

Energy Audit Report

Of

Shri Sarda Education Society's

(A Linguistic Minority Educational Institute)

**Smt Radhabai Sarda Arts, Commerce & Science College,
Anjangaon Surji, Dist Amravati (MS)**



Submitted by

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(Session 2019-2020)

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Introduction:

An energy audit is an inspection, survey and analysis of energy consumed in a system in order to identify opportunities for reducing energy expense and carbon footprints.

Energy Audit Objectives:

- To study the present pattern of energy consumption
- To identify energy saving measures for energy optimization
- To implement the acceptable and feasible measures for energy conservation.

Methodology:

➤ **Historical data Analysis:**

This step involves collection and study of electricity bills of college in order to established base line data on energy consumption and its variation with change in production volume. Energy audit team collected energy bills of college for session 2019-2020 and analysis them.

➤ **Actual measurement and data analysis:**

This step involves actual site measurement. Energy audit team visited to all units of college campus and collected the data for analysis like number of electrical appliances, their wattage and operating time.

➤ **Identification of energy conservation opportunities:**

This step involves the identification of acceptable and feasible opportunities for minimizing energy consumption and their evaluation for implementation. After the complete data analysis, energy audit team finds out the opportunities towards energy conservation and made some recommendations.

Summary of Energy Audit

1) Electrical energy system:

Source of electricity : MSEDCL (BU/1627/ANJANGAON SUB –DN)				
Details of Electricity Meters				
Installation area	Installation Date	Meter Number	Connection Type	Sanctioned Load
Arts Building	17/11/1989	359710030322	LT II	1.00 KW
Library Building	30/5/2014	359710158418	LT II	5.93 KW
Commerce Building	15/5/2015	359718101369	LT II	3.70 KW
Science Building	15/5/2015	359718101377	LT II	0.54 KW
Total Sanctioned Load : 11.17 KW				

2) Electricity Bill Analysis:

Period	Total consumption of Units	Avg. Consumption of units per month
Aug-19 to July-20	16271	1355.91

3) Connected loads and their consumption:

Total load connected	power requirement per month	Annual power requirement
51.11 KW	3820.11 KW	45841 KW

4) Assessment of lightning system:

Light Type	Quantity	Total Load (kW)	Annual lightning power consumption	% Annual lightning power consumption
LED bulbs/tube lights	162	3.31	5126.436 KW	100 %
Conventional lights	0	0	0	0
Total	162	0	5126.436 KW	100 %

5) Use of renewable energy sources:

Renewable energy source	Wattage	Quantity	Total Watt	Production per month
Solar street lamp	18	5	90	16.2 KW

6) Use of renewable energy sources:

Period	Total Units Consumption (KWh)	Total CO ₂ emitted	Avg. CO ₂ emitted per month
Aug-2019- July 2020	16271	13.02 MT	1.085 MT

7) Remarks:

- No use of incandescent bulb and CFL bulb
- 100% use of LED for lightening system.
- Good initiative towards use of renewable energy source through solar street lamp
- Maximum use of natural light.
- AC and refrigerator used are of three stars.

Thus, very good initiatives are taken by college for energy conservations.

7) Energy conservation opportunities:

- It has been observed that majority of electrical power consumption is through Ceiling fans having wattage 70 Watt. Therefore it is recommended to replace these ceiling Fans with 40 Watt Energy Efficient Fans.
- PV solar system is suggested to install in a campus to minimize electricity bill. 15 KV solar panel may generate about 60 units per day which saves Rs 1,25000 per year

Historical Data analysis

1) Source of electrical energy:

Smt Radhabai Sarada Arts, Commerce and Science College, Anjangaon Surji receives electrical energy from MSEDCL (BU/1627/ANJANGAON SUB-DN).

There are four meters installed in the campus. The details of meters are tabulated below.

