Report

On

Energy Audit

At

Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist- Nagpur

(Year 2023-24)

Prepared by

Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist-Nagpur 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	572	0.5
2	Minimum	227	0.2
3	Average	388	0.3
4	Total	4,654	3.7

2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 52 %.

5. 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 29 Nos T-8 fittings with 20W LED fittings	580	6,380	18,589	35
2	Replacement of 61 Nos Old Ceiling Fans with STAR rating fans	3,050	33,550	132,614	47
	Total	**3,630**	**39,930**	**151,203**	**45**

6. 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

Shree Pandharinath Arts and Commerce College ,Narkhed was established at Narkhed, Dist Nagpur by Prerana Education Society, Narkhed aiming at the Democratic Set Up of the college for the cause of higher education for poor, downtrodden and weaker sections of society. For qualitative education, management, teaching and non-teaching staff are working together. Now management is making efforts to make it better than ever before. The college was accredited in 2019 by NAAC with B+ grade and as per the recommendations of NAAC peer teem; the college is trying best to follow its Mission and Vision.

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	Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist- Nagpur
2	Address	Chawargaon Road, Block 3, Narkhed, Maharashtra 441304
3	Affiliation	Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

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 (40 W)	CFL	LED tube (20W)	LED bulb (12W)	Computers (65W)	Fans	Air Cooler
1	Office	2		4	8	3	6	1
2	Digital Room	3				1	4	
3	Seminar Hall			7	2		6	
4	Exam. Room	1		1	1	2	2	1
5	Staff Room			4	1		3	
6	Computer Room	2	1	2	2	3	2	
7	Class Room - BA-1			3			3	
8	Class Room - BA-2			3			3	
9	Labrary	7		4	2	2	7	1
10	NCC, Sport Wing	10	1	13		1	11	
11	YCMOU			3		1	3	1
12	B.Com.-3	1		2			3	
13	B.Com.-1			5			4	
14	B.Com.-2	2		1			2	
15	Ground				5			
16	Class Room - BA-3	1		1			2	
	TOTAL	**29**	**2**	**53**	**21**	**13**	**61**	**4**

Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	29	40	1.2
2	CFL	2	24	0.05
3	LED Tube-20W	53	20	1.1
4	LED bulb	21	12	0.3
5	Computers	13	65	0.8
6	Ceiling Fan	61	65	4.0
7	Air Cooler	4	250	1.0
8	Pumps (1 nos 2HP)			1.5
	Total			**6.5**

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

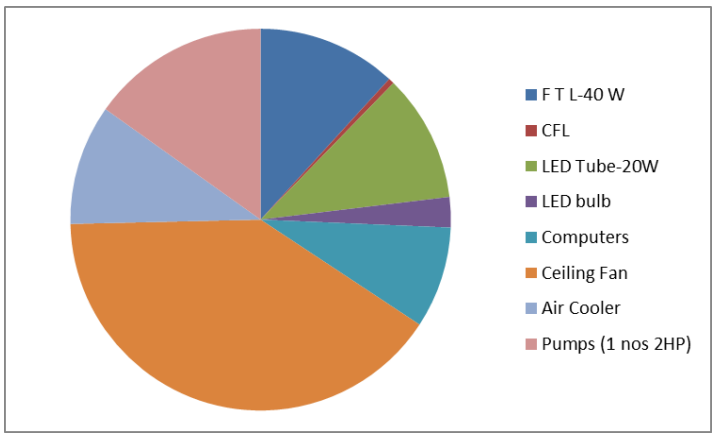

Figure 2.1: Distribution of connected load.

