

ENERGY AUDIT – 2021-22



THUNCHAN MEMORIAL GOVT COLLEGE

TIRUR, MALAPPURAM

EXECUTED BY



ATHUL ENERGY CONSULTANTS PVT LTD

4th FLOOR, CAPITAL LEGEND BUILDING,
KORAPPATH LANE, ROUND NORTH, THRISSUR-680020

Ph: +91 7356111990-6 Web: www.athulenergy.com E-Mail: info@athulenergy.com

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PREFACE

Every institution should be imparting knowledge about the campus environment and its surroundings through activities that follows the principles of sustainability. An energy audit is essential first step to reduce energy cost and greenhouse emissions. Audit is defined as a systematic and implement examination of data statements, records, operations and performance of an enterprise for a purpose. Energy audits is a systematic study or survey to identify how energy being used in its own facility. And identifying the energy savings opportunities in the building Behavioural Change through the student education can provide greatest benefit at least cost. Even small savings in each house holds make dramatic change in the society and for nation. The idea of energy conservation and sustainability will be percolated to society through students will have long standing effect and successful too.

This report is compiled by the BEE Certified Energy Auditor along with the project engineers who are experienced in the field of energy, environment and management. The student volunteers made a mammoth contribution with data collection and preparing an initial skeleton for the report.

ACKNOWLEDGEMENTS

We express our sincere gratitude to the **Thunchan Memorial Govt. College, Thirur** for giving us an opportunity to carry out the project of Energy Audit. We are extremely thankful to all the staffs for their support to carry out the studies and for input data, and measurements related to the project of energy audit.

1 Dr. Ajith MS Principal

Also mentioning our Energy audit team members for successfully completing the assignment in time and making their best efforts to add value.

ENERGY AUDIT TEAM

1	Mr. Santhosh A	Accredited Energy Auditor No – AEA 0275
2	Mr. Harikrishnan K	Project Engineer
3	Ms. Neema Joy P	Project Engineer
4	Mr. Muhammed Jasim	Intern

Yours faithfully




Managing Director
Athul Energy Consultants Pvt Ltd

EXECUTIVE SUMMARY

I. ENERGY SAVING PROPOSALS:

TABLE 1: EXECUTIVE SUMMARY –ENERGY

Sl. No	Energy conservation measures	Annual Energy Savings	Annual Financial Savings	Investment	Simple payback period
		kWh	Rs	Rs	Months
1	Replacement of Ceiling fans(70W) with BLDC fans 5 star rated(28W) – 170 no's	11,819	86,791	595,000	82
2	Replacement of Fluorescent lights T12(40W)-53 no's and T8(36W)-56 no's with LED 20W	2,054	14,685	27,250	22
Total Savings		13,873	1,01,475	6,22,250	74

II. AUDIT SUMMARY – ACTIONS

The actionable summary of the audit report is given in the table below.

TABLE 2: ENERGY AUDIT SUMMARY – ACTIONS

Sl No:	Particulars	Location	Action to be taken	Remarks
1	Energy efficiency – Replacement of ceiling fans with BLDC fans.	Office, staff rooms, Classrooms, Hostel	Change the existing old ceiling fans with BLDC fans	Power Consumption will get reduced
2	Energy efficiency – Replacement of fluorescent lights with LED lights.	Office, faculty rooms, laboratories Sections and Hostel.	Change the existing lights with LED lights.	Power Consumption will reduce.
3	Energy consumption – Set temperature of AC in between 24 – 27 °C.	Principal room and other air-conditioned rooms.	Change the temperature using the remote and switch on the fan for comfort.	Power Consumption will get reduced.

III. PRESENT ANNUAL ENERGY CONSUMPTION

The present annual energy consumption has been analysed in table below

➤ **COLLEGE**

TABLE 3: PRESENT ANNUAL ENERGY CONSUMPTION- COLLEGE

Particulars	Unit	Quantity	Gross calorific value (kCal)	Million kCal (Toe)	Percentage of distribution (%)
Electricity (KSEBL)	kWh	13876	860	1.19	68
Petrol	Kg	22.5	7875	0.02	1
LPG	Kg	511.2	10500	0.54	31
Total				1.75	100

