Amrut Sevabhavi Sanstha Parbhani's
Late Ku. Durga K. Banmeru Science College,
(B.Sc.,B.B.A.,B.C.A.,M.Sc.(Comp. Science))
Loni Road, Lonar Dist. Buldhana - 443302
Ph./Fax No. : 07260 - 221315
(Affiliated to Sant Gadgebaba Amravati University, Amravati & UGC 2 (f) & 12 (B) approved)
www.lkdkbanmerucollege.ac.in E-mail : pkbanmeru@yahoo.co.in; lkdkbscl@rediffmail.com

अमृत सेवाभावी संस्था, परभणी द्वारा संचलित
कै.कु. दुर्गा क. बनमेरू विज्ञान महाविद्यालय,
(बी.एस्सी.,बी.बी.ए.,बी.सी.ए.,एम.एस्सी. (कॉम्प्यु.सायन्स))
लोणी रोड, लोणार जि. बुलढाणा - ४४३३०२
दूरध्वनी / फॅक्स क्र. : ०७२६० - २२१३१५
(संत गाडगेबाबा अमरावती विद्यापीठ, अमरावती संलग्नीत व युजीसी २ (एफ) व १२(बी) मान्यता प्राप्त)

अमृतं तु विद्या। विज्ञानं यज्ञ तनुते ।।

Dr. Prakash K. Banmeru, Principal
Dr. Santosh K. Banmeru, Secretary
डॉ.प्रकाश क. बनमेरू, प्राचार्य
डॉ.संतोष क. बनमेरू, सचिव

7.1.3: Quality audits on environment and energy regularly undertaken by the Institution. The institutional environment and energy initiatives are confirmed through the following

2. Energy audit

Energy Audit Certificate (2019-20)

Nutan Urja Solutions

A 703, Balaji Witefield, Near Sunni's World,
Sus Road, Sus, Pune 411 021
Phone: 83568 18381. Email: nutanurja.solutions@gmail.com

Date: 07/10/2020

CERTIFICATE

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Nutan Urja Solutions,

K G Bhatwadekar,
Certified Energy Auditor,
EA - 22428

Nutan Urja Solutions

प्राचार्य
Late. Ku. Durga K. Banmeru Science College
LONAR, Dist.Buldhana

स्थापना : जून २००० (शासन क्र. एनजीसी २०००/न.म.वि.(१/२०००)म.शि.-३/दि. २८ जून २०००)
College Code No. : 337
महाविद्यालय कोड क्र. ३३७

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Phone: 83568 18381. Email: nutanurja.solutions@gmail.com

Date: 12/10/2021

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Date: 15/06/2021

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Late. Ku. Durga K. Banmeru Science College
LONAR, Dist.Buldhana

Report

On

Energy Audit

At

Late Ku Durga K Banmeru Science College,

Lonar, Buldhana

(Year 2019-20)

Prepared by

Nutan Urja Solutions

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Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO_2 emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	486	0.39
2	Minimum	30	0.02
3	Average	320	0.26
4	Total	3,843	3.07

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. There are about 10 Nos old T-8 type fittings which need to be replaced by 18 W LEDs.

5. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 54.36 %.

6. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
2	Replacement of 116 Nos Old Ceiling Fans with STAR rating fans	1,508	16,588	252,184	182
3	Installation of 2kW grid connected PV panel	3,000	33,000	100,000	36
	Total	**4,708**	**51,788**	**358,594**	**83**

7 Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : Rs 11/- per kWh

Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

1. Introduction

Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana, is an academic excellence and achievement, was established in June 2000. Main objective of institute is the Students of the institute should be skillfull, knowledgebale & all-round in science so that they become multidimensional. The institute provide the basic as well as advance science courses.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

No	Head	Particulars
1	Name of Institution	Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana.
2	Address	Late Ku Durga K Banmeru Science College, Loni Road, Lonar, Buldhana-443302, Maharashtra, India.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

No	Location	FTL (40W)	LED tube (20W)	CFL	Computers (65W)	Fans
	Building I					
1	Office	1	1	2	5	2
2	Principal office	1		1	2	1
3	Chemistry lab	1	1			1
4	Botany lab		2			1
5	Electronic lab		1	1	1	1
6	Physics lab	2	1			1
7	Zoology lab	1		1		1
8	NSS			1		1
9	Microbiology		2			2
10	Computer lab	2	2	1		35
11	IQAC room			1		2
12	Library	2	1		1	4
13	Auditorium		3			9
14	Wash room			2		
15	Staff room		2			1
16	Maths lab		1			1
17	Girls room		1			1
18	Class room 1		1			1
19	Class room 2		1			1
20	Class room 3		1			1
21	Class room 4		1			1
22	Class room 5		1			1
23	Girls wash room		3			
	Building II					
24	Principal office		2	1		3
25	Toilet			1		
26	Reading room		2			3
27	Toilet			1		
28	Ladies toilet		1	1		

29	Chemistry lab		2	1		3
30	Science and Tech lab		2	1		3
31	Agri		2	2		3
32	Fundamental science		2	1		3
33	Hall no 1		2	1		3
34	Staff room 1		1	1		2
35	Staff room 2		1	1		2
36	Class room 1		2	1		2
37	Hall		7	1		10
38	Class room 2		2			2
39	Class room 3		2			3
40	Wash room		1			
41	Girls common room		2	1		2
42	Class room 4		2			3
43	Wash room			1		
	Total	**10**	**61**	**26**	**9**	**116**

Apart from above load, the school has pumps. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	116	65	7.5
2	LED-20W	61	20	1.2
3	CFL	26	24	0.6
4	F T L-40 W	10	40	0.4
5	Computers	9	65	0.6
6	Pumps (2HP)	2		3.0
	Total			13.4

Data can be represented in terms of PIE chart as under,

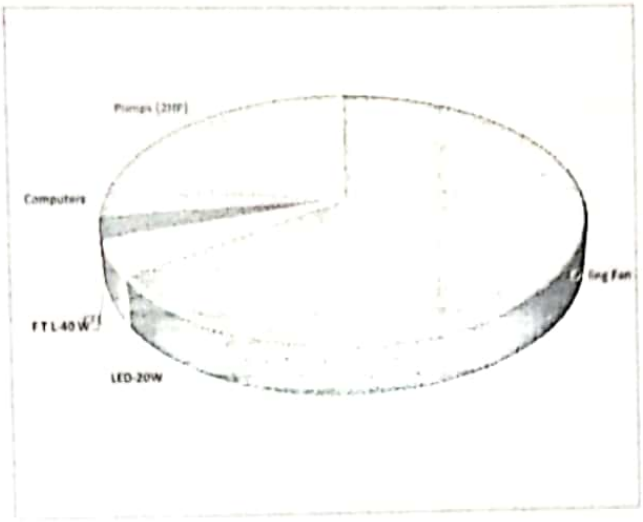

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Sep-20	319	3,700
2	Aug-20	30	345
3	Jul-20	414	4,720
4	Jun-20	342	4,172
5	May-20	272.5	3,406
6	Apr-20	391	4,927
7	Mar-20	289	3,439
8	Feb-20	336.5	4,038
9	Jan-20	359.5	4,350
10	Dec-19	276	3,367
11	Nov-19	327	4,055
12	Oct-19	486	5,735
	Total	**3842.5**	**46254**

Variation in energy consumption is as follows,

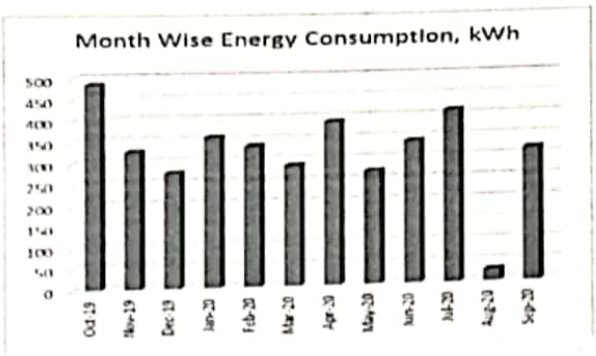

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

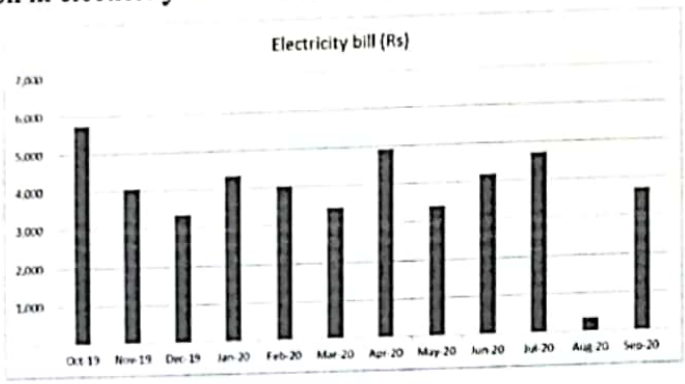

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	Bill Amount (Rs)
1	Maximum	486	5,735
2	Minimum	30	345
3	Average	320	3,855

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Sep-20	319	0.26
2	Aug-20	30	0.02
3	Jul-20	414	0.33
4	Jun-20	342	0.27
5	May-20	273	0.22
6	Apr-20	391	0.31
7	Mar-20	289	0.23
8	Feb-20	337	0.27
9	Jan-20	360	0.29
10	Dec-19	276	0.22
11	Nov-19	327	0.26
12	Oct-19	486	0.39
	Total	**3,843**	**3.07**

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

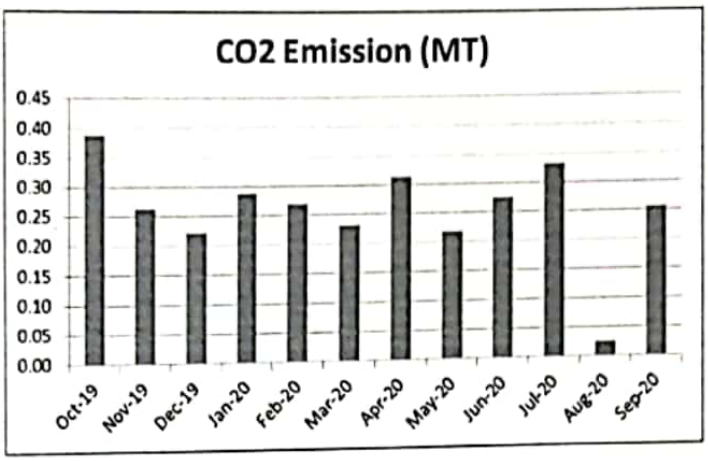

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

There are 10 FTL fittings with Electronic/ magnetic chokes and 61 LEDs in indoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 26 number of CFL lights.

5.2 Ceiling Fans

At building facility, there are about 116 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 2 Water pumps with 2HPcapacities.

6. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	10	40	0.4
2	CFL	26	24	0.624
	LED lighting load			
1	LED tube	61	20	1.22
	Total LED lighting load			**1.22**
	Total Lighting load			**2.244**

It can be seen that out of total lighting load 53.6% load is LED lighting load.

7. Energy conservation proposals

7.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 10 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	10	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	0.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	200	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	2200	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	6410	Rs lump sum
13	Simple Payback period	35	Months

7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 116 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	116	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	7.384	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1846	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	13291.2	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	308708	Rs lump sum
13	Simple Payback period	279	Months

7.3 Installation of Solar PV panel

It is recommended to install 2 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 20kW PV unit	2	kW
2	Energy saving	3000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monitory savings	33000	Rs/ Annum
5	Investment required	100000	Rs lump sum
6	Simple payback period	36	Months

7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
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In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	659	0.53
2	Minimum	100	0.08
3	Average	331	0.26
4	Total	3,973	3.18

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. There are about 10 Nos old T-8 type fittings which need to be replaced by 18 W LEDs.

5. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 54.36 %.

6. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
2	Replacement of 116 Nos Old Ceiling Fans with STAR rating fans	1,508	16,588	252,184	182
3	Installation of 2kW grid connected PV panel	3,000	33,000	100,000	36
	Total	**4,708**	**51,788**	**358,594**	**83**

7 Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : Rs 11/- per kWh

Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

1. Introduction

Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana, is an academic excellence and achievement, was established in June 2000. Main objective of institute is the Students of the institute should be skillfull, knowledgebale & all-round in science so that they become multidimensional. The institute provide the basic as well as advance science courses.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

No	Head	Particulars
1	Name of Institution	Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana.
2	Address	Late Ku Durga K Banmeru Science College, Loni Road, Lonar, Buldhana-443302, Maharashtra, India.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

No	Location	FTL (40W)	LED tube (20W)	CFL	Computers (65W)	Fans
	Building I					
1	Office	1	1	2	5	2
2	Principal office	1		1	2	1
3	Chemistry lab	1	1			1
4	Botany lab		2			1
5	Electronic lab		1	1	1	1
6	Physics lab	2	1			1
7	Zoology lab	1		1		1
8	NSS			1		1
9	Microbiology		2			2
10	Computer lab	2	2	1		35
11	IQAC room			1		2
12	Library	2	1		1	4
13	Auditorium		3			9
14	Wash room			2		
15	Staff room		2			1
16	Maths lab		1			1
17	Girls room		1			1
18	Class room 1		1			1
19	Class room 2		1			1
20	Class room 3		1			1
21	Class room 4		1			1
22	Class room 5		1			1
23	Girls wash room		3			
	Building II					
24	Principal office		2	1		3
25	Toilet			1		
26	Reading room		2			3
27	Toilet			1		
28	Ladies toilet		1	1		

29	Chemistry lab		2	1		3
30	Science and Tech lab		2	1		3
31	Agri		2	2		3
32	Fundamental science		2	1		3
33	Hall no 1		2	1		3
34	Staff room 1		1	1		2
35	Staff room 2		1	1		2
36	Class room 1		2	1		2
37	Hall		7	1		10
38	Class room 2		2			2
39	Class room 3		2			3
40	Wash room		1			
41	Girls common room		2	1		2
42	Class room 4		2			3
43	Wash room			1		
	Total	**10**	**61**	**26**	**9**	**116**

Apart from above load, the school has pumps. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	116	65	7.5
2	LED-20W	61	20	1.2
3	CFL	26	24	0.6
4	F T L-40 W	10	40	0.4
5	Computers	9	65	0.6
6	Pumps (2HP)	2		3.0
	Total			13.4

