ENERGY AUDIT REPORT

of

YASHAWANTRAO CHAVAN MAHARASHTRA OPEN UNIVERSITY,

Dnyangangotri, Near Gangapur Dam, Nashik 422 222

ज्ञानगंगा घरोघरी

Year: 2022-23

Prepared by:

ENGRESS SERVICES

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

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ENGRESS SERVICES

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

ENERGY AUDIT CERTIFICATE

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

This is to certify that we have conducted Energy Audit at Yashwantrao Chavan Maharashtra Open University, Dnyangangotri, Near Gangapur Dam, Nashik in the year 2022-23.

.The College has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Usage of BEE STAR Ratted Equipment
- Installation Off Grid 218.184 kWp Capacity Solar PV Plant
- Installation of 27000 LPD Solar Thermal Water Heating System

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

For Engress Services,

ENGRESS SERVICES PUNE

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

REGISTRATION CERTIFICATES

Regn. No. EA-8192

No. 2942

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr / Mr. *Achyut Yashavant Mehendale* son / daughter of Mr. *Yashavant* has passed the National Certification Examination for Energy Auditors in April - 2001, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practise as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfilment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 10th August 2001

Controller of Examination

AUDITOR CERTIFICATE

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency

(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandry,
Aundh, Pune, Maharashtra 411067
Ph No: 020-29800456
Email: eee@mahaurja.com, Web: www.mahaurja.com

CCN/2022-23/CR-43/1309

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 Maktangan 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 cancelling 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 (I.C.)

MEDA Registration Certificate

Certificate of Registration

This is to Certify that
Quality Management System of

ENGRESS SERVICES

26, YASHASHREE, BLOCK C, LOKMANYA NAGAR, NIRMAL BAGG SOC., PARVATI, PUNE - 411009, MAHARASHTRA, INDIA

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

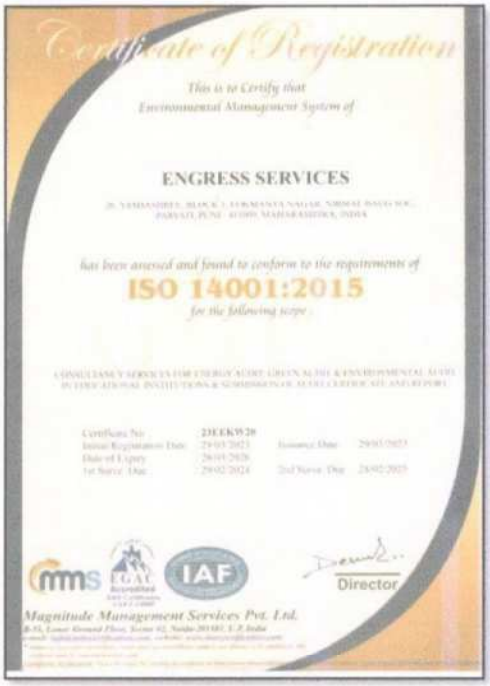
CONSULTANCY SERVICES FOR ENERGY AUDIT, GREEN AUDIT & ENVIRONMENTAL AUDIT IN EDUCATIONAL INSTITUTIONS & SUBMISSION OF AUDIT CERTIFICATE AND REPORT

Certificate No.	23EQKC13		
Initial Registration Date	27/01/2023	Issuance Date	27/01/2023
Date of Expiry	26/01/2026		
1st Surve. Due	27/02/2024	2nd Surve. Due	27/02/2025

Director

Magnitude Management Services Pvt. Ltd.

ISO: 9001-2015 Certificate



Certificate of Registration

This is to Certify that
Environmental Management System of

ENGRESS SERVICES

26, YASHASHREE, BLOCK C, LOKMANYA NAGAR, NIRMAL BAGG SOC., PARVATI, PUNE - 411009, MAHARASHTRA, INDIA

has been assessed and found to conform to the requirements of

ISO 14001:2015

for the following scope :

CONSULTANCY SERVICES FOR ENERGY AUDIT, GREEN AUDIT & ENVIRONMENTAL AUDIT IN EDUCATIONAL INSTITUTIONS & SUBMISSION OF AUDIT CERTIFICATE AND REPORT

Certificate No.	23EEKW20		
Initial Registration Date	29/03/2023	Issuance Date	29/03/2023
Date of Expiry	28/04/2026		
1st Surve. Due	29/02/2024	2nd Surve. Due	28/02/2025

Director

Magnitude Management Services Pvt. Ltd.

