GOVT. HOLKAR (MODEL AUTONOMOUS) SCIENCE COLLEGE, INDORE

(An ISO 9001:2015 & ISO 14001:2015 Certified Instituion)

SSR DOCUMENT

2017-18 TO 2021-22

CRITERION –7

Institutional Values and Social Responsibilities

Metric No. :7.1.6

Document Title:

Policy Document on environment and energy usage Certificate from the auditing Agency

SURESH T SILAWAT

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Energy Audit

9.0 ENERGY AUDIT

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Also, it can be said as "the strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total costs producing the output from these systems". The energy audit is key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility. The present policy of Government of India is to achieve Net Zero. All out efforts have been planned. Holkar Science College has done a lot towards green renewable energy. Mostly the campus is harvesting Solar energy. As discussed with the eminent professors, it was informed that sooner they are planning to harvest energy from wind energy also. Holkar Science College is committed to achieve the goal of becoming net zero policy.

9.1 Resource of Energy Audit

Energy resources utilized by all the departments, support services, and the administrative buildings of Holkar Science College, include Electricity, Solar Roof Top Systems, and Diesel Generators installed on the campus.

9.1.1 Energy Audit Objective:

The main energy audit objective to reduce power consumption and save revenue of college. The objective of audit to maximizing saving energy and using best technology to save energy.

9.1.2 Primary

- The first objective is to acquire, analyze data and find the necessary consumption pattern of the whole campus area.
- The second objective will be to calculate the wastage of energy pattern based on the results of the first objective.
- The final objective is to find and implement solutions that are acceptable and feasible in the most economical way.

9.1.3 Secondary

9.1.3.1 This would be the first exposure of college to this field hence experience gain would be vital (College themselves be able to identify the energy distribution).

9.1.3.2 This project will follow many follow up projects and hence helps to gain technical and management exposure required for future energy projects.

9.1.3.3 This will surely help create vital reduction hence will develop in overall achievement.

9.2 Source of Energy

As per last Energy audit report of 2021-2022 college total connected load was 333 kW and total sanctioned load was 145.57kW load.

9.3 Indirect Benefits of Energy Audit

Every time the Energy Audit is carried out it, there shall be analysis of Energy Conservation is an important function. Energy Auditors sharing their experience and knowledge with the Plant Personnel helps in fueling the innovative ideas for further action of reduction in Specific Power consumption (SPC). Any loose connections or heating of cables come to timely vision. For a next unbiased vision, a few points for Energy Conservation may be visible each time when perform the audit and this would help in achieving further saving. Inform any irregularities in Energy meter HT connections for rectification.

Till Last Audit Consumption was as below:

9.4 Details of Connected Load (kW) Till last year Audit

Sr. No.	Connected Load	Load in kW
1	Indoor Lighting Load	64.66
2	Outdoor Lighting Load	3.1
3	Ceiling Fan, Exhuast Fan, Wall Fan Load	74.88
4	Air Conditioning Load	31
	Pumping System	11.623
5	Printer, PC, Water Cooler, Refrigerator & Other lab equipments	148.03
	Total Connected Load in kW	333

9.5 The Audit conducted on 15th & 16th December 2022 showed following changes

Table 1: Different type of lighting fixture

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
1	Chemistry Department	Dr.Anamika Jain	2	36	1	72
			1	40	2	80
		Back Cabin	1	36	1	36
		Computer Cabin	2	36	1	72
			1	40	1	40
		Tea Room	3	36	1	108
		Rest Room	1	36	1	36
		Faculty Room 01	1	36	1	36
			5	40	1	200
		Faculty Room 02	3	36	1	108
			3	40	1	120
		Lab Ass. Cabin	1	40	1	40

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Chemistry Lab 01	18	36	1	648
			4	40	1	160
		Chemistry Lab 02	4	36	1	144
			8	40	1	320
		Chemistry Lab 03	10	36	1	360
			16	40	1	640
			3	15	1	45
			1	24	1	24
		Chemistry Lab 04	29	40	1	1160
2	Department of Seed & Horticulture	Dr.Kislaya Pancholi	2	36	1	72
		Class Room	6	36	1	216
			2	9	1	18
			2	18	1	36
			1	85	1	85
		Dept.of Horticulture.	2	36	1	72
		Staff Cabin 01	2	36	1	72
			1	85	1	85
		Staff Cabin 02	2	36	1	72
3	Department of Physics	Dr.G.D.Gupta Cabin	3	28	2	168
		Solar Energy Building.	10	28	1	280
			6	28	2	336
		Bathroom	4	28	1	112
		Account Office	3	36	1	108
			1	40	1	40
		Computer Lab	3	36	1	108
		Staff Room	1	18	1	18
			3	36	1	108
			5	40	1	200
		B.Sc. 1st Year				0
		Room No-01	12	36	1	432
		Room No-02	10	36	1	360
			1	18	1	18
		B.Sc. 2nd Year Lab	9	36	1	324
			5	40	1	200
			4	18	1	72
		M.Sc. 1st Year Lab	2	36	1	72
			7	18	1	126
			1	40	1	40
		M.Sc. Finel Year	9	36	1	324
		Seminar Hall	4	36	1	144