Data can be represented in terms of PIE chart as under,

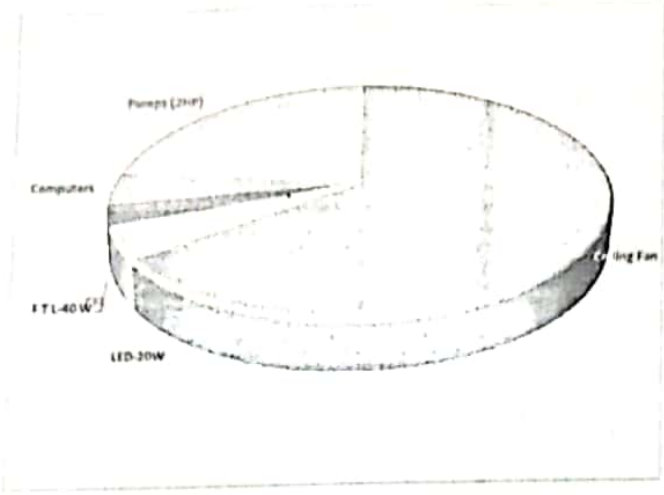

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Sep-21	333	7,510
2	Aug-21	280	3,450
3	Jul-21	183	2,420
4	Jun-21	497	6,075
5	May-21	100	1,320
6	Apr-21	382	4,966
7	Mar-21	268	3,430
8	Feb-21	365	4,891
9	Jan-21	365	4,964
10	Dec-20	206	2,472
11	Nov-20	335	3,987
12	Oct-20	659	7,776
	Total	**3973**	**53261**

Variation in energy consumption is as follows,

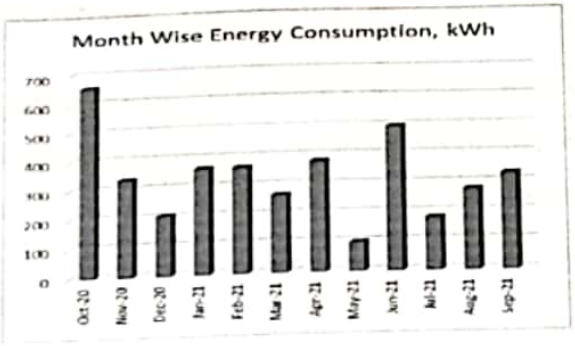

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

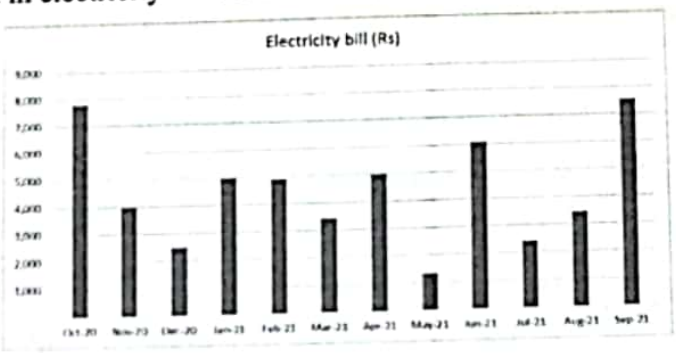

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	Bill Amount (Rs)
1	Maximum	659	7,776
2	Minimum	100	1,320
3	Average	331	4,438

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Sep-21	333	0.27
2	Aug-21	280	0.22
3	Jul-21	183	0.15
4	Jun-21	497	0.40
5	May-21	100	0.08
6	Apr-21	382	0.31
7	Mar-21	268	0.21
8	Feb-21	365	0.29
9	Jan-21	365	0.29
10	Dec-20	206	0.16
11	Nov-20	335	0.27
12	Oct-20	659	0.53
	Total	**3,973**	**3.18**

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

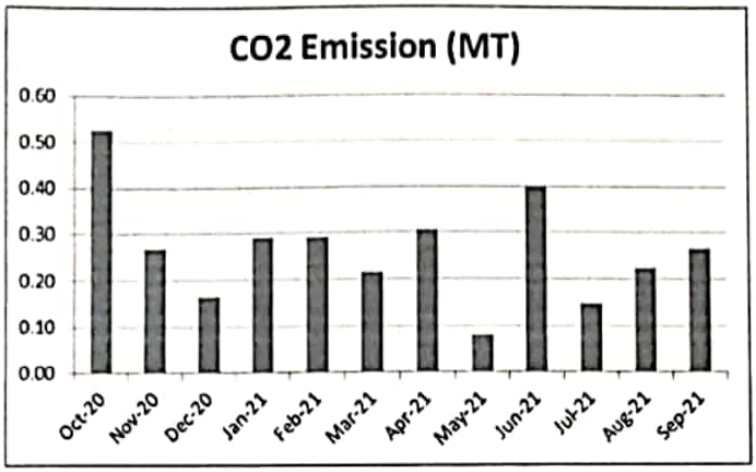

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

There are 10 FTL fittings with Electronic/ magnetic chokes and 61 LEDs in indoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 26 number of CFL lights.

