VSPM Academy of Higher Education
Jawaharlal Nehru Arts, Commerce and Science College Wadi, Nagpur
Dist. Nagpur (Maharashtra) 440023

Criterion VII
Institutional Values and Best Practices

7.1 Institutional Values and Social Responsibilities

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

1.Green audit / Environment audit
2.Energy audit
3.Clean and green campus initiatives
4.Beyond the campus environmental promotion activities

VSPM Academy of Higher Education Nagpur's

Jawaharlal Nehru Arts, Commerce and Science College, Wadi, Nagpur- 440023 (M.S.)

(Affiliated to RTM Nagpur University, Nagpur)

Website: www.jncwadi.ac.in E-mail: jnc.wadi@rediffmail.com Phone: (07104) 220963

Date: 10/09/2024

This document hereby confirms that the data enclosed, comprising information, supporting documents, numerical data, and reports, has been thoroughly examined and authenticated by both the IQAC and the Principal, and is deemed accurate.

Convenor
(IQAC)
JN. Arts, Comm. & Sci. College
Wadi, Nagpur

Principal
Jawaharlal Nehru Arts, Comm. & Sci.
College, Wadi, Nagpur

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ENERGY AUDIT

VSPM Academy of Higher Education Nagpur's

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2023-24

ENERGY AUDIT REPORT

CONSULTATION REPORT

JAWAHARLAL NEHRU
ARTS, COMMERCE & SCIENCE COLLEGE

WADI, NAGPUR-440023

YEAR 2023-24

Prepared By

Infinite Energy Services

Energy Consultants, Auditors and Risk Assessor

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ACKNOWLEDGEMENT

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Prashant Akarte
B.E. (Electrical)
Certified Energy Auditor [EA-17568]
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Chartered Electrical Safety Engineer
Chartered Engineer
(The Institution of Engineers (India))

EXECUTIVE SUMMARY

The executive summary of the energy audit report furnished in this section briefly gives the identified energy conservation measures and other recommendation during the project that can be implemented in a phased manner to conserve energy, increase productivity inside the college campus.

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy / cost saving exists and prepare proposals for energy / cost saving along with investment and payback periods.

The salient observations and recommendations are given below,

Jawaharlal Nehru Arts, Commerce & Science collage, Nagpur, uses energy in the following forms:

1) From MSEDCL
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Electrical energy is used for various applications, like: Computers, Lighting, Air-Conditioning, Fans Other Laboratory Equipment, Printers, Xerox machines, CCTV, UPS, LCD Projector, Router system, Flood light, Pumping motor etc.
The average cost of energy is around **Rs. 21,269 /Month** (Including diesel cost).

The Specific Energy Consumption **(SEC)** is the ratio of energy required per square meter. In this case the SEC is evaluated as electrical units consumed per square meter of area. It is calculated as under for (Electricity): **8.903 kWh / Sq.m.**

After the measurement and analysis, we propose herewith following Energy Efficiency Improvement measures.

- AREA OF IMPROVEMENT

TIMER CONTROLLED STREET LIGHTS

Installation of "Timer control on street lighting" in college campus is recommended.

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Replacement of "conventional ceiling fan (80W)" by energy efficient star rated fan or BLDC based energy efficient fan (28W) in "all departments classes" have great potential for energy saving.

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- Installation of "Cloud based (IoT based) energy monitoring system" including harmonic measurement (total voltage and current harmonic distortion %) in power house will be good initiate for energy monitoring as well as student demo project for management. Expected energy saving potential about 2 to 4%.

AMC FOR SOLAR SYSTEM:

- Annual Maintenance contract should be allotted to solar agency for proper maintenance of existing 10Kwp rooftop PV solar system.

ENERGY MANAGEMENT WORKSHOP and TRAINING:

- Develop energy management policies for college. Establish a procurement policy that is energy saving and eco-friendly.
- Conduct awareness and training programs for faculty, student and non-teaching staffs. Conduct seminars, workshops and exhibitions on energy management education.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in energy management system.

CHAPTER-1
INTRODUCTION

1.1 About College

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College has a pride to have NAAC accreditation grade B+ with CGPA 2.74. The college boasts on well- qualified and experienced teachers involved in promoting the research culture. The college has well equipped Gymnasium and advance library open for student to develop personally and prepare for competitive exams. The college has become an educational hub coping the demands and satisfying the needs of the region and hence it has got new coinage as one of the best Educational Institutions in the college and Vidarbha region. College is situated at western part of Nagpur city in Wadi area near Hingna MIDC.

Figure-1: Satellite image of college from google earth


WELL MAINTAINED COLLEGE CAMPUS

TRAINING CENTER

WORLD CLASS LIBRARY

WELL EQUIPPED GYMNASIUM

PHYSICAL EDUCATION AND SPORTS

10KWp ROOFTOP SOLAR PV PANELS

Fig-2: PICTORIAL VIEW OF COLLEGE INFRASTRUCTURE

COLLAGE MISSION AND MISSION

College Vision

The vision of college is to create a centre of academic excellence in the field of higher education for student and equip them to be good responsible citizens of the country by developing in them skills and competencies necessary for self-employment and values necessary for life irrespective of region, religion, caste, economic strata so as to enhance standard of living in rural areas.

College Mission

The Mission of the college is to develop human resource with higher education, right skills, strength of character and positive attitude, The College endeavours to inculcate global competencies among student to help them meet rapidly changing global challenges by disseminating quality education to rural youths to foster development of the rural areas.

Goals and objectives of college:

- *To advance the cause of higher education among middle, lower income and below poverty line groups and among students coming from rural agrarian background and grassroots of the society.*
- *To inculcate in students respect for self-reliance, self-employment and dignity of labour.*
- *To provide ad environment which fosters continuous improvement and innovation with technical support and facility to enhance student and faculty effectiveness.*
- *To develop community orientation and civic responsibilities in their outlook.*
- *To develop an orientation towards the national and global needs as responsible citizens.*
- *To honour scholarship and outstanding achievements in academics, sports and extra-curricular activities.*
- *To develop amongst the students' academic and all-round competency.*
- *To ensure awareness to gender and right gender justice.*
- *To develop environmental awareness amongst students.*
- *To develop skilled personal through vocational and entrepreneurial education.*

- *To sensitize the students on socio-economic issues*
- *To uplift rural women who lack education opportunities.*
- *To empower rural people by providing them counselling and orientation programmes.*
- *To empower girl students / rural women through need-based, futuristic courses with entrepreneurial skills.*

1.2 About Energy Audit

Energy audit helps to understand more about the ways energy is used in any institute and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to final consumer becomes 50%. Hence one unit saved in the end user is equivalent to two units generated in the power plant.
Energy audit is the most efficient way to identify the strength and weakness of energy management practices and to find a way to solve problems. Energy audit is a professional approach in utilizing economic, financial, and social and natural resources responsibility. Energy audits "adds value" to management control and is a way of evaluating the system.

Infinite Energy Services, Nagpur, carried out the "Energy Audit" at the site to find gaps in the energy consumption pattern for Jawaharlal Nehru Arts, Commerce and Science College, Wadi, Nagpur. A technical report is prepared as per the need and the requirement of the project.

1.3 Objectives of Energy Auditing

An energy audit provides vital information base for overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures. It aims at:

- To study the present pattern of energy consumption
- To identify potential areas for energy optimization
- To Identify potential areas of thermal and electrical energy economy.
- To recommend energy conservation proposals with cost benefit analysis.
- To highlight wastage in major areas.

1.4 Energy Audit Methodology:

Energy Audit Study is divided into following steps

1. Historical Data Analysis:

The historical data analysis involves establishment of energy consumption pattern to the established base line data on energy consumption and its variation with change in production volumes.

