6.5: Internal Quality Assurance System

6.5.2: Quality assurance initiatives of the institution include:

6.5.2.1 Quality audit reports/certificate as applicable and valid for the assessment period.

PRINCIPAL
JSPM's
Jayawantrao Sawant
Commerce & Science College

Index

PRINCIPAL
JSPM's
Jayawantrao Sawant
Commerce & Science College

ENVIRONMENTAL AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2022-23

Prepared by:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: engress123@gmail.com

REGISTRATION CERTIFICATES


Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, 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 CO_2 on account of Electricity Consumption
- Solid Waste: Bio degradable Garden Waste
- Liquid Waste: Human liquid waste

3. Present Energy Consumption & CO_2 Emission:

No	Particulars	Value	Unit
1	Annual Energy Purchased	37463	kWh
2	Annual CO_2 Emissions	33.72	MT

4. Renewable Energy Usage & Reduction in CO_2 Emissions:

- The College has installed Solar PV Plant of capacity 3 KW
- The Energy generated by Solar PV Plant in 2022-23 is 3600 kWh
- Reduction in CO_2 Emissions in 2022-23 is 3.24 MT

5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	53	31	34
2	Minimum	50	29	32

6. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	27.2	71	132	45
2	Minimum	27.1	69	105	40

7. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Microbial Waste	Provision of Autoclave
3	Sanitary Waste	Provision of Sanitary Waste Incinerator

8. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

9. Environment Friendly Initiatives:

- Tree Plantation in the campus.
- Creation of awareness on ban Single Use Plastic by Display of Posters.

10. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 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 CO_2 Emissions: www.tatapower.com
- For Various Indoor Air Parameters: www.ishrae.com
- For AQI Quality Standards: www.cpcb.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

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:

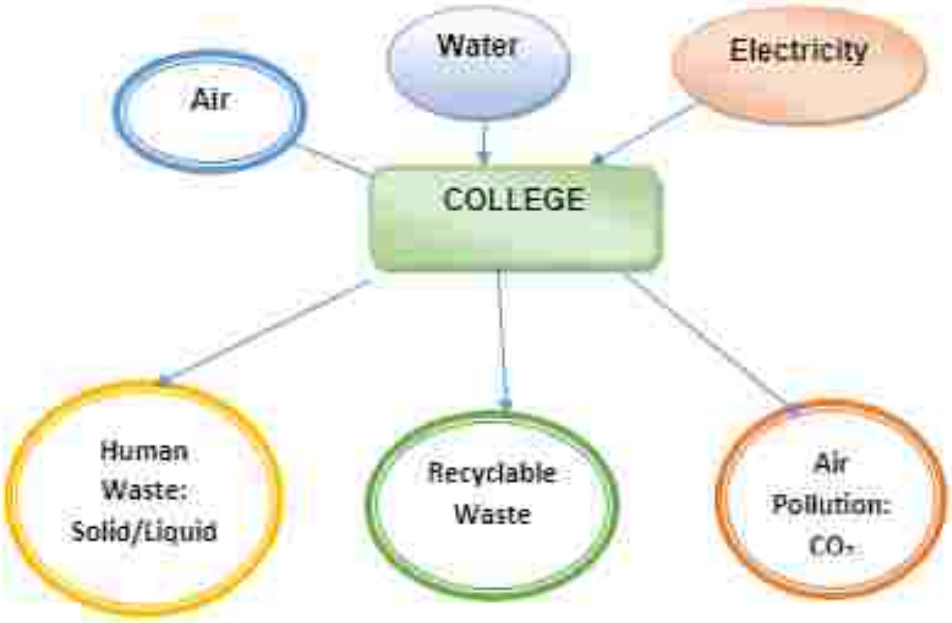
1.3 College Location Image:

CHAPTER-II
STUDY OF RESOURCE CONSUMPTION & CO_2 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 CO_2 on account of consumption of Electrical Energy.
The basis of Calculation for CO_2 emissions due to Electrical Energy is as under.

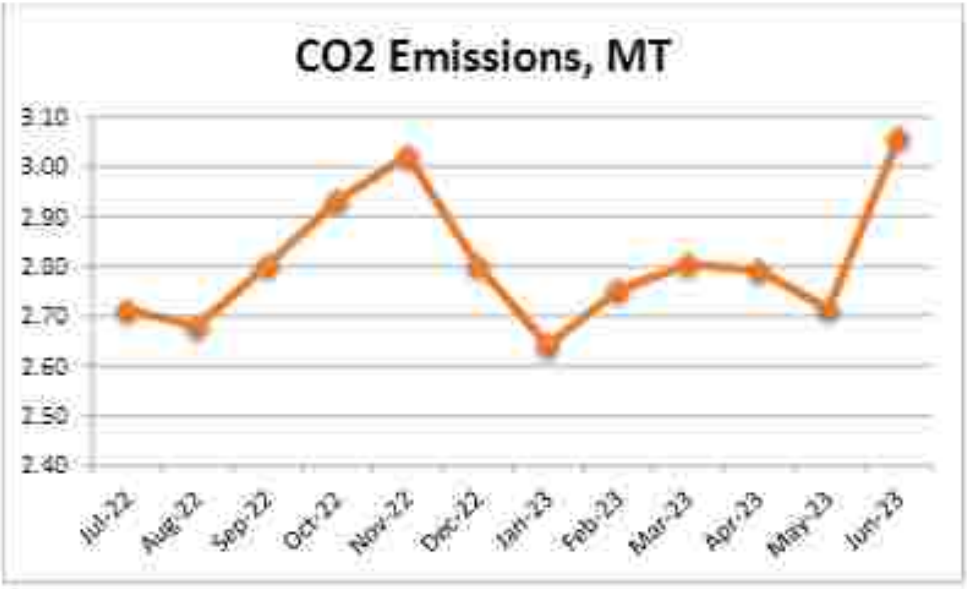
- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

Table No 1: Study of Purchase of Energy & CO_2 Emissions: 2022-23:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-22	3014	2.71
2	Aug-22	2978	2.68
3	Sep-22	3114	2.80
4	Oct-22	3258	2.93
5	Nov-22	3358	3.02
6	Dec-22	3114	2.80
7	Jan-23	2935	2.64

8	Feb-23	3058	2.75
9	Mar-23	3117	2.81
10	Apr-23	3102	2.79
11	May-23	3017	2.72
12	Jun-23	3398	3.06
13	Total	37463	33.72
14	Maximum	3398	3.06
15	Minimum	2935	2.64
16	Average	3121.92	2.81

Chart No 2: Month wise CO_2 Emissions:



CHAPTER III
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp**
In the following Table, we present the reduction in CO_2 emissions due to Solar Energy:

Table No 2: Computation of Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	kWp
2	Energy Generated in per kWp	4	kWh/kWp
3	Annual Solar Energy generation Days	300	Nos
4	Energy Generated in the Year 2022-23 = **1*2*3**	**3600**	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**	**3.24**	**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	Classroom	50	30	33
2	Electronics Dept	51	31	34
3	Exam Section	53	32	34
4	NSS Room	52	31	33
5	Office	50	29	32
	Maximum	53	31	34
	Minimum	50	29	32

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	Classroom	27.1	70	124	44.3
2	Electronics Dept	27.2	69	105	42
3	Exam Section	27.1	69	132	41.9
4	NSS Room	27.1	71	126	45
5	Office	27.2	69	132	40
	Maximum	**27.2**	**71**	**132**	**45**
	Minimum	**27.1**	**69**	**105**	**40**

CHAPTER VI
STUDY OF WASTE MANAGEMENT

6.1 Segregation of Waste at Source:

The Waste is segregated at source. Waste bins are located at various locations.

Photograph of Separate Waste Collection Bin:

6.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

6.3 Sanitary Waste Management:

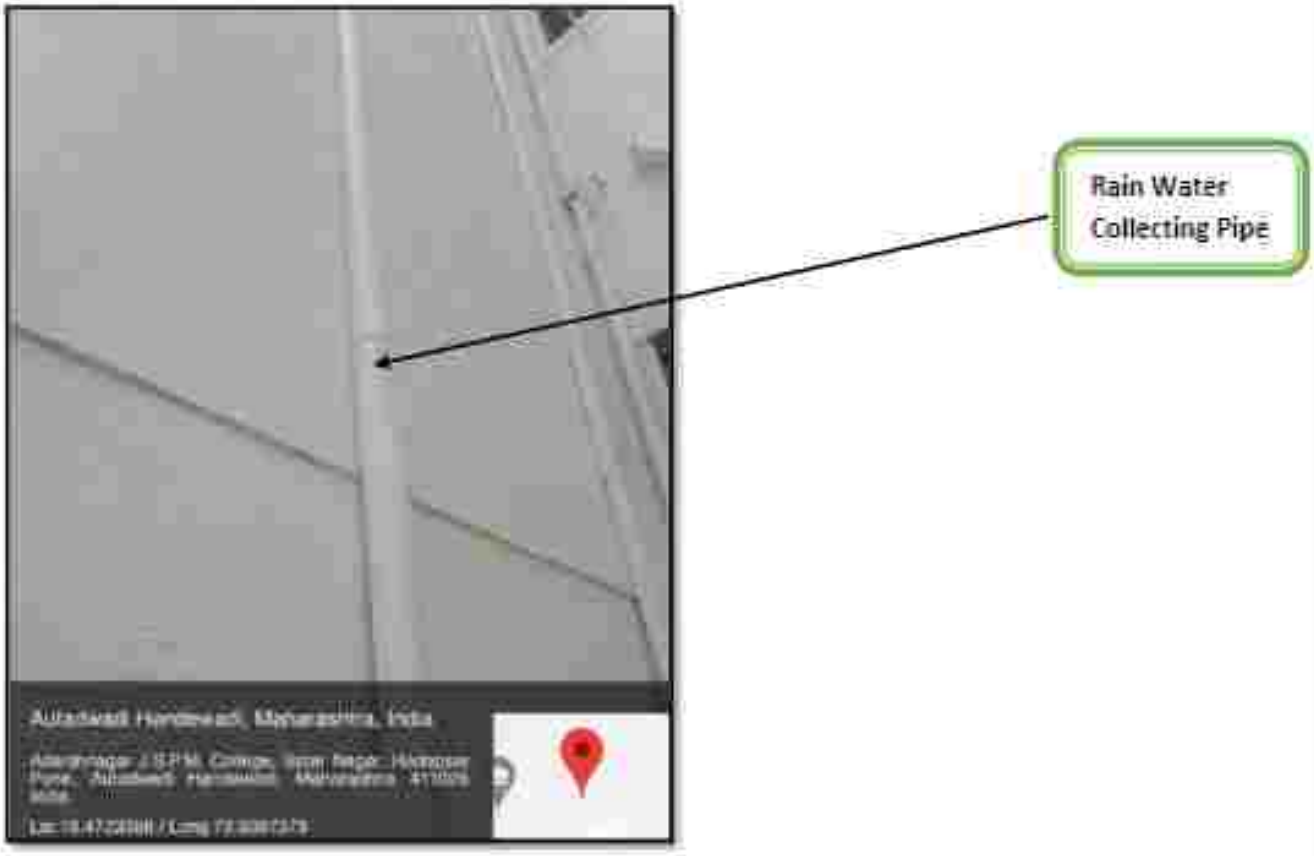
The College has installed Sanitary Waste Incinerator, for Disposal of Sanitary Waste.

Photograph of Sanitary Waste Incinerator:

CHAPTER-VII
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:



CHAPTER-VIII
STUDY OF ECO FRIENDLY INITIATIVES

8.1 Internal Tree Plantation:

The College has Tree Plantation in the campus.

Photograph of Tree plantation:

8.2 Creation of Awareness about Resource Conservation:

The College has displayed posters emphasizing on importance of Ban Single Use Plastic.

Photograph of Poster on Ban Single Use Plastic:

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^{0}C
2	Humidity	Less Than 70%

GREEN AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

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Year: 2022-23

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2. Present Energy Consumption & CO_2 Emission:

No	Particulars	Value	Unit
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2	Annual CO_2 Emissions	33.72	MT

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- The Energy generated by 3 kWp Solar PV Plant in 2022-23 is 3600 kWh.
- Reduction in CO_2 Emissions in 2022-23 is 3.24 MT

4. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Microbial Waste	Provision of Autoclave
3	Sanitary Waste	Provision of Sanitary Waste Incinerator

5. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

6. Green & Sustainable Practices:

- Maintenance of good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan
- Creation of awareness on ban Single Use Plastic by Display of Posters

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 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:

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ABBREVIATIONS

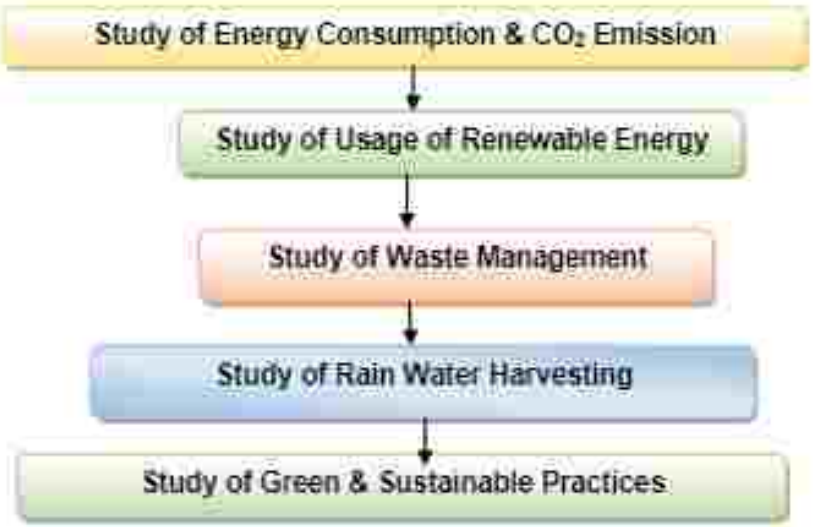
BEE	Bureau of Energy Efficiency
JSPM	Jayawant Shikshan Prasarak Mandal
kWh	Kilo Watt Hour
LPD	Liters Per Day
Kg	Kilo Gram
MT	Metric Ton
CO_2	Carbon Di Oxide
Qty	Quantity

CHAPTER-I
INTRODUCTION

1.1 Introduction:

A Green Audit is conducted at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Hadapsar,Pune

