

ENERGY AUDIT REPORT

of

The Poona Gujarati Kelavani Mandal's,
HARIBHAI V. DESAI COLLEGE, PUNE



Year: 2022-23

Prepared by:

ENGRESS SERVICES

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ISO: 9001-2015 Certified (Cert No: 23EQKC13),
ISO: 14001-2015 Certified (Cert No: 23EEKW20)

ENERGY AUDIT CERTIFICATE

Certificate No: ES/HVDC/22-23/01

Date: 20/4/2023

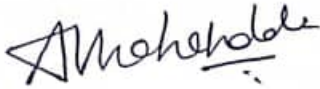
This is to certify that we have conducted Energy Audit at The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Pune, in the Academic year 2022-23.

.The College has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum Usage of Day Lighting
- Installation of 20 kWp Roof Top Solar PV Plant
- Installation of 125 LPD Solar Thermal Water Heating System

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

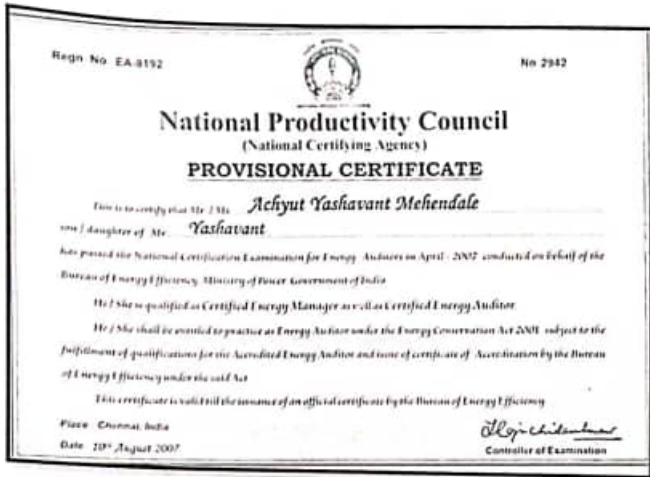
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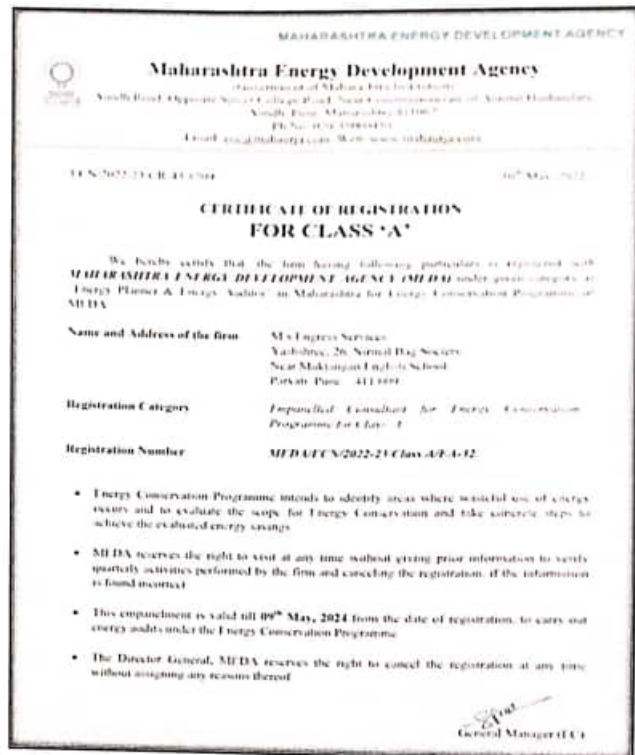
A Y Mehendale,
B E-Mechanical, M Tech- Energy
BEE Certified Energy Auditor, EA-8192



REGISTRATION CERTIFICATES



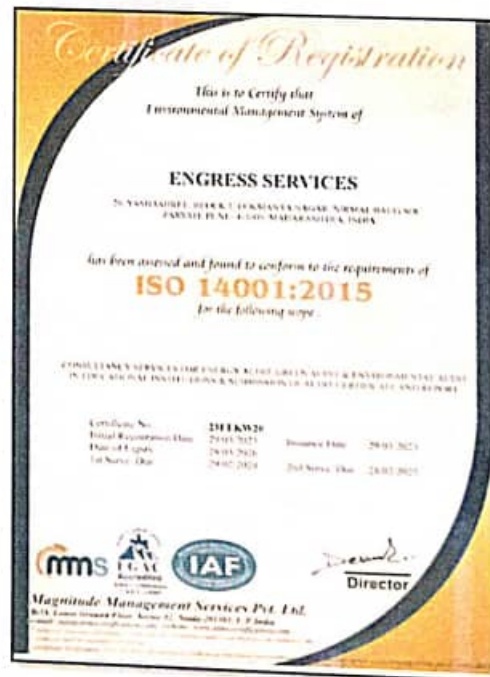
AUDITOR CERTIFICATE



MEDA Registration Certificate



ISO: 9001-2015 Certificate



ISO: 14001-2015 Certificate



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ACKNOWLEDGEMENT

We Engress Services, Pune, express our sincere gratitude to the management of The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Pune for awarding us the assignment of Energy Audit of their Campus for the Year : 2022-23.

We are thankful to all the staff members for helping us during the field study.



EXECUTIVE SUMMARY

1. The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College Pune consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	181	kW
2	Annual Energy Purchased	54463	kWh

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	54463	kWh
2	Annual Energy Generated	24000	kWh
3	Annual Energy Consumed=1+2	78463	kWh
4	Total Built up area of College	3348.42	m ²
5	Energy Performance Index =(3) / (4)	23.43	kWh/m ²

4. Study of Lighting Power Density & % Usage of LED Lighting:

No	Particulars	Value	Unit
1	Lighting Power Density	4.11	W/m ²
2	% of Usage of LED Lighting to Total Lighting Load	91	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of 20 kWp Roof Top Solar PV Plant.
- Installation of 125 LPD Solar Thermal Water Heating System

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere
2. Energy generated by Roof Top Solar PV Plant: 4 kWh/kWp per Day
3. Annual Solar Energy generation Days: 300 Nos

7. References:

- Audit Methodology: www.mahaurja.com
- Energy Conservation Building Code: ECBC-2017: www.beeindia.gov.in
- For CO₂ Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in



ABBREVIATIONS

LED	: Light Emitting Diode
MSEDCL	: Maharashtra State Electricity Distribution Company Limited
BEE	: Bureau of Energy Efficiency
ECBC	: Energy Conservation Building Code
MEDA	: Maharashtra Energy Development Agency
PV	: Photo Voltaic
Kg	: Kilo Gram
kWh	: kilo-Watt Hour
CO ₂	: Carbon Di Oxide
MT	: Metric Ton



CHAPTER-I INTRODUCTION

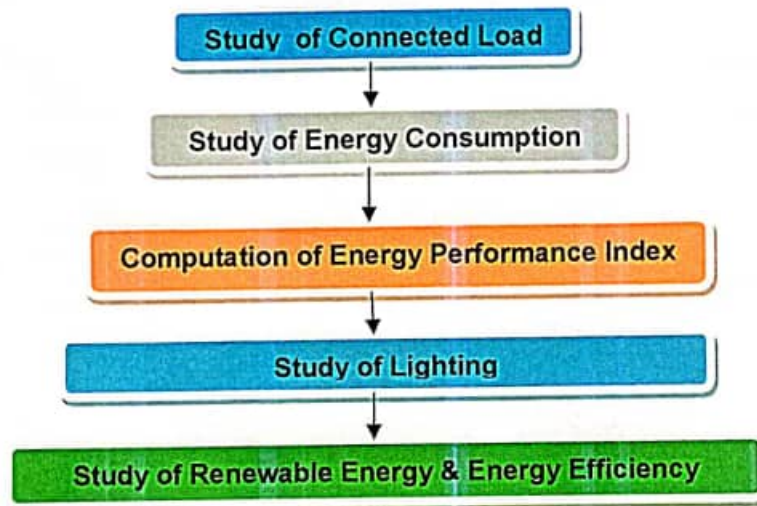
1.1 Introduction:

An Energy Audit is conducted at The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Budhwar Peth, Pune

The guidelines followed for conducting the Energy Audit are:

- BEE India's Energy Conservation Building Code: ECBC-2017
- Maharashtra Energy Development Agency (www.mahaurja.com)
- Tata Power: www.tatapower.com

1.2 Audit Procedural Steps:



1.3 College Location Image:



College
Campus

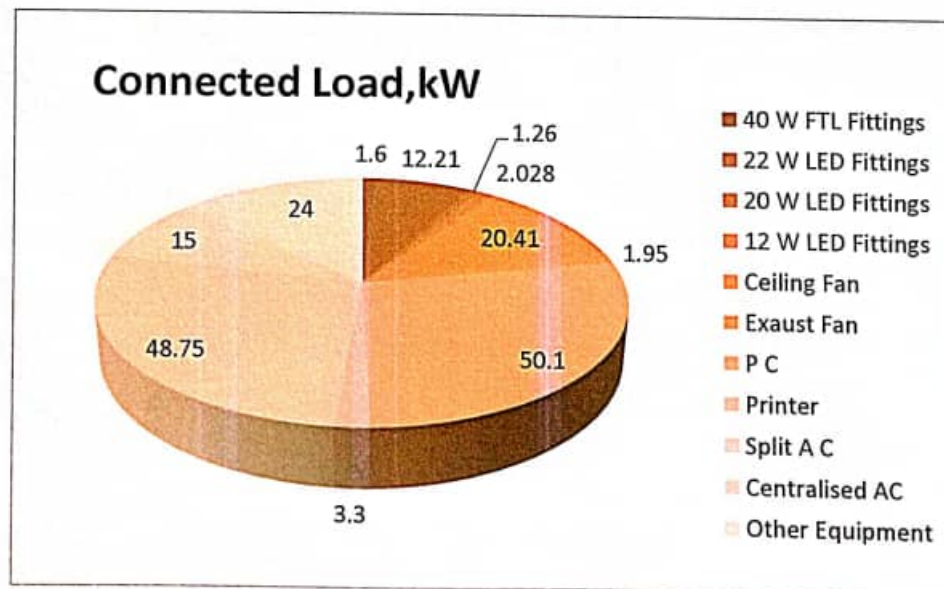
CHAPTER-II STUDY OF CONNECTED LOAD

The major contributors to the connected load of the College include:

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	40 W FTL Fittings	40	40	1.6
2	22 W LED Fittings	555	22	12.21
3	20 W LED Fittings	63	20	1.26
4	12 W LED Fittings	169	12	2.028
5	Ceiling Fan	314	65	20.41
6	Exhaust Fan	30	65	1.95
7	P C	334	150	50.1
8	Printer	22	150	3.3
9	Split A C	26	1875	48.75
10	Centralized AC			15
11	Other Equipment	160	150	24
12	Total			181

Chart No 1: Study of Connected Load:



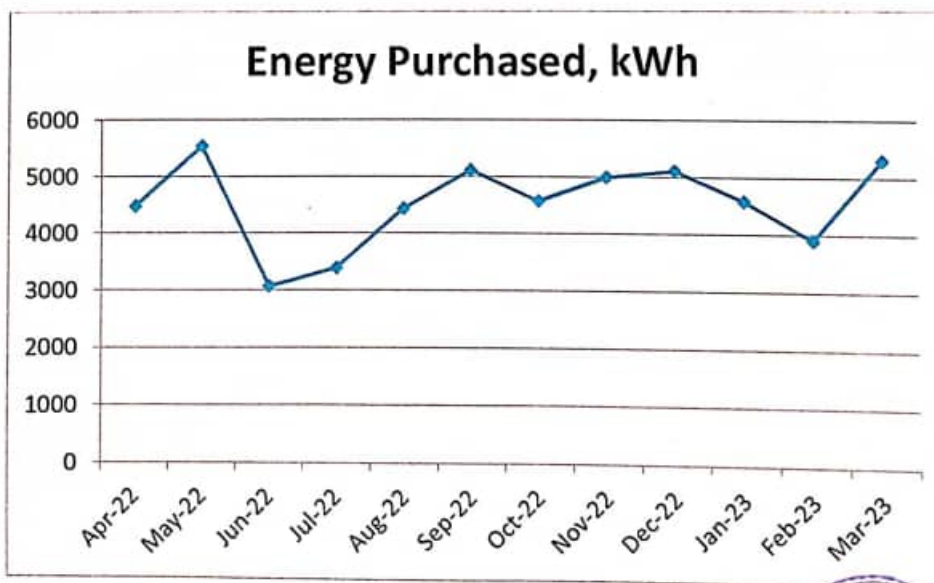
CHAPTER-III STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electrical Energy Consumption.

