Nutan Urja Solutions

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Date: 07/08/2020

CERTIFICATE

This is to certify that we have conducted Energy Audit at Rural Foundation Nandurbar Sanchalit, Senior Science College, Akkalkuwa, Dist. Nandurbar as per the guidelines of Maharashtra Energy Development Agency (www.mahaurja.com) in the year 2019-20.

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

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment

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

Rural Foundation Nandurbar Sanchalit,

Senior Science College,

Akkalkuwa

(Year 2019-20)

Prepared by

Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Rural Foundation Nandurbar Sanchalit, Senior Science College, Akkalkuwa, Dist. Nandurbar-425415 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, (kWh)	CO2 Emission (MT)
1	Maximum	89	0.07
2	Minimum	-	-
3	Average	37	0.03
4	Total	438	0.35

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. 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 39 %.

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 5 Nos T-8 fittings with 20W LED fittings	100	1,100	3,205	35
2	Replacement of 27 Nos Old Ceiling Fans with STAR rating fans	1,350	14,850	58,698	47
	Total	**1,450**	**15,950**	**61,903**	**47**

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

RFNS, Senior Science College, Akkalkuwa was established in 2003. This college has started its journey with Science Stream. College has its own separate building in the campus. The entire infrastructural development of the institution depends on management funding. This college got its affiliation from the North Maharashtra University, Jalgaon (MS).

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	Rural Foundation Nandurbar Sanchalit, Senior Science College, Akkalkuwa, Dist. Nandurbar
2	Address	Rural Foundation, Nandurbar Sanchalit, Senior Science College, Akkalkuwa, Dist. Nandurbar, 425 415.
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)	CFL	LED tube (20W)	Computers (65W)	Fans
1	Office	1	1		3	2
2	Pricipal Cabin		1	1		1
3	Staff Room		1	1		1
4	Ladies Room		1			1
5	Classroom 1		1	1		2
6	Botany Lab			4		2
7	Chemistry Lab 1	1	2			1
8	Chemistry Lab 2	1	2		1	1
9	Library	1	1	3	2	2
10	Computer Room		1	2	10	1
11	Geography Lab		2			2
12	IQAC Office		1		1	1
13	Classroom 2	1	1			2
15	Zoology Lab		2			1
15	Recreation Room			7		7
16	Stairs		2			
17	Ladies Toilet		1			
18	Gents Toilet		1			
	Total	**5**	**21**	**19**	**17**	**27**

Apart from above load, the college has pumps, street lights. 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	5	40	0.2
2	CFL	21	24	0.5
3	LED Tube-20W	19	20	0.4
4	Ceiling Fan	27	65	1.8
5	LED focus Street light	2	35	0.1
6	Pumps (2 nos 2HP)	1	1.5	1.5
	Total			3.3

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

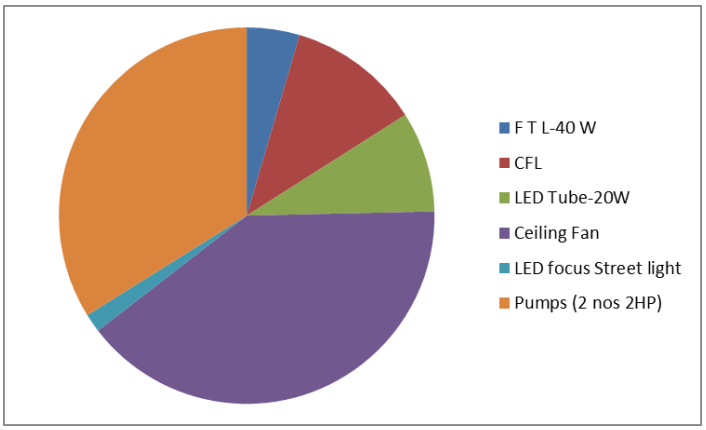

Figure 2.1: Distribution of connected load.