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
			2	40	1	80
		Gallery	2	36	1	72
		lab1 new block	28	20		
		lab2	28	20		
		lab3	28	20		
		lab4	28	20		
		lab5	28	20		
		lab6	28	20		
		Varandah	21	20	1	40
4	Department of Bioinformatics	Hall	4	36	1	144
			2	40	1	80
		Computer Lab	4	36	1	144
			1	40	1	40
5	Department of Statistics	Prof.M.Chaurang	6	36	1	216
		Staff Room	1	36	1	36
			3	40	1	120
			1	9	1	9
		Computer Lab	2	36	1	72
		Lab	5	36	1	180
			7	40	1	280
			3	18	1	54
		Gallery & Store	2	36	1	72
			9	40	1	360
6	Clinic	Hall	1	36	1	36
			2	12	1	24
			2	200	1	400
7	PWD Building	Office	4	9	1	36
			2	5	1	10
		Staff Room	2	15	1	30
			4	9	1	36
8	IGNOU	Staff Room	2	36	1	72
			3	40	1	120
			6	9	1	54
			4	12	1	48
9	Hostel	Office + Staff Room+ Canteen	1	18	1	18
			2	15	1	30
			2	12	1	24
		Ground Floor	12	9	1	108
			22	12	1	264

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
			4	12	1	48
			3	100	1	300
		First Floor	28	9	1	252
			14	12	1	168
			3	14	1	42
		Bath Room	4	18	1	72
10	Canteen		1	9	1	9
		Room	1	36	1	36
11	Department Of Botany	HOD Cabin	1	9	1	9
			1	36	1	36
		M.Sc. Lab	84	28	1	2352
			9	40	1	360
			2	85	1	170
		B.Sc. Lab	12	36	1	432
			2	40	1	80
			9	18	1	162
		Staff Room	6	40	1	240
		Store	4	40	1	160
12	Mathematics Wing	Room No.1	1	36	1	36
			3	40	1	120
		Store Room	1	85	1	85
			4	40	1	160
		Class Room 10	6	40	1	240
			3	9	1	27
			1	48	1	48
		Forensic Class	2	85	1	170
			1	40	1	40
			4	18	1	72
		Lab 1	3	40	1	120
			2	9	1	18
			1	85	1	85
		Lab Staff Room	1	9	1	9
		Lab2	1	40	1	40
13			2	18	1	36
			2	9	1	18

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Class Room 6	1	36	1	36
			1	85	1	85
		English Lab	3	40	1	120
			3	9	1	27
		Crime Science Lab	5	40	1	200
			2	18	1	36
		Ladies Room	2	40	1	80
			1	85	1	85
			2	9	1	18
		Pharmaceuticals Che.	4	40	1	160
		Class Room 3	4	36	1	144
			6	40	1	240
		Dept. of Hindi	1	85	1	85
			1	48	1	48
		Class Room 1	2	40	1	80
			2	36	1	72
			2	85	1	170
		Class Room 2	3	40	1	120
			1	85	1	85
			2	9	1	18
		Lab	7	40	1	280
			2	18	1	36
		HOD Cabin	2	9	1	18
		Class Room4	9	40	1	360
			1	85	1	85
			1	48	1	48
			1	36	1	36
		Class Room 5	7	40	1	280
			1	36	1	36
		Corridor	1	40	1	40
			2	36	1	72
			1	18	1	18
13	Block Building	Room No1	10	36	1	360
			1	18	1	18
			1	9	1	9
		Room No2	5	36	1	180
			2	18	1	36
			1	85	1	85
		Gents Toilet	1	36	1	36
		Room No3	3	36	1	108
			4	18	1	72

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Room No4	1	40	1	40
			6	36	1	216
			2	18	1	36
			2	65	1	130
		Room No5	2	40	1	80
			5	36	1	180
			3	18	1	54
		Girls Toilet	2	36	1	72
		Room No 6	4	36	1	144
			2	18	1	36
			2	65	1	130
		Room No7	8	40	1	320
			2	65	1	130
		Room No8	1	40	1	40
			8	36	1	288
			2	65	1	130
		Room No9	10	36	1	360
		Room No10	7	36	1	252
			3		1	54
		Waiting Room	10	36	1	360
		Staff Room	4	36	1	144
		Toilet	1	100	1	100
		HOD Cabin (English}	4	40	1	160
			1	70	1	70
		Kitchen	1	36	1	36
		Corridor	11	40	1	440
			7	9	1	63
		NCC	3	36	1	108
		Staff Room	6	18	1	108
		Class Room	4	18	1	72
		Room No11	8	36	1	288
		Room No12	12	36	1	432
		Room No13	12	36	1	432
		Ladies Toilet	2	36	1	72
		Room No14	12	18	1	216
		Room No15	12	18	1	216
		Room No16	8	18	1	144
		Room No17	12	18	1	216
		Room No18	12	18	1	216
		Room No19	12	18	1	216
		Room No20	8	18	1	144
		Room No 21	12	36	1	432

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Room No 22	12	36	1	432
		Toilet	2	36	1	72
		Room N1	13	40	80	720
		Room N2	13	40	80	720
		Room N3	13	40	80	720
		Room N4	13	40	80	720
		Room N5	13	40	80	720
		Room N6	13	40	80	720
		Staff Room	13	40	80	720
		Corridor	19	36	1	684
			10	18	1	180
14	Exam Controller Building	Control Room	1	18	1	18
		A/C Station	1	36	1	36
			1	65	1	65
		Semester Cell	2	65	1	130
		IT Cell	1	65	1	65
			4	36	1	144
			8	48	1	384
		Controller of Examination	1	36	1	36
			4	40	1	160
			1	40	1	40
		Computer Room	1	18	1	18
			1	36	1	36
		Recording Room	1	65	1	65
			1	100	1	100
		Toilet	1	40	1	40
			1	36	1	36
		Store Room	1	65	1	65
15	Department of Biotechnology	HOD Cabin	2	40	1	80
			1	36	1	36
		Corridor	10	40	1	400
			13	40	1	520
		Lab 1	3	36	1	108
		PTC Lab	1	40	1	40
		Lab-2	12	40	1	480
		Computer Lab	3	36	1	108
		Store Room	3	40	1	120
			1	85	1	85
		Staff Room	2	40	1	80

