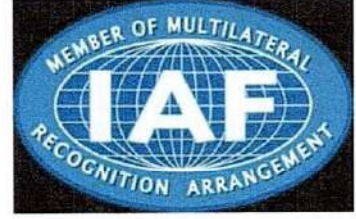


# Nutan Urja Solutions

(ISO 9001:2015, ISO 50001:2018, ISO 14001:2015,  
ISO/ IEC 17020:2012)

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Date: 23/09/2022

## CERTIFICATE

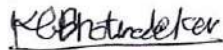
This is to certify that we have conducted Energy Audit at Lewa Educational Union's Dr. Annasaheb G. D. Bendale Mahila Mahavidyalaya, Jalgaon as per the guidelines of Maharashtra Energy Development Agency ([www.mahaurja.com](http://www.mahaurja.com)) in the year 2021-22.

The College has already adopted **Energy Efficient** practices like:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Installation of **27 kW** Roof Top Solar PV Power Plant.

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Green.

Nutan Urja Solutions,



K G Bhatwadekar,

Certified Energy Auditor,

EA - 22428



**Report  
On  
Energy Audit  
At  
Lewa Educational Union's Dr. Annasaheb G. D. Bendale Mahila  
Mahavidyalaya, Jalgaon  
(Year 2021-22)**



Prepared by  
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## Contents

Acknowledgement .....	2
Executive Summary .....	3
Abbreviations .....	5
1. Introduction .....	6
1.1 Objectives .....	6
1.2 Audit Methodology: .....	6
1.3 General Details of College .....	6
2. Study of connected load .....	7
3. Study of Electrical Energy Consumption .....	11
4. Carbon Foot printing .....	13
5. Study of utilities .....	15
5.1 Study of Lighting .....	15
5.2 Air-conditioners .....	15
5.3 Ceiling Fans .....	15
5.4 Water Pumps .....	15
6. Study of usage of alternate energy .....	16
7. Study of usage of LED lighting .....	17
8. Energy conservation proposals .....	18
8.1 Replacement of Old T-8 FTLs with 20 W LED fittings .....	18
8.2 Replacement of old fans with STAR Rated fans .....	19
8.3 Installation of Solar PV panel .....	20
8.4 Summary of Savings .....	21



## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Lewa Educational Union's Dr. Annasaheb G. D. Bendale Mahila Mahavidyalaya, Jalgaon 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<sub>2</sub> 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	6561	5.2
2	Minimum	1241	1.0
3	Average	3769	3.0
4	Total	45222	36.2

### 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.
4. Usage of STAR rated fans at new installations

### 3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.
4. There are about 27 Nos old T-8 type fittings which need to be replaced by 20 W LEDs.





#### 4. Percentage of Usage of Alternate Energy

The College has installed a Roof Top Solar PV Plant. The percentage of usage of Alternate Energy to Annual Energy Requirement is 44%.

#### 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 91 %.

#### 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 27 Nos T-8 fittings with 20W LED fittings	594	6,534	17,307	32
2	Replacement of 392 Nos Old Ceiling Fans with STAR rating fans	5,096	56,056	852,208	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1000,000	36
	<b>Total</b>	<b>35,690</b>	<b>392,590</b>	<b>1869,515</b>	<b>57</b>

#### 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

Lewa Educational Union's Dr. Annasaheb G. D. Bendale Mahila Mahavidyalaya is located in Jalgaon. The college was established in 1984 with a motto to provide specific education at different level to better educate women for their participation in education and National Development. College has Science, Computer, Arts, & Commerce faculties having more than 2300 students. College is situated in the heart of city to ensure the safety to the students.

### 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	Lewa Educational Union's Dr. Annasaheb G. D. Bendale Mahila Mahavidyalaya, Jalgaon.
2	Address	Mahatma Gandhi Rd, Pratap Nagar, Jalgaon, Maharashtra 425001
3	Affiliation	Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon.





## 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 (20 W)	Computers (65W)	LED bulb (12 W)	Fans	1.5 TR Star rated AC	1.5 TR old Acs
	<b>Hostel Building</b>							
1	Gymkhana		18	1	18	12	2	
2	Music room		3	1		2		
3	Exam Office		3	1		2		
4	stitchery Dept.				24	8	2	
5	Library				6	1		
6	Sketching Dept.		1			1		
7	Office		1			1		
8	Skin Care			1	8	4		
9	Hair Care				6	2		
10	Class room		6	1		6		
11	Spa section		2			2		
12	Clearing room		1			1		
13	Passage				8			
14	Wash room				3			
15	Dept. of commerce		12			8		
16	Hostel rooms	18	52			52		
17	Hostel rooms Passage	8	8					
	<b>Main Building (Ground Floor)</b>							



