Nutan Urja Solutions

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

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Date: 11/08/2024

CERTIFICATE

This is to certify that we have conducted Environmental Audit at Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur in the year 2023-24.

The College has already adopted following projects for making the campus Environmental Friendly.

- Installation of Bio Composting Pit
- Installation of Rain Water Harvesting System
- Installation of **45 kW** 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,

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K G Bhatwadekar,
Certified Energy Auditor,
EA – 22428

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CERTIFICATE

This is to certify that we have conducted Green Audit at Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur for the year 2023–24.

The College has already adopted **Green** practices like:

- Installation of Rain Water Harvesting system
- Installation of Bio composting pit
- Installation of **45 kW** Roof Top Solar PV Power Plant.
- Usage of Energy Efficient LED
- Usage of Energy Efficient BEE STAR Rated equipment

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

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Date: 11/08/2024

CERTIFICATE

This is to certify that we have conducted Energy Audit at Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur as per the guidelines of Maharashtra Energy Development Agency (www.mahaurja.com) in the year 2023-24.

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 **45 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.

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Report

On

Environmental Audit

At

Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur

(Year 2023-24)

Prepared by

Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

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

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO_2 on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO_2 Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	14,337	11.5
2	Minimum	5,420	4.3
3	Average	9,179	7.3
4	Total	110,142	88.1

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of **45 kW** Solar PV Power Plant.

4. Recommendations:

1. Installation of Bio Gas Generator Plant instead of Bio composting Plant.
2. Installation of Sewage treatment Plant to make campus a Zero Discharge campus

5. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

AC	:	Air conditioner
PES	:	Progressive Education Society
CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
kWh	:	kilo-Watt Hour
Qty	:	Quantity
W	:	Watt
kW	:	Kilo Watt
PF	:	Power Factor
M D	:	Maximum Demand
PC	:	Personal Computer
MSEDCL	:	Maharashtra State Electricity Distribution Company Ltd

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

1927	The Indian Forest Act
1972	The Wildlife Protection Act
1974	The Water (Prevention and Control of Pollution) Act
1977	The Water (Prevention & Control of Pollution) Cess Act
1980	The Forest (Conservation) Act
1981	The Air (Prevention and Control of Pollution) Act
1986	The Environment Protection Act
1991	The Public Liability Insurance Act
2002	The Biological Diversity Act
2010	The National Green Tribunal Act

1.1.5. Some Important Environmental Rules in India: Table No-2:

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Siting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules

2011	E-waste (Management and Handling) Rules
2011	National Green Tribunal (Practices and Procedure) Rules
2011	Plastic Waste (Management and Handling) Rules

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

1.	National Forest Policy, 1988
2.	National Water Policy, 2002
3.	National Environment Policy or NEP (2006)
4.	National Conservation Strategy and Policy Statement on Environment and Development, 1992
5.	Policy Statement for Abatement of Pollution (1992)
6.	National Action Plan on Climate Change
7.	Vision Statement on Environment and Human Health
8.	Technology Vision 2030 (The Energy Research Institute)
9.	Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency
10	The Road to Copenhagen; India's Position on Climate Change Issues (MoEF)

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

No	Head	Particulars
1	Name of Institution	Shri Nagpur Gujarati Mandal's VMV Comerce JMT Arts & JJP Science College, Nagpur
2	Address	VMV College, Central Ave, near Nagpur, Wardhaman Nagar Colony, Nagpur, Maharashtra 440008
3	Affiliation	Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

2. Study of Consumption of Various Resources

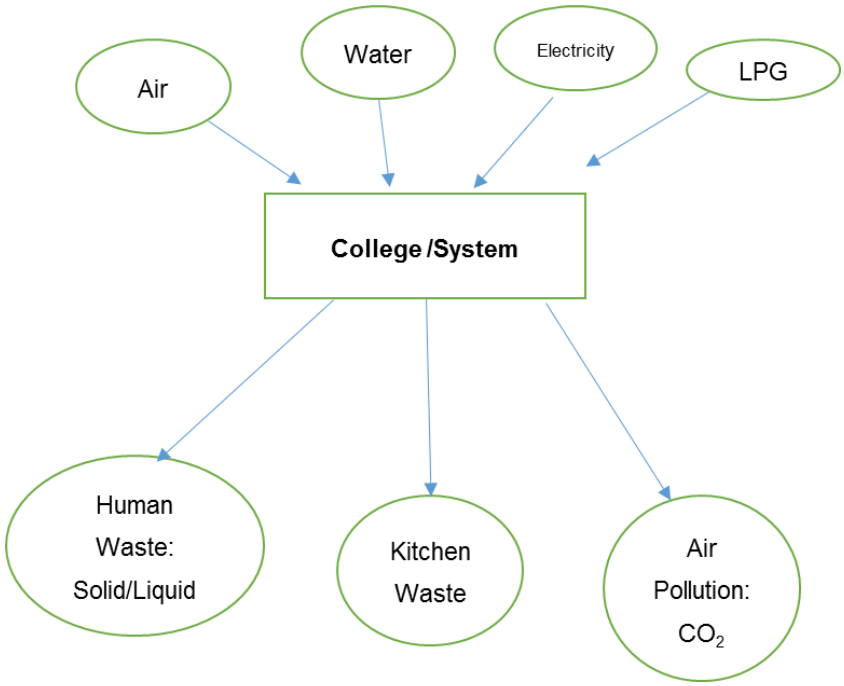
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO2 on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