1.2 Audit Procedural Steps:



1.3 College Location Image:

CHAPTER-II
STUDY OF ENERGY CONSUMPTION & CO_2 EMISSION

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions:**

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

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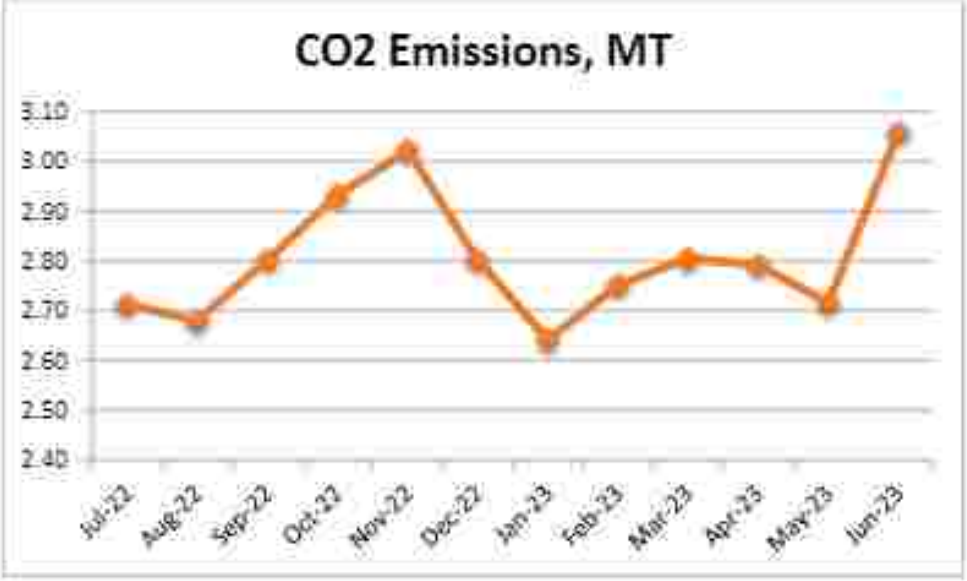

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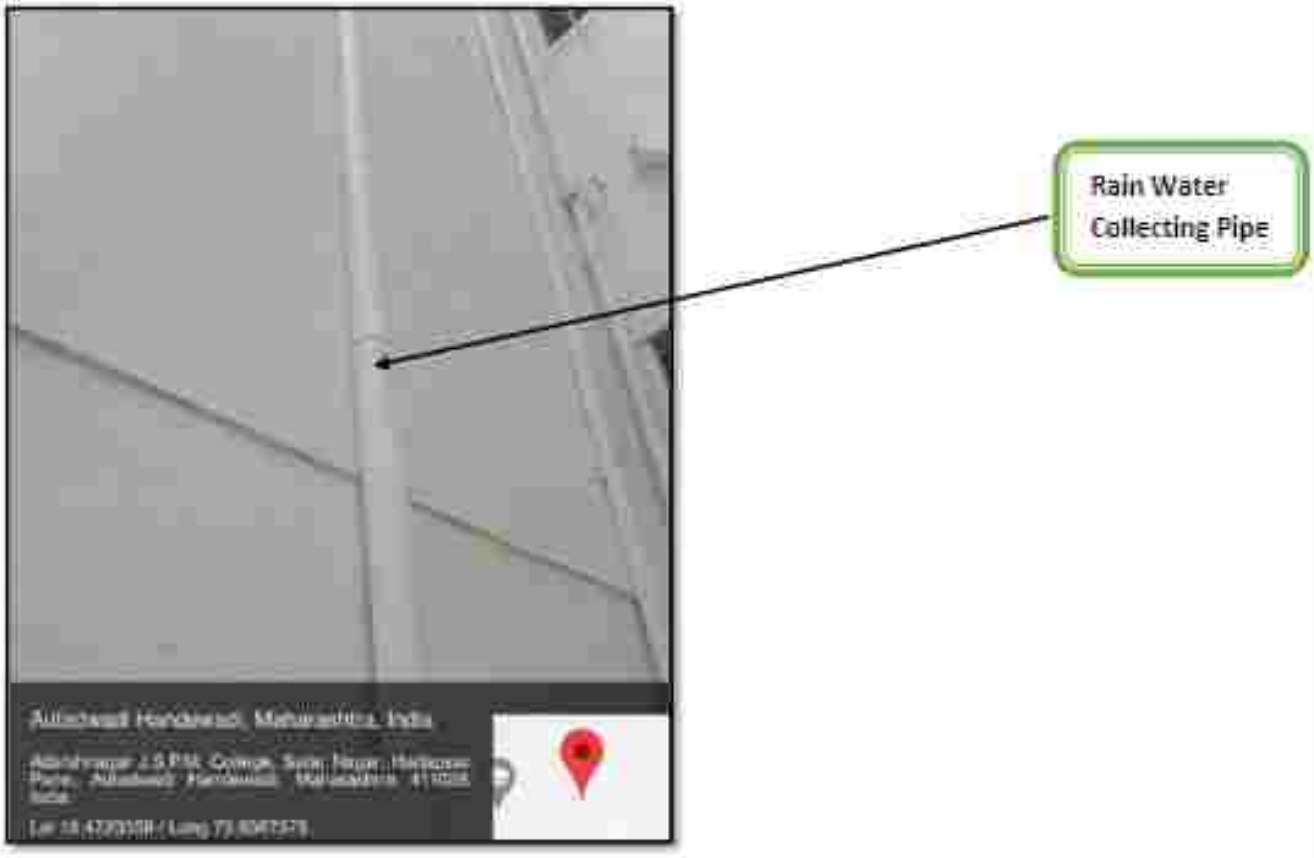

CHAPTER VI
STUDY OF GREEN & SUSTAINABLE PRACTICES

6.1 Pedestrian Friendly Road & Internal Tree Plantation:

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

Photograph of Internal Road & Tree 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 Resource Conservation:

The College has displayed posters emphasizing on importance of Ban Single Use Plastic.

Photograph of Poster on Ban Single Use Plastic:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: engress123@gmail.com
MEDA Registration No: ECN/2022-23/CR-43/1709
ISO: 9001-2015 Certified (Cert No: 23EQKC13).
ISO: 14001-2015 Certified (Cert No: 23EEKW20)

ENERGY AUDIT CERTIFICATE

Certificate No: ES/JSCSC/22-23/01 **Date: 10/7/2023**

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune, in the Academic year 2022-23.

The College has adopted Energy Efficient Practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of 3 kWp Roof Top Solar PV Plant

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

For Engress Services,

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

ENGRESS SERVICES PUNE

ENGRESS SERVICES

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- Good Internal Road
- Tree Plantation in the campus
- Creation of awareness on Ban Single Use Plastic 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 Eco Friendly.

For Engress Services,

A Y Mehendale,
B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-6192
ASSOCHAM GEM Certified Professional GEM: 22/788

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ENGRESS SERVICES PUNE

ENERGY AUDIT REPORT

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

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2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	53.59	kW
2	Annual Energy Purchased	37463	kWh

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	37463	kWh
2	Annual Energy Generated	3600	kWh
3	Annual Energy Consumed=1+2	41063	kWh
4	Total Built up area of College	1825.24	m^2
5	Energy Performance Index =(3) / (4)	22.50	kWh/m^2

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

No	Particulars	Value	Unit
1	Lighting Power Density	3.20	W/m^2
2	% of Usage of LED Lighting to Total Lighting Load	19.14	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Installation of 3 kWp Roof Top Solar PV Plant

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 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
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LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
JSPM	:	Jayawant Shikshan Prasarak Mandal
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

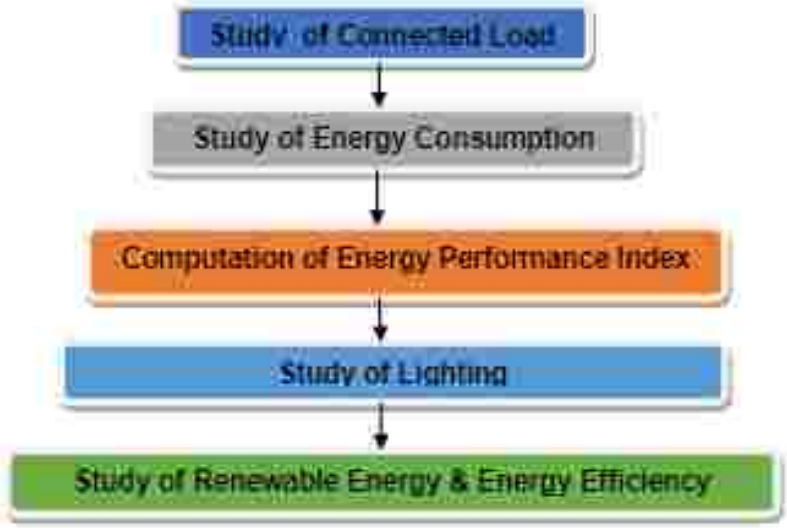
1.1 Introduction:

An Energy Audit is conducted at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Hadapsar,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:

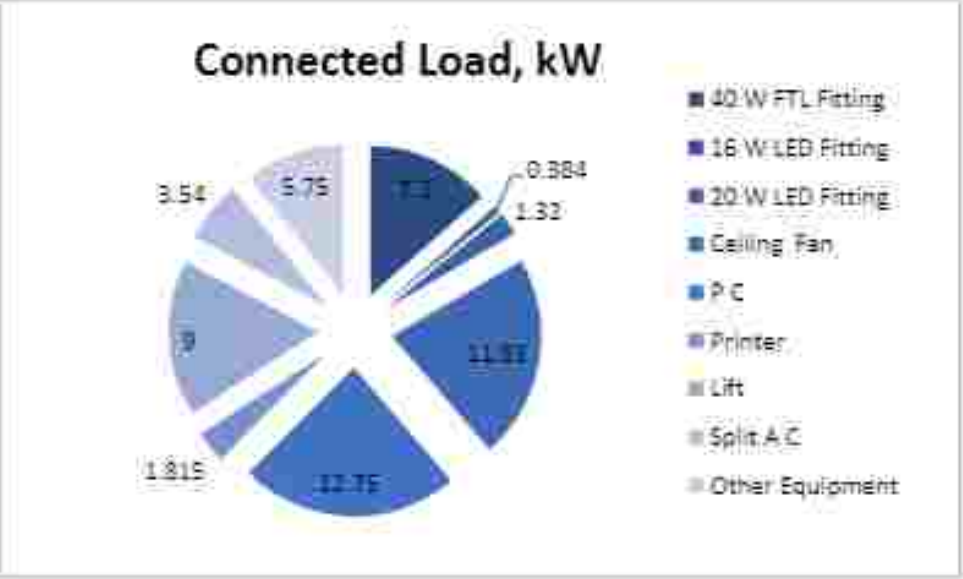
CHAPTER-II
STUDY OF CONNECTED LOAD

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 Fitting	180	40	7.2
2	16 W LED Fitting	24	16	0.384
3	20 W LED Fitting	66	20	1.32
4	Ceiling Fan	182	65	11.83
5	P C	85	150	12.75
6	Printer	11	165	1.815
7	Lift	1	9000	9
8	Split A C	3	1180	3.54
9	Other Equipment	23	250	5.75
10	**Total**			53.59

Chart No 1: Study of Connected Load:



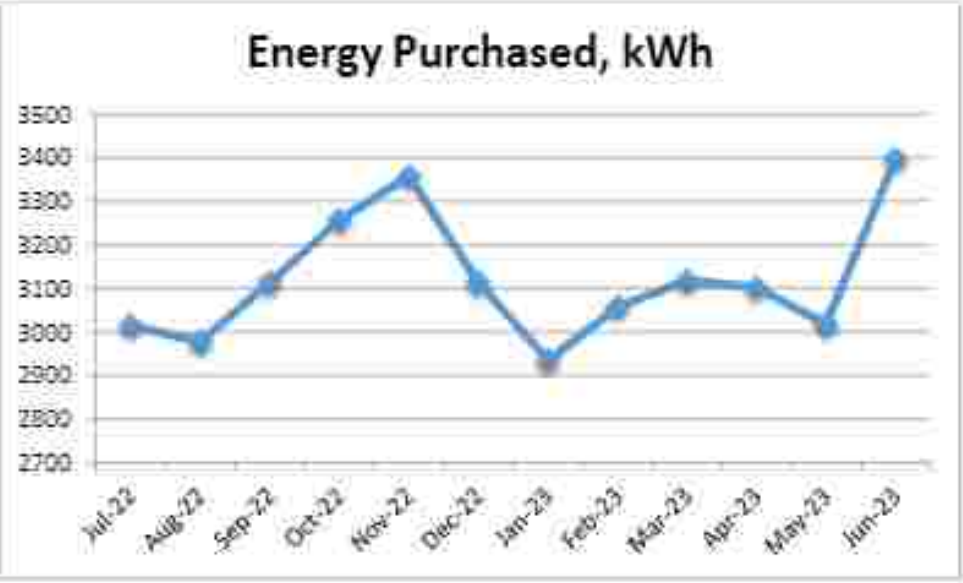
CHAPTER-III
STUDY OF PRESENT ENERGY CONSUMPTION

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	Jul-22	3014	2.71
2	Aug-22	2978	2.68
3	Sep-22	3114	2.80
4	Oct-22	3258	2.93
5	Nov-22	3358	3.02
6	Dec-22	3114	2.80
7	Jan-23	2935	2.64
8	Feb-23	3058	2.75
9	Mar-23	3117	2.81
10	Apr-23	3102	2.79
11	May-23	3017	2.72
12	Jun-23	3398	3.06
13	Total	37463	33.72
14	Maximum	3398	3.06
15	Minimum	2935	2.64
16	Average	3121.92	2.81

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:

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

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	37463	kWh
2	Energy Generated by Solar PV Plant	3600	kWh
3	Total Energy Consumed= 1+2	41063	kWh
4	Total Built up area of College	1825.24	m^2
5	Energy Performance Index =(3) / (4)	22.50	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/m²)

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 (W/m²/100 lux) 100 Installed power density (W/m²/100 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: Principal Sir Cabin:

No	Particulars	Value	Unit
1	No of 16 W LED Fittings	16	Nos
2	Load/unit of 16 W FTL Fitting	16	W/unit
3	Total Load of 16 W LED Fittings	**256**	**W**
4	Area of Room	**79.92**	**m²**
5	Lighting Power density = **(3) / (4)**	**3.20**	**W/m²**

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

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	180	Nos
2	Load/unit of 40 W FTL Fitting	40	W/unit
3	Total Load of 40 W FTL Fitting	**7.2**	kW
4	No of 16 W LED Fittings	24	Nos
5	Load/unit of 16 W LED Fitting	16	W/unit
6	Total Load of 16 W LED Fitting	**0.384**	kW
7	No of 20 W LED Fittings	66	Nos
8	Load/unit of 20 W LED Fitting	20	W/unit
9	Total Load of 20 W LED Fitting	**1.32**	kW
10	Total LED Lighting Load =6+9	1.704	kW
11	Total Lighting Load = 3+6+9	8.904	kW
12	% of LED to Total Lighting Load=**10*100/11**	**19.14**	%

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 3 **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 LED Lighting:

ENVIRONMENTAL AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2021-22

Prepared by:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795, Email: engress123@gmail.com

REGISTRATION CERTIFICATES

National Productivity Council

PROVISIONAL CERTIFICATE

BEE AUDITOR CERTIFICATE

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

FOR CLASS 'A'

MEDA EMPANELMENT CERTIFICATE

GEM Certificate

ASSOCHAM

Mr. A Y Mehendale

"Excellent Performance"

ASSOCHAM GEM CP CERTIFICATE

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ACKNOWLEDGEMENT

We Engress Services, Pune; express our sincere gratitude to the management of Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune for awarding us the assignment of Environmental Audit of their Campus for the Year: 2021-22.