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	Jul-24	441	4,542
2	Jun-24	572	6,178
3	May-24	362	4,054
4	Apr-24	361	4,332
5	Mar-24	294	3,851
6	Feb-24	261	3,002
7	Jan-24	238	2,592
8	Dec-23	227	2,315
9	Nov-23	473	4,868
10	Oct-23	507	5,476
11	Sep-23	474	5,309
12	Aug-23	444	4,992
	Total	**4,654**	**51,510**

Variation in energy consumption is as follows,

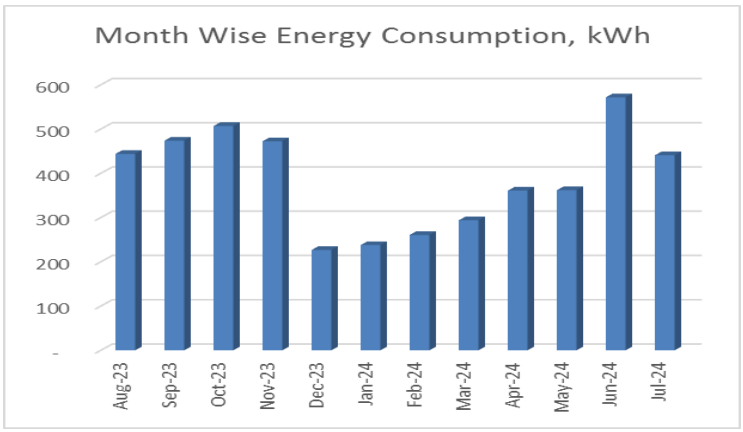

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

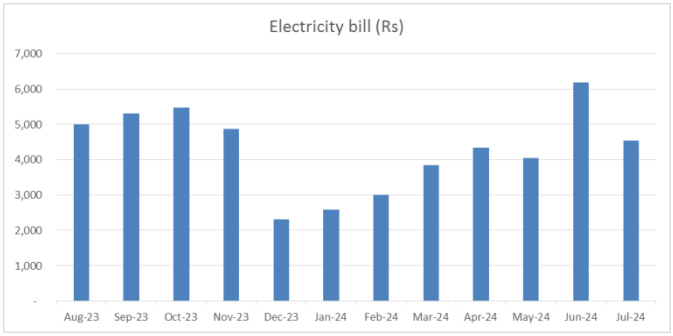

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	572	0.5
2	Minimum	227	0.2
3	Average	388	0.3
4	Total	4,654	3.7

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	Jul-24	441	0.35
2	Jun-24	572	0.46
3	May-24	362	0.29
4	Apr-24	361	0.29
5	Mar-24	294	0.24
6	Feb-24	261	0.21
7	Jan-24	238	0.19
8	Dec-23	227	0.18
9	Nov-23	473	0.38
10	Oct-23	507	0.41
11	Sep-23	474	0.38
12	Aug-23	444	0.36
	Total	**4,654**	**3.72**

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

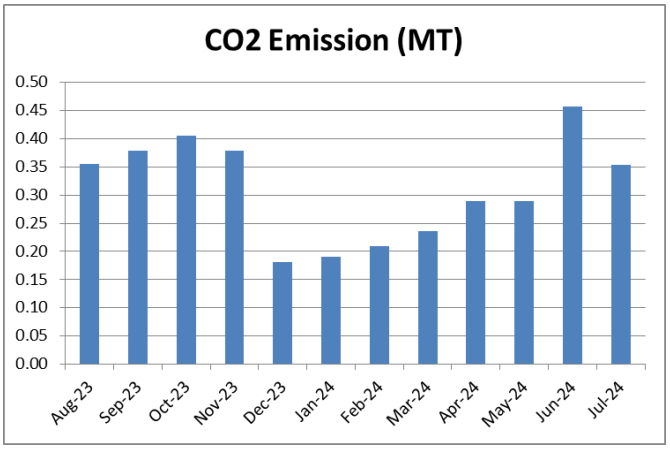

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 29 FTL fittings with Electronic/ magnetic chokes , 2 nos of CFLs, 53 nos of LED tubes, 21 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings.

5.2 Air-coolers

In the facility, there are about 04 Nos. of Air-coolers.

5.3 Ceiling Fans

At building facility, there are about 61 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.

5.4 Water Pumps

There are in total 1 Water pumps with 2HP capacity.