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
16	Department of Zoology	HOD Cabin	3	36	1	108
			1	65	1	65
		Staff Room	4	40	1	160
			2	9	1	18
		lab-1	27	40	1	1080
			3	9	1	27
		Office Staff	1	40	1	40
			1	85	1	85
		Toilet	2	100	1	200
		Corridor	1	85	1	85
17	Department of Biochemistry	HOD Cabin	2	18	1	36
		Research Lab	10	18	1	180
		New Room	8	40	0	0
		Kitchen	1	40	1	40
		Office	2	18	1	36
		BSc Lab	7	36	1	252
		MSc Lab	8	20	1	160
		Toilet	1	40	1	40
			1	36	1	36
		Corridor	12	20	1	240
			12	40	1	480
18	Department of Mathematics	HOD Cabin	2	40	1	80
			1	36	1	36
		Office	2	40	1	80
		Associate NCC Cabin	3	36	1	108
		Kitchen	1	40	1	40
		Corridor	3	36	1	108
		Staff Room	4	40	1	160
		Class Room 15	2	36	1	72
			1	40	1	40
			2	18	1	36
		Class Room 16	4	40	1	160
19	Department of Sport	HOD Cabin	2	36	1	72
			3	18	1	54
		Staff Room	1	40	1	40
		Electric Supply Room	2	40	1	80
		Placement Cell	1	40	1	40
			1	18	1	18
		Corridor	2	40	1	80

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
20	Yashwant Hall	Hall	40	40	1	1600
			30	36	1	1080
			5	15	1	75
			6	500	1	3000
			1	1000	1	1000
		Store Room	1	40	1	40
		Corridor	3	40	1	120
21	Department of Electronics	HOD cabin	6	40	1	240
			2	18	1	36
		Class Room	2	40	1	80
		Lab	7	40	1	280
22	Department of Geology	First Floor				
		MSc Class 1	1	18	1	18
		Class Room 2	2	40	1	80
			1	65	1	65
		Staff Room	3	40	1	120
			2	36	1	72
		Store Room	1	40	1	40
		Class Room	3	40	1	120
			3	36	1	108
		Faculty Room	1	18	1	18
		Ground Class Room	5	36	1	180
		Staff Room	2	36	1	72
		Museum	2	40	1	80
			3	36	1	108
		Room No-1	3	36	1	108
		Room No-2	3	36	1	108
		Room No-3	3	36	1	108
		Corridor	1	40	1	40
		Class Room 14	4	40	1	160
		Class Room 23	5	40	1	200
		Class Room 25	5	40	1	200
23	Library	Office	6	40	1	240
		Inside Study hall	49	40	1	1960
		Binding /Kitchen	1	40	1	40
		Study Hall	22	40	1	880
			3	50	1	150
			3	1000	1	3000
		E-Library	3	40	1	120
		Corridor	17	40	1	680

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Girls Toilet	2	40	1	80
		Boys Toilet	2	40	1	80
		first floor	25	40		
		Librarian	5	36	1	180
24	Admin Building	Office	3	18	1	54
			2	30	1	60
			1	85	1	85
		Account Section	1	30	1	30
			1	36	1	36
		Corridor	1	18	1	18
			1	9	1	9
		Data Store Room	2	30	1	60
		Scholarship Cabin	1	9	1	9
			2	85	1	170
			2	18	1	36
		Out Side Principal Cabin	4	40	1	160
			2	30	1	60
			1	9	1	9
		Principal Chamber	2	36	1	72
			6	18	1	108
			1	85	1	85
			1	200	1	200
		Kitchen	1	36	1	36
		Admis. Office	2	30	1	60
25	Department of Computer Science	Office	1	40	1	40
		Lab-1	2	40	1	80
			3	36	1	108
			2	18	1	36
			1	9	1	9
		Store Room	8	40	1	320
		Corridor	3	40	1	120
			3	36	1	108
		Lab-2	2	18	1	36
		E-Gallery	3	40	2	240
			11	36	1	396
			11	18	2	396
		Lab-4	2	18	1	36
			3	40	1	120
			9	36	1	324
		Store Room	4	40	1	160

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
			2	36	1	72
		MSc Room	6	40	1	240
		Staff Cafeteria	4	40	1	160
		Staff Room	2	40	1	80
		HOD Cabin	1	36	1	36
			3	40	1	120
			2	9	1	18
		Entrance	1	40	1	40
		Lab1	25	40	0	0
		Lab4	25	40	0	0
		Class1	23	40	0	0
		Class4	23	40	0	0
26	Dr.W.V.Bhagwat Lab	Front Lab	9	28	1	252
			2	18	1	36
			2	40	1	80
		Class Room	4	18	1	72
			3	36	1	108
			2	40	1	80
			2	85	1	170
		Store Room	2	40	1	80
		Gallery	2	40	1	80
		Conference Hall	5	18	1	90
			4	40	1	160
			21	40	2	1680
		Staff Room	1	18	1	18
27	Department of Microbiology	Flamming lab	3	40	1	120
		New Room	6	40	0	0
		Corridor	1	9	1	9
		Lobert Koch Lab	2	36	1	72
		Staff Room	2	36	1	72

Sr. No.	Location	Location of Fixture	No. of Lighting Fixture	Power (Watts)	No. of Lumanarie	Total Power (Watts)
		Louis Pasture Lab	2	85	1	170
		Gallery	2	40	1	80
			1	9	1	9
28	Fish Zone	Class Room	10	18	1	180
			3	9	1	27
		Out Side light	1	30	1	30