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, 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 CO_2 on account of Electricity Consumption
- Solid Waste: Bio degradable Garden Waste
- Liquid Waste: Human liquid waste

3. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	35308	31.78
2	Maximum	3117	2.81
3	Minimum	2690	2.42
4	Average	2942.33	2.65

4. Usage of Renewable Energy& Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3kWp
- The Electrical Energy generated in 21-22 is 3600 kWh.
- Reduction in CO_2 Emissions in 21-22 works out to be 3.24 MT.

5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	63	38	42
2	Minimum	56	30	35

6. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	25.8	86	190	54
2	Minimum	25.4	84	115	45.6

7. Waste Management:

7.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

7.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

7.3 Sanitary Waste Management:

A Sanitary Waste Incinerator is provided in the Campus for Disposal of Sanitary Waste.

8. Rain Water Management:

The rain water falling on the terrace is used for increasing the Underground Water Table.

9. Environment Friendly Initiatives:

- Internal Tree Plantation.
- Creation of Awareness on Energy Conservation by Display of Posters.

10. Assumptions:

1. **1 kWh** of Electrical Energy releases **0.9 Kg** of CO_2 into atmosphere
2. **1 kWp** Roof Top Solar PV Plant generates **4 kWh of Electrical Energy** per Day
3. Annual Solar Energy Generation Days: **300 Nos.**

11. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in
- For Various Indoor Air Parameters: www.ishrae.com
- For AQI &Water Quality Standards: www.cpcb.com

ABBREVIATIONS

Kg	:	Kilo Gram
JSPM	:	Jayawant Shikshan Prasarak Mandal
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

1.1Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

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

1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Sitting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules
2011	E-waste (Management and Handling) Rules

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

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

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

1.2 Objectives:

1. To study Resource Consumption & CO_2 Emissions
2. To Study Usage of renewable Energy
3. To study Indoor Air Quality Parameters
4. To study Indoor Comfort Condition Parameters
5. To Study of Waste Management
6. To Study of Rain Water Management
7. To Study of Environment Friendly Initiatives

1.3 Table No 4: General Details of College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028.
3	Affiliation	Savitribai Phule Pune University

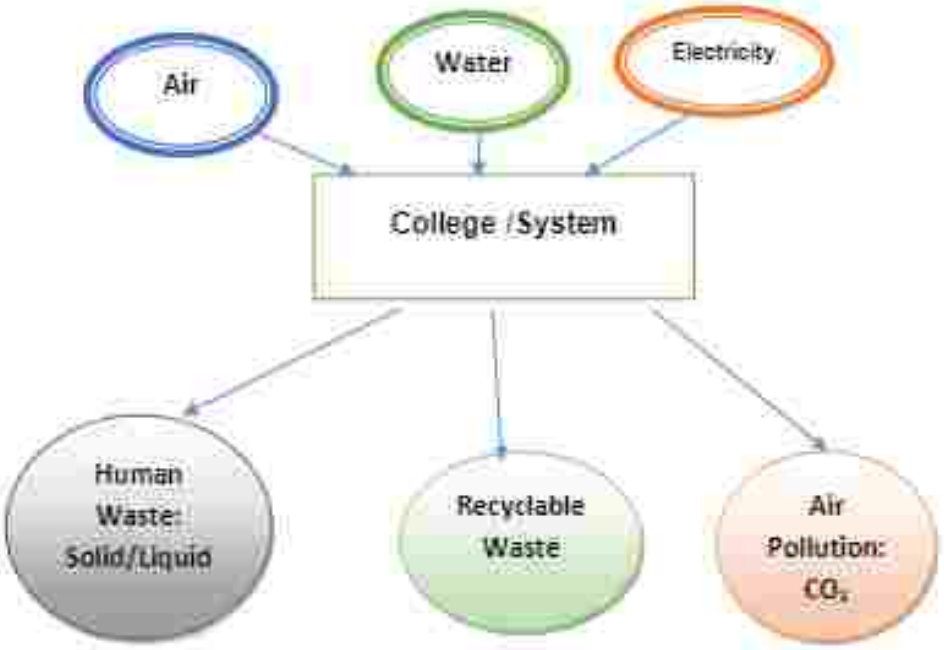
1.4 Google Earth Image:

CHAPTER-II
STUDY OF CONSUMPTION OF RECOURCES & CO_2 EMISSION

The Institute 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 CO_2 emissions due to Electrical Energy is as under

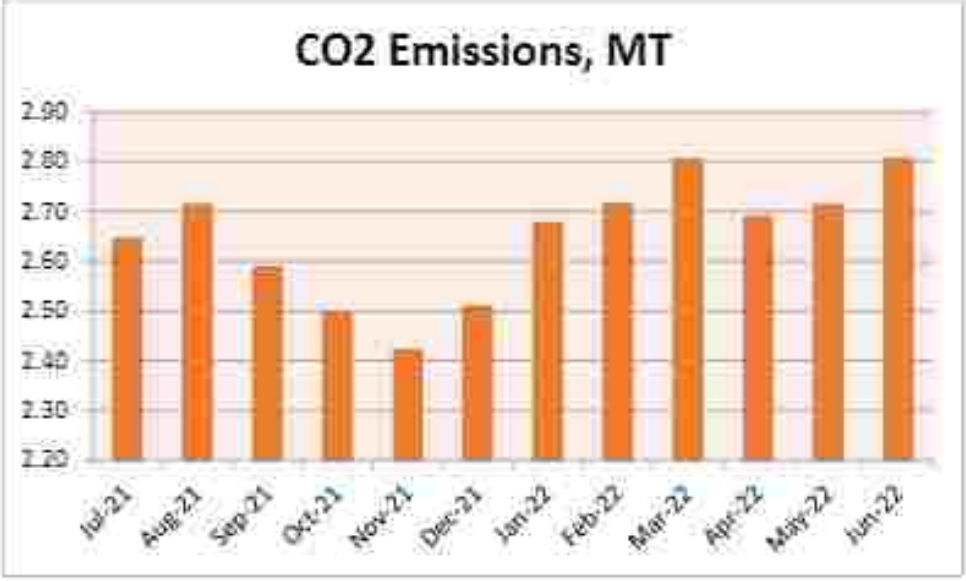
- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

Table No 5: Study of Consumption of Electrical Energy & CO_2 Emissions: 21-22:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-21	2940	2.65
2	Aug-21	3015	2.71
3	Sep-21	2875	2.59
4	Oct-21	2775	2.50
5	Nov-21	2690	2.42
6	Dec-21	2787	2.51
7	Jan-22	2974	2.68
8	Feb-22	3018	2.72

9	Mar-22	3115	2.80
10	Apr-22	2987	2.69
11	May-22	3015	2.71
12	Jun-22	3117	2.81
13	Total	35308	31.78
14	Maximum	3117	2.81
15	Minimum	2690	2.42
16	Average	2942.33	2.65

Chart No 2: Month wise CO_2 Emissions:



CHAPTER III
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 21-22	3600	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	3.24	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.

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

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

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

As per Section 2(a) of Air (Prevention and control of pollution) Act, 1981 '**air pollutant**' has been defined as '**any solid, liquid or gaseous substance [(including noise)] present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment**'

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.

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 7: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
1	Office	60	36	49
2	Physics Lab	56	33	37
3	Chemistry Lab	63	38	39
4	Class room	61	37	42
5	Faculty Cabin	56	30	35
	Maximum	63	38	42
	Minimum	56	30	35

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 8: Study of Indoor Comfort Condition Parameters:

No	Location	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Office	25.8	85	131	45.6
2	Physics Lab	25.4	86	119	46
3	Chemistry Lab	25.5	86	115	52
4	Class room	25.7	84	182	54
5	Faculty Cabin	25.7	84	190	53.6
	Maximum	**25.8**	**86**	**190**	**54**
	Minimum	**25.4**	**84**	**115**	**45.6**

CHAPTER VI
STUDY OF WASTE MANAGEMENT

6.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

6.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

6.3 Sanitary Waste Management:

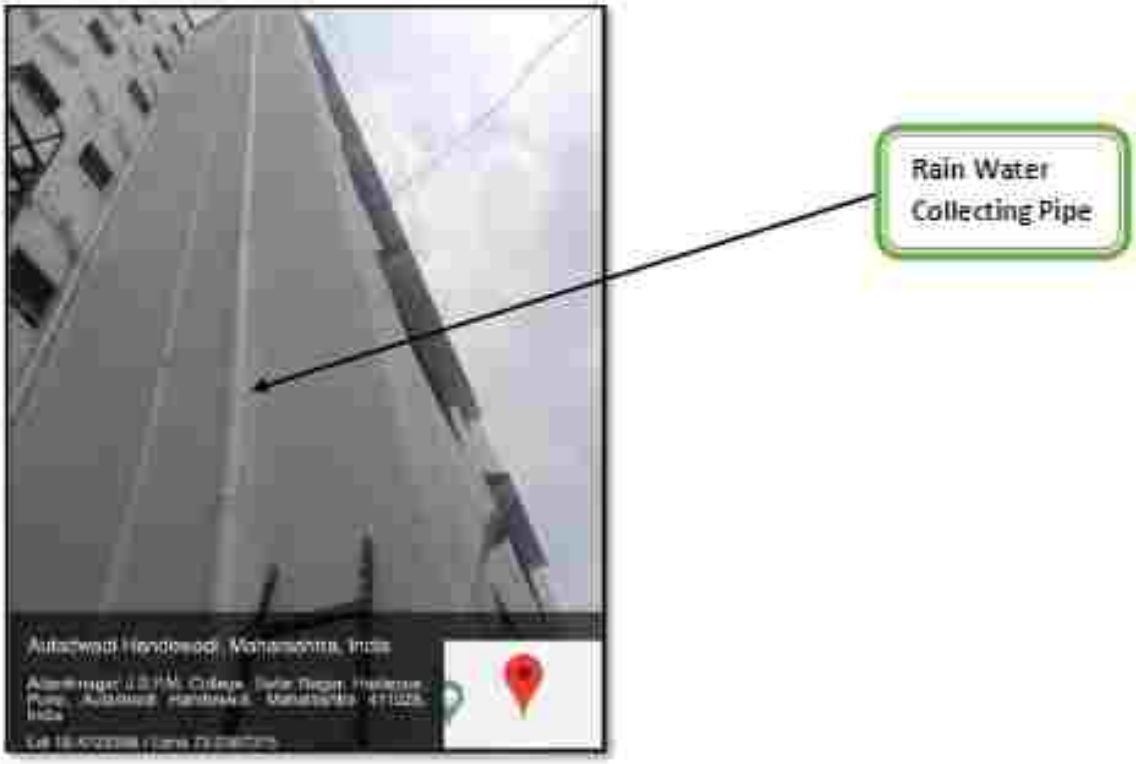
For disposal of Sanitary Waste, a Sanitary Waste Incinerator is installed in the campus.

Photograph of Sanitary Waste Incinerator:

CHAPTER-VII
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:



CHAPTER-VIII
STUDY OF ENVIRONMENT FRIENDLY INITIATIVES

8.1 Internal Tree Plantation:

The College has well maintained landscaped garden in the campus.

Photograph of Tree plantation:

8.2 Creation of Awareness on Energy Conservation:

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

Photograph of Poster on Energy Conservation:

ANNEXURE-I:
AIR QUALITY, NOISE & INDOOR 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%

GREEN AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2021-22

Prepared by:

ENGRESS SERVICES

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ASSOCHAM

Mr. A Y Mehendale

"Excellent Performance"

ASSOCHAM GEM CP CERTIFICATE

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4	Average	2942.33	2.65

3. Usage of Renewable Energy & Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp
- The Electrical Energy generated in 2021-22 is 3600 kWh.
- Reduction in CO_2 Emissions in 2021-22 works out to be 3.24 MT.

4. Waste Management:

4.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

4.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

4.3 Sanitary Waste Management:

A Sanitary Waste Incinerator is provided in the Campus for Disposal of Sanitary Waste.

5. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

6. Green & Sustainable Initiatives

- Good Internal Road
- Internal Tree Plantation
- Provision of Ramp for Divyangajan
- Creation of Awareness on Energy Conservation Display of Posters

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

8. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
JSPM	Jayawant Shikshan Prasarak Mandal
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 compute the CO_2 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 Table No 1: General Details of College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
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3	Affiliation	Savitribai Phule Pune University

1.3 Google Earth Image:

CHAPTER-II
STUDY OF PRESENT ENERGY CONSUMPTION

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

Table No 2: Electrical Bill Analysis- 2021-22:

No	Month	Energy Purchased, kWh
1	Jul-21	2940
2	Aug-21	3015
3	Sep-21	2875
4	Oct-21	2775
5	Nov-21	2690
6	Dec-21	2787
7	Jan-22	2974
8	Feb-22	3018
9	Mar-22	3115
10	Apr-22	2987
11	May-22	3015
12	Jun-22	3117
13	Total	35308
14	Maximum	3117
15	Minimum	2690
16	Average	2942.33

Chart No 1: Variation in Monthly Energy Consumption:

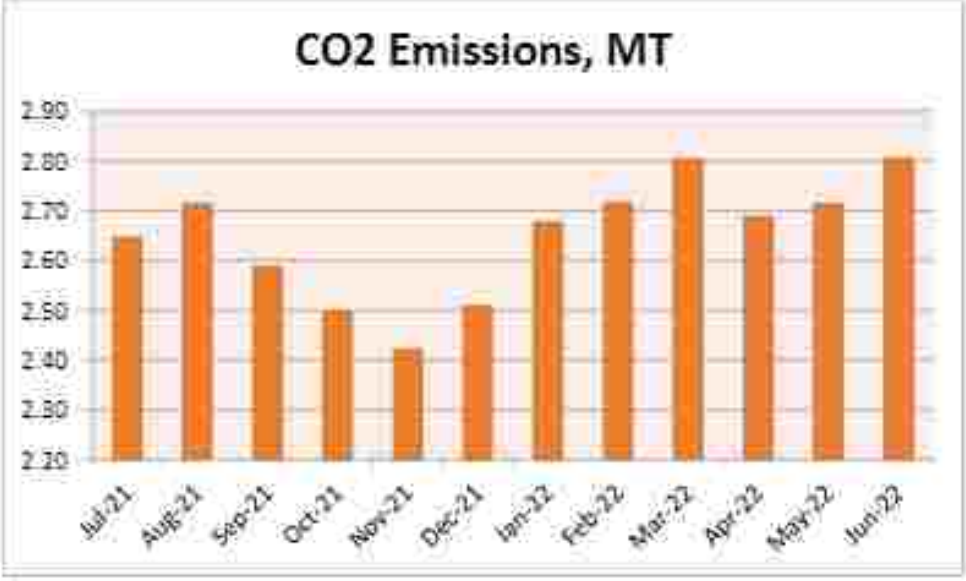
CHAPTER III
STUDY OF CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions: 1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-21	2940	2.65
2	Aug-21	3015	2.71
3	Sep-21	2875	2.59
4	Oct-21	2775	2.50
5	Nov-21	2690	2.42
6	Dec-21	2787	2.51
7	Jan-22	2974	2.68
8	Feb-22	3018	2.72
9	Mar-22	3115	2.80
10	Apr-22	2987	2.69
11	May-22	3015	2.71
12	Jun-22	3117	2.81
13	Total	35308	31.78
14	Maximum	3117	2.81
15	Minimum	2690	2.42
16	Average	2942.33	2.65

