

# ENVIRONMENTAL AUDIT REPORT

of

**YASHWANTRAO CHAVAN MAHARASHTRA  
OPEN UNIVERSITY,  
Dnyangangotri, Near Gangapur Dam,  
Nashik 422 222**



**ज्ञानगंगा घरोघरी**

**Year: 2020-21**

Prepared by:

**Enrich Consultants**

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**MAHARASHTRA ENERGY DEVELOPMENT AGENCY**

An ISO 9001 : 2000 Reg. no. : RQ 91 / 2462



**Maharashtra Energy Development Agency**

(Government of Maharashtra Institution)

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ECN/2021-22/CR-14/1577

22<sup>nd</sup> 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 cancelling the registration, if the information is found incorrect.
- This empanelment is valid till **21<sup>st</sup> 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

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Ref: EC/YCMOU/21-22/03

Date: 10/6/2021

### CERTIFICATE

This is to certify that we have conducted **Environmental Audit** at Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik in the year 2020-21.

The University has already adopted following **Environmentally Friendly** practices:

- Usage of Energy Efficient LED Fittings
- Maximum Usage of Day Lighting in the campus
- Installation of **13625 LPD** Solar Thermal Water Heating System.
- Installation of a Bio gas Plant
- Construction of Internal Bund of Capacity **26.2 Million Liters**
- Segregation of Recyclable Waste at source
- Installation of Sanitary pad dispenser and incinerator
- Plantation in the campus

We appreciate the support of Management and involvement of faculty members and staff members in the process of making the campus Energy Efficient and Green.

For Enrich Consultants,

  
**A Y Mehendale,**  
Certified Energy Auditor  
EA-8192





**H.B. Patil**  
Environmental Auditor



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## **ACKNOWLEDGEMENT**

We Enrich Consultants, Pune, express our sincere gratitude to the management of Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik 422 222 for awarding us the assignment of Environmental Audit of their Nashik Campus, for the Year: 2020-21.

We are thankful to:

- Prof. E. Vayunandan, Vice chancellor
- Dr. Dinesh Bhonde, Registrar
- Dr. Surya Gunjal, NAAC Coordinator
- Dr. Vijaya Patil, Associate Professor, School of Education
- Shri Kiran Hire, Executive Engineer
- Shri Sandip Bhagwat, Farm Manager, Krishi Vigyan Kendra

We are also thankful to other Staff members for helping us during the field study.

## EXECUTIVE SUMMARY

After the Field Study & analysis, we present herewith important observations made during the assignment of Environmental Audit.

**1. Yashwantrao Chavan Maharashtra Open University, Nashik** Energy in three forms, namely: **Electrical Energy, Diesel and LPG**.

### 2. Present Consumption of Various Resources & CO<sub>2</sub> Emission:

No	Parameter/ Value	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters	CO <sub>2</sub> Emissions, MT
1	Total	488779	290	5708	456.05
2	Maximum	50557	43.5	1349	45.59
3	Minimum	34505	0	0	32.72
4	Average	40731.58	24.17	475.67	38.00

### 3. Various Pollution caused due to Day-to-Day Activities:

- **Air pollution:** Mainly CO<sub>2</sub> on account of Electricity, LPG & Diesel Consumption
- **Solid Waste:** Bio degradable Kitchen Waste, Garden Waste, Recyclable Waste and Human Waste
- **Liquid Waste:** Human liquid waste

### 4. Various Environmental Friendly Projects already implemented:

- The University has installed a **13625 LPD** Solar Thermal Water Heating System.
- Usage of Energy Efficient **LED** Lighting.
- Annual **Reduction** of **CO<sub>2</sub> Emissions** above two projects: **98.37 MT**

### 5. Waste Management:

- **Segregation of Waste at Source & Recycling:** The recyclable waste, like paper, board etc. is segregated at source. There are separate bins for collection at various points and is disposed of for further for recycling.
- **Vermi-Composting:** The University has Vermi-composting facility & the compost is used as fertilizer for own garden.
- **Biogas Plant:** The University has installed a Biogas plant at the Yash Inn facility, to convert the kitchen waste into bio gas, which in turn is used for cooking, which leads to saving in consumption of LPG.
- **E-Waste Management:** The University follows the procedure as per the Government Regulations to dispose of the E-Waste.

### 6. Rain Water Harvesting:

The University has already installed Rain Water Harvesting Project by three ways:



- Constructing a Bund namely Yashwant Bund of storage capacity **26.2 Million** Liters,
- Farm pond
- Proper channelizing the rain water falling on the terrace of Main building & library.

#### 7. Environmentally Friendly Practices:

- **Smoke Free & Plastic Free Campus:** At various locations in the University campus boards are displayed, for making the Campus Smoke & Plastic free.
- **Paperless Office:** The University is using Software based system to address the Day-to-Day issues related to about **thirteen** various functions.
- **Green Cover:** Out of Total Area of **150 Acres**, almost **140 Acres** of area is under Green Cover. The percentage of Green Cover is more than **90%**.
- **Usage of Sanitary Dispenser & Incinerator:** The University has sanitary pad dispenser as well as incinerator for disposal of the sanitary waste.

#### 8. Eco Friendly & Sustainable Initiatives:

- **Participation in Unnat Bharat Abhiyan:** The University is actively participating in the **Unnat Bharat Abhiyan** and community development activities are undertaken under this.
- **Participation in National Service Scheme:** About 3200 plus students from affiliated Learning centers have carried out many activities like Tree Plantation, Water Conservation, Road construction in the adopted villages.
- **Construction of a Model Eco Friendly, Energy Efficient Bamboo House:** The University has built a Model, Energy Efficient, Low Cost house making use of locally available material like Bamboo, grass etc.

