MANAV RACHNA UNIVERSITY

Declared as State Private University vide Haryana Act 26 of 2014

MANAV RACHNA UNIVERSITY

ENERGY AUDIT REPORT

2021-2022

PREPARED BY

EHS ALLIANCE SERVICES

MANAV RACHNA UNIVERSITY

EHS alliance

CONTENTS

CERTIFICATE

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PRESENTED TO

MANAV RACHNA UNIVERSITY

Sector 43, Aravali Hills, Delhi-Surajkund Road, Faridabad, Haryana 121004

Has been assessed by EHS Alliance Services for the comprehensive study of Energy Audit on institutional working framework to fulfill the requirement of

ENERGY AUDIT

The energy-saving initiatives carried out by the University have been verified in the report submitted and were found to be satisfactory.

The efforts taken by management and faculty towards all types of energy used in the University and sustainability are highly appreciated and noteworthy.

SIGNATURE

EHS ALLIANCE SERVICES GURGAON

01.02.2023
DATE OF AUDIT

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ACKNOWLEDGEMENT

EHS Alliance Services would like to thank the management of Manav Rachna University for assigning this important work of Energy Audit. We appreciate the co-operation to the teams for completion of assessment.

We would also like to thank ***Prof. (Dr.) Meena Kapahi, Director - IQAC***, for her continuous support and guidance, without which the completion of the project would not have been possible. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

We are also thankful to

Prof. (Dr.) Sangita Banga – *Pro-Vice Chancellor - MRU*

Dr. Kameshwar Singh - *Registrar MRU*

Dr. Deepa Arora - *Associate Director – IQAC*

Mr. Kripa Shanker Mishra – *G. M. Administration*

Prof. (Dr.) Ajit Katiyar - *Mechanical Engineering*

Last but not the least, we would like to thank **Prof. (Dr.) I. K. Bhat – Hon'ble Vice Chancellor,** Manav Rachna University for giving us an opportunity to evaluate the environmental performance of the campus.

DISCLAIMER

EHS Alliance Services Energy Audit Team has prepared this Energy Audit Report for Manav Rachna University based on input data submitted by the representatives of university complemented with the best judgment capacity of the expert team.

While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the conclusions are arrived following best estimates and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

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EHS ALLIANCE SERVICES GURGAON

Vijay Singh
Lead Auditor EMS & Energy

Dr. Uday Pratap
Co-Auditor EMS & Energy

ABBREVIATION

A	Amps
AC	Air Conditioner
AC	Alternating Current
AMET	Academy of Maritime Education and Training
CFL	Compact fluorescent lamp
CIP	Comprehensive Inspection Programme
DC	Direct Current
HSD	High Speed Diesel
Hz	Hertz
kg	Kilogram
kVA	kilo-volt-ampere
kW	kilo Watts
kWh	kilowatt hour
kWp	Kilowatt peak
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
MMS	Module mounting structure
MPPT	Maximum Power Point Tracker
NAAC	The National Assessment and Accreditation Council
SEC	Specific Energy Consumption
SPV	Solar Photovoltaic
STC	Standard Test Condition
TV	Television
V	Volts
W	Watts
W/m2	watt per square metre

OVERVIEW OF THE UNIVERSITY

Manav Rachna University (MRU) is a leading State Private University (established by Haryana State Legislature Act No 26 of 2014 & under section 2(f) of UGC Act 1956), offering globally relevant education. The University has evolved from Manav Rachna College of Engineering (MRCE), which was established in the year 2004, a NAAC accredited 'A' Grade institution. Manav Rachna University is among the Top 2 Emerging Engineering Institutions of India and has been ranked the No. 1 Engineering Institution in India for Research Capability & Placements in the Times Engineering Survey 2022. The accreditations/rankings are testimonial to the trust of accrediting bodies in the quality of education being offered, a well-established teaching and learning process guided by the global best practices and a culture of academic excellence promoting research, innovation & entrepreneurship.

Strategic Objectives

- To facilitate, enhance & promote innovation in curriculum design and delivery and have Outcome-oriented Learning Culture.
- To promote Research Environment and Management Practices.
- To enhance the quality of the student learning experience.
- To provide Resources and Infrastructure for Academic Excellence.

VISION

To educate students in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens

MISSION

- To impart outcome based holistic education
- To disseminate education in frontier areas
- To produce globally competitive, ethical and socially responsible human resources
- To produce human resources sensitive to issues of Environment and Sustainable Development
- To develop Environment and Sustainable development as a thrust area of research and development.