Chart No 2: Month wise CO_2Emissions:



CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 21-22	3600	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	3.24	MT of CO_2

Photograph of Roof Top Solar PV Plant:

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

5.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

5.3 Sanitary Waste Management:

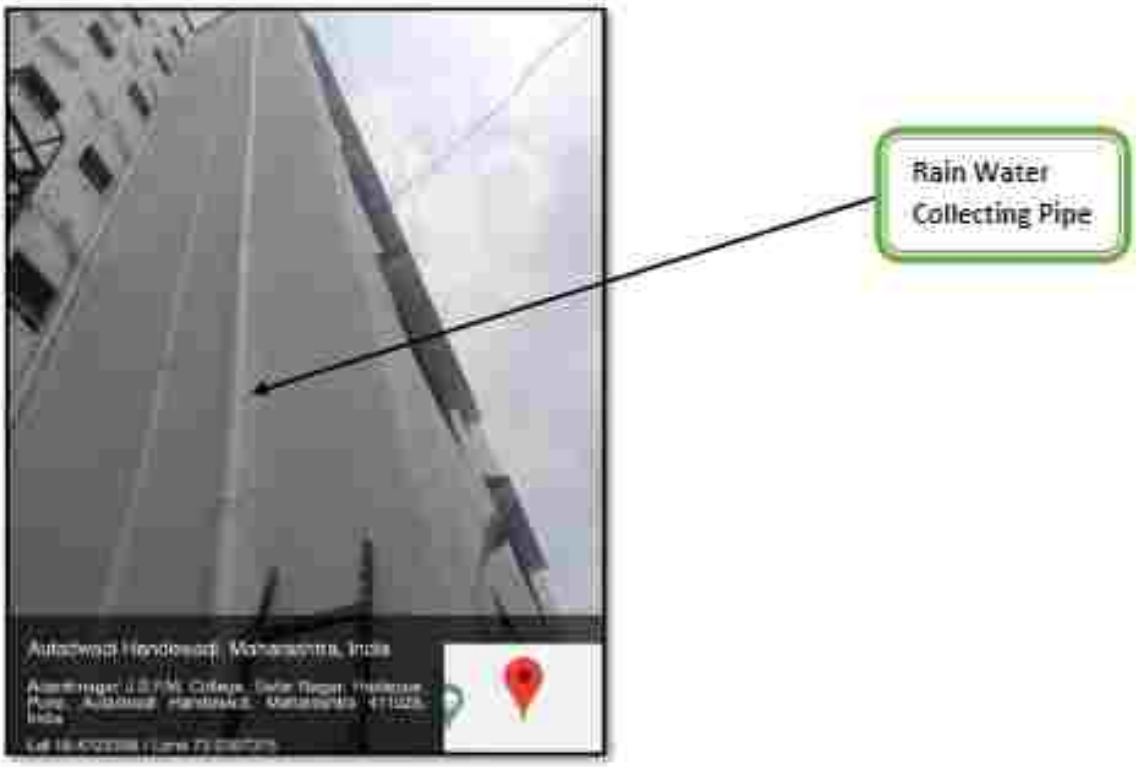
For disposal of Sanitary Waste, a Sanitary Waste Incinerator is installed in the campus.

Photograph of Sanitary Waste Incinerator:

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:



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 well maintained landscaped garden in the campus.

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 Creation of Awareness about Energy Conservation:

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

Photograph of Poster on Energy Conservation:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: engress123@gmail.com

Ref: ES/JSCSC/21-22/01 Date: 15/7/2022

CERTIFICATE

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune, in the Academic year 2021-22.

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 3 kWp Roof Top Solar PV Plant

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

For Engress Services,

ENGRESS SERVICES PUNE

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

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: engress123@gmail.com

Ref: ES/JSCSC/21-22/03 Date: 15/7/2022

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The College has adopted following Environment Friendly Practices.

- 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 3 kWp
- Segregation of Waste at source
- Provision of Sanitary Waste Incinerator, for Disposal of Sanitary Waste
- Good Internal Road
- Tree Plantation in the campus
- Creation of awareness on Energy 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,
Certified Energy Auditor, EA-8192
ASSOCHAM GEM Certified Professional GEM: 22/788

ENGRESS SERVICES • PUNE •

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: engress12@gmail.com

Ref: ES/JSCSC/21-22/02 Date: 19/7/2022

CERTIFICATE

This is to certify that we have conducted Green Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune, in the Academic year 2021-22.

The College has adopted following Green Practices:

- 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 3 kWp
- Segregation of Waste at source
- Provision of Sanitary Waste Incinerator, for Disposal of Sanitary Waste
- Good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan
- Creation of awareness on Energy 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,
Certified Energy Auditor, EA-8192
ASSOCHAM GEM Certified Professional: GEM: 22/788

ENGRESS SERVICES * PUNE *

ENERGY AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2021-22

Prepared by:

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
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REGISTRATION CERTIFICATES

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

Achyut Yashavant Mehendale

Yashavant

BEE AUDITOR CERTIFICATE

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

FOR CLASS 'A'

MEDA EMPANELMENT CERTIFICATE

INDEX

ACKNOWLEDGEMENT

We Engress Services, Pune; express our sincere gratitude to the management of Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune for awarding us the assignment of Energy Audit of their Campus for the Year: 2021-22.

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption& CO_2 Emission:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	35308	31.78
2	Maximum	3117	2.81
3	Minimum	2690	2.42
4	Average	2942.33	2.65

3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of 3 kWp Roof Top Solar PV Plant.

4. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.
- Energy purchased from MSEDCL is 143870 kWh.
- Energy generated by Roof Top Solar PV Plant is 3600 kWh.
- The percentage of Usage of Alternate Energy to Annual Energy Demand is 2.44 %.

5. Usage of LED Lighting:

- The Total Lighting load of the College is 8.972 kW.
- The Total LED Lighting Load is 1.572 kW.
- The percentage of LED Lighting to Total Lighting Demand is 17.52 %.

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

7. References:

- For CO_2 Emissions: www.tatapower.com
- For Roof Top Solar PV Plant Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
JSPM	:	Jayawant Shikshan Prasarak Mandal
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 Connected Load
2. To study present Energy Consumption
3. To compute the present CO_2 emissions
4. To study usage of Alternate Energy
5. To study usage of LED Lighting

1.2Table No 1: General Details of the College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028
3	Affiliation	Savitribai Phule Pune University

1.3 Google Earth Image:

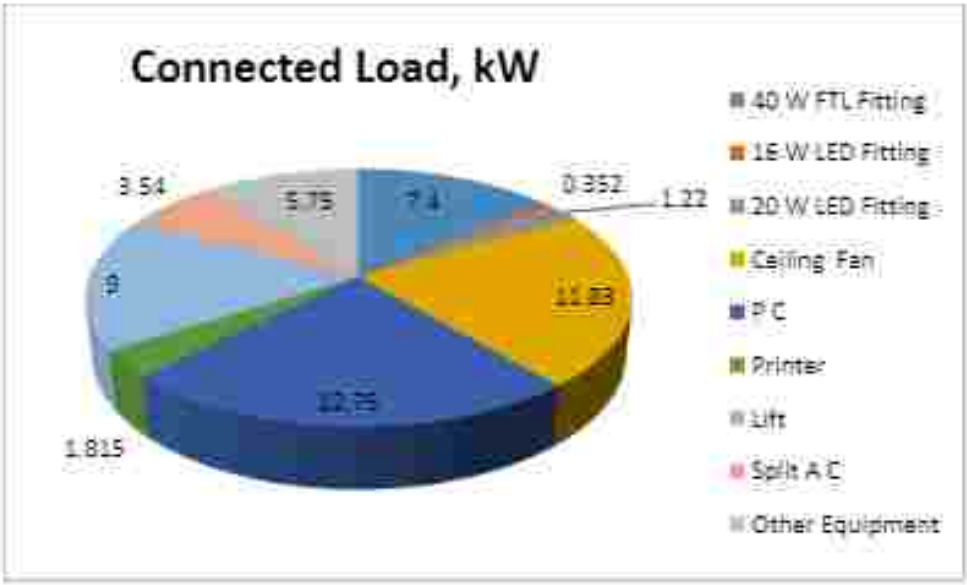
CHAPTER-II
STUDY OF CONNECTED LOAD

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	40 W FTL Fitting	185	40	7.4
2	16 W LED Fitting	22	16	0.352
3	20 W LED Fitting	61	20	1.22
4	Ceiling Fan	182	65	11.83
5	P C	85	150	12.75
6	Printer	11	165	1.815
7	Lift	1	9000	9
8	Split A C	3	1180	3.54
9	Other Equipment	23	250	5.75
10	Total			53.66

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- 2021-22:

No	Month	Energy Purchased, kWh
1	Jul-21	2940
2	Aug-21	3015
3	Sep-21	2875
4	Oct-21	2775
5	Nov-21	2690
6	Dec-21	2787
7	Jan-22	2974
8	Feb-22	3018
9	Mar-22	3115
10	Apr-22	2987
11	May-22	3015
12	Jun-22	3117
13	Total	35308
14	Maximum	3117
15	Minimum	2690
16	Average	2942.33

Chart No 2: Variation in Monthly Energy Consumption:

CHAPTER-IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions:** 1 kWh of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-21	2940	2.65
2	Aug-21	3015	2.71
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5	Nov-21	2690	2.42
6	Dec-21	2787	2.51
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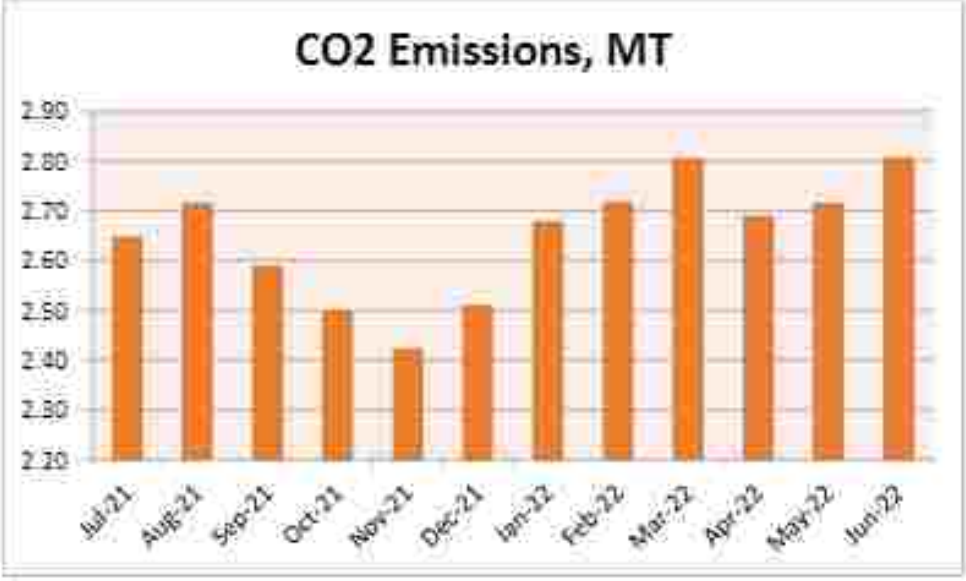
9	Mar-22	3115	2.80
10	Apr-22	2987	2.69
11	May-22	3015	2.71
12	Jun-22	3117	2.81
13	Total	35308	31.78
14	Maximum	3117	2.81
15	Minimum	2690	2.42
16	Average	2942.33	2.65

Chart No 3: Month wise CO_2Emissions:



CHAPTER-V
STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp.** The Plant is installed on **MBA Facility Building.**

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

Table No 5: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL	35308	kWh/Annum
2	Capacity of Roof Top Solar PV Capacity	3	kWp
3	Average Energy Generated per kWp per Day	4	kWh/kWp
4	Annual Generation Days	300	Nos
5	Annual Solar Energy Generated = 2*3*4	3600	kWh/Annum
6	Total Energy Requirement = (1) + (5)	38908	kWh/Annum
7	% of Alternate Energy to Annual Energy = (5)*100/(6)	9.25	%

Photograph of 3 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 6: Percentage of Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	185	Nos
2	Load/unit of 40 W FTL Fitting	40	W/unit
3	Total Load of 40 W FTL Fitting	**7.4**	kW
4	No of 16 W LED Fittings	22	Nos
5	Load/unit of 16 W LED Fitting	16	W/unit
6	Total Load of 16 W LED Fitting	**0.352**	kW
7	No of 20 W LED Fittings	61	Nos
8	Load/unit of 20 W LED Fitting	20	W/unit
9	Total Load of 20 W LED Fitting	**1.22**	kW
10	Total LED Lighting Load =6+9	1.572	kW
11	Total Lighting Load = 3+6+9	8.972	kW
12	% of LED to Total Lighting Load=**10*100/11**	**17.52**	%

ENVIRONMENTAL AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2020-21

Prepared by:

ENRICH CONSULTANTS

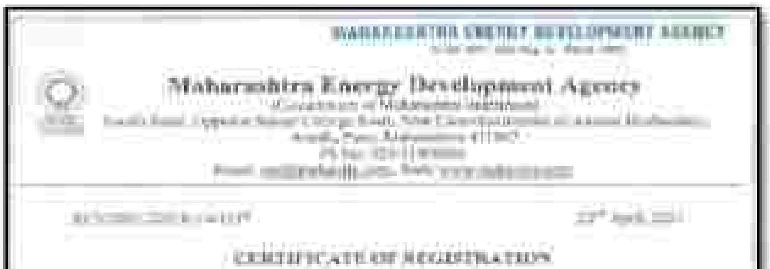
Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: enrichcons@gmail.com

REGISTRATION CERTIFICATES


National Productivity Council

PROVISIONAL CERTIFICATE

BEE ENERGY AUDITOR CERTIFICATE


Maharashtra Energy Development Agency

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FOR CLASS 'A'

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune for awarding us the assignment of Environmental 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. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, 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 CO_2 on account of Electricity Consumption
- Solid Waste: Bio degradable Garden Waste
- Liquid Waste: Human liquid waste

3. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	14253	12.83
2	Maximum	2902	2.61
3	Minimum	785	0.71
4	Average	14253	12.83

4. Usage of Renewable Energy& Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3kWp.
- The Electrical Energy generated in 2020-21 is 3600 kWh.
- Reduction in CO_2 Emissions in 2020-21 works out to be 3.24 MT.