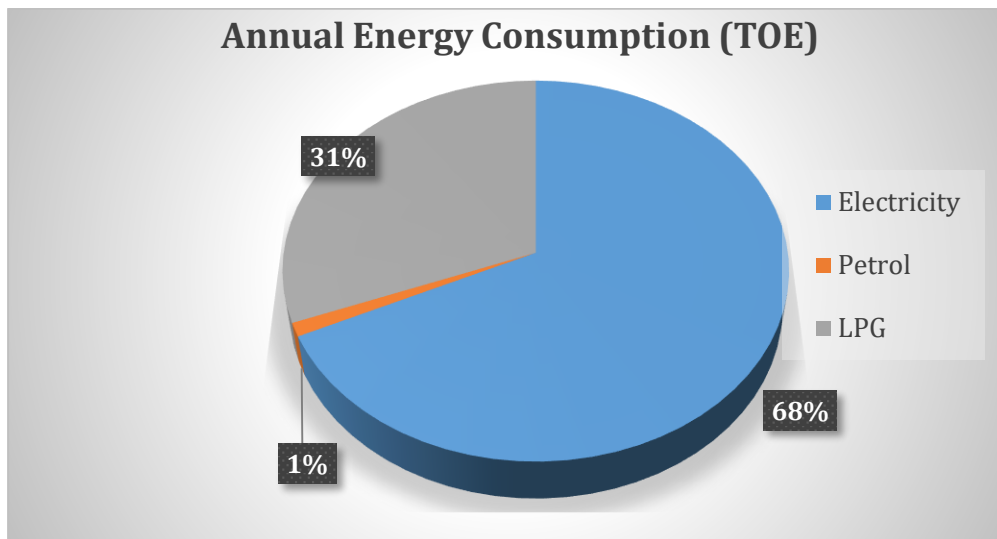


FIGURE 1: ANNUAL ENERGY CONSUMPTION - COLLEGE

➤ **LADIES HOSTEL**

TABLE 4: PRESENT ANNUAL ENERGY CONSUMPTION- LADIES HOSTEL

Particulars	Unit	Quantity	Gross calorific value (kCal)	Million kCal (Toe)	Percentage of distribution (%)
Electricity (KSEBL)	kWh	4009	860	0.34	39
LPG	kg	426	10500	0.45	50
Wood	kg	278	3500	0.10	11
Total		4713		0.89	100

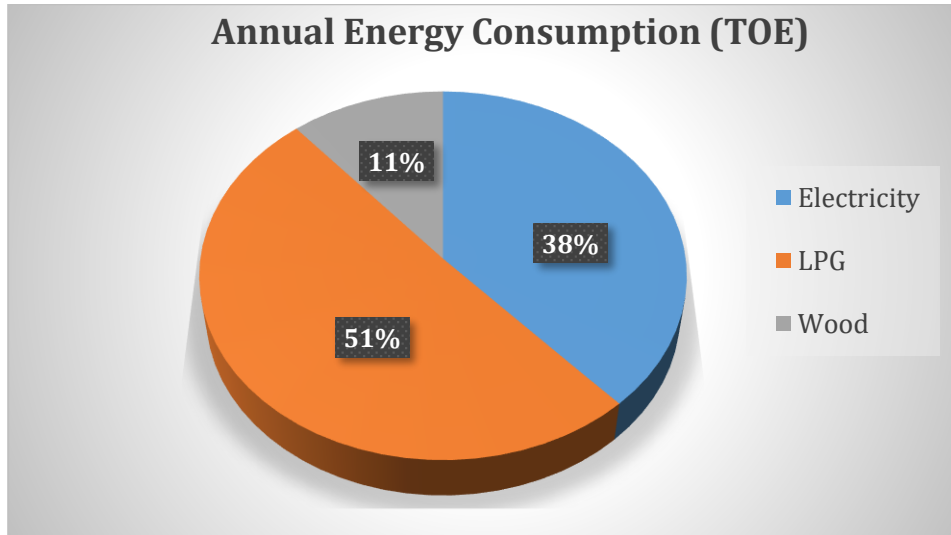


FIGURE 2: ANNUAL ENERGY CONSUMPTION - LADIES HOSTEL



IV. ENERGY PERFORMANCE INDEX (EPI)

EPI was based on the energy consumption in Apr 2021- Mar 2022. The projected energy consumption after the implementation of energy saving proposals in the college is given in the table below.

