ENERGY AUDIT REPORT

of

PUNE VIDYARTHI GRIHA'S,

CollegeofEngineeringand Technology&G K Pate (Wani)

Instituteof Management,

Vidyanagari, Parvati, Pune 411 009

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

MAHARASHTRA ENERGY DEVELOPMENT AGENCY
An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462

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

ECN/2021-22/CR-14/1577 — 22nd April, 2021

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 Enrich Consultants** Yashashree, Plot No. 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune - 411009.
Registration Category	:	*Empanelled Consultant for Energy Conservation Programme for Class 'A'*
Registration Number	:	***MEDA/ECN/2021-22/Class A/EA-03***

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **21st April, 2023** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

ENRICH CONSULTING * PUNE *

Enrich Consultants

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

Ref: EC/PVGCOETGKPOIM/20-21/01 Date: 10/8/2021

CERTIFICATE

This is to certify that we have conducted Energy Auditat Pune Vidyarthi Griha's College of Engineering and Technology& G K Pate(Wani) Institute of Management, Vidyanagari, Parvati, Pune 411 009 in the Academic year 2020-21.

.The College has adopted followingEnergy Efficientpractices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Maximum usage of Day Lighting
- Installation of **7.4 kWp** Roof Top Solar PV Plant
- Modifications in the Chiller System at the Auditorium

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

For Enrich Consultants,

ENRICH CONSULTANTS PUNE

A Y Mehendale,
Certified Energy Auditor
EA-8192

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ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management ofPune Vidyarthi Griha's College of Engineering and Technology& G K Pate(Wani) Institute of Management, Vidyanagari, Parvati, Pune 411 009, for awarding us the assignment of Energy Audit of their Campus for the Year: 2020-21.

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

EXECUTIVE SUMMARY

1.Pune Vidyarthi Griha's College of Engineering & Technology& G K Pate (Wani) Institute of Management, Vidyanagari, Parvati, Puneuses 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	125758	113.18
2	Maximum	13398	12.06
3	Minimum	8036	7.23
4	Average	10479.83	9.43

3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of BEE STAR Rated Equipment
- Maximum Usage of Day Lighting
- Installation of **7.4 kWp**Roof Top Solar PV Plant.
- Modifications in the Chiller System at the Auditorium

4. Usage of Alternate Energy:

- The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp.**
- The Energy purchased from MSEDCL is **125758 kWh**
- The Energy Generated by Roof Top Solar PV Plant is**8880 kWh**
- The percent of usage of Alternate Energy to Annual Energy Demand is **6.60%**

5. Usage of LED Lighting:

- The Total Lighting Load of the College is **35.55 kW.**
- The LED Lighting Load is **10.35 kW.**
- The percentage of Annual LED Lighting to Annual Lighting Demand is **29.12 %.**

6. Recommendations:

- Replacement of old lighting by LED Lighting, as per the budget availability
- Increase in Roof Top Solar PV Plant Capacity, as per the budget availability

7. Assumptions:

1. **1 kWh**of Electrical Energy releases **0.9 Kg of CO_2**into atmosphere
2. Annual Solar Energy Generation Days: **300 Nos**

8. References:

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

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
PVG	:	Pune Vidyarthi Griha
COET	:	College of Engineering and Technology
IOM	:	Institute of Management
BEE	:	Bureau of Energy Efficiency
FTL	:	Fluorescent Tube Light
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO_2	:	Carbon Di Oxide
MT	:	Metric Ton

CHAPTER-I
INTRODUCTION

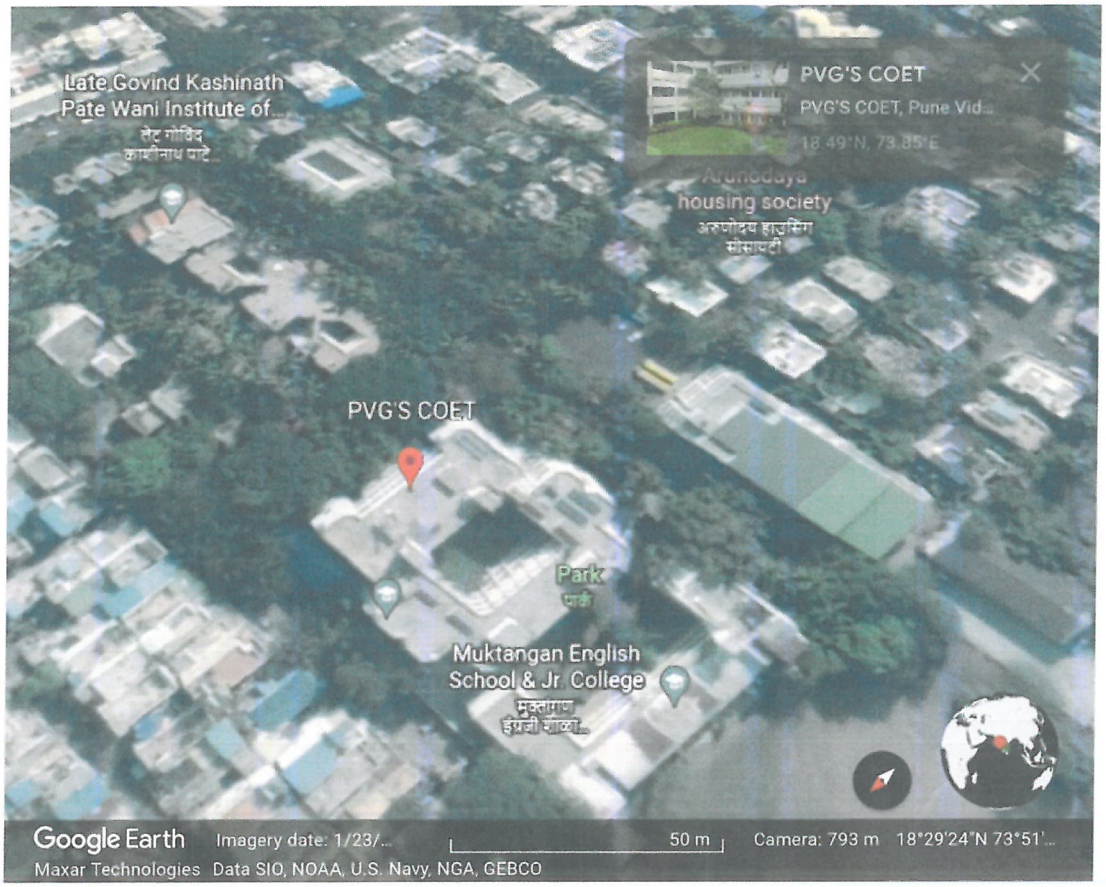
1.1 Objectives:

1. To study present Energy Consumption
2. To Study the present CO_2 emissions
3. To study usage of Alternate Energy
4. To study usage of LED Lighting

