.**

**Efforts for Carbon neutrality:**

Thinking about carbon footprints is a simple way of thinking about ways to reduce environmental pollution. By reducing our carbon footprints, each one of us can contribute to making the earth a safer, better place to live. Estimates suggest that almost half of our carbon footprint is due to electricity and 17% is due to lighting alone.

Carbon footprint is the amount of Green House Gases like carbon dioxide, methane, nitrous oxide emissions emitted by a building, organization etc. It relates to the amount of greenhouse gases we are producing in our day-to-day lives through burning fossil fuels for electricity, heating, transportation etc.

At Ajara Mahavidyalya Ajara, carbon footprint for indoor lighting in office building is considered. The performance of the building by using LED lights reduces the building carbon foot print. The carbon foot print is for –

1. Incandescent Light
2. CFL
3. LED Lights

**4.5: Electricity:**

By and large, half of our carbon footprint is due to electricity and 17 % is due to lighting alone. Electricity in turn can be produced by coal, natural gas, petroleum, and other. Electricity is produced from different sources and how much GHG released is shown is shown in table no. 7.



**Table No. 6: Electricity produced from different sources**

Source	Million metric tons of CO <sub>2</sub> emission for 1 year	Electricity generation (Billion kWh) for 1 year
Coal	1788	1882
Petroleum	106	119
Natural gas	337	562
Other	14	22
Non fossil fuels	None	1106
<b>Total</b>	<b>2245</b>	<b>3621</b>

Since close to 2245 million metric tons of CO<sub>2</sub> emitted by total electricity generation per year. A single kilowatt-hour of electricity will generate 619 grams of CO<sub>2</sub> emissions.

### **1. Incandescent Light**

Incandescent lamp is a source of light which produce light when the filament is being heated. It can release 80% electrical energy converted into heat energy. We can calculate how much CO<sub>2</sub> will be emitted by 40-watt incandescent bulb.

Power Consumption- 40 watts

- Operation per day- 10 hours
- Power Consumption per annum-146000 watt
- Electricity per hour (kwh) - 0.04 (1 kWh=619g CO<sub>2</sub> can be released)
- Lighting Carbon Emission per year/lamp (146\*619g) -90.3 kg.

A single 40 watts incandescent bulb will generate 90.3 kilograms of CO<sub>2</sub> for every year. The reduction of carbon footprint is none for this lamp.

### **2. Compact Fluorescent Light**

CFL produce less heat and more visible light compare than incandescent lamp. We can calculate how much CO<sub>2</sub> will be emitted by 14-watt incandescent bulb.

Power Consumption- 14 watts

- Operation per day- 10 hours
- Power Consumption per annum-51100 watt
- Electricity per hour (kwh) – 0.014 (1 kWh=619 g CO2 can be released)
- Lighting Carbon Emission per year/lamp- (51.1\*619g) - 31.6 kg.

A single 14 watts CFL lamp will generate 31.6 kilograms of CO2 for every year. The reduction of carbon footprint is none for this lamp. CFL contains harmful mercury which creates mercury emission. Estimated suggestion led lights only will reduce our carbon foot print over than other lights.

### 3. LED Lights

LED lights consumes low power and energy efficient over than other lights. Not even a single point we can't compare led lights with other lighting. We can calculate how much CO2 will be emitted by 8-watt LED lamp -

- Power Consumption- 8 watts
- Operation per day- 10 hours
- Power Consumption per annum-29200 watt
- Electricity per hour (kwh) – 0.008 (1 kWh=619 g CO2 can be released)
- Lighting Carbon Emission per year/lamp (29.2 \*619g) - 18 kg.

**A building's carbon footprint from led lighting can be reduced by 68%.**

- Reduction in Carbon Footprint (tons)-0.122(12.28 kg)

The 8-watt LED equivalent will only be responsible 18 kilograms of CO2 over the same time span.

**Table No. 7: Carbon foot prints**

	Incandescent Bulb	LED light
Power Consumption(watt)	40	8
Electricity(kwh)	0.04	0.008
Hours of Operation Per Day	10	10
Carbon Emissions (tons) per year/lamp	0.903	0.18
Reduction in Carbon Footprint (tons) / lamp	--	0.12

- LED light can reduce our carbon footprint by 0.12 tons per year.
- Led light does not contain mercury; it is a big benefit for this lamp.
- Incandescent, it is 5.8 mg from power plant.

The 8-watt LED equivalent will only be responsible 18 kilograms of CO<sub>2</sub> over the same time span.

Based on above comparisons, LED emerges as the BEST option to reduce carbon footprint.

At Ajara Mahavidyalaya, Ajara , all together there are 37 rooms ( including, class rooms, offices, labs etc.) 195 LED lamps .

Details of CO<sub>2</sub>emitted from these lights is given in table 8.

**Table No. 8: Details of CO<sub>2</sub> emitted due to bulbs**

<b>Bulbs LED</b>	<b>Watt</b>	<b>Power consumption WH/day @ 8hr</b>	<b>Equivalent</b>
2	6	96	
37	9	216	
1	12	96	
2	14	224	
66	18	9054	
<b>108</b>		10136	197 Bulbs of 8 Watt
<b>Incandescent</b>			
28	40	1120	
7	200	1400	
<b>35</b>		2520	63 bulbs of 40 Watts
<b>CFL</b>			
26	36	936	
31	40	1240	
30	5	150	
7	15	105	
3	18	54	
<b>97</b>		<b>2485</b>	<b>178 bulbs of 14 Watts</b>
<b>240</b>			

<b>Light</b>	<b>No. of bulbs</b>	<b>CO<sub>2</sub> emitted per lamp / year</b>	<b>Total CO<sub>2</sub> emitted per year</b>
Incandescent	63 of 40 watts	90.3 kg	5688.9
CFL	178 of 14 watts	31.6 kg.	5624.8
LED (Tubes)	197 Of 8 watts	18 kg.	3546.0
		<b>Total</b>	<b>14859.7</b>

CO<sub>2</sub> emitted from utilizing all types of bulbs per year is 14,859.7 kg/yr. Presently, College has taken initiative to replace Incandescent bulbs and CFL bulbs by LED. During the last year energy consumption of LED bulbs against the total energy requirement has been decreased. This has shown substantial reduction in the CO<sub>2</sub> emission per year. If all 240 bulbs are replaced by 8-Watt LED bulbs, CO<sub>2</sub> emitted per year would be  $240 \times 18 \text{ kg} = 4320 \text{ kg / year}$ . This means college can reduce CO<sub>2</sub> by 10539.7 kg / year (14859.7 kg- 4320 kg). It is suggested to replace all bulbs by LED bulbs in a phase manner. Further, all the fans should be replaced in phased manner energy efficient five-star rating fans.

### **5.: Suggestions:**

The college has taken a good number of good initiatives for the sustainable energy consumption. However, to get better result following suggestions may be considered by the college in a phased manner.

- Annual Power requirement met through LED bulbs 20.89 %. Further, all the fans should be replaced in phased manner energy efficient five-star rating fans.
- Replacement of conventional bulbs has contributed significantly in the reduction of CO<sub>2</sub>.
- It is also suggested to use solar energy as an alternate of energy for street light.