#### 9. Recommendations:

- Installation of Roof Top Solar PV Plant
- Installation of Bio Sewage Treatment Plant.
- Replacement of 600 Nos FTLs by 20 W LEDs.
- Setting up Target of reducing the Paper Usage by 5% on year-to-year basis

#### 10. Assumptions:

- ✓ **1 kWh** of Electrical Energy releases **0.9 Kg of CO<sub>2</sub>** into atmosphere
- ✓ **1 Kg of LPG** releases **2.93 Kg of CO<sub>2</sub>** into atmosphere
- ✓ **1 Liter of Diesel** emits **2.68 Kg of CO<sub>2</sub>** into atmosphere.
- ✓ Daily working hours-**7 to 12 Nos.**
- ✓ Annual working Days-**250 to 365 Nos.**
- ✓ Load Factor for use of Solar Thermal Water Heating System: **50%**

#### 11. References:

- For calculation of CO<sub>2</sub> Emissions: [www.tatapower.com](http://www.tatapower.com)
- For Energy Saved by Solar Thermal Plant: [www.mahaurja.com](http://www.mahaurja.com)

## **ABBREVIATIONS**

kWh	Kilo Watt Hour
kWp	Kilo Watt Peak
Kg	Kilo Gram
MT	Metric Ton
CO <sub>2</sub>	Carbon Di Oxide
LPD	Liters per Day
LPG	Liquefied Petroleum Gas
LED	Light Emitting Diode
Qty	Quantity
m	Meters
L	Length
B	Breadth
H	Height



## CHAPTER-I INTRODUCTION

### 1.1 Important 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 complied 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 University)
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 Audit Methodology:**

1. Study of University as System
2. Study of present Energy Consumption
3. Study of CO<sub>2</sub> emissions & Mitigation
4. Study of Waste Generation & Management
5. Study of Rain Water Harvesting

**1.2 Table No 4: General Details of the University:**

No	Head	Particulars
1	Name of Institution	Yashwantrao Chavan Maharashtra Open University
2	Address	Dnyangangotri, Near Gangapur Dam, Nashik 422 222
3	Year of Establishment	1989
4	Academic Programs Offered	200 Plus



## CHAPTER-II

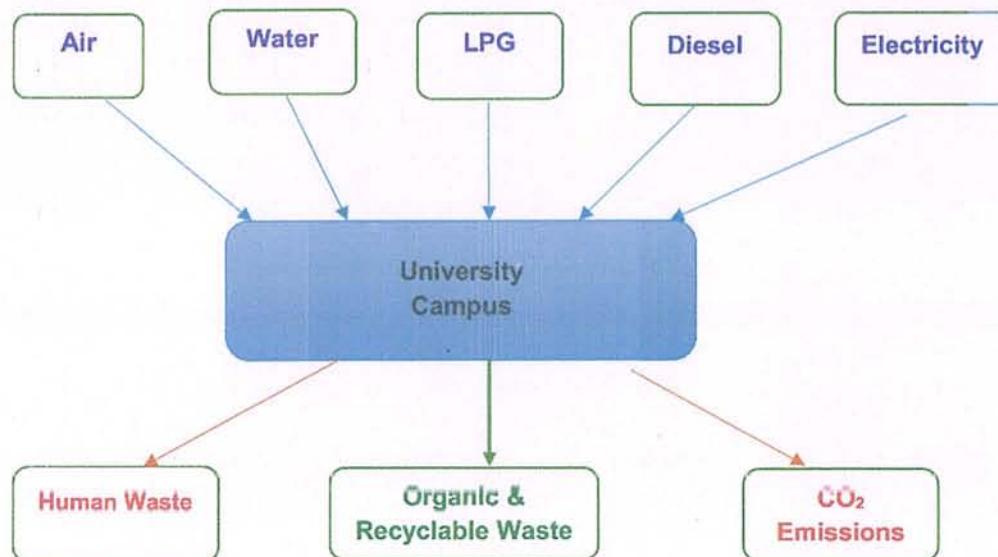
### STUDY OF CONSUMPTION OF VARIOUS RESOURCES

2.1 The University consumes following Natural/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas
5. Diesel

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

2.2 Chart No: 1: Representation of University as System:



Now we present the analysis of last year Energy Consumption

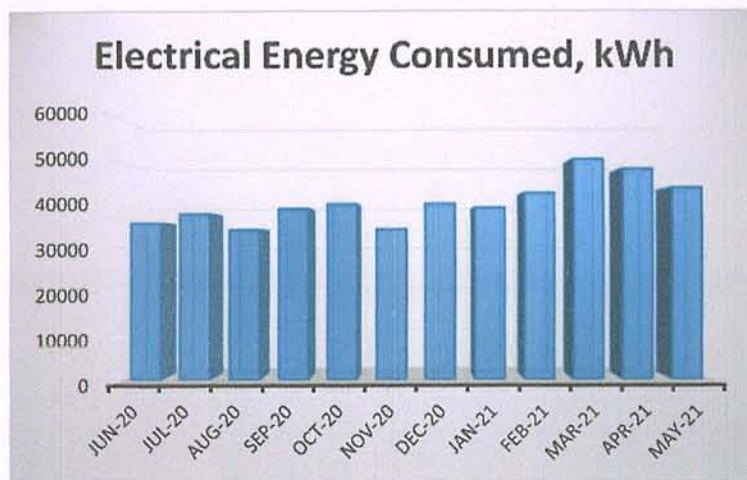
2.1 Table No 5: Study of Electrical Energy. LPG and Diesel Consumption: 20-21:

No	Month	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters
1	Jun-20	36095	29	1349
2	Jul-20	38204	29	931
3	Aug-20	34505	29	591
4	Sep-20	39347	29	623

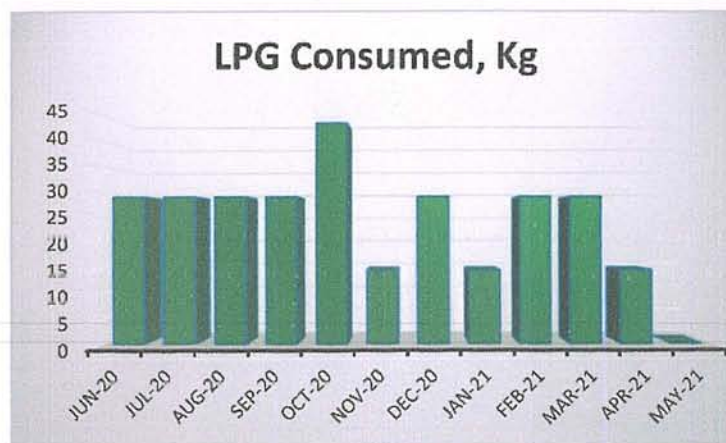


5	Oct-20	40380	43.5	606
6	Nov-20	34592	14.5	600
7	Dec-20	40408	29	382
8	Jan-21	39511	14.5	626
9	Feb-21	42847	29	0
10	Mar-21	50557	29	0
11	Apr-21	48321	14.5	0
12	May-21	44012	0	0
13	Total	488779	290	5708
14	Maximum	50557	43.5	1349
15	Minimum	34505	0	0
16	Average	40731.58	24.17	475.67