1.2Table No 1: General Details of the College:

No	Head	Particulars
1	Name of Institution	Pune Vidyarthi Griha's College of Engineering & Technology & G K Pate (Wani) Institute of Management
2	Address	Vidyanagari, Pune 411 009
3	Year of Establishment	1985

1.3 Google Earth Image:



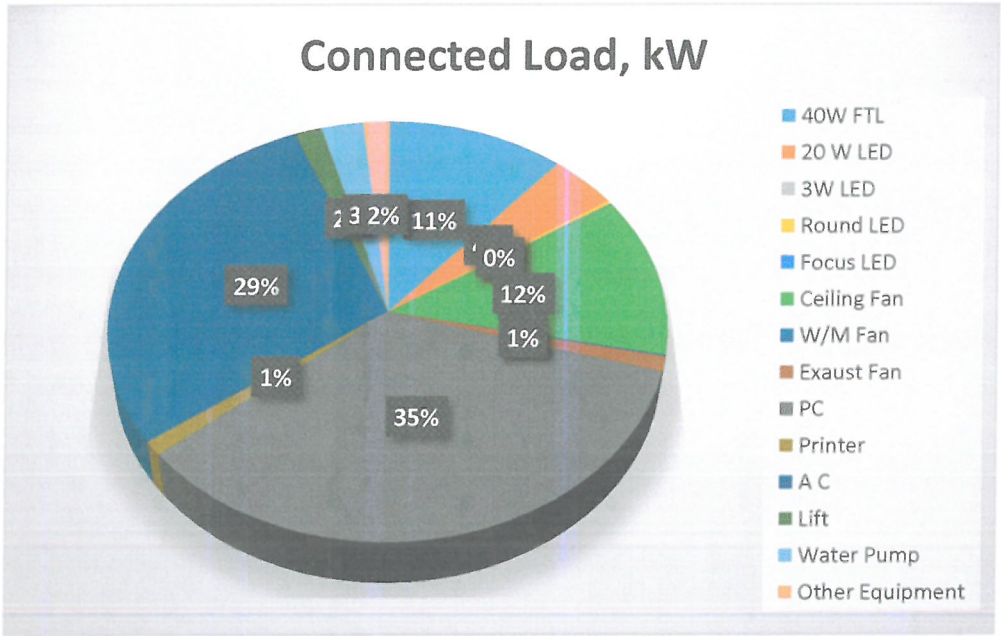
CHAPTER-II
STUDY OF CONNECTED LOAD

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	40W FTL	630	40	25.2
2	20 W LED	483	20	9.66
3	3W LED	11	3	0.03
4	Round LED	33	16	0.53
5	Focus LED	12	11	0.13
6	Ceiling Fan	426	65	27.69
7	W/M Fan	5	52	0.26
8	Exhaust Fan	49	52	2.55
9	PC	513	150	76.95
10	Printer	14	175	2.45
11	A C	36	1800	64.8
12	Lift	1	3730	3.73
13	Water Pump	1	5968	5.97
14	Other Equipment	25	150	3.75
15	**Total**			**224**

Chart No 1: Study of Connected Load:



CHAPTER-III
STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of last year Electricity Bills

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

No	Month	Energy Purchased, kWh
1	Jul-20	8780
2	Aug-20	9828
3	Sep-20	9286
4	Oct-20	11640
5	Nov-20	10952
6	Dec-20	12138
7	Jan-21	12470
8	Feb-21	10824
9	Mar-21	13398
10	Apr-21	8954
11	May-21	8036
12	Jun-21	9452
13	Total	125758
14	Maximum	13398
15	Minimum	8036
16	Average	10479.83

Chart No 2: Variation in Monthly Energy Consumption:

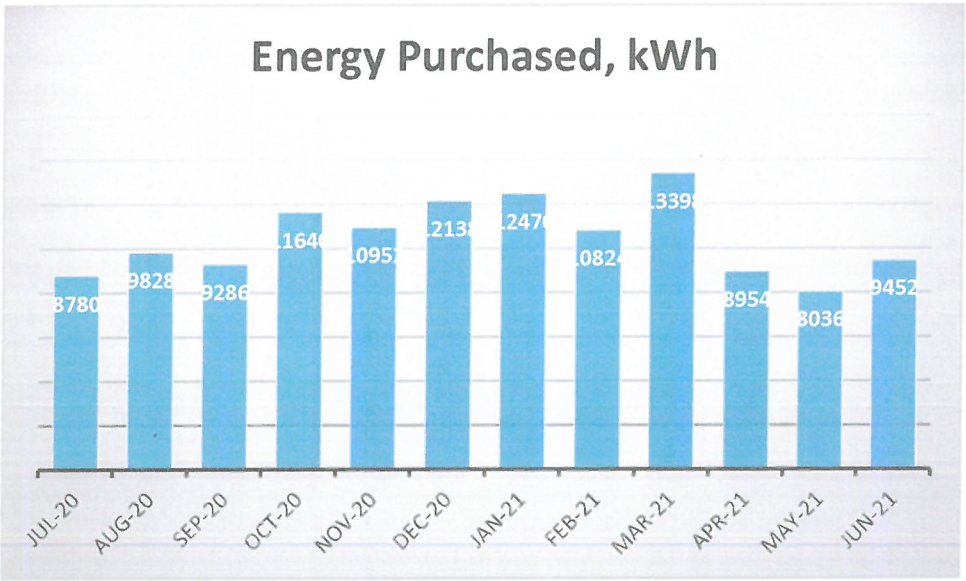


Table No4: Important Parameters:

No	Parameter/ Variation	Energy Purchased, kWh
1	Total	125758
2	Maximum	13398
3	Minimum	8036
4	Average	10479.83

CHAPTER-IV
CARBON FOOTPRINTING

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

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

The College uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO_2 Emissions:

- **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 No5: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	8780	7.90
2	Aug-20	9828	8.85
3	Sep-20	9286	8.36
4	Oct-20	11640	10.48
5	Nov-20	10952	9.86
6	Dec-20	12138	10.92
7	Jan-21	12470	11.22
8	Feb-21	10824	9.74
9	Mar-21	13398	12.06
10	Apr-21	8954	8.06
11	May-21	8036	7.23
12	Jun-21	9452	7.41
13	Total	125758	113.18
14	Maximum	13398	12.06
15	Minimum	8036	7.23
16	Average	10479.83	9.43

Chart No 3: Month wise CO_2Emissions:

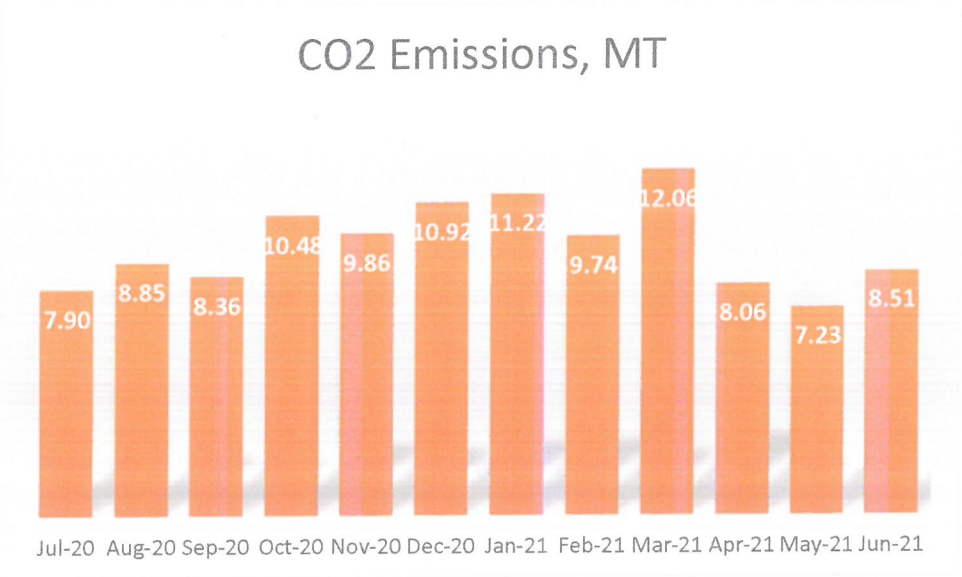


Table No 6: Important Parameters:

No	Parameter/ Variation	Energy Purchased, kWh	CO_2 Emissions, MT
1	Total	125758	113.18
2	Maximum	13398	12.06
3	Minimum	8036	7.23
4	Average	10479.83	9.43

CHAPTER-V
STUDY OF USAGE OF ALTERNATE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp**

We now calculate the percentage of usage of Alternate Energy to Annual Energy Demand.

Table No 7: % Usage of Alternate Energy to Annual Energy Demand:

No	Particulars	Value	Unit
1	Energy Purchased from MSEDCL	**125758**	kWh
2	Installed Roof Top Solar PV Plant Capacity	7.4	kWp
3	Average Daily Energy Generated	4	kWh/kWp
4	Annual Generation Days	300	Nos
5	Annual Solar Energy Generated	**8880**	kWh
6	Total Energy Demand = (1) + (5)	134638	kWh
7	% of Usage of Alternate Energy to Total Annual Energy Demand= (5)*100/ (6)	**6.60**	%

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 8: Percentage of Usage of LED Lighting to Annual Lighting Load

No	Particulars	Value	Unit
1	No of 40 W FTL fittings	630	Nos
2	No of 20 W LED fitting	483	Nos
3	No of 3 W LED Fittings	**11**	Nos
4	No of 16 W LED Down Lighter	33	Nos
5	No of 11 W Focus LEDs	12	Nos
6	Load/Unit of 40 W FTL fitting	40	W/Unit
7	Load/Unit of 20 W LED fitting	20	W/Unit
8	Load/Unit of 3 W LED fitting	3	W/Unit
9	Load/Unit of 16 W LED fitting	16	W/Unit
10	Load/Unit of 11 W LED fitting	11	W/Unit
11	Demand of 40 W FTL fittings	25.2	kW
12	Demand of 20 W LED fitting	9.66	kW
13	Demand of 3 W LED fitting	0.033	kW
14	Demand of 16 W LED fitting	0.528	kW
15	Demand of 11 W LED fitting	0.132	kW
16	Total Lighting Load=11+12+13+14+15	**35.55**	**kW**
17	Total LED Lighting Load=12+13+14+15	**10.35**	**kW**
18	% of usage of LED lights to Total Lighting Demand = **(17)*100/(16)**	**29.12**	%

GREEN AUDIT REPORT

of

PUNE VIDYARTHI GRIHA'S,

College of Engineering and Technology & G K Pate (Wani)
Institute of Management,
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Year: 2020-21

Prepared by:

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ENRICH CONSULTANTS

MAHARASHTRA ENERGY DEVELOPMENT AGENCY
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Maharashtra Energy Development Agency
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Ph No: 020-35000450
Email: eee@mahaurja.com, Web: www.mahaurja.com

ECN/2021-22/CR-14/1577

22nd April, 2021

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General Manager (EC)

ENRICH CONSULTANTS PUNE

Enrich Consultants

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

Ref: EC/PVGCOETGKPOIM/20-21/02

Date: 10/8/2021

CERTIFICATE

This is to certify that we have conducted Green Audit at Pune Vidyarthi Griha's College of Engineering and Technology & G K Pate(Wani) Institute of Management, Vidyanagari, Parvati, Pune 411 009 in the Academic year 2020-21.

The College has adopted following Green Initiatives:

- Usage of Energy Efficient LED Light Fitting
- Installation of **7.4** kWp Roof Top Solar PV Plant
- Maximum Usage of Day Lighting
- Segregation of Waste at source by provision of Bins
- Implementation of Bio Composting Unit
- Maintenance of good Internal Road
- Tree Plantation in the campus
- Provision of Ramp for Divyangajan
- Provision of Sanitary Waste Incinerator
- Creation of Awareness about 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 Enrich Consultants,

ENRICH CONSULTANTS PUNE

A Y Mehendale,
Certified Energy Auditor
EA-8192

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ACKNOWLEDGEMENT

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

EXECUTIVE SUMMARY

1.Pune Vidyarthi Griha's College of Engineering & Technology & G K Pate (Wani) Institute of Management, Vidyanagari, Parvati, Puneuses 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	125758	113.18
2	Maximum	13398	12.06
3	Minimum	8036	7.23
4	Average	10479.83	9.43

3. Various initiatives taken for Energy Conservation:

- Usage of Energy Efficient BEE STAR Rated Equipment
- Usage of Energy Efficient LED Lighting
- Maximum Usage of Day Lighting
- Installation of **7.4 kWp**Roof Top Solar PV Plant
- Modifications in the Chiller System at the Auditorium

4. Usage of Renewable Energy:

- The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp.**
- The Energy Generated by Roof Top Solar PV Plant is**8880 kWh**
- The reduction in CO_2 Emissions is**7.99 MT**

5. Waste Management:

5.1 Segregation of Waste at Source:

The recyclable waste, like paper, plastic waste is segregated at source by making provision of different waste collection bins. The Plastic Waste is handed over to Authorized Plastic Recyclers.

5.2 Organic Waste Management:

The College has installed Bio Composting unit to convert the Organic Waste into Bio compost. The same is used into own garden.

5.3E-Waste Management:

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

6. Water Conservation:

It is recommended to make proper channels to collect the rain water and store the same in the open well which is in operation as on today,

The Collegeis also planning to make one open well alive, which is not in use, at present.