Geo Coordinates from Google maps: 28.4490247, 77.2837703

AUDIT PARTICIPANTS

On behalf of University

Name	Designation
Prof. (Dr.) I. K. BHAT	*Vice Chancellor, Manav Rachna University*
Prof. (Dr.) Sangita Banga	*Pro VC, Manav Rachna University*
Dr. Kameshwar Singh	*Registrar, Manav Rachna University*
Prof. (Dr.) Ajit Katiyar	*Department of Mechanical Engineering*
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Dr. Deepa Arora	*Associate Director, IQAC*
Dr. Desh Pal Singh	*Sr. Manager, Horticulture*
Mr. Sudhir Pahuja	*Manager, Maintenance*
Mr. Gurdeep Singh	*Manager, Maintenance*

On behalf of EHS Alliance Services

Name	Position	Qualifications
Mr. Vijay Singh	Lead Auditor	M.Sc. M. Tech (Environment Science & Engineering), Energy Auditor, Post Diploma in Industrial Safety Management
Dr. Uday Pratap	Co-Auditor	Ph.D., EMS: Lead Auditor ISO14001:2015, QCI–WASH

EXECUTIVE SUMMARY

The purpose of this Energy Audit was to seek opportunities to improve the energy efficiency of the Manav Rachna University. Reducing the energy consumption despite improving the human comfort, health and safety were of primary concern.

Beyond just identifying the energy consumption pattern, this audit sought to detect and categorize the most energy efficient appliances. Additionally, some daily practices relating common appliances have been shared which may help reducing the energy consumption. Data collection for energy audit of the university was carried out by the EHS Alliance Team. The Energy Audit Report accounts for the energy consumption patterns of the university on actual survey and detailed analysis during the audit.

The work comprehends the area wise consumption traced using suitable equipment. The analysis was carried out by our team with the support of the staff members from Manav Rachna University. The report provides a list of possible actions to preserve and efficiently access the available source, resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff members would follow the recommendations in the best possible way. The report is based on certain generalizations including the approximations wherever necessary. The views conveyed may not reveal the general opinion. They merely represent the opinion of the team guided by the interviews of clients. We are happy to submit this Energy audit report to the Manav Rachna University.

ENERGY AUDIT - ANALYSIS

1. ENERGY CONSUMPTION

To understand the Energy Consumption trends and for analyzing the average monthly consumption we have collected electricity energy bills from July 2021 to June 2022

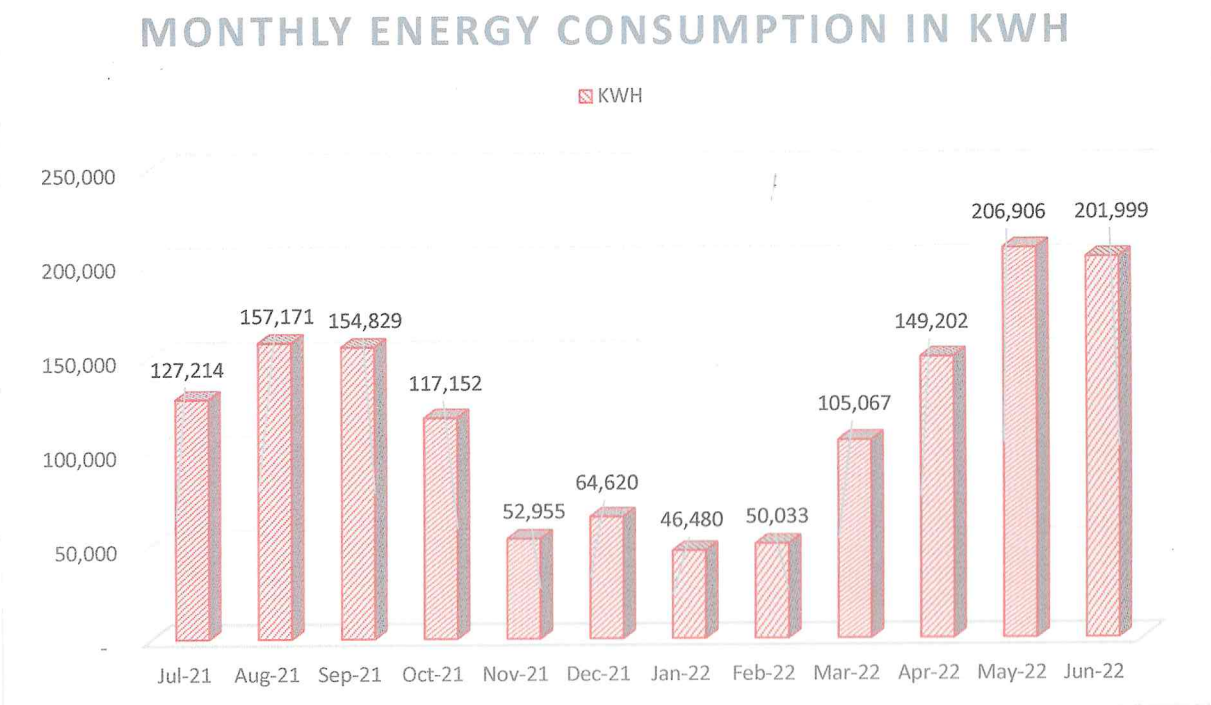
The details of **"Meter Connection"** at **"Manav Rachna University"** are as follows-