Table No 2: Electrical Energy Purchase Analysis- 2022-23:

No	Month	Energy Purchased, kWh	CO ₂ Emissions, MT
1	Apr-22	4475	4.03
2	May-22	5536	4.98
3	Jun-22	3065	2.76
4	Jul-22	3386	3.05
5	Aug-22	4431	3.99
6	Sep-22	5113	4.60
7	Oct-22	4569	4.11
8	Nov-22	4989	4.49
9	Dec-22	5106	4.60
10	Jan-23	4580	4.12
11	Feb-23	3904	3.51
12	Mar-23	5309	4.78
13	Total	54463	49.02
14	Maximum	5536	4.98
15	Minimum	3065	2.76
16	Average	4538.58	4.08

Chart No 2: Variation in Monthly Energy Purchased, kWh:



CHAPTER-IV STUDY OF ENERGY PERFORMANCE INDEX

Energy Performance Index: Energy Performance Index of a Building is its Annual Energy Consumption in Kilo Watt Hours per square meter of the Building

It is determined by:

$$\text{EPI} = \frac{\text{Annual Energy Consumption in kWh}}{\text{Total Built-up area in m}^2}$$

Now we compute the EPI for the College as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	54463	kWh
2	Energy Generated by Solar PV Plant	24000	kWh
3	Total Energy Consumed= 1+2	78463	kWh
4	Total Built up area of College	3348.42	m ²
5	Energy Performance Index =(3) / (4)	23.43	kWh/m ²



CHAPTER V STUDY OF LIGHTING

Terminology:

1. **Lumen** is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.
2. **Lux** is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.
3. **Circuit Watts** is the total power drawn by lamps and ballasts in a lighting circuit under assessment.
4. **Installed Load Efficacy** is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre (lux/W/m^2)
5. **Lamp Circuit Efficacy** is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt (lm/W)
6. **Installed Power Density.** The installed power density per 100 lux is the power needed per square metre of floor area to achieve 100 lux of average maintained illuminance on a horizontal working plane with general lighting of an interior. Unit: watts per square metre per 100 lux ($\text{W/m}^2/100 \text{ lux}$) 100 Installed power density ($\text{W/m}^2/100 \text{ lux}$)
7. **Lighting Power Density:** It is defined as Total Lighting Load in a room divided by the Area of that Room in square meters.

In this Chapter we compute the Lighting Power Density of Class Room and the percentage usage of LED Lighting to total Lighting Load of the College.

Now, we compute the usage of LED Lighting to Total Lighting Load, as under.

Table No 4: Computation of Lighting Power Density: Chemistry Lab:

No	Particulars	Value	Unit
1	Qty of 12 W LED Fittings in Chemistry Lab	19	Nos
2	Load of 12 W LED Fitting	12	W/unit
3	Total Load of 19 Nos, 12 W LED Fittings	228	W
4	Built up area of Class Room: GF-07	55.44	m^2
5	Lighting Power Density = (3)/(4)	4.11	W/m^2

Table No 5: Percentage Usage of LED Lighting to Total Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fitting	40	Nos
2	No of 22 W LED Fitting	555	Nos
3	No of 20 W LED Fitting	63	Nos
4	No of 12 W LED Fitting	169	Nos
5	Demand of 40 W FTL Fitting	40	W/Unit
6	Demand of 22 W LED Fitting	22	W/Unit
7	Demand of 20 W LED Fitting	20	W/Unit
8	Demand of 12 W LED Fitting	12	W/Unit
9	Load of 40 W FTL Fitting = $1 \times 4 / 1000$	1.6	kW
10	Load of 22 W LED Fitting = $2 \times 5 / 1000$	12.21	kW
11	Load of 20 W LED Fitting = $3 \times 6 / 1000$	1.26	kW
12	Load of 12 W LED Fitting = $4 \times 8 / 1000$	2.028	kW
13	Total Lighting Load = $9 + 10 + 11 + 12$	17.098	kW
14	Total LED Lighting Load = $10 + 11 + 12$	15.498	kW
15	% of LED to Total Lighting Load = $14 \times 100 / 13$	91	%

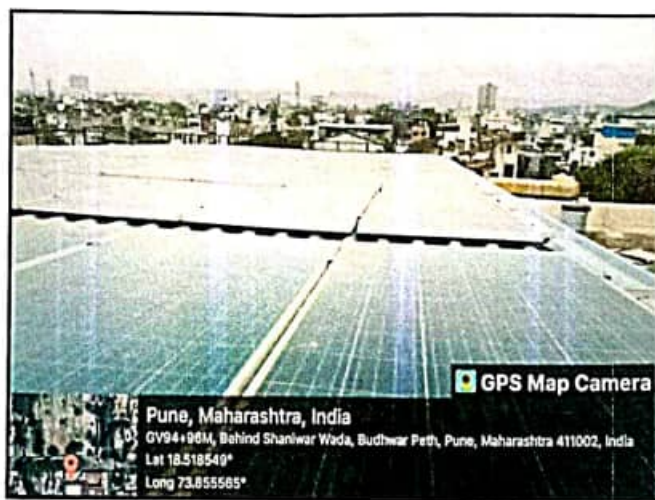
CHAPTER-VI STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

The College has installed:

- Roof Top Solar PV Plant of Capacity 20 kWp

Photograph of Roof Top Solar PV Plant:



6.2 Energy Efficiency Measures adopted:

- The College has Energy Efficient LED Fittings.
- Usage of BEE STAR Rated Equipment

Photographs of STAR Rated AC & LED Lighting:



GREEN AUDIT REPORT
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GREEN AUDIT CERTIFICATE

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Date: 20/4/2023

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The College has adopted following Green & Sustainable Practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 20 kWp Roof Top Solar PV Plant.
- Installation of 125 LPD Solar Thermal Water Heating System
- Provision of Separate Waste Collection Bins for Dry & Wet Waste
- Provision of Sanitary Waste Incinerator, for disposal of Sanitary Waste
- Provision of Photo-catalytic Reactor set up for Chemical Waste Water Treatment
- Installation of Rain Water Management Project
- Maintenance of Good Internal Road
- Maintenance of Terrace Garden
- Provision of Ramp for Divyangajan
- Creation of Awareness on Water Conservation, by Display of Posters

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

For Engress Services,



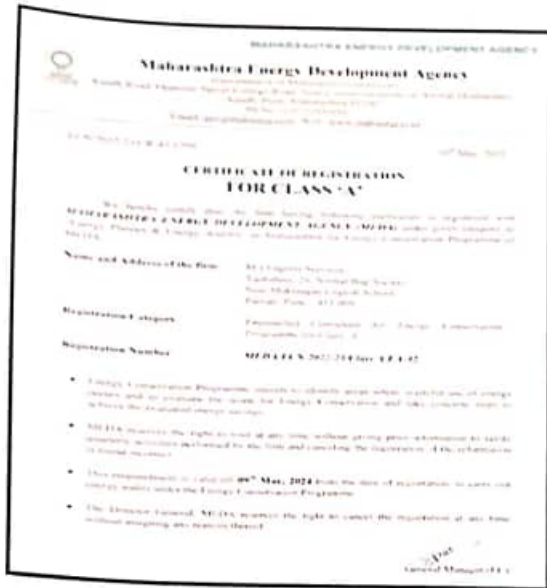
A Y Mehendale,

B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-8192

ASSOCHAM GEM Certified Professional: GEM: 22/788

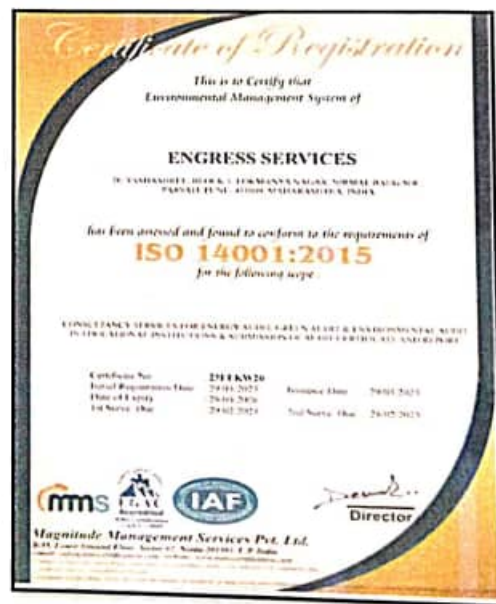
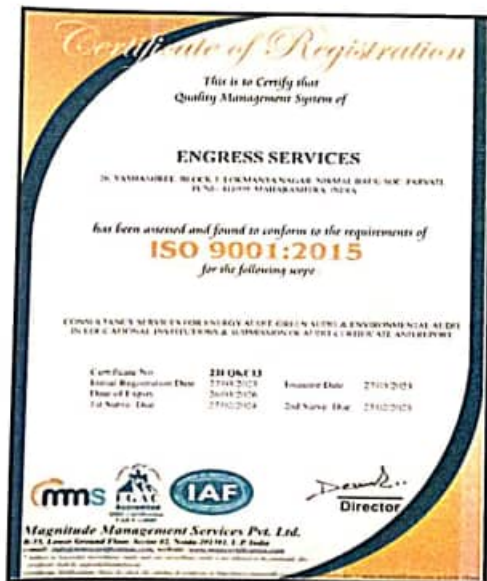


REGISTRATION CERTIFICATES



MEDA REGISTRATION CERTIFICATE

ASSOCHAM GEM CP CERTIFICATE



ISO: 9001-2015 Certificate

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2. Present Energy Consumption & CO₂ Emission:

No	Particulars	Value	Unit
1	Annual Energy Purchased	54463	kWh
2	Annual CO ₂ Emissions	49.02	MT

3. Renewable Energy & Reduction in CO₂ Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 20 kWp.
- The Energy generated by Solar PV Plant in 22-23 is 24000 kWh.
- Reduction in CO₂ Emissions in 22-23 is 21.6 MT

4. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Sanitary Waste	Provision of Sanitary Waste Incinerator
3	Waste Chemical Water	Provision of Photo-catalytic Reactor
4	E Waste Management	Provision of Separate E Waste Collection Bin

5. Rain Water Management:

The College has installed the Rainwater harvesting project; the rain water falling on the terrace is collected and is used for recharging the Well.

6. Green & Sustainable Practices:

- Maintenance of good Internal Road
- Maintenance of Terrace Garden.
- Provision of Ramp for Divyangajan
- Creation of awareness on Water Conservation Display of Posters

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere
2. Energy generated by Roof Top Solar PV Plant: 4 kWh/kWp per Day
3. Annual Solar Energy generation Days: 300 Nos

8. References:

- For CO₂ Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
kWh	Kilo Watt Hour
Kg	Kilo Gram
MT	Metric Ton
CO ₂	Carbon Di Oxide
Qty	Quantity

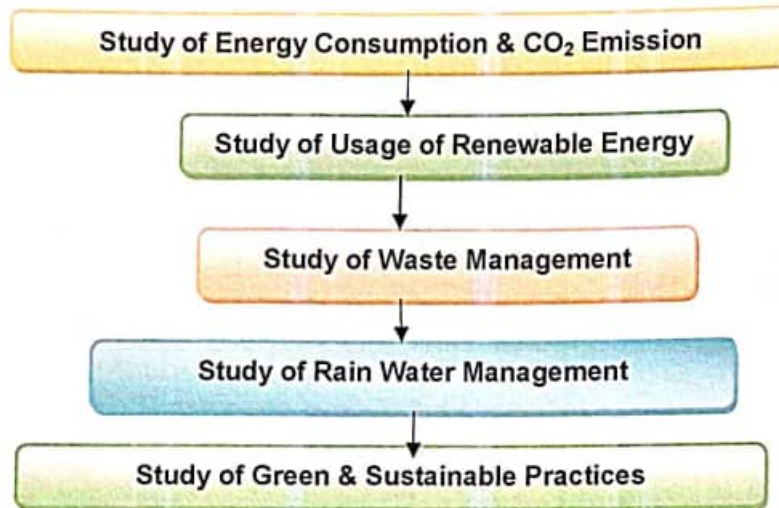


CHAPTER-I INTRODUCTION

1.1 Introduction:

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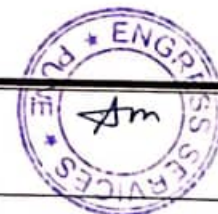
1.2 Audit Procedural Steps:



1.3 College Location Image:



College Campus



CHAPTER-II

STUDY OF ENERGY CONSUMPTION & CO₂ EMISSION

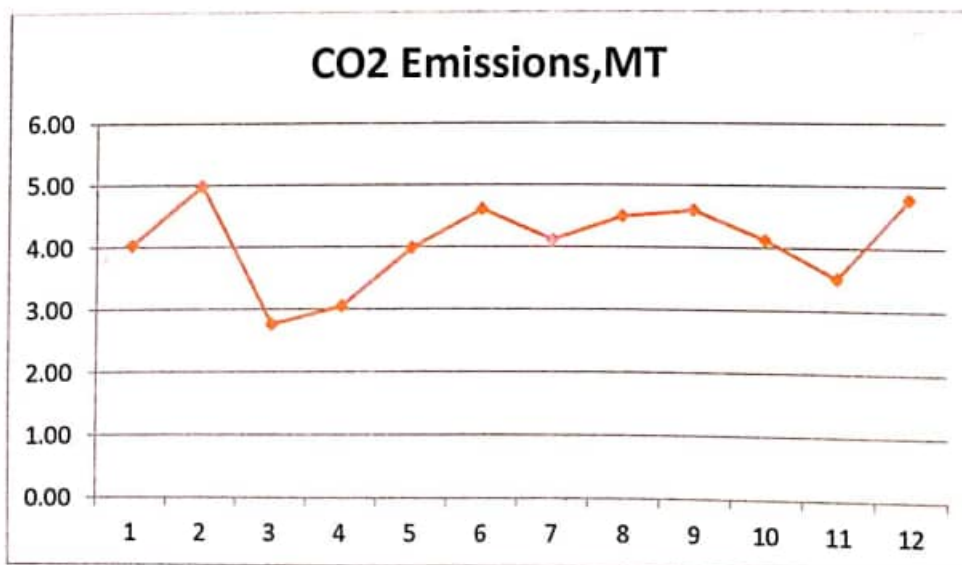
A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities.. The College uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO₂ Emissions: The basis of Calculation for CO₂ emissions due to Electrical Energy is as under. 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere

Table No 1: Month wise CO₂ Emissions:

No	Month	Energy Purchased, kWh	CO ₂ Emissions, MT
1	Apr-22	4475	4.03
2	May-22	5536	4.98
3	Jun-22	3065	2.76
4	Jul-22	3386	3.05
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13	Total	54463	49.02
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15	Minimum	3065	2.76
16	Average	4538.58	4.08

Chart No 1: Month wise CO₂ Emissions:



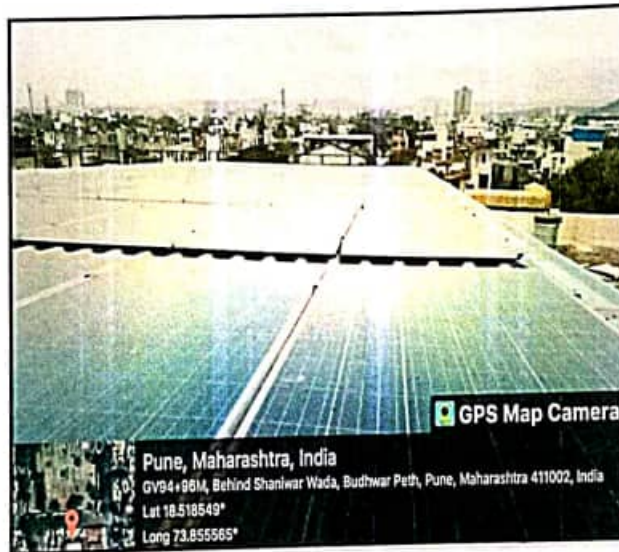
CHAPTER III STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 20 kWp
In the following Table, we present the reduction in CO₂ emissions due to Solar Energy:

Table No 3: Computation of Reduction in CO₂ Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	20	kWp
2	Energy Generated in per kWp	4	4 kWh/kWp
3	Annual Solar Energy generation Days	300	Nos
4	Energy Generated in the Year: 22-23	24000	kWh
5	1 kWh of Electrical Energy saves	0.9	Kg/kWh
6	Qty of CO ₂ Saved by Solar PV Plant = (4)*(5) /1000	21.6	MT of CO ₂

Photograph of Roof Top Solar PV Plant:



CHAPTER IV STUDY OF WASTE MANAGEMENT

4.1 Segregation of Waste at Source:

The recyclable waste, like paper waste is segregated at source and is handed over to authorized waste collecting agent for further recycling.

Photograph of Waste Collection Bin:



4.2 Sanitary Waste Management:

The College has installed a Sanitary Waste Incinerator to dispose of the Sanitary Waste.

Photograph of Sanitary Waste Incinerator:



4.3 Waste Chemical Water Management:

The College has installed Photo-Catalytic Reactor Unit to treat the Waste Chemical Water.

Photograph of Photo-Catalytic Reactor Unit:



4.4 E Waste Management:

For collection of E Waste, as separate Bin is provided.

Photograph of E Waste Collection Bin:



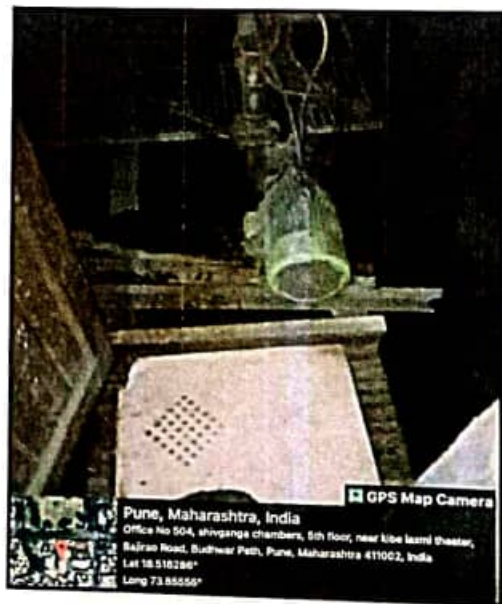
CHAPTER V STUDY OF RAIN WATER MANAGEMENT

The College has implemented the Rain Water Management Project. The College has installed Pipes from the terrace and the Rain water falling on the terrace is gathered and is used for recharging the Well.

Photograph of Rain Water Management Pipe & Well Recharge Point:



Rain Water
Carrying Pipe

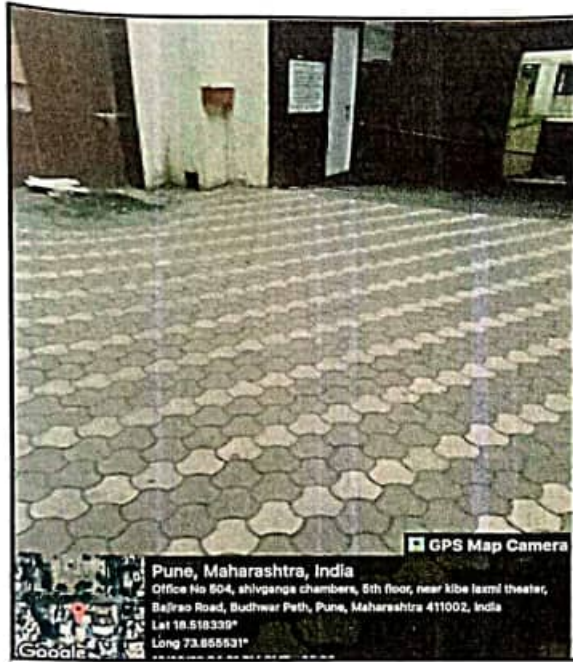


CHAPTER VI STUDY OF GREEN & SUSTAINABLE PRACTICES

6.1 Pedestrian Friendly Road & Terrace Garden:

The College has well maintained internal road to facilitate the easy movement of the students within the campus. The College has maintained Terrace Garden.

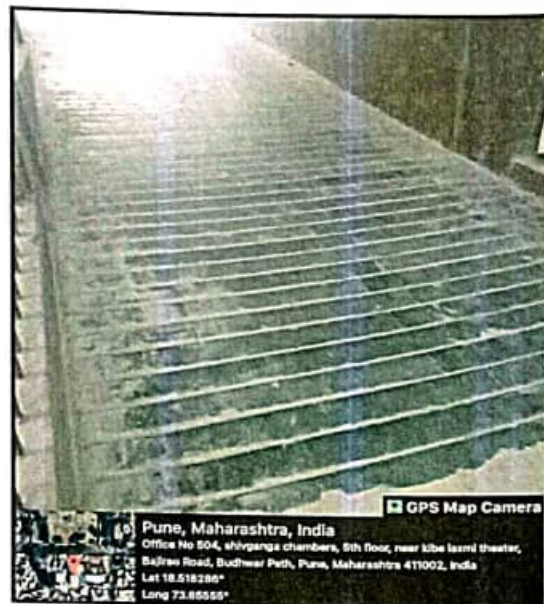
Photograph of Internal Road & Plantation:



6.2 Provision of Ramp for Divyangajan:

For easy movement of Divyangajan, the College has made provision of Ramp.

Photograph of Ramp:



6.3 Creation of Awareness about Water Conservation:

The College has displayed posters emphasizing on importance of Water Conservation.

Photograph of Poster on Water Conservation:



**ANNEXURE-1:
LIST OF PLANTS:**

No	Common name	No	Common Name
1	Acalypha	37	Shankasur
2	Jahrisontakka	38	Arum
3	Allamanda	39	Rui/Akdo/Ak
4	Korphad	40	Trumpet vine
5	Anthurium	41	Dev-kei/Kardal
6	Rock rose	42	Sadaphooli
7	Sprengers asparagus	43	Parlour palm
8	Sasachi-gongdi	44	Shevanti
9	Ferny asparagus	45	Gavaticaha
10	Asystasia	46	Bleeding heart vine
11	Gokarn	47	Gajar
12	Croton	48	Flax Lily
13	Kothimbir	49	Leopard Lily
14	Aboli	50	Dragon tree
15	Queen sago	51	Jalparni
16	Cactus	52	Lalpatti
17	Flame violet	53	Sher
18	Amazon Lily	54	Pink angel
19	Copper plant	55	Daisy
20	Fire bush	56	Terda/ Balsum
21	Suryphool	57	Raikuda
22	Jaswand	58	Fern
23	Venezela Lily	59	Lajalu/Lajari
24	Panphooti	60	Gulbus
25	Tantani/Ghaneri	61	Dhobi plant
26	Ruffled fan palm	62	Sarvad
27	4 leaf cover	63	Pine
28	Fern	64	Pathachur
29	Kanher	65	Lalpatti
30	Lotus	66	Nishigandha
31	Nivdung	67	Aralia
32	Wild passion flower	68	Ghol
33	Geralum	69	Pine
34	Purple false eranthemum	70	Jammy mouth
35	Varnish plant	71	Snake plant
36	Palm	72	Blue wings

ENVIRONMENTAL AUDIT REPORT

of

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HARIBHAI V. DESAI COLLEGE, PUNE



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ENVIRONMENTAL AUDIT CERTIFICATE

Certificate No: ES/HVDC/22-23/03

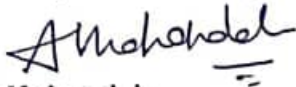
Date: 20/4/2023

This is to certify that we have conducted Environmental Audit at Haribhai V. Desai College,
Pune in the Academic year 2022-23.

The College has adopted following Environment Friendly practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 20 kWp Roof Top Solar PV Plant.
- Installation of 125 LPD Solar Thermal Water Heating System
- Provision of Separate Waste Collection Bins for Dry & Wet Waste
- Provision of Sanitary Waste Incinerator, for disposal of Sanitary Waste
- Provision of Photo-catalytic Reactor set up for Chemical Waste Water Treatment
- Installation of Rain Water Management Project
- Maintenance of Terrace Garden
- Creation of Awareness on Water Conservation, by Display of Posters

For Engress Services,



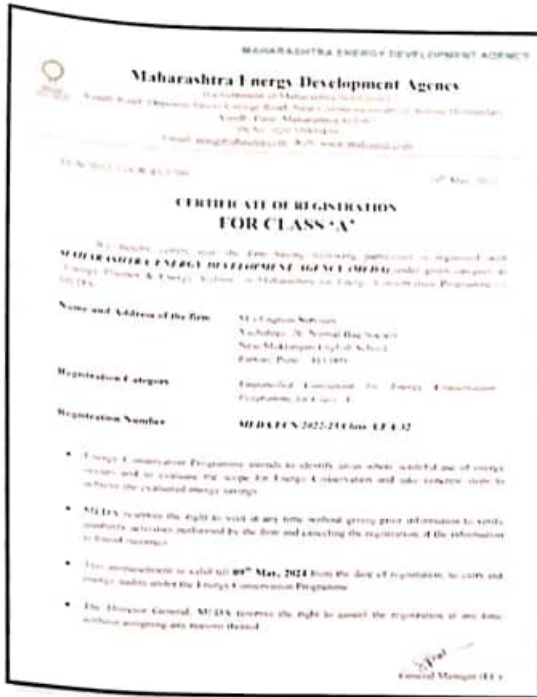
A Y Mehendale,

B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-8192

ASSOCHAM GEM Certified Professional: GEM: 22/788



REGISTRATION CERTIFICATES



MEDA Registration Certificate



ASSOCHAM GEM CP Certificate



ISO: 9001-2015 Certificate



ISO: 14001-2015 Certificate



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ACKNOWLEDGEMENT

We Engress Services, Pune, express our sincere gratitude to the management of Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Budhwar Peth, Pune for awarding us the assignment of Environmental Audit of their Campus for the Year: 2022-23.

We are thankful to all the staff members for helping us during the field study.



EXECUTIVE SUMMARY

1. The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College Pune consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Pollution due to College Activities:

- Air pollution: Mainly CO₂ on account of Electricity Consumption
- Solid Waste: Bio degradable Garden Waste
- Liquid Waste: Human liquid waste

3. Present Energy Consumption & CO₂ Emission:

No	Particulars	Value	Unit
1	Annual Energy Purchased	54463	kWh
2	Annual CO ₂ Emissions	49.02	MT

4. Renewable Energy & Reduction in CO₂ Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 20 kWp.
- The Energy generated by Solar PV Plant in 22-23 is 12000 kWh.
- Reduction in CO₂ Emissions in 22-23 is 21.6 MT

5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	73	44	69
2	Minimum	63	35	42

6. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	31.2	41	123	45
2	Minimum	30	40	98	41.6

7. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Sanitary Waste	Provision of Sanitary Waste Incinerator
3	Waste Chemical Water	Provision of Photo-catalytic Reactor
4	E Waste Management	Provision of Separate E Waste Collection Bin

8. Rain Water Management:

The College has installed the Rainwater harvesting project; the rain water falling on the terrace is collected and is used for recharging the Well.

9. Environment Friendly Initiatives:

- Tree Plantation in the campus.
- Creation of awareness on Water Conservation Display of Posters

10. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere
2. Energy generated by Roof Top Solar PV Plant: 4 kWh/kWp per Day
3. Annual Solar Energy generation Days: 300 Nos

11. References:

- For CO₂ Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in
- For Various Indoor Air Parameters: www.ishrae.com
- For AQI Quality Standards: www.cpcb.com

ABBREVIATIONS

Kg	: Kilo Gram
MSEDCL	: Maharashtra State Distribution Company Limited
MT	: Metric Ton
kWh	: kilo-Watt Hour
LPD	: Liters per Day
LED	: Light Emitting Diode
AQI	: Air Quality Index
PM-2.5	: Particulate Matter of Size 2.5 Micron
PM-10	: Particulate Matter of Size 10 Micron
CPCB	: Central Pollution Control Board
ISHRAE	: The Indian Society of Heating & Refrigerating & Air Conditioning Engineers



CHAPTER-I INTRODUCTION

1. Important Definitions:

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

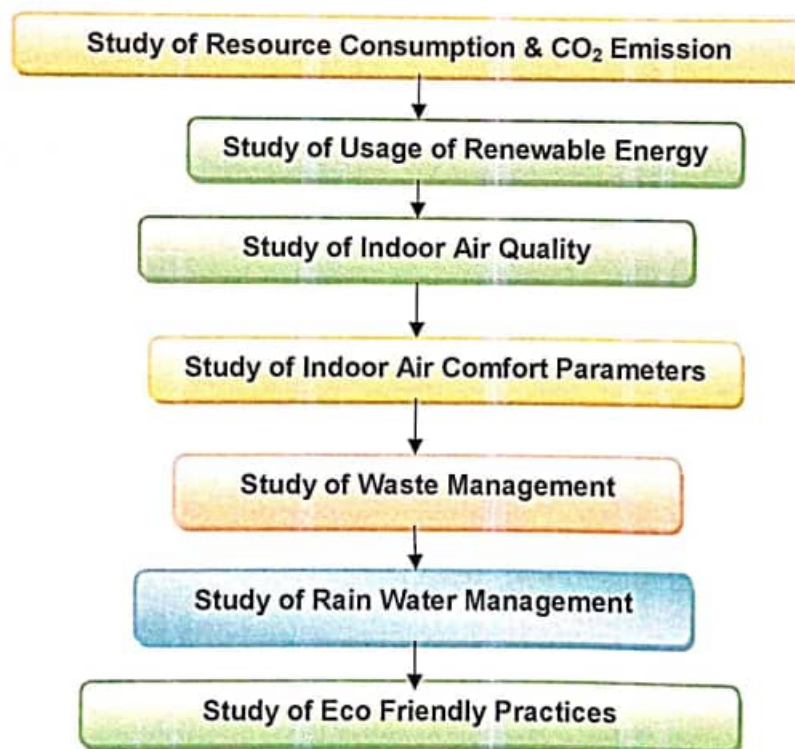
1.2. Environmental Audit: Definition:

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

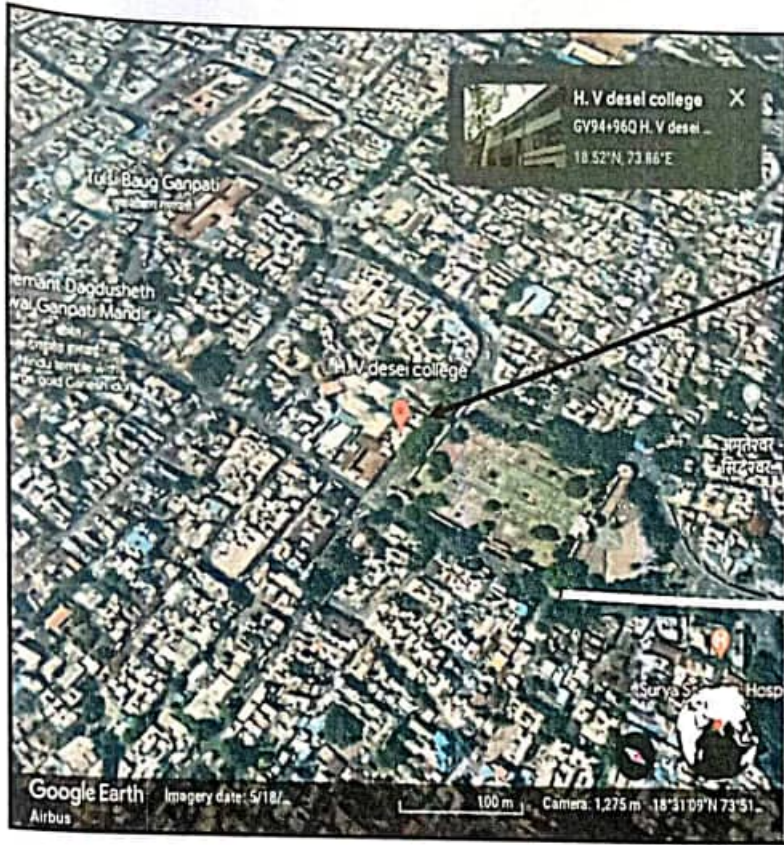
According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment"

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

1.4 Audit Procedural Steps:



1.5 College Location Image:



College Campus

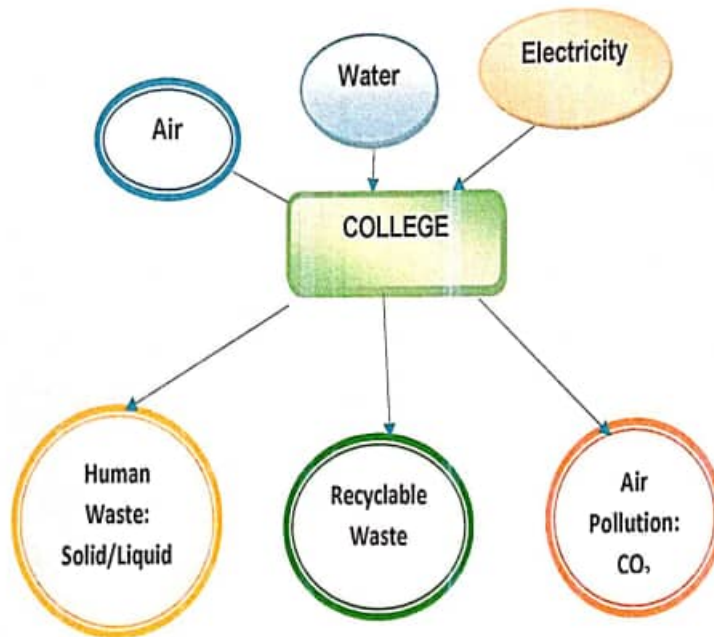


CHAPTER-II STUDY OF RESOURCE CONSUMPTION & CO₂ EMISSION

The College consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy

We try to draw a schematic diagram for the College System & Environment as under.
Chart No 1: Representation of College as System & Study of Resources & Waste



Now we compute the Generation of CO₂ on account of consumption of Electrical Energy.
The basis of Calculation for CO₂ emissions due to Electrical Energy is as under.

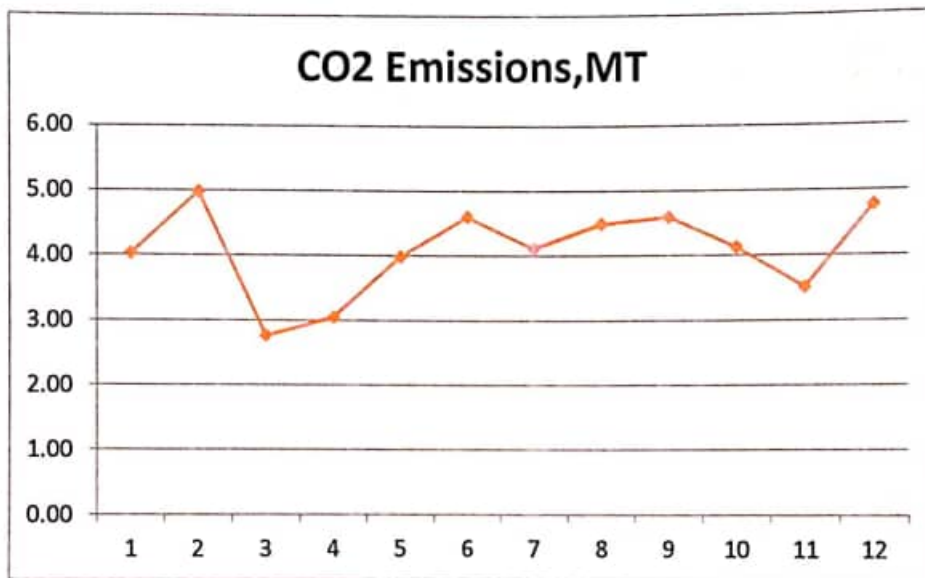
- 1 kWh of Electrical Energy releases 0.9 Kg of CO₂ into atmosphere

Table No 1: Study of Purchase of Energy & CO₂ Emissions: 22-23:

No	Month	Energy Purchased, kWh	CO ₂ Emissions, MT
1	Apr-22	4475	4.03
2	May-22	5536	4.98
3	Jun-22	3065	2.76
4	Jul-22	3386	3.05
5	Aug-22	4431	3.99
6	Sep-22	5113	4.60
7	Oct-22	4569	4.11

8	Nov-22	4989	4.49
9	Dec-22	5106	4.60
10	Jan-23	4580	4.12
11	Feb-23	3904	3.51
12	Mar-23	5309	4.78
13	Total	54463	49.02
14	Maximum	5536	4.98
15	Minimum	3065	2.76
16	Average	4538.58	4.08

Chart No 2: Month wise CO₂ Emissions:



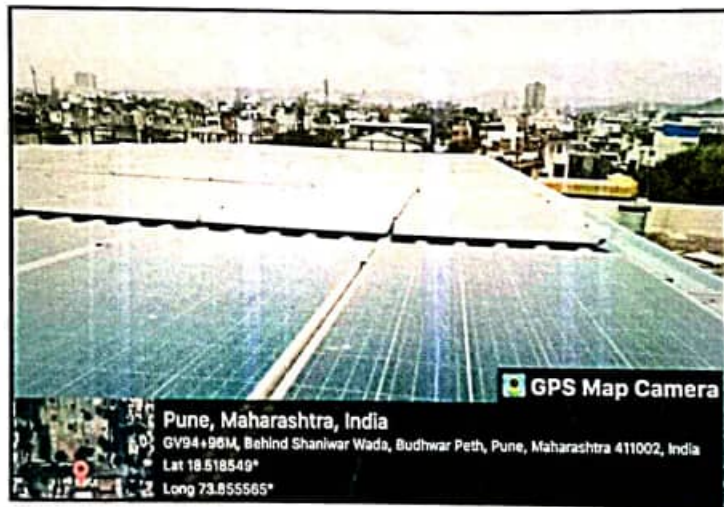
CHAPTER III STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 20 kWp
In the following Table, we present the reduction in CO₂ emissions due to Solar Energy:

Table No 2: Computation of Reduction in CO₂ Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	20	kWp
2	Energy Generated in per kWp	4	4 kWh/kWp
3	Annual Solar Energy generation Days	300	Nos
4	Energy Generated in the Year: 22-23	24000	kWh
5	1 kWh of Electrical Energy saves	0.9	Kg/kWh
6	Qty of CO ₂ Saved by Solar PV Plant $= (4) * (5) / 1000$	21.6	MT of CO ₂

Photograph of Roof Top Solar PV Plant:



CHAPTER IV STUDY OF INDOOR AIR QUALITY

4.1 Importance of 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 now and for future generations by affecting the health, the environment, the economy and the city's livability.

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

4.2 Air Quality Index:

An **Air Quality Index (AQI)** is a number used by government agencies to measure the **air pollution** levels and communicate it to the population. As the AQI increases, it means that a large percentage of the population will experience severe adverse health effects.

We present herewith following important Parameters.

1. AQI- Air Quality Index
2. PM-2.5- Particulate Matter of Size 2.5 micron
3. PM-10- Particulate Matter of Size 10 micron

Table No 3: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
1	Office	70	44	69
2	Dept of Chemistry	71	43	58
3	Physics Lab-II	73	44	50
4	Class Room-103	69	42	43
5	Class Room-202	65	35	42
6	R-309	63	38	52
7	Dept of Zoology	65	40	51
8	Class Room-403	70	42	52
	Maximum	73	44	69
	Minimum	63	35	42

CHAPTER V STUDY OF INDOOR COMFORT CONDITION PARAMETERS

In this Chapter, we present the various Indoor Comfort Parameters measured during the Audit. The Parameters include:

1. Temperature
2. Humidity
3. Lux Level
4. Noise Level.

Table No 4: Study of Indoor Comfort Condition Parameters:

No	Location	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Office	30	40	115	42.3
2	Dept of Chemistry	31	41	109	41.9
3	Physics Lab-II	31.1	41	98	42.6
4	Class Room-103	31.1	40	123	43
5	Class Room-202	31.2	40	110	44.2
6	R-309	30	41	112	45
7	Dept of Zoology	30.9	41	122	41.6
8	Class Room-403	31.2	40	106	42.3
	Maximum	31.2	41	123	45
	Minimum	30	40	98	41.6

CHAPTER VI STUDY OF WASTE MANAGEMENT

6.1 Segregation of Waste at Source:

The recyclable waste, like paper waste is segregated at source and is handed over to authorized waste collecting agent for further recycling.

Photograph of Waste Collection Bin:



6.2 Sanitary Waste Management:

The College has installed a Sanitary Waste Incinerator to dispose of the Sanitary Waste.

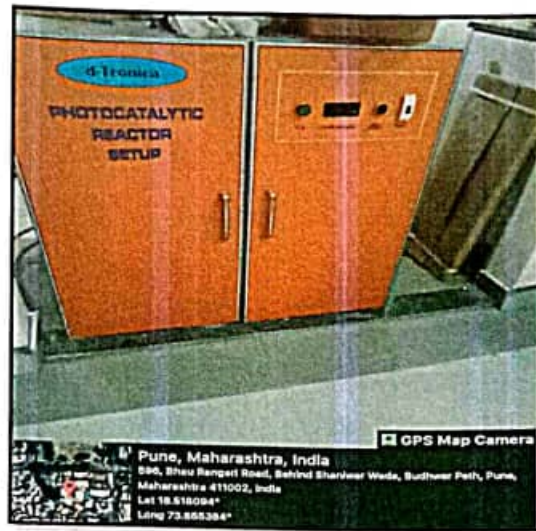
Photograph of Sanitary Waste Incinerator:



6.3 Waste Chemical Water Management:

The College has installed Photo-Catalytic Reactor Unit to treat the Waste Chemical Water.

Photograph of Photo-Catalytic Reactor Unit:



6.4 E Waste Management:

For collection of E Waste, as separate Bin is provided.

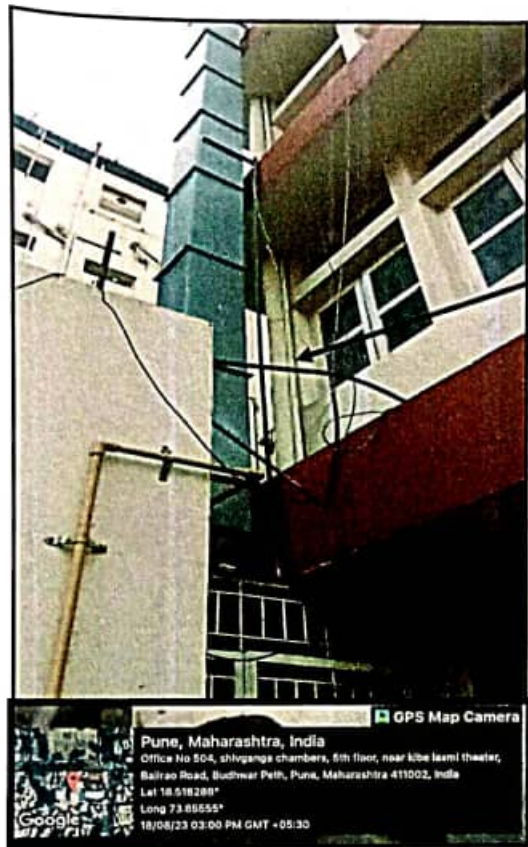
Photograph of E Waste Collection Bin:



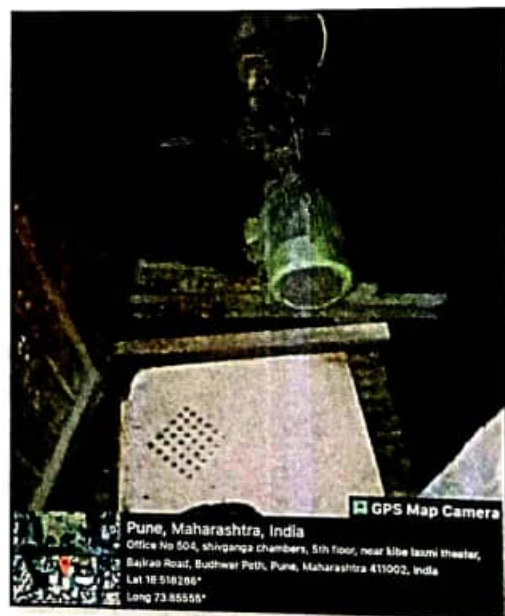
CHAPTER-VII STUDY OF RAIN WATER MANAGEMENT

The College has implemented the Rain Water Management Project. The College has installed Pipes from the terrace and the Rain water falling on the terrace is gathered and is used for recharging the Well.

Photograph of Rain Water Management Pipe & Well Recharge Point:



Rain Water
Carrying Pipe



CHAPTER-VIII STUDY OF ECO FRIENDLY INITIATIVES

8.1 Terrace Garden:

The College has maintained Terrace Garden.

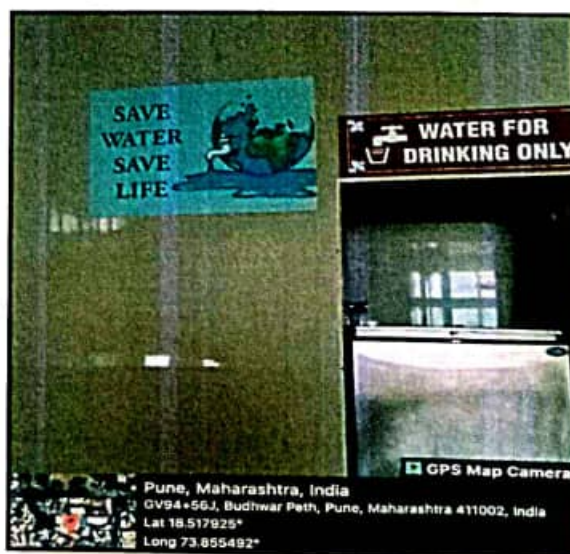
Photograph of Terrace Garden:



8.2 Creation of Awareness about Water Conservation:

The College has displayed posters emphasizing on importance of Water Conservation.

Photograph of Poster on Water Conservation:



**ANNEXURE-I:
VARIOUS AIR QUALITY, NOISE & COMFORT STANDARDS:**

1. Category Wise Air Quality Index Values & Concentration of PM 2.5 & PM10:

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

2. Recommended Noise Level Standards:

No	Location	Noise Level dB
1	Auditoriums	20-25
2	Outdoor Playground	55
3	Occupied Class Room	40-45
4	Un occupied Class Room	35
5	Apartment, Homes	35-40
6	Offices	45-50
7	Libraries	35-40
8	Restaurants	50-55

3. Thermal Comfort Conditions: For Non-conditioned Buildings:

No	Parameter	Value
1	Temperature	Less Than 33°C
2	Humidity	Less Than 70%

ENERGY AUDIT REPORT
of
**The Poona Gujarati Kelavani Mandal's,
HARIBHAI V. DESAI COLLEGE, PUNE**



Year: 2020-21

Prepared by:

Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Mukhtangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: enrichcons@gmail.com

MAHARASHTRA ENERGY DEVELOPMENT AGENCY <small>An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462</small>	
	Maharashtra Energy Development Agency (Government of Maharashtra Institution) Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary, Aundh, Pune, Maharashtra 411067 Ph No: 020-35000450 Email: eee@mahaurja.com , Web: www.mahaurja.com
ECN/2021-22/CR-14/1577	22 nd April, 2021
CERTIFICATE OF REGISTRATION FOR CLASS 'A'	
<p>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.</p>	
Name and Address of the firm	: M/s Enrich Consultants Yashashree, Plot No. 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune - 411009.
Registration Category	: <i>Empanelled Consultant for Energy Conservation Programme for Class 'A'</i>
Registration Number	: <i>MEDA/ECN/2021-22/Class A/EA-03</i>
<ul style="list-style-type: none">• 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 21st April, 2023 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 (EC)	

Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Mukangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: enrichcons@gmail.com

Ref: EC/TPGKMHVD/20-21/01

Date: 11/8/2021

CERTIFICATE

This is to certify that we have conducted Energy Audit at The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Pune, in the Academic year 2020-21.

.The College has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum Usage of Day Lighting
- Installation of 20 kWp Roof Top Solar PV Plant
- Installation of 125 LPD Solar Thermal Water Heating System

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For Enrich Consultants,

A Y Mehendale,
Certified Energy Auditor
EA-8192

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4	Carbon Foot Printing	12
5	Study of Usage of Alternate Energy	14
6	Study of LED Lighting	16

ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Budhwar Peth, Pune for awarding us the assignment of Energy Audit of their Campus for the Year: 2020-21.

We are thankful to all the staff members for helping us during the field study.

EXECUTIVE SUMMARY

1. The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College Pune consumes Energy in the form of **Electrical Energy** used for various Electrical Equipment, office & other facilities.

1. Present Energy Consumption & CO₂ Emission:

No	Parameter/ Value	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Total	16524	14.87
2	Maximum	6002	5.40
3	Minimum	0	0.00
4	Average	1377	1.24

2. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of **20 kWp** Roof Top Solar PV Plant.
- Installation of **125 LPD** Solar Thermal Water Heating System

3. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity **20 kWp**.
- Energy purchased from MSEDCL is **16524 kWh**.
- Energy generated by Roof Top Solar PV Plant is **25949 kWh**.
- The percentage of Usage of Alternate Energy to Annual Energy Demand is **61 %**.

4. Usage of LED Lighting:

- The Total Annual Lighting Demand of the College is **6839 kWh**.
- The Total Annual LED Lighting Demand is **6199 kWh**.
- The percentage of Annual LED Lighting to Annual Lighting Demand is **91 %**.

5. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere
2. Daily working hours-**4 Nos** (For Lighting Load Calculations)
3. Annual working Days-**100 Nos** (For Lighting Load Calculations)

6. References:

- For CO₂ Emissions: www.tatapower.com

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
IQAC	:	Internal Quality Assurance Cell
BEE	:	Bureau of Energy Efficiency
FTL	:	Fluorescent Tube Light
CFL	:	Compact Fluorescent Light
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO ₂	:	Carbon Di Oxide
MT	:	Metric Ton

CHAPTER-I INTRODUCTION

1.1 Objectives:

1. To study present Energy Consumption
2. To Study the present CO₂ emissions
3. To study usage of Alternate Energy
4. To study usage of LED Lighting

1.2 Table No 1: General Details of the College:

No	Head	Particulars
1	Name of Institution	The Poona Gujarati Kelavani Mandal's Haribahi V. Desai College
2	Address	Behind Shaniwarwada, Budhwar Peth, Pune 411002
3	Affiliation	Savitribai Phule Pune University

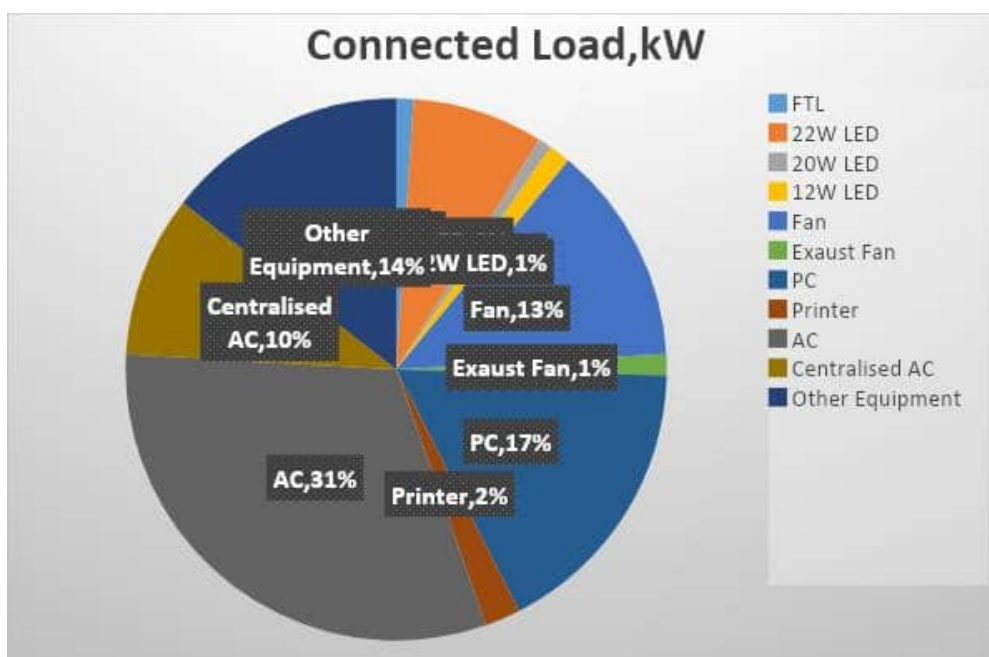
CHAPTER-II STUDY OF CONNECTED LOAD

The major contributors to the connected load of the College include:

Table No 2: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	FTL	40	40	1.6
2	22W LED	555	22	12.21
3	20W LED	63	20	1.26
4	12W LED	169	12	2.028
5	Fan	314	65	20.41
6	Exhaust Fan	30	65	1.95
7	PC	178	150	26.7
8	Printer	22	150	3.3
9	AC	26	1875	48.75
10	Centralized AC			15
11	Other Equipment	150	150	22.5
12	Total			156

Chart No 1: Study of Connected Load:



CHAPTER-III STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electrical Energy.

Table No 3: Electrical Bill Analysis- 2020-21:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Jul-20	0	0.00
2	Aug-20	6002	5.40
3	Sep-20	925	0.83
4	Oct-20	1322	1.19
5	Nov-20	843	0.76
6	Dec-20	1178	1.06
7	Jan-21	1221	1.10
8	Feb-21	1329	1.20
9	Mar-21	1137	1.02
10	Apr-21	814	0.73
11	May-21	749	0.67
12	Jun-21	1004	0.90
13	Total	16524	14.87
14	Maximum	6002	5.40
15	Minimum	0	0.00
16	Average	1377	1.24

Chart No 2: Variation in Monthly Energy Consumption:

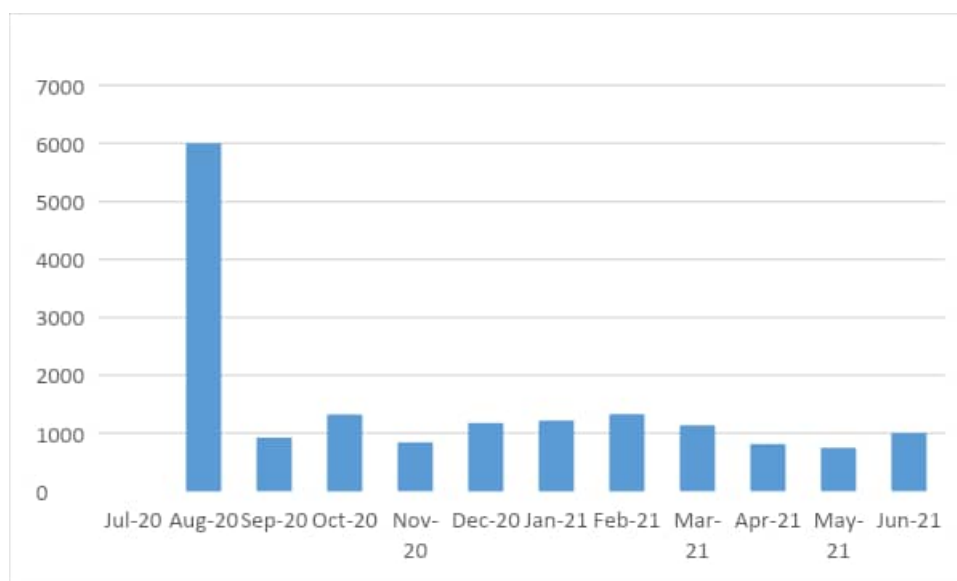


Table No 4: Variation in Important Parameters:

No	Parameter/Value	Energy Consumed, kWh
1	Total	16524
2	Maximum	6002
3	Minimum	0
4	Average	1377

CHAPTER-IV CARBON FOOTPRINTING

A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions, emitted due to various activities.

In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the College for performing its day to day activities

The College uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO₂ Emissions:

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Table No 5: Month wise CO₂ Emissions:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Jul-20	0	0.00
2	Aug-20	6002	5.40
3	Sep-20	925	0.83
4	Oct-20	1322	1.19
5	Nov-20	843	0.76
6	Dec-20	1178	1.06
7	Jan-21	1221	1.10
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12	Jun-21	1004	0.90
13	Total	16524	14.87
14	Maximum	6002	5.40
15	Minimum	0	0.00
16	Average	1377	1.24

Chart No 3: Month wise CO₂ Emissions:

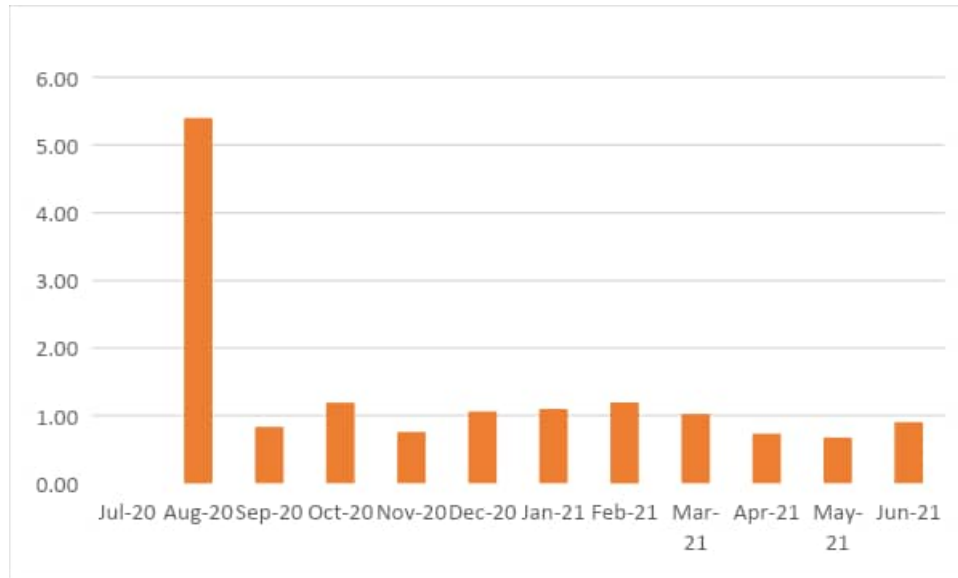


Table No 6: Important Parameters:

No	Parameter/Value	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Total	16524	14.87
2	Maximum	6002	5.40
3	Minimum	0	0.00
4	Average	1377	1.24

CHAPTER-V STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity **20 kWp**.

In the following Table, we present the Month wise Energy Generation by the Roof Top Solar PV Plant.

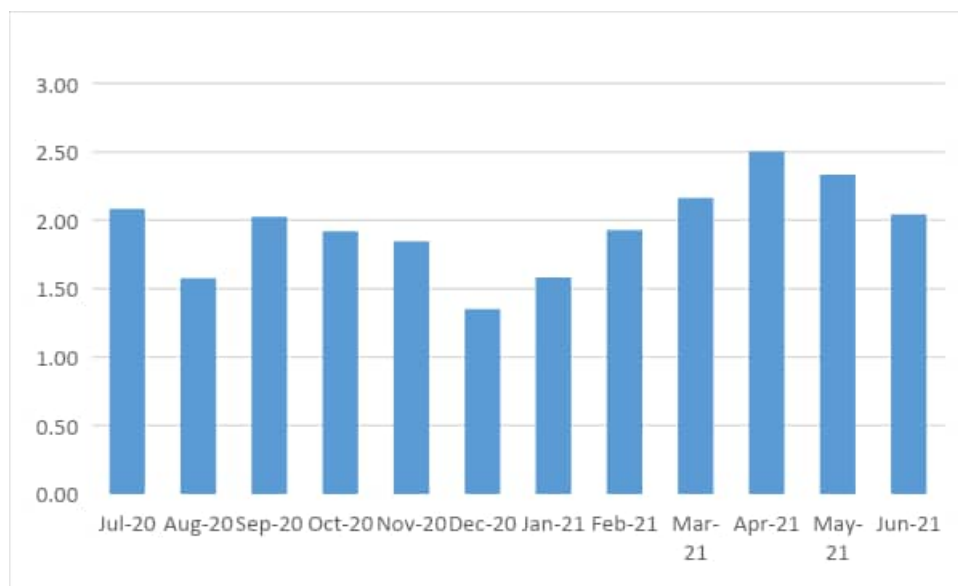
Table No 7: Month Wise Energy Generation & CO₂ Emission Reduction:

No	Month	Energy Generated, kWh	CO ₂ Emission Reduction, MT
1	Jul-20	2313.83	2.08
2	Aug-20	1752.15	1.58
3	Sep-20	2251.67	2.03
4	Oct-20	2134.27	1.92
5	Nov-20	2050.51	1.85
6	Dec-20	1499.79	1.35
7	Jan-21	1759.35	1.58
8	Feb-21	2142.12	1.93
9	Mar-21	2402.41	2.16
10	Apr-21	2781.44	2.50
11	May-21	2593.06	2.33
12	Jun-21	2268.26	2.04
13	Total	25948.86	23.35

Chart No 4: Month Wise Solar Energy Generation, kWh:



Chart No 5: Month Wise CO2 Emissions Reduction, MT:



In the following Table, we compute the percentage of Usage of Alternate Energy to Annual Energy Demand of the College.

Table No 8: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL in 20-21	16524	kWh
2	Capacity of Roof Top Solar PV Capacity	20	kWp
3	Annual Solar Energy Generated in 20-21	25949	kWh
4	Total Energy Requirement = (1) + (3)	42473	kWh
5	Percent of Alternate Energy to Annual Energy Requirement = $(3) \times 100 / (4)$	61	%

Photograph of 20 kWp Roof Top Solar PV Plant:



CHAPTER VI

STUDY OF USAGE OF LED LIGHTING

In this chapter, we compute the percentage of usage of LED Lighting to Annual Lighting power requirement.

Table No 9: Percentage of Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL	40	Nos
2	No of 22 W LED Fitting	555	Nos
3	No of 20 W LED Fitting	63	Nos
4	No of 12 W LED Fitting	169	Nos
5	Demand of 40 W FTL Fitting	40	W/Unit
6	Demand of 22 W LED Fitting	22	W/Unit
7	Demand of 20 W LED Fitting	20	W/Unit
8	Demand of 12 W LED Fitting	12	W/Unit
9	Load of 40 W FTL Fitting = $1 \times 4 / 1000$	1.6	kW
10	Load of 22 W LED Fitting = $2 \times 5 / 1000$	12.21	kW
11	Load of 20 W LED Fitting = $3 \times 6 / 1000$	1.26	kW
12	Load of 12 W LED Fitting = $4 \times 8 / 1000$	2.028	kW
13	Total Lighting Load = $9 + 10 + 11 + 12$	17.098	kW
14	Total LED Lighting Load = $10 + 11 + 12$	15.498	kW
15	Average Daily Usage Period	4	Hrs
16	Annual Working Days	100	Nos
17	Annul Total Lighting Demand = $13 \times 15 \times 16$	6839	kWh
18	Annual LED Lighting Demand = $14 \times 15 \times 16$	6199	kWh
19	% of Annual Lighting Demand met by LED = $18 \times 100 / 17$	91	%

GREEN AUDIT REPORT
of
**The Poona Gujarati Kelavani Mandal's,
HARIBHAI V. DESAI COLLEGE, PUNE**



Year: 2020-21

Prepared by:

Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Mukhtangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: enrichcons@gmail.com

MAHARASHTRA ENERGY DEVELOPMENT AGENCY <small>An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462</small>	
	Maharashtra Energy Development Agency (Government of Maharashtra Institution) Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary, Aundh, Pune, Maharashtra 411067 Ph No: 020-35000450 Email: eee@mahaurja.com , Web: www.mahaurja.com
ECN/2021-22/CR-14/1577	22 nd April, 2021
CERTIFICATE OF REGISTRATION FOR CLASS 'A'	
<p>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.</p>	
Name and Address of the firm	: M/s Enrich Consultants Yashashree, Plot No. 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune - 411009.
Registration Category	: <i>Empanelled Consultant for Energy Conservation Programme for Class 'A'</i>
Registration Number	: <i>MEDA/ECN/2021-22/Class A/EA-03</i>
<ul style="list-style-type: none">• 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 21st April, 2023 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 (EC)	

Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Mukangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: enrichcons@gmail.com

Ref: EC/TPGKMHVD/20-21/02

Date: 11/8/2021

CERTIFICATE

This is to certify that we have conducted Green Audit at, The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Pune, in the Academic year 2020-21.

The College has adopted following Green Initiatives:

- Usage of Energy Efficient LED Light Fitting
- Usage of BEE STAR Rated Energy Efficient Equipment
- Maximum Usage of Day Lighting
- Installation of Roof Top Solar PV Plant of Capacity **20 kWp**
- Installation of **125 LPD** Solar Thermal Water Heating System
- Segregation of Waste at source
- Installation of a Bio Gas Plant
- Implementation of Rain Water Harvesting Project
- Maintenance of good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan
- Provision of Sanitary Waste Incinerator
- Creation of Awareness by Display of Posters on Resource Conservation

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

For Enrich Consultants,

A Y Mehendale,
Certified Energy Auditor
EA-8192

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College, Budhwar Peth, Pune for awarding us the assignment of Green Audit of their Campus for the Year: 2020-21.

We are thankful to all the staff members for helping us during the field study.

EXECUTIVE SUMMARY

1. The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College Pune consumes Energy in the form of **Electrical Energy** used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption & CO₂ Emissions:

No	Parameter/ Value	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Total	16524	14.87
2	Maximum	6002	5.40
3	Minimum	0	0.00
4	Average	1377	1.24

3. Various initiatives taken for Energy Conservation:

- Usage of Energy Efficient BEE STAR Rated Equipment
- Usage of Energy Efficient LED Lighting
- Maximum Usage of Day Lighting
- Installation of Roof Top Solar PV Plant of Capacity **20 kWp**.
- Installation of **125 LPD** Solar Thermal Water Heating System

4. Usage of Renewable Energy:

- The College has installed Roof Top Solar PV Plant of Capacity **20 kWp**.
- The Electrical Energy generated in 20-21 is **25949 kWh**.
- Reduction in CO₂ Emissions in 2020-21 works out to be **16 MT**.

5. Waste Management:

5.1 Solid Waste Management:

5.1.1 Segregation of Waste at Source:

Waste bins are provided at various locations and the recyclable waste, like paper, plastic waste is handed over to Authorized waste collecting agent for further recycling.

5.2 Organic Waste Management:

The College has installed Bio Gas Plant for conversion of organic waste into Bio Gas.

5.3 E-Waste Management:

The E-Waste is disposed of through Authorized E-Waste collecting agency.

6. Rain Water Harvesting:

The College has installed the Rainwater harvesting project, the rain water falling on the terrace is collected and is used for recharging the bore well.

7. Green & Sustainable Initiatives

- Maintenance of good Internal Road
- Tree Plantation in the Campus
- Provision of Ramp for Divyangajan
- Provision of Sanitary Waste Incinerator
- Creation of Awareness by Display of Posters on Resource Conservation

8. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere

9. References:

- For CO₂ Emissions: www.tatapower.com

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
kWh	Kilo Watt Hour
LPD	Liters Per Day
Kg	Kilo Gram
MT	Metric Ton
CO ₂	Carbon Di Oxide
Qty	Quantity

CHAPTER-I INTRODUCTION

1.1 Objectives:

1. To study present Energy Consumption
2. To Study CO₂ emissions
3. To study usage of Renewable Energy
4. Study of Waste Management
5. Study of Rain Water Harvesting
6. Study of Green & Sustainable Practices

1.2 General Details of College: Table No 1:

No	Head	Particulars
1	Name of Institution	The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College
2	Address	Behind Shaniwarwada, Budhwar Peth, Pune 411002
3	Affiliation	Savitribai Phule Pune University

CHAPTER-II STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electrical Energy.

Table No 2: Electrical Bill Analysis- 2020-21:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Jul-20	0	0.00
2	Aug-20	6002	5.40
3	Sep-20	925	0.83
4	Oct-20	1322	1.19
5	Nov-20	843	0.76
6	Dec-20	1178	1.06
7	Jan-21	1221	1.10
8	Feb-21	1329	1.20
9	Mar-21	1137	1.02
10	Apr-21	814	0.73
11	May-21	749	0.67
12	Jun-21	1004	0.90
13	Total	16524	14.87
14	Maximum	6002	5.40
15	Minimum	0	0.00
16	Average	1377	1.24

Chart No 1: Variation in Monthly Energy Consumption:

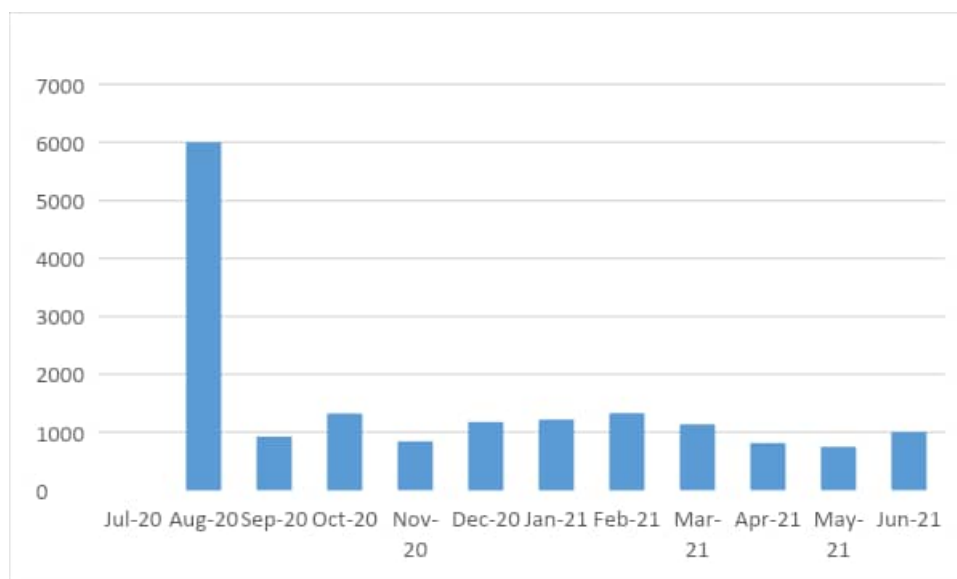


Table No 3: Variation in Important Parameters:

No	Parameter/Value	Energy Consumed, kWh
1	Total	16524
2	Maximum	6002
3	Minimum	0
4	Average	1377

CHAPTER III

STUDY OF CARBON FOOTPRINTING

A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions, emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the College for performing its day to day activities

The College uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy are as under

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO₂** into atmosphere

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Table No 4: Month wise CO₂ Emissions:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Jul-20	0	0.00
2	Aug-20	6002	5.40
3	Sep-20	925	0.83
4	Oct-20	1322	1.19
5	Nov-20	843	0.76
6	Dec-20	1178	1.06
7	Jan-21	1221	1.10
8	Feb-21	1329	1.20
9	Mar-21	1137	1.02
10	Apr-21	814	0.73
11	May-21	749	0.67
12	Jun-21	1004	0.90
13	Total	16524	14.87
14	Maximum	6002	5.40
15	Minimum	0	0.00
16	Average	1377	1.24

Chart No 2: Month wise CO₂ Emissions:

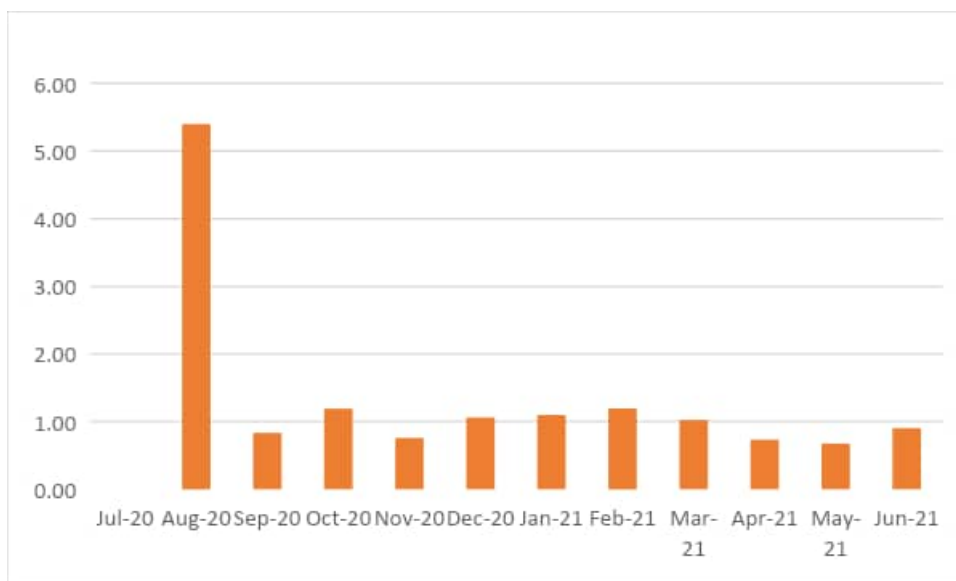


Table No 5: Variation in Important Parameters:

No	Parameter/Value	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Total	16524	14.87
2	Maximum	6002	5.40
3	Minimum	0	0.00
4	Average	1377	1.24

CHAPTER IV STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity **20 kWp**.

In the following Table, we present the Month wise Energy Generation by the Roof Top Solar PV Plant.

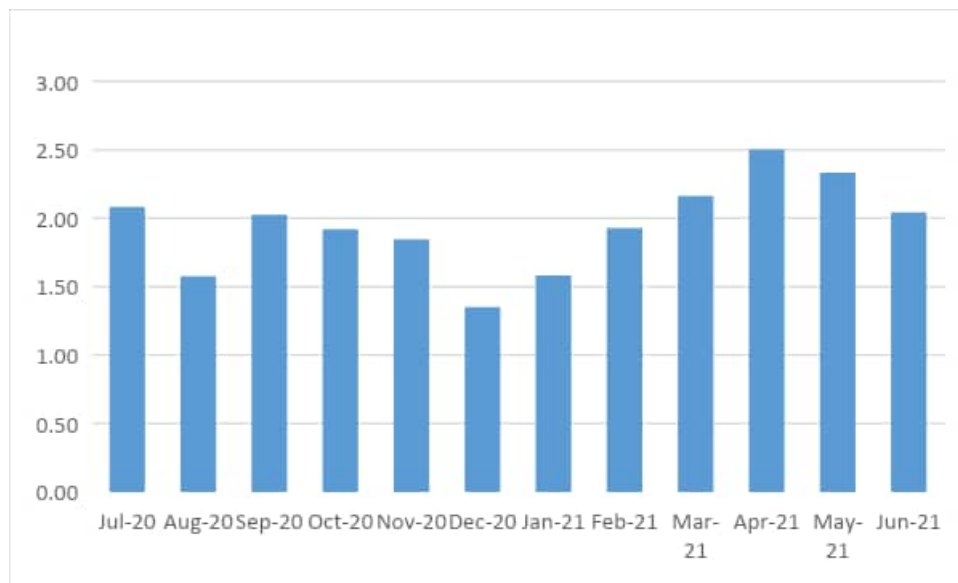
Table No 6: Month Wise Energy Generation & CO₂ Emission Reduction:

No	Month	Energy Generated, kWh	CO ₂ Emission Reduction, MT
1	Jul-20	2313.83	2.08
2	Aug-20	1752.15	1.58
3	Sep-20	2251.67	2.03
4	Oct-20	2134.27	1.92
5	Nov-20	2050.51	1.85
6	Dec-20	1499.79	1.35
7	Jan-21	1759.35	1.58
8	Feb-21	2142.12	1.93
9	Mar-21	2402.41	2.16
10	Apr-21	2781.44	2.50
11	May-21	2593.06	2.33
12	Jun-21	2268.26	2.04
13	Total	25949	23.35

Chart No 3: Month Wise Solar Energy Generation, kWh:



Chart No 4: Month Wise CO2 Emissions Reduction, MT:



In the following Table, we compute the Annual Reduction in CO₂ Emissions due to installation of 20 kWp Roof Top Solar PV Plant.

Table No 7: Computation of Annual Reduction in CO₂ Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	20	kWp
2	Energy Generated in the Year: 20-21	25949	kWh
3	1 kWh of Electrical Energy saves	0.9	Kg/kWh
4	Qty of CO₂ Saved by Solar PV Plant = (2)*(3) /1000	16	MT of CO₂

Photograph of Roof Top Solar PV Plant:



CHAPTER V

STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

5.1.1 Segregation of Waste at Source:

The recyclable waste, like paper waste is segregated at source and is handed over to authorized waste collecting agent for further recycling.

Photograph of Waste Collection Bin:



5.1.2 Organic Waste Management:

The College has installed Bio Gas Plant for conversion of organic waste into Bio Gas.

Photograph of Vermi Composting Plant:



5.3 E-Waste Management: The E-Waste is disposed of through Authorized Agency.

CHAPTER-VI STUDY OF RAIN WATER HARVESTING

The College has implemented the Rain Water Harvesting Project. The College has installed Pipes from the terrace and the Rain water falling on the terrace is gathered and is used for recharging the bore well.

Photograph of Rain water Harvesting Pipe & Well Recharge Point:



CHAPTER-VII

STUDY OF GREEN & SUSTAINABLE PRACTICES

7.1 Pedestrian Friendly Roads:

The College has well maintained internal road to facilitate the easy movement of the students within the campus.

Photograph of Internal Road:



7.2 Internal Tree Plantation:

The College has done the plantation on the terrace.

Photograph of Tree plantation:



7.3 Provision of Ramp for Divyangajan:

For easy movement of Divyangajan, the College has made provision of Ramp as well as dedicated wash room.

Photograph of Ramp:



7.4 Provision of Sanitary Waste Incinerator:

For disposal of Sanitary Waste, a Sanitary Waste Incinerator is installed in the campus.

Photograph of Sanitary Waste Incinerator:



7.5 Creation of Awareness about Resource Conservation:

The College has displayed posters emphasizing on importance of Resource Conservation.

Photograph of Posters on Resource Conservation:



ANNEXURE-1: LIST OF TREES & PLANTS IN THE CAMPUS:

Sr.	Accepted name as per IUCN	Common name	Habit	Family	Origin	Fl & Fr.
1	<i>Acalypha hispida</i> Burm.f.	Acalypha	Shrub	Euphorbiaceae	New Guinea	Apl.-June
2	<i>Allamanda cathartica</i> Linn. Var. <i>cathartica</i> L.	Jahri sontakka	Shrub	Apocynaceae	Guiana	All
3	<i>Allamanda grandiflora</i> Raffle.	Allamanda	Shrub	Apocynaceae	America T.	All
4	<i>Aloe vera</i> Burm.f.	Korphad	Herb	Liliaceae	Arabia	Dec.-May
5	<i>Anthurium sp</i>	Anthurium	Herb	Araceae		All
6	<i>Mesembryanthemum cordifolium</i> L. fil.	Rock rose	Herb	Aizoaceae	America	
7	<i>Asparagus aethiopicus</i> (L.) Kunth.	Sprengers asparagus	Herb	Asparagaceae	Africa S.	
8	<i>Asparagus racemosus var. javanica</i>	Sasachi-gongdi	Shrub	Liliaceae	Asia	June-Oct.
9	<i>Asparagus setaceus</i> (Kunth.) Jessop.	Ferny asparagus	Herb	Asparagaceae	Old World	
10	<i>Asystasia gangetica</i> (L.) Anders.	Asystasia	Herb	Acanthaceae	America S.	Nov.-Apl.
11	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Shankasur	Shrub	Caesalpinaceae	America T.	All
12	<i>Caladium bicolor</i> Vent.	Arum	Herb	Araceae	America S.	July-Sept.
13	<i>Calotropis procera</i> R.Br.	Rui/Akdo/Ak	Shrub	Asclepiadaceae	Africa T.	All
14	<i>Campsis radicans</i> (L.) Seem.	Trumpet vine	Climber	Bignoniaceae	America N.	June-Dec.
15	<i>Canna indica</i> L.	Dev-kel/Kardal	Herb	Cannaceae	India	All
16	<i>Catharanthus roseus</i> Murr. G. Don.	Sadaphooli	Herb	Apocynaceae	America T.	July-Sept.
17	<i>Chamaedorea elegans</i> Willd.	Parlour palm	Herb	Araceae	America	
18	<i>Chrysanthemum indicum</i> L.	Shevanti	Herb	Asteraceae	China	
19	<i>Citronella sp</i>	Gavati chaha	Herb	Poaceae		
20	<i>Clerodendrum thomsoniae</i> Balf.	Bleeding heart vine	Climber	Verbenaceae	Africa T.	
21	<i>Clitoria ternatea</i> Linn.	Gokarn	Climber	Fabaceae	Asia T.	May-Dec.
22	<i>Clusea rosea</i> L.		Shrub	Clusiaceae		
23	<i>Codiaeum variegatum</i> Blume.	Croton	Shrub	Euphorbiaceae	Indonesia, Australia	Oct.-Feb.
24	<i>Coriandrum sativum</i> Linn.	Kothimbir	Herb	Apiaceae	Mediterranean region	July-Sept.
25	<i>Crossandra infundibuliformis</i> (L.) Nees.	Aboli	Shrub	Acanthaceae	Asia	Dec.-May
26	<i>Cycas circinalis</i> L.	Queen sago	Tree	Cycadaceae	Mediterranean region	
27	<i>Cyperus alternifolius</i> L.		Herb	Cyperaceae	Africa	Sept.-Oct.
28	<i>Daucus carota</i> L.	Gajar	Herb	Apiaceae	Eurasia	May
29	<i>Dianthus caryophyllus</i> L.	Flax Lily	Herb	Caryophyllaceae	Europe	May-June
30	<i>Dieffenbachia compacta</i> Schott.	Leopard Lily	Herb	Araceae (Palmae)		
31	<i>Dracaena compacta</i> L.	Dragon tree	Shrub	Asparagaceae	Madagascar	
32	<i>Eichhornia crassipes</i> (Mart.) Solms.	Jalparni	Herb	Pontederiaceae	America	July-Nov.
33	<i>Epiphyllum oxypetalum</i> Haworth.	Cactus	Shrub	Cactaceae	Mexico	May
34	<i>Episcia cupreata</i> (Hook.) Hanst.	Flame violet	Herb	Gesneriaceae	America	
35	<i>Eucharis grandiflora</i> Planch. & Linden.	Amazon Lily	Herb	Asperagaceae	Colombia	Dec.-Jan.

36	<i>Euphorbia cotinifolia</i> L.	Copper plant	Shrub	Euphorbiaceae	Mexico	
37	<i>Euphorbia millii</i> Desmoul. Var. <i>millii</i>		Herb	Euphorbiaceae	Madagascar	All
38	<i>Euphorbia pulcherrima</i> Linn.	Lalpatti	Shrub	Euphorbiaceae	America	Sept.-Jan.
39	<i>Euphorbia tirucalli</i> Linn.	Sher	Herb	Euphorbiaceae	Africa T.	Aug.-Sept.
40	<i>Fittonia albivenis</i> (Lindl. Ex Vieth) Brummit.	Pink angel	Herb	Acanthaceae	Colombia	
41	<i>Furcraea foetida</i> (L.) Haw.		Shrub	Agavaceae	America S.	Aug.-Dec.
42	<i>Gazania linearis</i> (Thunb.) Druce	Daisy	Herb	Asteraceae	Africa	
43	<i>Geranium ocellatum</i> Cambess. in Jacquem.		Herb	Geraniaceae	Europe SE.	July.-Aug.
44	<i>Gerbera jamesonii</i> Bolus ex Hooker f.		Herb	Asteraceae	Africa	
45	<i>Hamelia patens</i> Jacq.	Fire bush	Shrub	Rubiaceae	America T.	
46	<i>Helianthus annuus</i> Linn.	Suryphool	Herb	Asteraceae	Africa N.	July-Jan.
47	<i>Hibiscus rosa sinensis</i> Linn.	Jaswand	Shrub	Malvaceae	Asia E.	All
48	<i>Hippeastrum reginae</i> (L.) Herb.	Venezela Lily	Herb	Amaryllidaceae	Africa	
49	<i>Hymenocallis caribaea</i> (L.) H.		Herb	Amaryllidaceae	Africa	
50	<i>Impatiens balsamina</i> L.	Terda/ Balsum	Herb	Balsaminaceae	Asia SE.	Aug.-Dec.
51	<i>Ixora parviflora</i> Andr.	Raikuda	Shrub	Rubiaceae	Asia	All
52	<i>Jatropha integerrima</i> Jacq.		Shrub	Euphorbiaceae	West Indies	July-Jan.
53	<i>Justicia brandegeana</i> L.		Herb	Acanthaceae	Asia	
54	<i>Kalanchoe kodolagoensis</i> Eckl.		Herb	Crassulaceae	Madagascar	
55	<i>Kalanchoe pinnatum</i> (Lam.) Oken.	Panphooti	Herb	Crassulaceae	Madagascar	
56	<i>Lantana camara</i> Linn. var. <i>aculeata</i> Linn. Mold.	Tantani/Ghaneri	Shrub	Verbenaceae	America T.	All
57	<i>Licuala grandis</i> (Hort. ex W. Bull.) H. Wendl.	Ruffled fan palm	Shrub	Arecaceae	Vanuath	
58	<i>Marsilea quadrifolia</i> L.	4 leaf cover	Herb	pteridophyte	America	Non flow.
59	<i>Melampodium divaricatum</i> (L.C.Rich.) DC.		Herb	Asteraceae (Compositae)	America T.	
60	<i>Microsorium membranaceum</i> (D. Don.) Ching.	Fern	Herb	pteridophyte	Asia	Non flow.
61	<i>Mimosa pudica</i> Linn.	Lajalu/Lajari	Shrub	Mimosaceae	America	Sept.-Jan.
62	<i>Mirabilis jalapa</i> L.	Gulbus	Herb	Nyctaginaceae	Mexico	Aug.-Jan.
63	<i>Mussaenda erythrophylla</i> Schum. & Thonn.	Dhobi plant	Shrub	Rubiaceae	Africa T.	
64	<i>Mussaenda frondosa</i> L.	Sarvad	Shrub	Rubiaceae	Africa T.	Feb.-Sept.
65	<i>Nephrolepis cordata</i> L.	Fern	Herb	pteridophyte	Asia australia	Non flow.
66	<i>Nerium indicum</i> Mill.	Kanher	Shrub	Apocynaceae	China	All
67	<i>Nymphaea panama</i> L.	Lotus	Herb	Nymphaeaceae	America	
68	<i>Opuntia elatior</i> Mill.	Nivdung	Shrub	Cactaceae	America S.	Jan.-July
69	<i>Passiflora edulis</i> Sims.	Wild passion flower	Climber	Passifloraceae	America	Apl.-Feb.
70	<i>Pelargonium antidysentericum</i> A.G.	Geralum	Shrub	Geraniaceae	Africa S.	Apl.-May
71	<i>Philodendron xanadu</i> Croat. Mayo & J. Boos.		Herb	Araceae	Africa	
72	<i>Pilea</i> sp		Herb	Urticaceae	America T.	Aug.-Feb.
73	<i>Pinus roxburghii</i> L.	Pine	Tree	Pinaceae	Japan	
74	<i>Plectranthus amboinicus</i> (Lour.) Spr.	Pathachur	Herb	Lamiaceae	Asia	Aug.-Nov.
75	<i>Euphorbia pulcherrima</i> Linn.	Lalpatti	Shrub	Euphorbiaceae	America	Sept.-Jan.

76	<i>Polianthes tuberosa</i> L.	Nishigandha	Herb	Amaryllidaceae	Mexico	Apl.-June
77	<i>Polyscias balfouriana variegata</i> (Andre.) L.H. Bailey.	Aralia	Shrub	Araliaceae	Africa	
78	<i>Portulaca oleracea</i> L.	Ghol	Herb	Portulacaceae	Europe	June- Feb.
79	<i>Pseuderantherum laxiflorum</i> L.	Purple false eranthemum	Shrub	Acanthaceae	America	
80	<i>Pseuderantherum carruthersii</i> (Hook. F.) Radlk.)	Varnish plant	Shrub	Acanthaceae	Africa	Sept.-Oct.
81	<i>Rhoeo spathacea</i> (Swartz.) Stearn.		Herb	Commelinaceae	America	All
82	<i>Raphis ecelsa</i> L.	Palm	Herb	Arecaceae		
83	<i>Rivina humilis</i> L.		Herb	Phytolaccaceae	America T.	Sept.-Jan.
84	<i>Russelia equisetiformis</i> Sch.& Cham.		Shrub	Scrophulariaceae	Mexico, Guatemala	Dec.
85	<i>Ruttya fruticosa</i> Lindau.	Jammy mouth	Shrub	Acanthaceae	Africa	
86	<i>Sansevieria trifasciata</i> Prain.	Snake plant	Herb	Liliaceae	Africa N.	
87	<i>Torenia fournieri</i> Linden ex E. Fourn.	Blue wings	Herb	Linderniaceae	China	All
88	<i>Zephyranthes candida</i> Herb.		Herb	Amaryllidaceae	Mexico	July- Dec.