2. Actual measurement and data analysis:

This step involves actual site measurement and field trials using various portable measurement instruments. It also involves input to output analysis to establish actual operating equipment efficiency and finding out losses in the system.

3. Identification and evaluation of Energy Conservation Opportunities:

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period.

1.5 Present Energy Scenario:

College uses energy in the form of electricity purchased from grid connected system. The electricity bill is based on the 73/LT-X B10-20 KW Public ser oth. The college has sanction demand of 14.5 KW.

Also college has installed on grid Solar PV panels of 10KWp capacity connected to grid. During Audit, it is found that 10KWp solar panels were reinstalled at some height from floor and well-maintained.

Fig: PV Solar Panels

MSEDCL import power billing is being done as net metering. Total billing amount of electricity bill of college has been found to be about INR 250322/ - for 14 months analysis period from April - 2023 to May - 2024.

Also one HSDG of rating 25 KVA is being used in case of emergency. The average annual diesel consumption is around 50 liters.

Fig: 25 KVA DG Set

CHAPTER- 2
ELECTRICITY BILL ANALYSIS

2.1 Month-wise Electrical Energy Consumption of college (Year 2023-24)

Table:-1 Electrical Energy consumption (Year 2023-24)

Sr. No	Month & Year	Total Unit Billed (kWh)
1	Apr-23	0
2	May-23	2630
3	Jun-23	2699
4	Jul-23	2598
5	Aug-23	2089
6	Sep-23	2793
7	Oct-23	3225
8	Nov-23	1868
9	Dec-23	1270
10	Jan-24	1239
11	Feb-24	1640
12	Mar-24	2001
13	Apr-24	2529
14	May-24	1848
	Total	**28429**

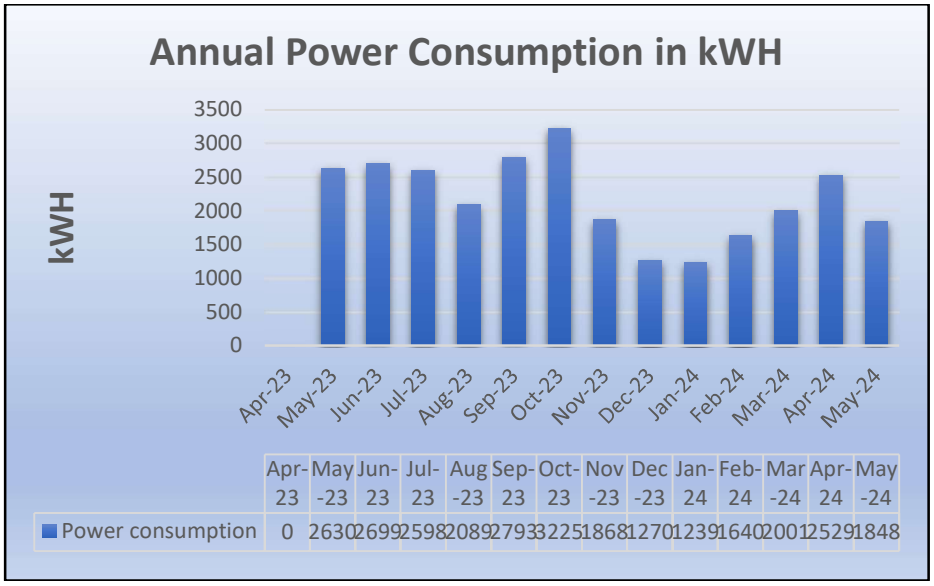


Fig.-3: - Graphical Presentation for Month-wise Energy Consumption (kWh)

2.2 Month-wise Total Electricity bills of college (Year 2023-24)

The monthly Electricity bill amount of the college for all four energy meters are as under:

Table:- 2 Energy consumption and billing amount (Year 2022-23)

Sr. No.	MONTH	ELECTRICITY BILL AMOUNT (Rs)
1	Apr-23	422
2	May-23	23540
3	Jun-23	24010
4	Jul-23	22800
5	Aug-23	17720
6	Sep-23	25470
7	Oct-23	29410
8	Nov-23	17540
9	Dec-23	9480
10	Jan-24	9670
11	Feb-24	13430
12	Mar-24	17240
13	Apr-24	22420
14	May-24	17170
	Total Annual Bill	**250322**
	Average Monthly Bill	**19256**

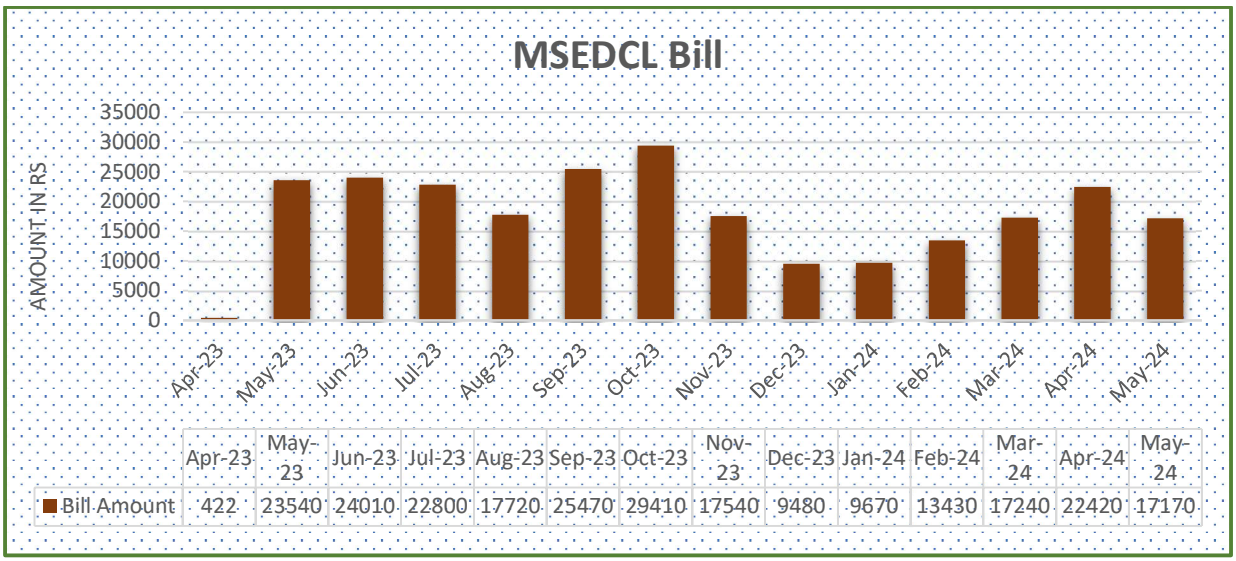


Fig.4:- Graphical Presentation of MSEDCL Bill Amount (Rs)

2.3 Month-wise Solar Power Generation (Year 2023-24)

Table:- 3 Month-wise Solar Power Generation (Year 2023-24)

Sr. No.	MONTH	SOLAR POWER GENERATION (KWh)
1	Apr-23	0
2	May-23	11
3	Jun-23	361
4	Jul-23	63
5	Aug-23	133
6	Sep-23	8
7	Oct-23	0
8	Nov-23	1
9	Dec-23	271
10	Jan-24	237
11	Feb-24	227
12	Mar-24	181
13	Apr-24	150
14	May-24	129
	TOTAL GENERATION	**1772**
	AVG GENERATION	**136**