7. Green & Sustainable Initiatives

- Maintenance of good Internal Road
- Maintenance of Internal Garden
- Provision of Ramp for Divyangajan
- Provision of Sanitary Waste Incinerator
- Display of Posters on Resource Conservation

8. Recommendations:

- Replacement of old lighting by LED Lighting, as per the budget availability
- Increase in Solar PV Plant Capacity, as per the budget availability
- Carry out repairs of internal road section, as per the budget availability

9. Notes &Assumptions:

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

BEE	Bureau of Energy Efficiency
PVG	Pune Vidyarthi Griha
COET	College of Engineering & Technology
IOM	Institute of Management
kWh	Kilo Watt Hour
LPD	Liters Per Day
Kg	Kilo Gram
MT	Metric Ton
CO_2	Carbon Di Oxide
Qty	Quantity

CHAPTER-I
INTRODUCTION

1.1 Objectives:

1. To study present Energy Consumption
2. To Study CO_2 emissions
3. To study usage of Renewable Energy
4. Study of Waste Management
5. Study of Water Conservation
6. Study of Green & Sustainable Practices

1.2 General Details of College: Table No 1:

No	Head	Particulars
1	Name of Institution	Pune Vidyarthi Griha's College of Engineering & Technology & G K Pate (Wani) Institute of Management
2	Address	Vidyanagari, Pune 411 009
3	Year of Establishment	1985

1.3 Google Earth Image:

CHAPTER-II
STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of last year Electricity Bills

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

No	Month	Energy Purchased, kWh
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12	Jun-21	9452
13	Total	125758
14	Maximum	13398
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Chart No 1: Variation in Monthly Energy Consumption:

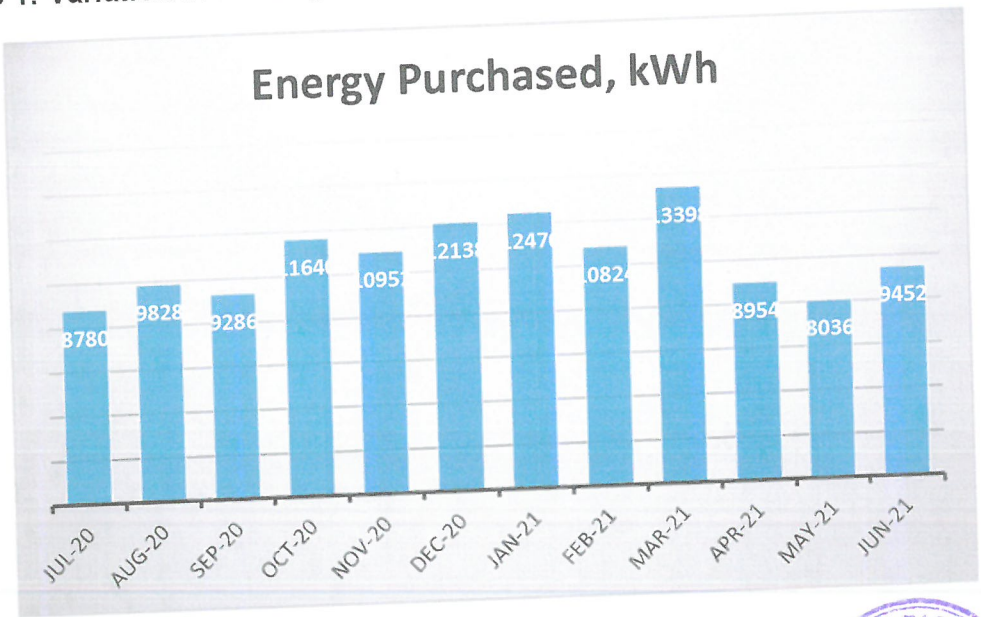

Table No 3: Important Parameters:

No	Parameter/ Variation	Energy Consumed, kWh
1	Total	125758
2	Maximum	13398
3	Minimum	8036
4	Average	10479.83

CHAPTER III
STUDY OF CARBON FOOTPRINTING

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

The College uses Electrical Energy for various Electrical gadgets.

Basis for computation of 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 No4: Month wise CO_2 Emissions:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	8780	7.90
2	Aug-20	9828	8.85
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4	Oct-20	11640	10.48
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10	Apr-21	8954	8.06
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13	Total	125758	113.18
14	Maximum	13398	12.06
15	Minimum	8036	7.23
16	Average	10479.83	9.43

Chart No 2: Month wise CO_2Emissions:

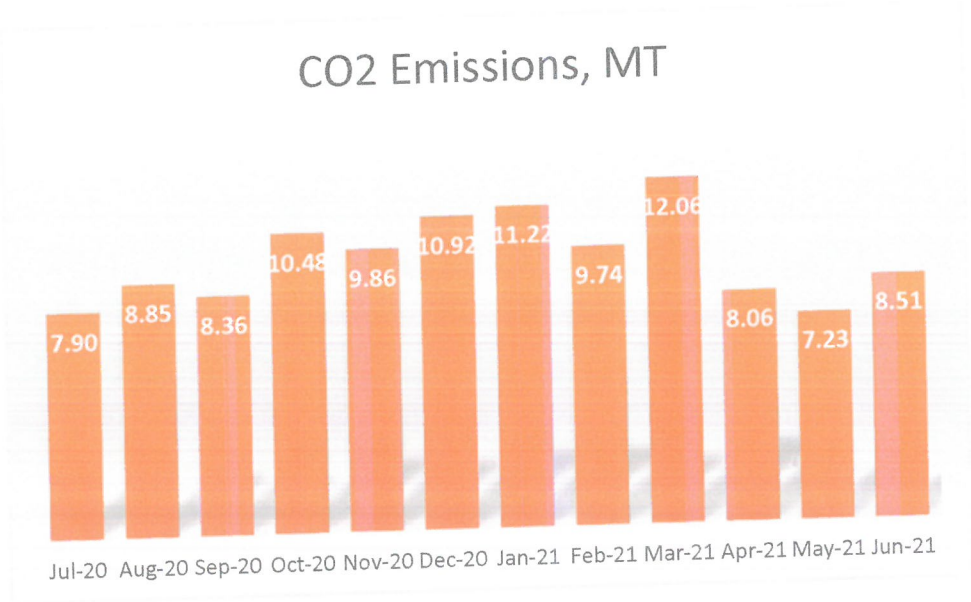

Table No 5: Variation in Important Parameters:

No	Parameter/ Variation	Energy Consumed, kWh	CO2 Emissions, MT
1	Total	125758	113.18
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4	Average	10479.83	9.43

CHAPTER IV
STUDY OF USAGE OF RENEWABLE ENERGY

The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp**
We now calculate the reduction in CO_2 Emission due to Solar PV Plant.