Sr. No.	Installation area	Installation Date	Meter Number	Connection Type	Sanctioned Load
1	Arts Building	17/11/1989	359710030322	LT II	1.00 KW
2	Library Building	30/5/2014	359710158418	LT II	5.93 KW
3	Commerce Building	15/5/2015	359718101369	LT II	3.70 KW
4	Science Building	15/5/2015	359718101377	LT II	0.54 KW

Total sanctioned load is **11.17 KW**

2) Major Consumers of electricity:

Major consumers of electricity in the college campus are

➤ AC	➤ Computer
➤ Fan / Exhaust fan	➤ Printer and Scanner
➤ LED bulb/tube light	➤ Xerox Machines
➤ Refrigerator	➤ LCD projectors
➤ Water purifier	➤ Laboratory equipments
➤ Pumping motors	➤ UPS
➤ Router system	➤ CCTV

3) Study of month wise unit consumption:

Month	Consumption Unit (kWh)				
	Office & Arts Building	Commerce Building	Library Building	Science Building	Total Consumption (Monthly)
Aug-19	1157	279	202	248	1886
Sep-19	1023	295	213	306	1837
Oct-19	991	309	193	306	1799
Nov-19	958	239	199	317	1713
Dec-19	825	140	134	49	1148
Jan-20	686	183	153	46	1068
Feb-20	609	140	188	57	994
Mar-20	724	119	177	122	1142
Apr-20	424	147	109	75	755
May-20	67	147	17	75	306
Jun-20	67	147	17	75	306
Jul-20	2019	304	872	122	3317
Total Consumption (Yearly)	9550	2449	2474	1798	16271
Average Monthly Consumption	795.83	204.08	206.16	149.8	1355.91
% Energy consumption	58.69 %	15.05 %	15.20 %	11.05 %	100 %

Observations:

- Total annual consumption of college campus is **16271 kWh**.
- Average monthly consumption of college campus is **1355 kWh**
- Electricity conservation of office and arts building is found to be **maximum (58.69 %)**
- Electricity conservation of Science building is found to be **minimum (11.05 %)**
- The energy conservation for the months April, May and June is observed to be minimum because of lock down imposed by Govt. of India due to COVID-19 pandemic.