NOTE:

Note: Holkar Science College Authorities are committed, to convert all CFL light sin LED lights

9.6 Analysis of Energy data

9.6.1 Indoor Lightings:

Table 1: The Detail of Different Types of Indoor Lighting System

S. No.	Power in (Watt)	Recommended LED in Watts	No. of Lighting Fixture	Total Power Load Before Changing Lights (Watts Per Day)	Total Power After changing Lights (Watts) per hour	Load Diffrence in Watts per hour	Saving Watts in %	Per Year Charge Electricity in Rs.	Price of LED Bulb	Total Price of LED Bulb	Electricity Rate in Rs.	Per Year Charges of Electricity after Changing Light	Net Gain Annualy in Rs.
1	5	Same	2	10	10	0	0.00	221.88	0	0	8.56	221.88	0.00
2	9	Same	100	900	900	0	0.00	19968.77	0	0	8.56	19968.77	0.00
3	12	Same	48	576	576	0	0.00	12780.01	0	0	8.56	12780.01	0.00
4	14	Same	3	42	42	0	0.00	931.88	0	0	8.56	931.88	0.00
5	15	Same	12	180	180	0	0.00	3993.75	0	0	8.56	3993.75	0.00
6	18	15	230	4140	3450	690	16.67	91856.33	65	14950	8.56	76546.94	15309.39
7	20	15	349	6980	5235	1745	25.00	154868.89	65	22685	8.56	116151.67	38717.22
8	24	15	1	24	15	9	37.50	532.50	65	65	8.56	332.81	199.69
9	28	15	116	3248	1740	1508	46.43	72065.06	65	7540	8.56	38606.28	33458.78
10	30	15	10	300	150	150	50.00	6656.26	65	650	8.56	3328.13	3328.13
11	36	15	463	16668	6945	9723	58.33	369821.58	65	30095	8.56	154092.33	215729.26
12	40	15	978	39120	14670	24450	62.50	867975.78	65	63570	8.56	325490.92	542484.86
13	48	15	11	528	165	363	68.75	11715.01	65	715	8.56	3660.94	8054.07
14	50	Same	3	150	150	0	0.00	3328.13	0	0	8.56	3328.13	0.00
15	65	50	16	1040	800	240	23.08	23075.02	310	4960	8.56	17750.02	5325.00
16	70	50	1	70	50	20	28.57	1553.13	310	310	8.56	1109.38	443.75
17	85	50	27	2295	1350	945	41.18	50920.36	310	8370	8.56	29953.15	20967.21
18	100	50	7	700	350	350	50.00	15531.26	310	2170	8.56	7765.63	7765.63
19	200	100	3	600	300	300	50.00	13312.51	499	1497	8.56	6656.26	6656.26
20	500	200	6	3000	1200	1800	60.00	66562.56	499	2994	8.56	26625.02	39937.54
21	1000	200	4	4000	800	3200	80.00	88750.08	499	1996	8.56	17750.02	71000.06
			2390	**84571**	**39078**	**45493**	**53.79**	**1876420.75**	**Rs.**	**162567**		**867043.91**	**1009376.85**
												Cost of Purchase of Bulbs etc.	**162567.00**
												Purchase Cost Recovery Period in Months	**1.93**

9.6.2 *Outdoor Lightings*

Table 2: The Detail of Different Types of Outdoor Lighting System

S.No.	Power in (Watts)	Recommended LED in Watts	No. of Lighting Fixture	Total Power Load Before Changing Lights (Watts Per Day)	Total Power After changing Lights (Watts) per hour	Load Diffrence in Watts per hour	Saving in %	Per Year Charge Electricity in Rs.	Price of LED Bulb in Rs.	Total Price of LED Bulb in Rs.	Electricity Rate	Per Year Charges of Electricity after Changing Light	Net Gain Annualy in Rs.
1	12	12	1	12	12	0	0.00	443.75	0	0	8.56	266.25	177.50
2	18	15	6	108	90	18	16.67	3993.75	65	390	8.56	1996.88	1996.88
3	24	15	1	24	15	9	37.50	887.50	65	65	8.56	332.81	554.69
4	30	15	3	90	45	45	50.00	3328.13	65	195	8.56	998.44	2329.69
5	36	15	2	72	30	42	58.33	2662.50	65	130	8.56	665.63	1996.88
6	40	15	4	160	60	100	62.50	5916.67	65	260	8.56	1331.25	4585.42
7	50	50	1	50	50	0	0.00	1848.96	310	310	8.56	1109.38	739.58
8	85	50	22	1870	1100	770	41.18	69151.10	310	6820	8.56	24406.27	44744.83
9	500	100	1	500	100	400	80.00	18489.60	499	499	8.56	2218.75	16270.85
			41	**2886**	**1502**	**1384**	**47.96**	**106721.97**	**Rs.**	**8669**		**33325.66**	**73396.32**
Cost of Purchase of Bulbs etc.													**8669.00**
Purchase Cost Recovery Period in Months													**1.42**