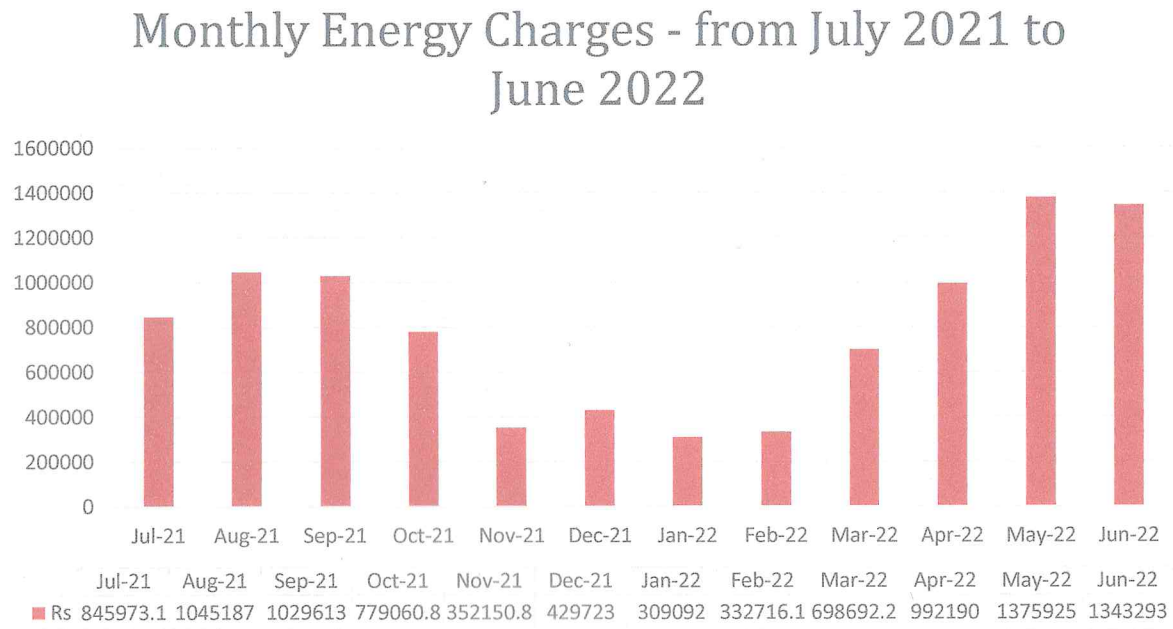
Name	-	Uthan Education Trust
CA No.	-	3569930000

1.1 Summary of Monthly Electricity Consumption and Total Bill Amount

To understand the Energy consumption trend and for developing the baseline parameter we have collected monthly energy bill for the 12 months i.e. from July 2021 to June 2022

Month	Grid Billing	Solar PV	Total	Rate INR	Amount in INR
Jul-21	1,27,214	7911	1,35,125	6.65	8,45,973.10
Aug-21	1,57,171	6834	1,64,005	6.65	10,45,187.15
Sep-21	1,54,829	8893	1,63,722	6.65	10,29,612.85
Oct-21	1,17,152	6405	1,23,557	6.65	7,79,060.80
Nov-21	52,955	5867	58,822	6.65	3,52,150.75
Dec-21	64,620	5185	69,805	6.65	4,29,723.00
Jan-22	46,480	7843	54,323	6.65	3,09,092.00
Feb-22	50,033	10010	60,043	6.65	3,32,716.13
Mar-22	1,05,067	9444	1,14,511	6.65	6,98,692.23
Apr-22	1,49,202	9493	1,58,695	6.65	9,92,189.98
May-22	2,06,906	9000	2,15,906	6.65	13,75,924.90
Jun-22	2,01,999	7767	2,09,766	6.65	13,43,293.35
SUM	**14,33,627**	**94,652**	**15,28,279**		**95,33,616.2**