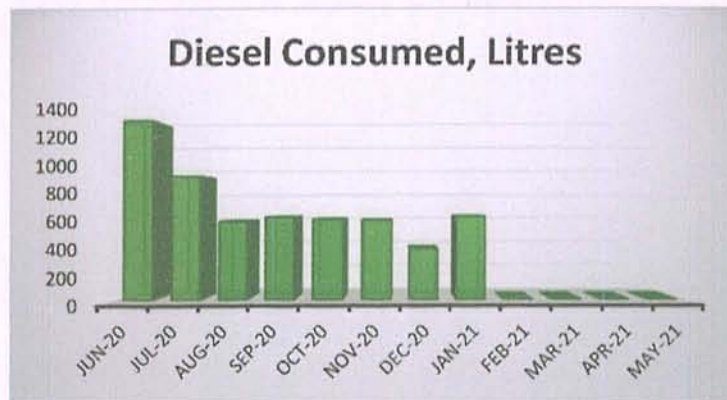
**2.2 To study the variation of Monthly Electrical Energy Consumption: Chart No: 2:**



**2.3 Study of Month wise LPG Consumption: Chart No 3:**



#### 2.4 Study of Month wise Diesel Consumption: Chart No 4:



From the above analysis, we present following important parameters:

**Table No 6: Variation in Important Parameters:**

No	Parameter/ Value	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters
1	Total	488779	290	5708
2	Maximum	50557	43.5	1349
3	Minimum	34505	0	0
4	Average	40731.58	24.17	475.67

### CHAPTER-III

#### STUDY OF CO<sub>2</sub> EMISSIONS

##### 3.1 Air Pollution:

The University uses three forms of Energies, namely, Electrical Energy used for day to day operations, LPG and Diesel. The major pollutant on account of above Energy forms is the Carbon Di Oxide. **A Carbon Foot print** is defined as the Total Greenhouse Gas emissions, emitted due to various activities.

##### Basis for computation of CO<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to LPG & Electrical Energy are as under

- 1 Unit (kWh) of Electrical Energy releases **0.9 Kg of CO<sub>2</sub>** into atmosphere
- 1 Kg of LPG releases **2.93 Kg** of CO<sub>2</sub> into atmosphere.
- 1 Liter of Diesel releases **2.68 Kg** of CO<sub>2</sub> into atmosphere.

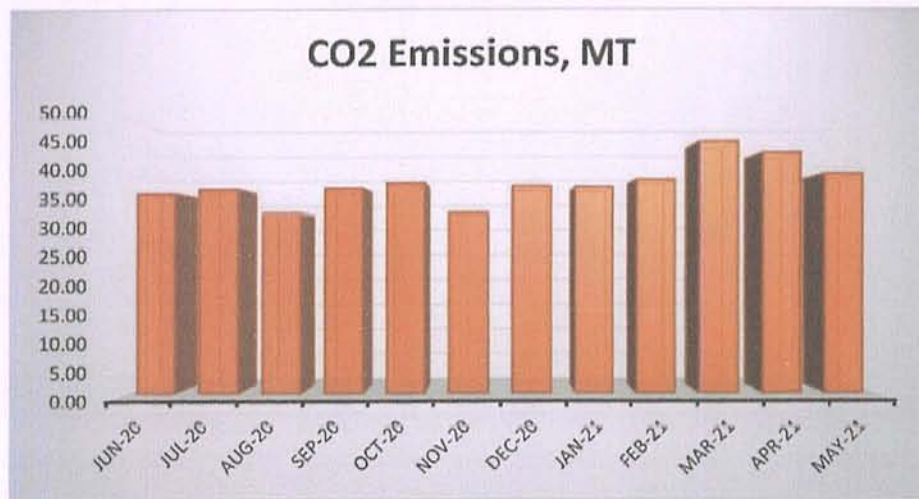
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the University due to its Day to Day operations

**Table No 7: Month wise CO<sub>2</sub> Emissions:**

No	Month	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters	CO <sub>2</sub> Emissions, MT
1	Jun-20	36095	29	1349	36.19
2	Jul-20	38204	29	931	36.96
3	Aug-20	34505	29	591	32.72
4	Sep-20	39347	29	623	37.17
5	Oct-20	40380	43.5	606	38.09
6	Nov-20	34592	14.5	000	32.78
7	Dec-20	40408	29	382	37.48
8	Jan-21	39511	14.5	626	37.28
9	Feb-21	42847	29	0	38.65
10	Mar-21	50557	29	0	45.59
11	Apr-21	48321	14.5	0	43.53
12	May-21	44012	0	0	39.61
13	Total	488770	290	5708	456.05
14	Maximum	50557	43.5	1349	45.59
15	Minimum	34505	0	0	32.72
16	Average	40731.58	24.17	475.67	38.00



**Representation of Month wise CO<sub>2</sub> emissions: Chart No: 5:**



**Study of Important Parameters: Table No 8:**

No	Parameter/ Value	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters	CO <sub>2</sub> Emissions, MT
1	Total	488779	290	5708	456.05
2	Maximum	50557	43.5	1349	45.59
3	Minimum	34505	0	0	32.72
4	Average	40731.58	24.17	475.67	38.00

## CHAPTER-IV

### STUDY OF CO<sub>2</sub> MITIGATION

4.1 There are two ways by which the University is reducing the CO<sub>2</sub> emissions, namely:

1. Usage of Renewable Energy, by installation of **13625 LPD** Solar Thermal Water Heating System
2. Usage of 400 Nos 20 W Energy Efficient LED Lighting.

4.2 Table No 9: Details of Solar Thermal Water Heating System:

No	Location	Capacity in LPD
1	Yash Inn Centre	8625
2	Godawari Hostel	2500
3	Abhyagat Niwas	2500
4	Total	13625

4.3 Photograph of Solar Thermal Water Heating System: At Yash Inn Facility:



4.4 Computation of Reduction in CO<sub>2</sub> Emission: Table No 10:

No	Particulars	Value	Unit
1	Capacity of Solar Thermal Water Heating System	13625	LPD
2	Electrical Energy Saved by 100 LPD Solar Thermal System per annum	1500	kWh
3	For calculations, we assume the Annual Energy saved in the year:20-21	750	kWh
4	Annual Equivalent Energy Saved by Solar Thermal System	102188	kWh
5	1 kWh of Electrical Energy emits	0.9	Kg of CO <sub>2</sub>
6	Annual Reduction in CO <sub>2</sub> emission by Solar Thermal Water Heating System	91.97	MT

7	Energy Saved by replacing 400 Nos 28WT-5 fittings by 20 W LEDs per Day(For 10 hour Operation)	32	kWh
8	Annual Energy Saved (For 250 Days per annum)	<b>8000</b>	kWh
9	Annual Reduction in CO <sub>2</sub> Emission by LED Lighting	<b>6.4</b>	MT
10	<b>Total Annual CO<sub>2</sub> Emission = (6) + (9)</b>	<b>98.37</b>	<b>MT</b>



## **CHAPTER V**

### **STUDY OF WASTE MANAGEMENT**

#### **5.1 Solid Waste Management:**

##### **5.1.1 Recyclable Waste Management:**

The recyclable waste, namely paper waste is segregated at the source of the generation. There are about 100 plus bins for collection of waste placed at all strategic locations. This waste material is further given to Authorized vendor for further disposal & recycling.