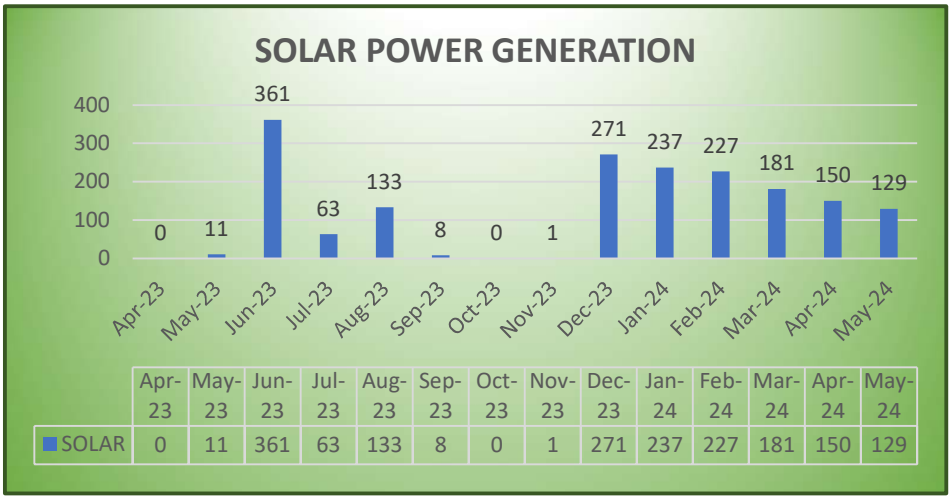


Fig.5:- Graphical Presentation Solar Power Generation (KWh)

2.4 Annual Energy Generation and Consumption of College (Last 3 years Comparison)

Table-4: Annual Energy Generation and Consumption of College (Last 3 Year)

Year	POWER CONSUMPTION (kwH)	SOLAR POWER GENERATION (KWh)	REMARKS
2021-22	4645.00	2273.00	Energy Metering not proper
2022-23	2799.00	8193.00	Energy Metering not proper
2023-24	28429.00	1772.00	Less solar Generation

Conclusion:

Monthly Electricity Bill Variation has been identified and it was due to seasonal requirement and impact of solar generation.

CHAPTER -3
CONNECTED LOAD DETAILS

3.1 Connected load of college

Table 5:- Connected load of college

Sr. No	Type of Electrical Equipment	Rated (watt)	Quantity (no)	Total Watt	Load (%)
1	Tube Light (LED)	10	192	1920	4.91
2	Ceiling Fan	80	146	11680	29.90
3	Exhaust Fan	100	3	300	0.77
4	PC	70	81	5670	14.51
5	Printer	150	19	2850	7.29
6	Photocopy M/c	550	3	1650	4.22
7	Water cooler	1550	3	4650	11.90
8	Water purifier	1500	1	1500	3.84
9	Refrigerator	250	4	1000	2.56
10	Water pump	2200	2	4400	11.26
11	Air Conditioners	1500	1	1500	3.84
12	Projector	150	7	1050	2.69
13	Interactive Board	150	6	900	2.30
Total Connected Load				**39,070**	**100**

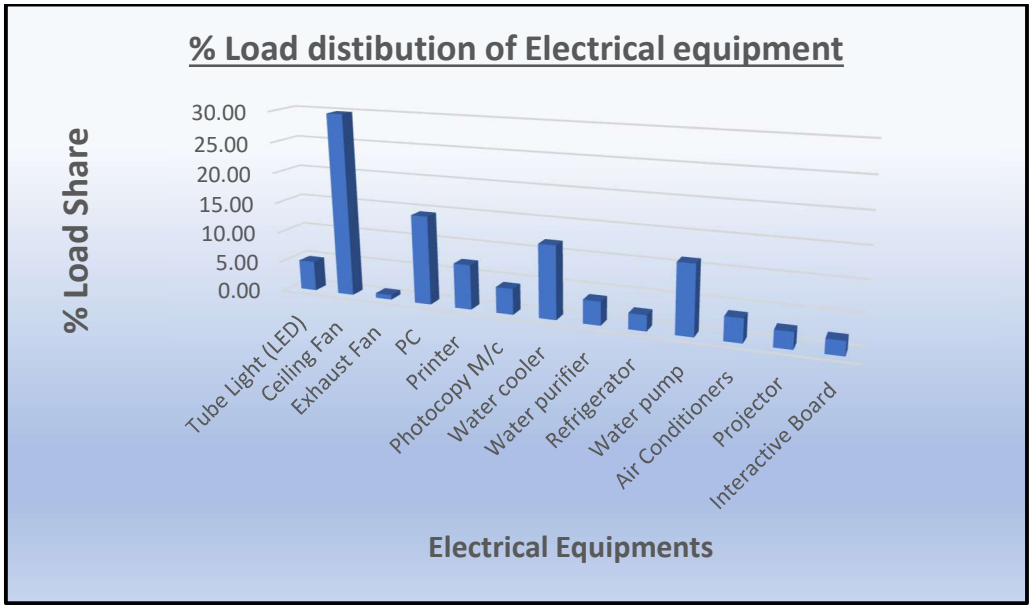


Fig.6:- Graphical Presentation % Load Distribution

CHAPTER- 4
CARBON DI-OXIDE EMISSION

4.1 CO2 Emission

Table 6:- CO_2 Emission

Month	Power Consumption (KwH)	CO2 Emission (Kg)
Apr-23	0	0
May-23	2630	1873
Jun-23	2699	1922
Jul-23	2598	1850
Aug-23	2089	1487
Sep-23	2793	1989
Oct-23	3225	2296
Nov-23	1868	1330
Dec-23	1270	904
Jan-24	1239	882
Feb-24	1640	1168
Mar-24	2001	1425
Apr-24	2529	1801
May-24	1848	1316
Total	**28429**	20241

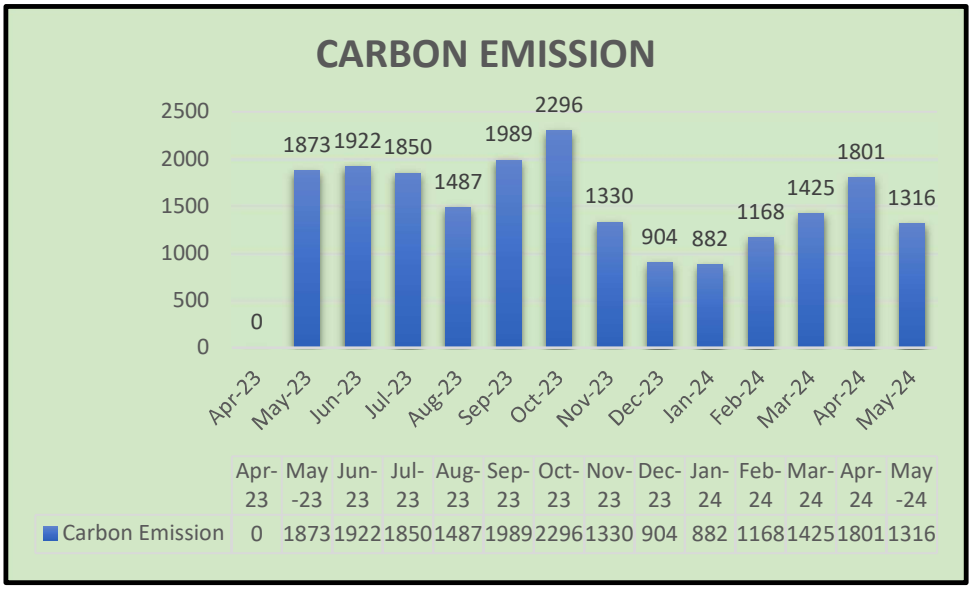
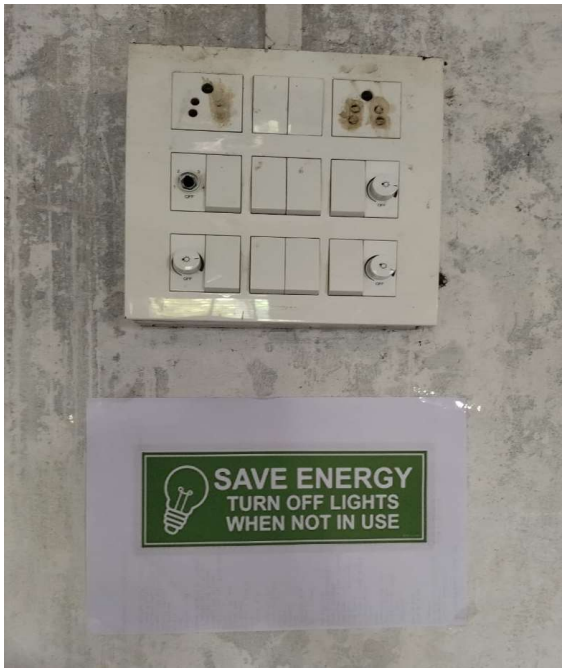