TABLE 5: ENERGY PERFORMANCE INDEX

Energy Performance	Unit	Present Consumption	Projection
Annual Electricity Consumption	kWh	13876	3179
Annual LPG Consumption	kg	511	511
Annual Petrol Consumption	kg	23	23
Energy Performance Index	TOE/m ²	0.00077	0.00036
Specific Energy Consumption	TOE/Head	0.00189	0.00089
Annual Energy Cost	Rs/Year	135,673	68,509
Carbon Footprint - Electricity	Ton CO ₂	10.96	2.51
Carbon Footprint - LPG	Ton CO ₂	1.53	1.53
Carbon Footprint - Petrol	Ton CO ₂	0.07	0.07
Annual Carbon Footprint	Ton CO ₂	12.56	4.11
Specific Carbon Footprint - Annual	Ton CO ₂ /Head	0.0136	0.0044

Not

e: Unit conversions:

TOE	=	10 million kCal (BEE energy audit manual)
MWh of electricity	=	0.79 Ton of CO ₂ (www.cea.gov.in)
Ton of LPG	=	2.99 Ton of CO ₂ (www.cea.gov.in)
Ton of Petrol	=	3.1 Ton of CO ₂ (www.cea.gov.in)
Kg of Petrol	=	7875 kCal (BEE energy audit manual)
Kg of LPG	=	10500 kCal (BEE energy audit manual)
kWh of electricity	=	860 kCal (BEE energy audit manual)

V. CARBON FOOT PRINT

Carbon foot print is often used as short hand for the amount of carbon emission (usually in Tones) being emitted by an activity or by organization this is an important component in ecological foot print or the depicting the biological space reduction in the earth. Various environment protection and energy conservation connected with carbon footprint. The college took its accountability to protect nature and taken few steps for the carbon neutral campus

1. Protecting and conserving trees inside and outside the campus through various students' activities
2. Replacement of old CFLs and tubes with energy efficient LED lights
3. Sustainable construction of buildings for natural ventilation and light in the classrooms and laboratories.

TABLE 6 CARBON FOOT PRINT

Particulars	Energy consumption reduction (kWh)	Carbon Emission reduction (Ton CO ₂)	% of total
Replacement of 61 numbers of 40W-T12 Tube with 20W-LED tube light	1281	1.01	42
Replacement of 64 numbers of 36W-T8 Tube with 20W-LED tube light	1075	0.85	35
Replacement of 52 number of 18W-CFL with 9W LED Bulb	491	0.39	16.10
Replacement of 15 number of 18W-CFL with 5 W LED Bulb	205	0.16	6.71
Total	3,052	2	100

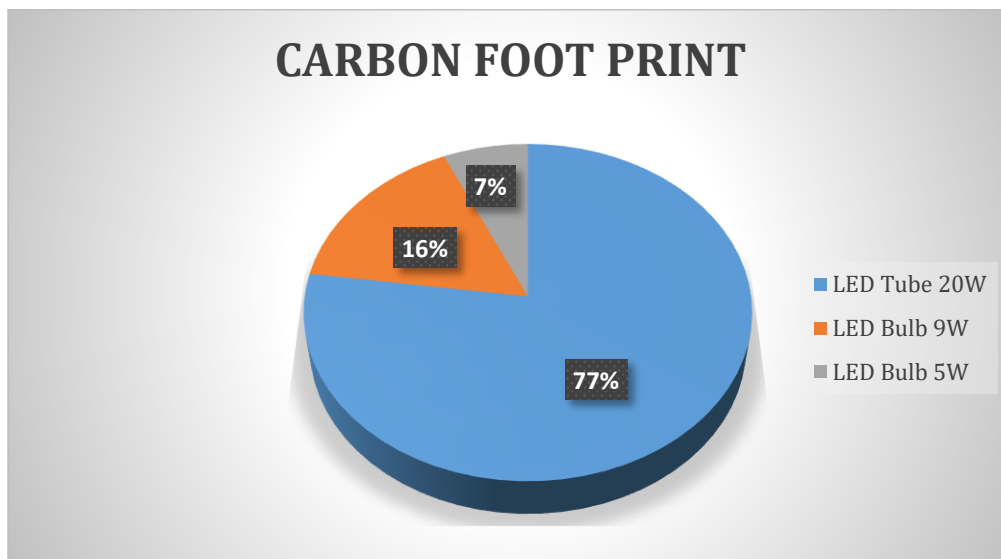


FIGURE 3: CARBON FOOT PRINT

INTRODUCTION

I. ENERGY AUDIT

An energy audit is a key to assessing the energy performance of an energy consuming facility and for developing an energy management program. The typical steps of an energy audit are:

- Preparation and planning
- Data collection and review
- Plant surveys and system measurements
- Observation and review of operating practices
- Data documentation and analysis
- Reporting of the results and recommendations

1.1. Definition of energy auditing

In the Indian Energy Conservation Act of 2001 (**BEE 2008**), an energy audit is defined as: **"The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energy consumption."**

1.2. Objectives of Energy Auditing

The objectives of an energy audit can vary from one plant to another. However, an energy audit is usually conducted to understand how energy issued within the plant and to find opportunities for improvement and energy saving. Sometimes, energy audits are conducted to evaluate the effectiveness of an energy efficiency project or program. As per the request from the institution, we have assessed the energy consumption and saving opportunities at present scenario.

Methodology for the study

The methodology adopted for energy audit starts from historical energy data analysis, power quality analysis, monitoring of operational practices, system evaluation, cost benefit analysis of the energy conservation opportunities, and prepare plan for implementation. The proposals given in the report includes economical energy efficiency measures to reduce facilities unnecessary energy consumption and cost. The energy conservation options, recommendations and cost benefit ratio, indicating payback period are included in this report.

Scope of Work

The Scope of Work includes:

1. Historical energy data analysis.
2. Electrical, Mechanical and Thermal energy analysis.
3. Power Quality Analysis.

II. THUNCHAN MEMORIAL GOVT COLLEGE, THIRUR

The college was set up in the year 1980 and supported the student community a long way in their pursuit of dreaming the hike of the sky in acquiring knowledge. The Institute has a standing of about 43 years, dedicated and glorious service to the cause of higher education in one of the most socially and economically backward area, Vettom Panchayath of the District of Malappuram, Kerala.

The college was started as a junior college with Pre-Degree course in the year 1980 and has maintained its affiliation with the University of Calicut for more than 42 years since its inception. The enrolment over the years reveals that the college has made substantial contribution for the education of women, especially girls from educationally and socially backward and minority communities. The college was upgraded into a degree College in the year 1991, into P.G. College in the year 1995 by introducing M.Sc. Mathematics and now looks forward in establishing research centres.

At present College has eleven academic departments and two skill acquisition centres supported by the several service centres like LAN lab, INFLIB Net, Audio Visual Lab, Language labs and Central Library. The college offers six Under-Graduate programmes in different subjects viz Mathematics, Physics, Commerce, Arabic and Malayalam and four Post-Graduate courses, viz Mathematics, Commerce, Arabic and Malayalam. The college has made enviable progress in terms of physical infrastructure and learning resources. Apart from academic activities, the co-curricular activities, sports, cultural and social- service activities form very important parts of the life of the students. College has a rich Alumni base that has significantly contributed to the development of the college over the years. The Institute takes pride in alumni, have done remarkably well in all spheres of life at both national and international levels and brought name and fame for themselves as well as to their Alma Mater.

➤ ***Mission***

We endeavour to facilitate the creation and promotion of socially relevant education, towards creation of a society that is sensitive to human rights, ecology, environment and sustainable development.

➤ ***Vision***

To be an institution that strives for excellence in higher education, to create a just and vibrant society through the development and promotion of knowledge upholding the values envisaged by Thunchath Ezhuthachan, the father of modern Malayalam.

III. GENERAL DETAILS

The general details of the College are given below.

TABLE 7: GENERAL DETAILS

Sl. No:	Particulars	Details
1	Name of the College	Thunchan Memorial Govt College
2	Address	Thunchan Memorial Govt. College Vakkad P.O., Malappuram Dist. Kerala, India PIN-676502
3	Contact Person	Ms. Rekha A M, Ph: 9496459031
4	E-mail ID	tmgctirur@gmail.com
5	Website Details	www.tmgctirur.org
7	No: of students	865
8	No: of teaching staffs	43
9	No: of non-teaching staffs	17
10	Total campus area (m ²)	91057 Sq.mm
11	Total built up area (m ²)	2276.7 Sq.mm

IV. LOAD BALANCE- ELECTRICAL

Load balance among the connected loads in the college is given in the figure below. The detailed connected load details are given in Annexure 2