9.6.3 *Fans:*

Table 3: The Detail of Different Types of FAN

S No.	Power (Watts)	Recommended BLDC FAN in Watts	Number of FAN	Total Power Load Before Changing BLDC FAN (Watts Per Day)	Total Power After changing BLDC FAN (Watts) per hour	Diffrence in Watts	Saving in %	Per Year Charge Electricity in Rs.	Price of BLDC FAN	Total Price of BLDC FAN	Electricity Rate	Per Year charges of Electricity after changing BLDC FAN	Net Gain Annualy in Rs.
1	45	45	60	2700	2700	0	0.00	59906.30	0	0	8.56	59906.30	0.00
2	50	50	50	2500	2500	0	0.00	55468.80	0	0	8.56	55468.80	0.00
3	55	55	4	220	220	0	0.00	4881.25	0	0	8.56	4881.25	0.00
4	60	60	289	17340	17340	0	0.00	384731.60	0	0	8.56	384731.60	0.00
5	75	75	6	450	450	0	0.00	9984.38	0	0	8.56	9984.38	0.00
6	80	80	1001	80080	80080	0	0.00	1776776.60	0	0	8.56	1776776.60	0.00
7	100	35	2	200	70	130	65.00	4437.50	3200	6400	8.56	1553.13	2884.38
8	120	35	19	2280	665	1615	70.83	50587.55	3200	60800	8.56	14754.70	35832.84
9	150	35	32	4800	1120	3680	76.67	106500.10	3200	102400	8.56	24850.02	81650.07
			1463	**110570**	**105145**	**5425**	**4.91**	**2453274.09**	**Rs.**	**169600**		**2332906.79**	**120367.30**
Cost of Purchase of BLDC FAN etc.													**169600.00**
Purchase Cost Recovery Period in Months													**16.91**

9.6.4 *Air Conditioners:*

Table 4: The Details of Different Type AC System													
S.No	Power Watts)	Recommended Star Inverter AC in Watts	Number of AC	Total Power Load Before Changing AC (Watts Per Day)	Total Power After Changing AC (Watts) per hour	Diffrence in Watts	Saving in %	Pay Per Year Charge Electricity in Rs.	Price of Hot & Cool Inverter AC	Total Price of AC (Hot & Cold Inverter AC)	Electricity Rate	Per Year Charges of Electricity after changing Inverter AC	Net Gain Annualy in Rs.
1	1425	1425	3	4275	4275	0	0.00	94851.65	0	0	8.56	94851.65	0.00
2	1450	1450	2	2900	2900	0	0.00	64343.81	0	0	8.56	64343.81	0.00
3	1452	1452	1	1452	1452	0	0.00	32216.28	0	0	8.56	32216.28	0.00
4	1556	1556	3	4668	4668	0	0.00	103571.34	0	0	8.56	103571.34	0.00
5	1650	1650	1	1650	1650	0	0.00	36609.41	0	0	8.56	36609.41	0.00
6	1850	1500	2	3700	3000	700	18.92	82093.82	42000	84000	8.56	66562.56	15531.26
7	1925	1925	10	19250	19250	0	0.00	427109.76	0	0	8.56	427109.76	0.00
8	1950	1500	4	7800	6000	1800	23.08	173062.66	42000	168000	8.56	133125.12	39937.54
9	2375	2375	4	9500	9500	0	0.00	210781.44	0	0	8.56	210781.44	0.00
			30	**55195**	**52695**	**2500**	**4.53**	**1224640.17**		**252000**		**1169171.37**	**55468.80**
										Cost of Purchase of AC, etc.			252000.00
										Purchase Cost Recovery Period in Months			54.52

- Out of 30 Air conditioners, total 24 Star Rated Air Conditioner provided at Holkar Science College. The college is in phase of changing old normal air conditioner with new star rated ACs as and when there is requirement. Remaining 6 are also in process of replacement

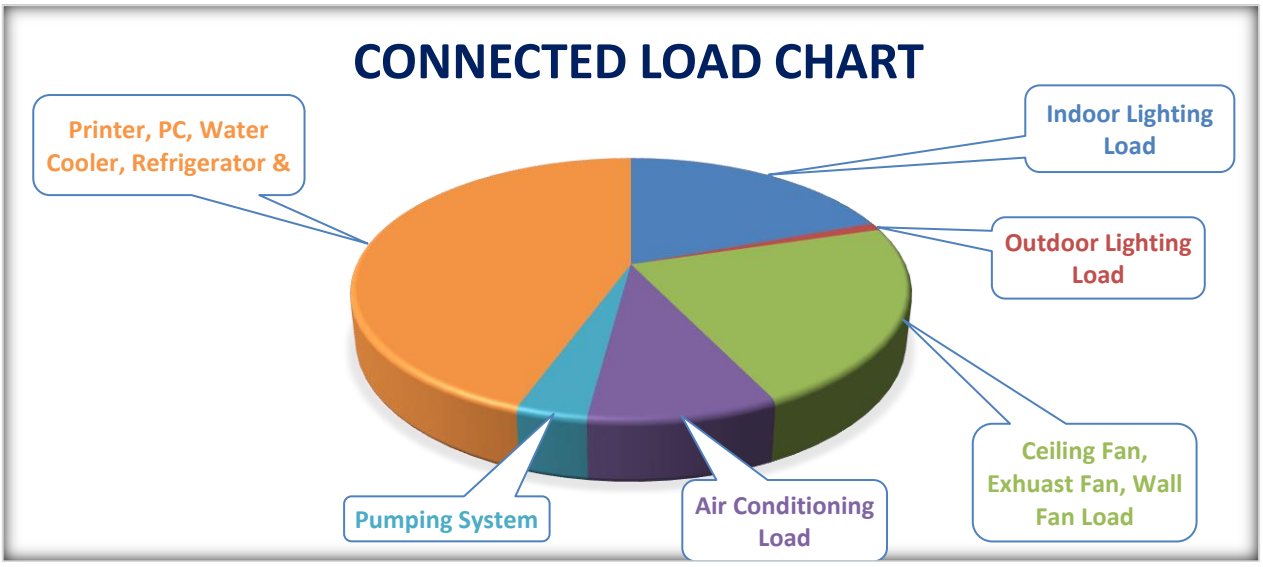
9.6.5 Submersibles:

Location of Water Motor	Power in HP	Power Consumed Per Hours (Kw)	Working Hours Per Day	Number of Pump	Total Power Consumed (kW Per Day)	Total Power Consumption (kW Per Year)	Electricity Rate in Rs.	Per Year Electricity Charges in Rs.
Botany Building	1	0.746	3	1	2.238	26.86	8.56	229.89
Chemistry Building	1.5	1.119	3	1	3.357	40.28	8.56	344.83
Academic Building	1.5	1.119	3	1	3.357	40.28	8.56	344.83
Main Office	1	0.746	3	1	2.238	26.86	8.56	229.89
Library	1.5	1.119	3	1	3.357	40.28	8.56	344.83
Front of Zoology Department	1.5	1.119	3	1	3.357	40.28	8.56	344.83
of Zoology Department	1	0.746	3	1	2.238	26.86	8.56	229.89
Hostel	2	1.492	4	1	5.968	71.62	8.56	613.03
Infront of 3 No. Gate	3	2.238	3	1	6.714	80.57	8.56	689.66
Infront of Baba Garden	1.5	1.119	3	1	3.357	40.28	8.56	344.83
Per Year Power Consumption in kW						**434.17**	**Total Rs.**	**3716.51**

9.6.6 Overall Analysis

Sr. No.	Connected Load	Load in kW 2021	Present Load kWh	Load after suggestion is implemented	Saving in Rupees
1	Indoor Lighting Load	64.66	69.70	45.49	605133.8
2	Outdoor Lighting Load	3.1	3.10	1.50	39992.32
3	Ceiling Fan, Exhuast Fan, Wall Fan Load	74.88	110.57	105.15	135474
4	Air Conditioning Load	31	55.20	44.94	256450.8
	Pumping System	11.623	11.62	11.62	0
5	Printer, PC, Water Cooler, Refrigerator & Other lab equipments	148.03	148.03	148.03	0
6	As per information provided 600 nos. of new computers have been purchased		120	120	0
Total Connected Load in kW		333	518.22	476.73	Rs 1037051

Thus, from the above table it is seen that if we only change the indoor lightings and outdoor lightings, we can save Rs 6,40,000 approx. Annually. The return of cost of expenditure is also less than 2 months.



As per the future policy, Holkar College is committed to convert all CFL into LED and they are already in a mode to purchase all electrical appliances star rated in future purchase. Hence forth all electrical appliances which are being purchased are all-star rated.

For Analysis of Energy audit of the last year audit we had made certain assumptions:

1. One month is of 30 days.
2. In one month, 24 days working and 6 leave.
3. On working days total 8 hours of working in which all lights are on.
4. On 6 holidays half of the lights are on.
5. Outdoor lightings 12 hours daily (6 PM to 6AM) for 365 days

9.7 Observation:

1. There is lot of scope of improvement at Holkar College in reduction of Energy.
2. If we only consider indoor **lights (bulbs & tubes)** and as per our recommendation if accepted:
   - Annual saving of **Rs. 6,05,133.80.**
   - If we purchase the fixture for lighting inside only will **cost Rs. 1,17,262.**
   - Hence the **purchase price return will be in 3 months.**

- Annual saving for the **first year will be Rs. 4,87,871.80**
- After that **annual recurring benefit of Rs. 6,05,133.80will be saved by college annually.**

3. If recommendation of replacing outdoor lightings is accepted by college authorities, then:
   - **Annual Saving is Rs. 39,992.32/-**
   - **Cost of purchase is Rs. 8,669/-**
   - **Cost of purchase recovery period is 2. Months**
   - **First year profit will of Rs. 31,323.32**
   - **After first year annual savings of Rs. 39,992.32/**

4. If recommendation regarding fans **100 watts & above (Total Fans 74 numbers of fans) to replace with BLDC fans is accepted by College administration,** then:
   - **Annual Savings Rs. 1,35,474/-**
   - **Cost of purchase of BLDC fans is Rs. 2,36,800/-**
   - **Return of cost of purchase is 22 months.**
   - **So after 2 years net Annual profit will be Rs. 2,36,800/-**
   - **This purchase can be split in 2 years as per administration's decision.**

5. Total No. Air Conditioner has been given as 30. But no data of blowers used during winter season has been provided. Out of total 30 Ac we suggest replacing 6 AC (with hot & cold facility). If our recommendation of replacement of 12 AC is accepted, then:
   - Annual saving will be Rs. **2,56,450.8**
   - Cost of purchase of Hot & cold AC is Rs. **2,52,000/-**
   - Return of cost of purchase is **11 months**
   - So first year profit will be Rs. NIL
   - Afterwards annual profit will be Rs. **2,56,450.00/-**
6. More solar plant for generation of renewable energy can be installed on various buildings.
7. Normal fans can be replaced by BLDC fans and cost of return is within leases then 2 years.
8. Street lights consuming huge energy can be replaced with normal LED light which are energy efficient as well as cost saving. Management can plan according to budget & sanctioning powers.
9. By estimating the quantity of water and time of operation of pump & motor, we could reduce the consumption of electricity as well.

9.7.1 Lighting system

Lighting is an essential service in all industries, Universities, Hospitals, Malls, etc. Innovation and continuous improvement in the field of lighting, have given rise to tremendous energy-saving opportunities in this area. Lighting is an area, which provides some major scope to achieve energy efficiency at the design stage, by incorporation of modern energy-efficient lamps, luminaries, and gears, apart from good operational practices.

