MAHARISHI MARKANDESHWAR (DEEMED TO BE UNIVERSITY), MULLANA, AMBALA HARYANA

ENERGY AUDIT REPORT

Prepared by:

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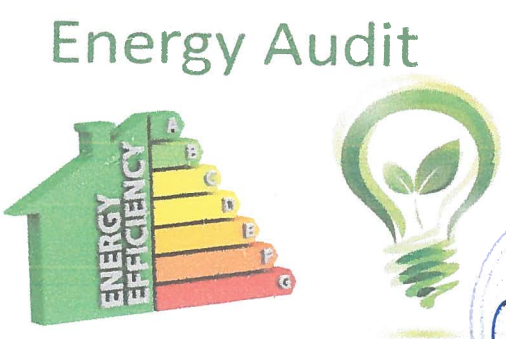


ENERGY AUDIT

MM(DU) conducted a Pre-Energy Audit of its campus and facilities in 2019. In order to optimize the power consumption in the whole MM(DU) campus, the internal energy audit was conducted. The instructions given by the audit team are implemented. The institution is also utilizing renewable energy by installing street solar lights in the campus.

The present audit is a Pre-audit to collect the details required for external auditing and Pre-audit activities. The pre-audit activities include the following.

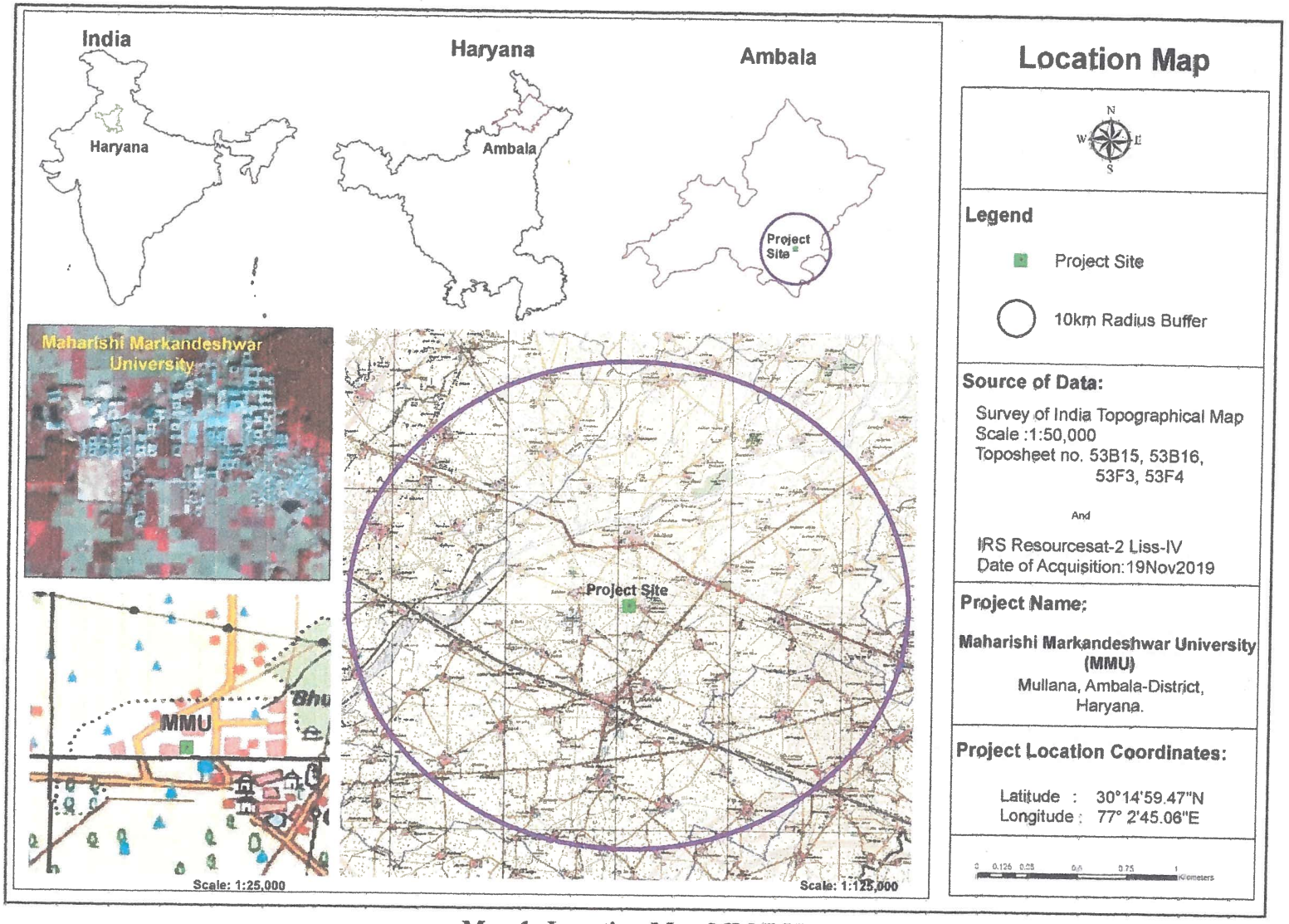
1. The institute area/division that are to be audited, need to be determined and selected.
2. The auditee was informed of the date of the audit enabled them to adjust and become a part to the concept.
3. The audit plan was designed in such a way that it accommodated changes based on information gathered during the audit and effective use of energy.
4. Energy Audit Committee and assignment of responsibility were established.
5. The chosen working papers were collected. This facilitated the auditor's investigations on the sites.
6. The background information on the facility including the facility' organization, layout and processes, and the relevant regulations and standards, were collected.