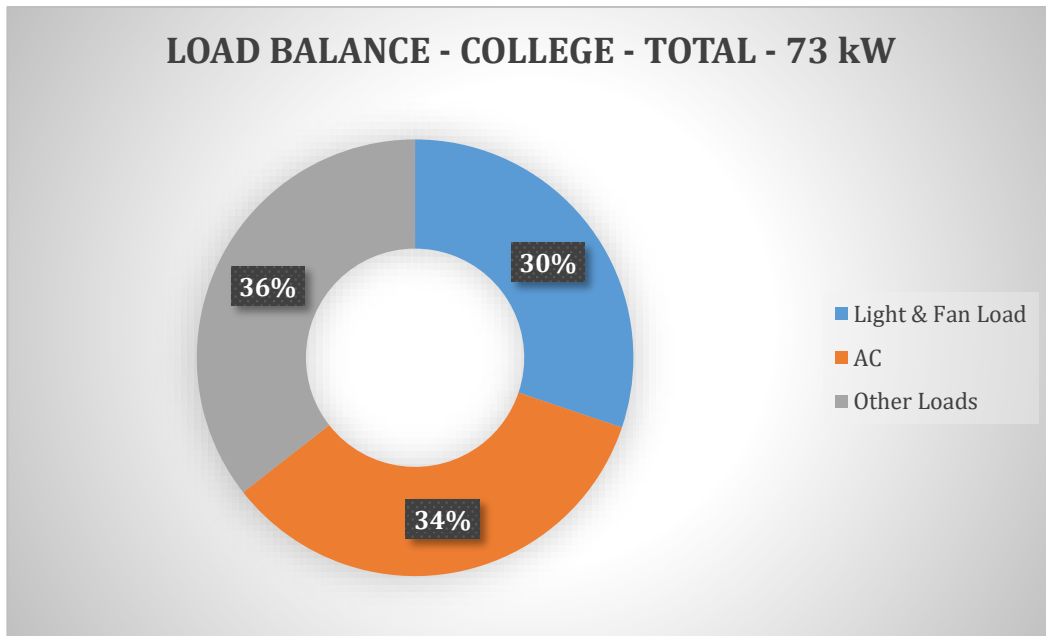


FIGURE 4: LOAD BALANCE-COLLEGE

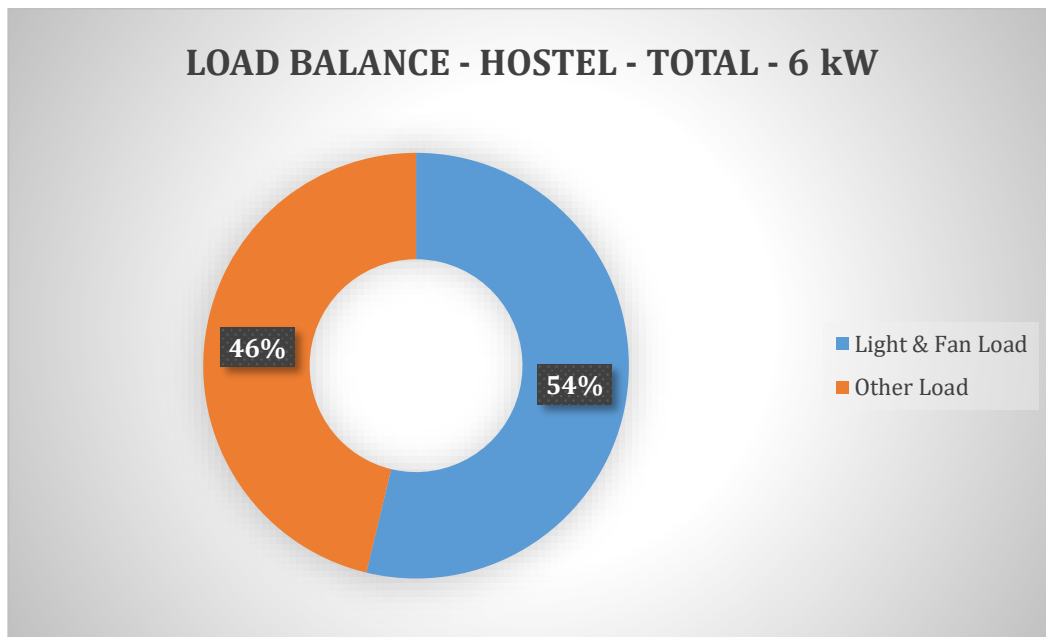


FIGURE 5: LOAD BALANCE- LADIES HOSTEL

ENERGY & UTILITY DESCRIPTION

In this section the single line diagrams of electricity and water are given which provides an overview of the energy flow in the building.