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 6.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	29	40	1.2
2	CFL	2	24	0.0
	LED lighting load			
1	LED tube	53	20	1.1
2	LED bulbs	21	12	0.3
	Total LED lighting load			**1.3**
	Total Lighting load			**2.5**

It can be seen that out of total lighting load 52% 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 29 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	29	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	2.32	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	580	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	6380	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	18589	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 61 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	61	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	12.2	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	3050	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	33550	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	132614	Rs lump sum
13	Simple Payback period	47	Months

7.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 29 Nos T-8 fittings with 20W LED fittings	580	6,380	18,589	35
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6. Notes & Assumptions

1. Daily working hours-10 Nos
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Abbreviations

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V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

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6	Computer Room	2	1	2	2	3	2	
7	Class Room - BA-1			3			3	
8	Class Room - BA-2			3			3	
9	Labrary	7		4	2	2	7	1
10	NCC, Sport Wing	10	1	13		1	11	
11	YCMOU			3		1	3	1
12	B.Com.-3	1		2			3	
13	B.Com.-1			5			4	
14	B.Com.-2	2		1			2	
15	Ground				5			
16	Class Room - BA-3	1		1			2	
	TOTAL	**29**	**2**	**53**	**21**	**13**	**61**	**4**

Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
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2	CFL	2	24	0.05
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4	LED bulb	21	12	0.3
5	Computers	13	65	0.8
6	Ceiling Fan	61	65	4.0
7	Air Cooler	4	250	1.0
8	Pumps (1 nos 2HP)			1.5
	Total			**6.5**

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

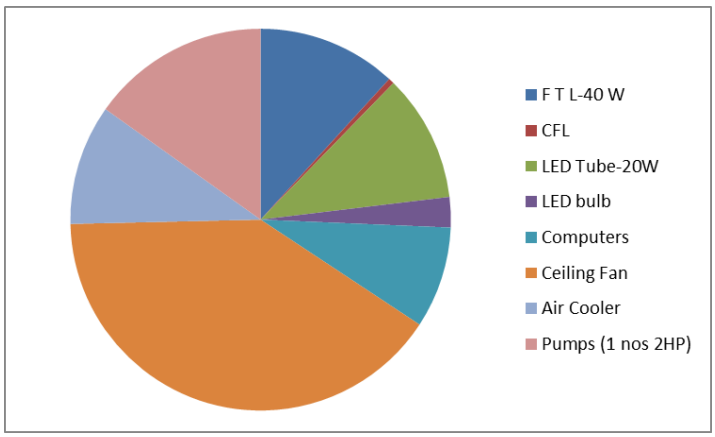

Figure 2.1: Distribution of connected load.

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

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No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	370	4,131
2	May-23	303	3,320
3	Apr-23	276	3,007
4	Mar-23	338	3,310
5	Feb-23	374	3,403
6	Jan-23	307	3,131
7	Dec-22	260	2,678
8	Nov-22	345	3,726
9	Oct-22	495	5,544
10	Sep-22	374	4,488
11	Aug-22	365	4,782
12	Jul-22	804	8,700
	Total	**4,611**	**50,220**

Variation in energy consumption is as follows,

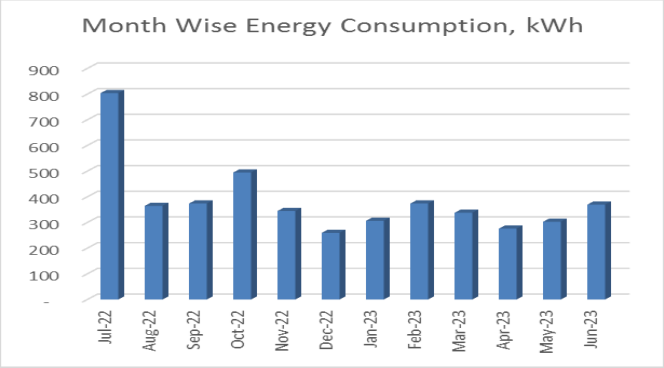

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

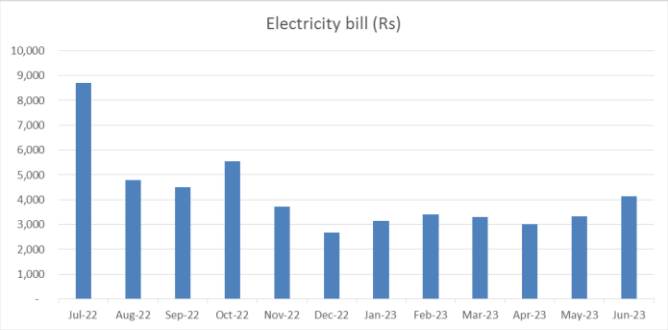

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	804	0.6
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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

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6	Jan-23	307	0.25
7	Dec-22	260	0.21
8	Nov-22	345	0.28
9	Oct-22	495	0.40
10	Sep-22	374	0.30
11	Aug-22	365	0.29
12	Jul-22	804	0.64
	Total	**4,611**	**3.69**

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

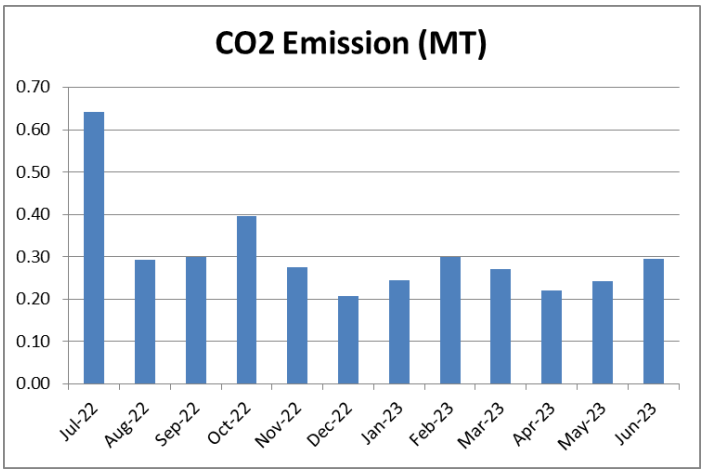

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 29 FTL fittings with Electronic/ magnetic chokes , 2 nos of CFLs, 53 nos of LED tubes, 21 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings.

5.2 Air-coolers

In the facility, there are about 04 Nos. of Air-coolers.

5.3 Ceiling Fans

At building facility, there are about 61 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.

5.4 Water Pumps

There are in total 1 Water pumps with 2HP capacity.

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.

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	Total LED lighting load			**1.3**
	Total Lighting load			**2.5**

It can be seen that out of total lighting load 52% 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 29 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.

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10	Annual Monetary saving	6380	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	18589	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 61 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	61	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	12.2	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	3050	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	33550	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	132614	Rs lump sum
13	Simple Payback period	47	Months

7.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 29 Nos T-8 fittings with 20W LED fittings	580	6,380	18,589	35
2	Replacement of 61 Nos Old Ceiling Fans with STAR rating fans	3,050	33,550	132,614	47
	Total	**3,630**	**39,930**	**151,203**	**45**

Report

On

Energy Audit

At

Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist- Nagpur

(Year 2021-22)

Prepared by

Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist-Nagpur 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	573	0.5
2	Minimum	153	0.1
3	Average	281	0.2
4	Total	3,375	2.7

2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 52 %.

5. 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 29 Nos T-8 fittings with 20W LED fittings	580	6,380	18,589	35
2	Replacement of 61 Nos Old Ceiling Fans with STAR rating fans	3,050	33,550	132,614	47
	Total	**3,630**	**39,930**	**151,203**	**45**

6. 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

Shree Pandharinath Arts and Commerce College ,Narkhed was established at Narkhed, Dist Nagpur by Prerana Education Society, Narkhed aiming at the Democratic Set Up of the college for the cause of higher education for poor, downtrodden and weaker sections of society. For qualitative education, management, teaching and non-teaching staff are working together. Now management is making efforts to make it better than ever before. The college was accredited in 2019 by NAAC with B+ grade and as per the recommendations of NAAC peer teem; the college is trying best to follow its Mission and Vision.