ONSITE AUDIT ACTIVITIES:

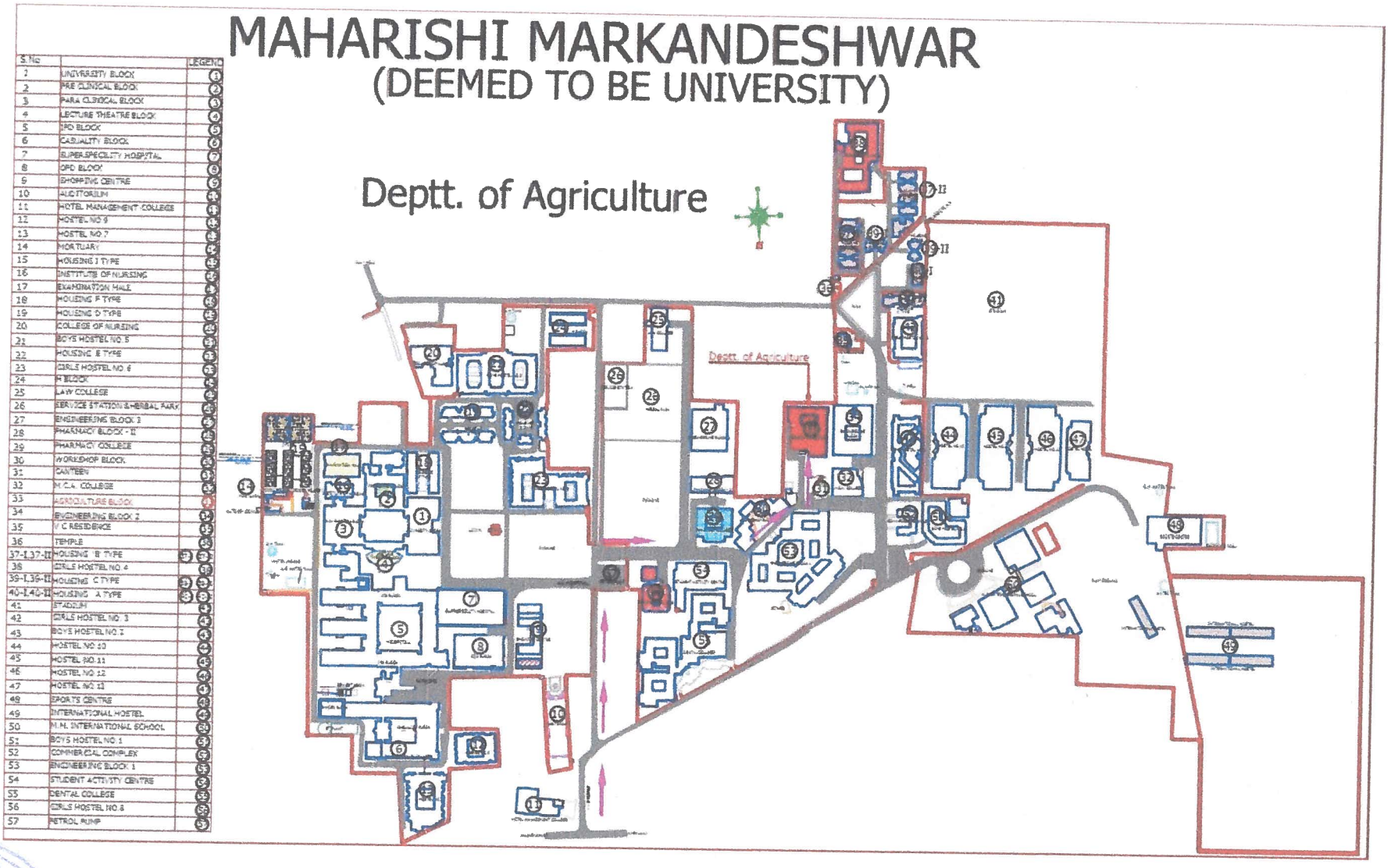
The onsite audit includes

1. The opening meeting is the first step between the Energy Audit team and Estate Department. In this meeting the purpose of audit, the procedure and the time schedule were discussed.
2. Site inspection is the second step for onsite activity. In this step the audit team discovered matters which are important to the audit, but which were not identified at the planning stage.
3. Onsite phase of the audit developed a working understanding of how the facility manages the activities that influence the working environment.
4. If there is one works assessed strengths and weaknesses of the auditee's management controls and risks associated with their failure were established.

5. Gathering audit evidence i.e. collecting data and information.
6. Communicated with the staff of the auditee to obtain most information.
7. Evaluate the audit evidence against the objectives established for the audit.