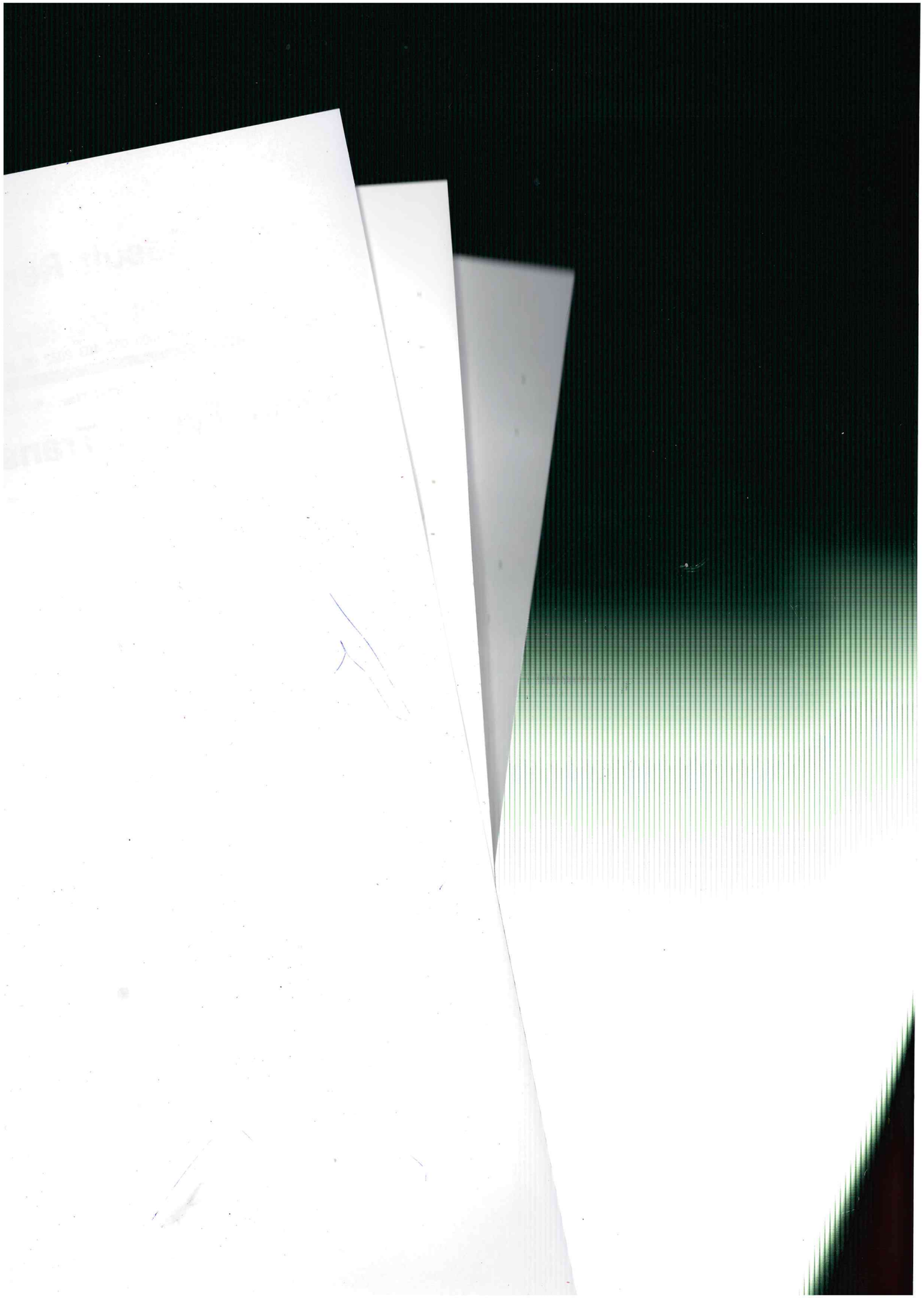


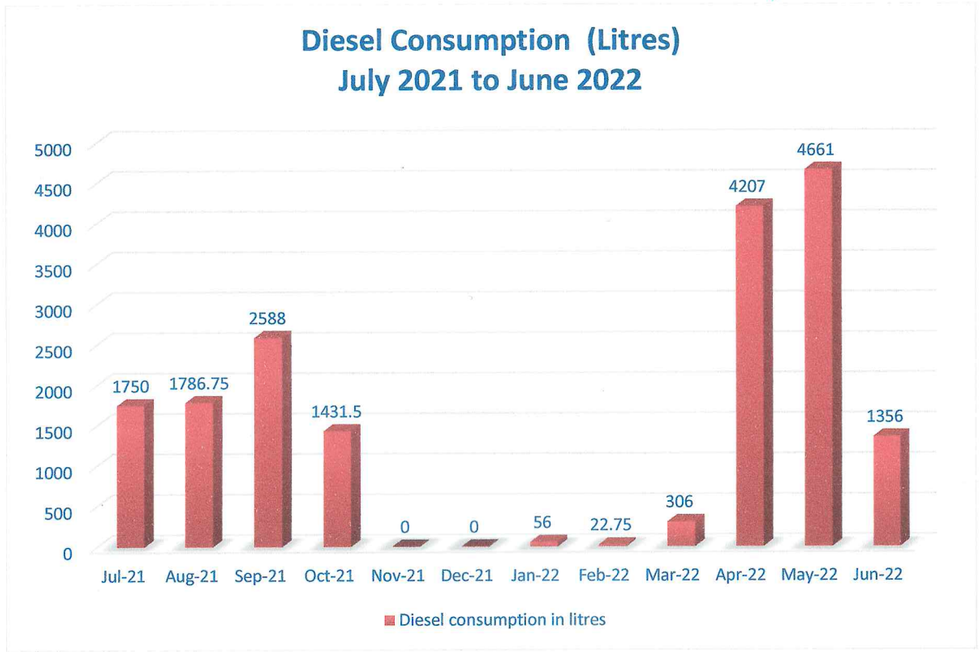


2. DIESEL CONSUMPTION

Below is the diesel consumption details in litres from from July 2021 to June 2022.

Period	Diesel consumption (in litres)
Jul-21	1750
Aug-21	1786.75
Sep-21	2588
Oct-21	1431.5
Nov-21	0
Dec-21	0
Jan-22	56
Feb-22	22.75
Mar-22	306
Apr-22	4207
May-22	4661
Jun-22	1356
Total	**18165**





3. ANALYSIS OF DG SETS

In the university, there are two Diesel Generator (DG) sets for its electrical power needs in case of Grid power failure. Total installed DG sets capacity is 1500 kVA.

DG Set Design Details			
Description	Unit	DG at Station 1	DG at station 2
Rated capacity	kVA	750 KVA	750 KVA
Hz		50	50
Sl No.		08.20/20-21/0272	08.20/20-21/0273
Make		Sudhir Cummins	Sudhir Cummins
Volts	Volts	415 Volts	415 Volts
PF		0.8	0.8
Phase		3 Phase	3 Phase
RPM		1500	1500
Amps	Amps	1050	1050
Mfg.		2009	2009

DG Set Operation details		
Operating hours during testing	Hours	0.50
% Loading	%	63.58
Energy Generation	kWh	35.73
Load	kVA	91.34
Fuel consumption during testing	Litre	10
Specific energy generation	kWh/litre	3.34

Observation and Suggestions:- As per the trial taken during the energy audit the percentage loading of DG set is 63.58% which is ok and specific energy consumption of DG Sets 3.34 kWh/Litre which is satisfactory because as per manufacturer recommendation, best practices for SEC in DG sets range from 3.0 to 3.5 kWh/Litre and above.

4. AC SYSTEM

Energy Efficiency Ratio (EER): Performance of smaller chillers and rooftop units is frequently measured in EER rather than kW/ton. EER is calculated by dividing a chiller's cooling
Capacity (in Btu/h) by its power input (in watts) at full-load conditions. The higher the EER, the More efficient the unit. The cooling effect produced is quantified as tons of refrigeration (TR). The above TR is also called as air-conditioning tonnage.