ISO: 14001-2015 Certificate

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ACKNOWLEDGEMENT

We at Engress Services, 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: 2022-23.

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

EXECUTIVE SUMMARY

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

2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	**872**	kW
2	Annual Energy Purchased	**527744**	kWh
3	Annual Diesel Consumed	**9600**	Liters

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	527744	kWh
2	Energy Generated by Solar PV Plant	261820.8	kWh
3	Total Energy Consumed= 1+2	789564.8	kWh
4	Total Built up area of University	**179814.2**	m^2
5	Energy Performance Index **=(3) / (4)**	**4.39**	kWh/m^2

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

No	Particulars	Value	Unit
1	Lighting Power Density	**7.89**	W/m^2
2	% of Usage of LED Lighting to Total Lighting Load	**100**	%

5. Renewable Energy & Energy Efficiency Projects:

1. Usage of Energy Efficient LED fittings & BEE STAR Rated Equipment
2. The University has installed a **27000 LPD** Solar Thermal Water Heating System.
3. The Total Off Grid Solar PV Plant capacity is **218.184 kWp.**
4. The University is also going to install **300 kWp** Grid Connected Solar PV Plant

6. Assumptions:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere
2. **1 Liter of Diesel** releases **2.68 Kg of CO_2** into atmosphere
3. Energy generated by Roof Top Solar PV Plant: **4 kWh/kWp per Day**
4. Annual Solar Energy generation Days: **300 Nos**

7. References:

- Audit Methodology: www.mahaurja.com
- Energy Conservation Building Code: ECBC-2017: www.beeindia.gov.in
- For CO_2 Emissions: www.tatapower.com
- For Solar PV Energy generation: www.solarrooftop.gov.in

ABBREVIATIONS

LED	:	Light Emitting Diode
MSEDCL	:	Maharashtra State Electricity Distribution Company Limited
BEE	:	Bureau of Energy Efficiency
ECBC	:	Energy Conservation Building Code
MEDA	:	Maharashtra Energy Development Agency
PV	:	Photo Voltaic
Kg	:	Kilo Gram
kWh	:	kilo-Watt Hour
CO_2	:	Carbon Di Oxide
MT	:	Metric Ton

CHAPTER-I
INTRODUCTION

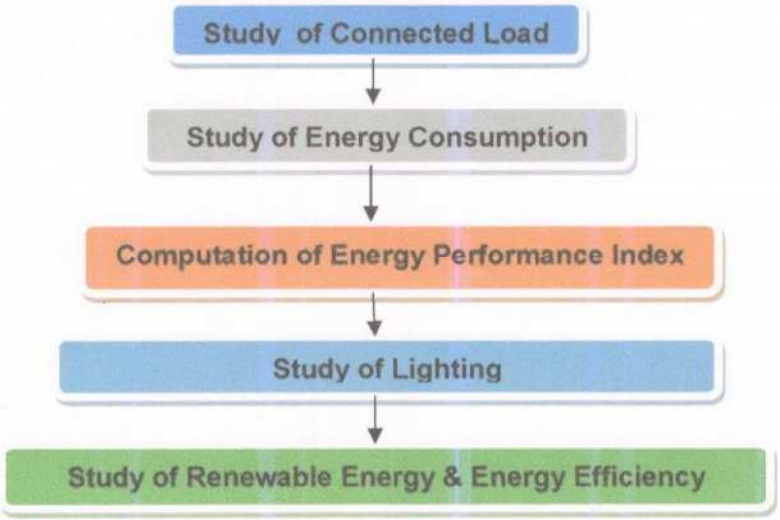
1.1 Introduction:

An Energy Audit is conducted at Yashwantrao Chavan Maharashtra Open University Nashik.