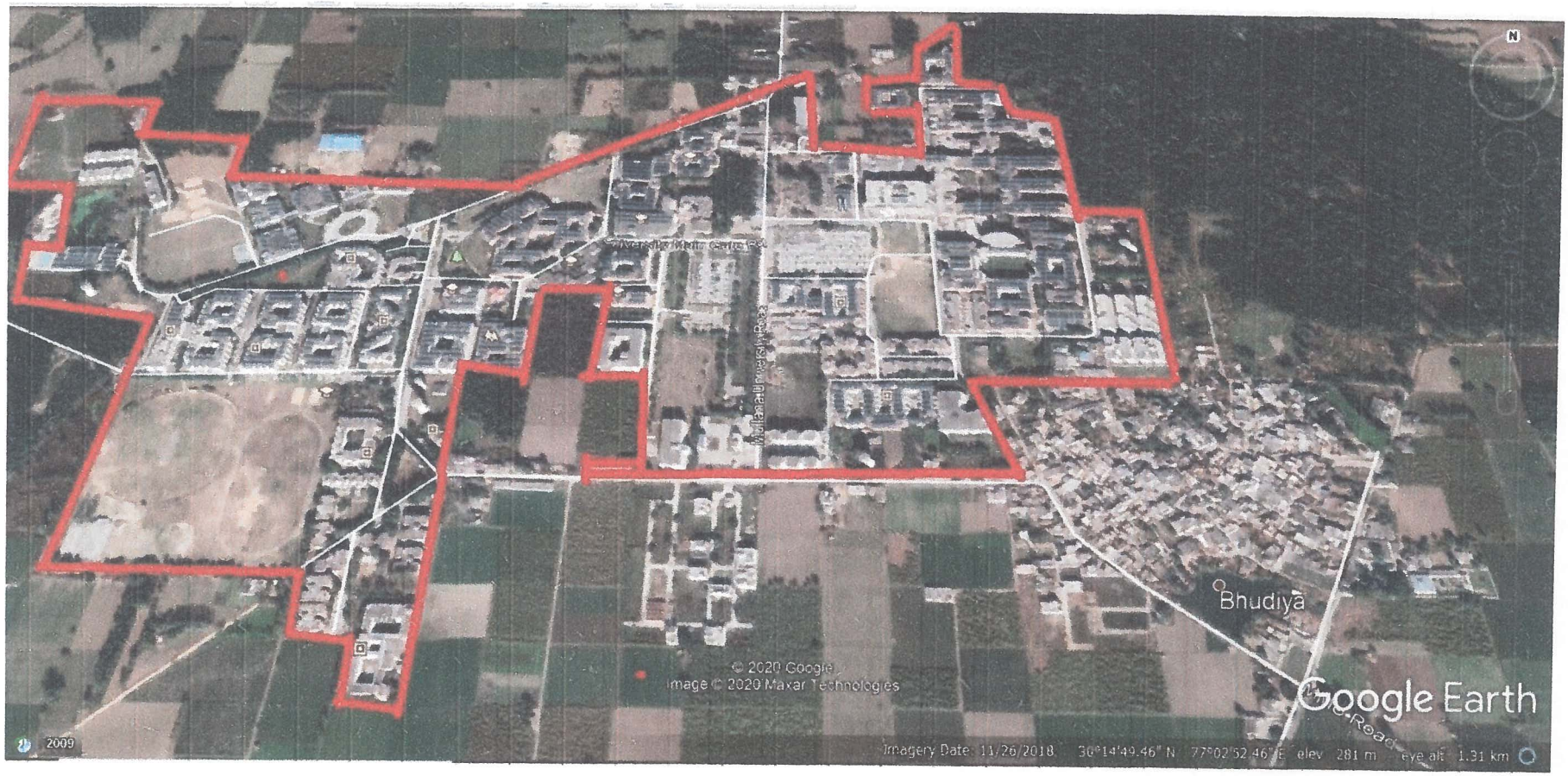


Map 1: Location Map MM(DU)



S.No		LEGEND
1	UNIVERSITY BLOCK	1
2	PRE CLINICAL BLOCK	2
3	PARA CLINICAL BLOCK	3
4	LECTURE THEATRE BLOCK	4
5	OPD BLOCK	5
6	CASUALITY BLOCK	6
7	SUPER SPECILITY HOSPITAL	7
8	OPD BLOCK	8
9	SHOPPING CENTRE	9
10	AUDITORIUM	10
11	HOTEL MANAGEMENT COLLEGE	11
12	HOSTEL NO 6	12
13	HOSTEL NO 7	13
14	MORTUARY	14
15	HOUSING I TYPE	15
16	INSTITUTE OF NURSING	16
17	EXAMINATION HALL	17
18	HOUSING F TYPE	18
19	HOUSING D TYPE	19
20	COLLEGE OF NURSING	20
21	BOYS HOSTEL NO 5	21
22	HOUSING E TYPE	22
23	GIRLS HOSTEL NO 6	23
24	H BLOCK	24
25	LAW COLLEGE	25
26	SERVICE STATION & HERBAL FARM	26
27	ENGINEERING BLOCK 3	27
28	PHARMACY BLOCK - II	28
29	PHARMACY COLLEGE	29
30	WORKSHOP BLOCK	30
31	CANTEEN	31
32	M.C.A. COLLEGE	32
33	AGRICULTURE BLOCK	33
34	ENGINEERING BLOCK 2	34
35	V.C RESIDENCE	35
36	TEMPLE	36
37-I,37-II	HOUSING B TYPE	37
38	GIRLS HOSTEL NO 4	38
39-I,39-II	HOUSING C TYPE	39
40-I,40-II	HOUSING A TYPE	40
41	STADIUM	41
42	GIRLS HOSTEL NO 3	42
43	BOYS HOSTEL NO 2	43
44	HOSTEL NO 10	44
45	HOSTEL NO 11	45
46	HOSTEL NO 12	46
47	HOSTEL NO 13	47
48	SPORTS CENTRE	48
49	INTERNATIONAL HOSTEL	49
50	M.M. INTERNATIONAL SCHOOL	50
51	BOYS HOSTEL NO 1	51
52	COMMERCIAL COMPLEX	52
53	ENGINEERING BLOCK 1	53
54	STUDENT ACTIVITY CENTRE	54
55	DENTAL COLLEGE	55
56	GIRLS HOSTEL NO 8	56
57	PETROL PUMP	57

Map 2: Layout map of MM(DU)



Map 3: Google Image Map of MM(DU), Mullana

PROCEDURE FOLLOWED:

One team was formed consisting of three members under the guidance of Mrs. Daksha Gupta, to analysis of energy consumption and costs.