**Photograph of Waste collection Bin:**



##### **5.1.2 Vermicomposting:**

The University has almost 140 acres of plantation. The University has installed a Vermi-Composting Plant and almost 100 MT of vermi compost is produced in this plant.

**Photograph of Vermicomposting:**



### **5.1.3 Bio Gas Plant:**

The University has installed Bio Gas Plant at the Yash Inn facility. The kitchen waste at the facility is fed in this Plant and Bio gas is generated. In the full load operation it has resulted in saving about 1 LPG Cylinder per month.

#### **Photograph of Bio Gas Plant:**



### **5.2 Liquid Waste Management:**

It is recommended to install Bio Sewage Treatment Plant, in order to treat the human waste. The treated water can be used for watering the garden trees.

### **5.3 E-Waste management:**

The E-Waste Includes: PCs, Printers, pen drives, CDs etc.

For E-Waste management, the University follows the Methodology, as per the Government Regulations & it is disposed of by calling the tenders, as per the Regulations.



## **CHAPTER-VI**

### **STUDY OF RAIN WATER HARVESTING**

#### **6.1 Yashwant Bandhara:**

The dimensions of the Bund are: L=350 m \* B=15m \* H=5m

The total Water Storage capacity is about **26.2 Million Liters**.

The Dam was completed in the Year: 2001-02 with cost of **Rs 15 Lakhs**.

The water from this Dam is used for watering the Plants and for the domestic use. Only drinking water is purchased from the Nashik Municipal Council.

#### **Photograph of Yashwant Bandhara:**



#### **6.2 Farm Pond:**

The University has a farm pond which can store approximately -- million liters of Water. This farm pond has helped the nearby farmers, as the underground water level has increased substantially due to this farm pond.



**Photograph of Farm Pond:**



**6.3 Rain water harvesting from Terrace at Main Building:**

The University has laid pipes to collect the Rain Water collected on the terrace of the University buildings. Separate water channels are built to further store this collected Water to Yashwant Dam.

**Photograph of Rain Water Collecting Pipe from Terrace:**



#### **6.4 Rain water harvesting from Terrace at Library Building:**

The University has laid pipes to collect the Rain Water collected on the terrace of the Library building. This water is stored and in turn used for maintaining the Lawn within the premises.

#### **Photograph of Rain Water Pipes laid on the Ground:**





## **CHAPTER-VII**

### **STUDY OF ENVIRONMENTALLY FRIENDLY PRACTICES**

#### **7.1 Smoke Free Campus:**

The entire campus is smoke free. At common places boards are displayed appealing to keep the campus Smoke Free.

**Photograph of Smoke Free Campus display board: Need the photo:**



#### **7.2 Plastic Free Campus:**

The University is taking strict measures to keep the campus Plastic Free. At prominent places, boards are displayed to keep the campus Plastic Free.

**Photograph of Display board displaying Plastic Free campus at the main entrance:**





### **7.3 Paperless Office:**

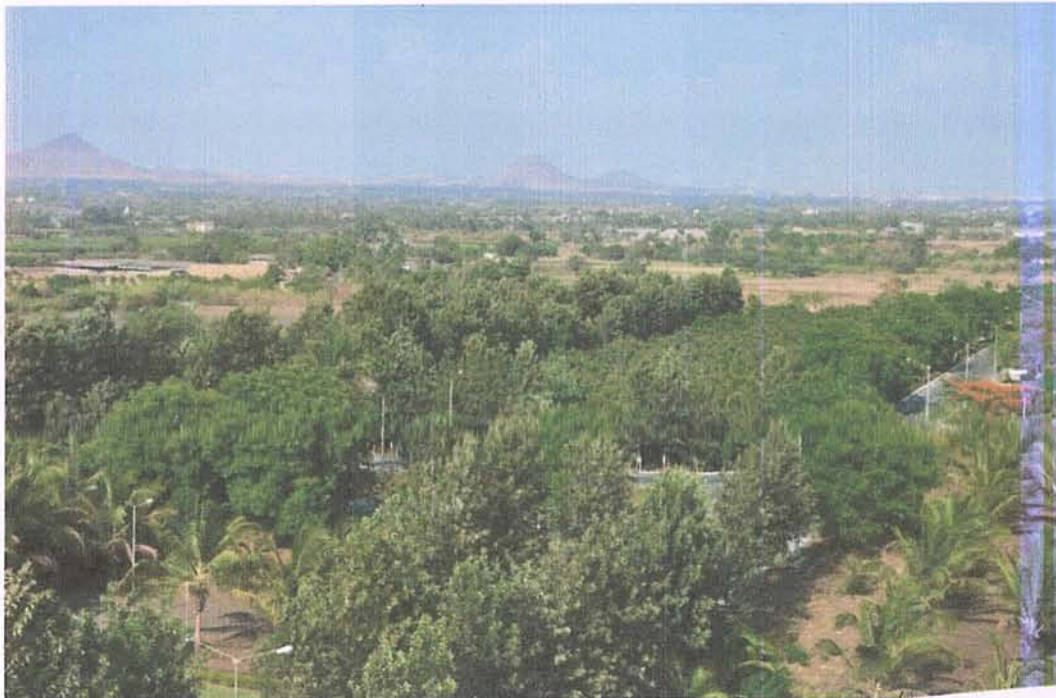
The University is taking various measures to make the Day-to-Day operations Paper less. There about Thirteen sections/operations wherein software based solutions are adopted are:

- ✓ E-Books Down load
- ✓ YCMOU Regional Centers
- ✓ Finance
- ✓ Admission
- ✓ Results
- ✓ Migration
- ✓ Grievances
- ✓ Scanned copy of Mark list, to name a few
- ✓ Revaluation of Answer Book
- ✓ E-Tenders

### **7.4 Green Cover in the campus:**

Out of a total area of 150 Acres, almost **103 Acres** of Land is under Krishi Vigyan Kendra, while 40 Acres under the plantation. More than **90%** of total area is Green.