5.2 Ceiling Fans

At building facility, there are about 116 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 2 Water pumps with 2HPcapacities.

6. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	10	40	0.4
2	CFL	26	24	0.624
	LED lighting load			
1	LED tube	61	20	1.22
	Total LED lighting load			**1.22**
	Total Lighting load			**2.244**

It can be seen that out of total lighting load 53.6% load is LED lighting load.

7. Energy conservation proposals

7.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 10 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	10	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	0.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	200	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	2200	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	6410	Rs lump sum
13	Simple Payback period	35	Months

7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 116 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	116	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	7.384	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1846	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	13291.2	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	308708	Rs lump sum
13	Simple Payback period	279	Months

7.3 Installation of Solar PV panel

It is recommended to install 2 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 20kW PV unit	2	kW
2	Energy saving	3000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monitory savings	33000	Rs/ Annum
5	Investment required	100000	Rs lump sum
6	Simple payback period	36	Months

7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
2	Replacement of 116 Nos Old Ceiling Fans with STAR rating fans	1,508	16,588	252,184	182
3	Installation of 2kW grid connected PV panel	3,000	33,000	100,000	36
	Total	**4,708**	**51,788**	**358,594**	**83**

Report

On

Energy Audit

At

Late Ku Durga K Banmeru Science College,

Lonar, Buldhana

(Year 2021-22)

Prepared by

Nutan Urja Solutions

A 703, Balaji Witefield, Near Sunni's World,

Sus Road, Sus, Pune 411 021

Phone: 83568 18381. Email: nutanurja.solutions@gmail.com

Contents

Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Late Ku Durga K Banmeru Science College, Lonar, Buldhana for awarding us the assignment of Energy Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO_2 emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	445	0.36
2	Minimum	183	0.15
3	Average	315	0.25
4	Total	3,778	3.02

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. There are about 10 Nos old T-8 type fittings which need to be replaced by 18 W LEDs.

5. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 54.36 %.

6. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
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3	Installation of 2kW grid connected PV panel	3,000	33,000	100,000	36
	Total	**4,708**	**51,788**	**358,594**	**83**

7 Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

1. Introduction

Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana, is an academic excellence and achievement, was established in June 2000. Main objective of institute is the Students of the institute should be skillfull, knowledgebale & all-round in science so that they become multidimensional. The institute provide the basic as well as advance science courses.

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1. Study of connected load
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3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

No	Head	Particulars
1	Name of Institution	Late Ku. Durga K. Banmeru Science College, Lonar Dist. Buldana.
2	Address	Late Ku Durga K Banmeru Science College, Loni Road, Lonar, Buldhana-443302, Maharashtra, India.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

No	Location	FTL (40W)	LED tube (20W)	CFL	Computers (65W)	Fans
	Building I					
1	Office	1	1	2	5	2
2	Principal office	1		1	2	1
3	Chemistry lab	1	1			1
4	Botany lab		2			1
5	Electronic lab		1	1	1	1
6	Physics lab	2	1			1
7	Zoology lab	1		1		1
8	NSS			1		1
9	Microbiology		2			2
10	Computer lab	2	2	1		35
11	IQAC room			1		2
12	Library	2	1		1	4
13	Auditorium		3			9
14	Wash room			2		
15	Staff room		2			1
16	Maths lab		1			1
17	Girls room		1			1
18	Class room 1		1			1
19	Class room 2		1			1
20	Class room 3		1			1
21	Class room 4		1			1
22	Class room 5		1			1
23	Girls wash room		3			
	Building II					
24	Principal office		2	1		3
25	Toilet			1		
26	Reading room		2			3
27	Toilet			1		
28	Ladies toilet		1	1		