Table No 6: Computation of Reduction in CO_2 Emission:

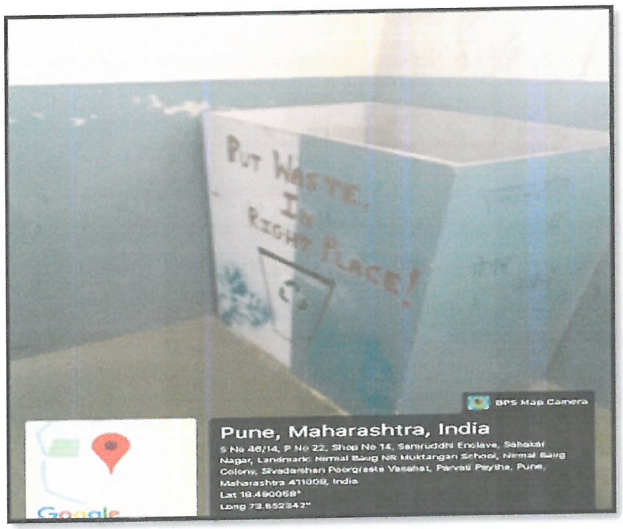
No	Particulars	Value	Unit
1	Installed Roof Top Solar PV Plant Capacity	7.4	kWp
2	Average Daily Energy Generated	4	kWh/kWp
3	Annual Generation Days	300	Nos
4	Annual Solar Energy Generated	**8880**	kWh
5	1 kWh of Electrical Energy is equivalent to	0.9	Kg of CO_2
6	**Annual Reduction in CO_2 Emission = (4) * (5) /1000**	**7.992**	**MT**

CHAPTER V
STUDY OF WASTE MANAGEMENT

5.1 Segregation of Waste at source:

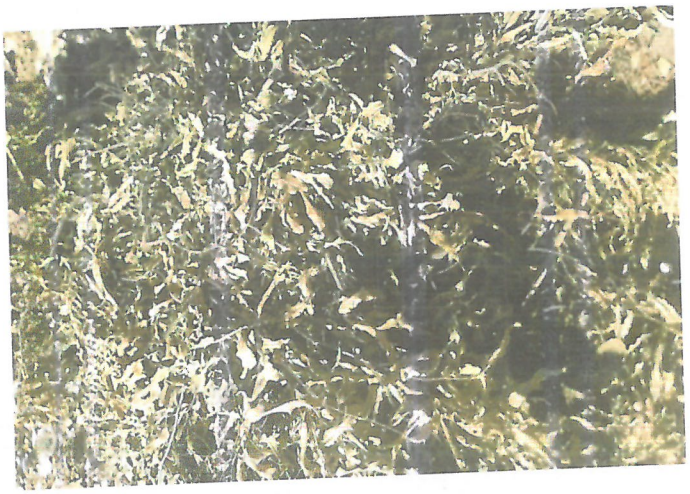
The recyclable waste, like paper, plastic waste is segregated at source by making provision of different waste collection bins. The Plastic Waste is handed over to Authorized Plastic Recyclers.

Photograph of Waste Collection Bins:



5.2Organic Waste Management:
The recyclable waste, like paper waste is handed over to authorized waste collecting agent for further recycling.

Photograph of Bio Composting Unit:



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

CHAPTER-VI
STUDY OF WATER CONSERVATION

It is recommended to make proper channels to collect the rain water and store the same in the open well which is in operation as on date.

The Collegeis also planning to make one open well alive, which is not in use, at present.

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 Internal Lawn and Tree plantation:

7.3 Provision of Ramp:

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

Photograph of Ramp:

7.4 Provision of Sanitary Waste Incinerator:

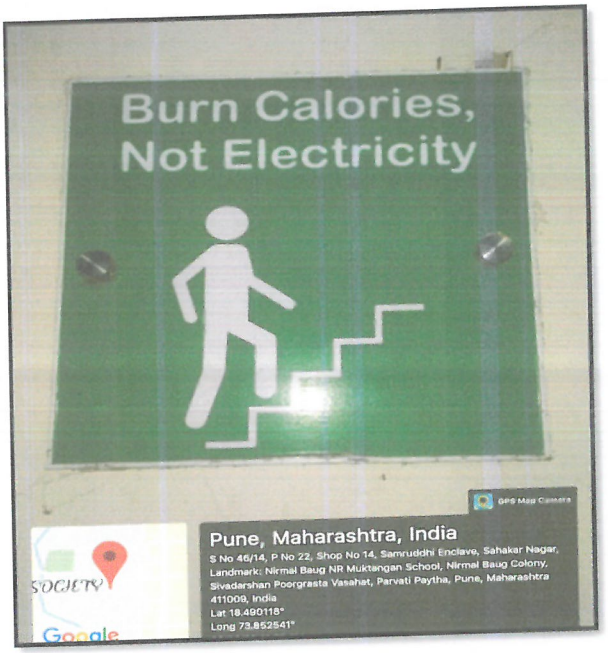
The College has made provision of Sanitary Waste Incinerator for disposal of Sanitary Waste.

Photograph of Sanitary Waste Incinerator:

7.5 Creation of Awareness about Resource Conservation:

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

Photograph of Poster on Energy Conservation:



ANNEXURE-I

LIST OF TREES AND PLANTS

List of Trees:

No	Common Name of Tree	Qty
1	Ashok	64
2	Coconut	45
3	English Chicha	10
4	Fanas	1
5	Mango	8
6	Shevga	1
7	Bel	2
8	Neem	1
9	Sonchampa	4
10	Jamun	6
11	Ramfal	2
12	Gulmohor	17
13	Cheru	1
14	Subabhul	35
15	Kaduneem	25
16	Karanj	3
17	Tabobia	3
18	Bor	5
19	Valava	1
20	Jackranda	3
21	Umbar	6
22	Spalordia	2
23	Bakanlimb	3
24	Raintree	11
25	Kashid	7
26	Fan Palm Tree	1
27	Cyprus Tree	3
28	Parijatak	2
29	Red Champa	2
30	Bamboo Bet	2
31	Putravanti	1
32	Guava	4
33	Shisu	1
34	Bakul	1
35	Supari	6
36	Traveller Palm	2
37	Pestoforum	3
38	Bottle Brush	3
39	Ficus	6

40	Gol	5
41	Kanchan	3
42	Apta	2
43	Bahava	4
44	Booch	2
45	Silver Oak	2
46	Vachava	2
47	White Champa	2
48	Almond	2
49	Hirada	3
50	Amala	2
51	Australian Babhul	4
52	Vad	3
53	Peltoforum	4
54	Karanj	5
55	Sitaranjan	1
56	Arjun	2
57	**Total**	**351**

List of Plants:

No	Common Name
1	Jaswand
2	Duranta
3	Drecena
4	Coleus
5	Saptaparni

Photograph of Heritage Tree:

ENVIRONMENTAL AUDIT REPORT

of

PUNE VIDYARTHI GRIHA'S,

College of Engineering and Technology & G K Pate (Wani) Institute of Management,

Vidyanagari, Parvati, Pune 411 009

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

ENRICH CONSULTANTS

MAHARASHTRA ENERGY DEVELOPMENT AGENCY
An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462

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

ECN/2021-22/CR-14/1577

22nd April, 2021

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 Enrich Consultants** Yashashree, Plot No. 26, Nirmal Bag Society, Near Muktangan English School, Parvati, Pune - 411009.
Registration Category	:	*Empanelled Consultant for Energy Conservation Programme for Class 'A'*
Registration Number	:	***MEDA/ECN/2021-22/Class A/EA-03***

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **21st April, 2023** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

ENRICH CONSULTANTS PUNE

Enrich Consultants

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

Ref: EC/PVGCOS/20-21/03Date: 10/8/2021

CERTIFICATE

This is to certify that we have conducted Environmental Auditat Pune Vidyarthi Griha's College of Engineering and Technology & G K Pate(Wani) Institute of Management, Vidyanagari, Parvati, Pune 411 009 in the Academic year 2020-21.

The College has adopted following Environment Friendly Practices:

- Usage of Energy Efficient LED Light Fitting
- Maximum Usage of Day Lighting
- Installation of 7.4 kWp Roof Top Solar PV Plant
- Provision of Separate bins for Dry & Wet Waste
- Provision of Bio Composting Pit for conversion of Organic Waste
- Tree Plantation in the campus
- Provision of Sanitary Waste Incinerator
- Creation of awareness about Resource Conservation by displaying posters

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

For Enrich Consultants,

ENRICH CONSULTANTS PUNE

A Y Mehendale,
Certified Energy Auditor
EA-8192

INDEX

ACKNOWLEDGEMENT

We Enrich Consultants, Pune, express our sincere gratitude to the management ofPune Vidyarthi Griha's College of Engineering and Technology & G K Pate(Wani) Institute of Management, Vidyanagari, Parvati, Pune 411 009, 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.Pune Vidyarthi Griha's College of Engineering & Technology & G K Pate (Wani) Institute of Management, Vidyanagari, Parvati, Puneuses Energy in the form of **Electrical Energy**used for various Electrical Equipment, office & other facilities.

2. Various Pollution due to Institute 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	125758	113.18
2	Maximum	13398	12.06
3	Minimum	8036	7.23
4	Average	10479.83	9.43

4. Various initiatives taken for Energy Conservation:

- Usage of Energy Efficient BEE STAR Rated Equipment
- Usage of Energy Efficient LED Lighting
- Maximum Usage of Day Lighting
- Installation of **7.4 kWp** Roof Top Solar PV Plant
- Modifications in the Chiller System at the Auditorium

5. Usage of Renewable Energy& Reduction in CO_2 Emission:

- The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp.**
- The Energy Generated by Roof Top Solar PV Plant is**8880 kWh**
- The reduction in CO_2 Emissions is**7.99 MT**

6. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	115	70	82
2	Minimum	90	54	64

7. Indoor Comfort Conditions:

No	Parameter/Value	Temperature, °C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	30.5	51	237	61
2	Minimum	28.1	44	102	40

8. Waste Management:

8.1 Segregation of Waste at Source:

The recyclable waste, like paper, plastic waste is segregated at source by making provision of different waste collection bins. The Plastic Waste is handed over to Authorized Plastic Recyclers.

8.2 Organic Waste Management:

The College has installed Bio Composting unit to convert the Organic Waste into Bio compost. The same is used into own garden.

8.3E-Waste Management:

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

9. Water Conservation:

It is recommended to make proper channels to collect the rain water and store the same in the open well which is in operation as on today,

The Collegeis also planning to make one open well alive, which is not in use, at present.

10. Environment Friendly Initiatives

- Maintenance of Internal Garden
- Provision of Sanitary Waste Incinerator
- Creation of awareness by display of Posters on Resource Conservation

11. Recommendations:

- Replacement of old lighting by LED Lighting, as per the budget availability
- Increase in Solar PV Plant Capacity, as per the budget availability
- Carry out repairs of internal road section, as per the budget availability

12. Notes &AssumptionsNotes &Assumptions:

- **1 kWh**of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere
- Annual Solar Energy Generation Days: **300 Nos**

13. References:

- For CO_2 Emissions: www.tatapower.com
- For Roof Top Solar 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
PVG	:	Pune Vidyarthi Griha
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

1.1Important 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. 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)

1.2Objectives:

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 Waste Management
6. To Study Rain Water Harvesting
7. To Study Environmental Friendly Initiatives

1.3 General Details of Institute: Table No 4:

No	Head	Particulars
1	Name of Institution	Pune Vidyarthi Griha's College of Engineering & Technology & G K Pate (Wani) Institute of Management
2	Address	Vidyanagari, Pune 411 009
3	Year of Establishment	1985

1.4 Google Earth Image:

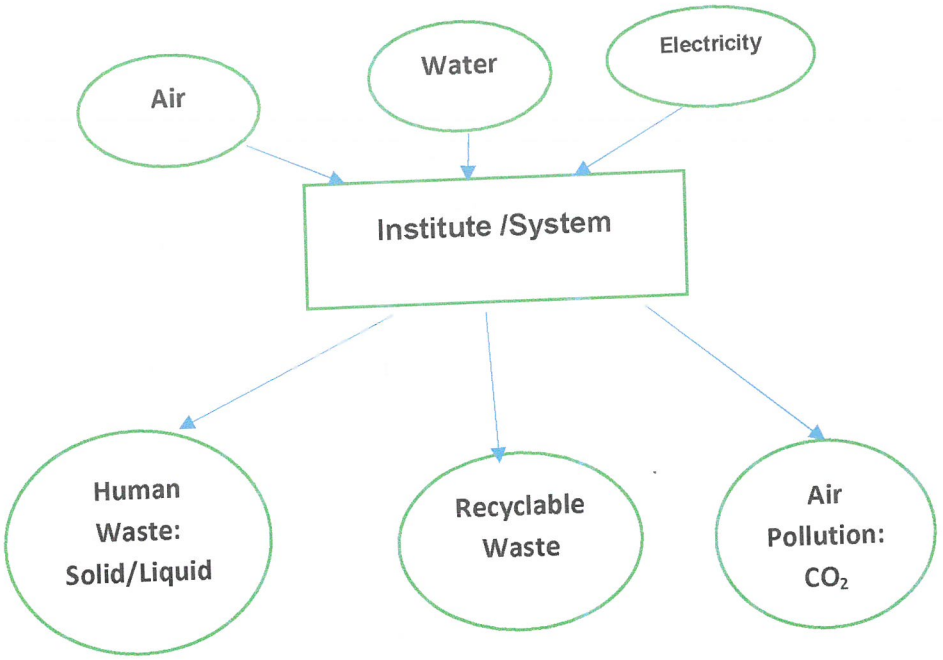
CHAPTER-II
STUDY OF CONSUMPTION OF RECOURCES & CO_2 EMISSION