18	Passage		10			3		
19	Admin Office		9	14	8	14		
20	Wash room		3		4	1		
21	Principal Office		3	1	10	2	1	
22	Vice Princial Office 1		2			2		
23	Vice Princial Office 2		2			2		
24	Vice Princial Office 3		2			2		
25	NAAC room		2			2		
26	Staff Room		14			12		
27	Meeting Hall			2	9	4	2	
	<b>Main Building (First Floor)</b>							
28	Learning Center		1	27	6	4		
29	Incubation Center			1	10	5	1	
30	Passage		6			1		
31	Scial Science		3	2		2		
32	Class room 1		2			2		
33	Class room 2		2			2		
34	Botany Staff Room		2	1		2		
35	Botany Lab		10	1		8		1
36	Zoology Lab		6	1	5	8		
37	Zoology Staff Room		2	1		2		
	<b>Main Building (Second Floor)</b>							
38	Geography Staff Room		2	1		2		
39	Geo Lab		8	10		7		
40	Maths Staff Room		2	1		2		
41	Class Room		2			3		
42	Electronic Lab		10	4		11		
43	Electronic Staff Room		2	1		2		





44	Wash room		3				
45	Physics Lab		14			15	
46	Passage		6				
47	Chemistry Lab		22			10	
48	Staff Room		4			4	
49	Psychology Staff Room		9	1		9	
50	Class Room		3			3	
51	Language Lab		8	19		8	
	<b>Main Building (Third Floor)</b>						
52	Passage		6			2	
53	Computer Maintenance Room		2			5	
54	Java lab		6	25		3	
55	VB Net Lab		4	25			
56	Wash room		3			3	
57	Linux Lab		4	25		3	
58	ORACLE Lab		4	20		3	
59	Class Room 1		3			2	
60	Class Room 2		2			2	
61	Staff Room		2			3	
62	C Lab		4	15		6	
63	Terrace	1					
64	Trust Office		4	2	8		1
	<b>Library Building</b>						
65	Study Room				40	8	5
66	GD Room		2		3	18	
67	Passage		1		4	1	
68	Class Room		4	2	4		1
69	Office						1





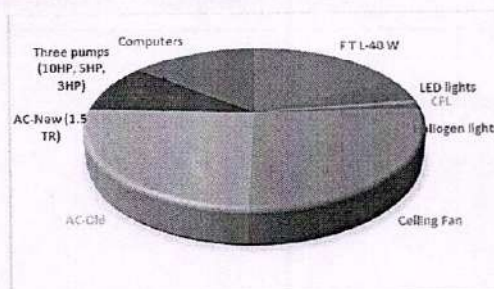
70	Library		34			21		
71	Reading Room		14	8		8	1	
72	Class Rooms		27			32		
73	Seminar Hall		20	2		14	6	
	<b>Total</b>	<b>27</b>	<b>429</b>	<b>217</b>	<b>184</b>	<b>392</b>	<b>23</b>	<b>1</b>

Apart from above load, the college has pumps, LED street lights and LED focus street lights on streets and grounds. 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	392	65	25.5
2	AC-Old (1.5 Tr)	1	2200	2.2
3	AC-New (1.5 TR)	23	1838	42.3
4	LED Tube-20W	429	20	8.6
5	LED Bulb	184	12	2.2
6	F T L-40 W	27	40	1.1
7	Computers	217	65	14.1
8	Pumps (2 No 2HP, 3nos 1HP)			5.3
9	LED street lights	14	35	0.5
	<b>Total</b>			<b>101.7</b>

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



**Figure 2.1: Distribution of connected load.**



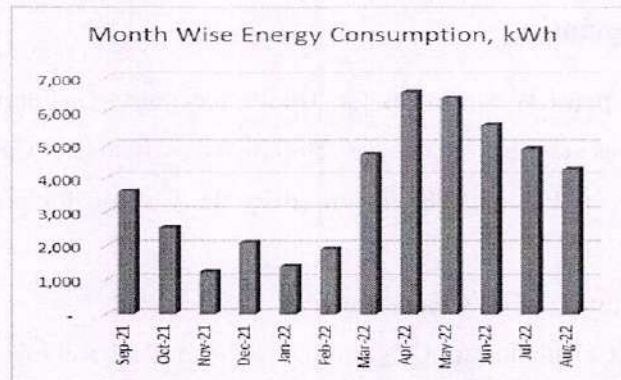
### 3. Study of Electrical Energy Consumption

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

**Table no 3.1: Summary of electricity bills**

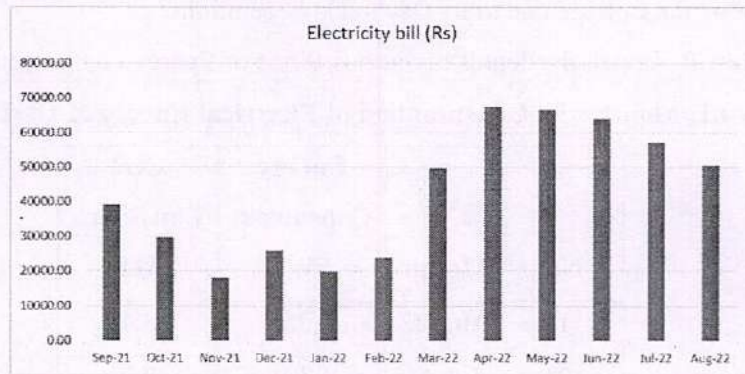
No	Month	Energy (kWh)	Bill Amount (Rs)
1	Aug-22	4,257	50,513
2	Jul-22	4,894	57,242
3	Jun-22	5,596	64,144
4	May-22	6,389	66,788
5	Apr-22	6,561	67,599
6	Mar-22	4,724	49,517
7	Feb-22	1,905	24,002
8	Jan-22	1,397	19,981
9	Dec-21	2,104	25,949
10	Nov-21	1,241	18,210
11	Oct-21	2,539	29,780
12	Sep-21	3,615	38,958
	<b>Total</b>	<b>45,222</b>	<b>512,683</b>