Fig.7:- Graphical Presentation of Carbon Emission

CHAPTER- 5
ENERGY CONSERVATION MEASURES

ENERGY CONSERVATION INITIATIVES IMPLEMENTED DURING 2023-24

1) All Class Rooms and labs have **Display Messages** regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. “Save Energy – Turn off lights when not in use”, “Conserve Energy – Turn off lights”,



5.1 Use of Master Switch Outside each room

Installation of a Master Switch outside a room can make it easy for a person to switch off all the appliances of a room in case someone forgets to switch off while leaving the room. This can help improving energy efficiency.

Table-7:- Payback calculation- Use of Master switch

Sr. No	Items	Parameters	Units
1	Consider following equipments switched off for one hr in a month	No.	142
2	Tube Light (LED) - 192 nos	Watt	1920
3	Ceiling Fan - 146 nos	Watt	11680
4	Total wattage saved in a month	KW	14
5	Annual Enery saved	KwH	163
6	Cost of Energy saved	INR	1436
7	Cost of new MCB required (20 nos) **@200/-**	INR	4000
8	Simple payback (Investment/annual savings)	Years	3

5.2 Replacing existing Ceiling Fans of rating 80W by 28 W BLDC Ceiling Fan

Table-8:- Payback calculation- Replacing existing ceiling fans

Sr. No	Items	Parameters	Units
1	80 Watt Ceiling fans (A1)	No.	142
2	Rated Power (A2)	Watt/ unit	80
3	Operating Hrs (B)	Hrs/day	4
4	Operating Annual Days ©	Days/Year	200
5	Unit Consumed Annually (A1*A2*B*C)/1000)	kWh/Year	9088
	REPLACEMENT		
6	Replacement with 28 W BLDC Ceiling Fan	Watt/unit	28
7	Unit Consumed Annually	kWh/Year	3181
8	Energy Saving (Old- New Annual Consumption)	kWh	5907
9	Annual Energy Cost Saving @ Rs. 8.80 per unit	INR	51983
	COST BENEFIT CALCULATION		
10	Capital Cost @2300 per item	INR	326600
11	TOTAL INVESTMENT	INR	326600
12	Net Annual Saving	INR	51983
13	Simple payback (Investment/annual savings)	Years	6.3

5.3 Providing AMC for maintenance of rooftop Solar system

Solar system is not performing as per the design since after 11 months of commissioning, so by maintaining the solar panel and inverter system, there is a huge scope of energy saving as detailed below.

Table-9:- Payback calculation- Providing AMC for rooftop Solar system

Sr. No	Items	Parameters	Units
1	Average Solar Generation after commissioning (11 Months)	Kwh/month	951
2	Average Solar Generation during last year (11 Months)	Kwh/month	148
3	Total generation loss	Kwh/month	803
4	Excess billed amount	INR/month	5300
5	Approx. AMC Charges (Annually)	INR	50000
6	Payback period	Months	1

5.4 General Recommendations

- In few cases, generally, all the tube lights in a class room and staff rooms are kept ON, even though; there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24˚C to 26˚C.
- Lights in toilet area may be kept OFF during daytime
- Use AUTOMATIC POWER FACTOR CORRECTION (APFC) Panel FOR PF improvement.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.

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2022-23

ENERGY AUDIT REPORT

CONSULTATION REPORT

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ARTS, COMMERCE & SCIENCE COLLEGE

WADI, NAGPUR-440023

YEAR 2022-23

Prepared By

Infinite Energy Services

Energy Consultants, Auditors and Risk Assessor

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Energy Audit report prepared by IES,

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Figure: Satellite image of college from google earth


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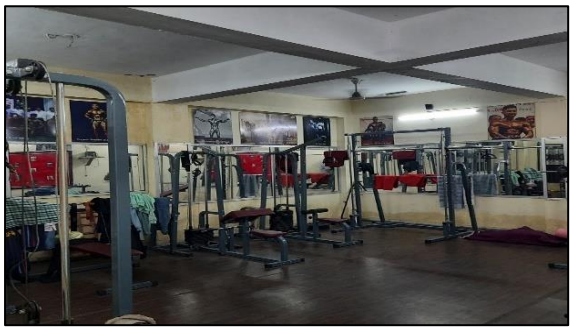

WELL EQUIPPED GYMNASIUM

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ROOFTOP SOLAR PV PANELS

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Energy audit helps to understand more about the ways energy is used in any institute and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to final consumer becomes 50%. Hence one unit saved in the end user is equivalent to two units generated in the power plant.

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Energy Audit Study is divided into following steps

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College uses energy in the form of electricity purchased from grid connected system. The electricity bill is based on the 73/LT-X B10-20 KW Public ser oth. The college has sanction demand of 14.5 KW.

Also college has installed on grid Solar PV panels of 10KWp capacity connected. During Audit, it is found that 10KWp solar panels were properly installed and well-maintained.

Fig: PV Solar Panels

MSEDCL import power billing is being done as net metering. Total billing amount of electricity bill of college has been found to be about INR 31270/ - for 12 months analysis period from April - 2022 to March- 2023.

Also one HSDG of rating 25 KVA is being used in case of emergency. The average yearly diesel consumption is 50 liters.

Fig: 25 KVA DG Set

CHAPTER- 2
ELECTRICITY BILL ANALYSIS

2.1 Monthly Electrical Energy Consumption of college (Year 2022-23)

Table:-1 Electrical Energy consumption (Year 2022-23)

Sr. No	Month & Year	Total Unit Billed (kWh)
1	Apr-22	399
2	May-22	400
3	Jun-22	200
4	Jul-22	200
5	Aug-22	200
6	Sept-22	200
7	Oct-22	200
8	Nov-22	200
9	Dec-22	200
10	Jan-23	200
11	Feb-23	200
12	Mar -23	200
	Total	**2799**

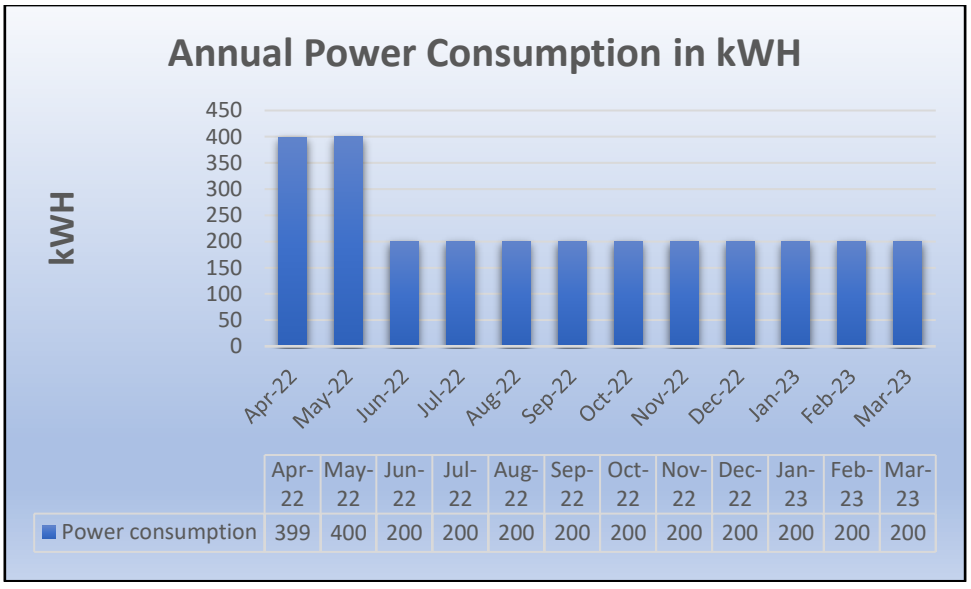


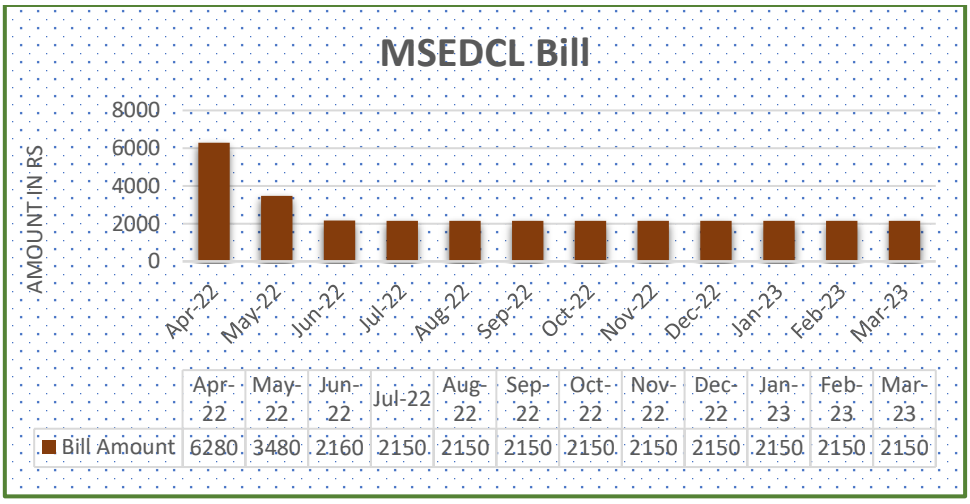
Fig.2.1- Graphical Presentation for Monthly Energy Consumption (kWh)

2.2 Monthly Total Electricity bills of college (Year 2022-23)

The monthly Electricity bill amount of the college for all four energy meters are as under:

Table:- 2 Energy consumption and billing amount (Year 2022-23)

Sr. No.	Month	Electricity Bill Amount (Rs.)
1	Apr-22	6280
2	May-22	3480
3	Jun-22	2160
4	Jul-22	2150
5	Aug-22	2150
6	Sep-22	2150
7	Oct-22	2150
8	Nov-22	2150
9	Dec-22	2150
10	Jan-23	2150
11	Feb-23	2150
12	Mar-23	2150
	Total Annual Bill	**31270**
	Average Monthly Bill	**2606**



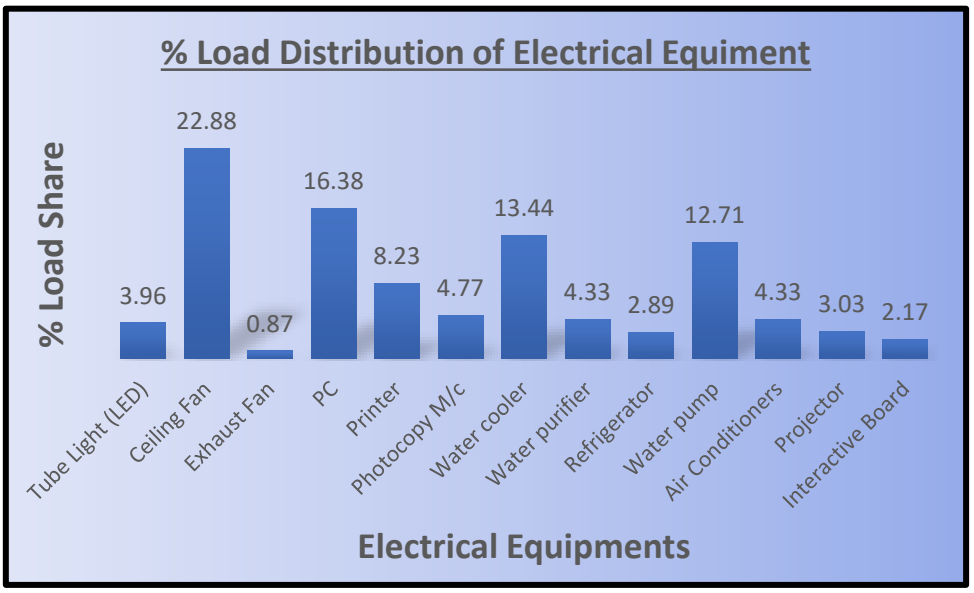
<u>Conclusion</u>: Monthly Electricity Bill Variation has been identified.

CHAPTER -3
CONNECTED LOAD DETAILS

3.1 Connected load of college

Table 3:- Connected load of college

Sr. No	Type of Electrical Equipment	Rated (watt)	Quantity (no)	Total Watt	Load (%)
1	Tube Light (LED)	10	137	1370	3.96
2	Ceiling Fan	80	99	7920	22.88
3	Exhaust Fan	100	3	300	0.87
4	PC	70	81	5670	16.38
5	Printer	150	19	2850	8.23
6	Photocopy M/c	550	3	1650	4.77
7	Water cooler	1550	3	4650	13.44
8	Water purifier	1500	1	1500	4.33
9	Refrigerator	250	4	1000	2.89
10	Water pump	2200	2	4400	12.71
11	Air Conditioners	1500	1	1500	4.33
12	Projector	150	7	1050	3.03
13	Interactive Board	150	5	750	2.17
Total Connected Load				**34,610**	**100**

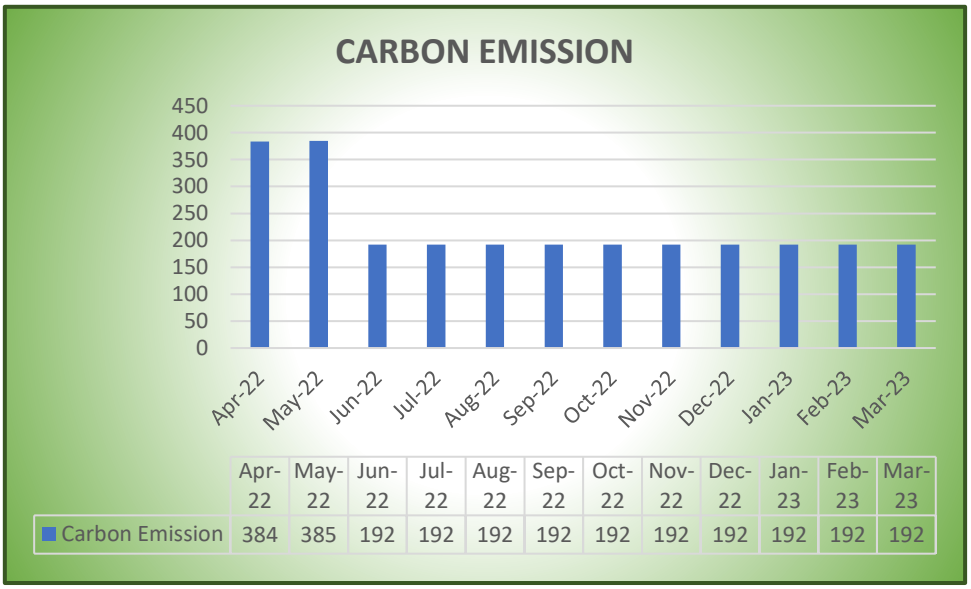


CHAPTER- 4
CARBON DI-OXIDE EMISSION

4.1 CO2 Emission

Table 4:- CO_2 Emission

Month	Power Consumption (KwH)	CO2 Emission (Kg)
Apr-22	399	384
May-22	400	385
Jun-22	200	192
Jul-22	200	192
Aug-22	200	192
Sep-22	200	192
Oct-22	200	192
Nov-22	200	192
Dec-22	200	192
Jan-23	200	192
Feb-23	200	192
Mar-23	200	192
Total	**2799**	**2691**



CHAPTER- 5
ENERGY CONSERVATION MEASURES

5.1 Use of Master Switch Outside each room

Installation of a Master Switch outside a room can make it easy for a person to switch off all the appliances of a room in case someone forgets to switch off while leaving the room. This can help improving energy efficiency.

5.2 Replacing Ceiling Fan 80W by 28 W BLDC Ceiling Fan

Sr. No	Items	Parameters	Units
1	Ceiling Fan (80W)	No.	136
2	Rated Power	Watt/ unit	80
3	Operating Hrs	Hrs/day	12
4	Operating Annual Days	Days/Year	300
5	Unit Consumed Annually (AI*AII*B*C)/1000)	kWh/Year	39168
6	REPLACEMENT		
7	Replacement with 28 W BLDC Ceiling Fan	Watt/unit	28
8	Unit Consumed Annually	kWh/Year	13709
9	Energy Saving (Old- New Annual Consumption)	kWh	25459
10	Annual Energy Cost Saving @ Rs. 6.20 per unit	INR	1,57,846/-
11	COST BENEFIT CALCULATION		
12	Capital Cost @1800 per item	INR	2,44,800/-
13	TOTAL INVESTMENT	INR	2,44,800/-
14	Net Annual Saving	INR	1,57,846/-
15	Simple payback (Investment/annual savings)	Month	19

5.3 Replacing 225MM EX Fans by 250MM BLDC EX Fans

Sr. No	Items	Parameters	Units
1	225MM EX Fans (60 W)	No.	03
2	Rated Power	Watt/ unit	100
3	Operating Hrs	Hrs/day	12
4	Operating Annual Days	Days/Year	300
5	Unit Consumed Annually (AI*AII*B*C)/1000)	kWh/Year	1080
6	REPLACEMENT		
7	Replacement with 20W (250MM BLDC) EX Fans	Watt/unit	20
8	Unit Consumed Annually	kWh/Year	216
9	Energy Saving (Old- New Annual Consumption)	kWh	864
10	Annual Energy Cost Saving @ Rs. 6.20 per unit	INR	5357/-
11	COST BENEFIT CALCULATION		
12	Capital Cost @2000 per item	INR	6,000/-
13	TOTAL INVESTMENT	INR	6,000/-
14	Net Annual Saving	INR	5,357/-
15	Simple payback (Investment/annual savings)	Month	14

5.4 General Recommendations

- All Class Rooms and labs to have **Display Messages** regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. “Save electricity”. **Display the stickers of save electricity, save nature** everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- In few cases, generally, all the tube lights in a class room and staff rooms are kept ON, even though; there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24˚C to 26˚C.
- Lights in toilet area may be kept OFF during daytime
- Use AUTOMATIC POWER FACTOR CORRECTION (APFC) Panel FOR PF improvement.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.

VSPM Academy of Higher Education Nagpur's

Jawaharlal Nehru Arts, Commerce and Science College, Wadi, Nagpur- 440023 (M.S.)

(Affiliated to RTM Nagpur University, Nagpur)

Website: www.jncwadi.ac.in E-mail: jnc.wadi@rediffmail.com Phone: (07104) 220963

2021-22

REPORT

On

"ENERGY AUDIT"

at

JAWAHARLAL NEHRU ARTS COMMERCE & SCIENCE COLLEGE

WADI, NAGPUR-440023

YEAR 2021-22

Prepared by-

Orbit Energy & Engineering Services

Licensed Electrical Contractors, Chartered Electrical Safety Engineers, Chartered Engineers, Energy Auditors & Technical Consultants

G-2, Plot No 2A, Irrigation Colony, Trimurty Nagar, Nagpur-440022.

Contact No: 7709978395, E-mail: orbitenergy.es@gmail.com & prashant.akarte@gmail.com

Energy Audit Report
Jawaharlal Nehru Arts, Commerce & Science College, Wadi, Nagpur Year 2021-22

CONTENT

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ACKNOWLEDGEMENT

Orbit Energy & Engineering Services (OEES), Nagpur, takes this opportunity to appreciate & thank to the management of **Jawaharlal Nehru Arts, Commerce & Science College, Wadi, Nagpur** for giving us an opportunity to conduct energy audit for the college.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation the course of study.

Sincerely,

Prashant Akarte (Managing Partner)
B.E. (Electrical)
Certified Energy Auditor [EA-17568]
(BEE, Ministry of Power, Govt. of India)
Chartered Electrical Safety Engineer
Chartered Engineer
(The Institution of Engineers (India))

Ashish Vyawhare (Managing Partner)
B.E.(Power), MBA (Finance & Marketing)
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(BEE, Ministry of Power, Govt. of India)
PG Diploma (Energy Management)
Certified Boiler Operation Engineer

Energy Audit Report
Jawaharlal Nehru Arts, Commerce & Science College, Wadi, Nagpur Year 2021-22

EXECUTIVE SUMMARY

The executive summary of the energy audit report furnished in this section briefly gives the identified energy conservation measures and other recommendation during the project that can be implemented in a phased manner to conserve energy, increase productivity inside the college campus.

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy / cost saving exists and prepare proposals for energy / cost saving along with investment and payback periods.

The salient observations and recommendations are given below,

Jawaharlal Nehru Arts, Commerce & Science collage, Nagpur, uses energy in the following forms:

1) From MSEDCL
2) From Grid connected Roof Top Solar PV
3) High speed Diesel Generator (HSDG)

Electrical energy is used for various applications, like: Computers, Lighting, Air-Conditioning, Fans Other Laboratory Equipment, Printers, Xerox machines, CCTV, UPS, LCD Projector, Router system, Flood light, Pumping motor etc.
The average cost of energy is around **Rs. 3,638/Month** (Including diesel cost)**.**

The Specific Energy Consumption **(SEC)** is the ratio of energy required per square meter. In this case the SEC is evaluated as electrical units consumed per square meter of area. It is calculated as under for (Electricity): **1.931 kWh / Sq.m.**

After the measurement and analysis, we propose herewith following Energy Efficiency Improvement measures.

AREA OF IMPROVEMENT

TIMER CONTROLLED STREET LIGHTS

Installation of “Timer control on street lighting” in college campus is recommended.

CEILING FAN AND EXHAUST FAN:

Replacement of “conventional ceiling fan (80W)” by energy efficient star rated fan or BLDC based energy efficient fan (28W) in “all departments classes” have great potential for energy saving.

- Replacement of “conventional exhaust fan (100 Watt)” by energy efficient star rated

fan or BLDC based energy efficient Fan (20 Watt) in all departments classes and faculties cabin have great potential for energy saving.

IOT BASED ENERGY MONITORING SYSTEM AT MAIN FEEDER

- Installation of "Cloud based (IoT based) energy monitoring system" including harmonic measurement (total voltage and current harmonic distortion %) in power house will be good initiate for energy monitoring as well as student demo project for management. Expected energy saving potential about 2 to 4%.

ENERGY Management Workshop and Training:

- Develop energy management policies for college. Establish a procurement policy that is energy saving and eco-friendly.
- Conduct awareness and training programs for faculty, student and non-teaching staffs. Conduct seminars, workshops and exhibitions on energy management education.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in energy management system.

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Fig: PV Solar Panels

Total billing amount of electricity bill of college has been found to be about INR 38760/ - for 12 months analysis period from April - 2021 to March- 2022.

Also one HSDG of rating 25 KVA is being used in case of emergency. The average yearly diesel consumption is 50 liters.

Fig: 25 KVA DG Set

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Table-1 Electrical Energy consumption (year 2021-22)

Sr. No	Month & Year	Total Unit Billed (kWh)
1	Apr-21	201
2	May-21	414
3	Jun-21	708
4	Jul-21	1187
5	Aug-21	1107
6	Sept-21	0
7	Oct-21	0
8	Nov-21	0
9	Dec-21	0
10	Jan-22	430
11	Feb-22	199
12	Mar -22	399
		Total = 4645

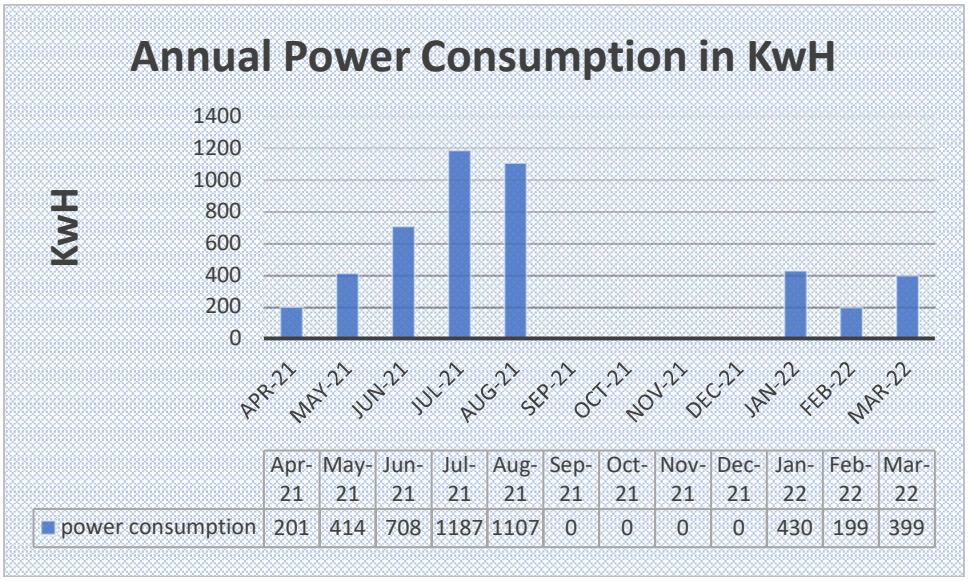


Fig.2.1- Graphical Presentation for Monthly Energy Consumption (kWh)

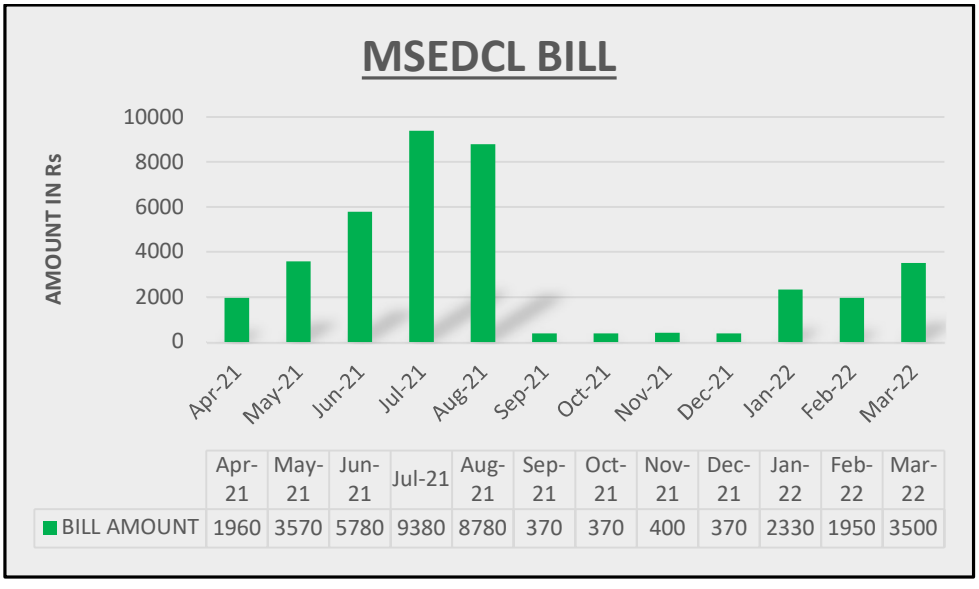
Energy Audit Report
Jawaharlal Nehru Arts, Commerce & Science College, Wadi, Nagpur Year 2021-22

2.2 Monthly Total Electricity bills of collage (Year 2021-22)

The monthly Electricity bill amount of the collage for all four energy meters are as under:

Table-2 Energy consumption and billing amount (year 2021-22)

Sr. No.	Month	Electricity Bill Amount (Rs.)
1	Apr-21	1960
2	May-21	3570
3	Jun-21	5780
4	Jul-21	9380
5	Aug-21	8780
6	Sept-21	370
7	Oct-21	370
8	Nov-21	400
9	Dec-21	370
10	Jan-22	2330
11	Feb-22	1950
12	Mar-22	3500
	Total Annual Bill =	**38760**
	Average Monthly Bill =	**3230**



Conclusion: Monthly Electricity Bill Variation has been identified.

Energy Audit Report
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CHAPTER -3
CONNECTED LOAD DETAILS

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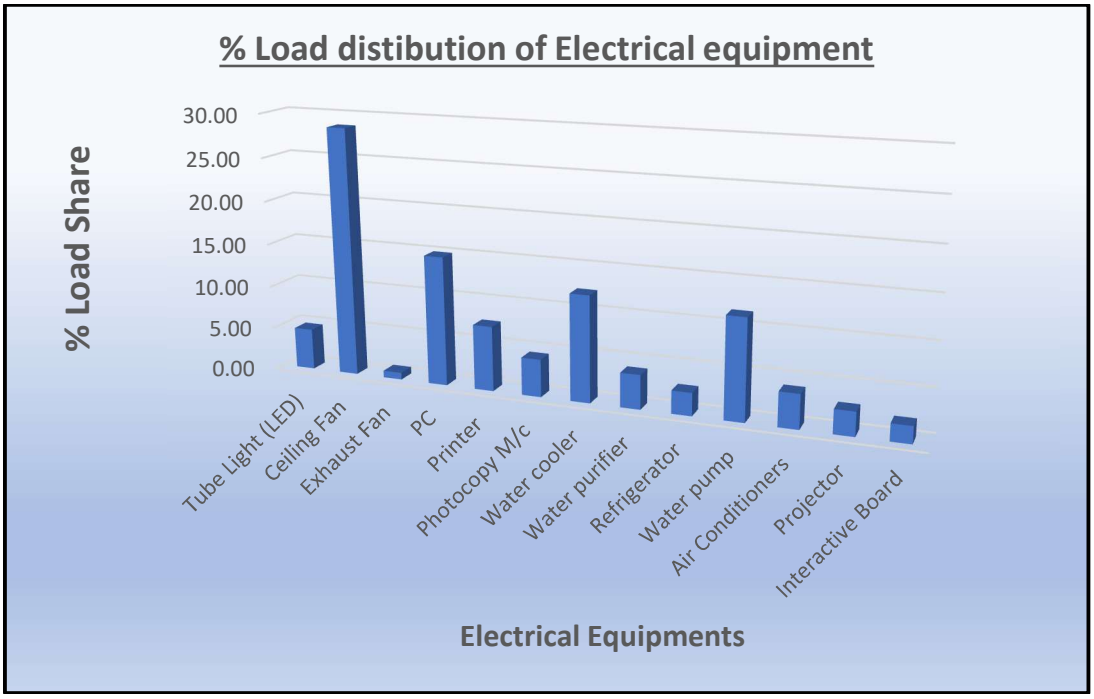
8	Water purifier	**1500**	1	1500	3.95
9	Refrigerator	250	4	1000	2.63
10	Water pump	2200	2	4400	11.58
11	Air Conditioners	1500	1	1500	3.95
12	Projector	150	7	1050	2.76
13	Interactive Board	150	5	750	1.97
Total Connected Load				**38,000**	**100**



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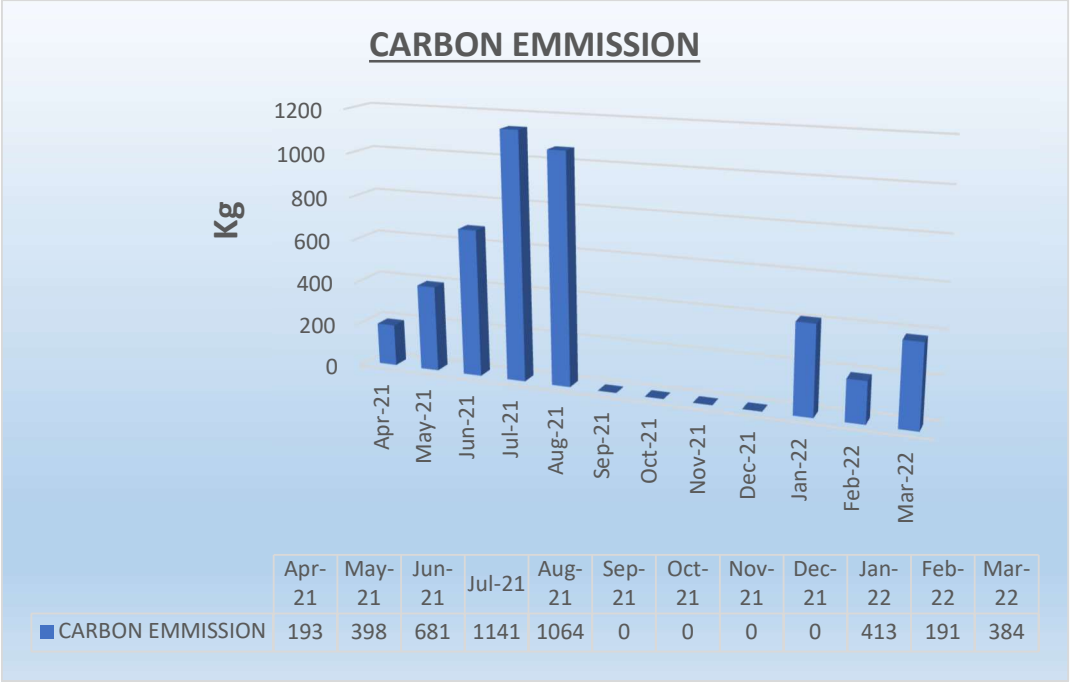
CHAPTER- 4
CARBON DI-OXIDE EMISSION

4.1 CO2 Emission

Table 4 : CO_2 Emission

Month	power Consumption (KwH)	CO2 Emission (Kg)
Apr-21	201	193
May-21	414	398
Jun-21	708	681
Jul-21	1187	1141
Aug-21	1107	1064
Sep-21	0	0
Oct-21	0	0
Nov-21	0	0
Dec-21	0	0
Jan-22	430	413
Feb-22	199	191
Mar-22	399	384
Total	**4645**	**4465**



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CHAPTER- 5
ENERGY CONSERVATION MEASURES

5.1 Grid Connected Roof Top Solar PV System (10 KWp) maintenance:

There is good potential for improvement in 10KWp installed solar panels by regular preventive maintenance and surrounding area housekeeping. From the MSEDCL bill records for last one year, it is observed that, power is being imported except three months of rainy season. During Audit, the solar panels were found covered with tree branches at one corner. (Images attached)

Fig: UN-UTILISED SOLAR PANELS PORTION (COVERED BY TREE)

Recommendation: - It is recommended to clean the solar panels surrounding area on regular interval and follow the preventative maintenance practice to get the solar panel utilization.

5.2 Replacing Ceiling Fan 80W by 28 W BLDC Ceiling Fan

Sr. No	Items	Parameters	Units
1	Ceiling Fan (80W)	No.	136
2	Rated Power	Watt/ unit	80
3	Operating Hrs	Hrs/day	12
4	Operating Annual Days	Days/Year	300
5	Unit Consumed Annually (AI*AII*B*C)/1000)	kWh/Year	39168
6	REPLACEMENT		
7	Replacement with 28 W BLDC Ceiling Fan	Watt/unit	28
8	Unit Consumed Annually	kWh/Year	13709
9	Energy Saving (Old- New Annual Consumption)	kWh	25459
10	Annual Energy Cost Saving @ Rs. 6.20 per unit	INR	1,57,846/-
11	COST BENEFIT CALCULATION		
12	Capital Cost @1800 per item	INR	2,44,800/-
13	TOTAL INVESTMENT	INR	2,44,800/-
14	Net Annual Saving	INR	1,57,846/-
15	Simple payback (Investment/annual savings)	Month	19

5.3 Replacing 225MM EX Fans by 250MM BLDC EX Fans

Sr. No	Items	Parameters	Units
1	225MM EX Fans (60 W)	No.	03
2	Rated Power	Watt/ unit	100
3	Operating Hrs	Hrs/day	12
4	Operating Annual Days	Days/Year	300
5	Unit Consumed Annually (AI*AII*B*C)/1000)	kWh/Year	1080
6	REPLACEMENT		
7	Replacement with 20W (250MM BLDC) EX Fans	Watt/unit	20
8	Unit Consumed Annually	kWh/Year	216
9	Energy Saving (Old- New Annual Consumption)	kWh	864
10	Annual Energy Cost Saving @ Rs. 6.20 per unit	INR	5357/-
11	COST BENEFIT CALCULATION		
12	Capital Cost @2000 per item	INR	6,000/-
13	TOTAL INVESTMENT	INR	6,000/-
14	Net Annual Saving	INR	5,357/-
15	Simple payback (Investment/annual savings)	Month	14

5.4 General Recommendations

- All Class Rooms and labs to have **Display Messages** regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. "Save electricity". **Display the stickers of save electricity, save nature** everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- In few cases, generally, all the tube lights in a class room and staff rooms are kept ON, even though; there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24˚C to 26˚C.
- Lights in toilet area may be kept OFF during daytime
- Use AUTOMATIC POWER FACTOR CORRECTION (APFC) Panel FOR PF improvement.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.