No	Month	Energy (kWh)
1	Jun-24	9,740
2	May-24	7,225
3	Apr-24	9,365
4	Mar-24	6,258
5	Feb-24	5,420
6	Jan-24	8,282
7	Dec-23	8,200
8	Nov-23	7,998
9	Oct-23	11,202
10	Sep-23	11,922
11	Aug-23	14,337
12	Jul-23	10,193
	Total	**110,142**
	Maximum	14,337
	Minimum	5,420
	Average	9,179

2.1 Variation of Monthly Electrical Energy Consumption

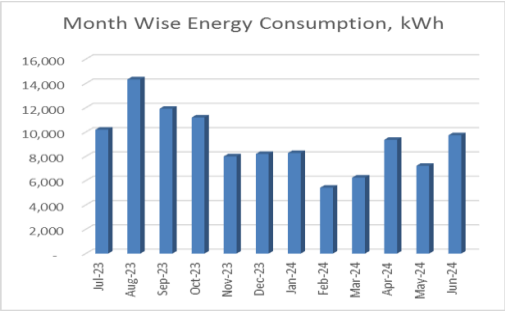


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

No	Parameter/ Value	Energy Consumed, kWh
1	Total	110,142
2	Maximum	14,337
3	Minimum	5,420
4	Average	9,179

3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO_2 in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO_2 in the atmosphere

In the following Table, we present the CO_2 emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO_2 Emissions:

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-24	9,740	7.79
2	May-24	7,225	5.78
3	Apr-24	9,365	7.49
4	Mar-24	6,258	5.01
5	Feb-24	5,420	4.34
6	Jan-24	8,282	6.63
7	Dec-23	8,200	6.56
8	Nov-23	7,998	6.40
9	Oct-23	11,202	8.96
10	Sep-23	11,922	9.54
11	Aug-23	14,337	11.47
12	Jul-23	10,193	8.15
	Total	**110,142**	**88.11**
	Maximum	14,337	11.5
	Minimum	5,420	4.3
	Average	9,179	7.3

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

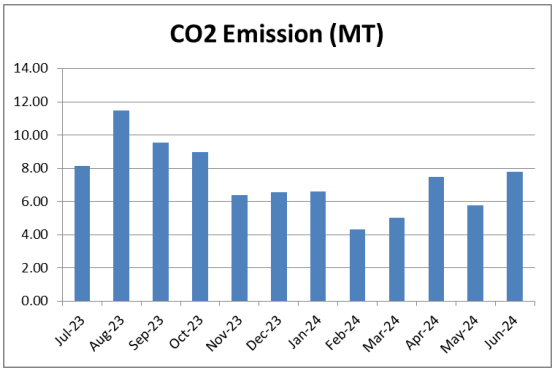


Figure 2.1: CO2 emission due to usage of electrical energy.

3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

3.2.1 Photograph of Bio Composting Processing Tanks

3.3 Study of Liquid Waste Generation

The college has washrooms on each floor. The college has total following nos of toilets at present

Ladies Toilets

Indian style - 51 nos

Western style – 12 nos

Gents toilets

Indian style - 51 nos

Western style – 12 nos

Urinals – 44 nos

The Liquid Waste generated due to day to day operations is drained off to the municipal Corporation through a pipe.

The MoU, signed on June 1, 2021, ensures Dhruv Lab handles campus biological waste per strict environmental standards. They oversee collection, transport, and certified disposal, ensuring transparency and regulatory alignment, reinforcing VMV College's commitment to safety, sustainability, and public health standards.

3.4 Study of Paper Waste

Efforts are taken to generate minimal amount of paper waste. As per the documents retention policy, paper waste is sent for recycling through certified agencies.

VMV College partners with **Jagdish Trading Company** to manage and recycle campus paper waste sustainably. This collaboration exemplifies our commitment to environmental stewardship, reducing landfill waste, and promoting resource conservation. The partnership Underscores VMV College's dedication to a cleaner, greener campus and model sustainable practices.

3.5 Study of e-Waste Management:

E-Waste in the premises is disposed through E waste disposal drive in association with RENOVATIO.

The MoU between VMV College and Renovatio NGO, signed on July 1, 2023, promotes environmental awareness through ewaste and solid waste management. Renovatio will offer workshops, seminars, and ewaste drives, giving students handson learning, skills through internships, and volunteering opportunities, without financial obligation to VMV College.

Photograph of E-waste disposal drive

4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting

5. Study of Indoor Air Quality

5.1 Importance of Indoor Air Quality

Air: The common name given to the atmospheric gases used in breathing and photosynthesis.

By volume, Dry air contains 78.09% Nitrogen, 20.95% Oxygen, 0.93% Argon, 0.039% Carbon Dioxide and small amounts of other gases.

On average, a person inhales about 14,000 liters of air every day. Therefore, poor air quality may affect the quality of life no and for future generations by affecting the health, the environment, the economy and the city's livability.

Rapid urbanization and industrialization has added other elements/ compounds to the pure air and thus caused the increase in pollution. In order to prevent, control and debate air pollution. In order to prevent, control and abate air pollution, the Air (Presentation and Control of Pollution) Act as enacted in 1981.

Air quality is a measure of the suitability of air for breathing by people, plants and animals

According to section 2(b) of air (Prevention and control of pollution) Act. 1981 **'Air pollution' has been defined as 'the presence in the atmosphere of any air pollutant'**

As per section 2(a) o air (Prevention and control of pollution) Act, 1981 has been defined as **'any solid, liquid or gaseous substance present in the atosphere in such concentration as ay be or tend to be injurious to huan beings or other living creatures or plants or property or envirnent'**

5.2 Air Quality Index:

An Air Quality Index (AQI) is a number used by government agencies to measure the air pollution levels and commuicate it to the population. As the AQI increases, it means that a large percentage of the population will experience severe adverse health effects. The measurement of the AQI requires an air monitor and an air pollutant concentration over a specified averaging period.

We present following important parameters

1. (AQI) Air Quality Index
2. PM-2.5 - Particular Matter of Size 2.5 Micron
3. PM-10 - Particular Matter of Size 10 Micron

Table no 5.1: Air Quality Values

No	Category	AQI Value	Concentration Range PM 2.5	Concentration Range PM 10
1	Good	0-50	0-30	0-50
2	satisfactory	51-100	31-60	50-100
3	Moderately Polluted	101-200	61-90	101-250
4	Poor	201-300	91-120	251-350
5	Very Poor	301-400	121-250	351-430
6	Severe	401-500	250+	430+

After measurement, it is found that, air quality values of in all places of institutes and classrooms are found good and satisfactory.

6. Study of Environment Friendly Initiatives

6.1 Internal Tree Plantation

The college has beautifully developed garden. The college conduct tree plantation programs.

Photographs of Garden

6.2 Provision of Sanitary Waste Incinerator

For disposal of sanitary waste , sanitary waste incinerators are installed.

Photographs of Sanitary Waste Incinerator

7. Fire Safety Measures

To ensure a safe workplace, free from any fire hazards, the institute has fire prevention arrangements within their work environment. A fire fighting system in a building is a collection of equipment and systems that help prevent and manage fires.

Fire measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the development and effects of a fire after it starts. Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

7.1 Building-wise Availability of Fire Safety Systems

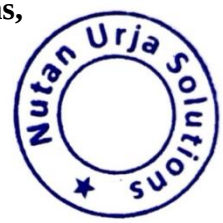
Sr.NO	Buildings/Unit	Fire fighting Availability
1	Old building	Fire Hydrant Fire Auto Detection, Fire Alarm, Fire Extinguishers ldings / Unit
2	New building	Fire Hydrant Fire Auto Detection, Fire Alarm, Fire Extinguishers

8. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Bio Gas Generator Plant instead of Bio composting Plant.
- Installation of Sewage treatment Plant to make campus a Zero Discharge campus

Nutan Urja Solutions,



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Report

On

Green Audit

At

Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur

(Year 2023-24)

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Contents

Acknowledgement

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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 and green practices. 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