**Photograph of Green Cover in the campus:**



#### 7.5 Participation SWACHH BHARAT ABHIYAN:

The University is an active participant in the Government of India's most prestigious project of **SWACHH BHARAT ABHIYAN**.

The important highlights under this Program are:

- The campus is **SWACHHA** from inside: Has adequate number of Toilets, The Hostel facilities are cleanly maintained, The Water supply is sufficient & the cooking equipment are modern & efficient
- There are ample number of Garbage Bins and the collection of garbage is on Daily basis
- The Garden Waste is composted by **Vermi-Composting** route
- The Kitchen waste is used for generating Bio Gas in a Bio Gas Plant
- Swachhta Lectures are held annually
- To promote the **Swachhta Abhiyan** the University has adopted **Ghanshe** Village, of population 200 & the Village is **Open Defecation Free (ODF)**

#### 7.6 Sanitary Dispenser and Incinerator:

The University has sanitary pad dispenser as well as incinerator for disposal of the sanitary waste. The napkins are made available at a very nominal cost of Rs 5/- per unit.

As the university has installed the Incinerator, the disposal of pads is carried out in an environmentally friendly manner.

#### Photograph of Sanitary Dispenser & Incinerator:





## **CHAPTER VIII**

### **STUDY OF ECO FRIENDLY & SUSTAINABLE INITIATIVES**

In this Chapter, we discuss the various Eco Friendly and Sustainable Initiatives undertaken by the University.

#### **8.1 Participation in Unnat Bharat Abhiyan:**

Under this Program, the following activities are taken in the adopted Village:  
Disseminating the information on:

- Need & Importance of Personal Hygiene & Sanitation
- Hygiene of Water resources
- Waste Water treatment
- Promotion of importance of Nutrition among the rural communities

#### **8.2 Participation of Affiliated Colleges in National Service Scheme (NSS) Program:**

Under the University there are about 50 Plus Learning centers. From these affiliated centers, about 3200 plus students are involved in the National Service Scheme (NSS) program.  
The major activities under this Program are:

- Tree Plantation Campaign
- Water conservation
- Health awareness and road construction in adopted **Ghanshe & Kumbhale** Villages in Nashik District

#### **8.3 Energy Efficient Model Bamboo House:**

In order to build a small house with minimum usage of external items and maximum use of Eco friendly and readily available natural material, the University has built a Model Bamboo house in the University campus.

The major highlights of this House are:

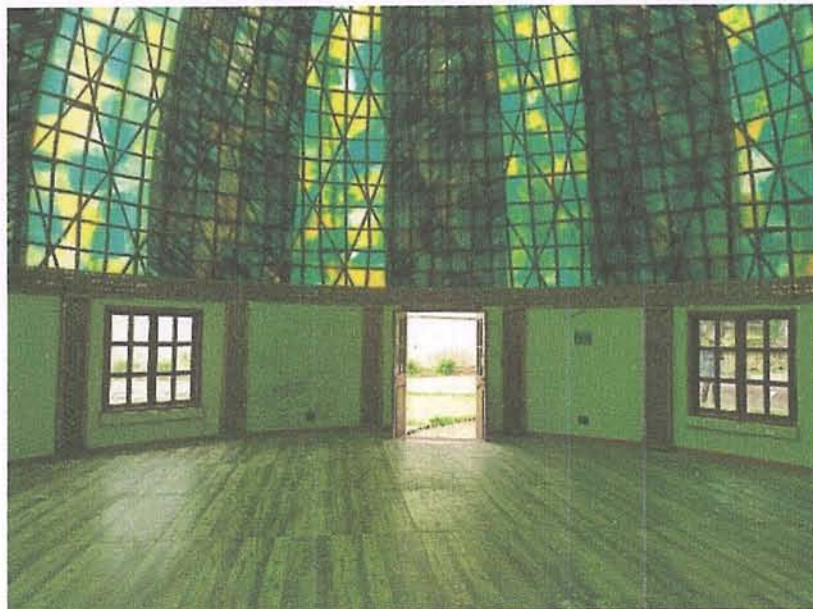
- Eco friendly Bamboo material usage
- Readily Availability of Material
- Usage of Bamboo for Columns, Beams, Foundation & Walls
- Non usage of Steel
- Non usage of Cement
- Green Building
- Low cost
- Low Energy usage in construction as compared to conventional house



**Photograph of Model Bamboo House: External View:**



**Photograph of Model Bamboo House: Internal View:**



## **CHAPTER IX RECOMMENDATIONS**

It is recommended to:

1. Install Roof Top Solar PV Plant
2. Replace 600 Nos T-5 Fittings by 20 W LED Fittings
3. To set target of reduction in use of paper by about 5 % on year-to-year basis.
4. To install a Bio Sewage Treatment Plant.

# **ANNEXURE-I**

## **LIST OF PLANTED TREES**

No	Name of the Tree	No. of plants
1	Babhul	1188
2	Eucalyptus	3404
3	Casurina	522
4	Australian Acacia	1869
5	Subabul	60
6	Neem	244
7	Cashew	13
8	Mango	10
9	Jamun	16
10	Umbar	42
11	Kashid	117
12	Shiso	385
13	Vilayati Chinch	11
14	Glyrisidia	715
15	Shivan	76
16	Karani	133
17	Bamboo	20
18	Tembhurni	10
19	Sadada	19
20	Waras	06
21	Agasti	70
22	Moha	31
23	Bhendi	15
24	Kadamb	61
25	Pimpal	22
26	Jakaranda	38
27	Shiras	766
28	Raintree	279
29	Silver Oak	54



**ENERGY AUDIT REPORT**  
of  
**YASHAWANTRAO CHAVAN MAHARASHTRA**  
**OPEN UNIVERSITY,**  
**Dnyangangotri, Near Gangapur Dam,**  
**Nashik 422 222**



**ज्ञानगंगा घरोघरी**

**Year: 2020-21**

Prepared by:

**Enrich Consultants**

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**MAHARASHTRA ENERGY DEVELOPMENT AGENCY**

An ISO 9001: 2000 Reg. no.: RQ 91 / 2482



**Maharashtra Energy Development Agency**

(Government of Maharashtra Institution)

Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary,  
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Email: [ccc@mahaurja.com](mailto:ccc@mahaurja.com), Web: [www.mahaurja.com](http://www.mahaurja.com)

ECN/2021-22/CR-14/1577

22<sup>nd</sup> 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 21<sup>st</sup> 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

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Tel: 09890444795 Email: [enrichcons@gmail.com](mailto:enrichcons@gmail.com)

Ref: EC/YCMOU/21-22/01

Date: 10/6/2021

## CERTIFICATE

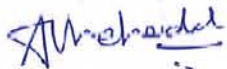
This is to certify that we have conducted Energy Audit at Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik in the year 2019-20.

The University has already adopted **Energy Efficient** practices like:

- Usage of Energy Efficient LED Fittings
- Maximum Usage of Day Lighting
- Maintenance of Power Factor close to Unity.
- Installation of **13625 LPD** Solar Thermal Water Heating System

We appreciate the support of Management and involvement of faculty & Staff members in the process of making the campus Energy Efficient.

For Enrich Consultants,



A Y Mehendale,  
Certified Energy Auditor  
EA-8192





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## **ACKNOWLEDGEMENT**

We at Enrich Consultants, Pune, express our sincere gratitude to the management of Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik 422 222 for awarding us the assignment of Energy Audit of their Nashik Campus, for the Year: 2020-21.

We are thankful to:

- Prof. E. Vayunandan, Vice chancellor
- Dr. Dinesh Bhonde, Registrar
- Dr. Surya Gunjal, NAAC Coordinator
- Dr. Vijaya Patil, Associate Professor, School of Education
- Shri Kiran Hire, Executive Engineer

We are also thankful to other Staff members for helping us during the field study.

## EXECUTIVE SUMMARY

After the Field Study & analysis, we present herewith important observations made during the assignment of Energy Audit.

**1. Yashwantrao Chavan Maharashtra Open University, Nashik** uses Energy in three forms, namely: **Electrical Energy, Diesel and LPG**.

### 2. Present Energy Consumption:

No	Parameter/ Value	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters	CO <sub>2</sub> Emissions, MT
1	Total	488779	290	5708	458.05
2	Maximum	50557	43.5	1349	45.59
3	Minimum	34505	0	0	32.72
4	Average	40731.58	24.17	475.67	38.00

### 3. Energy Conservation projects already installed:

- Usage of Energy Efficient LED fittings
- Usage of Maximum Day Lighting
- Maintenance of Good Power Factor close to Unity.
- Installation of **13625 LPD** Solar Thermal Water Heating System.

### 4. Usage of Alternate/Renewable Energy:

The University has installed a **13625 LPD Solar Thermal Water Heating System**. The percentage of usage of Alternate Energy to Annual Energy Demand is **17.29 %**.

### 5. Usage of LED Lighting:

The total Annual Lighting consumption of the University is **110149 kWh**. The annual LED Lighting consumption is **76549 kW**. The percentage of Annual LED Lighting Usage to Annual Lighting Power requirement is **69.50 %**.

### 6. Recommendations:

1. It is recommended to install Roof Top Solar PV Plant.
2. It is recommended to replace 600 Nos, T-5/28 W FTL fittings by 20 W LED Fittings

### 7. Assumptions:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO<sub>2</sub>** into atmosphere
2. **1 Kg of LPG** releases **2.93 Kg of CO<sub>2</sub>** into atmosphere
3. **1 Liter of Diesel** emits **2.68 Kg of CO<sub>2</sub>** into atmosphere.
4. Daily working hours-**7 to 12 Nos.**
5. Annual working Days-**250 to 365 Nos.**
6. Load Factor for use of Solar Thermal Water Heating System: **50%**



#### 8. References:

- For calculation of CO<sub>2</sub> Emissions: [www.tatapower.com](http://www.tatapower.com)
- For Energy Saved by Solar Thermal Plant: [www.mahaurja.com](http://www.mahaurja.com)

## **ABBREVIATIONS**

kWh	Kilo Watt Hour
kWp	Kilo Watt Peak
Kg	Kilo Gram
MT	Metric Ton
CO <sub>2</sub>	Carbon Di Oxide
LPD	Liters per Day
LPG	Liquefied Petroleum Gas
FTL	Fluorescent Tube Light
Qty	Quantity
LED	Light Emitting Diode

## **CHAPTER-I INTRODUCTION**

### **1.1 Objectives:**

1. To study Connected Load.
2. To study present level of Energy Consumption
3. To Study the present CO<sub>2</sub> emissions
4. To assess the various equipment/facilities from Energy efficiency aspect
5. To study usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

### **1.2 Table No 1: General Details of the University:**

No	Head	Particulars
1	Name of Institution	Yashwantrao Chavan Maharashtra Open University
2	Address	Dnyangangotri, Near Gangapur Dam, Nashik 422 222
3	Year of Establishment	1989
4	Academic Programs Offered	200 Plus



## CHAPTER-II STUDY OF CONNECTED LOAD

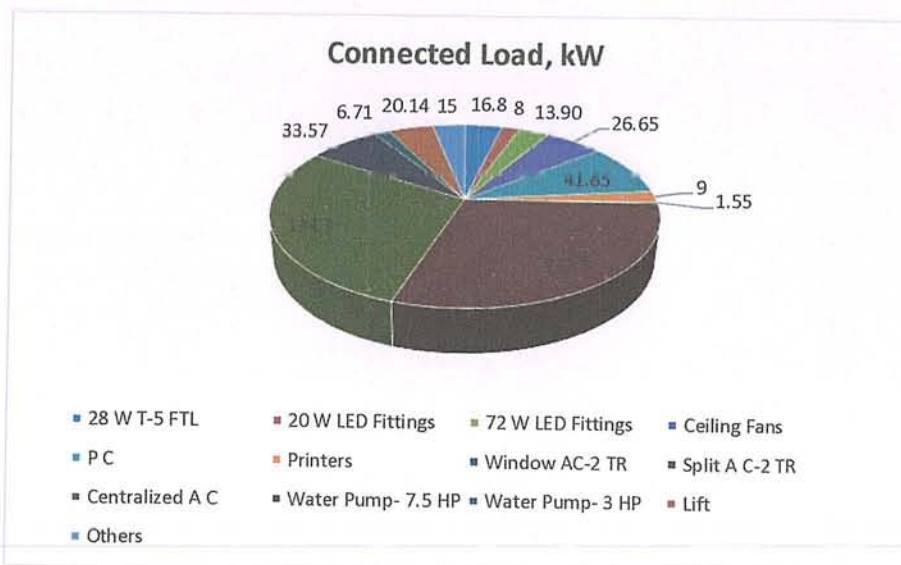
The major contributors to the connected load of the University are as under.