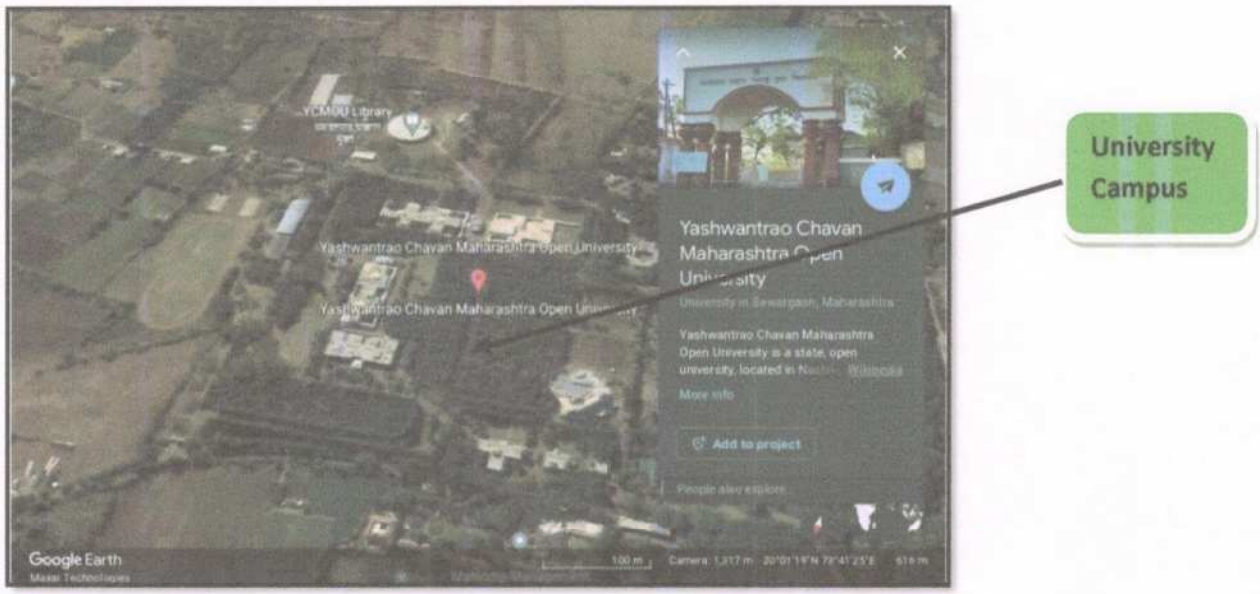
The guidelines followed for conducting the Energy Audit are:

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

1.2 Audit Procedural Steps:



1.3 University Location Image:

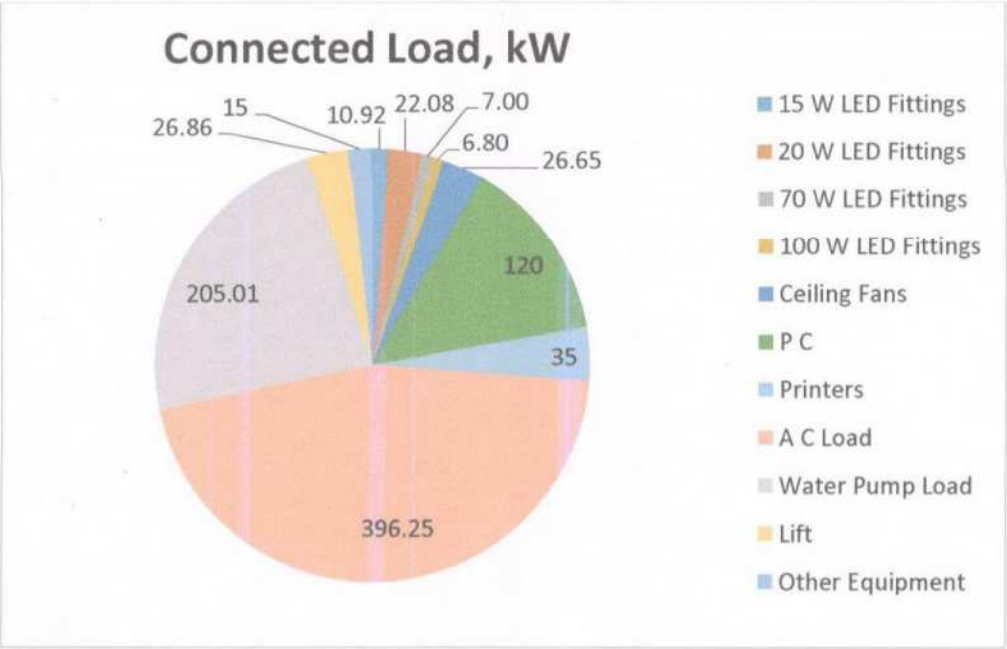


CHAPTER-II
STUDY OF CONNECTED LOAD

The major contributors to the connected load of the University include:
Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	15 W LED Fittings	728	15	10.92
2	20 W LED Fittings	1104	20	22.08
3	70 W LED Fittings	100	70	7.00
4	100 W LED Fittings	68	100	6.80
5	Ceiling Fans	410	65	26.65
6	P C	800	150	120
7	Printers	200	175	35
8	A C Load	317	1250	396.25
9	Water Pump Load	15	13667	205.01
10	Lift	4	6714	26.86
11	Other Equipment	100	150	15
12	**Total**			**872**