Based on our assessment, the different sources of carbon-dioxide emitted from our campus are:

1. 16 DG sets
2. Electric Motors
3. Refrigerators
4. Air conditioners
5. RO water Plants

I. There are 450 refrigerators, 400 No. of air conditioners in the MM(DU) campus. The students, teaching and non-teaching staff and the visitors also contribute to carbon-dioxide emission.

It is suggested use five-star rating Refrigerator and Air-Condition, this will help to increase to the efficiency of equipment and save energy.

Similarly, it is also suggested to use energy efficient motor instead of conventional motor which can increase the efficiency by 4 to 6%.

II. Analysis of Energy consumption and costs the college is well equipped with electricity supply. Each department along with hospital possess computers, printers, fans, plug points, tube lights, bulbs etc. As part of "Green Campus" initiation, MM(DU) has shifted from conventional energy to solar energy, to reduce electricity bill and increase the usage of solar energy, installed as Roof Top Solar Plant with capacity of 3850 KW has been installed in university.

TABLE 1: LIST OF EQUIPMENT

S.NO	EQUIPMENT'S	NUMBERS
1.	Spectrophotometer	10
2.	Horizontal and vertical electrophoresis	8
3.	A distillation unit	12
4.	Digital calorimeter	20
5.	Autoclaves	20
6.	An exhaust fan	350
7.	A laminar air flow	20
8.	A hot plate	50
9.	An incubator	30

10.	A table fan	20
11.	A hot air oven	35
12.	Centrifuges	25
13.	Telephones	350
14.	LCD Projectors	250
15.	Hand mikes	250

Initiatives taken by the University for Energy Conservation:

The following measures are undertaken by the Construction & Maintenance Department for the conservation of energy.

- Copper chokes in tube lights are converted to electronic chokes which consumes less energy.
- All the rooms of the campus are equipped with CFL/LED.
- All Incandescent light bulbs and high consumption tube lights are replaced with LEDs and CFLs.
- About 4207 no. of LED Tube lights and CFL bulbs are used in place of ordinary bulbs in all buildings in the campus. Use of Compact florescent light (CFL) generate less heat and reduce carbon emission (maximum of 25-35% power).
- Tripping system is used in case of short circuiting, overloading, and circuit break of.
- New Air conditioners with Three Star & Five Star rating in power saving fitted in the campus. Approx. 300 air conditioners are functioning in campus.
- Sensors for switching on / off motor pumps are installed.
- Replacement of resistance regulator with electronic regulator.
- Replacement of CRT monitors with LCD/TFT monitors fitted with Computers.
- Replacement of DOT matrix printers with Desk Jet/Laser printers.
- Electric vehicles are used for internal transportation within the campus.
- Common switch for all electronic equipment is installed in each classroom to cut the power of the class when not in use.
- Central heating and cooling system are installed in the campus.
- Implementation of energy saving techniques is ensured i.e. Lights and fans are switched off by floor peons and staff after completion of work in that area.
- All rooms are provided with large windows to ensure appropriate natural light and ventilation so that the use of electricity can be minimized.

- The major materials used for construction of the building is steel, cement, bricks, metal, flooring tiles/stones, sanitary and hardware items, electrical fittings, water etc. The building materials with low-embodied energy and which are locally available is used in construction.
- Day to Day behavior is taken care to conserve energy.
- Using energy efficient DG sets run by HSD having capacity of 500 KVA (2 Nos.), 250 KVA (3 Nos.), 125 KVA (2 Nos.), 62 KVA (2 Nos.) and 300 KVA, 35 KVA installed as standby for electricity supply to minimize air pollution.

This shows the institution's commitment towards energy conservation.

TABLE 2: DG SETs USED

S. No.	Particular	KVA
1.	Oxygen Plant	500+200+200
2.	Mortuary	320
3.	L.T plant AC	200
4.	Hostel no-6	200+200
5.	SSB	1000+500+200
6.	MBA	500+320
7.	Temple	320
8.	Hostel no- 13	320
9.	Hostel no- 13	200
10.	PG Hostel- 15	35
11.	School	200

List of electrical appliances used in the campus on regular basis are as follows:

TABLE 3: LIST OF ELECTRICAL APPLIANCES

S.No.	EQUIPMENT NAME	QUANTITY
1	Lift	23
2	RO	15000 l/hr
3	UPS 10 KVA	13
	UPS 6 KVA	28
	UPS 5 KVA	40
	UPS 20 KVA	2
	UPS 30 KVA	4
	UPS 60 KVA	2

	UPS 80 KVA	4
	UPS 120 KVA	2
	UPS 160 KVA	2
	UPS 200 KVA	2
4	Photocopy	21
5	LCD Projector	135
6	Hot Water Generator	24
7	Washing Machine 30&15Kg	10
8	Laundry Dryer 30 &15 Kg	6
	Refrigerator (-4 degree)	6
	Refrigerator (-40 degree)	6
	Deep Refrigerator	8
10	Air Conditioner	300

DG Sets

CFL's & LED's

Large windows

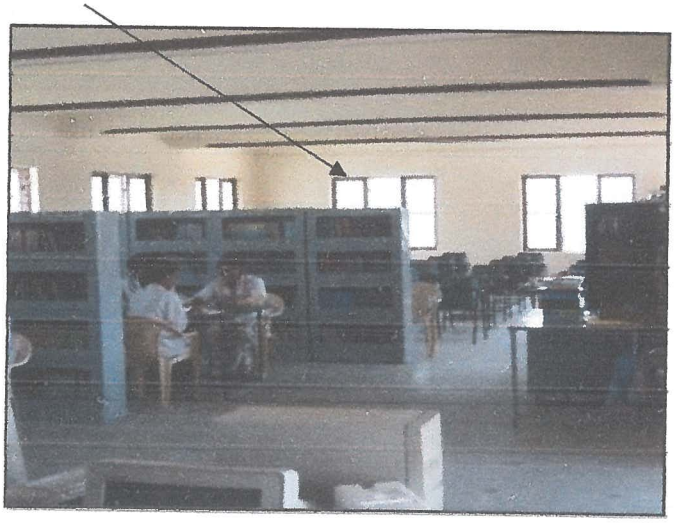


FIGURE 1: DG SETS , CFL's & LED's and LARGE WINDOWS

USE OF RENEWABLE ENERGY

Adoption of solar energy under renewable energy is the best course of action in the existing circumstances. Solar technologies are broadly characterized as passive or active solar technologies depending on the way these equipment's capture, convert and distribute solar energy.

- Solar Panels having Photo voltaic cells are installed on roof tops of buildings in the campus for generation of 3850 KW of electricity, which is being utilized in the campus.
- Solar water heating system are installed for use of hot water in the campus.
- This initiative helped to reduce the carbon emission.