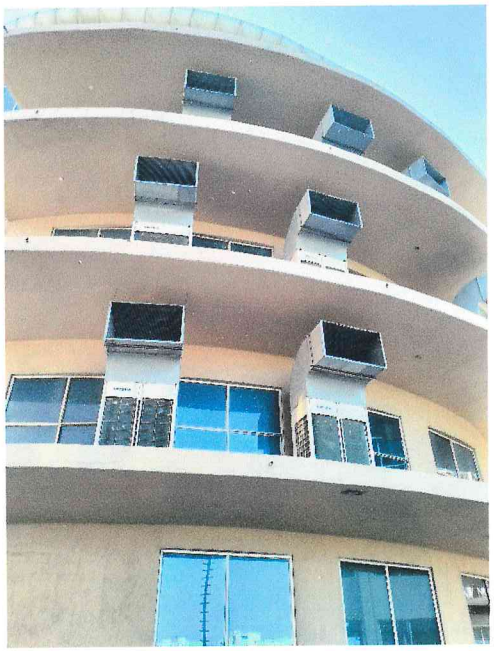
There are Split ACs installed in Manav Rachna University in various areas of various capacity which detail is given below:-

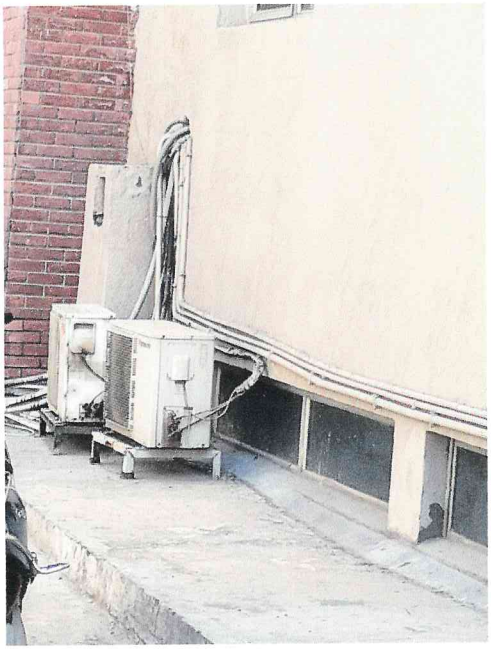
S.No	Location	Type (S/W/D/C)	Rated capacity (TR)	Qty	Room Temp. (°C)	AC-Tout (°C)	AC-Tin (°C)	Room-RH (%)	Area (m2)	Air velocity (m/s)	Enthalpy Hout	Enthalpy Hin	Heat Load in TR	KW supplied	(Eff.) Power per Ton (KW /TON)	EER
1	G Block	C	1.5	3	24	12	20	52	0.03	2.2	25	38	0.32	0.55	1.72	2.04
2	H block	S/D	1.5	7	24	11	19	52	0.03	2.6	24	37	0.38	0.57	1.52	2.31
3	I block	S/D	1.5	1	24	10	18	52	0.03	2.4	24	37	0.35	0.53	1.53	2.3
4	J Block	S/D	1.5	4	23	12	20	52	0.03	2.3	25	38	0.33	0.55	1.67	2.11
5	K block	S/D	1.5	1	23	11	19	52	0.03	2	22	37	0.33	0.58	1.74	2.02
6	L block	S/D	1.5	3	23	13	20	52	0.03	2.3	26	38	0.31	0.53	1.74	2.02
7	M block	S/D	1.5	13	23	12	20	52	0.03	2.2	25	38	0.32	0.55	1.74	2.03
8	N block	S/D	1.5	2	23	12	19	52	0.03	2.3	24	37	0.33	0.58	1.74	2.02
9	CBH 1	S/D	1.5	6	24	11	20	52	0.03	2.3	22	38	0.38	0.65	1.69	2.08
10	CBH 2	S/D	1.5	87	24	12	20	53	0.03	2.5	25	38	0.34	0.6	1.79	1.97
11	G Block	C	2	41	24	12	20	53	0.03	2.4	25	38	0.33	0.58	1.78	1.98
12	H block	S/D	2	4	22	10.5	21	52	0.062	2.4	22	39	0.88	1.53	1.74	2.02
13	I block	S/D	2	2	22	10.5	20	52	0.062	2.1	21	38	0.77	1.28	1.67	2.1
14	J Block	S/D	2	9	22	10.5	21	52	0.062	2.4	22	39	0.88	1.53	1.74	2.02
15	L block	S/D	2	2	22	10.5	20	52	0.062	2.1	21	38	0.77	1.28	1.67	2.1
16	G Block	C	3	11	23	11	19	53	0.03	2.4	22	38	0.4	0.81	2.02	1.74
17	K block	S/D	4	1	22	11.5	22	52	0.03	2.1	23	43	0.44	0.77	1.77	1.99
18	H block	S/D	5.5	6	23	11	21	52	0.03	2.4	24	40	0.4	0.72	1.8	1.95
19	I block	S/D	5.5	13	22	10	19	52	0.03	2.2	20	37	0.39	0.78	1.99	1.77
20	J Block	S/D	5.5	8	23	11	21	53	0.03	2.5	24	40	0.42	0.74	1.77	1.99
21	K block	S/D	5.5	13	22	12	20	52	0.03	2.6	25	38	0.35	0.71	2.02	1.74
22	L block	S/D	5.5	10	23	12	22	53	0.03	2.3	24	43	0.46	0.74	1.62	2.17
23	N block	S/D	5.5	2	23	12	20	53	0.03	2.7	25	38	0.37	0.65	1.78	1.98