Chart No 1: Study of Connected Load:



CHAPTER-III
STUDY OF PRESENT ENERGY CONSUMPTION

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

Table No 2: Electrical Energy & Diesel Consumption Analysis- 2022-23:

No	Month	Energy Purchased, kWh	Diesel Consumed, Liters	CO_2 Emissions, MT
1	Jul-22	41443	800	39.44
2	Aug-22	35748	1500	36.19
3	Sep-22	31888	2300	34.86
4	Oct-22	38101	400	35.36
5	Nov-22	39147	150	35.63
6	Dec-22	40366	350	37.27
7	Jan-23	43706	200	39.87
8	Feb-23	42891	200	39.14
9	Mar-23	38269	900	36.85
10	Apr-23	48573	700	45.59
11	May-23	63837	1200	60.67
12	Jun-23	63775	900	59.81
13	Total	527744	9600	500.70
14	Maximum	63837	2300	60.67
15	Minimum	31888	150	34.86
16	Average	43978.67	800	41.72

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

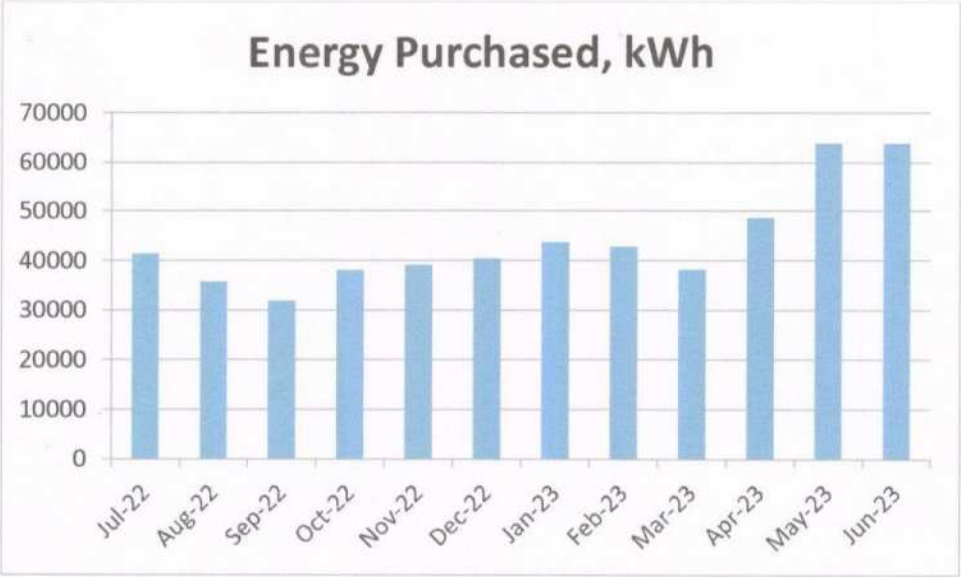
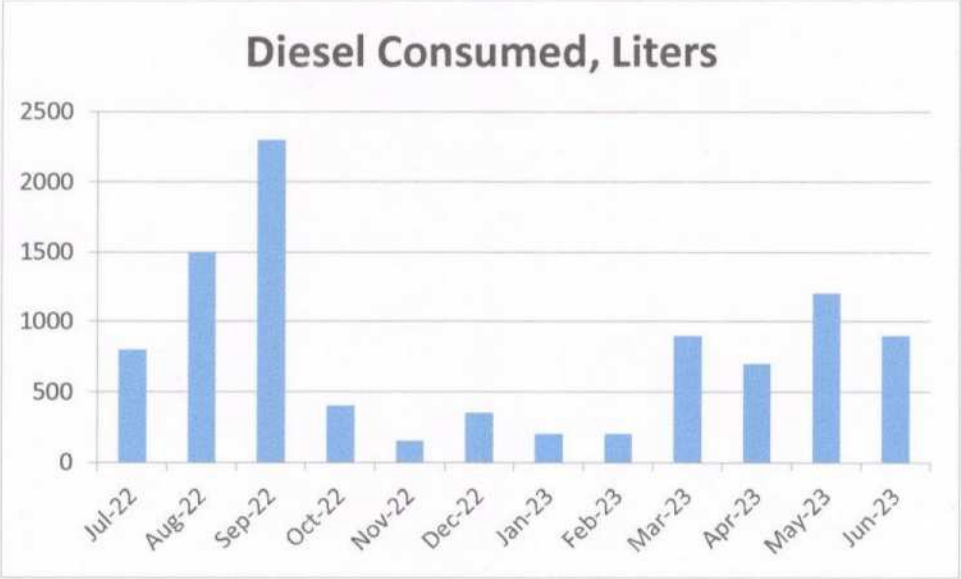