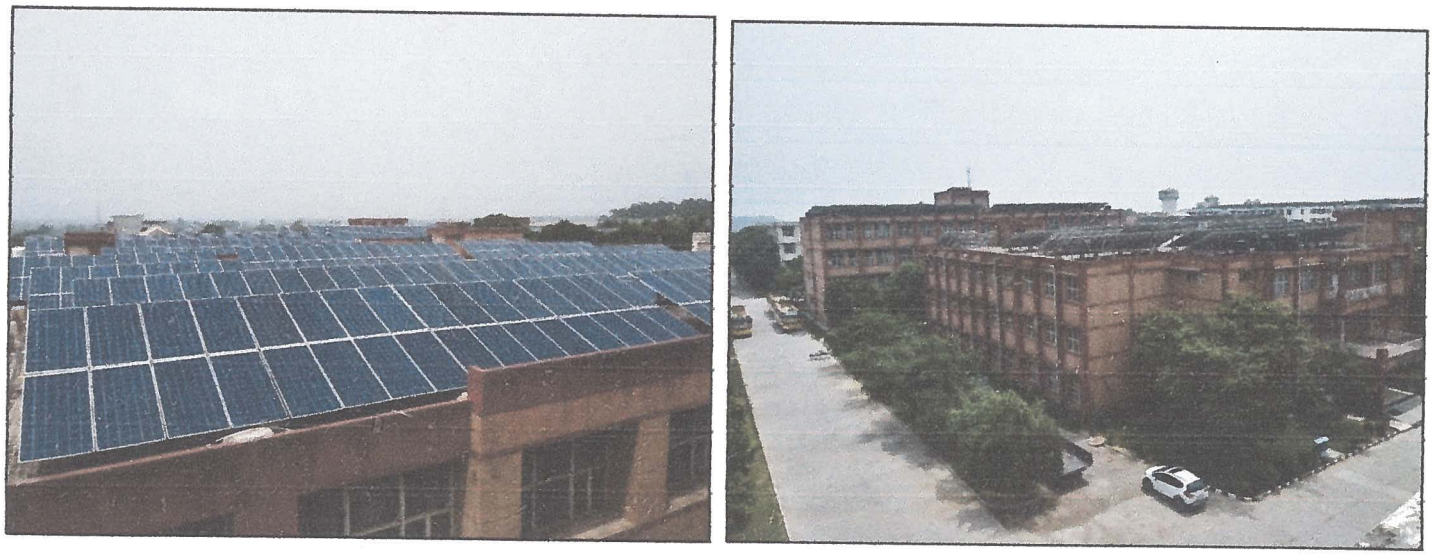


FIGURE 2: SOLAR PANELS

EFFORTS FOR CARBON NEUTRALITY

The Carbon Neutrality or having a net zero carbon footprint refers to achieving net zero carbon emissions by balancing carbon released with an equivalent sequestered or offset method.

Carbon offsetting initiatives:

1. **Reducing the use of electrical energy:**
   - Solar water heaters are widely used in hostels for supplying hot water.
   - Photo voltaic cells/ solar panel are used for electricity generation.
2. **Reducing the use of stationery**

- Communication to the faculty through conventional paper circulars has been almost replaced with the use of e-mail service or text message.
- Whole campus has the Wi-Fi accessibility.
- Admission to the campus through on-line portal is initiated.

It can be seen that average electricity consumption in the last 7 months is 394594 kWh.

TABLE 4: REDUCTION IN CARBON EMISSION ADOPTING LED

	Incandescent	**LED**
Power Consumption (Watt)	40	15
KWh (units of electricity used each Hour)	0.04	0.015
Hours of Operation per day	10	10
Number of light usage day in year	8*30= 240 days	8*30= 240 days
Carbon Emissions (tons) per year per lamp	0.008256	0.003096
Reduction in Carbon Emission (tons) per year/ lamp		0.00516
Total Number of Lamps Replaced Till Now	2500	2500
Reduction in Carbon Emission (tons) per year		12.9

TABLE 5: REDUCTION IN CARBON EMISSION ADOPTING CFL

	Flood Lights	**CFL**
Power Consumption (Watt)	1000	50
KWh (units of electricity used each Hour)	1	0.05
Hours of Operation per day	10	10
Number of light usage day in year	8*30= 240 days	8*30= 240 days
Carbon Emissions (tons) per year per light	0.2064	0.0214
Reduction in Carbon Emission (tons) per year/ light		0.185
Total Number of Flood Lights Replaced Till Now	1707	1707
Reduction in Carbon Emission (tons) per year		315.79

TABLE 6: REDUCTION IN CARBON EMISSION ADOPTING LIGHT LOAD FANS

	Heavy Load Fans	Light Load Fans
Power Consumption (Watt)	90	60
KWh (units of electricity used each Hour)	0.09	0.06
Hours of Operation per day	10	10
Number of fans usage day in year	6*30= 180 days	6*30=180 days
Carbon Emissions (tons) per year per light	0.013932	0.009288
Reduction in Carbon Emission (tons) per year/ lamp		0.004644
Total Number of fans replaced Till Now (approx)	3081	3081
Reduction in Carbon Emission (tons) per year		14.30

Total of CO_2 emissions reduction = 12.9+315.79+14.30 ≈ **342.99343 tons per year**

Observations:

1. By adopting LED, CFL and light load fans the total CO_2 emissions reduction was estimated as 342.99343 tons/year.
2. Energy consumption is yet another component that is to be taken from the solar panel system. (3850 KW).