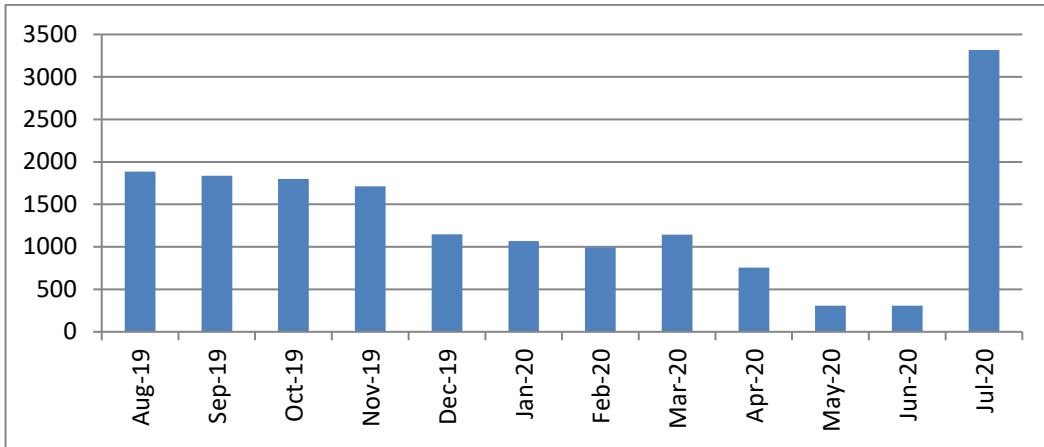


Figure 1 Month wise total units consumption in college

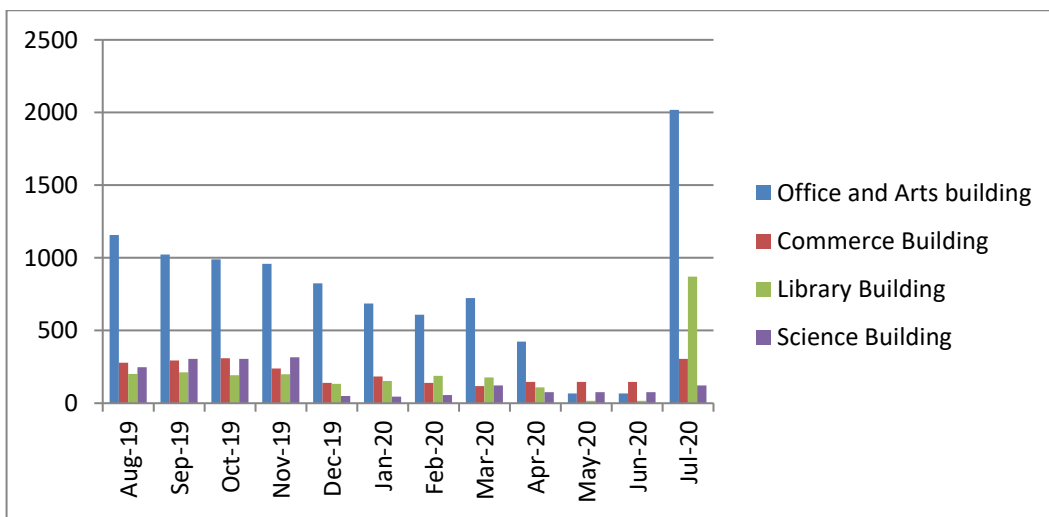


Figure 2 Month wise and building wise units consumption

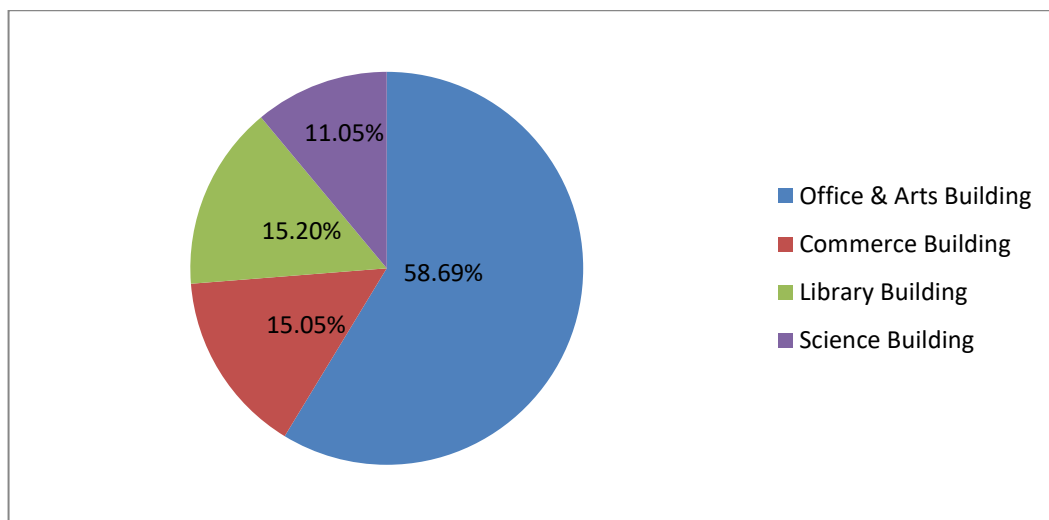


Figure 3 Building wise % unit consumption

Actual measurement and data analysis

1) Total Load consumption in college:

Electrical Appliance	Power Rating (Watt)	Quantity	Power consumption in 1 Hr (kWh)	Operating Hours (Hours)	Operating days per month	Power consumption per month (kW)	% consumption per month
AC	1400	1	1.4	5	21	147	3.85%
Fan	70	192	13.44	5	21	1411.2	36.94%
Exhaust Fan	15	11	0.165	4	21	13.86	0.36%
Water Cooler	240	7	1.68	1	21	35.28	0.92%
LED tube bulb	23	15	0.345	6	21	43.47	1.14%
LED tube light	22	29	0.638	6	21	80.388	2.10%
LED tube light	20	54	1.08	6	21	136.08	3.56%
LED POP bulb	15	40	0.6	6	21	75.6	1.98%
LED POP bulb	10	7	0.07	6	21	8.82	0.23%
LED POP bulb	6	3	0.018	6	21	2.268	0.06%
LED POP bulb	3	3	0.009	6	21	1.134	0.03%
LED Street Light	45	4	0.18	10	30	54	1.41%
LED Street Light	30	4	0.12	10	30	36	0.94%
LED Focus (150 W)	150	1	0.15	10	30	45	1.18%
LED Focus (50 W)	50	2	0.1	10	30	30	0.79%
Computer	100	52	5.2	5	21	546	14.29%
Printer	300	12	3.6	1	21	75.6	1.98%
Scanner	45	2	0.09	0.5	21	0.945	0.02%
Xerox Machine	650	3	1.95	0.5	21	20.475	0.54%
Lamination Machine	620	1	0.62	1	21	13.02	0.34%
TV	85	2	0.17	5	21	17.85	0.47%
UPS	1500	5	7.5	2	21	315	8.25%
CCTV	10	38	0.38	24	30	273.6	7.16%
LCD Projector	270	5	1.35	3	21	85.05	2.23%
Refrigerator	50	3	0.15	1	30	4.5	0.12%
Cofee Machine	1300	1	1.3	0.5	21	13.65	0.36%
Wifi Router	15	3	0.045	8	21	7.56	0.20%
Hot air oven	1500	2	3	2	21	126	3.30%
Furnace	2000	2	4	1	21	84	2.20%
Pumping motor 1HP	750	4	1	1	21	21	0.55%
Electric Bell	5	2	0.01	6	21	1.26	0.03%
Water Purifier	750	1	0.75	6	21	94.5	2.47%
Total			51.11			3820.11	100%