Chart No 3: Variation in Monthly Diesel Consumed, kWh:



CHAPTER-IV
STUDY OF ENERGY PERFORMANCE INDEX

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

It is determined by:

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

Now we compute the EPI for the University as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Purchased	527744	kWh
2	Energy Generated by Solar PV Plant	261820.8	kWh
3	Total Energy Consumed= 1+2	789564.8	kWh
4	Total Built up area of University	**179814.2**	m^2
5	Energy Performance Index **=(3) / (4)**	**4.39**	kWh/m^2

CHAPTER V
STUDY OF LIGHTING

Terminology:

1. Lumen is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.

2. Lux is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.

3. Circuit Watts is the total power drawn by lamps and ballasts in a lighting circuit under assessment.

4. Installed Load Efficacy is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre (lux/W/m²)

5. Lamp Circuit Efficacy is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt (lm/W)

6. Installed Power Density. The installed power density per 100 lux is the power needed per square metre of floor area to achieve 100 lux of average maintained illuminance on a horizontal working plane with general lighting of an interior. Unit: watts per square metre per 100 lux (W/m²/100 lux) 100 Installed power density (W/m²/100 lux)

7. Lighting Power Density: It is defined as Total Lighting Load in a room divided by the Area of that Room in square meters.

In this Chapter we compute the Lighting Power Density of Class Room and the percentage usage of LED Lighting to total Lighting Load of the University.
Now, we compute the usage of LED Lighting to Total Lighting Load, as under.
Table No 4: Computation of Lighting Power Density: Executive Engineer Cabin:

No	Particulars	Value	Unit
1	Qty of 15 W LED Fittings in Executive Engineer Cabin	8	Nos
2	Load of 15 W LED Fitting	15	W/unit
3	Total Load of 8 Nos, 15 W LED Fittings	**120**	W
4	Built up area of Class Room:	**15.21**	m^2
5	**Lighting Power Density = (3)/(4)**	**7.89**	W/m^2

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

No	Particulars	Value	Unit
1	Qty of 15 W LED Fittings	728	Nos
2	Load per unit of 15 W LED Fittings	15	W
3	Total Load of 15 W LED Fittings	**10.92**	kW
4	Qty of 20 W LED Fittings	1104	Nos
5	Load per unit of 20 W LED Fittings	20	W
6	Total Load of 20 W LED Fittings	**22.08**	kW
7	Qty of 70 W LED Fittings	100	Nos
8	Load per unit of 70 W LED Fittings	70	W
9	Total Load of 70 W LED Fittings	**7**	kW
10	Qty of 100 W LED Fittings	68	Nos
11	Load per unit of 100 W LED Fittings	100	W
12	Total Load of 100 W LED Fittings	**6.8**	kW
13	Total LED Lighting Load **=3+6+9+12**	46.8	kW
14	Total Lighting Load **=3+6+9+12**	46.8	kW
15	% of LEDs to Total Lighting Load=**13*14/100**	**100**	%

CHAPTER-VI
STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

The University has installed:

- Roof Top Solar PV Plant on various Buildings, Solar Street Lights, Solar Based Traffic Signals & Solar High Mast Lights.
- The Total Installed Solar PV Capacity is **218.184 kWp**
- Solar Thermal Water Heating System of Capacity **27000** Liters per Day
- The University is also installing Grid Connected Solar PV Plant of Capacity **300 kWp**

Photograph of Roof Top Solar PV Plant & Solar Thermal Water Heating System:

6.2 Energy Efficiency Measures adopted:

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

Photographs of STAR Rated AC & LED Lighting & BEE STAR Rated AC: