ENERGY AUDIT REPORT

of

Progressive Education Society's,
Modern College of Arts, Science & Commerce,
Ganeshkhind, Pune 411 053

Year: 2021-22

Prepared by

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
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ENGRESS SERVICES PUNE

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency
(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary,
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ECN/2022-23/CR-43/1709

10th May, 2022

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

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

Name and Address of the firm	:	M/s Engress Services Yashshree, 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune – 411 009.
Registration Category	:	*Empanelled Consultant for Energy Conservation Programme for Class 'A'*
Registration Number	:	***MEDA/ECN/2022-23/Class A/EA-32.***

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **09th May, 2024** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

ENGRESS SERVICES PUNE

ENGRESS SERVICES

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

Ref: ES/PESMCASC/21-22/01

Date: 20/5/2022

CERTIFICATE

This is to certify that we have conducted Energy Audit at Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune in the 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
- Installation of **21 kW** Hybrid Roof Top Solar PV/Wind Power Plant.

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

CONTENTS

ACKNOWLEDGEMENT

We at Engress Services, Pune wish to express our sincere gratitude to the management of Progressive Education Society's Modern College of Arts, Science &Commerce, Ganeshkhind, Pune for assigning the work of Energy Audit of Ganeshkhind campus for the Year: 2021-22.

We are thankful to all staff members who helped us during the field study.

EXECUTIVE SUMMARY

1. Progressive Education Society's Modern College of Arts, Science& Commerce, Ganeshkhind, Pune uses Electrical Energy as the source of Energy for various equipment.

2. Present Level of Energy Consumption & CO_2 Emission:

No	Parameter /Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

3. Various measures adopted for Energy Conservation & Renewable Energy:

1. Usage of LED tube lights
2. Usage of STAR Rated equipment
3. Installation of **21 kWp** Solar (15 kW-Solar) & Wind (6 kW-Wind) Hybrid roof top plant.

4. Percentage of Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity **15 kWp.**
- Energy purchased from MSEDCL is **108359 kWh.**
- Energy generated by Roof Top Solar PV Plant is **18000 kWh.**
- Total Energy Requirement of College is **126359 kWh.**
- Percentage of Usage of Alternate Energy to Annual Energy Demand is **14.25 %.**

5. Percentage of Usage of LED Lighting:

- The Total Lighting Load of the College is **11184.6 kW.**
- The Total LED Lighting Load of the College is **3616.2 kW.**
- The percentage of Annual LED Lighting to Annual Lighting Demand is **32.3 %.**

6. Notes & Assumptions:

1. 1 kWh of Electrical Energy releases **0.9 Kg** of CO_2into atmosphere
2. 1 kWp 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

PES	:	Progressive Education Society
LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
IQAC	:	Internal Quality Assurance Cell
BEE	:	Bureau of Energy Efficiency
FTL	:	Fluorescent Tube Light
CFL	:	Compact Fluorescent Light
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO_2	:	Carbon Di Oxide
MT	:	Metric Ton

CHAPTER 1
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

1.2 Table No 1: General Details of College:

No	Head	Particulars
1	Name of Institution	Progressive Education Society's Modern College of Arts, Commerce & Science
2	Address	Ganeshkhind, Pune
3	Affiliation	Savitribai Phule Pune University

1.3 Google Earth Image:

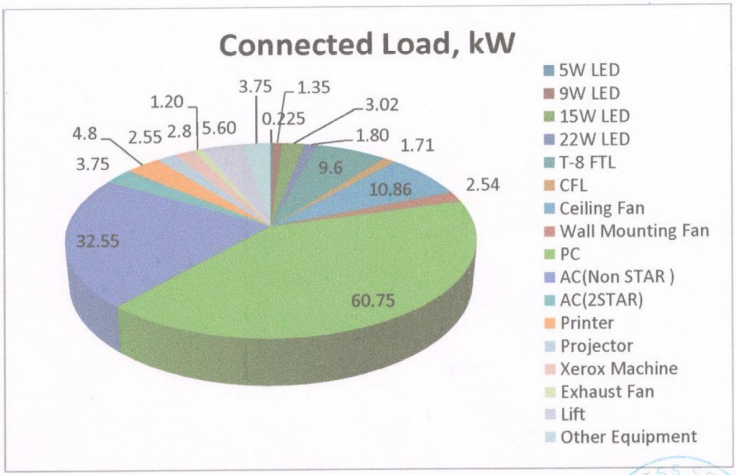
CHAPTER-II
STUDY OF CONNECTED LOAD

In this chapter, we present the details of various Electrical loads as under

Table No 2: Overall Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	5W LED	45	5	0.225
2	9W LED	150	9	1.35
3	15W LED	201	15	3.02
4	22W LED	82	22	1.80
5	T-8 FTL	240	40	9.6
6	CFL	95	18	1.71
7	Ceiling Fan	167	65	10.86
8	Wall Mounting Fan	39	65	2.54
9	PC	405	150	60.75
10	AC(Non STAR)	14	2325	32.55
11	AC(2STAR)	2	1875	3.75
12	Printer	32	150	4.8
13	Projector	17	150	2.55
14	Xerox Machine	4	700	2.8
15	Exhaust Fan	23	52	1.20
16	Lift	1	5595	5.60
17	Other Equipment	25	150	3.75
17	**Total**			**145**

Chart No-1: Details of Connected Load:



CHAPTER-III
STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electricity Bills

Table No 3: Electrical Bill Analysis- 2021-22:

No	Month	Energy Purchased ,kWh
1	May-21	5106
2	Jun-21	4716
3	Jul-21	5356
4	Aug-21	5457
5	Sep-21	6346
6	Oct-21	8178
7	Nov-21	8355
8	Dec-21	11595
9	Jan-22	8068
10	Feb-22	7654
11	Mar-22	15475
12	Apr-22	22053
13	Total	108359
14	Maximum	22053
15	Minimum	4716
16	Average	9029.92

Chart No 2: Monthly Unit Consumption (kWh) Variation:

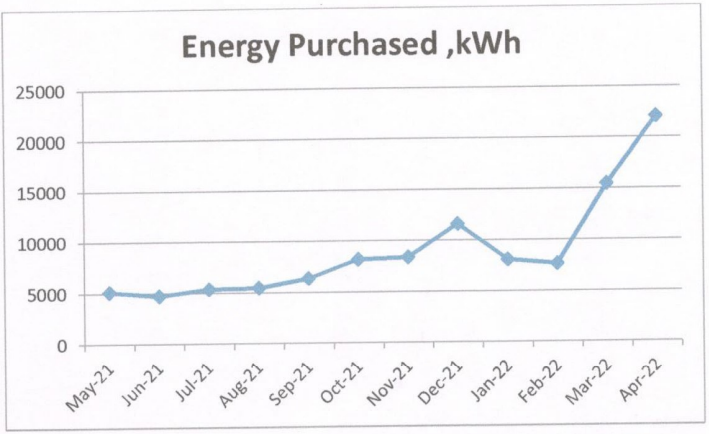


Table No 4: Important Parameters:

No	Parameter/ Value	Energy Purchased, kWh
1	Total	108359
2	Maximum	22053
3	Minimum	4716
4	Average	9029.92

CHAPTER IV
CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

Basis for computation of CO_2 Emissions:

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

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

Table No 5: Month wise Consumption of Electrical Energy & CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	May-21	5106	4.60
2	Jun-21	4716	4.24
3	Jul-21	5356	4.82
4	Aug-21	5457	4.91
5	Sep-21	6346	5.71
6	Oct-21	8178	7.36
7	Nov-21	8355	7.52
8	Dec-21	11595	10.44
9	Jan-22	8068	7.26
10	Feb-22	7654	6.89
11	Mar-22	15475	13.93
12	Apr-22	22053	19.85
13	Total	108359	97.52
14	Maximum	22053	19.85
15	Minimum	4716	4.24
16	Average	9029.92	8.13

Chart No 3: Representation of Month wise CO_2 Emissions:

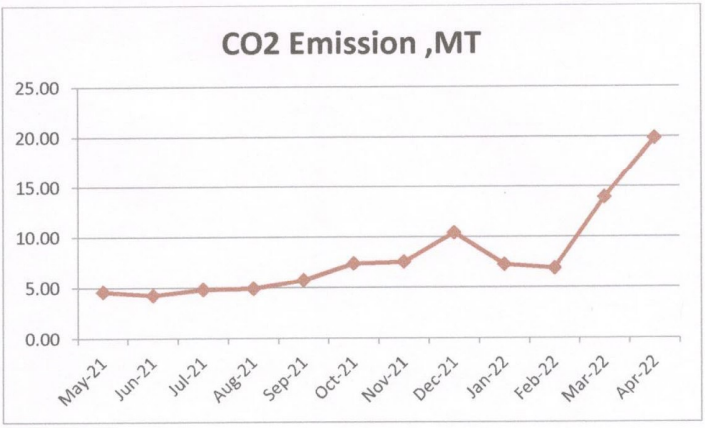


Table No 6: Key Parameters:

No	Parameter /Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

CHAPTER V
STUDY OF USAGE OF ALTERNATE ENERGY

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar Wind Hybrid System. The Installed Capacity of Solar PV Plant is **15kWp**, while of Wind Power is **6 kW.** For Calculation purpose, we consider only Energy generated by the Solar PV Plant.

Table No 7: Computation of % Usage of Alternate Energy to Annual Energy Requirement:

No	Particulars	Value	Unit
1	Energy Purchased from MSEDCL	**108359**	kWh/Annum
2	Capacity of Roof Top Solar PV Capacity	15	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**	**18000**	kWh/Annum
6	Total Energy Requirement = **(1) + (5)**	**126359**	kWh/Annum
7	% Usage of Alternate Energy to Total Energy Demand = **(5)*100/(6)**	**14.25**	%

Photograph of 15 kWp Roof Top Solar PV Plant:

CHAPTER VI
STUDY OF USAGE OF LED LIGHTING

In this Chapter, we compute the percentage of LED Lighting to Total Lighting Load of the College.

Table No 8: Calculation of % Usage of LED Lighting to Total Lighting Load:

No	Particulars	Value	Unit
1	Quantity of 5 W LED Fittings	45	Nos
2	Load/Unit of W LED Fittings	5	W/Unit
3	Total Load of 39 No of fittings	**0.225**	kW
4	Quantity of 9 W LED Fittings	150	Nos
5	Load/Unit of 9 W LED Fittings	9	W/Unit
6	Total Load of 144 Nos of fittings	**1.35**	kW
7	Quantity of 15 W LED Fittings	201	Nos
8	Load/Unit of 15 W LED Fittings	15	W/Unit
9	Total Load of No 188 of fittings	**3.015**	kW
10	Quantity of 22 W LED Fittings	82	Nos
11	Load/Unit of 22 W LED Fittings	22	W/Unit
12	Total Load of 78 Nos of fittings	**1.804**	kW
13	Quantity of CFL Fittings	95	Nos
14	Load/Unit of CFL Fittings	18	W/Unit
15	Total Load of 103 Nos of fittings	**1.71**	kW
16	Quantity of T-8 Fittings	240	Nos
17	Load/Unit of T-8 Fittings	40	W/Unit
18	Total Load of 269 No of fittings	**9.6**	kW
19	Total LED Lighting Load = 3+6+9+12	**6.394**	kW
20	Total Lighting Load = 3+6+9+12+15+18	**17.704**	kW
21	% of LED Lighting to Total Lighting Load= **19*100/20**	**36.12**	**%**

ENVIRONMENTAL AUDIT REPORT

of

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Year: 2021-22

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ECN/2022-23/CR-43/1709 — 10th May, 2022

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General Manager (EC)

ENGRESS SERVICES PUNE

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

Ref: ES/PESMCASC/21-22/03 Date: 20/5/2022

CERTIFICATE

This is to certify that we have conducted Environmental Audit at Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune in the year 2021-22.

The College has adopted following Environmental Friendly Initiatives:

- Usage of Energy Efficient LED Lighting
- Installation of 21kW Hybrid Roof Top Solar PV/Wind Power Plant
- Segregation of Waste at source
- Installation of Baction Unit for conversion of Organic Waste
- Effluent Treatment Plant, for treatment of Laboratory Liquid Waste
- Provision of Sanitary Waste Incinerator
- Implementation of Rain Water Management Project
- Internal Tree Plantation
- Creation of Awareness 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 Environment Friendly

For Engress Services,

A Y Mehendale,
Certified Energy Auditor
EA-8192

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ACKNOWLEDGEMENT

We Engress Services, Pune wish to express our sincere gratitude to the management of Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune for assigning the work of Environmental Audit of Ganeshkhind campus for the Year: 2021-22.

We are thankful to all the staff members who helped us during the field study.

EXECUTIVE SUMMARY

1. Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune uses Electrical Energy as the source of Energy for various equipment

2. Pollution due to College Activities:

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

3. Present Energy Consumption & CO_2 Emissions:

No	Parameter/ Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

4. Various projects implemented for Environmental Conservation:

- Usage of LED Lighting
- Installation of 21 kWp Capacity Roof top Hybrid Solar PV/Wind Power Plant.
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Management

5. Usage of Renewable Energy & CO_2 Emission Reduction:

- The College has installed **15 kWp** Roof Top Solar PV Plant.
- The Energy generated by the Plant is **18000 kWh** per annum.
- The Reduction in CO_2 Emissions in 21-22 is **16.2 MT**.

6. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	100	68	78
2	Minimum	89	52	60

7. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, ^0C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	34.6	46	279	46
2	Minimum	32.4	44	75	35.6

8. Waste Management:

8.1 Segregation of Waste at Source:

The Waste is segregated at source by keeping the Waste collection bins at various locations.

8.2 Organic Waste Management:

The College has installed Baction Unit, to convert the Organic Waste into Bio Compost.

8.3 Laboratory Chemical Liquid Waste Management:

The College has Effluent Treatment Plant, for treatment of Laboratory Liquid Waste.

8.4 Sanitary Waste Management:

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

8.5 E-Waste Management:

The E Waste is disposed of through Authorized Agency.

9. Rain Water Management:

The College has installed the Rainwater Management project. The rain water falling on the terrace is channelized through Pipe and is used to increase the underground Water Table.

10. Environment Friendly Initiatives:

- Maintenance of Good Internal Garden
- Creation of Awareness by Display of Posters

11. Notes & Assumptions:

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

12. References:

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

ABBREVIATIONS

Kg	:	Kilo Gram
PES	:	Progressive Education Society
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:

1.1.1Environment: Definition as per environment Protection Act: 1986

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

1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

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

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

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

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

1.2 Objectives:

1. To study Resource Consumption & CO_2 Emissions
2. To Study CO_2 Emission Reduction
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 Google Earth Image:

1.4 General Details of College: Table No-4:

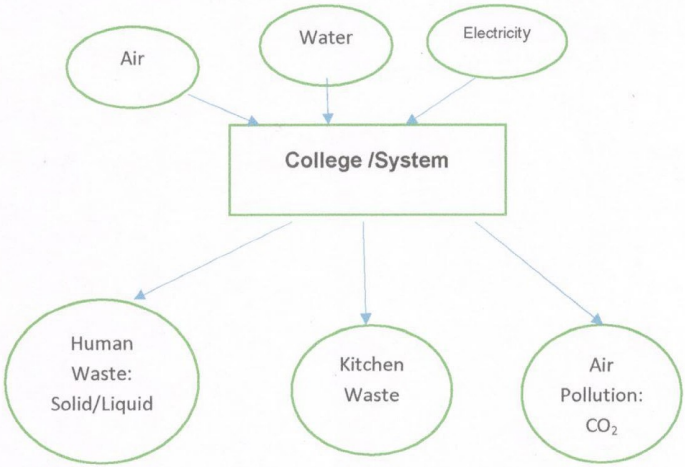
No	Head	Particulars
1	Name of College	Progressive Education Society's Modern College of Arts, Commerce & Science
2	Address	Ganeshkhind, Pune
3	Affiliation	Savitribai Phule Pune University

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

- 1 Unit (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	May-21	5106	4.60
2	Jun-21	4716	4.24
3	Jul-21	5356	4.82
4	Aug-21	5457	4.91
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9	Jan-22	8068	7.26
10	Feb-22	7654	6.89
11	Mar-22	15475	13.93
12	Apr-22	22053	19.85
13	Total	108359	97.52
14	Maximum	22053	19.85
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Chart No 2: Representation of Month wise CO_2 emissions:

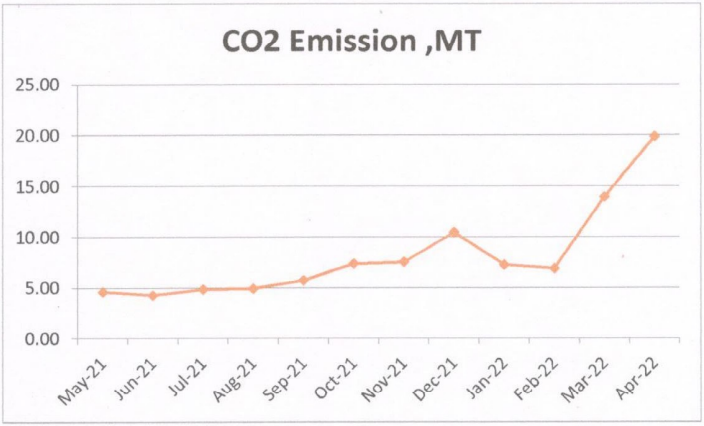


Table No-6: Key Parameters:

No	Parameter /Value	Energy Consumed, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

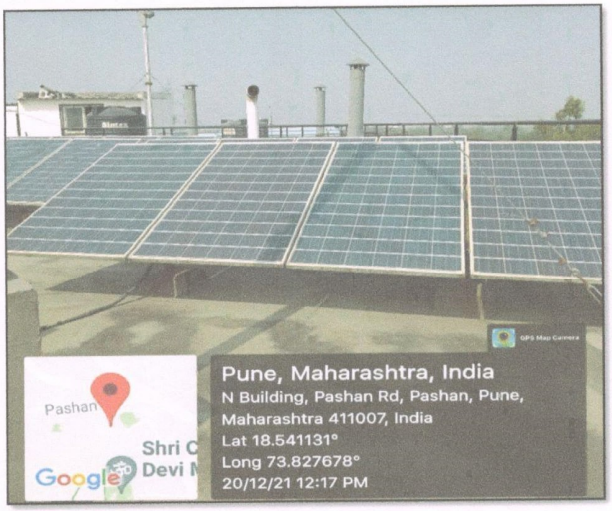
CHAPTER-III
STUDY OF CO_2 EMISSION REDUCTION

In this Chapter, we study the Usage of Renewable Energy and compute the reduction in Annual CO2 Emissions. The College has installed Roof Top Solar Wind Hybrid System. The Installed Capacity of Solar PV Plant is **15 kWp**, while of Wind Power is **6 kW.**

Table No 7: Computation of Reduction in CO_2 Emission in 21-22:

No	Particulars	Value	Unit
1	Capacity of Roof Top Solar PV Capacity	15	kWp
2	Average Energy Generated per kWp per Day	4	kWh/kWp
3	Annual Generation Days	300	Nos
4	Annual Solar Energy Generated = 2*3*4	**18000**	kWh/Annum
5	1 kWh of Electrical Energy is equivalent to	0.9	Kg of CO_2
6	Reduction in Annual CO_2 Emission = (4) * (5) /1000	**16.2**	**MT**

5.3 Photograph of Hybrid Solar/Wind Power Generation 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.

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. As the AQI increases, it means that a large percentage of the population will experience severe adverse health effects. The measurement of the **AQI** requires an **air monitor** and an **air pollutant** concentration over a specified **averaging period**.

We present 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 8: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
	Main Building			
1	Comp. Lab III	96	58	61
2	Comp. Lab I	99	62	76

3	Electronic Sci. Dept	100	60	78
4	Dept. of Statistics	95	57	74
5	Dept. of Physics	96	58	74
6	Class roomA-4	100	60	78
7	Class roomA-5	100	68	72
8	Class roomA-6	100	60	78
9	Class roomA-7	95	57	69
10	Botany Lab	96	52	64
11	Classroom A-8	93	57	72
12	Classroom A-9	100	60	75
13	Exam Centre	93	57	67
	Arts Building			
1	Economics Dept	93	56	70
2	Geography Dept	91	54	68
3	Zoology Dept	93	56	69
4	Staff Room	93	55	70
5	History Dept	91	54	67
6	C-5	90	55	66
7	C-6	89	54	60
	Maximum	**100**	**68**	**78**
	Minimum	**89**	**52**	**60**

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 9: Study of Indoor Comfort Condition Parameters:

No	Location	Temperature, ^{0}C	Humidity, %	Lux Level	Noise Level, dB
	Main Building				
1	Comp. Lab III	32.4	46	225	42.3
2	Comp. Lab I	34.2	44	135	46
3	Electronic Sci. Dept	32.6	45	132	41
4	Dept. of Statistics	34.2	46	77	42.3
5	Dept. of Physics	34.1	45	75	42.1
6	Class roomA-4	34.2	46	152	42
7	Class roomA-5	33.9	46	204	41
8	Class roomA-6	33.8	45	179	43.1
9	Class roomA-7	33.6	46	254	39.6
10	Botany Lab	33.6	46	165	40.3
11	Classroom A-8	33.9	45	275	41
12	Classroom A-9	34	45	200	42.1
13	Exam Centre	34.1	46	179	45
	Arts Building				
1	Economics Dept	34.5	46	279	39.6
2	Geography Dept	34.5	46	216	35.6
3	Zoology Dept	34.6	45	190	38
4	Staff Room	34.4	46	151	42
5	History Dept	33.9	45	175	41
6	C-5	34.1	45	190	43
7	C-6	34	46	109	44
	Maximum	**34.6**	**46**	**279**	**46**
	Minimum	**32.4**	**44**	**75**	**35.6**

CHAPTER-VI
STUDY OF WASTE MANAGEMENT

6.1 Segregation of Waste at Source:

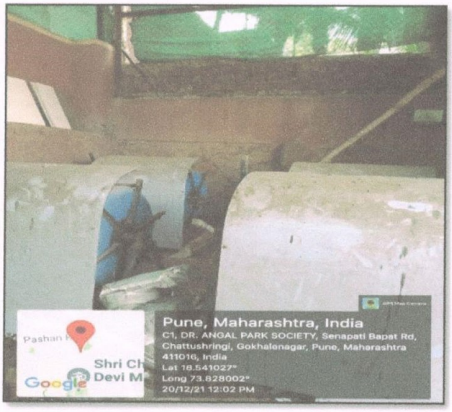
The Waste is segregated at source by keeping the Waste collection bins at various locations.

Photograph of Waste Collection Bins:

6.2 Organic Waste Management:

The College has installed Tumbler Unit, to convert the Organic Waste into Bio Compost.

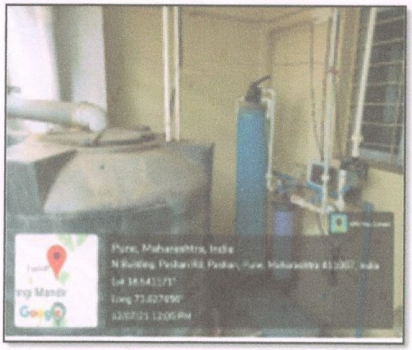
Photograph of Bio Composting Storage Tanks:



6.3 Laboratory Chemical Liquid Waste Management:

The College has installed Baction Unit, to treat the Laboratory Liquid Waste.

Photograph of Effluent Treatment Plant:



6.4 Sanitary Waste Management:

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

Photograph of Sanitary Waste Incinerator:

6.5 E-Waste Management:

The E Waste is disposed of through Authorized Agency.

CHAPTER-VII
STUDY OF RAIN WATER MANAGEMENT

The College has installed the Rainwater Management project. The rain water falling on the terrace is channelized through Pipe and is used to increase the underground Water Table.

Photograph of Rain Water Management Pipe:

CHAPTER-VIII
STUDY OF GREEN & INNOVATIVE PRACTICES

8.1 Green Landscaping with Trees and Plants:

The Institute has well maintained Internal Garden.

Photograph of Lawn and Tree plantation in the campus:

8.2 Creation of Awareness on Resource Conservation:

In order to create awareness on Resource Conservation, amongst the stake holders, the College has displayed various Posters at important locations.

Photograph of Poster on Resource Conservation:

ANNEXURE-1:
VARIOUS AIR QUALITY, WATER 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 Water Quality Standards:

No	Designated Best Use	Criteria
1	Drinking Water Source without conventional Treatment but after disinfection	pH between **6.5 to 8.5** Dissolved Oxygen **6 mg/l or more**
2	Drinking water source after conventional treatment and disinfection	pH between **6 to 9** Dissolved Oxygen **4 mg/l or more**
3	Outdoor Bathing (Organized)	pH between **6.5 to 8.5** Dissolved Oxygen **5 mg/l or more**
4	Controlled Waste Disposal	pH between **6 to 8.5**

3. 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

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

No	Parameter	Value
1	Temperature	Less Than 33^0C
2	Humidity	Less Than 70%

GREEN AUDIT REPORT

of

Progressive Education Society's,
Modern College of Arts, Science & Commerce,
Ganeshkhind, Pune 411 053

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

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency
(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary,
Aundh, Pune, Maharashtra 411067
Ph No: 020-35000450
Email: eee@mahaurja.com, Web: www.mahaurja.com

ECN/2022-23/CR-43/1709 10th May, 2022

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

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

Name and Address of the firm : M/s Engress Services
Yashshree, 26, Nirmal Bag Society,
Near Muktangan English School,
Parvati, Pune – 411 009.

Registration Category : *Empanelled Consultant for Energy Conservation Programme for Class 'A'*

Registration Number : ***MEDA/ECN/2022-23/Class A/EA-32.***

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **09th May, 2024** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

ENGRESS SERVICES PUNE

ENGRESS SERVICES

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

Ref: ES/PESMCASC/21-22/02 Date: 20/5/2022

CERTIFICATE

This is to certify that we have conducted Green Audit at Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune in the year 2021-22.

The College has adopted following Energy Efficient and Green Practices:

- Usage of Energy Efficient LED Lighting
- Installation of 21 kW Hybrid Roof Top Solar PV/Wind Power Plant.
- Installation of Baction Unit for Organic Waste conversion
- Effluent Treatment Plant for treatment of Laboratory Liquid Waste
- Provision of Sanitary Waste Incinerator
- Implementation of Rain Water Management Project
- Maintenance of Good internal Road
- Maintenance of Internal Garden'
- Ramp for Divyangajan
- Creation of Awareness on Resource 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

ENGRESS SERVICES PUNE

CONTENTS

ACKNOWLEDGEMENT

We Engress Services, Pune wish to express our sincere gratitude to the management of Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune for assigning the work of Green Audit of Ganeshkhind campus for the Year: 2021-22.

We are thankful to all Staff members who helped us during the field study.

EXECUTIVE SUMMARY

1. Progressive Education Society's Modern College of Arts, Science & Commerce, Ganeshkhind, Pune uses Electrical Energy for various equipment in the college campus.

2. Present Energy Consumption & CO_2 Emission:

No	Parameter /Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

3. Various measures adopted for Energy Conservation & Renewable Energy:

1. Usage of LED tube lights
2. Usage of STAR Rated equipment
3. Maintenance of good power factor
4. Installation of **21 kWp** Solar & Wind Hybrid roof top plant.

4. Usage of Renewable Energy& CO_2 Emission Reduction:

- The College has installed Roof Top Solar PV Plant of Capacity **15 kWp.**
- Energy generated by Roof Top Solar PV Plant is **18000 kWh.**
- The Reduction in CO_2 Emission due to Solar PV Plant in 21-22 is **16.2 MT.**

5. Waste Management:

5.1 Segregation of Waste at Source:

The Waste is segregated at source by keeping the Waste collection bins at various locations.

5.2 Organic Waste Management:

The College has installed Baction Unit, to convert the Organic Waste into Bio Compost.

5.3 Laboratory Chemical Liquid Waste Management:

The College has Effluent Treatment Plant, for treatment of Laboratory Liquid Waste.

5.4 Sanitary Waste Management:

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

5.5 E Waste Management:

The E Waste is disposed of through Authorized Agency.

6. Rain Water Management:

The College has installed the Rainwater Management project. The rain water falling on the terrace is channelized through Pipe and is used to increase the underground Water Table.

7. Green & Sustainable Initiatives:

- Maintenance of Good Internal Road
- Maintenance of Good Internal Garden
- Provision of Ramp, Wheel Chair for Divyangajan
- Creation of Awareness by Display of Posters

8. Notes & Assumptions:

1. 1 kWh of Electrical Energy releases **0.9 Kg** of CO_2into atmosphere
2. 1 kWp Solar PV Plant generates **4 kWh** of Electrical Energy per Day
3. Annual Solar Energy Generation Days: **300 Nos.**

9. References:

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

ABBREVIATIONS

PES	:	Progressive Education Society
CO_2	:	Carbon Di Oxide
LED	:	Light Emitting Diode
kWh	:	kilo-Watt Hour
Qty	:	Quantity
MT	:	Metric Ton
kW	:	Kilo Watt
MSEDCL	:	Maharashtra State Electricity Distribution Company Ltd

CHAPTER-I
INTRODUCTION

1.1 Objectives:

1. To study present Energy Consumption
2. To Study the present CO_2 emissions
3. To study usage of Renewable Energy
4. To study Waste Management
5. To study rain water Management
6. To stud Green Practices

Table No 1: General Details of College:

No	Head	Particulars
1	Name of College	Progressive Education Society's Modern College of Arts, Commerce & Science
2	Address	Ganeshkhind, Pune
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 Electricity Bills

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

No	Month	Energy Purchased ,kWh
1	May-21	5106
2	Jun-21	4716
3	Jul-21	5356
4	Aug-21	5457
5	Sep-21	6346
6	Oct-21	8178
7	Nov-21	8355
8	Dec-21	11595
9	Jan-22	8068
10	Feb-22	7654
11	Mar-22	15475
12	Apr-22	22053
13	Total	108359
14	Maximum	22053
15	Minimum	4716
16	Average	9029.92

Chart No 1: Month Wise Energy Consumption Variation, kWh:

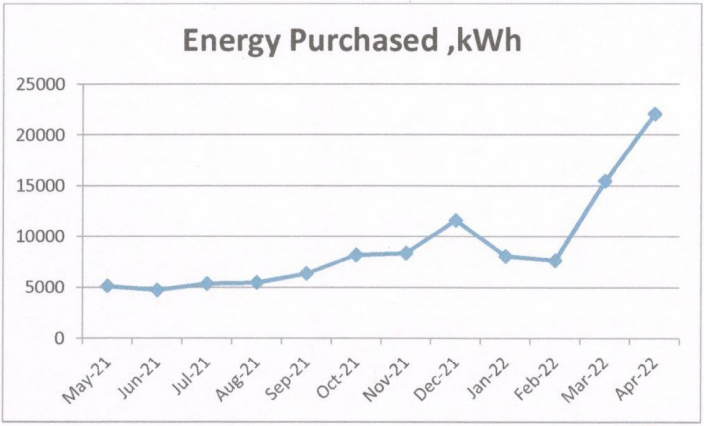


Table No 3: Important Parameters:

No	Parameter/ Value	Energy Purchased, kWh
1	Total	108359
2	Maximum	22053
3	Minimum	4716
4	Average	9029.92

CHAPTER III
STUDY OF CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

Basis for computation of CO_2 Emissions:

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

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations.

Table No 4: Month wise Consumption of Electrical Energy & CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	May-21	5106	4.60
2	Jun-21	4716	4.24
3	Jul-21	5356	4.82
4	Aug-21	5457	4.91
5	Sep-21	6346	5.71
6	Oct-21	8178	7.36
7	Nov-21	8355	7.52
8	Dec-21	11595	10.44
9	Jan-22	8068	7.26
10	Feb-22	7654	6.89
11	Mar-22	15475	13.93
12	Apr-22	22053	19.85
13	Total	108359	97.52
14	Maximum	22053	19.85
15	Minimum	4716	4.24
16	Average	9029.92	8.13

Chart No 2: Representation of Month wise CO_2 Emissions:

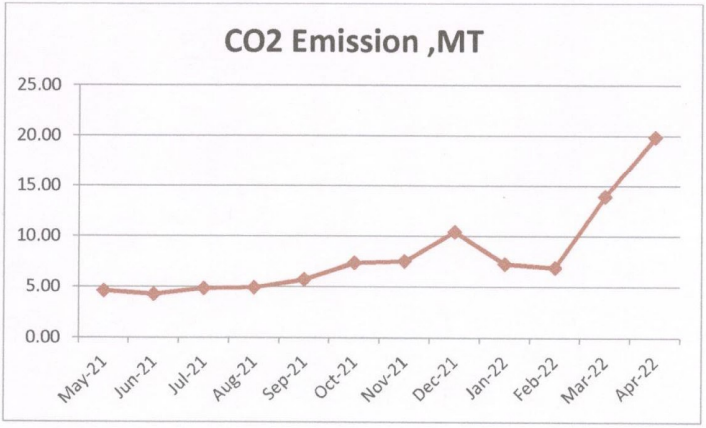


Table No 5: Key Parameters:

No	Parameter /Value	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	108359	97.52
2	Maximum	22053	19.85
3	Minimum	4716	4.24
4	Average	9029.92	8.13

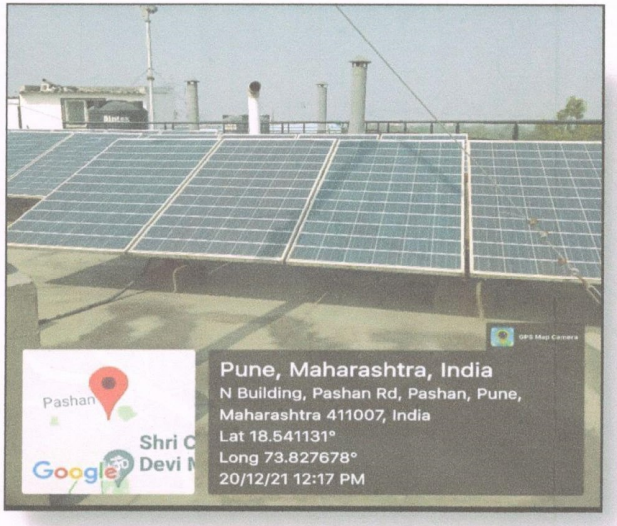
CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

In this Chapter, we study the Usage of Renewable Energy and compute the reduction in Annual CO_2 Emissions. The College has installed Roof Top Solar Wind Hybrid System. The Installed Capacity of Solar PV Plant is **15kWp**, while of Wind Power is **6 kW.**

Table No 6: Computation of Reduction in CO_2 Emission in 21-22:

No	Particulars	Value	Unit
1	Capacity of Roof Top Solar PV Capacity	15	kWp
2	Average Energy Generated per kWp per Day	4	kWh/kWp
3	Annual Generation Days	300	Nos
4	Annual Solar Energy Generated = **2*3*4**	**18000**	kWh/Annum
5	1 kWh of Electrical Energy is equivalent to	**0.9**	Kg of CO_2
6	Reduction in Annual CO_2 Emission = **(4) * (5) /1000**	**16.2**	**MT**

Photograph of 15 kWp Roof Top Solar PV Plant:



CHAPTER-V
STUDY OF WASTE MANAGEMENT

5.1 Segregation of Waste at Source:

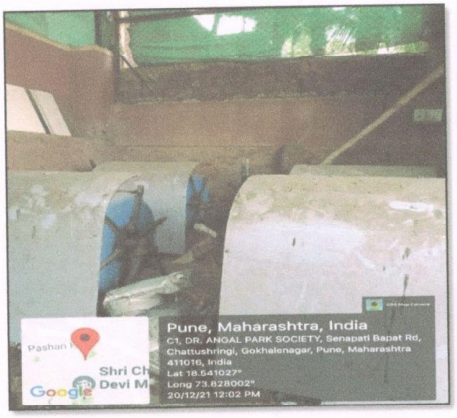
The Waste is segregated at source by keeping the Waste collection bins at various locations.

Photograph of Waste Collection Bins:

5.2 Organic Waste Management:

The College has installed Baction Unit, to convert the Organic Waste into Bio Compost.

Photograph of Bio Composting Storage Tanks:



5.3 Laboratory Chemical Liquid Waste Management:

The College has installed Baction Unit, to treat the Laboratory Liquid Waste.

Photograph of Effluent Treatment Plant:

5.4 Sanitary Waste Management:

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

Photograph of Sanitary Waste Incinerator:

5.5 E-Waste Management:

The E Waste is disposed of through Authorized Agency.

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The College has installed the Rainwater Management project. The rain water falling on the terrace is channelized through Pipe and is used to increase the underground Water Table.

Photograph of Rain Water Management Pipe:

CHAPTER-VII
STUDY OF GREEN & INNOVATIVE PRACTICES

7.1 Pedestrian Friendly Roads:

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

Photograph of Road within campus:

7.2 Green Landscaping with Trees and Plants:

The Institute has well maintained Internal Garden.

Photograph of Lawn and Tree plantation in the campus:

7.3 Provision of Ramp for Divyangajan:

The College has made provision of Ramp for Divyangajan.

Photograph of Ramp:

7.4 Creation of Awareness on Resource Conservation:

In order to create awareness on Resource Conservation, amongst the stake holders, the College has displayed various Posters at important locations.

Photograph of Poster on Resource Conservation:

ANNEXURE-1:
LIST of TREES & PLANTS:

No.	Name of Tree	Family	Common Name
1.	*Aegle marmelos* (L.) Correa.	Rutaceae	Bel
2.	*Ailanthus excelsa* Roxb.	Simaroubaceae	
3.	*Albizia julibrissin* Durazz.	Fabaceae	
4.	*Areca catechu* L.	Arecaceae	
5.	*Arucaria heterophylla* (Salisb.) Franco.	Araucariaceae	
6.	*Azadirachta indica* A.Juss.	Meliaceae	
7.	*Bambusa vulgaris* Schrad. ex J.C.Wendl	Poaceae	
8.	*Caryota mitis* Lour.	Arecaceae	Fishtail palm
9.	*Cassia fistula* L.	Fabaceae	
10.	*Casuarina equisetifolia* L.	Casurinaceae	
11.	*Citrus limon* (L.) Osbeck.	Rutaceae	Lemon/Limbu
12.	*Cocos nucifera* L.	Arecaceae	
13.	*Delonix regia*(Boj. ex Hook.) Raf.	Fabaceae	
14.	*Dypsis lutescens*(H.Wendl.) Beentje & J.Dransf.	Arecaceae	
15.	*Erythrina variegate* L.	Fabaceae	pangara
16.	*Ficus benghalensis* L.	Moraceae	Vad
17.	*Ficus benjamina* L.	Moraceae	Weeping fig
18.	*Ficus elastic* Roxb. ex Hornem.	Moraceae	
19.	*Ficus racemosa* L.	Moraceae	
20.	*Ficus religiosa* L.	Moraceae	Pimpal
21.	*Hibiscus rosa-sinensis* L.	Malvaceae	
22.	*Jacaranda mimosifolia*D. Don.	Bignoniaceae	
23.	*Lawsonia inermis* L.	Lytheraceae	Mehandi
24.	*Livistona chinensis* (Jacq.) R.Br. ex Mart.	Arecaceae	
25.	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae	Pivla Chafa
26.	*Mangifera indica* L.	Anacardiaceae	
27.	*Manilkara zapota* (L.) P.Royen	Sapotaceae	Sapota/Chiku
28.	*Millingtonia hortensis* L.F.	Bignoniaceae	Indian cork tree

29.	*Murraya koenigii* (L.) Sprengel	Rutaceae	Curry leaf/Godlimb
30.	*Phyllanthus emblica* L.	Euphorbiaceae	Aavala
31.	*Plumeria alba* L.	Apocynaceae	
32.	*Polyalthia longifolia* (Sonn.) Thwaites	Annonaceae	Ashok
33.	*Ravenalia madagascarensis* Sonn.	Sterlitziaceae	
34.	*Roystonea regia* (Kunth) O. F. Cook	Arecaceae	
35.	*Syzygium cumuni* (L.) Skills	Myrtaceae	Jambhul
36.	*Tamarindus indica* L.	Fabaceae	Chinch
37.	*Tecoma stans* (L.) Juss. Ex Kunth.	Bignoniaceae	
38.	*Terminalia catappa*L.	Combretaceae	

MEDICINAL/AROMATIC/SPICES PLANTS

1. *Aloe vera* Burm
2. *Asparagus racemosus* Willd.
3. *Asparagus densiflorus* (Kunth) Jessop
4. *Bryophyllum pinnatum* (Lam.) Oken
5. *Catharanthus roseus* L.
6. *Centella asiaticatica* (I.) Urb.
7. *Chlorophytum inornatum*Ker Gawl.
8. *Cinnamomum tamala* (Buch.-Ham.) T. Nees & Eberm.
9. Cissus quadrangulari L.
10. *Costus igneus* N.E. Br.
11. *Cymbopogon citratus* DC
12. *Eclipta prostrata* (L.) L.
13. *Euphorbia tirucalli* L.
14. *Gymnema sylvestre* R. Br.
15. *Justicia adhatoda* L.
16. *Mentha arvensis* L
17. *Mimosa pudica* L.
18. *Murraya koenigii*(L.) Spreng.
19. *Ocimum sanctum* L.
20. *Piper nigrum* L.
21. *Spilanthes acmella* Dc.

FERN

1. *Asplenium nidus* L.
2. *Livistona rotundifolia* (Lam.) Mart.
3. *Nephrolepis biserrata* (Sw.) Schott.
4. *Nephrolepis* Sp.
5. *Pteris ensiformis* Burm. F.

FLOWERING/ FOLIAGE PLANTS

1. *Adenium obesum*(forssk.) Roem. & schult.
2. *Allamanda violacea* Gardner
3. *Asparagus densiflorus* (Kunth) Jessop
4. *Bryophyllum* sp.
5. *Canna indica*
6. *Chlorophytum comossum* (thunb).
7. *Chlorophytum comosum* (Thunb.) Jacques
8. *Clematis triloba* Thunb.
9. *Coleus blumei* Benth.
10. *Crossandra undulaefolia* Salisb.
11. *Dracaena colorama*
12. *Dracaena deremensis* Engl
13. *Dracaena marginata* Hort.
14. *Euphorbia milli* Des Moul.
15. *Euphorbia pulcherrima* Willd. Ex Klotzsch
16. *Hibiscus rosa-sinensis* L.
17. *Ixora chinensis* Lam.
18. *Jatropha integerrima* Jacq.
19. *Nerium indicum* Mill.
20. *Oxalis regnelli* Miq.
21. *Pentas lanceolata* (Forssk) Deflers
22. *Rhoeo spathacea* (Sw.) Stearn

ENGRESS SERVICES

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

INVOICE

To **Progressive Education Society's,** **Modern College of Arts, Science & Commerce,** **Ganeshkhind, Pune**	**Invoice No: 2022-23/83** **Date: 29/11/2022**

Work Order No	
PAN No	**AMOPM6853B**

No	Particulars	Charges per Unit, Rs.	Quantity Nos.	Amount in Rs.
1	Consultancy Service Charges for Energy, Green & Environmental Audit Report of Ganeshkhind Campus for the Year: 2021-22	3000.00	03	9000.00
2	**Total Amount**			**9000.00**
3	**Amount in Words: Rupees Nine Thousand only.**			

For Engress Services,

Authorized Signatory

Bank Details:

Name of Account	Engress Services
Bank	SVC Co-Operative Bank Ltd
Branch	Sahakarnagar Branch, Pune
Current Account	112904180000319
IFSC Code	SVCB0000129