This is the total load consumption in college calculated approximately. Actual load consumption might be different according to actual use of power for a particular time period.

Observations:

- Maximum power requirement per month is **3820 KW**
- AC, Fan, Computers, UPS and CCTVs are the major consumers of electricity in college.
- Consumptions for lightning system is minimum because of use of LED type lights.

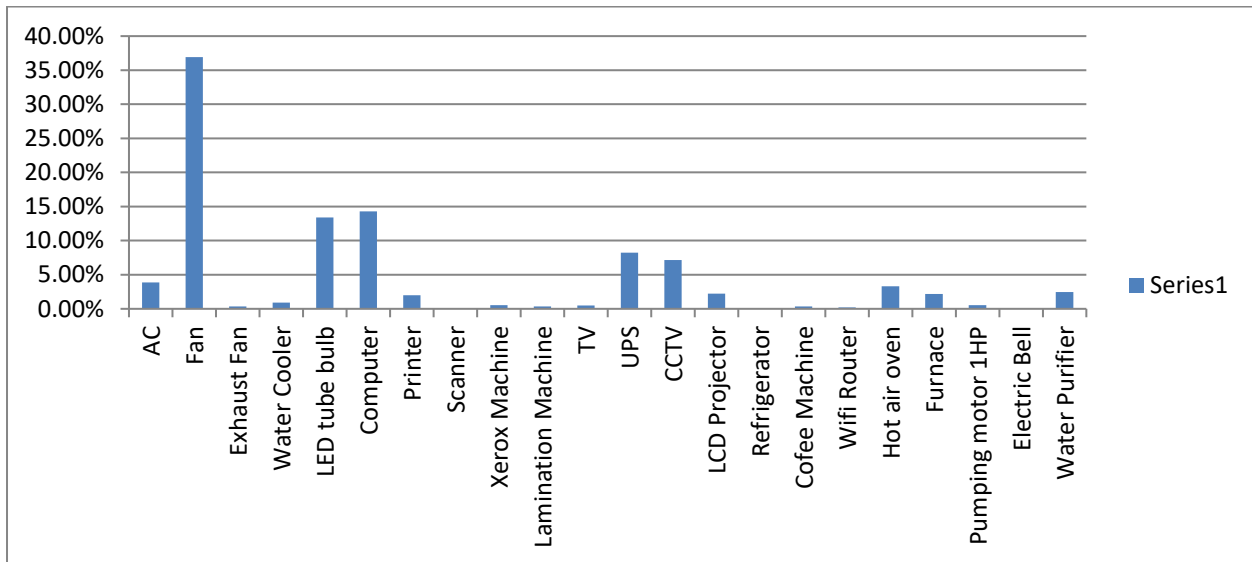


Figure 4 % consumption of electrical appliances

2) Performance assessment of lighting system:

Unit	Area	Light Type	Wattage	Quantity	Operating Hours	Power consumption per day (kWh)	Power consumption per month (kWh)
Administrative and Arts Building	Principal Cabin	LED tube light	22	1	6	0.132	2.772
		LED POP bulb	15	4	6	0.36	7.56
		LED POP bulb	10	4	6	0.24	5.04
		LED POP bulb	6	3	6	0.108	2.268
		LED POP bulb	3	3	6	0.054	1.134
	Administrative office (Room 6)	LED POP bulb	15	11	6	0.99	20.79
		LED POP bulb	10	3	6	0.18	3.78
	Administrative office (Room 7)	LED tube light	22	2	7	0.308	6.468
	Seminar Hall	LED POP bulb	15	15	3	0.675	14.175
	IQAC office	LED POP bulb	15	6	7	0.63	13.23
	Computer Lab	LED tube light	22	6	6	0.792	16.632
		LED bulb	15	4	6	0.36	7.56
	Porch	LED tube light	22	8	4	0.704	14.784
		LED Street light	45	3	10	1.35	28.35
		LED Street light	30	2	10	0.6	12.6
	Staff Room/Exam Office	LED tube light	22	2	6	0.264	5.544
	Class Room 14	LED tube light	22	1	6	0.132	2.772
	Porch	LED tube light	22	4	4	0.352	7.392
	English Department	LED tube light	22	2	6	0.264	5.544
	Marathi Department	LED tube light	22	2	6	0.264	5.544
Porch	LED tube light	22	1	4	0.088	1.848	
Commerce Building	YCMOU office	LED tube light	20	1	6	0.12	2.52
		LED bulb	23	1	6	0.138	2.898
	Physical Education	LED tube light	20	2	6	0.24	5.04
	Home Science	LED bulb	23	6	6	0.828	17.388
	Porch	LED bulb	23	1	6	0.138	2.898
		LED tube light	20	1	6	0.12	2.52
		LED Street light	30	1	10	0.3	6.3
	Digital Room	LED tube light	20	2	6	0.24	5.04
	Staff Room	LED tube light	20	1	6	0.12	2.52
PORCH	LED tube light	20	1	6	0.12	2.52	

Science Building	Chemistry Lab	LED tube light	20	3	6	0.36	7.56
	Class Room	LED tube light	20	2	6	0.24	5.04
	Class Room	LED tube light	20	2	6	0.24	5.04
	Class Room	LED tube light	20	2	6	0.24	5.04
	Physics Lab	LED tube light	20	2	6	0.24	5.04
	Dark Room	LED tube light	20	1	1	0.02	0.42
	Porch	LED tube light	20	2	2	0.08	1.68
	Zoology Lab	LED tube light	20	2	6	0.24	5.04
	Botany Lab	LED tube light	20	2	6	0.24	5.04
	Class Room	LED tube light	20	2	6	0.24	5.04
	Class Room	LED tube light	20	2	6	0.24	5.04
	Porch	LED tube light	20	1	2	0.04	0.84
		LED Focus	150	1	10	1.5	31.5
		LED Focus	50	2	10	1	21
	Common Room	LED tube light	20	2	6	0.24	5.04
	Math Department	LED tube light	20	2	6	0.24	5.04
	Staff Room	LED tube light	20	1	6	0.12	2.52
	Class room	LED tube light	20	1	6	0.12	2.52
	Class room	LED tube light	20	1	6	0.12	2.52
	Porch	LED tube light	20	1	2	0.04	0.84
Library Building	Library	LED tube light	20	4	6	0.48	10.08
		LED bulb	23	2	6	0.276	5.796
	Reading Room	LED tube light	20	6	6	0.72	15.12
	room	LED tube light	23	1	6	0.138	2.898
	Room	LED tube light	23	2	6	0.276	5.796
		LED Street light	45	1	10	0.45	9.45
	Store Room	LED tube light	23	2	2	0.092	1.932
MCVC Building	Staff Room	LED tube light	20	1	6	0.12	2.52
	Class Room	LED tube light	20	1	6	0.12	2.52
	Class Room	LED tube light	20	1	6	0.12	2.52
	Class Room	LED tube light	20	1	6	0.12	2.52
	Class Room	LED tube light	20	1	6	0.12	2.52
		LED Street light	30	1	10	0.3	6.3
Total				162		20.343	427.203

Type wise lighting distribution

Light Type	Quantity	Total Load (kW)	Annual lightning power consumption	% Annual lightning power consumption
LED bulbs/tube lights	162	3.31	5126.436 KW	100 %
Conventional lights	0	0	0	0
Total	162	0	5126.436 KW	100 %

Observations:

- Maximum lightning power requirement per month is **427.203 KW**
- Annual lightning power requirement is **5126.436 KW**
- **Complete lightning power requirement is met through LED light.**

3) Use of renewable energy sources:

In college campus there are five solar lights each of 18 W. They reduce approximately 16.2 KW electricity per month or in other words they decrease units in bill by 16.