Green Audit of Shri Nagpur Gujarati Mandal's VMV Comerce JMT Arts & JJP Science College, Nagpur is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Shri Nagpur Gujarati Mandal's VMV Comerce JMT Arts & JJP Science College, Nagpur uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	14,337	11.5
2	Minimum	5,420	4.3
3	Average	9,179	7.3
4	Total	110,142	88.1

2. Various Green Practices Adopted

1. Celebration of no vehicle day
2. Ban on use of plastic in college campus
3. Usage of STAR Rated ACs at new installations
4. Usage of LED lights at some indoor locations
5. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed **45 kW** Solar PV Power Plant.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails. E-Waste in the premises is disposed through E waste disposal drive in association with RENOVATIO.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 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

Being one of the oldest institutes dedicated towards the promotion and spread of education in this part of India, Shri Nagpur Gujarati Mandal has been rendering unflinching services for this cause. Since its inception in 1905, the Mandal is proud today to have established educational institutions catering to the needs of nursery, *primary*, secondary, higher secondary, higher education and technical education students through Hindi, Marathi and English. Infact, Shri Nagpur Gujarati Mandal is the only century old institution beyond the boundaries of the then Greater Gujarat State. VMV Comerce JMT Arts & JJP Science College, Nagpur is one of the renowned college in Nagpur area. .

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO_2 emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. 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

2. Study of Electrical Energy Consumption

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

Table no 2.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-24	9,740	149,967
2	May-24	7,225	107,977
3	Apr-24	9,365	175,182
4	Mar-24	6,258	94,058
5	Feb-24	5,420	84,682
6	Jan-24	8,282	131,324
7	Dec-23	8,200	131,641
8	Nov-23	7,998	124,391
9	Oct-23	11,202	185,776
10	Sep-23	11,922	192,873
11	Aug-23	14,337	219,199
12	Jul-23	10,193	168,785
	Total	**110,142**	**1,765,855**

Variation in energy consumption is as follows,

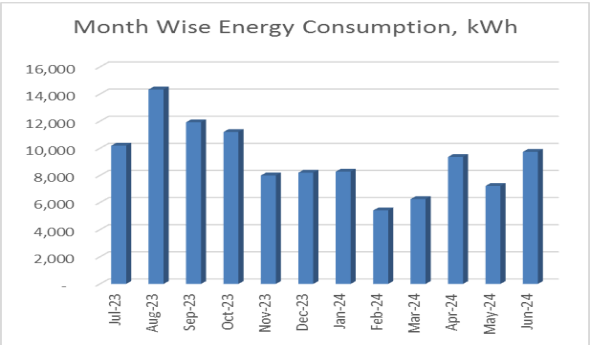


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

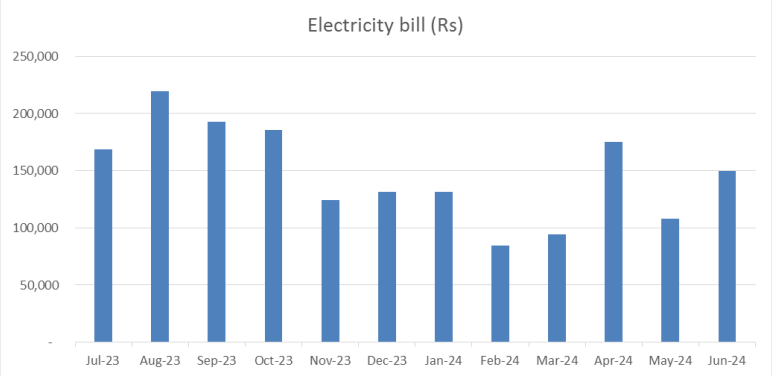


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	14,337	11.5
2	Minimum	5,420	4.3
3	Average	9,179	7.3
4	Total	110,142	88.1

3. 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 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-24	9,740	7.7
2	May-24	7,225	5.7
3	Apr-24	9,365	7.5
4	Mar-24	6,258	5.0
5	Feb-24	5,420	4.3
6	Jan-24	8,282	6.6
7	Dec-23	8,200	6.6
8	Nov-23	7,998	6.4
9	Oct-23	11,202	8.9
10	Sep-23	11,922	9.5
11	Aug-23	14,337	11.4
12	Jul-23	10,193	8.1
	Total	**110,142**	**88.1**