The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy

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

Chart No 1: Representation of Institute 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 5: Study of Consumption of Electrical Energy & CO_2 Emissions: 20-21:

No	Month	Energy Purchased, kWh	CO_2 Emissions, MT
1	Jul-20	8780	7.90
2	Aug-20	9828	8.85
3	Sep-20	9286	8.36
4	Oct-20	11640	10.48
5	Nov-20	10952	9.86
6	Dec-20	12138	10.92

7	Jan-21	12470	11.22
8	Feb-21	10824	9.74
9	Mar-21	13398	12.06
10	Apr-21	8954	8.06
11	May-21	8036	7.23
12	Jun-21	9452	7.41
13	Total	125758	113.18
14	Maximum	13398	12.06
15	Minimum	8036	7.23
16	Average	10479.83	9.43

Chart No 2: Month wise CO_2Emissions:

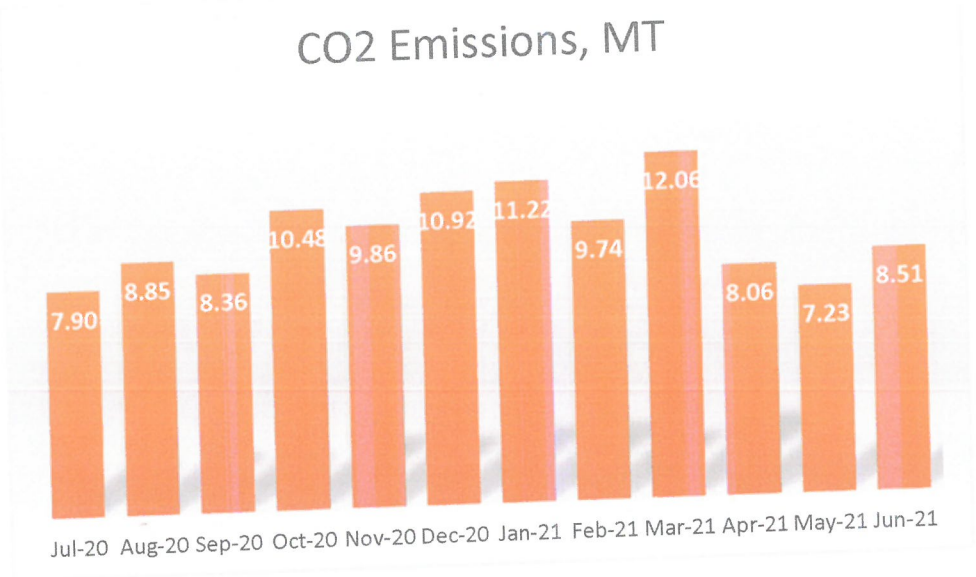


Table No 6: Important Parameters:

No	Parameter/ Variation	Energy Consumed, kWh	CO_2 Emissions, MT
1	Total	125758	113.18
2	Maximum	13398	12.06
3	Minimum	8036	7.23
4	Average	10479.83	9.43

CHAPTER III
STUDY OF CO_2 EMISSION REDUCTION

The College has installed Roof Top Solar PV Plant of Capacity **7.4 kWp**

We now calculate the reduction in CO_2 Emission due to Solar PV Plant.

Table No 7: Computation of Reduction in CO_2 Emission:

No	Particulars	Value	Unit
1	Installed Roof Top Solar PV Plant Capacity	7.4	kWp
2	Average Daily Energy Generated	4	kWh/kWp
3	Annual Generation Days	300	Nos
4	Annual Solar Energy Generated	**8880**	kWh
5	1 kWh of Electrical Energy is equivalent to	0.9	Kg of CO_2
6	**Annual Reduction in CO_2 Emission = (4) * (5) /1000**	**7.99**	**MT**

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.

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 10micron

Table No8: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
	Ground Floor			
	Main Building			
1	Power Systems Elec. Machine Lab	100	62	82
2	Lab 5	95	60	80
3	Computer Lab-6	96	58	73

4	Flexo Lab	106	60	78
5	Lab-9	107	61	79
	First Floor			
1	Director's Office	110	67	78
2	Seminar hall	109	59	79
3	Classroom-4	100	60	67
4	Classroom-3	101	61	67
	Second Floor			
1	DOM Lab	105	59	69
2	Lab-21	106	60	78
3	Dept. Of Mech. Engg.	110	68	79
4	HOD Cabin	100	61	68
	Third Floor			
1	Lab-31	110	68	78
2	Lab-33	106	61	79
3	Lab-34	111	68	79
4	Lab-35	111	68	78
	Fourth Floor	109	65	74
1	E & TC Dept	112	69	79
2	Lab-32	110	67	79
3	Dept Of CE	104	63	72
4	Basic Electronics Lab	106	60	78
1	**Workshop**	115	70	82
	Auditorium Building			
1	Lab-45	109	64	75
2	Lab-46	108	67	74
	MBA Building			
	Ground Floor	96	58	73
1	Maintenance Lab	106	60	78
2	HOD Cabin	91	54	66
3	Physics Lab-102	100	60	78
	First Floor			

1	FE Classroom201,202	110	67	78
2	Engg. Mech.Classroom	91	54	79
3	Computer Center	90	54	67
	Second Floor			
1	Room	100	60	67
2	Computer Lab	95	56	64
	Third Floor			
1	Room	91	55	72
2	Faculty Room	91	54	72
3	SEM/EG Lab	95	57	72
	Fourth Floor			
1	Room	100	62	82
2	Room	106	60	77
3	Classroom	108	61	78
	Maximum	**115**	**70**	**82**
	Minimum	**90**	**54**	**64**

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 No9: Study of Indoor Comfort Condition Parameters:

No	Location	Temperature, ^0C	Humidity, %	Lux Level	Noise Level, dB
	Ground Floor				
	Main Building				
1	Power Systems Elec. Machine Lab	28.1	45	137	52
2	Lab 5	29	48	139	46
3	Computer Lab-6	29.8	50	194	41
4	Flexo Lab	30	50	165	43
5	Lab-9	30	50	150	46
	First Floor				
1	Director's Office	30.2	49	159	45
2	Seminar hall	30.2	49	178	49
3	Classroom-4	30.4	49	142	61
4	Classroom-3	30.4	49	146	60
	Second Floor				
1	DOM Lab	30.5	49	203	61
2	Lab-21	30.5	50	226	61
3	Dept. Of Mech. Engg.	30.2	49	169	41
4	HOD Cabin	30.4	50	187	43
	Third Floor				
1	Lab-31	30.4	49	174	46
2	Lab-33	30.4	49	178	46
3	Lab-34	30.4	49	203	50
4	Lab-35	30.4	49	236	49