24	H block	S/D	8.55	17	23	12	22	53	0.03	2.2	24	43	0.44	0.73	1.67	2.11
25	I block	S/D	8.55	19	23	12	22	53	0.03	2.3	24	42	0.43	0.71	1.63	2.15
26	J Block	S/D	8.55	13	23	12	22	52	0.03	2.3	24	43	0.46	0.76	1.67	2.11
27	K block	S/D	8.55	17	24	12	20	52	0.03	2.2	25	38	0.32	0.55	1.72	2.04
28	L block	S/D	8.55	19	24	11	19	52	0.03	2.6	24	37	0.38	0.57	1.52	2.31
29	M block	S/D	8.55	1	24	10	18	52	0.03	2.4	24	37	0.35	0.53	1.53	2.3
30	N block	S/D	8.55	2	23	12	20	53	0.03	2.7	25	38	0.37	0.65	1.78	1.98

Remarks: - We have checked Energy Efficiency Ratio of AC's and EER of AC's is fairly OK. But in future you should purchase 5-Star rated invertor based split AC's because power consumption of Inverter based BEE 5-Star rated AC's is less than non-star rated AC's.

Also, we recommend MRU to organize periodic maintenance schedule and take corrective actions for insulating of AC's refrigerant lines in order to protect energy losses.





5. FANS ANALYSIS

In the MRU, 1815 Fans are installed, out of which 1567 fans are ceiling fans, 98 fans are 60W wall fans and 150 fresh air fans. The observation and suggestion are given below.

Sl No.	Location/Identification	Ceiling Fan-60W	Fresh air	Wall Fan-60W

			fans	
1	Boys Hostel 01	210	60	2
2	Boys Hostel 02	240	16	1
3	G block	77	9	10
4	H block	126	12	20
5	I block	147	8	6
6	J block	80	8	8
7	K block	154	8	21
8	L block	136	11	12
9	M block	68	10	16
10	N block	59	8	2
Total		**1297**	**150**	**98**

Observation and Suggestions:-

In the university, all the ceiling fans are of 60 W but BEE 5 Star Rated of 30W Ceiling Fans are present in the market. But the pay-back period for new BEE 5 star rated fans is longer, so we don't recommend to replace to BEE 5 Star rated 30W fans.

ECRM-1-Energy saving by replacing 120 W fans with energy efficient 30W ceiling fans

Total no of Ceiling Fans (60W)	=	1297	Nos.
Total wattage of 60W Ceiling Fans	=	94020	Watt
Total wattage of BEE 5 Star rated Fans (30W)	=	47010	Watt
Total saving in Wattage after replacement	=	47010	Watt
Operating hours per day	=	8	Hours
Operating days per annum	=	180	Days
Energy charges per unit in Rs.	=	6.65	INR
Saving in Rs./annum	=	450167.76	INR
Investment INR	=	4701000	INR
Payback period:- Months	=	10.44	Years

Note:- Energy saving will increase or decrease if operating hours of machine /equipment will be increased or decreased and payback period will also increase or decrease if cost of investment (Cost of machine/equipment/accessories of machine) will increase or decrease because cost of investment is taken on tentative basis.

6. ANALYSIS OF LIGHTING SYSTEM

6.1 Brief description of existing system

For assessing energy efficiency of lighting system, Inventory of the Lighting System has been noted / collected, with the aid of a lux meter, measurement and documentation of the lux levels at various locations at working level has been done.

6.2 Inventory of Lighting

Sl. No.	Location/Identification	400 W-LED flood light	150W-LED Flood light	50W LED street light	120 w street light	10W LED 2'	15W LED Light Round	9 W led lamp	36W	2'*2' led	20W LED	39W LED	2*18w	4*18	20W LED
1	Boys Hostel 01		4			240					440				
2	Boys Hostel 02	6	4			240		120			184				
3	G block						164				69				
4	H block	28	1	5			54		15		149			54	61
5	I block	2	1		6		63		21	20	271			70	
6	J block		1				56		19		139	19			
7	K block	1	2				101		106				13	36	
8	L block	1	2				121				165				
9	M block						35		88						
10	N block						0								
Total		**38**	**15**	**5**	**6**	**480**	**594**	**120**	**249**	**20**	**1417**	**19**	**13**	**160**	**61**

6.3 Lux Measurement

Description	Lux	Remark
Class Rooms	120 to 235	Acceptable
Offices	130 to 240	Acceptable
Corridors	35 to 90	Acceptable
Washrooms	45 to 76	Acceptable
Outdoor	36 to 95	Acceptable

Computer Lab	150 to 289	Acceptable
Parking area	45 to 94	Acceptable
Canteen	69 to 185	Acceptable

Observation

University have initiated LED based lighting solution, but still there are 1596 (36W) tube lights. LEDs save energy, the life span is much greater and emit virtually no heat. We recommend to replace the tube lights with LEDs.

We also recommend to use solar lights for open areas like parking, ground, street lights, etc. Table below shows the performance characteristics comparison of all luminaries.

Table - Luminous Performance Characteristics of Commonly Used Luminaries

Type of Lamp	Lumens/Watt		Colour Rendering Index	Typical Application	Typical Life
	Range	Avg.			
Incandescent	8-18	14	Excellent (100)	Homes, restaurants, general lighting emergency lighting	1000
Fluorescent lamps	46-60	50	Good w.r.t coating (67-77)	Offices, shops, hospitals, homes	5000
Compact fluorescent Lamps (CFL)	40-70	60	Very Good (85)	Hotels, shops, homes, offices	8000-10000
High pressure mercury (HPMV)	44-57	50	Fair (45)	General lighting in factories, garages, car parking. flood lighting	5000
Halogen lamps	18-24	22	Excellent (100)	Display, flood lightening, stadium exhibition grounds, construction areas	2000 - 4000
High pressure sodium (HPSV) SON	67-121	90	Fair (22)	General lighting in ware houses, factories, street lighting	6000 - 12000

Low pressure sodium (LPSV) SOX	101-175	150	Poor (10)	Roadways, tunnels, canals, street lighting	6000 - 12000
Metal halide lamps	75-125	100	Good (70)	Industrial bays, spot lighting, flood lighting, retail stores	8000
LED Lamps	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lights, etc.	40000 - 100000

7. OTHER POWER CONSUMPTION

82W Exhaust Fan	16
Water Cooler-200W	15

Sr. No.	Description	Unit	Pump No.-1	Pump No.-2	Pump No.-3	Pump No.-4	Pump No.-5
			KSB 4 hp 25 stage	BS 5 hp 5 stage	crompton5 hp 1stage	KSB 4 hp 25 stage	crompton5 hp 1stage
1	Rated Power of Motor	KW	3	3.73	3.73	3	3.73
2	Motor Eff.	%	65	50	50	50	65
3	Discharge Head	m	78-148	180-640	180-520	78-148	50-180
4	Suction Head	m	Flooded	Flooded	Flooded	Flooded	Flooded
5	Pump Type	Type	Submersible	Submersible	Monoblock	Submersible	Monoblock

S No.	Location	Desktop	LAB DESKTOPS	Laptop	Printers	Scanners
1	I Block	12	67	14	11	0
2	J Block	6	40	8	11	0
3	k Block	10	156	1	8	0
4	L Block	9	120	15	8	0
5	H Block	24	0	19	26	0
6	G Block	4	0	4	5	0
7	M Block	5	0	1	1	0
8	N Block	2	20	0	0	0

ANALYSIS

There should be regular maintenance schedule of equipment like geyser, water coolers, pumps, etc. University should use solar water heater instead of electric geysers. Solar geysers are convenient to use and cost effective as well as environment friendly. Electronics such as computers, printers, scanners, etc. more than 3 year or 5 years (as per their life) should be replaced with new computers/laptops.

8. CAPACITOR BANK

Sl. No.	Identification	Capacity in KVAR
1	Main LT Panel 2 Room	200
2	Main LT Panel 2 Room	200

***** **END OF THE REPORT** ******