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	Prerana Education Society's Shree Pandharinath Arts and Commerce College, Narkhed, Dist- Nagpur
2	Address	Chawargaon Road, Block 3, Narkhed, Maharashtra 441304
3	Affiliation	Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

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 (40 W)	CFL	LED tube (20W)	LED bulb (12W)	Computers (65W)	Fans	Air Cooler
1	Office	2		4	8	3	6	1
2	Digital Room	3				1	4	
3	Seminar Hall			7	2		6	
4	Exam. Room	1		1	1	2	2	1
5	Staff Room			4	1		3	
6	Computer Room	2	1	2	2	3	2	
7	Class Room - BA-1			3			3	
8	Class Room - BA-2			3			3	
9	Labrary	7		4	2	2	7	1
10	NCC, Sport Wing	10	1	13		1	11	
11	YCMOU			3		1	3	1
12	B.Com.-3	1		2			3	
13	B.Com.-1			5			4	
14	B.Com.-2	2		1			2	
15	Ground				5			
16	Class Room - BA-3	1		1			2	
	TOTAL	**29**	**2**	**53**	**21**	**13**	**61**	**4**

Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	29	40	1.2
2	CFL	2	24	0.05
3	LED Tube-20W	53	20	1.1
4	LED bulb	21	12	0.3
5	Computers	13	65	0.8
6	Ceiling Fan	61	65	4.0
7	Air Cooler	4	250	1.0
8	Pumps (1 nos 2HP)			1.5
	Total			**6.5**

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

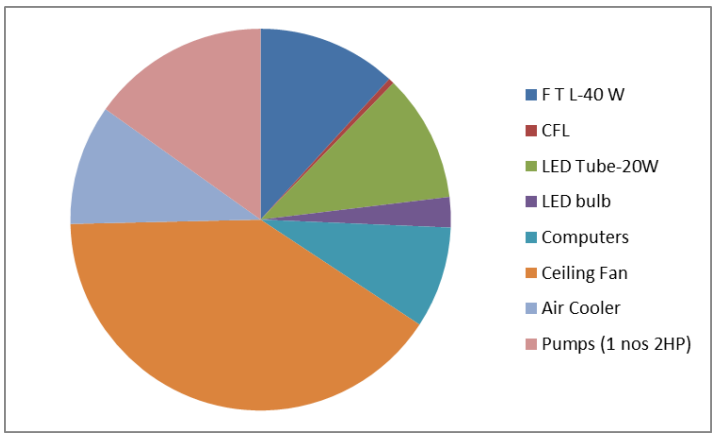

Figure 2.1: Distribution of connected load.

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	404	4,369
2	May-22	442	4,829
3	Apr-22	463	5,153
4	Mar-22	223	2,505
5	Feb-22	215	3,053
6	Jan-22	153	2,341
7	Dec-21	186	1,823
8	Nov-21	573	5,386
9	Oct-21	189	1,928
10	Sep-21	172	1,968
11	Aug-21	170	1,957
12	Jul-21	185	2,142
	Total	**3,375**	**37,454**