Basic Terms in Lighting System and Features:

9.7.2 Lamps

Lamp is equipment, which produces light. The most used lamps are

Described briefly as follows:

9.7.3 Incandescent lamps

Incandescent lamps produce light by means of a filament heated to incandescence by the flow of electric current through it. The principal parts of an incandescent lamp, also known as GLS (General Lighting Service) lamp include the filament, the bulb, the filling, and the cap.

9.7.4 Reflector lamps

Reflector lamps are basically incandescent, provided with a high-quality internal mirror, which follows exactly the parabolic shape of the lamp. The reflector is resistant to corrosion, thus making the lamp maintenance free and output efficient.

9.7.5 Gas discharge lamps

The light from a gas discharge lamp is produced by the excitation of gas contained in either a tubular or elliptical outer bulb. The most used discharge lamps are as follows:

- Fluorescent tube lamps (FTL)
- Compact Fluorescent Lamps (CFL)
- Mercury Vapor Lamps
- Sodium Vapor Lamps
- Metal Halide Lamps

10 Energy Conservation and Renewable energy

10.1 Renewable Energy

Computer Science department of Holkar Science College was checked. This department is generating 5kW of solar energy. Total load of is 25 kW solar energy is being generated by the college through solar plant installed on the roof top. It also has capacity to transfer to the grid as per need and necessity. Further the college is in process of converting wind energy into next source of renewable energy which will also cater further need of the department. Several other departments are going to provide roof top solar panels

10.2 Renewable Energy (Solar) Analysis:

Details of Renewable Energy (Solar) at Holkar Science College, Indore					
Department Name	**Power Genrating in kW Per Hours**	**Solar Panel Power Genrating in kW Per Day**	**Solar Panel Power Genrating in kW Per Year**	**Electricity Rate in Rs.**	**Net Gain Annualy in Rs.**
New Exam Department	5	40	14600	8.56	124976
New Physics Lab	5	40	14600	8.56	124976
New Computer Block	5	40	14600	8.56	124976

Administrative Building	5	40	14600	8.56	124976
Academic Block	5	40	14600	8.56	124976
Total Power Generate in kW	**25**	**200**	**73000**	**624880**	**624880**

Holkar Science college, Indore has taken a big Leap by making 25kW solar energy & thus saving conventional energy by 73000 kW annually with annual saving of Rs. 6,24,880/- also.

10.3 Exemplary Reduce Power Consumption in Holkar Science College

During last 1-year Holkar College has achieved 25 kW of renewable Energy through solar power. This has reduced the electric consumption through power grid by 25 kW thus having a net saving of Rs. 6.24 Lakhs Annually. College administration is planning to install solar panel on other building also.