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	6,561	5.2
2	Minimum	1,241	1.0
3	Average	3,769	3.0
4	Total	45,222	36.2





#### 4. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

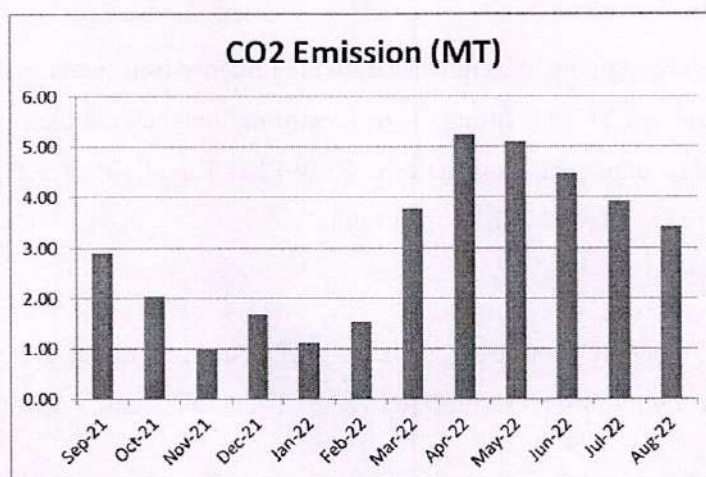
We herewith furnish the details of various forms of Energy consumption as under

**Table 4.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Aug-22	4,257	3.4
2	Jul-22	4,894	3.9
3	Jun-22	5,596	4.5
4	May-22	6,389	5.1
5	Apr-22	6,561	5.2
6	Mar-22	4,724	3.8
7	Feb-22	1,905	1.5
8	Jan-22	1,397	1.1
9	Dec-21	2,104	1.7
10	Nov-21	1,241	1.0
11	Oct-21	2,539	2.0
12	Sep-21	3,615	2.9
	<b>Total</b>	<b>45,222</b>	<b>36.2</b>



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 27 FTL fittings with Electronic/ magnetic chokes and 429 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 14 No of LED street lights.

### **5.2 Air-conditioners**

In the facility, there are about 01 Nos. of 1.5 Tr old Air-conditioner. It is recommended to replace these Old ACs with BEE STAR Rated ACs. There is 23 star rated new AC of 1.5Tr capacity.

### **5.3 Ceiling Fans**

At building facility, there are about 392 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 5 Water pumps with 2 nos of 2HP, and 3nos of 3HP capacities respectively.



## 6. Study of usage of alternate energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Solar PV System of 27kW capacity. Also, college has installed 12 nos of LED solar lights.

**Table 6.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement**

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	45,222	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	35,127	kWh/Annum
3	Total Energy Requirement of College	80,349	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	44	%

### Photograph of Solar PV plant





## 7. 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	27	40	1.08
	<b>LED lighting load</b>			
1	LED tube	429	20	8.6
2	LED bulb	184	12	2.2
3	LED street lights	14	35	0.49
	<b>Total LED lighting load</b>			<b>11.2</b>
	<b>Total Lighting load</b>			<b>12.3</b>

It can be seen that out of total lighting load 91% load is LED lighting load.

## 8. Energy conservation proposals

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

In the facility, there are about 27 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	27	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 18 W LED fittin	18	W/Unit
4	Reduction in demad	22	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	2.376	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	594	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	6534	Rs/Annum
11	Cost of 18 W LED Tube	641	Rs/Unit
12	Investment required	17307	Rs lump sum
13	Simple Payback period	32	Months



## 8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 392 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	392	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	20.384	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5,096	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	56,056	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2,174	Rs/unit
12	Investment required	852,208	Rs lump sum
13	Simple Payback period	182	Months



### 8.3 Installation of Solar PV panel

It is recommended to install 1 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	20	kW
2	Energy saving	30,000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	330,000	Rs/ Annum
5	Investment required	1000,000	Rs lump sum
6	Simple payback period	36	Months





#### 8.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 27 Nos T-8 fittings with 20W LED fittings	594	6,534	17,307	32
2	Replacement of 392 Nos Old Ceiling Fans with STAR rating fans	5,096	56,056	852,208	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1000,000	36
	<b>Total</b>	<b>35,690</b>	<b>392,590</b>	<b>1869,515</b>	<b>57</b>