I. SINGLE LINE DIAGRAM – ELECTRICAL

The electrical single line diagram of the college is given below:

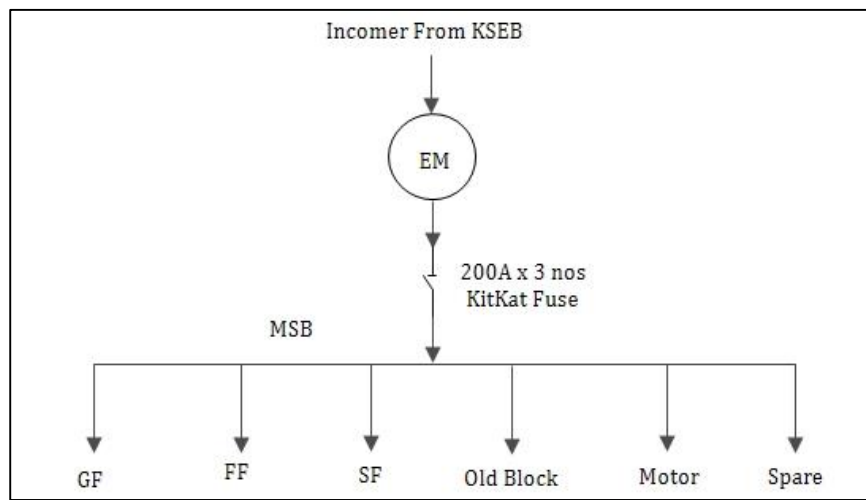


FIGURE 6: SINGLE LINE DIAGRAM – ELECTRICAL (COLLEGE)

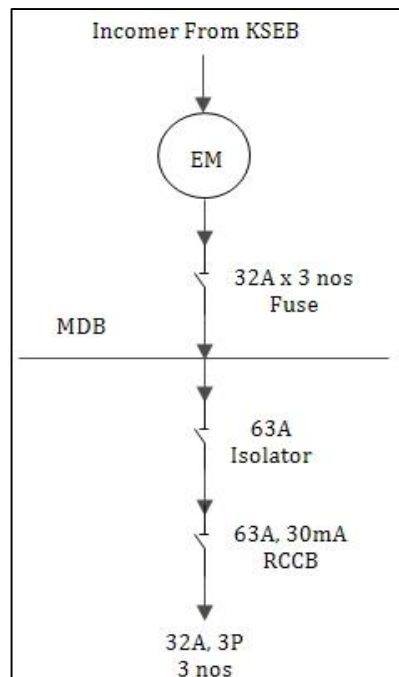


FIGURE 7: SINGLE LINE DIAGRAM – ELECTRICAL (LADIES HOSTEL)