5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	95	56	69
2	Minimum	86	52	59

6. Waste Management:

6.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

6.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

6.3 Sanitary Waste Management:

A Sanitary Waste Incinerator is provided in the Campus for Disposal of Sanitary Waste.

7. Rain Water Management:

The rain water falling on the terrace is used for increasing the Underground Water Table.

8. Environment Friendly Initiatives:

- Internal Tree Plantation.
- Creation of Awareness on 3R's Reduce,Reuse & Recycle by Display of Posters

9. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere.
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

10. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in
- For AQI Standards: www.cpcb.com

ABBREVIATIONS

Kg	:	Kilo Gram
JSPM	:	Jayawant Shikshan Prasarak Mandal
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

CHAPTER-I
INTRODUCTION

1.1Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

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

1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Sitting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules
2011	E-waste (Management and Handling) Rules

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

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

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

1.2 Objectives:

1. To study Resource Consumption & CO_2 Emissions
2. To Study Usage of renewable Energy
3. To study Indoor Air Quality Parameters
4. To study Indoor Comfort Condition Parameters
5. To Study of Waste Management
6. To Study of Rain Water Management
7. To Study of Environment Friendly Initiatives

1.3 Table No 4: General Details of College:

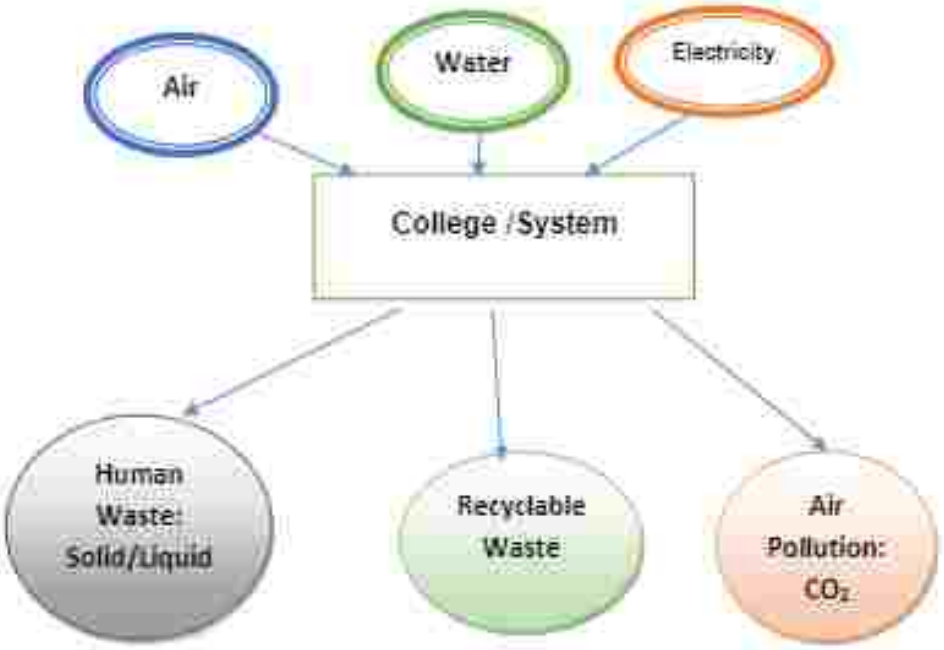
No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028
3	Affiliation	Savitribai Phule Pune University

CHAPTER-II
STUDY OF CONSUMPTION OF RECOURCES & CO_2 EMISSION

The Institute 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 CO_2 emissions due to Electrical Energy is as under

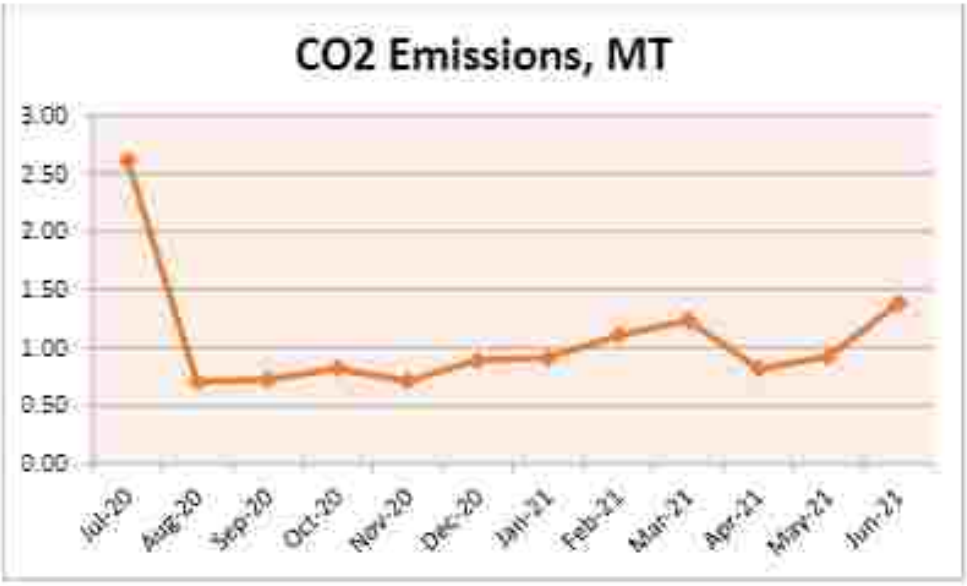
- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

Table No 5: Study of Consumption of Electrical Energy & CO_2 Emissions: 20-21:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	2902	2.61
2	Aug-20	785	0.71
3	Sep-20	805	0.72
4	Oct-20	907	0.82
5	Nov-20	789	0.71
6	Dec-20	990	0.89
7	Jan-21	1012	0.91
8	Feb-21	1228	1.11

9	Mar-21	1368	1.23
10	Apr-21	907	0.82
11	May-21	1025	0.92
12	Jun-21	1535	1.38
13	Total	14253	12.83
14	Maximum	2902	2.61
15	Minimum	785	0.71
16	Average	1187.75	1.07

Chart No 2: Month wise CO_2 Emissions:



CHAPTER III
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp**.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 20-21	3600	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	3.24	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.

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

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

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

As per Section 2(a) of Air (Prevention and control of pollution) Act, 1981 '**air pollutant**' has been defined as '**any solid, liquid or gaseous substance [(including noise)] present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment**'

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.

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 7: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
1	Faculty Room	93	55	67
2	Microbiology Dept	90	54	64
3	Library	94	55	68
4	Classroom	86	52	59
5	Physics Dept	95	56	69
	Maximum	**95**	**56**	**69**
	Minimum	**86**	**52**	**59**

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

5.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

5.3 Sanitary Waste Management:

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

Photograph of Sanitary Waste Incinerator:

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:

CHAPTER-VII
STUDY OF ENVIRONMENT FRIENDLY INITIATIVES

7.1 Internal Tree Plantation:

The College has well maintained landscaped garden in the campus.

Photograph of Tree plantation:

7.2 Creation of Awareness about 3 R's:

The College has displayed posters emphasizing on importance of 3 R's i.e Reduce, Reuse & Recycle.

Photograph of Poster on importance of 3R's i.e Reduce, Reuse & Recycle:

ANNEXURE-I:
INDOOR AIR QUALITY 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 +

GREEN AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2020-21

Prepared by:

ENRICH CONSULTANTS

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	14253	12.83
2	Maximum	2902	2.61
3	Minimum	785	0.71
4	Average	1187.75	1.07

3. Usage of Renewable Energy & Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp
- The Electrical Energy generated in 2020-21 is 3600 kWh.
- Reduction in CO_2 Emissions in 2020-21 works out to be 3.24 MT.

4. Waste Management:

4.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

4.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

4.3 Sanitary Waste Management:

A Sanitary Waste Incinerator is provided in the Campus for Disposal of Sanitary Waste.

5. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

6. Green & Sustainable Initiatives

- Good Internal Road
- Internal Tree Plantation
- Provision of Ramp for Divyangajan
- Creation of Awareness on 3R's Reduce,Reuse & Recycle by Display of Posters

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

8. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
JSPM	Jayawant Shikshan Prasarak Mandal
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 compute the CO_2 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 Table No 1: General Details of College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028
3	Affiliation	Savitribai Phule Pune University

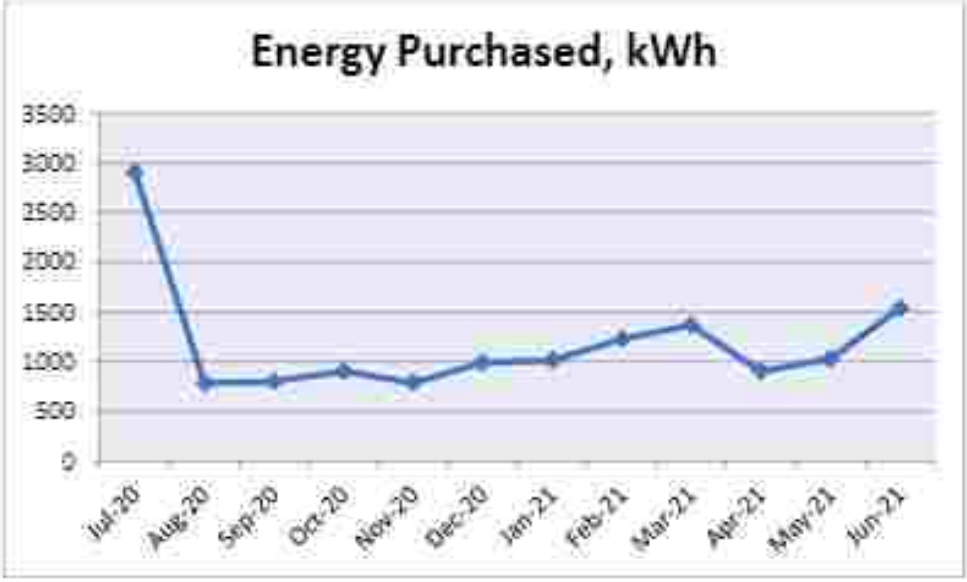
CHAPTER-II
STUDY OF PRESENT ENERGY CONSUMPTION

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

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

No	Month	Energy Purchased, kWh
1	Jul-20	2902
2	Aug-20	785
3	Sep-20	805
4	Oct-20	907
5	Nov-20	789
6	Dec-20	990
7	Jan-21	1012
8	Feb-21	1228
9	Mar-21	1368
10	Apr-21	907
11	May-21	1025
12	Jun-21	1535
13	Total	14253
14	Maximum	2902
15	Minimum	785
16	Average	1187.75

Chart No 1: Variation in Monthly Energy Consumption:



CHAPTER III
STUDY OF CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions: 1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	2902	2.61
2	Aug-20	785	0.71
3	Sep-20	805	0.72
4	Oct-20	907	0.82
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7	Jan-21	1012	0.91
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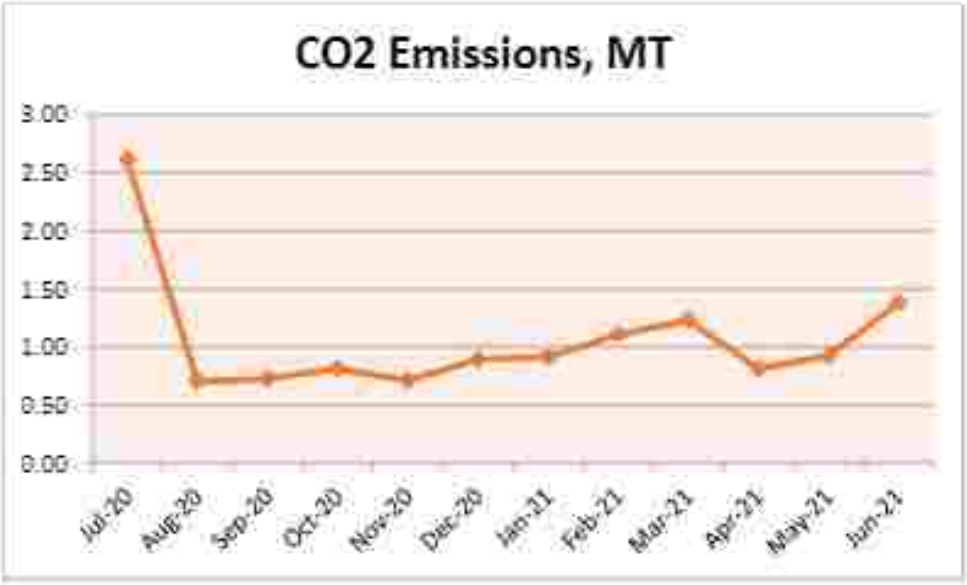
11	May-21	1025	0.92
12	Jun-21	1535	1.38
13	Total	14253	12.83
14	Maximum	2902	2.61
15	Minimum	785	0.71
16	Average	1187.75	1.07

Chart No 2: Month wise CO_2Emissions:



CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 20-21	3600	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	3.24	MT of CO_2

Photograph of Roof Top Solar PV Plant:

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

5.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

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

Photograph of Sanitary Waste Incinerator:

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table

Photograph of Rain water Collecting Pipe:

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 well maintained landscaped garden in the campus.

Photograph of Tree plantation:

7.3 Provision of Ramp for Divyangajan:

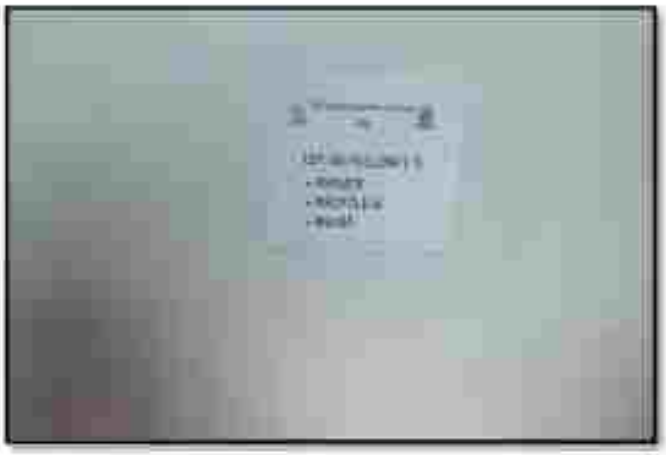
For easy movement of Divyangajan, the College has made provision of Ramp as well as dedicated wash room.