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

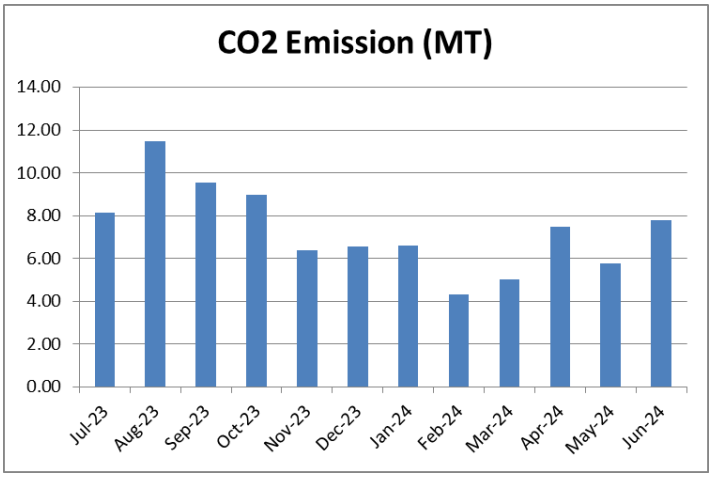


Figure 3.1: Month wise CO2 Emission

4. 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 Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is 45 kWp.

Table 4.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	110,142	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	67500	kWh/Annum
3	Total Energy Requirement of College	177,642	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	38	**%**

Photograph of Solar PV plant

5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting

6. Study of Waste Management

6.1 Solid Waste Management

The College have Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden. The cage is installed in which the collected trash is allowed for decomposition. This method is aerobic method in which water is sprayed on trash for fast decomposition.

Photographs of Bio Composting Storage Tanks:

6.2 Liquid Waste Management

The college has washrooms on each floor. The college has total following nos of toilets at present

Ladies Toilets

Indian style - 51 nos

Western style – 12 nos

Gents toilets

Indian style - 51 nos

Western style – 12 nos

Urinals – 44 nos

The Liquid Waste generated due to day to day operations is drained off to the municipal Corporation through a pipe.

6.3 e-Waste Management

The internal communication is through emails. E-Waste in the premises is disposed through E waste disposal drive in association with RENOVATIO.

Photograph of E-waste disposal drive

6.4 Paper Waste Management

Efforts are taken to generate minimal amount of paper waste. As per the documents retention policy, paper waste is sent for recycling through certified agencies. College have paper shredder to dispose the paper waste.

7. Study of Green Practices

7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 90% students don't use own Automobile.

7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. Institute encourages students to not to use automobiles. Institute celebrates no vehicle day in campus.

Professors and staff of the college use public transport to come to college. No vehicle day is celebrated in college.

7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus

7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

7.6 Provision of Sanitary Waste Incinerator

The college has installed Sanitary Waste Incinerator to dispose of the sanitary waste.

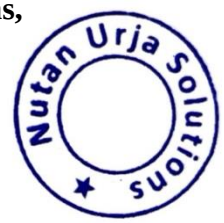
Photograph of Sanitary Waste Incinerator

7.7 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.

Figure 7.1: Beautiful maintained Garden of college

Nutan Urja Solutions,



K G Bhatwadekar,
Certified Energy Auditor,
EA- 22428

Report

On

Energy Audit

At

Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, Nagpur

(Year 2023-24)

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 Shri Nagpur Gujarati Mandal's VMV Commerce JMT Arts & JJP Science College, 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	14,337	11.5
2	Minimum	5,420	4.3
3	Average	9,179	7.3
4	Total	110,142	88.1

2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at 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 Alternate Energy

The College has installed a Roof Top Solar PV Plant. The percentage of usage of Alternate Energy to Annual Energy Requirement is 38 %.

5. 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 100 %.

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	Installation of 50kW grid connected PV panel	75,000	825,000	2,500,000	36
	Total	**75,000**	**825,000**	**2,500,000**	**36**

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

Being one of the oldest institutes dedicated towards the promotion and spread of education in this part of India, Shri Nagpur Gujarati Mandal has been rendering unflinching services for this cause. Since its inception in 1905, the Mandal is proud today to have established educational institutions catering to the needs of nursery, *primary*, secondary, higher secondary, higher education and technical education students through Hindi, Marathi and English. Infact, Shri Nagpur Gujarati Mandal is the only century old institution beyond the boundaries of the then Greater Gujarat State. VMV Comerce JMT Arts & JJP Science College, Nagpur is one of the renowned college in Nagpur area.

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	Shri Nagpur Gujarati Mandal's VMV Comerce JMT Arts & JJP Science College, Nagpur
2	Address	VMV College, Central Ave, near Nagpur, Wardhaman Nagar Colony, Nagpur, Maharashtra 440008
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	LED tube (20W)	Computers (65W)	Fans	1.5TR old Acs
1	OFFICE	15	20	6	2
2	OFFICE STORE	6	0	6	0
3	GYM	6	0	2	0
4	Chemistry LAB	18	2	13	0
5	Class Room	4	0	4	0
6	Botany Lab	18	2	10	0
7	PRINCIPAL OFFICE	25	1	5	2
8	SENIOR DEPARTMENT	85	4	16	7
9	Computer Lab	4	21	4	0
10	Computer Lab	4	21	4	0
11	MCA LAB 1	32	62	10	5
12	MCA LAB 2	12	41	7	1
13	MCA OFFICE	19	3	5	2
14	Physics Lab	11	2	15	0
15	Computer Lab	10	28	9	4
16	Home Eco.	8	1	4	0
17	Exam Room	5	2	4	0
18	JUNIOR STAFF ROOM	27	5	7	2
19	JR. Vice Principal office	3	1	2	0
20	SEMINAR HALL	19	1	10	4
21	Computer Lab	17	55	7	0
22	MCA Library	7	1	7	0
23	MCA Staff room	12	4	5	1
24	MCA CLASS ROOM	4	0	5	0
25	MCA CLASSROOM	5	0	6	0
26	Net Café	5	13	5	
27	Lang Lab	8	25	4	
28	Electronic Lab	3	1	6	
29	NCC	1	1	2	
30	Class Room	7	0	7	

31	Class Room	5	0	7	
32	Class Room	7	0	7	
33	Class Room	6	0	7	
34	ROOM	7	1	4	
35	Class Room	3	0	3	
36	Class Room	2	0	4	
37	Class Room	1	0	5	
38	ROOM	3	0	2	
39	ROOM	2	0	2	
40	ROOM	1	0	1	
41	Class Room	4	0	8	
42	Class Room	4	0	7	
43	Class Room	5	0	10	
44	MCA Class room	4	0	5	
45	Class Room	5	0	2	0
46	Class Room	4	0	2	0
47	Class Room	6	0	5	0
48	Class Room	4	0	5	0
49	Class Room	5	0	5	0
50	Class Room	4	0	5	0
51	Class Room	5	0	5	0
52	B.VOC OFFICE	3	2	2	0
53	B.VOC (Video Studio)	16	3	1	2
54	B.VOC (Audio Studio)	20	1	1	1
55	B.VOC (Make-up)	19	0	2	1
56	AUDITORIUM	35	1	11	12
57	ABHIMUNCH	13	0	8	0
58	Class Room	5	0	8	0
59	Class Room	6	0	7	0
60	Class Room	4	0	6	0
61	Class Room	4	0	2	
62	B.Sc. CBZ Zoology Lab	9	1	6	
63	B.Sc. CBZ Chemistry Lab	12	1	13	
64	M.Sc. Physics Lab	15	1	8	
65	M.Sc. Chemistry Lab	12	1	6	
66	Class Room	6	0	2	
67	Staff Room	6	1	2	
68	Chemical Room	3	0	1	
69	Class Room	6		4	

70	Class Room	6		4	
71	Class Room	6		4	
72	Class Room	2		2	
73	Class Room	1		2	
74	Class Room	2		2	
75	Class Room	2		2	
76	Class Room	0		0	
77	Class Room	4		2	
78	Reading Room	12		6	
79	Class Room	8		4	
80	LAB 1	12	181	13	1
81	LAB 2	4	51	4	
82	LAB 3	4	51	4	
83	LAB 4	8	56	4	
84	LAB 5	8	56	4	
85	GENERATOR ROOM	0	0	0	1
86	Class Room	5	0	2	
87	Class Room	5	0	2	
88	Class Room	8	0	4	
89	Class Room	7	0	4	
90	PHD CELL	4	1	2	
91	Class Room	5	0	2	
92	Class Room	7	0	4	
93	Class Room	8	0	4	
94	Room	0	0	0	
	Total	**809**	**726**	**469**	**48**

Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	LED Tube-20W	809	20	16.2
2	Computers	726	65	47.2
3	Ceiling Fan	469	65	30.5
4	AC (1.5Tr)	48	1838	88.2
5	Pumps (3 nos 3HP, 1 no 5 HP)			10.4
6	LED streer lights	13	35	0.5
	Total			**129.1**

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

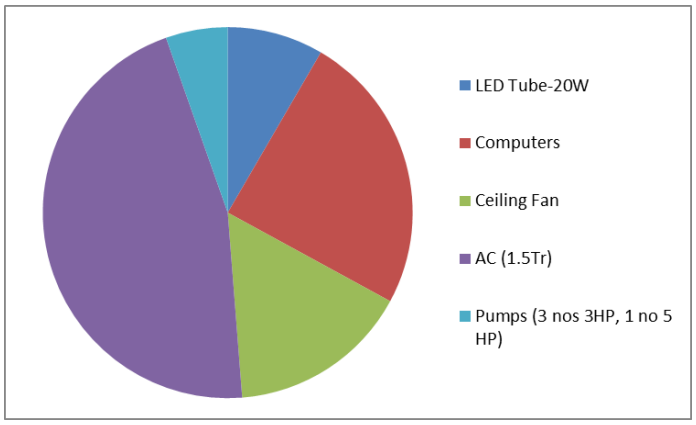


Figure 2.1: Distribution of connected load.

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-24	9,740	149,967
2	May-24	7,225	107,977
3	Apr-24	9,365	175,182
4	Mar-24	6,258	94,058
5	Feb-24	5,420	84,682
6	Jan-24	8,282	131,324
7	Dec-23	8,200	131,641
8	Nov-23	7,998	124,391
9	Oct-23	11,202	185,776
10	Sep-23	11,922	192,873
11	Aug-23	14,337	219,199
12	Jul-23	10,193	168,785
	Total	**110,142**	**1,765,855**

Variation in energy consumption is as follows,

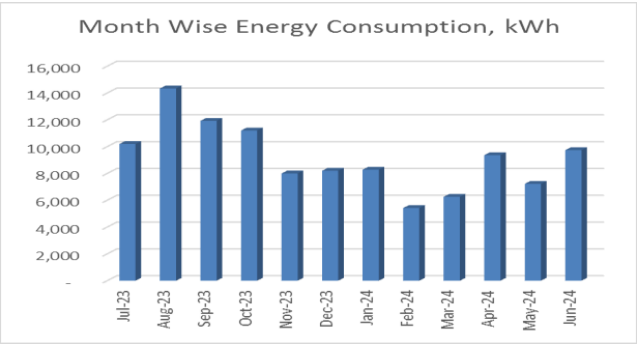


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

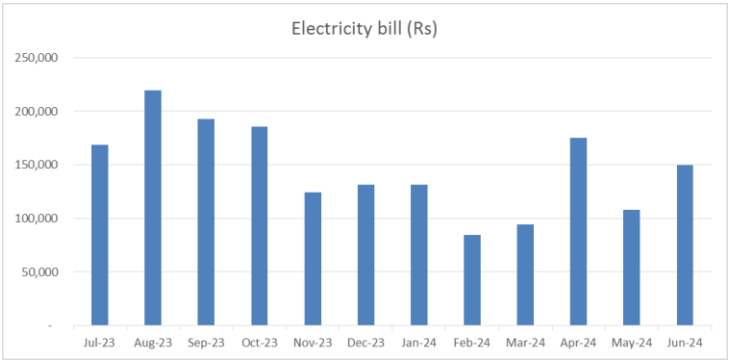


Figure 3.2: Month wise electricity bill

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	14,337	11.5
2	Minimum	5,420	4.3
3	Average	9,179	7.3
4	Total	110,142	88.1

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-24	9,740	7.79
2	May-24	7,225	5.78
3	Apr-24	9,365	7.49
4	Mar-24	6,258	5.01
5	Feb-24	5,420	4.34
6	Jan-24	8,282	6.63
7	Dec-23	8,200	6.56
8	Nov-23	7,998	6.40
9	Oct-23	11,202	8.96
10	Sep-23	11,922	9.54
11	Aug-23	14,337	11.47
12	Jul-23	10,193	8.15
	Total	**110,142**	**88.11**

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

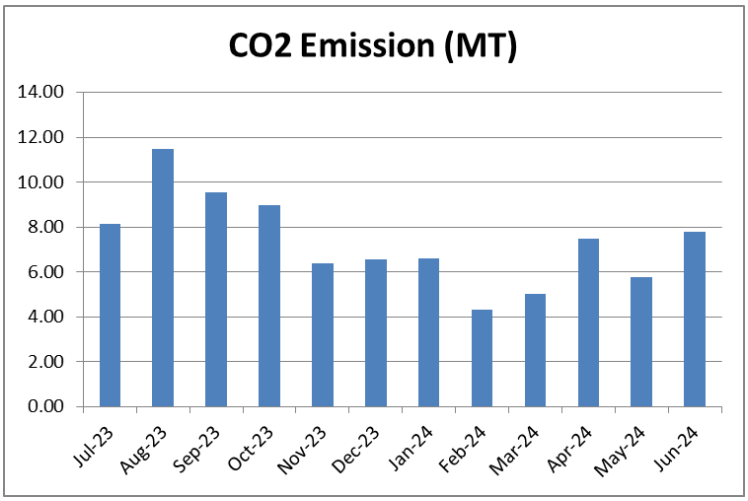


Figure 4.1: Month wise CO2 Emission

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 809 nos of LED tubes and 13 nos of LED street lights.