II. SINGLE LINE DIAGRAM – WATER

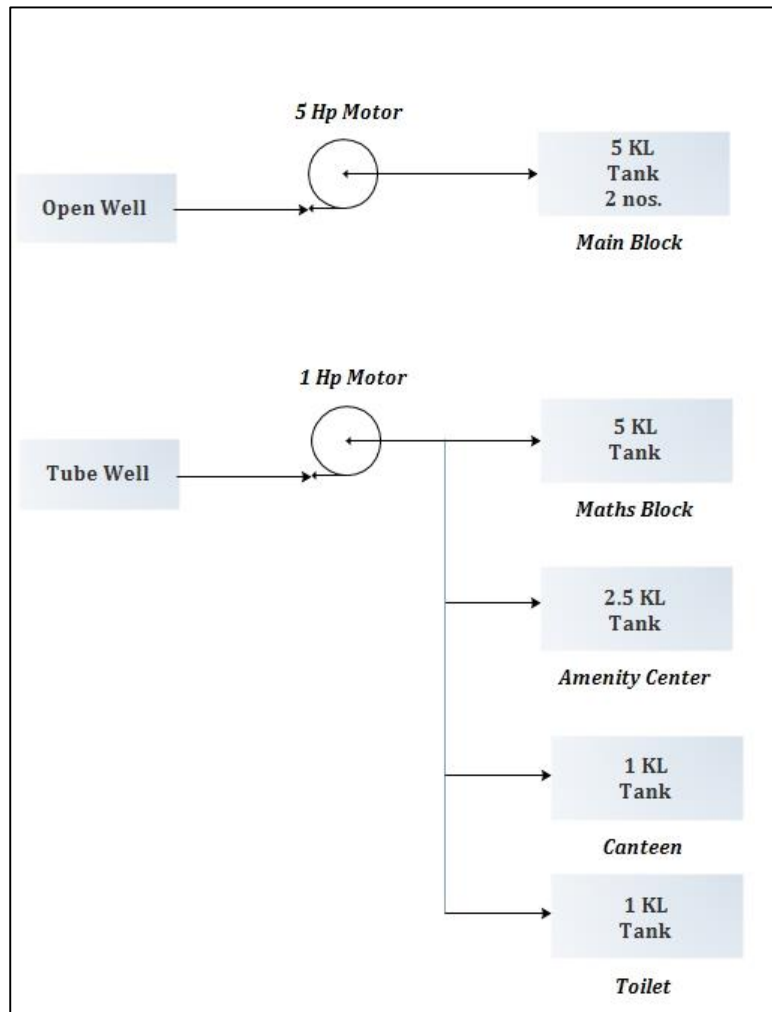


FIGURE 8: SINGLE LINE DIAGRAM – WATER (COLLEGE)

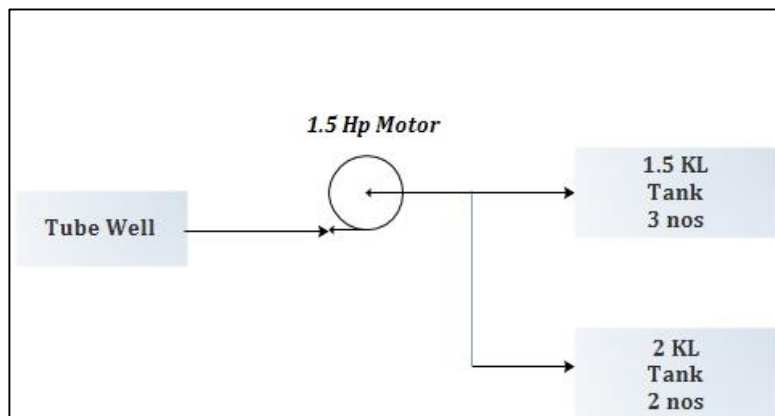


FIGURE 9: SINGLE LINE DIAGRAM – WATER (COLLEGE)

ENERGY ANALYSIS

The different type's energy usage is given in this section. The major source of energy to the college is electricity. The other energy sources are LPG, Petrol, and wood for which the pattern of consumption described below.

I. ELECTRICITY CONSUMPTION ANALYSIS

The major source of electricity to the college is electrical connection from the KSEBL. A generator is provided in the college, but it is only used during the power failures.

I. DESCRIPTION OF ELECTRICITY BILL

Base line data given below is based on the Electricity bill provided by the electricity supplier to the College.

TABLE 8: KSEB BILL ANALYSIS

Particulars	College	Ladies Hostel
Consumer No	1167302002574	1167303013844
Electrical section	Vettom	Vettom
Approved connected Load	48	8.63
Measured connected load	73	6
Tariff	LT-6A/Three	LT-6B/Three
Average monthly consumption (kWh)	1156	668
Average monthly electricity charges (Rs)	19852	6806

II. TARIFF RATES ANALYSIS

The average monthly energy and demand charges for the period Apr 2021- Mar 2022 is represented in Fig.