Photograph of Ramp:

7.4 Creation of Awareness about 3 R's:

The College has displayed posters emphasizing on importance of 3 R's i.e Reduce, Reuse & Recycle.

Photograph of Poster on importance of 3R's i.e Reduce, Reuse & Recycle:



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Tel: 09890444795 Email: [redacted]

Ref: EC/JSCSC/20-21/01 Date: 14/7/2021

CERTIFICATE

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, 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 3 kWp Roof Top Solar PV Plant

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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- 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 3 kWp
- Segregation of Waste at source
- Provision of Sanitary Waste Incinerator, for Disposal of Sanitary Waste
- Good Internal Road
- Tree Plantation in the campus
- Creation of awareness on importance of 3R's i.e Reduce, Reuse & Recycle 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.

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The College has adopted following Green Practices:

- 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 3 kWp
- Segregation of Waste at source
- Provision of Sanitary Waste Incinerator, for Disposal of Sanitary Waste
- Good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan
- Creation of awareness on importance of 3R's i.e Reduce, Reuse & Recycle 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.

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ENRICH CONSULTANTS * PUNE *

ENERGY AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2020-21

Prepared by:

ENRICH CONSULTANTS

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EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption& CO_2 Emission:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	14253	12.83
2	Maximum	2902	2.61
3	Minimum	785	0.71
4	Average	1187.75	1.07

3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of 3 kWp Roof Top Solar PV Plant

4. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.
- Energy purchased from MSEDCL is 14253 kWh.
- Energy generated by Roof Top Solar PV Plant is 3600 kWh.
- The percentage of Usage of Alternate Energy to Annual Energy Demand is 20.16 %.

5. Usage of LED Lighting:

- The Total Lighting load of the College is 8.972 kW.
- The Total LED Lighting Load is 1.572 kW.
- The percentage of LED Lighting to Total Lighting Demand is 17.52 %.

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days 300 Nos.

7. References:

- For CO_2 Emissions: www.tatapower.com
- For Roof Top Solar PV Plant Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
JSPM	:	Jayawant Shikshan Prasarak Mandal
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 Connected Load
2. To study present Energy Consumption
3. To compute the present CO_2 emissions
4. To study usage of Alternate Energy
5. To study usage of LED Lighting

1.2Table No 1: General Details of the College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
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3	Affiliation	Savitribai Phule Pune University

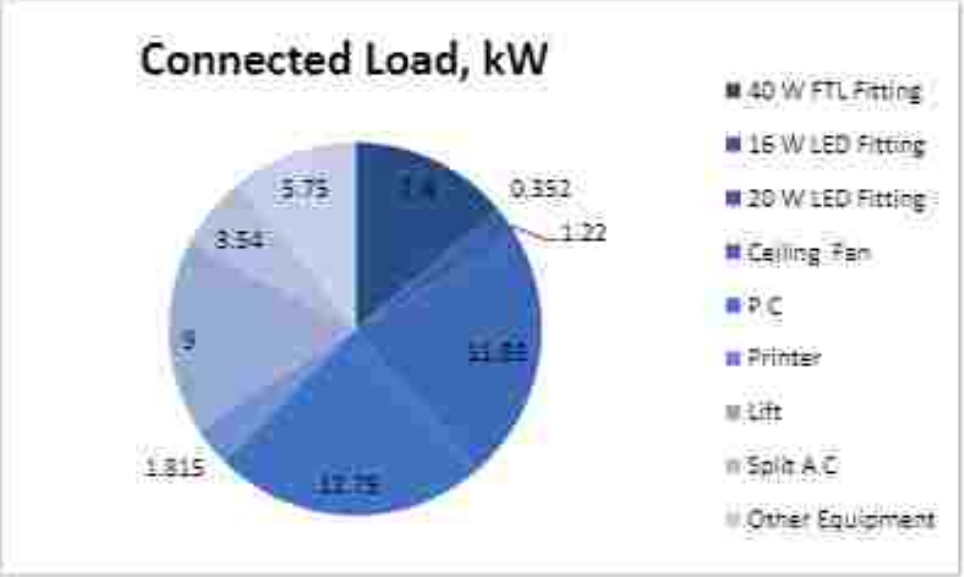
CHAPTER-II
STUDY OF CONNECTED LOAD

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	40 W FTL Fitting	185	40	7.4
2	16 W LED Fitting	22	16	0.352
3	20 W LED Fitting	61	20	1.22
4	Ceiling Fan	182	65	11.83
5	P C	85	150	12.75
6	Printer	11	165	1.815
7	Lift	1	9000	9
8	Split A C	3	1180	3.54
9	Other Equipment	23	250	5.75
10	Total			53.66

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 Purchased, kWh
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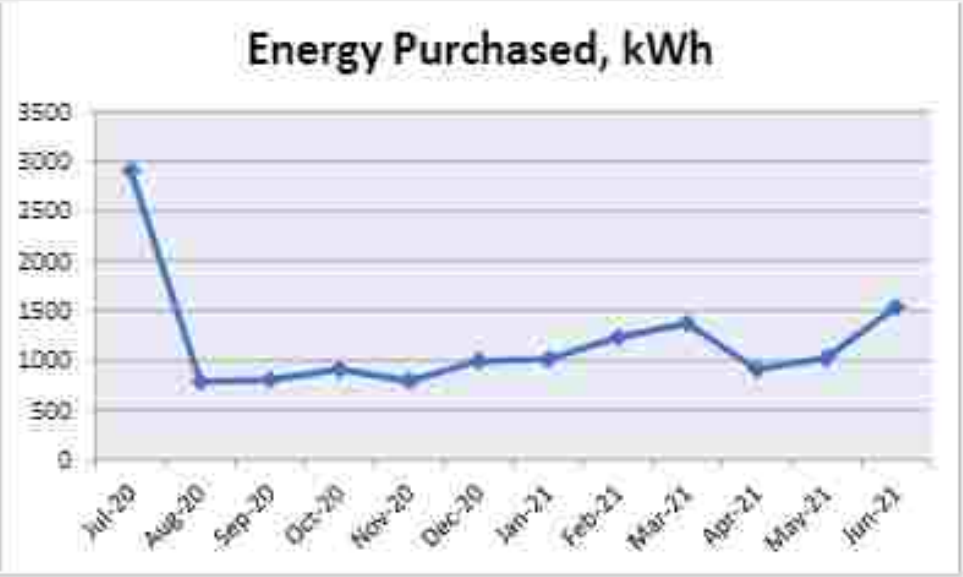
13	Total	14253
14	Maximum	2902
15	Minimum	785
16	Average	1187.75

Chart No 2: Variation in Monthly Energy Consumption:



CHAPTER-IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities **Basis for computation of CO_2 Emissions:** 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	2902	2.61
2	Aug-20	785	0.71
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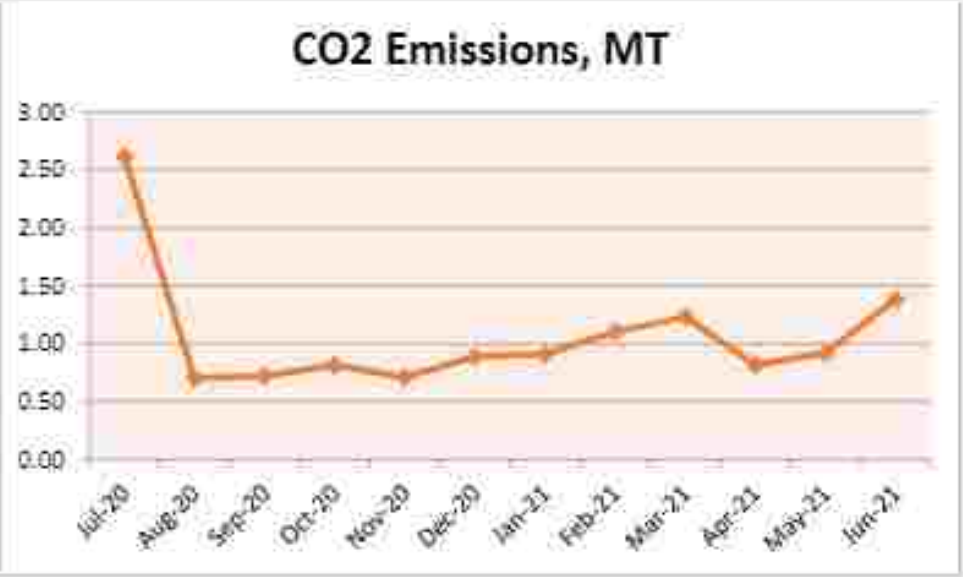

CHAPTER-V
STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity **3 kWp.** The Plant is installed on **MBA Facility Building.**

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

Table No 5: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL	14253	kWh/Annum
2	Capacity of Roof Top Solar PV Capacity	3	kWp
3	Average Energy Generated per kWp per Day	4	kWh/kWp
4	Annual Generation Days	300	Nos
5	Annual Solar Energy Generated = 2*3*4	3600	kWh/Annum
6	Total Energy Requirement = (1) + (5)	17853	kWh/Annum
7	% of Alternate Energy to Annual Energy = (5)*100/(6)	20.16	%

Photograph of 3 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 6: Percentage of Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	185	Nos
2	Load/unit of 40 W FTL Fitting	40	W/unit
3	Total Load of 40 W FTL Fitting	**7.4**	kW
4	No of 16 W LED Fittings	22	Nos
5	Load/unit of 16 W LED Fitting	16	W/unit
6	Total Load of 16 W LED Fitting	**0.352**	kW
7	No of 20 W LED Fittings	61	Nos
8	Load/unit of 20 W LED Fitting	20	W/unit
9	Total Load of 20 W LED Fitting	**1.22**	kW

10	Total LED Lighting Load =6+9	1.572	kW
11	Total Lighting Load = 3+6+9	8.972	kW
12	% of LED to Total Lighting Load=**10*100/11**	**17.52**	%

ENVIRONMENTAL AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

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Year: 2019-20

Prepared by,

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MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

FOR CLASS 'A'

Name and Address of the Firm : Enrich Consultants

Registration Category :

Registration Number :

MEDA EMPANELMENT CERTIFICATE

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1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, 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 CO_2 on account of Electricity Consumption
- Solid Waste: Bio degradable Garden Waste
- Liquid Waste: Human liquid waste

3. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	23526	21.17
2	Maximum	2557	2.30
3	Minimum	1012	0.91
4	Average	1960.50	1.76

4. Usage of Renewable Energy& Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3kWp.
- The Electrical Energy generated in 2019-20 is 3600 kWh.
- Reduction in CO_2 Emissions in 2019-20 works out to be 3.24 MT.

5. Waste Management:

5.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

5.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

6. Rain Water Management:

The rain water falling on the terrace is used for increasing the Underground Water Table.

7. Environment Friendly Initiatives:

- Internal Tree Plantation:

8. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day

3 Annual Solar Energy Generation Days: **300 Nos.**

10. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

Kg	:	Kilo Gram
JSPM	:	Jayawant Shikshan Prasarak Mandal
MT	:	Metric Ton
kWh	:	kilo-Watt Hour
LPD	:	Liters per Day
LED	:	Light Emitting Diode

CHAPTER-I
INTRODUCTION

1.1Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

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

1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Sitting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules
2011	E-waste (Management and Handling) Rules

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

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

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

1.2 Objectives:

1. To study Resource Consumption & CO_2 Emissions
2. To Study Usage of renewable Energy
3. To study Indoor Air Quality Parameters
4. To study Indoor Comfort Condition Parameters
5. To Study of Waste Management
6. To Study of Rain Water Management
7. To Study of Environment Friendly Initiatives

1.3 Table No 4: General Details of College:

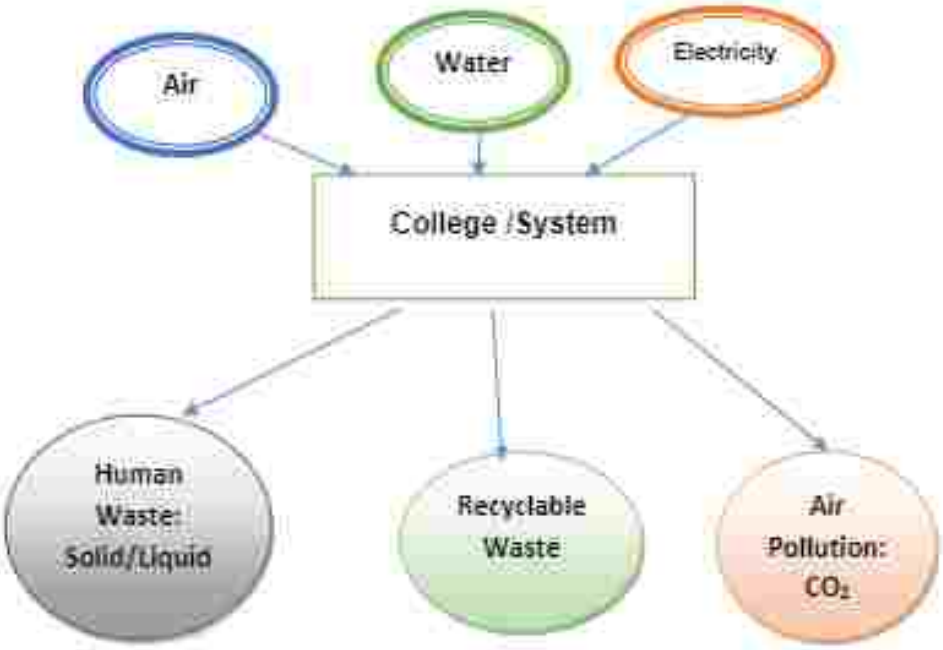
No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028
3	Affiliation	Savitribai Phule Pune University

CHAPTER-II
STUDY OF CONSUMPTION OF RECOURCES & CO_2 EMISSION

The Institute 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 CO_2 emissions due to Electrical Energy is as under

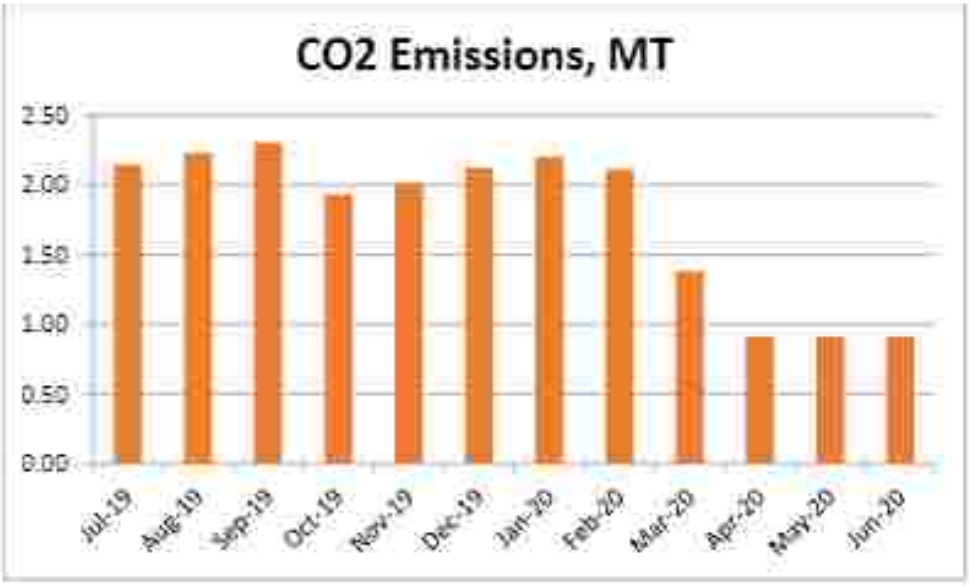
- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

Table No 5: Study of Consumption of Electrical Energy & CO_2 Emissions: 2019-20:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-19	2385	2.15
2	Aug-19	2478	2.23
3	Sep-19	2557	2.30
4	Oct-19	2145	1.93
5	Nov-19	2236	2.01
6	Dec-19	2358	2.12
7	Jan-20	2447	2.20
8	Feb-20	2348	2.11

9	Mar-20	1536	1.38
10	Apr-20	1012	0.91
11	May-20	1012	0.91
12	Jun-20	1012	0.91
13	Total	23525	21.17
14	Maximum	2557	2.30
15	Minimum	1012	0.91
16	Average	1960.50	1.76

Chart No 2: Month wise CO_2 Emissions:



CHAPTER III
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp**.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 19-20	3600	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	3.24	MT of CO_2

Photograph of Roof Top Solar PV Plant:

CHAPTER IV
STUDY OF WASTE MANAGEMENT

4.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

4.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:

CHAPTER-VII
STUDY OF ENVIRONMENT FRIENDLY INITIATIVES

7.1 Internal Tree Plantation:

The College has well maintained landscaped garden in the campus.