**Table No 2: Equipment wise Connected Load:**

No	Equipment	Qty	Load, W/Unit	Load, kW
1	28 W T-5 FTL	600	28	16.8
2	20 W LED Fittings	400	20	8
3	72 W LED Fittings	193	72	13.90
4	Ceiling Fans	410	65	26.65
5	P C	310	135	41.85
6	Printers	60	150	9
7	Window AC-2 TR	5	310	1.55
8	Split A C-2 TR	50	2750	137.5
9	Centralized A C	5	26856	134.3
10	Water Pump- 7.5 HP	6	5595	33.57
11	Water Pump- 3 HP	3	2238	6.71
12	Lift	3	6714	20.14
13	Others	100	150	15
14	<b>Total</b>			<b>465</b>

We present the above Data in a PIE Chart as under.

**Chart No1: Connected Load:**



### CHAPTER III

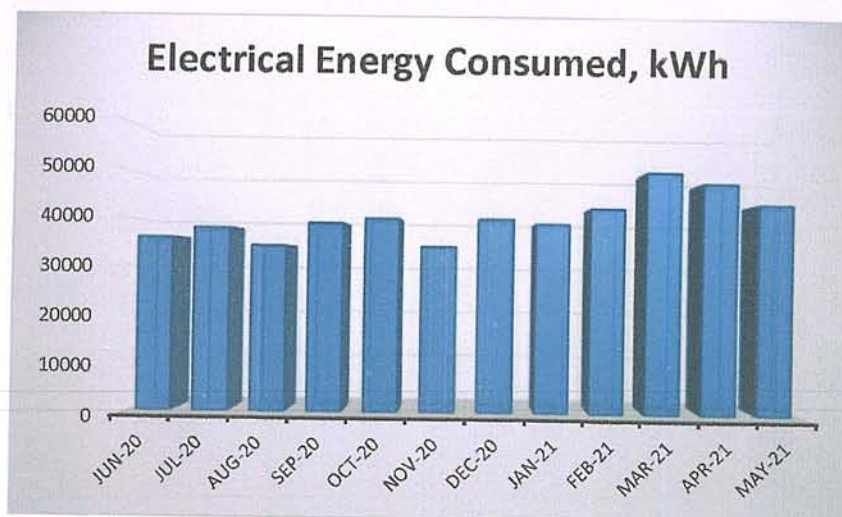
### STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of last year Energy Consumption

3.1 Table No. 3: Study of Electrical Energy, LPG and Diesel Consumption: 20-21:

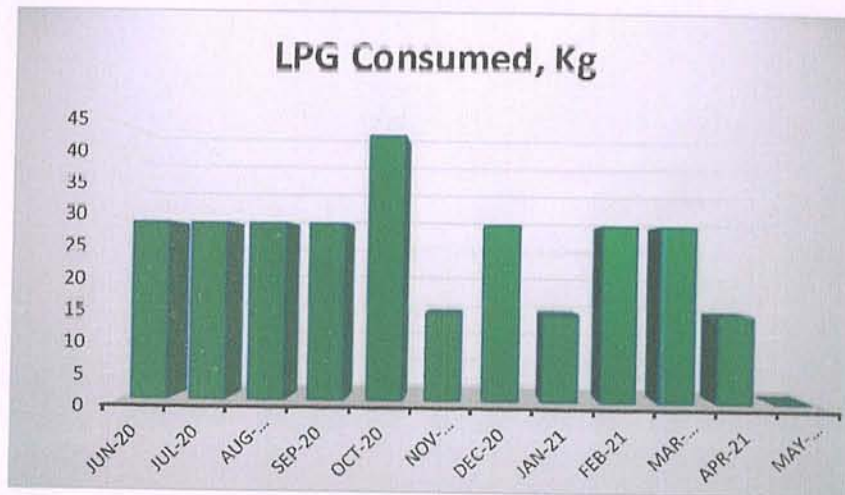
No	Month	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters
1	Jun-20	36095	29	1349
2	Jul-20	38204	29	931
3	Aug-20	34505	29	601
4	Sep-20	39347	29	623
5	Oct-20	40380	43.5	606
6	Nov-20	34592	14.5	600
7	Dec-20	40408	29	382
8	Jan-21	39511	14.5	626
9	Feb-21	42847	29	0
10	Mar-21	50557	29	0
11	Apr-21	48321	14.5	0
12	May-21	44012	0	0
13	Total	488779	290	5708
14	Maximum	50557	43.5	1349
15	Minimum	34505	0	0
16	Average	40731.58	24.17	475.67

3.2 To study the variation of Monthly Electrical Energy Consumption; Chart No: 2:

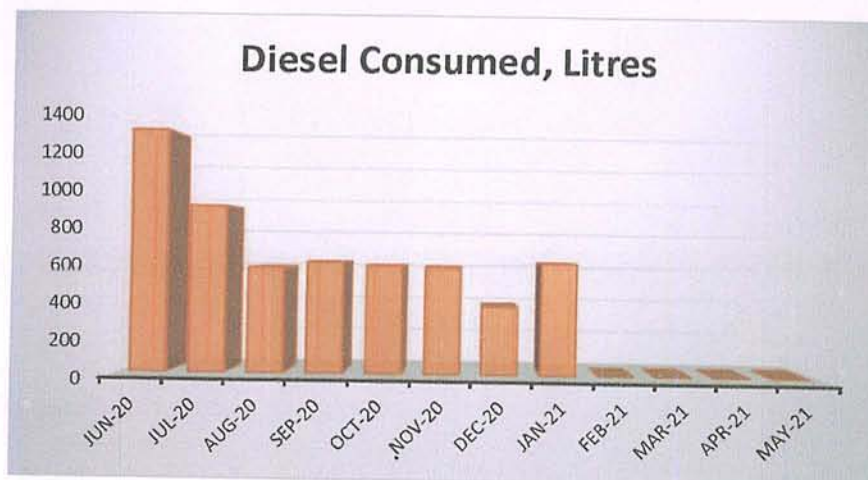




### 3.3 Study of Month wise LPG Consumption: Chart No 3:



### 3.4 Study of Month wise Diesel Consumption: Chart No 4:



From the above analysis, we present following important parameters:

**Table No 4: Variation in Important Parameters:**

No	Parameter/ Value	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters
1	Total	488779	290	5708
2	Maximum	50557	43.5	1349
3	Minimum	34505	0	0
4	Average	40731.58	24.17	475.67



## 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 University for performing its day to day activities

The University uses three forms of Energy namely: Electrical Energy for various Electrical gadgets, LPG and Diesel.