Variation in energy consumption is as follows,

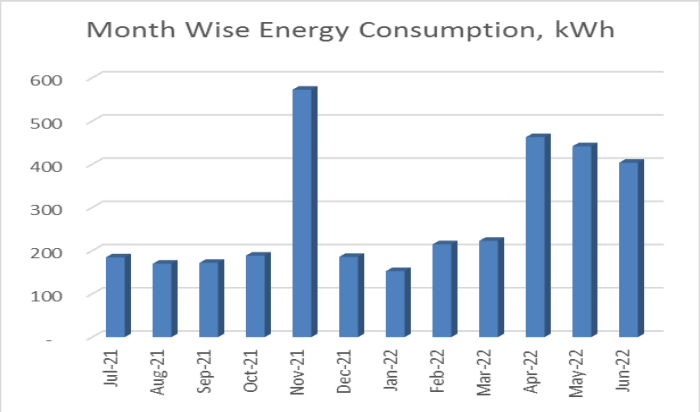

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

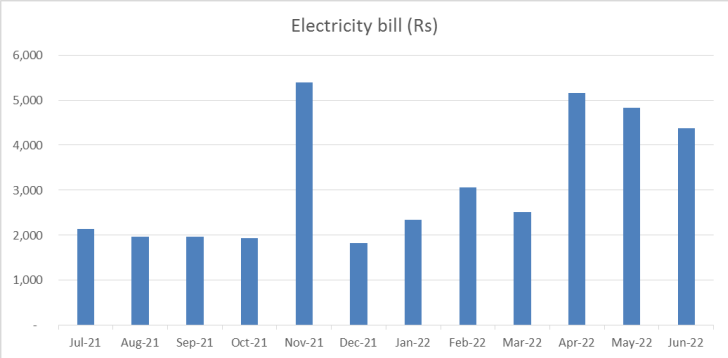

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	573	0.5
2	Minimum	153	0.1
3	Average	281	0.2
4	Total	3,375	2.7

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	404	0.32
2	May-22	442	0.35
3	Apr-22	463	0.37
4	Mar-22	223	0.18
5	Feb-22	215	0.17
6	Jan-22	153	0.12
7	Dec-21	186	0.15
8	Nov-21	573	0.46
9	Oct-21	189	0.15
10	Sep-21	172	0.14
11	Aug-21	170	0.14
12	Jul-21	185	0.15
	Total	**3,375**	**2.70**

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

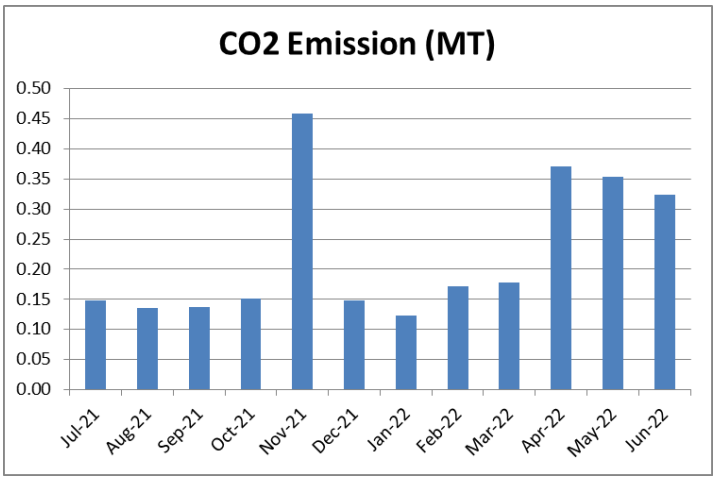

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 29 FTL fittings with Electronic/ magnetic chokes , 2 nos of CFLs, 53 nos of LED tubes, 21 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings.

5.2 Air-coolers

In the facility, there are about 04 Nos. of Air-coolers.

5.3 Ceiling Fans

At building facility, there are about 61 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.

5.4 Water Pumps

There are in total 1 Water pumps with 2HP capacity.

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 6.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	29	40	1.2
2	CFL	2	24	0.0
	LED lighting load			
1	LED tube	53	20	1.1
2	LED bulbs	21	12	0.3
	Total LED lighting load			**1.3**
	Total Lighting load			**2.5**

It can be seen that out of total lighting load 52% 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 29 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	29	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	2.32	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	580	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	6380	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	18589	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 61 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	61	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
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12	Investment required	132614	Rs lump sum
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7.3 Summary of Savings

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