Photograph of Tree plantation:

GREEN AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2019-20

Prepared by:

ENRICH CONSULTANTS

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

REGISTRATION CERTIFICATES

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

BEE ENERGY AUDITOR CERTIFICATE

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

FOR CLASS 'A'

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune for awarding us the assignment of Green Audit of their Campus for the Year: 2019-20.

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	23526	21.17
2	Maximum	2557	2.30
3	Minimum	1012	0.91
4	Average	1960.50	1.76

3. Usage of Renewable Energy & Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp
- The Electrical Energy generated in 2019-20 is 3800 kWh.
- Reduction in CO_2 Emissions in 2019-20 works out to be 3.24 MT.

4. Waste Management:

4.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

4.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

5. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

6. Green & Sustainable Initiatives

- Good Internal Road
- Internal Tree Plantation
- Provision of Ramp for Divyangajan

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

8. References:

- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
JSPM	Jayawant Shikshan Prasarak Mandal
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 compute the CO_2 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 Table No 1: General Details of College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
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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- 2019-20:

No	Month	Energy Purchased, kWh
1	Jul-19	2385
2	Aug-19	2478
3	Sep-19	2557
4	Oct-19	2145
5	Nov-19	2236
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7	Jan-20	2447
8	Feb-20	2348
9	Mar-20	1536
10	Apr-20	1012
11	May-20	1012
12	Jun-20	1012
13	Total	23526
14	Maximum	2557
15	Minimum	1012
16	Average	1960.50

Chart No 1: Variation in Monthly Energy Consumption:

CHAPTER III
STUDY OF CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions: 1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-19	2385	2.15
2	Aug-19	2478	2.23
3	Sep-19	2557	2.30
4	Oct-19	2145	1.93
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6	Dec-19	2358	2.12
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8	Feb-20	2348	2.11
9	Mar-20	1536	1.38
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13	Total	23526	21.17
14	Maximum	2557	2.30
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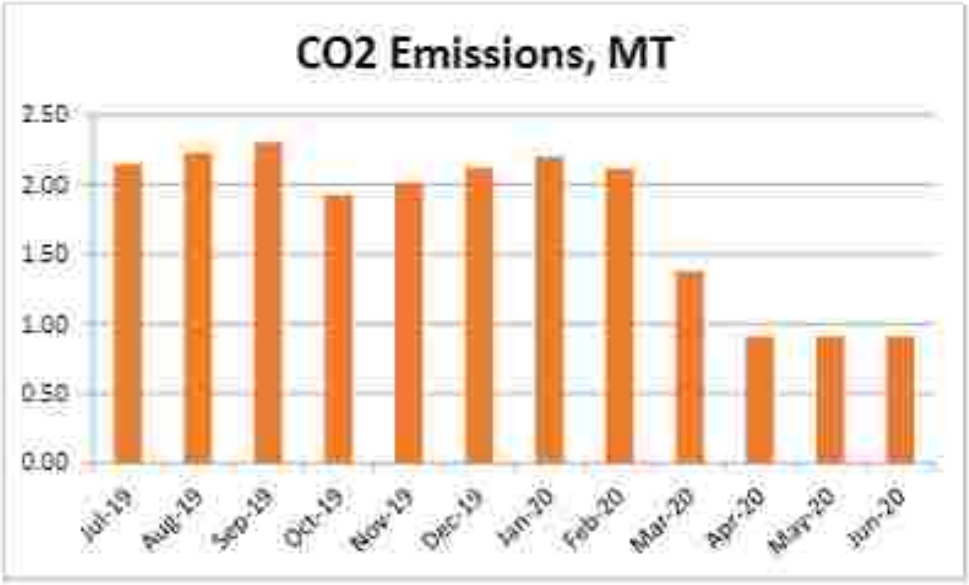
Chart No 2: Month wise CO_2Emissions:



CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 19-20	3600	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	3.24	MT of CO_2

Photograph of Roof Top Solar PV Plant:

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

5.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:

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 well maintained landscaped garden in the campus.

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:

Enrich Consultants

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

Ref: EC/JSCSC/19-20/01 Date: 19/7/2020

CERTIFICATE

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune, in the Academic year 2019-20.

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 3 kWp Roof Top Solar PV Plant

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

ENRICH CONSULTANTS • PUNE •

Enrich Consultants

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The College has adopted following Environment Friendly Practices:

- 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 3 kWp
- Segregation of Waste at source
- Good Internal Road
- Tree Plantation in the campus

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,

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The College has adopted following Green Practices:

- 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 3 kWp
- Segregation of Waste at source
- Good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan

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

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A Y Mehendale,
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ENRICH CONSULTANTS PUNE

ENERGY AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2019-20

Prepared by:

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Ashpat Yashwant Mahendale

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption& CO_2 Emission:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	23526	21.17
2	Maximum	2557	2.30
3	Minimum	1012	0.91
4	Average	1960.50	1.76

3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of 3 kWp Roof Top Solar PV Plant.

4. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.
- Energy purchased from MSEDCL is 23526 kWh.
- Energy generated by Roof Top Solar PV Plant is 3600 kWh.
- The percentage of Usage of Alternate Energy to Annual Energy Demand is 13.27 %.

5. Usage of LED Lighting:

- The Total Lighting load of the College is 9.04 kW.
- The Total LED Lighting Load is 1.44 kW.
- The percentage of LED Lighting to Total Lighting Demand is 15.93 %.

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

7. References:

- For CO_2 Emissions: www.tatapower.com
- For Roof Top Solar PV Plant Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
JSPM	:	Jayawant Shikshan Prasarak Mandal
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 Connected Load
2. To study present Energy Consumption
3. To compute the present CO_2 emissions
4. To study usage of Alternate Energy
5. To study usage of LED Lighting

1.2Table No 1: General Details of the College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
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3	Affiliation	Savitribai Phule Pune University

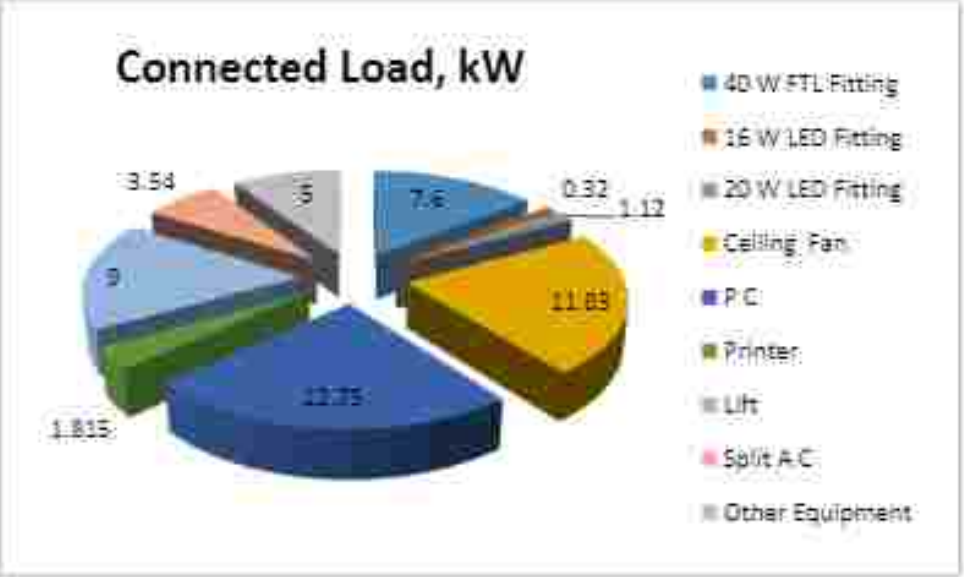
CHAPTER-II
STUDY OF CONNECTED LOAD

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	40 W FTL Fitting	190	40	7.6
2	16 W LED Fitting	20	16	0.32
3	20 W LED Fitting	56	20	1.12
4	Ceiling Fan	182	65	11.83
5	P C	85	150	12.75
6	Printer	11	165	1.815
7	Lift	1	9000	9
8	Split A C	3	1180	3.54
9	Other Equipment	20	250	5
10	Total			52.98

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- 2019-20:

No	Month	Energy Purchased, kWh
1	Jul-19	2385
2	Aug-19	2478
3	Sep-19	2557
4	Oct-19	2145
5	Nov-19	2236
6	Dec-19	2358
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11	May-20	1012
12	Jun-20	1012
13	Total	23526
14	Maximum	2557
15	Minimum	1012
16	Average	1960.50

Chart No 2: Variation in Monthly Energy Consumption:

CHAPTER-IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions:** 1 kWh of Electrical Energy releases 0.9 Kg of CO_2 into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
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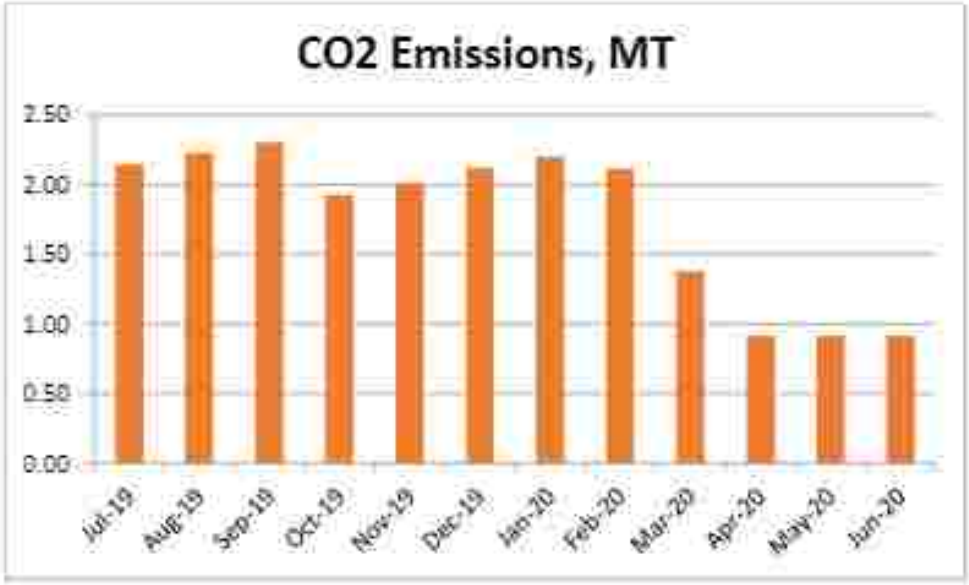

CHAPTER-V
STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp.** The Plant is installed on **MBA Facility Building.**

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

Table No 5: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL	23526	kWh/Annum
2	Capacity of Roof Top Solar PV Capacity	3	kWp
3	Average Energy Generated per kWp per Day	4	kWh/kWp
4	Annual Generation Days	300	Nos
5	Annual Solar Energy Generated = 2*3*4	3600	kWh/Annum
6	Total Energy Requirement = **(1) + (5)**	27126	kWh/Annum
7	% of Alternate Energy to Annual Energy = (5)*100/(6)	13.27	%

Photograph of 3 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 6: Percentage of Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	190	Nos
2	Load/unit of 40 W FTL Fitting	40	W/unit
3	Total Load of 40 W FTL Fitting	**7.6**	kW
4	No of 16 W LED Fittings	20	Nos
5	Load/unit of 16 W LED Fitting	16	W/unit
6	Total Load of 16 W LED Fitting	**0.32**	kW
7	No of 20 W LED Fittings	56	Nos
8	Load/unit of 20 W LED Fitting	20	W/unit
9	Total Load of 20 W LED Fitting	**1.12**	kW
10	Total LED Lighting Load =6+9	1.44	kW
11	Total Lighting Load = 3+6+9	9.04	kW
12	% of LED to Total Lighting Load=**10*100/11**	**15.93**	%

GREEN AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

Year: 2018-19

Prepared by:

ENRICH CONSULTANTS

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Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795 Email: enrichcons@gmail.com

REGISTRATION CERTIFICATES

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

BEE ENERGY AUDITOR CERTIFICATE

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION

FOR CLASS 'A'

MEDA EMPANELMENT CERTIFICATE

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management of Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune for awarding us the assignment of Green Audit of their Campus for the Year: 2018-19.

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

EXECUTIVE SUMMARY

1. Jayawant Shikshan Prasarak Mandal's, Jayawantrao Sawant Commerce & Science College, Hadapsar, Pune consumes Energy in the form of Electrical Energy; used for various Electrical Equipment, office & other facilities.

2. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	24970	22.47
2	Maximum	2234	2.01
3	Minimum	1887	1.70
4	Average	2080.83	1.87

3. Usage of Renewable Energy & Reduction in CO_2 Emissions:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.
- The Electrical Energy generated in 2018-19 is 3600 kWh.
- Reduction in CO_2 Emissions in 2018-19 works out to be 3.24 MT.