29	Chemistry lab		2	1		3
30	Science and Tech lab		2	1		3
31	Agri		2	2		3
32	Fundamental science		2	1		3
33	Hall no 1		2	1		3
34	Staff room 1		1	1		2
35	Staff room 2		1	1		2
36	Class room 1		2	1		2
37	Hall		7	1		10
38	Class room 2		2			2
39	Class room 3		2			3
40	Wash room		1			
41	Girls common room		2	1		2
42	Class room 4		2			3
43	Wash room			1		
	Total	**10**	**61**	**26**	**9**	**116**

Apart from above load, the school has pumps. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	116	65	7.5
2	LED-20W	61	20	1.2
3	CFL	26	24	0.6
4	F T L-40 W	10	40	0.4
5	Computers	9	65	0.6
6	Pumps (2HP)	2		3.0
	Total			13.4

Data can be represented in terms of PIE chart as under,

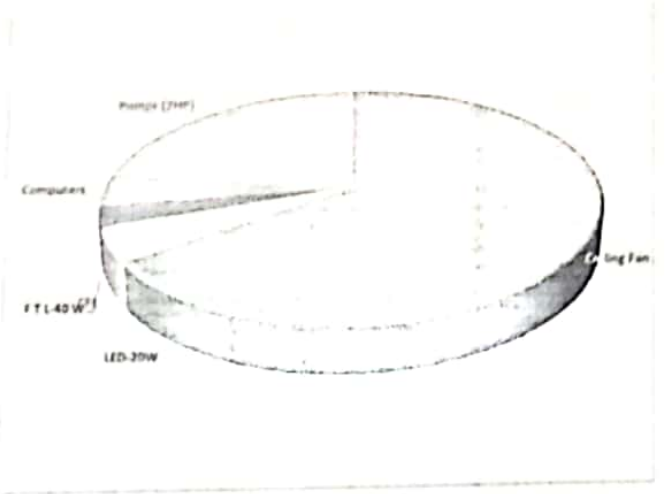

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-22	187	7,810.00
2	May-22	445	10,100.00
3	Apr-22	400	4,800.00
4	Mar-22	310	3,760.00
5	Feb-22	308	3,750.00
6	Jan-22	354	4,220.00
7	Dec-21	346	4,150.00
8	Nov-21	319	3,860.00
9	Oct-21	313	3,800.00
10	Sep-21	333	7,510.00
11	Aug-21	280	3,450.00
12	Jul-21	183	2,420.00
	Total	**3778**	**59630**

Variation in energy consumption is as follows,

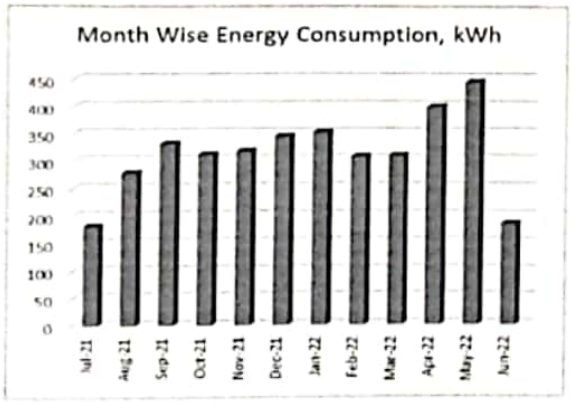

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

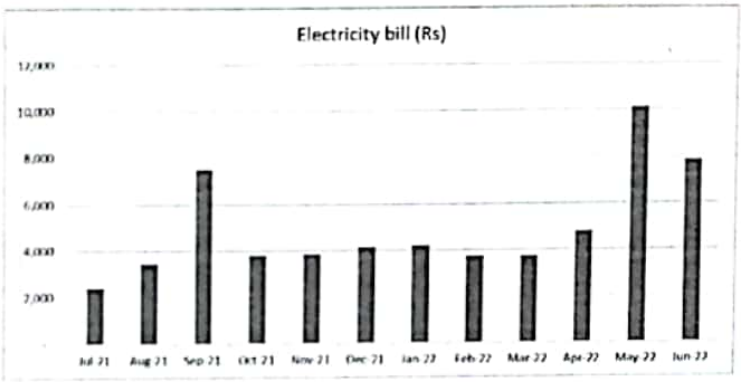

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	Bill Amount (Rs)
1	Maximum	445	10,100
2	Minimum	183	2,420
3	Average	315	4,969

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-22	187	0.15
2	May-22	445	0.36
3	Apr-22	400	0.32
4	Mar-22	310	0.25
5	Feb-22	308	0.25
6	Jan-22	354	0.28
7	Dec-21	346	0.28
8	Nov-21	319	0.26
9	Oct-21	313	0.25
10	Sep-21	333	0.27
11	Aug-21	280	0.22
12	Jul-21	183	0.15
	Total	**3,778**	**3.02**

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

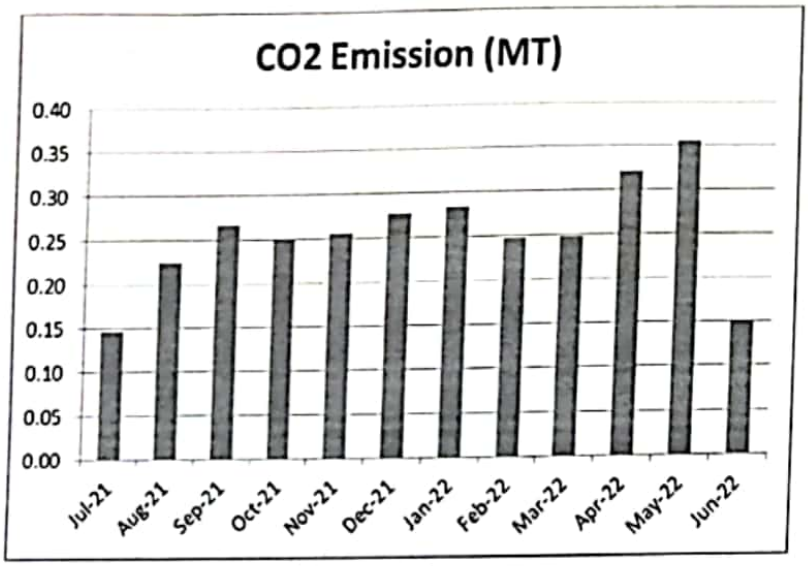

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

There are 10 FTL fittings with Electronic/ magnetic chokes and 61 LEDs in indoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 26 number of CFL lights.

5.2 Ceiling Fans

At building facility, there are about 116 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.3 Water Pumps

There are in total 2 Water pumps with 2HPcapacities.

6. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	10	40	0.4
2	CFL	26	24	0.624
	LED lighting load			
1	LED tube	61	20	1.22
	Total LED lighting load			**1.22**
	Total Lighting load			**2.244**

It can be seen that out of total lighting load 53.6% load is LED lighting load.

7. Energy conservation proposals

7.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 10 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	10	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
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5	Average Daily Usage period	4	Hrs/Day
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10	Annual Monetary saving	2200	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	6410	Rs lump sum
13	Simple Payback period	35	Months

7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 116 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	116	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	7.384	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1846	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	13291.2	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	308708	Rs lump sum
13	Simple Payback period	279	Months

7.3 Installation of Solar PV panel

It is recommended to install 2 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 20kW PV unit	2	kW
2	Energy saving	3000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monitory savings	33000	Rs/ Annum
5	Investment required	100000	Rs lump sum
6	Simple payback period	36	Months

7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 10 Nos T-8 fittings with 20W LED fittings	200	2,200	6,410	35
2	Replacement of 116 Nos Old Ceiling Fans with STAR rating fans	1,508	16,588	252,184	182
3	Installation of 2kW grid connected PV panel	3,000	33,000	100,000	36
	Total	**4,708**	**51,788**	**358,594**	**83**