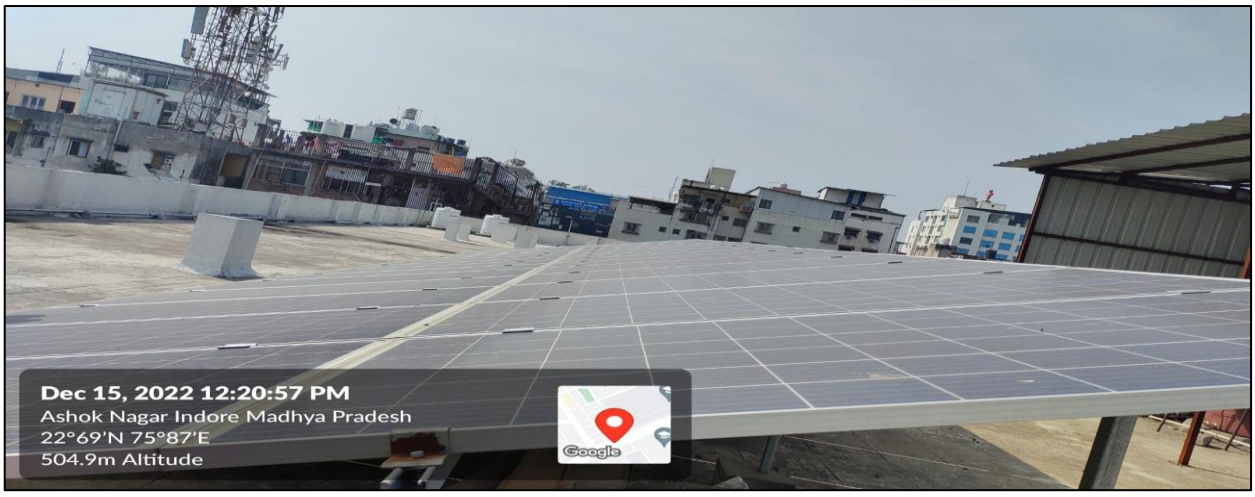


Figure1: Renewable Energy photograph of New Building Block

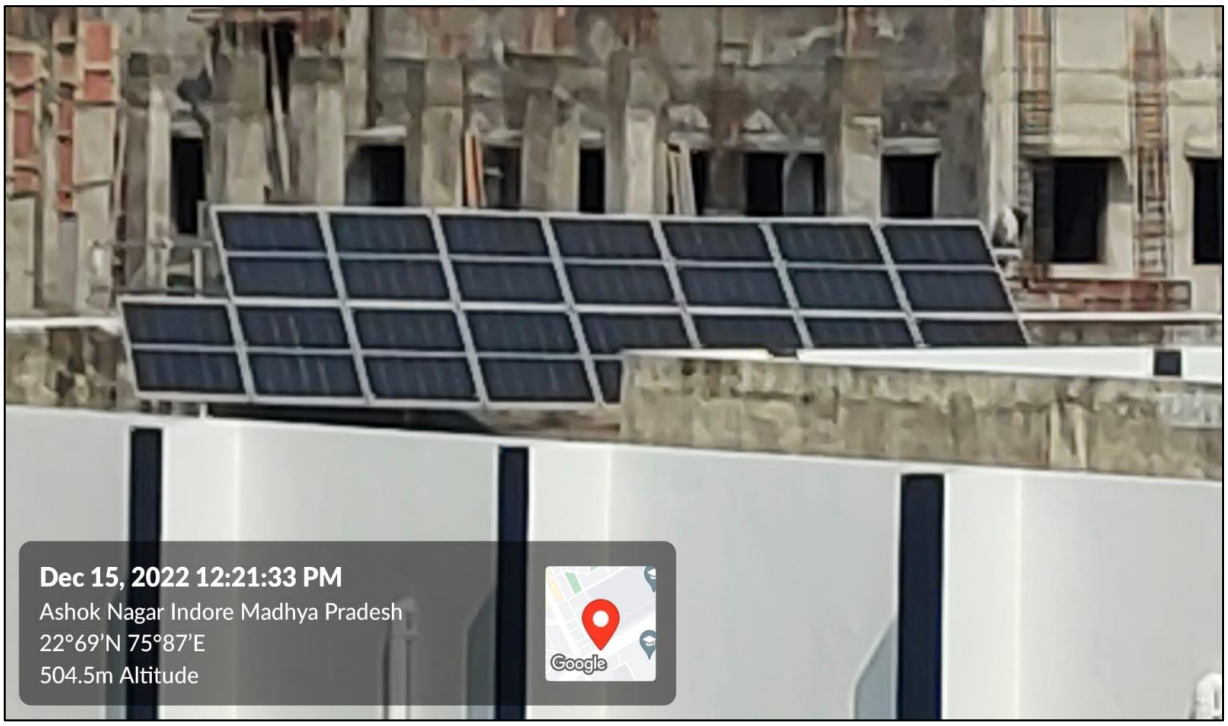
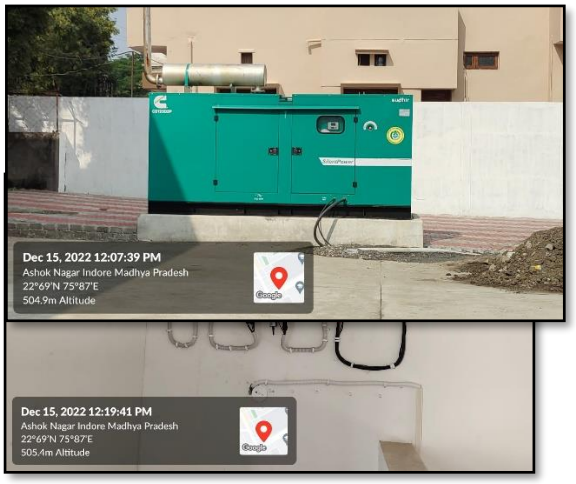
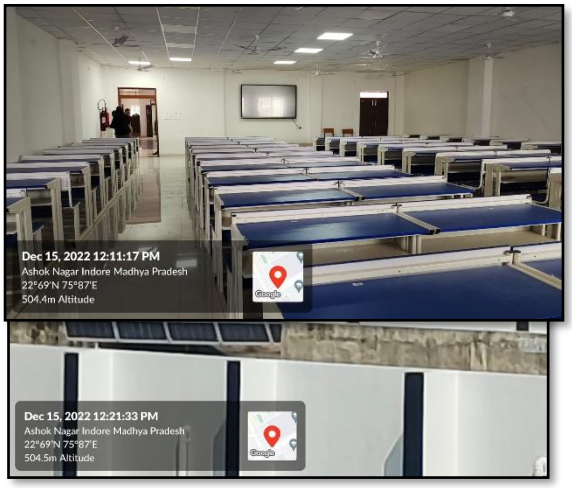


Figure2: RENEWABLE ENERGY PHOTOGRAPH OF DEPARTMENT OF PHYSICS

Figure3: RENEWABLE ENERGY PHOTOGRAPH OF DEPARTMENT OF COMPUTER SCIENCE

Renewable Energy and water filtration plant on the roof top of Computer Science Department





10.3.1 Energy Management Strategy

Energy Management should be seen as a continuous process. Strategies should be reviewed annually and revised as necessary. The key activities suggested have been outlined below:

10.3.2 College Corporate Approach

The starting point in energy management is to identify a strategic corporate approach to energy management. Clear accountability for energy usage needs to be established, appropriate financial and staffing resources must be allocated, and reporting procedures initiated. An energy management program requires commitment from the whole organization to be successful. A record of Energy consumption must be kept and monitored on regular basis, to optimize the Energy consumption. For this, various meters may have to be installed.

10.3.2.1 Designate an energy manager

An Energy Manager must be identified, and time bound responsibility must be given to him in getting implemented the findings of the Energy Audit points, which the Plant Establishment has planned to implement.

10.3.2.2 Setup an energy monitoring and reporting system

Successful energy management requires the establishment of a system to collect/analyses and report the energy costs and consumption pattern. This will enable an overview of energy use and its related costs, as well as facilitating the identification of savings that might 'otherwise not be detected. The system needs to record both historical and ongoing energy use, as well as cost information from billing data, and capable of producing

summary reports on a regular basis. This information will provide how trends can be analyzed and reviewed for corrective measures.

10.4 Implement a staff awareness and Training program

A key ingredient to the success of an energy management program is maintaining a high level of awareness among staff. This can be achieved in several ways, including formal training, newsletters, posters and publications. It is important to communicate program plans and case studies that demonstrate savings, and to report results at least at 12-month intervals. Staff may need training from specialists on energy saving practices and equipment.