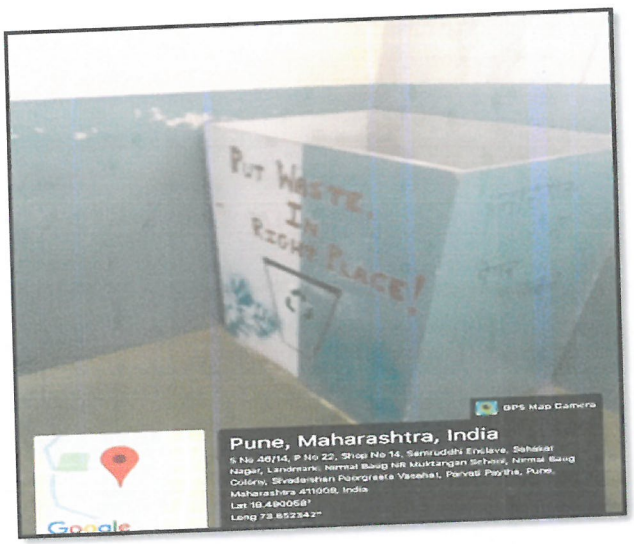
	Fourth Floor	30.2	49	169	43
1	E & TC Dept	30.2	49	169	40
2	Lab-32	30.2	49	148	47
3	Dept Of CE	30.2	51	163	43
4	Basic Electronics Lab	30.2	50	179	40
1	**Workshop**	30.4	51	112	60
	Auditorium Building				
1	Lab-45	30.4	49	110	54
2	Lab-46	30.4	50	102	56
	MBA Building				
	Ground Floor	30.1	50	229	46
1	Maintenance Lab	30	50	223	42
2	HOD Cabin	30.1	44	148	49
3	Physics Lab-102	30.2	49	159	46
	First Floor				
1	FE Classroom201,202	30.2	49	169	47
2	Engg.mech.Class room	30.2	50	183	54
3	Computer Center	30.3	44	196	54
	Second Floor				
1	Room	30.4	49	150	52
2	Computer Lab	30.4	45	179	54
	Third Floor				
1	Room	30.5	49	196	52
2	Faculty Room	30.5	49	231	49
3	Sem/EG Lab	30.5	49	236	49
	Fourth Floor				
1	Room	30.5	49	237	49
2	Room	30.4	50	236	56
3	Classroom	30.4	49	201	54
	Maximum	**30.5**	**51**	**237**	**61**
	Minimum	**28.1**	**44**	**102**	**40**

CHAPTER VI
STUDY OF WASTE MANAGEMENT

6.1 Segregation of Waste at source:

The recyclable waste, like paper, plastic waste is segregated at source by making provision of different waste collection bins. The Plastic Waste is handed over to Authorized Plastic Recyclers.

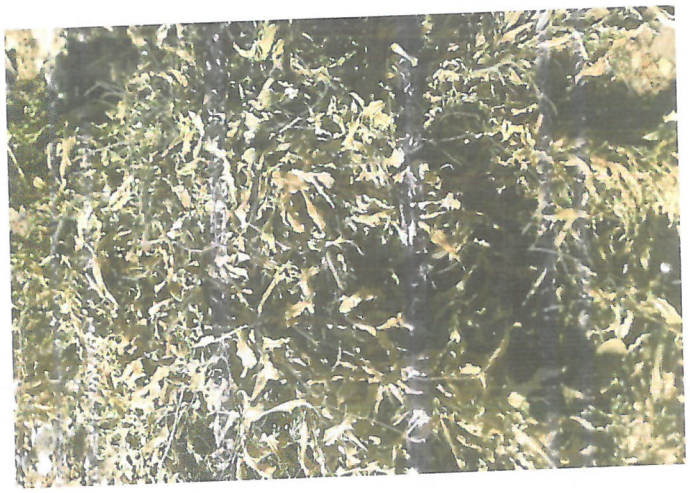
Photograph of Waste Collection Bins:



6.2Organic Waste Management:

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

Photograph of Bio Composting Unit:



6.3E-Waste Management: The E-Waste is disposed of through Authorized Agency.

CHAPTER-VII
STUDY OF WATER CONSERVATION

It is recommended to make proper channels to collect the rain water and store the same in the open well which is in operation as on date.

The Collegeis also planning to make one open well alive, which is not in use, at present.

CHAPTER-VIII
STUDY OF ENVIRONMENT FRIENDLY INITIATIVES

8.1 Internal Tree Plantation:

The Institute has well maintained landscaped garden in the campus.

Photograph of Tree plantation:

8.2 Provision of Sanitary Waste Incinerator:

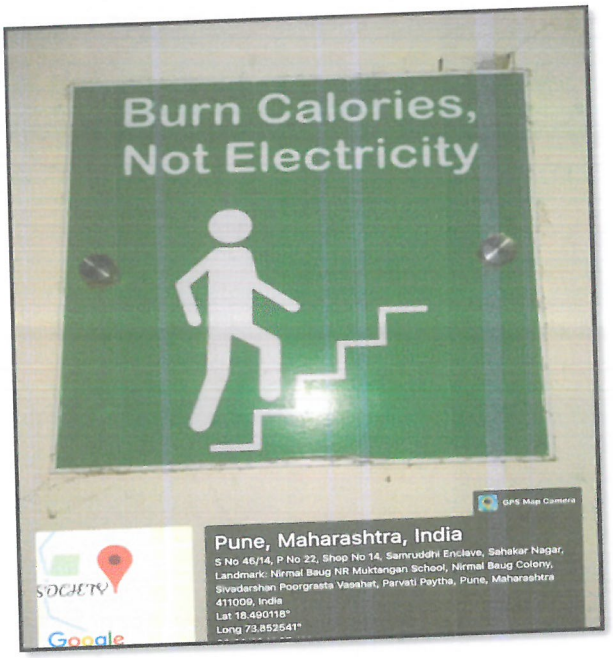
The College has made provision of Sanitary Waste Incinerator for disposal of Sanitary Waste.

Photograph of Sanitary Waste Incinerator:

8.3 Creation of Awareness about Resource Conservation:

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

Photograph of Poster on Energy Conservation:



ANNEXURE-I:
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 7.4** Dissolved Oxygen **6 mg/l or more**
2	Drinking water source after conventionaltreatment and disinfection	pH between **6 to 9** Dissolved Oxygen **4 mg/l or more**
3	Outdoor Bathing (Organized)	pH between **6.5 to 7.4** Dissolved Oxygen **5 mg/l or more**
4	Controlled Waste Disposal	pH between **6 to 7.4**

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%