Requirement of NAAC

1) Percentage of lighting power requirement met through LED bulbs:

Annual total lighting power requirement of college = **5126.43 KW**

Annual lighting power requirement met through LED = **5126.43 KW**

Therefore, Annual Percentage of lighting power requirement met through LED bulbs

$$= \frac{\text{Annual lighting power requirement met through LED bulb}}{\text{Annual total lighting power requirement}} \times 100$$

$$= \frac{5126.43}{5126.43} \times 100$$

$$= \mathbf{100 \%}$$

2) Alternative Energy Initiative:

Total power requirement of college per month = **427.203 KW**

Power requirement met by renewable energy sources = **16.2 KW**

Therefore, Percentage of power requirement met by renewable energy sources

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

$$= \frac{16.2}{427.203} \times 100$$

$$= \mathbf{3.80 \%}$$

Carbon Di-Oxide emission

Here we computed the CO₂ emission due to electricity consumption. In India, 0.8 Kg of CO₂ is emitted for consumption of 1 unit of electricity.

Sr No.	Month	Unit consumption (KWh)	CO ₂ Emitted in MT
1	Aug-19	1886	1.51
2	Sep-19	1837	1.47
3	Oct-19	1799	1.44
4	Nov-19	1713	1.37
5	Dec-19	1148	0.92
6	Jan-20	1068	0.85
7	Feb-20	994	0.80
8	Mar-20	1142	0.91
9	Apr-20	755	0.60
10	May-20	306	0.24
11	Jun-20	306	0.24
12	Jul-20	3317	2.65
Total		16271	13.02
Average emission=1.085 MT			

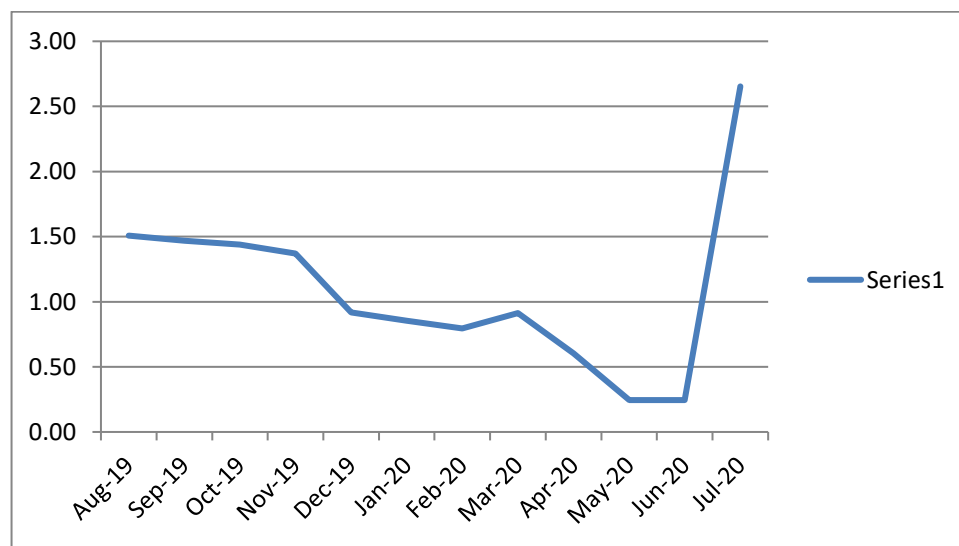


Figure 5 Month wise CO₂ emission

Identification of energy conservation opportunities

After complete data analysis, energy audit team finds scope for energy conservation in some area.

Accordingly following recommendations are suggested.

Executive Recommendations:

- It has been observed that majority of electrical power consumption is through Ceiling fans having wattage 70 Watt. Therefore it is recommended to replace these ceiling Fans with 40 Watt Energy Efficient Fans.
- PV solar system is suggested to install in a campus to minimize electricity bill. 15 KW solar panel may generate about 60 units per day which saves Rs 1,25,000 per year

General Recommendations:

- Use renewable energy sources like solar , wind , biogas energy
- Use power saver circuit for AC
- Connect computer and printers in LAN
- Avoid the unnecessary use of electrical appliances
- Provide cross ventilation to laboratory and class rooms in order to reduce number of fans
- Established college level student community to monitor college campus for energy consumption parameters.