5.3 Air-conditioners

In the facility, there are about 48 Nos. of 1.5 Tr Air-conditioners.

5.4 Ceiling Fans

At building facility, there are about 479 Nos Old Ceiling Fans, which consumed about 65W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.5 Water Pumps

There are in total 3 Water pumps with 3HP and 1 water pump with 5HP 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 Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is 45 kWp.

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

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	110,142	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	67500	kWh/Annum
3	Total Energy Requirement of College	177,642	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	38	**%**

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
	LED lighting load			
1	LED tube	809	20	16.1
	LED street lighs	13	35	0.4
	Total LED lighting load			**16.6**
	Total Lighting load			**16.6**

It can be seen that out of total lighting load 100% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 469 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	469	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 demand	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	93.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	23450	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	257950	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	1019606	Rs lump sum
13	Simple Payback period	47	Months

8.2 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Installation of 50kW grid connected PV panel	75,000	825,000	2,500,000	36
	Total	**75,000**	**825,000**	**2,500,000**	**36**

Nutan Urja Solutions,

K G Bhatwadekar,
Certified Energy Auditor,
EA- 22428

Certificate of Registration

This is to certify that

NUTAN URJA SOLUTIONS

A 703, BALAJI WHITEFIELD, NEAR SUNNY'S WORLD,
SUS ROAD, PUNE – 411021, INDIA

has been independently assessed by QRO
and is compliant with the requirement of:

ISO 9001:2015

Quality Management System

For the following scope of activities:

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1st Surveillance Audit Due: 6th September 2023
2nd Surveillance Audit Due: 6th September 2024
Certificate Expiry: 6th September 2025

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Certificate Expiry: 6th September 2025

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Certificate of Compliance

This is to certify that the

NUTAN URJA SOLUTIONS

A 703, BALAJI WHITEFIELD, NEAR SUNNY'S WORLD, SUS ROAD, PUNE – 411021, INDIA

Has been assessed and found to operate in Compliance meets the requirements of following standard:

ISO/IEC 17020:2012

"Conformity Assessment: Requirements For Tha Operation Of Various Types Of Bodies Performing Inspection"
For the following scope:

ENERGY AUDIT, GREEN AUDIT, ENVIRONMENTAL AUDIT AND SAFETY AUDIT

Certificate Number: QVA-NLHV-22-0514882

To verify this certificate please visit at www.gaafs.us

Date of Certification	05TH September 2022
Issuance Date	05TH September 2022
1st Surveillance Due	04TH September 2023
2nd Surveillance Due	04TH September 2024
Re-Certificate Due	04TH September 2025

Registered

Authorized Signatory

CERTIFIED QVA Certification

QVA Certification
CAB Address : Maryland Avenue, SW Washington, D.C. 20202
Validity of this certificate is subject to annual surveillance audits to be done successfully
This certificate is the property of QVA Certification and shall be returned immediately on request
QVA Certification is an independent Systems Products and Personal assessment Body, QVA Certification is a accredited by GAAFS.US

Regn. No. EA-22428

Certificate No. 8725

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Mrs./ Ms. Koustubh Ganesh Bhatwadekar

son / daughter of Mr. Ganesh K Bhatwadekar

has passed the National Certification Examination for Energy Auditors held in September - 2015 conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 10th February, 2016

Controller of Examination

Maharashtra Energy Development Agency

(A Government of Maharashtra undertaking)
Aundh Road, Opposite Spicer College,
Near Commissionerate of Animal Husbandry, Aundh, Pune - 411 067
Ph No: 020-26614393/266144403
Email: eee@mahaurja.com, Web: www.mahaurja.com

ECN/2023-24/CR-11/99 — 28th August, 2023

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

We hereby certify that, the firm having following particulars is registered with *MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)* under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm	:	M/s. Nutan Urja Solutions A 703, Balaji Whitefield, Sus Road, Near Sunni's World, Pune - 411 021.
Registration Category	:	*Empanelled Consultant for Energy Conservation Programme for Class 'A'*
Registration Number	:	*MEDA/ECN/2023-24/ClassA/EA-09*

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **27th August, 2025** from the date of registration, to carry out energy audits under the Energy Conservation Programme.
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (I/C)