### Basis for computation of CO<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to LPG & Electrical Energy are as under

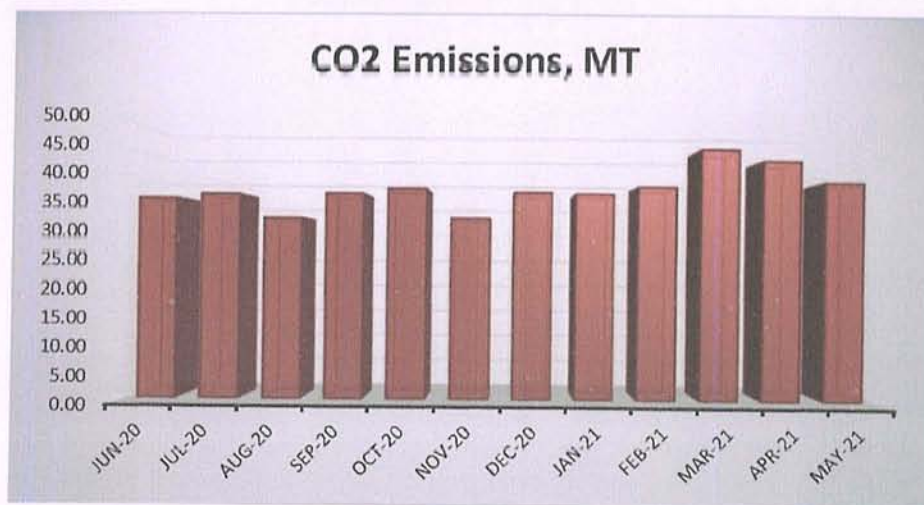
- 1 Unit (kWh) of Electrical Energy releases **0.9 Kg of CO<sub>2</sub>** into atmosphere
- 1 Kg of LPG releases **2.93 Kg** of CO<sub>2</sub> into atmosphere.
- 1 Liter of Diesel releases **2.68 Kg** of CO<sub>2</sub> into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the University due to its Day to Day operations

**Table No 5: Month wise Energy Consumption & CO<sub>2</sub> Emissions:**

No	Month	Electrical Energy Consumed, kWh	LPG Consumed, Kg	Diesel Consumed, Liters	CO <sub>2</sub> Emissions, MT
1	Jun-20	36095	29	1340	36.19
2	Jul-20	38204	29	931	36.96
3	Aug-20	34505	29	591	32.72
4	Sep-20	39347	29	623	37.17
5	Oct-20	40380	43.5	606	38.09
6	Nov-20	34592	14.5	600	32.78
7	Dec-20	40408	29	382	37.48
8	Jan-21	39511	14.5	626	37.28
9	Feb-21	42847	29	0	38.65
10	Mar-21	50557	29	0	45.59
11	Apr-21	48321	14.5	0	43.53
12	May-21	44012	0	0	39.61
13	Total	488779	290	5708	456.05
14	Maximum	50557	43.5	1349	45.59
15	Minimum	34505	0	0	32.72
16	Average	40731.58	24.17	475.67	38.00

Representation of Month wise CO<sub>2</sub> emissions: Chart No: 5:





## CHAPTER-V

### STUDY OF USAGE OF ALTERNATE ENERGY

The University has installed Solar Thermal Water Heating System. The details of installation are as under.

**Table No 6: Details of Solar Thermal Water Heating System:**

No	Location	Capacity in LPD
1	Yash Inn Centre	8625
2	Godawari Hostel	2500
3	Abhyagat Niwas	2500
4	<b>Total</b>	<b>13625</b>

**Table No 7: Percentage of Usage of Alternate Energy:**

No	Particulars	Value	Unit
1	Energy purchased from MSEDCL in the Year: 2020-21	488779	kWh
2	Capacity of Solar Thermal Water Heating System	13625	LPD
3	Electrical Energy Saved by 100 LPD Solar Thermal System per annum	1500	kWh
4	For calculations, we assume the Annual Energy saved in the year:20-21	750	kWh
5	Annual Equivalent Energy Saved by Solar Thermal System	102188	Nos
6	Total Annual Electrical Energy Requirement = (1) + (5)	590967	kWh
8	Percent of Alternate Energy to Annual Energy Requirement = $(6) \times 100 / (7)$	17.29	%

**Photograph of Solar Thermal Water Heating System: At Yash Inn Facility:**





## 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, as under.

**Table No 8: Computation of Percent Usage of LED Lighting to Annual Lighting Load:**

No	Particulars	Value	Unit
1	No of T-5, 28 W FTL Fittings	600	Nos
2	Load/Unit of T-5, 28 W FTL Fitting	28	W/Unit
3	Total Load of 600 Nos, T-5 Fittings	16.8	kW
4	Daily Working Hours	8	Nos
5	Annual Working Days	250	Nos
6	Annual Lighting Consumption of T-5 Fittings=3*4*5	33600	kWh
7	No of 20 W LED Fittings	400	Nos
8	Load/Unit of 20W LED Fitting	20	W/Unit
9	Total Load of 400 Nos, 20 W LED Fittings	8	kW
10	Daily Working Hours	8	Nos
11	Annual Working Days	250	Nos
12	Annual Lighting Consumption of T-5 Fittings=10*11*12	16000	kWh
13	No of 72 W LED Fittings	192	Nos
14	Load/Unit of 72 W LED Fittings	72	W/Unit
15	Total Load of 192 Nos, 72 W LED Fittings	13.824	kW
16	Daily Working Hours	12	Nos
17	Annual Working Days	365	Nos
18	Annual Lighting Consumption of T-5 Fittings=15*16*17	60549.1	kWh
19	Total Annual Lighting Load=6+12+18	110149	kWh
20	Annual LED Lighting Load = 12+18	76549.1	kWh
21	% of Annual LED Lighting to Total Lighting Load =20*100/19	69.50	%

## **CHAPTER VII RECOMMENDATIONS**

It is recommended to:

1. Install Roof Top Solar PV Plant
2. Replace 600 Nos T-5/28 W FTL Fittings by 20 W LED Fittings