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-20	5	1330
2	May-20	5	1330
3	Apr-20	0	790
4	Mar-20	89	1867
5	Feb-20	27	493
6	Jan-20	22	402
7	Dec-19	21	383
8	Nov-19	36	736
9	Oct-19	35	716
10	Sep-19	72	1476
11	Aug-19	63	1292
12	Jul-19	63	1292
	Total	**438**	**12,107**

Variation in energy consumption is as follows,

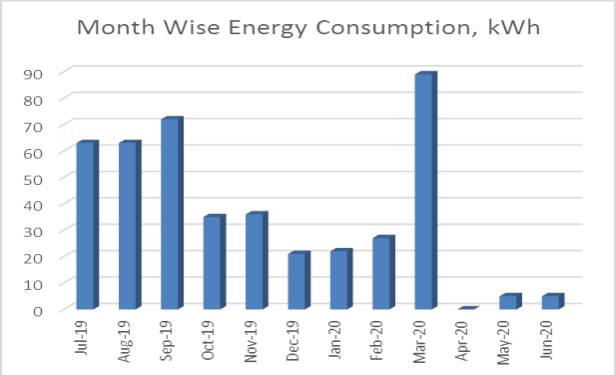

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

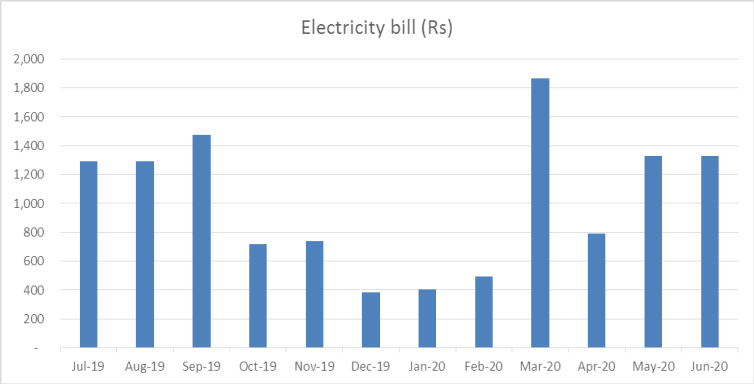

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Maximum	89	0.07
2	Minimum	-	-
3	Average	37	0.03
4	Total	438	0.35

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-20	5	0.00
2	May-20	5	0.00
3	Apr-20	-	0.00
4	Mar-20	89	0.07
5	Feb-20	27	0.02
6	Jan-20	22	0.02
7	Dec-19	21	0.02
8	Nov-19	36	0.03
9	Oct-19	35	0.03
10	Sep-19	72	0.06
11	Aug-19	63	0.05
12	Jul-19	63	0.05
	Total	**438**	**0.35**

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

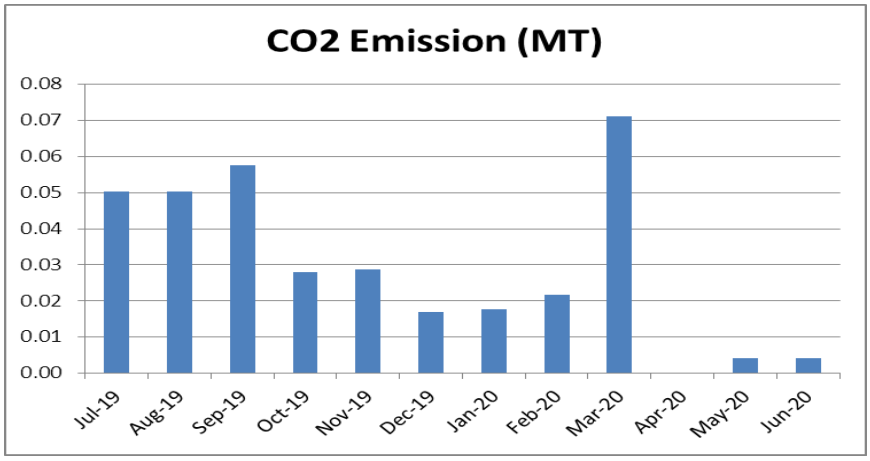

Figure 4.1: Month wise CO2 Emission

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 5 FTL fittings with Electronic/ magnetic chokes , 21 nos of CFLs, 19 nos of LED tubes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 2 No of LED street lights.

5.2 Ceiling Fans

At building facility, there are about 27 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 2HP capacities each.

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	5	40	0.2
2	CFL	21	24	0.50
	LED lighting load			
1	LED tube	19	20	0.38
2	LED street lights	2	35	0.07
	Total LED lighting load			**0.45**
	Total Lighting load			**1.15**

It can be seen that out of total lighting load 39% 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 5 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	5	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	0.4	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	100	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	1100	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	3205	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 27 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	27	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	5.4	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1350	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	14850	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	58698	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 5 Nos T-8 fittings with 20W LED fittings	100	1,100	3,205	35
2	Replacement of 27 Nos Old Ceiling Fans with STAR rating fans	1,350	14,850	58,698	47
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