

Energy Audit Report (Executive Summary) University of Kerala Kariavattom Campus, Thiruvananthapuram



Energy Audit Conducted by



KERALA STATE ELECTRICITY BOARD LTD. (KSEBL)

Save Energy

Save our Planet

ACKNOWLEDGMENT

We express our sincere gratitude to the Vice Chancellor and Authorities of the University of Kerala having authorize the KSEB for conducting the Energy Audit at the Academic Campus of the University, Kariavattom.

We hope that KSEB have been able to fulfill the duty entrust to us in a satisfactory manner.

We look forward to associate with the Kerala University in similar matter in future.

We, express sincere thanks and gratitude to the employees of **UNIVERSITY OF KERALA, KARIAVATTOM CAMPUS**, Thiruvananthapuram, for the co-operation and the needful assistance extended to us, during the conduct of Energy Audit.

Our sincere thanks to the following dignitaries, for having given us an opportunity to conduct Energy Audit in Kariavattom Campus Buildings, Thiruvananthapuram.

1. **Sri. R. Dilip**, Joint Registrar campus Administration, University of Kerala Kariavattom , Thiruvananthapuram
2. **Smt. Sobha. K**, University Engineer, University of Kerala Kariavattom Thiruvananthapuram
3. **Sri. R .Radhakrishnan**, Assistant Executive Engineer II (Civil) University of Kerala Kariavattom Thiruvananthapuram
4. **Sri. P.T. Joseph**, Assistant Executive Engineer I, University of Kerala Kariavattom Thiruvananthapuram
5. **Sri. E. Chandrasekharan Nair**, Assistant Executive Engineer (Ele), University of Kerala Kariavattom Thiruvananthapuram
6. **Smt. Salini. s**, Assistant Engineer (Ele), University of Kerala Kariavattom Thiruvananthapuram
7. **Smt. Aswathy.B.S**, Assistant Engineer (Ele),in charge, University of Kerala Kariavattom Thiruvananthapuram
8. **Sri. Satheeshkumar.N**, Electrician Grade I, University of Kerala Kariavattom Thiruvananthapuram
9. **Sri. Reghu.S**, Electrician Grade II, University of Kerala Kariavattom Thiruvananthapuram

10. **Sri. Anilkumar. K.V**, Electrician Grade II, University of Kerala Kariavattom Thiruvananthapuram

11. **Sri. Shajahan. A. S**, Line Helper, University of Kerala Kariavattom Thiruvananthapuram

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The Energy Audit was carried out by qualified and experienced Energy professionals/Engineers, including BEE certified Energy Auditors/Managers, of the Energy Savings Co-ordination Team (ESCOT) of KSEB Ltd. (List is given in Annexure 1)

**Chief Engineer
(Renewable Energy & Energy Savings)**

**31-08-2018
Thiruvananthapuram**

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1. Energy Audit Recommendations at a glance

1. Retrofit the existing inefficient/old/obsolete appliances/equipments, with energy efficient and environment friendly appliances/equipments (such as LED bulbs/Tubes, Star rated Fan, Inverter Air Conditioners, water pumps etc.)
2. Balance loads in feeders and maintain Harmonic Distortion Level, within limit.
3. Maintain standard lux levels at the different Areas /Class rooms/Departments of the campus.
4. Ensure DG maintenance, as per the maintenance check list.
5. Periodic maintenance of Air Conditioning system.
6. Give more attention to Electrical Safety
7. Apply sun films/curtains on the window panes of air conditioned rooms and avoid air leakage of the rooms. Set the thermostat temperature range 25-26 degree Celsius.
8. Utilize the potential for Roof top Solar and Rain water harvesting and Bio-gas plants.
9. Conduct Energy Conservation Awareness Campaign among the staff for reducing energy consumption and display posters/slogans of Energy Conservation, Electrical safety etc. at conspicuous places
10. Update Single Line Diagram (SLD), regularly.
11. Plant trees and plants, which is very desirable for college campus atmosphere.
12. Establish a Facility Management System, exclusively for energy efficiency activities.

2. Executive Summary

As requested by the Joint Registrar, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Energy Saving Coordination Team (ESCOT), of Kerala State Electricity Board Ltd (KSEBL) conducted detailed energy audit at Kariavattom campus buildings during August 2017 to July 2018.

An energy saving potential of **0.720 MU** per annum was observed, which is summarised as below. **It has been found an energy saving potential of about 37%.**

1. Retrofitting of 40W fluorescent tube lights with conventional ballast with 18W LED tubes can save **81842.904 kWh** per year
2. 60W fan regulator can be replaced with new and energy saving efficient electric regulator which saves **105902.51 kWh** per year.
3. Retrofitting old & inefficient split type AC with 5 star AC. The expected energy saving potential is **207005.32 kWh** per year.
4. Retrofitting of old street lights with LED Lights. The expected energy saving potential is **33283.8 kWh** per year.
5. The monthly maximum (MD) recorded during July 2017 to June 2018, ranges from 423 kVA to 522 kVA. But, the contract demand is 700 kVA. As per the tariff regulation, the consumer has to pay a minimum fixed charge for 75% of contract demand. That is, for the present load conditions, the consumer has to pay fixed charge for 525 kVA.. Hence, it is recommended to revise the contract demand, so that the consumer can have a financial saving of Rs. **3.04549** lakh per annum. (Detailed Calculation Shown in Table -2)

A) The investment required, for an energy saving of **0.720 MU** per year would be **2.0 Crore** (aprox.), which has a **payback period of 4.3 years**. The financial savings is about Rs. **47.4 lakh**.

B) Financial savings with the revision of Contract Demand is Rs. **3.04549** lakh per annum.

Grand Total financial savings (A+B) = (Rs. 47.4 lakh +3.04549 lakh)

= 50.45 lakh

**3. Energy Saving potential of University of Kerala,
Kariavattom Campus Buildings, Thiruvananthapuram
(Consolidated)**

A. Retrofitting Lights, Fans and Air conditioners with energy efficient appliances						
Sl. no.	Name of Building(Location)	No. of Equipments to be retrofitted (nos.)	Annual Energy Savings (kWh)	Annual Energy Financial Savings Rs	Investment Required (Rs)	Payback Period (years)
1	Dept. of Botany & Mass communication & Journalism	284	20699.68	129054.5	697240	5.4
2	Dept. of Zoology	176	14636.66	95151.47	593080	6.2
3	Botany Pump House	4	95.904	652.146	4246	6.5
4	Administration wing	67	3310.848	22513.76	48320	2.1
5	Electrical Section	15	687.782	4667.62	9710	2
6	Cafeteria	17	452.088	3074.242	12700	4.1
7	Office of the campus Administration	65	4088.01	27798.5	49260	1.7
8	SBI	78	6892.532	44771.18	194730	4.3
9	Substation	41	3032.028	20617.78	32970	1.5
10	Aquatic Biology & Hachering building	691	32745.9	218665.2	1009960	4.6
11	CSS building	116	15542.84	103203.9	242520	2.3
12	Environmental Science	148	6204.723	40912.11	188190	4.5
13	Arts Block	226	11814.75	79182.95	351250	4.4
14	Dept. of Malayalam	332	11553.34	76646.73	595120	7.7
15	Canteen	13	408.456	2777.54	12980	4.6
16	Dept of Arabic	158	10413.2	70110.47	257970	3.6
17	Performing Arts	54	1399.312	17101.85	83090	4.8
18	Biochemistry	59	6578.96	42631.18	299290	7
19	Staff Union Office	11	63.728	433.378	16150	37
20	University college of Engineering	620	56061.75	363911.2	1326450	3.6
21	Clock Tower	3	6.48	44.06	1500	34
22	Golden Jubilee Campus Library	403	17556.65	119385.5	422580	3.5
23	Dept. of	78	12688.88	80968.77	569790	7

	Biotechnology					
24	Computer science	339	40874.23	267374.4	1089550	4
25	Campus Nursery school	24	590.112	4012.758	24070	6
26	Day care	20	409.104	2781.903	18010	6.4
27	Quarters C	306	13521.81	91948.31	167940	1.8
28	Quarters D	454	15676.2	106598.1	298660	2.8
29	Quarters E	519	23739.78	161431.2	236950	1.4
30	Quarters F	403	32124.67	184693.3	207740	1.1
31	Staff Housing society	17	824.52	6151.98	15150	2.4
32	Campus association office	11	192.744	993.86	7660	7.7
33	Guest House 1 & 2	148	13237.82	84558.52	689160	8.1
34	Post office	19	1153.008	7840.46	11420	1.4
35	Employment cooperative society	26	1528.84	9999.196	49030	4.9
36	Security building	33	1016.3	6910.749	26120	3.7
37	Teachers Hostel	165	6271.776	42648.04	140400	3.2
38	Health centre	45	881.712	4330.565	37670	8.6
39	Quarters A	128	5751.624	38498.67	153440	3.9
40	Quarters B	102	5967.488	39119.73	231820	5.9
41	PG Hostel	269	15375.18	104551.7	291400	2.7
42	Research hostel	347	13407.52	91171.15	309530	3.3
43	IMK & Law building	296	10226.5	69540.22	143500	2
44	USIC Workshop	32	869.4	5911.92	30850	5.2
45	ATM	1	4310.56	26725.5	32500	0.9
46	CGIST	148	12544.99	82436.97	379350	4.6
47	PG of Women's hostel	385	10312.85	69284.26	309520	4.4
48	Additional block Women's hostel	226	8600.248	58481.77	132620	2.2
49	Bus garage	7	49.68	337.824	3800	11.2
50	Rest room	11	254.88	1733.194	10940	6.3
51	She toilet	1	2.16	14.68	500	24.5
52	Chemistry block	481	24947.6	163005.5	1002090	6.1
53	Bio informatics centre	278	28801.73	188253.4	841240	4.4
54	Gamma shine	25	331.344	2253.13	20130	8.9
55	CEIB	94	6732.856	44180.27	485420	10.9
56	Botany Pump house	7	40.608	276.128	3440	12.4

57	Geology, Statistics, Maths, Psychology	809	53365.97	355679.4	1381940	3.8
58	Political science	497	25772.82	174824.5	624400	3.5
59	Hymavathy pump house	4	87.696	596.292	4700	7.8
60	SICC	248	19028.88	121222.9	1078220	8.8
61	Dept. of Physics	183	14758.13	95018.07	649110	6.8
62	Campus library	181	11259.26	75398.27	268110	3.5
63	Dept. of Opto electronics	272	25051.83	163092.7	1059520	6.4
Sub Total		11220	686828.9	4518158	19486716	4.3

B. Retrofitting the existing inefficient and Old street lights with energy efficient lights						
Sl. no.	Name of Building	No. of Equipments to be retrofitted (nos.)	Annual Energy Savings (kWh)	Annual Energy Financial Savings (Rs)	Investment Required (Lakh)	Payback Period (years)
1	Kariavattom Campus Street lighting	221	33283.8	226329.46	1240650	5.4
Sub Total		221	33283.8	226329.46	1240650	5.4
Grand Total (A+B)			720112.7	47.4 Lakh	2.0 Crore	4.3

Annual Energy saving potential of approximately 720112.7 kWh and a financial savings of about Rs. 47.4 lakh with an effective payback period of 4.3 years.

An investment of approximately Rs. 2.0 Crore is required for the implementation of energy savings recommendations.

(Payback period is higher for the buildings where energy savings is less which is due to the fact that comparatively less usage of appliances and also the appliances used are comparatively energy efficient. It also depends on the cost of the appliances/equipments.)

5. Executive Summary of the Buildings/Areas

(1) Department of Botany & Mass Communication Journalism

Annual Energy saving potential – 20699.68 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	170	8058.96	54800.93	93500	1.7
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	25	1140.48	7755.3	12500	1.6
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	2	21.6	146.88	1000	6.8
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	2	2	1.728	240	20.4
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	58	903.36	6142.85	116000	18.9
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	14	8720	54064	474000	8.7
7	Operation of computers in sleep/shut down mode, when not in use.	13	1853.28	6142.85	No investment	
	Total	284	20699.68	129054.5	697240	5.4

An investment of approximately Rs. 6.9 Lakh is required for the implementation of above recommendations. This would result an energy savings of 20699.68 units per annum with a simple payback period of 5.4 years.

(2) Department of Zoology

Annual Energy saving potential – 14636.66 units

Sl. no	Description of Work	No. of Equipments. (nos.)	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20 W LED Tubes.	70	1776.6	12081	38500	3.2
2	Retrofitting of 2 x 40 W Fluorescent Tube Lights & conventional ballast by 2 x 20 W LED tubes	2	151.2	1028.16	2200	2.1
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	17	285.12	1938.8	8500	4.4
4	Retrofitting of 2 x 25 W Fluorescent Tube Lights & conventional ballast by 2 x 18 W LED tubes	1	18	122.4	900	7.4
8	Retrofitting of existing 11 W CFL with 7 W LED lamps.	4	3.456	23.500	480	20.4
9	Retrofitting of existing inefficient and old Fan with 5 star rated Fan	39	1114.6	7579.01	78000	10.3
10	Replacing the existing ordinary and old Air Conditioners with Inverter Air Conditioners	15	7296	45235.2	464500	10.2
11	Operation of computers in sleep/shut down mode, when not in use.	28	3991.68	27143.4	No investment	
	Total	176	14636.66	95151.47	593080	6.2

An investment of approximately Rs.5.9 Lakh is required for the implementation of above recommendations. This would result an annual energy savings of 14636.66 units and financial savings of Rs. 95151.47 with a simple payback period of 6.2 years.

(3) Botany Pump House

Annual Energy saving potential – 95.904 units

Sl. No	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual cost saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting existing 11 W CFL with 7 W LED bulbs	2	5.184	35.25	240	6.8
2	Retrofitting of existing ordinary and old fans with new 5 star rated fans	2	90.72	616.896	4000	6.5
	Total	4	95.904	652.146	4240	6.5

An investment of Rs. 4240 for implementation of above recommendation would result energy savings of 95.904 units per annum and a financial savings of Rs. 652.14/-, with a simple payback period of 6.5 Years.

4) Administration Wing

Annual energy saving potential – 3310.848 units

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	22	453.6	3084.5	12100	3.9
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	7	178.2	1211.8	3500	2.9
3	Retrofitting of existing 9 W CFL with 7 W LED lamps.	5	2.16	14.688	600	40.8
4	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	7.128	48.47	120	2.5
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	16	388.8	2643.8	32000	12.1
6	Operation of computers in sleep/shut down mode, when not in use.	16	2280.96	15510.5	No investment	
	Total	67	3310.848	22513.76	48320	2.1

An investment of approximately Rs. 48320 is required for the implementation of above recommendations. This would result an energy savings of 3310.848 units per annum and a financial savings of Rs. 22513.76/-, with a simple payback period of 2.1 years.

(5) Electrical Section

Annual energy saving potential – 687.782 units

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	2	60.48	411.26	1100	2.7
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	5	135.43	920.9	2500	2.7
3	Retrofitting of existing 14 W CFL with 7 W LED lamps.	1	1.512	10.28	110	10.7
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	3	110.2	740.09	6000	8
6	Operation of computers in sleep/shut down mode, when not in use.	4	380.16	2585.09	No investment	
	Total	15	687.782	4667.62	9710	2

An investment of approximately Rs.9710/- is required for the implementation of above recommendations. This would result an energy savings of 687.782 units per annum and a financial savings of Rs. 4667.62/-, with a simple payback period of 2 years.

(6) Cafeteria

Annual energy saving potential -452.088 units

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40W Ordinary tube lights with 20W LED Tubes.	3	113.4	771.12	1650	2.1
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	3	106.92	727.1	1500	2.1
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	2	21.6	146.88	1000	6.8
4	Retrofitting of existing 14 W CFL with 7 W LED lamps.	5	28.728	195.35	550	2.8
5	Retrofitting of inefficient and old Fan with 5 star rated	4	181.44	1233.792	8000	6.5
	Total	17	452.088	3074.242	12700	4.1

An investment of Rs. 12700/- for the implementation of above recommendations would result an energy savings of 452.088 units per annum and annual financial savings of Rs. 3074.242/-, with a simple payback period of 4.1 years.

(7) Office Of the Campus Administration

Annual energy saving potential of 4088.01 units

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	23	922.32	6271.8	12650	2
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	4	192.456	1308.7	2000	1.5
3	Retrofitting of existing 9 W CFL with 7 W LED lamps.	4	3.45	23.5	480	20.4
4	Retrofitting of existing 18 W CFL with 9 W LED lamps	1	1.944	13.22	130	9.8
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	17	686.88	4670.78	34000	7.3
6	Operation of computers in sleep/shut down mode, when not in use.	16	2280.96	15510.5	No investment	
	Total	65	4088.01	27798.5	49260	1.77

An investment of approximately Rs.49260/- is required for the implementation of above recommendations. This would result an energy savings of 4088.01 units per annum and financial savings of Rs. 27798.5/-, with a simple payback period of 1.77 years.

(8) SBI**Annual energy saving potential of 6892.532 units**

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	8	725.76	4935.16	4400	0.9
2	Retrofitting of existing 2X36 W Ordinary tube lights with 2X18 W LED Tubes.	2	342.14	2326.6	2000	0.9
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	10	90.72	616.896	5000	8.1
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	14	118.368	804.90	1680	2.1
5	Retrofitting of existing 14 W CFL with 7 W LED lamps.	23	243.432	1655.34	2530	1.5
6	Retrofitting of existing 9W CFL with 7 W LED lamps.	1	0.432	2.9376	120	40.8
7	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	4	45.36	308.448	8000	25.9
8	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	5	3496.8	21680.2	171000	7.8
9	Operation of computers in sleep/shut down mode, when not in use.	11	1829.52	12440.7	No investment	
	Total	78	6892.532	44771.18	194730	4.3

An investment of Rs. 1.94 lakh for the implementation of the above recommendations would result an energy savings of 6892.532 kWh per annum and a financial savings of Rs. 44771.18/-, with a simple payback period of 4.3 years.

(9) Ele. Substation

Energy saving potential of 3032.028 kWh per year

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	5	204.12	1388.02	2750	2
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	11	1995.84	13571.7	12100	0.9
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.468	3.1824	120	37.7
4	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	20	209.52	1424.736	10000	7
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	4	622.08	4230.14	8000	1.9
	Total	41	3032.028	20617.78	32970	1.5

An investment of Rs. 32970/- for the implementation of the above recommendations would result an energy savings of 3032.028 kWh per annum and a financial savings of Rs. 20617.78/-, with a simple payback period of 1.5 years.

(10) Aquatic Biology & Fisheries

Energy saving potential of 32745.9 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	272	6081.264	41353	149600	3.6
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	16	241.92	1645	1100	10.7
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	77	1499.73	10198.2	38500	3.8
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	1	71.28	484.7	1000	2.1
5	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2 x 18 W LED Tubes.	16	207.36	1410	7200	5.1
6	Retrofitting of existing 9W CFL with 7 W LED lamps.	11	3.19	21.73	1320	60.7
7	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	2	14.256	96.941	240	2.5
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	212	5807.1	39488.3	424000	10.7
9	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	11	6678.4	41406.1	387000	9.3
10	Operation of computers in sleep/shut down mode, when not in use.	73	12141.4	82561.2	No investment	
	Total	691	32745.9	218665.2	1009960	4.6

An investment of Rs. 10 Lakh for the implementation of the above recommendations would result an energy savings of 32745.9 kWh per annum and a financial savings of Rs. 218665.2/-, with a simple payback period of 4.6 years.

(11) CSS and Central Computing Facility

Energy saving potential of 15542.84 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	22	892.08	6066.1	12100	2
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	13	1254.96	8533.73	14300	1.7
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	2	99.792	678.6	1000	1.5
4	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	7.128	48.4704	120	2.5
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	10	304.56	2071.01	20000	9.7
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	6	4145.6	25702.7	195000	7.5
7	Operation of computers in sleep/shut down mode, when not in use.	62	8838.72	60103.3	No investment	
	Total	116	15542.84	103203.9	242520	2.3

An investment of Rs. 2.4 Lakh for the implementation of the above recommendations would result an energy savings of 15542.84 kWh per annum and a financial savings of Rs. 1.03 Lakh, with a simple payback period of 2.3 years.

(12) Environmental Science**Energy saving potential of 6204.723 kWh per year**

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	26	408.237	2776	14300	5.2
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	9	163.79	1113.81	9900	8.9
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	16	627.264	4265.4	8000	2
4	Retrofitting of existing 2X25W Ordinary tube lights with 2X18 W LED Tubes.	6	25.92	176.256	2700	15.3
5	Retrofitting of existing 25W Ordinary tube lights with 18 W LED Tubes.	16	101.52	690.336	8000	11.6
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	8	4.32	29.376	960	32.7
7	Retrofitting of existing 14 W CFL with 7 W LED lamps.	3	1.512	10.28	330	32.1
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	52	1313.28	8930.27	104000	11.6
9	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	2	2133.28	13226.3	40000	3.02
10	Operation of computers in sleep/shut down mode, when not in use.	10	1425.6	9694.08	No investment	
	Total	148	6204.723	40912.11	188190	4.5

An investment of Rs. 1.8 Lakh for the implementation of the above recommendations would result an energy savings of 6204.723 kWh per annum and a financial savings of Rs. 40912.11/-, with a simple payback period of 4.5 years.

(13) Indian Languages Building

Energy saving potential of 11814.75 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	79	2116.8	14394	43450	3
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	18	1088.64	7402.75	19800	2.7
13	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	4	17.28	117.504	2000	17
4	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	19	598.752	4071.5	9500	2.3
5	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	4	285.12	1938.8	4000	2.1
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	77	2643.84	17978.1	154000	8.6
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	3	1928	11953.3	118500	9.9
8	Operation of computers in sleep/shut down mode, when not in use.	22	3136.32	21327	No investment	
	Total	226	11814.75	79182.95	351250	4.4

An investment of Rs. 3.5 Lakh for the implementation of the above recommendations would result an energy savings of 11814.75 kWh per annum and a financial savings of Rs. 79182.95/-, with a simple payback period of 4.4 years.

(14) Department of Malayalam, Tamil, Sanskrit, Vedanta
Energy saving potential of 11553.34 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	78	1953.71	13285.3	42900	3.2
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	8	453.6	3084.88	8800	3
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	40	1204.63	8191.5	20000	2.4
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	4	342.14	2326.6	4000	1.7
5	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	47	398.35	2708.81	23500	8.7
6	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2 x 18 W LED Tubes.	52	1154.67	7851.77	46800	6
7	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	7.12	48.47	120	2.5
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	95	2844.72	19344.1	190000	9.8
9	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	7	3194.4	19805.3	259000	13
10	Operation of computers in sleep/shut down mode, when not in use.	42	5987.52	40715.1	No investment	
	Total	332	11553.34	76646.73	595120	7.7

An investment of Rs. 5.9 Lakh for the implementation of the above recommendations would result an energy savings of 11553.34 kWh per annum and a financial savings of Rs. 76646.73, with a simple payback period of 7.7 years.

(15) Canteen

Energy saving potential of 408.456 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 36 W Ordinary tube lights with 18W LED Tubes.	3	106.92	727.1	1500	2.1
2	Retrofitting of existing 2X36W Ordinary tube lights with 2X18 W LED Tubes.	1	71.28	484.7	1000	2.1
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	4	3.456	23.5	480	20.4
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	5	226.8	1542.24	10000	6.5
Total		13	408.456	2777.54	12980	4.6

An investment of Rs. 12980/- for the implementation of the above recommendations would result an energy savings of 408.456 kWh per annum and a financial savings of Rs. 2777.54/-, with a simple payback period of 4.6 years.

(16) Department of Arabic & ICKS

Energy saving potential of 10413.2 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	31	861.84	5860.5	17050	3
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	13	786.24	5346.43	14300	2.7
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	25	819.72	5574.1	12500	2.2
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	10	912.38	6204.2	10000	1.6
5	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	6	47.52	323.136	3000	9.3
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.864	5.875	120	20.4
7	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	36	1114.56	7579.01	72000	9.5
8	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	3	1165.6	7226.72	129000	17.8
9	Operation of computers in sleep/shut down mode, when not in use.	33	4704.48	31990.5	No investment	2.1
Total		158	10413.2	70110.47	257970	3.6

An investment of Rs. 2.57 lakh for the implementation of the above recommendations would result an energy savings of 10413.2 kWh per annum and a financial savings of Rs. 70110.47/-, with a simple payback period of 3.6 years.

(17) Performing and Visual Arts**Energy saving potential of 1399.312 kWh per year**

Executive Summary						
Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	19	116.64	793.152	9500	12
2	Retrofitting of existing 2X25 W Ordinary tube lights with 2X18 W LED Tubes.	5	129.6	881.28	2250	5.1
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	7	4.752	32.31	840	26
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	19	583.2	3965.76	38000	9.6
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	1	137.44	8521.128	32500	38
7	Operation of computers in sleep/shut down mode, when not in use.	3	427.68	2908.22	No investment	2.1
	Total	54	1399.312	17101.85	83090	4.8

An investment of Rs. 83090/- for the implementation of the above recommendations would result an energy savings of 1399.312 kWh per annum and a financial savings of Rs. 17101.85/-, with a simple payback period of 4.8 years.

(18) Department of Bio Chemistry, Animal House

Energy saving potential of 6578.96 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40W Ordinary tube lights with 20W LED Tubes.	15	710.64	4832.4	8250	1.7
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	3	332.64	2261.95	3300	1.5
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	13	527.472	3586.8	6500	1.8
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	2	1.728	11.75	240	20.4
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	12	356.4	2423.52	24000	9.9
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	6	3509.6	21759.5	257000	11.8
7	Operation of computers in sleep/shut down mode, when not in use.	8	1140.48	7755.26	No investment	
	Total	59	6578.96	42631.18	299290	7

An investment of Rs. 2.99 lakh- for the implementation of the above recommendations would result an energy savings of 6578.96 kWh per annum and a financial savings of Rs. 42631.18/-, with a simple payback period of 7 years.

(19) Staff Union Office

Energy saving potential of 63.728 kWh per year

Executive Summary					
Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	3	7.56	51.408	1650	32.1
Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	1	7.128	48.5	500	10.3
Retrofitting of existing inefficient and old Fan with 5 star rated Fans	7	49.04	333.47	14000	42
Total	11	63.728	433.378	16150	37

An investment of Rs. 16150/- for the implementation of the above recommendations would result an energy savings of 63.728 kWh per annum and a financial savings of Rs. 433.378/-, with a simple payback period of 37 years.

(20) Engineering College**Annual Energy saving potential – 56061.75 units**

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	143	4204.11	28587.99	78650	2.8
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	52	2268	15422.4	57200	3.7
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	88	2013.08	13689.0	44000	3.2
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	15	684.29	4653.2	15000	3.2
5	Retrofitting of existing 12 W CFL with 7 W LED lamps.	1	0.864	5.875	120	20.4
6	Retrofitting of existing 9 W CFL with 7 W LED lamps.	4	6.048	41.1264	480	11.7
9	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	136	3780.56	25707.8	272000	10.6
10	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	31	28848.8	178863	859000	4.8
11	Operation of computers in sleep/shut down mode, when not in use.	150	14256	96940.8		
	Total	620	56061.75	363911.2	1326450	3.6

An investment of approximately Rs.13.26 Lakh is required for the implementation of above recommendations. This would result an annual energy savings of 56061.75 units and financial savings of Rs. 3.6 Lakh, with a simple payback period of 3.6 years.

(21) Clock Tower

Annual Energy Saving potential – 6.48 units

Sl. no	Description of Work	No. of Equipments. (nos.)	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	3	6.48	44.06	1500	34
	Total	3	6.48	44.06	1500	34

An investment of approximately Rs.1500/- is required for the implementation of above recommendations. This would result an annual energy savings of 6.48 units and financial savings of Rs. 44.06/-, with a simple payback period of 34 years.

(22) Golden Jubilee Building (Block I, II, III)**Annual Energy saving potential – 17556.65 units**

Sl. No	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual cost saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	85	4641.84	31564.51	46750	1.5
2	Retrofitting of existing 2X40 W Ordinary tube lights with 20W LED Tubes.	37	5292	35985.6	40700	1.1
3	Retrofitting of existing 36 W Ordinary tube lights with 18W LED Tubes.	30	1254.528	8530.8	15000	1.8
4	Retrofitting of existing 2X 36 W Ordinary tube lights with 2X18W LED Tubes	3	114.048	775.5	3000	3.9
5	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes	127	1384.56	9415.00	63500	6.7
6	Retrofitting existing 14 W ICL with 7 W LED bulbs	1	10.584	71.9712	110	1.5
7	Retrofitting existing 9 W ICL with 7 W LED bulbs	2	1.296	8.8128	240	27.2
8	Retrofitting existing 11W ICL with 7 W LED bulbs	2	1.728	11.704	240	20.4
9	Retrofitting of existing 2XT5 W Ordinary tube lights with 18W LED Tubes	10	43.2	293.76	240	15.3
10	Retrofitting of existing 4X14 W Ordinary tube lights with 18W LED Tubes	34	1747.87	11885.5	108800	9.2
11	Retrofitting of existing ordinary and old fans with new 5 star rated fans	72	3065	20842.3	144000	6.9
12	Retrofitting of existing ordinary and old window and split Air Conditioners with Inverter AC.	7	6621.6	41053.92	278000	6.7

13	Operation of computers in sleep/shut down mode, when not in use.	52	6177.6	42007.7	No Investment	
	Total	403	17556.65	119385.5	422580	3.5

An investment of Rs. 4.2 lakh for implementation of above recommendation would result energy savings of 17556.65 units per annum and a financial savings of Rs. 1.19 lakh, with a simple payback period of 3.5 Years

(23) Bio-Technology**Annual energy saving potential – 12688.88 units**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40W Ordinary tube lights with 20W LED Tubes.	15	710.64	4832.35	8250	1.7
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	3	332.64	2261.95	3300	1.5
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	13	527.472	3586.8	6500	1.8
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	2	1.728	11.7504	240	20.4
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	12	356.4	2423.52	24000	9.9
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	17	8859.2	54927	527500	9.6
7	Operation of computers in sleep/shut down mode, when not in use.	16	1900.8	12925.4	No Investment	
	Total	78	12688.88	80968.77	569790	7

An investment of approximately Rs. 5.6 Lakh is required for the implementation of above recommendations. This would result an energy savings of 12688.88 units per annum and a financial savings of Rs. 80968.77/-, with a simple payback period of 7 years.

(24) Computer Science Buildings (Demography And PRC)

Annual energy saving potential – 40874.23 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40W Ordinary tube lights with 20W LED Tubes.	61	1666.22	11330	33550	3
2	Retrofitting of existing 2X40 W Ordinary tube lights with 2X20 W LED Tubes.	20	1784.16	12132.3	22000	1.8
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	21	662.904	4507.7	10500	2.3
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	8	513.216	3489.9	8000	2.3
5	Retrofitting of existing 25W Ordinary tube lights with 18 W LED Tubes.	2	21.6	146.88	1000	6.8
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	58	1740.53	11835.6	116000	9.8
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	27	17616	109219	898500	8.2
8	Operation of computers in sleep/shut down mode, when not in use.	142	16869.6	114713	No Investment	
	Total	339	40874.23	267374.4	1089550	4

An investment of approximately Rs.10.8 Lakh is required for the implementation of above recommendations. This would result an energy savings of 40874.23 units per annum and a financial savings of Rs. 2.6 lakh, with a simple payback period of 4 years.

(25) Campus Nursery School

Annual energy saving potential – 590.112 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	9	226.8	1542.24	4950	3.2
2	Retrofitting of existing 25W Ordinary tube lights with 18 W LED Tubes.	6	51.84	352.51	3000	8.5
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.432	2.9376	120	40.8
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	8	311.04	2115.07	16000	7.6
	Total	24	590.112	4012.758	24070	6

An investment of Rs. 24070/- for the implementation of above recommendations would result an energy savings of 590.112 units per annum and annual financial savings of Rs. 4012.758/-, with a simple payback period of 6 years.

(26) Day Care

Annual energy saving potential of - 409.104 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	3	68.04	462.672	1650	3.6
2	Retrofitting of existing 25W Ordinary tube lights with 18 W LED Tubes.	8	86.4	587.52	4000	6.8
3	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	3	21.384	145.411	360	2.5
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	6	233.28	1586.30	12000	7.6
	Total	20	409.104	2781.903	18010	6.4

An investment of approximately Rs.18010/- is required for the implementation of above recommendations. This would result an energy savings of 409.104 units per annum and financial savings of Rs. 2781.903, with a simple payback period of 6.4 years.

(27) C Quarters

Annual energy saving potential of 13521.81 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	67	3343.03	22732.6	3500	1.5
2	Retrofitting of existing 9 W CFL with 7 W LED lamps.	73	190.944	1298.41	8760	4.8
3	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	64	2280.96	15510.5	7680	0.5
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	74	4380.48	29787.3	148000	5
5	Operation of computers in sleep/shut down mode, when not in use.	28	3326.4	22619.5	No Investment	
	Total	306	13521.81	91948.31	167940	1.8

An investment of Rs. 1.67 lakh for the implementation of the above recommendations would result an energy savings of 13521.81 kWh per annum and a financial savings of Rs. 91948.31/- with a simple payback period of 1.8 years.

(28) D Quarters

Annual energy saving potential of 15676.2 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	80	3008.88	20460.4	44000	2.2
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	65	2601.72	17691.7	32500	1.8
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	118	928.8	6315.84	59000	9.3
4	Retrofitting of existing 9 W CFL with 7 W LED lamps.	43	108	734.4	5160	7
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	50	2209.68	15025.8	6000	0.4
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	76	4205.52	28597.5	152000	5.3
7	Operation of computers in sleep/shut down mode, when not in use.	22	2613.6	17772.5	No Investment	
	Total	454	15676.2	106598.1	298660	2.8

An investment of Rs. 2.98 lakh for the implementation of the above recommendations would result an energy savings of 15676.2 kWh per annum and a financial savings of Rs. 1.06 Lakh with a simple payback period of 2.8 years.

(29) E Quarters

Annual energy saving potential of 23739.78 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	75	4536	30845	41250	1.3
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	21	1197.5	8143.0	10500	1.3
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	32	171.6	1167.206	3840	3.3
4	Retrofitting of existing 9 W CFL with 7 W LED lamps.	128	1520.64	10340.35	15360	2.9
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	150	6885.64	46822.4	18000	0.4
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	74	4795.2	32607.4	148000	4.5
7	Operation of computers in sleep/shut down mode, when not in use.	39	4633.2	31505.8	No Investment	
	Total	519	23739.78	161431.2	236950	1.4

An investment of Rs. 2.36 lakh for the implementation of the above recommendations would result an energy savings of 23739.78 kWh per annum and a financial savings of Rs. 1.61 lakh with a simple payback period of 1.4 years.

(30) F Quarters

Annual energy saving potential of 32124.67 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	30	2923.2	19877.76	16500	0.9
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	14	798.336	5428.7	7000	1.3
3	Retrofitting of existing 9 W CFL with 7 W LED lamps.	36	427.68	2908.22	4320	2.9
4	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	216	15857.85	74078.89	25920	0.3
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	77	4989.6	33929.3	154000	4.5
6	Operation of computers in sleep/shut down mode, when not in use.	30	7128	48470.4	No Investment	
	Total	403	32124.67	184693.3	207740	1.12

An investment of Rs. 2.07 lakh for the implementation of the above recommendations would result an energy savings of 32124.67 kWh per annum and a financial savings of Rs. 1.84 lakh with a simple payback period of 1.12 years.

(31) Staff Housing Society

Annual energy saving potential of 824.52 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	3	147	999.6	1650	1.7
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	7	205.92	1952.3	3500	1.8
3	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	5	234	1584.4	10000	6.3
4	Operation of computers in sleep/shut down mode, when not in use.	2	237.6	1615.68	No Investment	
	Total	17	824.52	6151.98	15150	2.4

An investment of Rs. 15150/- for the implementation of the above recommendations would result an energy savings of 824.52 kWh per annum and a financial savings of Rs. 6151.98/- with a simple payback period of 2.4 years.

(32) Campus Association Office

Annual energy saving potential of 192.744 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	6	45.36	308.45	3300	10.7
2	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	3	21.384	145.41	360	2.5
3	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	2	126	540	4000	7.4
	Total	11	192.744	993.86	7660	7.7

An investment of Rs. 7660/- for the implementation of the above recommendations would result an energy savings of 192.744 kWh per annum and a financial savings of Rs. 993.86/- with a simple payback period of 7.7 years.

(33)University Guest House & ASC- Guest House

Annual energy saving potential of 13237.82 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	16	672.84	4575.312	8800	1.9
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	22	855.36	5816.4	11000	1.9
3	Retrofitting of existing 2X40 W Ordinary tube lights with 20 W LED Tubes	6	453.6	3084.48	6600	2.1
4	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes	10	95.04	646.272	5000	7.7
5	Retrofitting of existing 2XT5 W Ordinary tube lights with 18 W LED Tubes	12	703.872	4786.33	10800	2.3
6	Retrofitting of existing 11W CFL with 7 W LED lamps.	33	139.104	945.9072	3960	4.2
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	18	9097.6	56405.1	585000	10.3
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	29	1172.88	7975.58	58000	7.3
9	Operation of computers in sleep/shut down mode, when not in use.	2	47.52	323.136	No Investment	
	Total	148	13237.82	84558.52	689160	8.1

An investment of Rs. 6.89 lakh for the implementation of the above recommendations would result an energy savings of 13237.82 kWh per annum and a financial savings of Rs. 84558.52/- with a simple payback period of 8.1 years.

(34) Post Office**Annual energy saving potential of 1153.008 units**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 55 W Ordinary tube lights with 20W LED Tubes.	4	181.44	1233.79	2200	1.8
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	1	49.896	339.3	500	1.5
3	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	6	277.992	1890.35	720	0.8
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	4	168.48	1145.66	8000	7.0
5	Operation of computers in sleep/shut down mode, when not in use.	4	475.2	3231.36		
	Total	19	1153.008	7840.46	11420	1.4

An investment of Rs. 11420/- for the implementation of the above recommendations would result an energy savings of 1153.008 kWh per annum and a financial savings of Rs. 7840.46/- with a simple payback period of 1.4 years.

(35) Employees Co-operative Society

Annual energy saving potential of 1528.84 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	3	45.36	308.45	1650	5.3
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	6	106.92	727.1	3000	4.1
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	3	32.4	220.32	1500	6.8
4	Retrofitting of existing 18 W CFL with 9 W LED lamps.	2	19.44	132.19	260	2.0
5	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	4.32	29.376	120	4.1
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	5	64.8	440.64	10000	22.7
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	1	661.6	4101.92	32500	7.9
8	Operation of computers in sleep/shut down mode, when not in use.	5	594	4039.2		
	Total	26	1528.84	9999.196	49030	4.9

An investment of Rs. 49030/- for the implementation of the above recommendations would result an energy savings of 1528.84 kWh per annum and a financial savings of Rs. 9999.196/- with a simple payback period of 4.9 years.

(36) Security Wing

Annual energy saving potential of 1016.3 units

executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40W Ordinary tube lights with 20W LED Tubes.	6	128.54	873.936	3300	3.8
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	8	228.096	1551.1	4000	2.6
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	3	4.32	29.376	360	12.3
4	Retrofitting of existing 14 W CFL with 7 W LED lamps.	2	6.048	41.1264	220	5.3
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	2	14.256	96.9408	240	2.5
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	9	278.64	1894.75	18000	9.5
7	Operation of computers in sleep/shut down mode, when not in use.	3	356.4	2423.52	No Investment	
	Total	33	1016.3	6910.749	26120	3.7

An investment of Rs. 26120/- for the implementation of the above recommendations would result an energy savings of 1016.3 kWh per annum and a financial savings of Rs. 6910.749/- with a simple payback period of 3.7 years.

(37) Teachers Hostel

Annual energy saving potential of 6271.776 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	27	1632.96	11104.1	14850	1.3
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	41	2045.736	13911.0	20500	1.5
3	Retrofitting of existing 18W CFL with 7 W LED lamps.	1	15.552	105.75	130	1.2
4	Retrofitting of existing 9W CFL with 7 W LED lamps.	14	42.336	287.88	1680	5.8
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	27	1347.192	9160.91	3240	0.4
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	50	712.8	4847.04	100000	20.6
7	Operation of computers in sleep/shut down mode, when not in use.	5	475.2	3231.36		
	Total	165	6271.776	42648.04	140400	3.2

An investment of Rs. 140400/- for the implementation of the above recommendations would result an energy savings of 6271.776 kWh per annum and a financial savings of Rs. 42648.04/- with a simple payback period of 3.2 years.

(38) Health Centre

Annual energy saving potential of 881.712 units

Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	11	173.88	1182.38	6050	5.1
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	23	434.808	2956.7	11500	3.9
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.864	5.875	120	20.4
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	10	272.16	185.61	20000	10.8
	Total	45	881.712	4330.565	37670	8.6

An investment of Rs. 37670/- for the implementation of the above recommendations would result an energy savings of 881.712 kWh per annum and a financial savings of Rs. 4330.565/- with a simple payback period of 8.6 years.

(39) A Type Quarters

Annual energy saving potential of 5751.624 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 36 W Ordinary tube lights with 18W LED Tubes.	22	1254.52	8530.8	11000	1.3
2	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	4	69.12	470.016	2000	4.3
3	. Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	22	627.264	4265.4	2640	0.6
4	Retrofitting of existing 9 W CFL with 7 W LED lamps.	40	101.52	690.336	4800	7
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	34	2203.2	14981.8	68000	4.5
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	2	1020.8	6328.96	65000	10.2
7	Operation of computers in sleep/shut down mode, when not in use.	4	475.2	3231.36		
8	Total	128	5751.624	38498.67	153440	3.9

An investment of Rs. 1.53 Lakh for the implementation of the above recommendations would result an energy savings of 5751.624 kWh per annum and a financial savings of Rs. 38498.67/- with a simple payback period of 3.9 years.

(40) B Type Quarters

Annual energy saving potential of 5967.48 units

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	30	1496.88	10178.8	15000	1.5
2	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	8	228.096	1551.053	960	0.6
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	12	57.024	387.76	1440	3.5
4	Retrofitting of existing 9 W CFL with 7 W LED lamps.	16	29.808	202.6944	1920	9.5
5	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	25	1010.88	6873.98	50000	7.3
6	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	5	2432	15078.4	162500	10.7
7	Operation of computers in sleep/shut down mode, when not in use.	6	712.8	4847.04		
	Total	102	5967.488	39119.73	231820	5.9

An investment of Rs. 2.31 Lakh for the implementation of the above recommendations would result an energy savings of 5967.488 kWh per annum and a financial savings of Rs. 39119.73/- with a simple payback period of 5.9 years.

(41PG Men's Hostel)**Energy saving potential of 15375.18 Units**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	11	172.8	1175.04	5500	4.7
2	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2X18W LED Tubes.	2	60.48	411.264	900	2.2
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	52	3588.94	24405.2	26000	1.1
4	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	66	4205.52	28597.5	7920	0.3
5	Retrofitting of existing 11 W CFL with 7 W LED lamps.	9	42.336	287.884	1080	3.8
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	128	7186.3	48867	250000	5.2
7	Operation of computers in sleep/shut down mode, when not in use.	1	118.8	807.84		
	Total	269	15375.18	104551.7	291400	2.7

An investment of Rs. 2.91 Lakh for the implementation of the above recommendations would result an energy savings of 15375.18 kWh per annum and a financial savings of Rs. 1.04 Lakh with a simple payback period of 2.7 years.

(42) Research Men's Hostel

Energy saving potential of 13407.52 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	112	2410.32	16390.17	56000	3.4
2	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes	11	551.88	3752.78	6050	1.6
3	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2X18W LED Tubes.	1	34.56	235.008	900	3.8
4	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	69	2908.22	19775.9	34500	1.7
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	12	684.288	4653.158	1440	0.3
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	2	12.096	82.2528	240	2.9
7	Retrofitting of existing 9W CFL with 7 W LED lamps.	20	93.6	636.48	2400	3.8
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	120	6712.56	45645.4	208000	4.6
	Total	347	13407.52	91171.15	309530	3.3

An investment of Rs.3.09 Lakh for the implementation of the above recommendations would result an energy savings of 13407.52 kWh per annum and a financial savings of Rs. 91171.15/- with a simple payback period of 3.3 years.

(43) IMK Law and Journalism**Energy saving potential of 10226.5 kWh per year**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	92	3817.8	25961.04	50600	1.9
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	6	635.04	4318.27	6600	1.5
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	92	4433.616	30148.6	46000	1.5
4	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	2	199.584	1357.2	2000	1.5
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	2	85.536	581.645	240	0.4
6	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	49	597	4059.6	24500	6.0
7	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2 x 18 W LED Tubes.	9	378	2570.4	8100	3.2
8	Retrofitting of existing 18 W CFL with 7 W LED lamps.	18	34.992	237.95	2340	9.8
9	Retrofitting of existing 11 W CFL with 7 W LED lamps.	26	44.928	305.5104	3120	10.2
10	Retrofitting of existing 9 W CFL with 7 W LED lamps.	22	58.752	399.51	2640	6.6

11	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	136	5229.36	35559.6	272000	5.5
12	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	12	5236	32463.2	421500	12.9
13	Operation of computers in sleep/shut down mode, when not in use.	53	6296.4	42815.5	No Investment	
Total		296	10226.5	69540.22	143500	2

An investment of Rs.1.43 Lakh for the implementation of the above recommendations would result an energy savings of 10226.5 kWh per annum and a financial savings of Rs. 69540.22 with a simple payback period of 2 years.

(44) USIC Workshop

Energy saving potential of 869.4 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	21	506.52	3444.34	11550	3.4
2	Retrofitting of existing 2x40 W Ordinary tube lights with 2x20 W LED Tubes.	3	181.44	1233.79	3300	2.7
3	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	8	181.44	1233.79	16000	13
Total		32	869.4	5911.92	30850	5.2

An investment of Rs. 30850/- for the implementation of the above recommendations would result an energy savings of 869.4 kWh per annum and a financial savings of Rs. 5911.92/- with a simple payback period of 5.2 years.

(45) ATM

Energy saving potential of 2375.2 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	1	2375.2	14726.2	32500	2.2
	Total	1	2375.2	14726.2	32500	2.2

An investment of Rs. 32500/- for the implementation of the above recommendations would result an energy savings of 2375.2 kWh per annum and a financial savings of Rs. 14726.2/- with a simple payback period of 2.2 years.

(46) CGIST**Energy saving potential of 12544.99 kWh per year**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	13	687.96	4678.12	7150	1.5
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	5	249.48	1696.5	2500	1.5
3	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	3	128.30	872.46	360	0.4
4	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	27	382.32	2599.77	13500	5.2
5	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2 x 18 W LED Tubes.	10	302.4	2056.32	9000	4.4
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	3	15.552	105.75	360	3.4
7	Retrofitting of existing 9 W CFL with 7 W LED lamps.	4	12.096	82.2528	480	5.8
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	33	1496.88	10178.8	66000	6.5
9	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	7	4161.6	25429.9	280000	11
10	Operation of computers in sleep/shut down mode, when not in use.	43	5108.4	34737.1		
	Total	148	12544.99	82436.97	379350	4.6

An investment of Rs. 3.79 Lakh for the implementation of the above recommendations would result an energy savings of 12544.99 kWh per annum and a financial savings of Rs. 82436.97/- with a simple payback period of 4.6 years.

(47) PG Women's Hostel

Energy saving potential of 10312.85 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	28.512	193.88	120	0.6
2	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	189	3153.6	21444.48	94500	4.4
3	Retrofitting of existing 2 x 25 W Ordinary tube lights with 2 x 18 W LED Tubes.	5	112.32	763.776	4500	5.9
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	6	31.104	211.50	720	3.4
5	Retrofitting of existing 9 W CFL with 7 W LED lamps.	63	155.95	217.38	1680	7.7
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	120	6712.56	45645.4	208000	4.6
7	Operation of computers in sleep/shut down mode, when not in use.	1	118.8	807.84		
	Total	385	10312.85	69284.26	309520	4.4

An investment of Rs. 3.09 Lakh for the implementation of the above recommendations would result an energy savings of 10312.85 kWh per annum and a financial savings of Rs. 69284.26/- with a simple payback period of 4.4 years.

(48) Research & M Phil Women's Hostel

Energy saving potential of 8600.248 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	10	604.8	4112.64	5500	1.3
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	6	342.144	2326.6	3000	1.3
3	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes.	2	199.58	1357.2	2000	1.5
4	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	87	4048.7	27531.2	10440	0.4
5	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	38	477.36	3246.048	19000	5.9
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	35	154.656	1051.66	4200	4
7	Retrofitting of existing 9 W CFL with 7 W LED lamps.	4	6.048	41.1264	480	11.7
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	44	2766.96	18815.3	88000	4.7
	Total	226	8600.248	58481.77	132620	2.2

An investment of Rs. 1.32 Lakh for the implementation of the above recommendations would result an energy savings of 8600.248 kWh per annum and a financial savings of Rs. 58481.77/- with a simple payback period of 2.2 years.

(49) BUS Garage

Energy saving potential of 49.68 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	6	45.36	308.448	3300	10.7
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	1	4.32	29.376	500	17
	Total	7	49.68	337.824	3800	11.2

An investment of Rs. 3800/- for the implementation of the above recommendations would result an energy savings of 49.68 kWh per annum and a financial savings of Rs. 337.824/- with a simple payback period of 11.2 years.

(50) Rest Room

Energy saving potential of 254.88 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	4	120.96	822.52	2200	2.7
2	Retrofitting of existing 36W Ordinary tube lights with 18 W LED Tubes.	1	28.512	193.9	500	2.6
3	Retrofitting of existing 11 W CFL with 7 W LED lamps	2	1.728	11.75	240	20.4
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	4	103.68	705.024	8000	11.3
	Total	11	254.88	1733.194	10940	6.3

An investment of Rs.10940/- for the implementation of the above recommendations would result an energy savings of 254.88 kWh per annum and a financial savings of Rs. 1733.194/- with a simple payback period of 6.3 years.

(51) She Toilet

Energy saving potential of 2.16 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	1	2.16	14.68	500	24.5
	Total	1	2.16	14.68	500	24.5

An investment of Rs. 500/- for the implementation of the above recommendations would result an energy savings of 2.16 kWh per annum and a financial savings of Rs. 14.68/- with a simple payback period of 24.5 years.

(52)Chemistry Block**Energy saving potential of 24947.6 kWh per year**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	227	5201.28	35368.7	124850	3.5
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	25	1814.4	12337.9	27500	2.2
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	35	1040.668	7076.8	17500	2.5
4	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	40	237.6	1615.68	20000	12.4
5	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.864	5.8752	120	20.4
6	Retrofitting of existing 9 W CFL with 7 W LED lamps.	1	0.864	5.8752	120	20.4
7	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	105	2617.92	17801.9	142000	8
8	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	22	11064	68596.8	670000	9.7
9	Operation of computers in sleep/shut down mode, when not in use.	25	2970	20196	No Investment	
	Total	481	24947.6	163005.5	1002090	6.1

An investment of Rs. 1.00 Lakh for the implementation of the above recommendations would result an energy savings of 24947.6 kWh per annum and a financial savings of Rs. 1.63 Lakh with a simple payback period of 6.1 years.

(53) Bio- Informatics Dept**Energy saving potential of 28801.73 kWh per year**

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes	25	559.44	3804.2	13750	3.6
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	17	1118.88	7608.38	18700	2.5
3	Retrofitting of existing 2 x 36 W Ordinary tube lights with 2 x 18 W LED Tubes	17	898.13	6107.3	17000	2.8
4	Retrofitting of existing 25W Ordinary tube lights with 18 W LED Tubes.	29	138.24	940.032	14500	15.4
5	Retrofitting of existing 2x25 W Ordinary tube lights with 18 W LED Tubes.	61	155.52	1057.54	27450	26
6	Retrofitting of existing 11 W CFL with 7 W LED lamps.	5	11.232	76.37	600	7.9
7	Retrofitting of existing 9 W CFL with 7 W LED lamps.	2	2.592	17.62	240	13.6
8	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	19	447.1	3040	38000	12.5
9	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	26	12664	78516.8	711000	9
10	Operation of computers in sleep/shut down mode, when not in use.	77	12806.6	87085.2	No Investment	
	Total	278	28801.73	188253.4	841240	4.4

An investment of Rs. 8.41 lakh for the implementation of the above recommendations would result an energy savings of 28801.73 kWh per annum and a financial savings of Rs. 1.88 lakh, with a simple payback period of 4.4 years.

(54) Seed Bank

Energy saving potential of 331.344 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	3	90.72	616.896	1650	2.7
2	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	12	97.2	660.96	6000	9.1
3	Retrofitting of existing 11 W CFL with 7 W LED lamps.	4	7.344	49.93	480	9.6
4	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	6	136.08	925.344	12000	13
	Total	25	331.344	2253.13	20130	8.9

An investment of Rs. 20130/- for the implementation of the above recommendations would result an energy savings of 331.344 kWh per annum and a financial savings of Rs. 2253.13/-, with a simple payback period of 8.9 years.

(55) CEIB**Energy saving potential of 6732.856 kWh per year**

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	14	325.08	2210.5	7700	3.5
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	8	199.584	1357.2	4000	3
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	16	69.12	470.016	8000	17
4	Retrofitting of existing 2X25 W Ordinary tube lights with 18 W LED Tubes.	8	199.584	1357.2	3600	2.9
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	7.128	48.47	120	2.5
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	17	266.6	1812.88	34000	18.8
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	12	2672	16566.4	428000	25.8
8	Operation of computers in sleep/shut down mode, when not in use.	18	2993.76	20357.6	No Investment	
	Total	94	6732.856	44180.27	485420	10.9

An investment of Rs. 4.8 lakh for the implementation of the above recommendations would result an energy savings of 6732.856 kWh per annum and a financial savings of Rs. 44180.27/-, with a simple payback period of 10.9 years.

(56) Botany old Pump House

Energy saving potential of 40.608 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	2	8.64	58.752	1000	17
2	Retrofitting of existing 14 W CFL with 7W LED lamps.	4	6.048	41.12	440	10.7
3	Retrofitting of existing inefficient and old Fan with 5 star rated	1	25.92	176.256	2000	11.3
	Total	7	40.608	276.128	3440	12.4

An investment of Rs. 3440/- for the implementation of the above recommendations would result an energy savings of 40.608 kWh per annum and a financial savings of Rs. 276.128/-, with a simple payback period of 12.4 years.

(57) Science Block II (Dept.of Geology, Mathematics, Statistics)

Energy saving potential of 53365.97 kWh per year

Executive Summary						
Sl. No	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20 W LED Tubes.	354	13331.64	90655	194700	2.1
2	Retrofitting of existing 2 X 40 W Ordinary tube lights with 20 W LED tubes.	39	2978.64	20254.76	42900	2.1
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	78	3079.296	20939.2	39000	1.8
4	Retrofitting of existing 2 X36 W Ordinary tube lights with 2 x 18 W LED Tubes.	4	242.352	1648	4000	2.4
5	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	26	289.44	1968.192	13000	6.6
7	Retrofitting of existing 11 W CFL with 7 W LED lamps.	7	26.784	182.1268	840	4.6
9	Retrofitting of existing inefficient and old Fan with 5 star rated fan	185	5768.52	39225.9	370000	9.4
10	Retrofitting of existing ordinary and old Air Conditioners with inverter Air Conditioners	22	12015.2	74494.2	717500	9.6
11	Operation of computers in sleep/shut down mode, when not in use.	94	15634.1	106312	No Investment	
	Total	809	53365.97	355679.4	1381940	3.8

An investment of Rs. 13 lakh for the implementation of the above recommendations would result an energy savings of 53365.97 kWh per annum and a financial savings of Rs. 3.5 lakh, with a simple payback period of 3.8 years.

(58) Arts Block I (Politics Science, Sociology, History, Economics)

Energy saving potential of 25772.82 kWh per year

Sl. No	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 2 X 25 W Ordinary tube lights with 2 x 18 W LED tubes.	18	544.32	3701.38	8100	2.2
2	Retrofitting of existing 2 X36 W Ordinary tube lights with 2 x 18 W LED Tubes.	8	798.336	5428.7	8000	1.5
3	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	241	3414.96	23221.728	120500	5.2
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	9	31.04	211.5072	1080	5.1
5	Retrofitting of existing 9 W CFL with 7 W LED lamps.	6	18.144	123.37	720	5.8
6	Retrofitting of existing inefficient and old Fan with 5 star rated fan	136	5955.12	41685.84	272000	6.5
7	Retrofitting of existing ordinary and old Air Conditioners with inverter Air Conditioners	5	2703.2	16759.8	214000	12.7
8	Operation of computers in sleep/shut down mode, when not in use.	74	12307.7	83692.2	No Investment	
	Total	497	25772.82	174824.5	624400	3.7

An investment of Rs. 6.24 lakh for the implementation of the above recommendations would result an energy savings of 25772.82 kWh per annum and a financial savings of Rs. 1.74 lakh, with a simple payback period of 3.7 years.

(59) Himavathy Pump House

Energy saving potential of 87.696 kWh per year

Sl. No	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 2 X 40 W Ordinary tube lights with 2 x 20 W LED tubes.	2	60.48	411.264	2200	5.3
2	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	1	14.256	96.9	500	5.2
3	Retrofitting of existing inefficient and old Fan with 5 star rated fan	1	12.96	88.128	2000	22.7
	Total	4	87.696	596.292	4700	7.8

An investment of Rs. 4700/- for the implementation of the above recommendations would result an energy savings of 87.696 kWh per annum and a financial savings of Rs. 596.292/-, with a simple payback period of 7.8 years.

(60) SICC**Energy saving potential of 19028.88 kWh per year**

Sl. No.	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 25 W Ordinary tube lights with 18W LED Tubes.	139	1097.28	7461.504	65500	9.3
2	Retrofitting of existing 11 W CFL with 7 W LED lamps.	31	34.56	235.008	3720	15.8
3	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	31	1114.56	7579.01	62000	8.2
4	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	28	13622.4	84458.9	947000	11.2
5	Operation of computers in sleep/shut down mode, when not in use.	19	3160.08	21488.5		
	Total	248	19028.88	121222.9	1078220	8.8

An investment of Rs. 10 lakh for the implementation of the above recommendations would result an energy savings of 19028.88 kWh per annum and a financial savings of Rs. 1.21 lakh, with a simple payback period of 8.8 years.

(61) Physics**Energy saving potential of 14758.13 kWh per year**

Sl. No	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20 W LED tubes.	17	597.24	4061.2	9350	2.3
2	Retrofitting of existing 2X 40 W Ordinary tube lights with 2 X 20 W LED tubes.	4	423.36	2875.85	4400	1.5
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED tubes.	16	235.224	1599.5	8000	5
4	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	66	297.78	2024.95	33000	16.3
5	Retrofitting of existing 11 W CFL with 7 W LED lamps.	1	0.864	5.875	120	20.4
6	Retrofitting of existing ICL with 7 W LED lamps.	2	14.256	96.941	240	2.5
7	Retrofitting of existing inefficient and old Fan with 5 star rated fan	40	806.287	5482.75	80000	14.6
8	Retrofitting of existing ordinary and old Air Conditioners with inverter Air Conditioners	16	8890.4	55120.5	514000	9.3
9	Operation of computers in sleep/shut down mode, when not in use.	21	3492.72	23750.5	No Investment	
	Total	183	14758.13	95018.07	649110	6.8

An investment of Rs. 6.49 lakh for the implementation of the above recommendations would result an energy savings of 14758.13 kWh per annum and a financial savings of Rs. 95018.07/-, with a simple payback period of 6.8 years.

(62) Manuscript Library**Energy saving potential of 11259.26 kWh per year**

Sl. No	Description of Work	No. of Equipment's	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required. (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20 W LED tubes.	54	2857.68	19432	29700	1.5
2	Retrofitting of existing 2X 40 W Ordinary tube lights with 2 X 20 W LED tubes.	14	1345.68	9150.62	15400	1.7
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED tubes.	2	85.536	581.6	1000	1.7
4	Retrofitting of existing 25 W Ordinary tube lights with 18 W LED Tubes.	6	90.72	616.896	3000	4.9
5	Retrofitting of existing 11 W CFL with 7 W LED lamps.	2	5.184	35.25	240	6.8
6	Retrofitting of existing 9 W CFL with 7 W LED lamps.	3	2.592	17.62	360	20.4
7	Retrofitting of existing 2 X 25 W Ordinary tube lights with 2 X 18 W LED Tubes.	33	997.92	6785.86	14850	2.2
8	Retrofitting of existing ICL with 7 W LED lamps.	13	92.664	630.12	1560	2.5
9	Retrofitting of existing inefficient and old Fan with 5 star rated fan	37	1678.32	11412.6	74000	6.5
10	Retrofitting of existing ordinary and old Air Conditioners with inverter Air Conditioners	4	1940.8	12033	128000	10.6
11	Operation of computers in sleep/shut down mode, when not in use.	13	2162.16	14702.7	No Investment	
	Total	181	11259.26	75398.27	268110	3.5

An investment of Rs. 2.68 lakh for the implementation of the above recommendations would result an energy savings of 11259.26 kWh per annum and a financial savings of Rs. 75398.27/-, with a simple payback period of 3.5 years.

(63) Opto Electronics

Energy saving potential of 25051.83 kWh per year

Executive Summary						
Sl. No.	Description of Work	No. of Equipments	Annual Energy Saving potential (kWh)	Annual financial saving (in Rupees)	Investment Required (in Rupees)	Payback Period in years
1	Retrofitting of existing 40 W Ordinary tube lights with 20W LED Tubes.	80	2155.628	14658	44000	3
2	Retrofitting of existing 2 x 40 W Ordinary tube lights with 20W LED Tubes.	48	1887.762	12837	52800	4.1
3	Retrofitting of existing 36 W Ordinary tube lights with 18 W LED Tubes.	7	349.272	2375	3500	1.5
4	Retrofitting of existing 11 W CFL with 7 W LED lamps.	5	37.2	252.96	600	2.4
5	Retrofitting of existing inefficient Incandescent Bulb of 40 W with 7 W LED lamps	1	7.128	48.47	120	2.5
6	Retrofitting of existing inefficient and old Fan with 5 star rated Fans	74	3195	21725	148000	6.8
7	Retrofitting of inefficient and old individual Air conditioners with inverter Air conditioners.	25	12097.6	75005.1	810500	10.8
8	Operation of computers in sleep/shut down mode, when not in use.	32	5322.24	36191.2	No Investment	
	Total	272	25051.83	163092.7	1059520	6.4

An investment of Rs. 10 lakh for the implementation of the above recommendations would result an energy savings of 25051.83 kWh per annum and a financial savings of Rs. 1.63 lakh, with a simple payback period of 6.4 years.

6. Diesel Generator system.

One 250 kVA Diesel Generator set is installed, for giving supply to the building of Sophisticated Instrumentation & Computation Centre Kariavattom.

Air intake of the DG set is seen 44 degree Celsius instead of atmospheric temperature 29 degree Celsius. Hot air of radiator output returned back to air intake side. This DG set is installed in a sheet roofed room. This Diesel engine is subject to thermosyphon, which is due to collection of hot air in the roof cavity fed by the radiator and silencer. Due to working in the hot atmosphere, engine efficiency reduces considerably. Hence, hot air can be driven out by providing suitable ducts for radiator output. Then the hot air can be sent outside of the generator room through the roof. Exhaust silencer and exhaust pipes of engines are not insulated against feeding heat towards turbo inter cooler. Hence it is to be insulating using Rock wool/Glass wool. Exhaust silencer is also needs to be insulated for better efficiency.



Top side of the DG Set



Top side of the DG Set



Hot air passes through this portion

Energy Saving Measures for DG Sets

1. Ensure steady load conditions on the DG set, and provide cold, dust free air at intake (use of air washers for large sets, in case of dry, hot weather, can be considered).
2. Improve air filtration.
3. Ensure fuel oil storage, handling and preparation as per manufacturers' guidelines/oil company data.
4. Consider fuel oil additives in case they benefit fuel oil properties for DG set usage.
5. Calibrate fuel injection pumps frequently.
6. Ensure compliance with maintenance checklist.
7. Ensure steady load conditions, avoiding fluctuations, imbalance in phases, harmonic loads.
8. In case of a base load operation, consider waste heat recovery system adoption for steam generation or refrigeration chiller unit incorporation. Even the Jacket Cooling Water is amenable for heat recovery, vapour absorption system adoption.
9. In terms of fuel cost economy, consider partial use of biomass gas for generation. Ensure tar removal from the gas for improving availability of the engine in the long run. (Biogas may be generated from the degradable waste generated at the college campus)
10. Carryout regular field trials to monitor DG set performance, and maintenance planning as per requirements.

7. Street Lighting

Energy Efficiency in Street Lighting of Kariavattom Campus, Thiruvananthapuram.

Energy Audit was conducted by ESCOT wing of KSEBL in the area of Street Lights of University of Kerala, Kariavattom Campus premises, Thiruvananthapuram. The existing street lights do not have sufficient illumination, which consists of High Mast, Ordinary Fluorescent tube lights, Mercury Vapour, Sodium Vapour and Metal Halide Lights. Energy efficient Fluorescent Tube Lights (T5) are used in the campus buildings which are facing the road.

Some of the street lights are covered by the branches of trees, so that the present illumination level is not satisfactory and also, some of the existing street light supporting poles are not mechanically strong and not aesthetic.

All street lights are maintained by University of Kerala.

Sl. No	Type of Fixture	No. Of Fixtures	Proposed LED Fixtures (W)
1	Sodium Vapour	12	20
2	CFL	197	20
3	High Mast	12	18

- 1. Present Annual Consumption of all Street Lights = 62766 units**
- 2. Annual Consumption after replacement with LED Lights = 33283.8 units**
- 3. Annual Energy Savings in Rupees = Rs. 226329.46**
- 4. Total Investment = Rs. 1240650**
- 5. Pay back = 1240650/226329.46 = 5.4 years**

8. Energy Efficiency in water Pumping System

WATER PUMPING SYSTEM

There are three pump houses in the Kariavattom campus. They are

- (1) Hymavathy Pump House
- (2) Green Pump House
- (3) Botany Pump House

Sl No	Name of Pump House	Capacity (hp)	Nos	Type	No. of working hours per day	Consumption (kWh)
1	Hymavathy Pump House	15	2	Submersible	7	1879.92
2	Green Pump House	15	2	Submersible	1	268.56
3	Botany Pump House	20	3	Monoblock	7	3759.84

Ordinary submersible pumps are filled with radial flow impeller having efficiency range 35 to 50%. Whereas submersible mixed flow impeller pumps have efficiency up to 80%. (bronze / stainless steel impeller). Existing radial flow impeller submersible pumps are to be replacing with mixed flow stainless steel impeller.

Maintain the water tanks, pipe lines and taps are in the leak proof condition. Install water meter in each building water line and monitor the consumption every month. If any abnormal water consumption seen, find the reason and control it.

During the Energy Audit it is seen that the pumps installed in the University of Kerala, Kariavattom Campus are not very old. Whenever the existing pumps damaged at that time that may be replaced with star rated Energy efficient pump. It is seen that the above process is economical.

Energy Conservation Opportunities in Pumping Systems

1. Ensure availability of basic instruments at pumps like pressure gauges, flow meters.
2. Operate pumps near best efficiency point.
3. Modify pumping system and pumps losses to minimize throttling.

4. Adapt to wide load variation with variable speed drives or sequenced control of multiple units.
5. Stop running multiple pumps - add an auto-start for an on-line spare or add a booster pump in the problem area.
6. Use booster pumps for small loads requiring higher pressures.
7. Repair seals and packing to minimize water loss by dripping.
8. Balance the system to minimize flows and reduce pump power requirements.
9. Avoid pumping head with a free-fall return (gravity); Use siphon effect to advantage:
10. Conduct water balance to minimise water consumption
11. In multiple pump operations, carefully combine the operation of pumps to avoid throttling
12. Provide booster pump for few areas of higher head
13. Replace old pumps by energy efficient pumps
14. In the case of over designed pump, provide variable speed drive, or downsize / replace impeller or replace with correct sized pump for efficient operation.
15. Reduce system resistance by pressure drop assessment and pipe size optimisation

9. Illumination Level

During the audit, it has been found that the building interior lighting requirement (lux level) is not as per the standard lux levels. The lux level modification is possible at the time of implementation stage of Energy Audit recommendations. The lux level in each area of the buildings is given in the report of the each building.

10. Methodology for verification of Energy Savings

Verification of Energy Savings can be done by monitoring monthly energy consumption, **feeder wise**.

11.Tariff and electricity charges

The electric supply at Kariavattom university campus is charged under HT II(A) General of the latest tariff order (wide order no. 1007/FRT/KSERC/2016 dated 17-04-2017) of the Kerala state electricity regulatory commission the tariff structure of HT II(A) general is given in table 5.

As per the Time-Of-Day (TOD) tariff, electricity consumption for normal period (6.00 hours to 18.00 hours) will be charged at full rates 100% , peak period (18.00 hours to 22.00 hours) will be charged at 150% of the above rate and off peak period (22.00 hours to 6.00 hours) will be charged 75% of the above rates.

Table 1-Tariff structure-HT II (A) General

HIGH TENSION – II – GENERAL (A)	
(A) Demand Charges(Rs./kVA of billing demand/month	350
(B)Energy Charge (Paise/kWh)	540

Since, the tariff rate is low during off peak hours, it is advised to shift non essential consumption from the peak and normal hours to off peak hours.

Table -2 Maximum Demand & Contract Demand

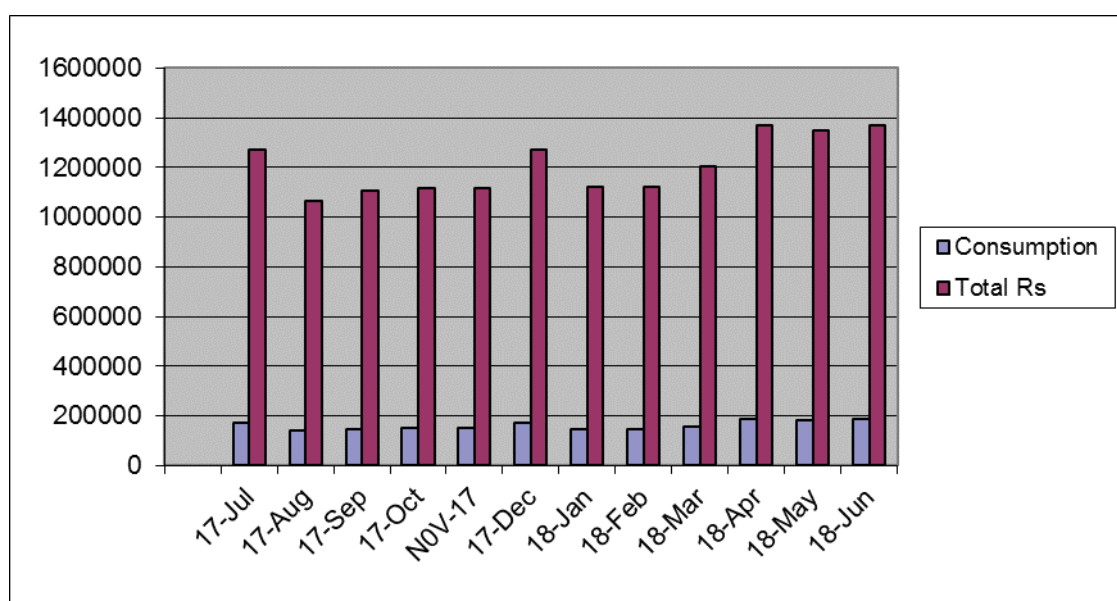
SI No	Month	Maximum Demand (kVA)	Contract Demand (CD) (kVA)	Amount for the actual MD (Rs.)	Amount for 75% CD (Rs.)	Difference (Rs.)
1	Jul-17	465.42	700	162897	183750	20853
2	Aug-17	433.08	700	151578	183750	32172
3	Sep-17	445	700	155750	183750	28000
4	Oct-17	408.75	700	143062.5	183750	40687.5
5	NOV-17	494.17	700	172959.5	183750	10790.5
6	Dec-17	446.83	700	156390.5	183750	27359.5
7	Jan-18	430.14	700	150549	183750	33201
8	Feb-18	423.19	700	148116.5	183750	35633.5
9	Mar-18	426.88	700	149408	183750	34342
10	Apr-18	459.61	700	160863.5	183750	22886.5
11	May-18	474.31	700	166008.5	183750	17741.5
12	Jun-18	522.48	700	182868	183750	882
Total		5429.86	8400	1900491	2205000	304549

12. ENERGY BALANCE

The monthly energy consumption in kWh for the past 12 months are shown in Table-3.

Table – 3: Energy Consumption pattern

SI No	Month	Consumption (kWh)	Energy Charges (Rs.)	Fixed Charge (Rs.)	Total Rs
1	Jul-17	173075	904317	196000	1100317
2	Aug-17	140375	739311	183750	923061
3	Sep-17	148000	775495	183750	959245
4	Oct-17	151300	779864	183750	963614
5	NOV-17	153200	781748	183750	965498
6	Dec-17	174100	915507.56	183750	1099257
7	Jan-18	145542	791967	183750	975717
8	Feb-18	145542	791967	183750	975717
9	Mar-18	157493	860302	183750	1044052
10	Apr-18	185790	985661	198100	1183761
11	May-18	181250	954928.78	210350	1165278.78
12	Jun-18	185830	980123.96	200900	1181023.96
Total		1941497	10261192.3		12536541.7



13. Electrical Safety & Renewable Energy and Rain water Harvesting

a) Electrical Safety

It was found during Energy Audit, Electrical safety needs more attention. Recommendations are given in reports of each building.

b) Renewable Energy and Rain water Harvesting

The roof tops of the Buildings of University of Kerala, Kariavattom Campus premises are found suitable for the installation of solar power plants.

Provisions for Rain water harvesting facility are already done, partially and hence, it is recommended that the same may be executed fully.

14. References

1. Central Electricity Authority (CEA) Regulations & Supply Code 2014
2. Institute of Electrical and Electronics Engineers (IEEE) standards.
3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standards. Ventilation for Indoor Air Quality. 2013
4. Bureau of Energy Efficiency (BEE) guide lines and Energy Management Centre web site.