4. Waste Management:

4.1 Solid Waste Management:

Waste is segregated at Source. Waste bins are provided at various locations.

4.2 Microbial Waste Management:

The Microbial Waste is degenerated in an Autoclave before disposal.

5. Rain Water Management:

The rain water falling on terrace is used for increasing the underground water table.

6. Green & Sustainable Initiatives

- Good Internal Road
- Internal Tree Plantation

7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.8 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

8. References:

- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
JSPM	Jayawant Shikshan Prasarak Mandal
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 compute the CO_2 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 Table No 1: General Details of College:

No	Head	Particulars
1	Name of Institution	Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College
2	Address	Handewadi Road, Hadapsar, Pune 411 028
3	Affiliation	Savitribai Phule Pune University

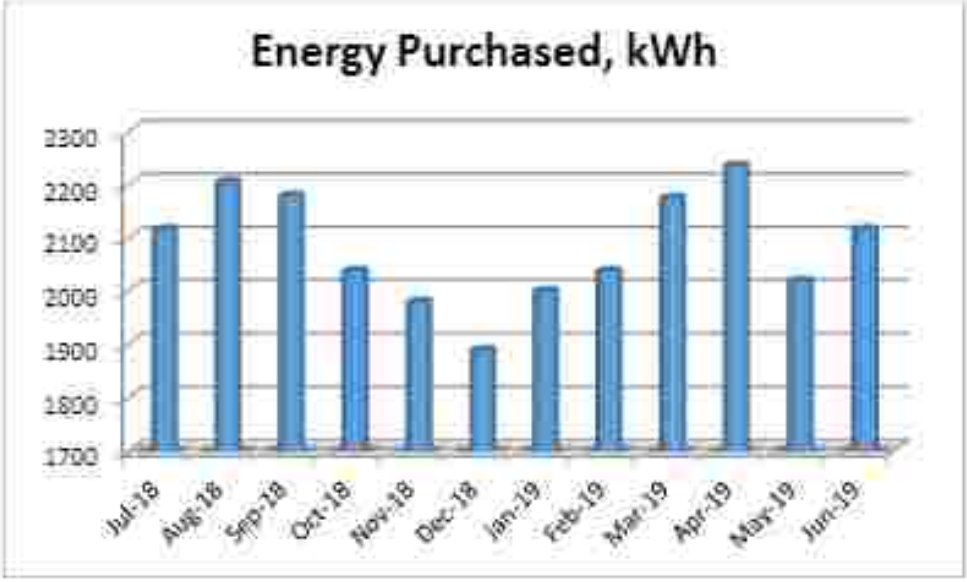
CHAPTER-II
STUDY OF PRESENT ENERGY CONSUMPTION

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

Table No 2: Electrical Bill Analysis- 2018-19:

No	Month	Energy Purchased, kWh
1	Jul-18	2114
2	Aug-18	2204
3	Sep-18	2178
4	Oct-18	2036
5	Nov-18	1978
6	Dec-18	1887
7	Jan-19	1998
8	Feb-19	2036
9	Mar-19	2174
10	Apr-19	2234
11	May-19	2017
12	Jun-19	2114
13	Total	24970
14	Maximum	2234
15	Minimum	1887
16	Average	2080.83

Chart No 1: Variation in Monthly Energy Consumption:



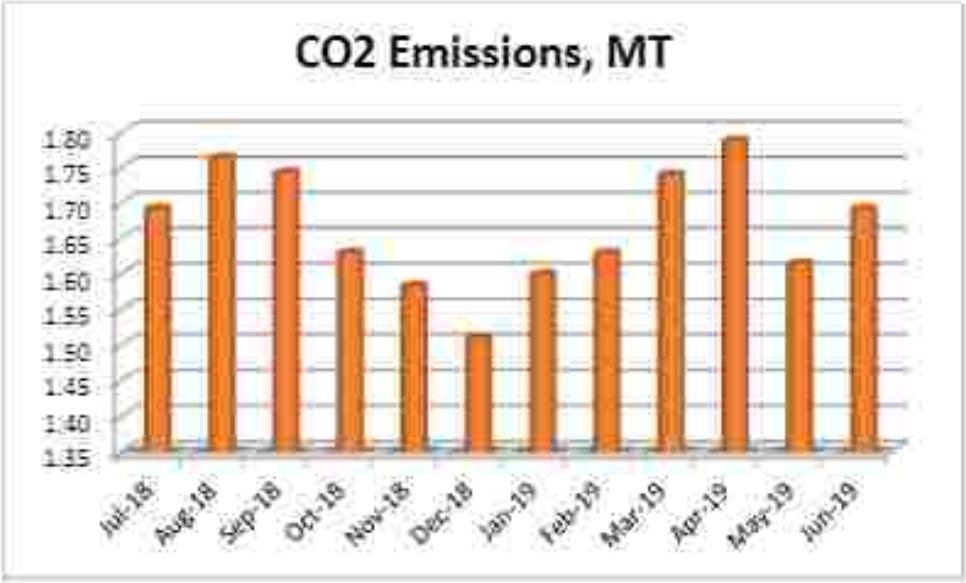
CHAPTER III
STUDY OF CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions: 1 kWh** of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Table No 4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-18	2114	1.69
2	Aug-18	2204	1.76
3	Sep-18	2178	1.74
4	Oct-18	2036	1.63
5	Nov-18	1978	1.58
6	Dec-18	1887	1.51
7	Jan-19	1998	1.60
8	Feb-19	2036	1.63
9	Mar-19	2174	1.74
10	Apr-19	2234	1.79
11	May-19	2017	1.61
12	Jun-19	2114	1.69
13	Total	24970	19.98
14	Maximum	2234	1.79
15	Minimum	1887	1.51
16	Average	2080.83	1.66

Chart No 2: Month wise CO_2Emissions:



CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.

In the following Table, we compute the Annual Reduction in CO_2 Emissions due to installation of Roof TOP Solar PV Plant.

Table No 6: Computation of Annual Reduction in CO_2 Emissions:

No	Particulars	Value	Unit
1	Installed Capacity of Roof Top Solar PV Plant Capacity	3	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: 18-19	3600	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	3.24	MT of CO_2

Photograph of Roof Top Solar PV Plant:

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Solid Waste Management:

The Waste is segregated at Source. Waste Bins are kept at various locations in the Campus.

Photograph of Waste Collection Bin:

5.2 Microbial Waste Management:

The Microbial Waste is completely degenerated in an Autoclave, before disposal.

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed Pipes from the terrace. The Rain Water is used to increase the underground water table.

Photograph of Rain water Collecting Pipe:

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 well maintained landscaped garden in the campus.

Photograph of Tree plantation:

Enrich Consultants

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

Ref: EC/JSCSC/18-19/01 Date: 11/7/2019

CERTIFICATE

This is to certify that we have conducted Energy Audit at Jayawant Shikshan Prasarak Mandal's Jayawantrao Sawant Commerce & Science College, Handewadi Road, Hadapsar, Pune, in the Academic year 2018-19.

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 3 kWp Roof Top Solar PV Plant

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 Mohendale,
Certified Energy Auditor
EA-8192

ENRICH CONSULTANTS PUNE

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The College has adopted following Green Practices:

- 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 3 kWp
- Segregation of Waste at source
- Good Internal Road
- Tree Plantation in the campus

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

ENRICH CONSULTANTS PUNE

ENERGY AUDIT REPORT

of

JAYAWANT SHIKSHAN PRASARAK MANDAL'S,

JAYAWANTRAO SAWANT COMMERCE & SCIENCE COLLEGE,

Handewadi Road, Hadapsar, Pune

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Name and Address of the Firm : Enrich Consultants

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1	Total	24970	22.47
2	Maximum	2234	2.01
3	Minimum	1887	1.70
4	Average	2080.83	1.87

3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Installation of 3 kWp Roof Top Solar PV Plant.

4. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity 3 kWp.
- Energy purchased from MSEDCL is 24970 kWh.
- Energy generated by Roof Top Solar PV Plant is 3600 kWh.
- The percentage of Usage of Alternate Energy to Annual Energy Demand is 12.60 %.

5. Usage of LED Lighting:

- The Total Lighting load of the College is 9.28 kW.
- The Total LED Lighting Load is 1.28 kW.
- The percentage of LED Lighting to Total Lighting Demand is 13.79 %.

6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.8 Kg of CO_2 into atmosphere
2. 1 kWp Roof Top Solar PV Plant generates 4 kWh of Electrical Energy per Day
3. Annual Solar Energy Generation Days: 300 Nos.

7. References:

- For Roof Top Solar PV Plant Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
JSPM	:	Jayawant Shikshan Prasarak Mandal
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 Connected Load
2. To study present Energy Consumption
3. To compute the present CO_2 emissions
4. To study usage of Alternate Energy
5. To study usage of LED Lighting

1.2Table No 1: General Details of the College:

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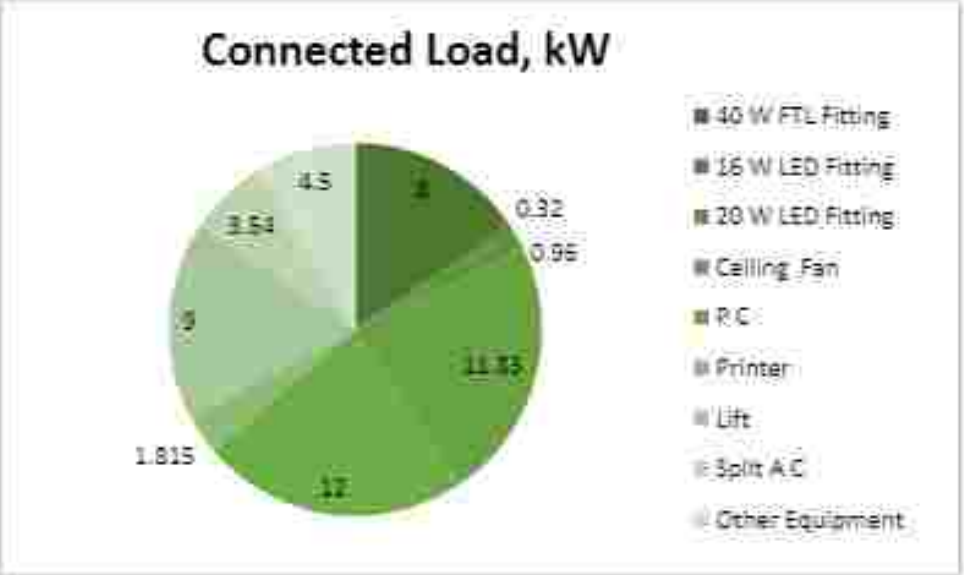
CHAPTER-II
STUDY OF CONNECTED LOAD

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	40 W FTL Fitting	200	40	8
2	16 W LED Fitting	20	16	0.32
3	20 W LED Fitting	48	20	0.96
4	Ceiling Fan	182	65	11.83
5	P C	80	150	12
6	Printer	11	165	1.815
7	Lift	1	9000	9
8	Split A C	3	1180	3.54
9	Other Equipment	18	250	4.5
10	**Total**			**51.97**

Chart No 1: Study of Connected Load:



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STUDY OF PRESENT ENERGY CONSUMPTION

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

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13	Total	24970
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Chart No 2: Variation in Monthly Energy Consumption:

CHAPTER-IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO_2 Emissions:** 1 kWh of Electrical Energy releases 0.8 Kg of CO_2 into atmosphere.

Table No 4: Month wise CO_2 Emissions:

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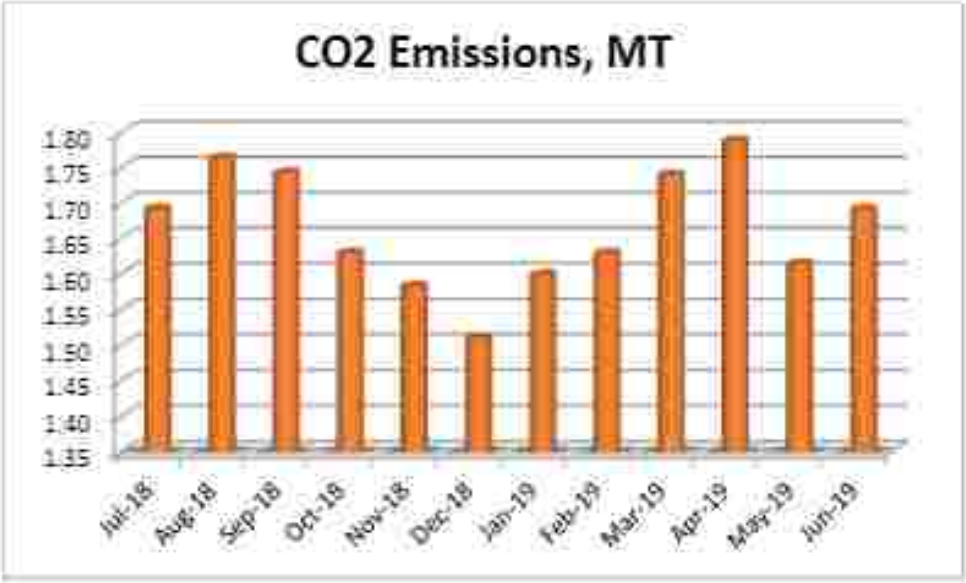

CHAPTER-V
STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity 3 **kWp.** The Plant is installed on **MBA Facility Building.**

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

Table No 5: Computation of % Annual Energy Demand met by Alternate Energy:

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL	24970	kWh/Annum
2	Capacity of Roof Top Solar PV Capacity	3	kWp
3	Average Energy Generated per kWp per Day	4	kWh/kWp
4	Annual Generation Days	300	Nos
5	Annual Solar Energy Generated = 2*3*4	3600	kWh/Annum
6	Total Energy Requirement = **(1) + (5)**	28570	kWh/Annum
7	% of Alternate Energy to Annual Energy = (5)*100/(6)	12.60	%

Photograph of 3 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 6: Percentage of Usage of LED Lighting to Annual Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	200	Nos
2	Load/unit of 40 W FTL Fitting	40	W/unit
3	Total Load of 40 W FTL Fitting	8	kW
4	No of 16 W LED Fittings	20	Nos
5	Load/unit of 16 W LED Fitting	16	W/unit
6	Total Load of 16 W LED Fitting	**0.32**	kW
7	No of 20 W LED Fittings	48	Nos
8	Load/unit of 20 W LED Fitting	20	W/unit
9	Total Load of 20 W LED Fitting	**0.96**	kW
10	Total LED Lighting Load =6+9	1.28	kW
11	Total Lighting Load = 3+6+9	9.28	kW
12	% of LED to Total Lighting Load=**10*100/11**	**13.79**	%