➤ College

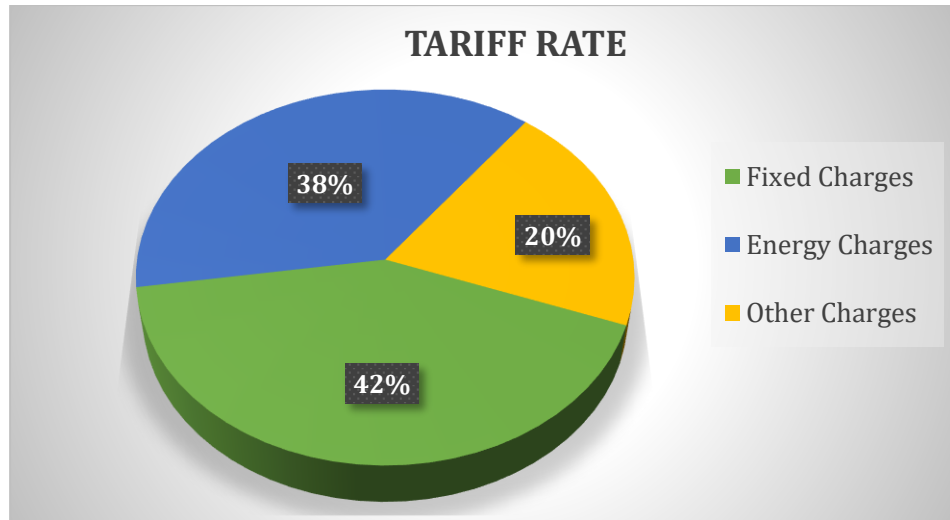


FIGURE 10: TARIFF RATE ANALYSIS - COLLEGE

Inference

- i. The average fixed charges was Rs 8,360/ per month.
- ii. The total energy charges during the past one year were Rs 89891/-

➤ Hostel

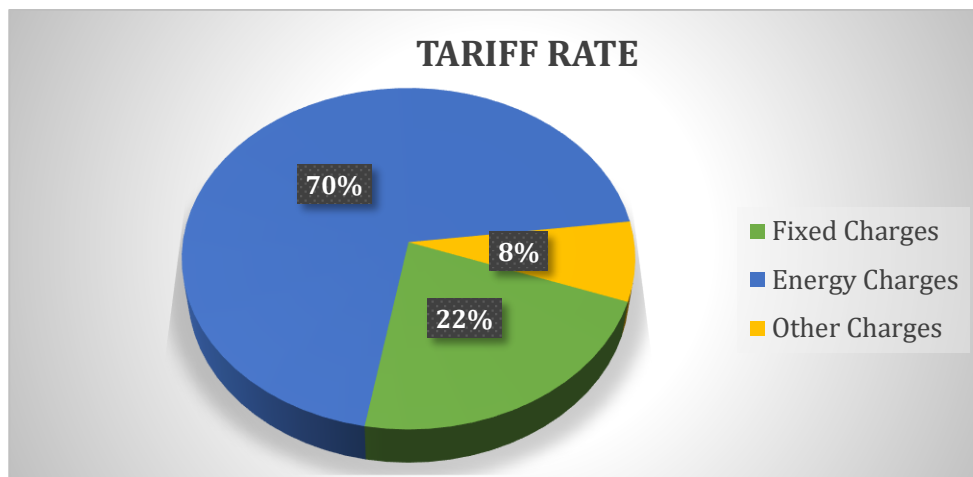


FIGURE 11: TARIFF RATE ANALYSIS - LADIES HOSTEL

Inference

- i. The average fixed charges were Rs. 1515/-monthly.
- ii. The total energy charges during past one year were Rs. 28664/-

III. SPECIFIC ELECTRICITY CONSUMPTION

The electricity consumption from Apr 2021- Mar 2022 has been taken for the benchmarking. Here the comparison is done with electricity consumption and the number of persons and building area. The below table shows the specific electricity consumption of the college.

TABLE 9: SPECIFIC ELECTRICITY CONSUMPTION

Month	Electricity Consumption kWh	Number of Persons Number	Building Area m ²	SEC kWh/Persons	SEC kWh/ m ²
Apr-21	980	925	2276.7	1.06	0.43
May-21	380	925	2276.7	0.41	0.17
Jun-21	508	925	2276.7	0.55	0.22
Jul-21	1064	925	2276.7	1.15	0.47
Aug-21	1020	925	2276.7	1.10	0.45
Sep-21	832	925	2276.7	0.90	0.37
Oct-21	1236	925	2276.7	1.34	0.54
Nov-21	1592	925	2276.7	1.72	0.70
Dec-21	1840	925	2276.7	1.99	0.81
Jan-22	1264	925	2276.7	1.37	0.56
Feb-22	1480	925	2276.7	1.60	0.65
Mar-22	1680	925	2276.7	1.82	0.74
Average	1156.3	925	2277	1.25	0.51
Annual Specific Electricity consumption				15.0	6.1
Annual Electricity Consumption(kWh)				13876	

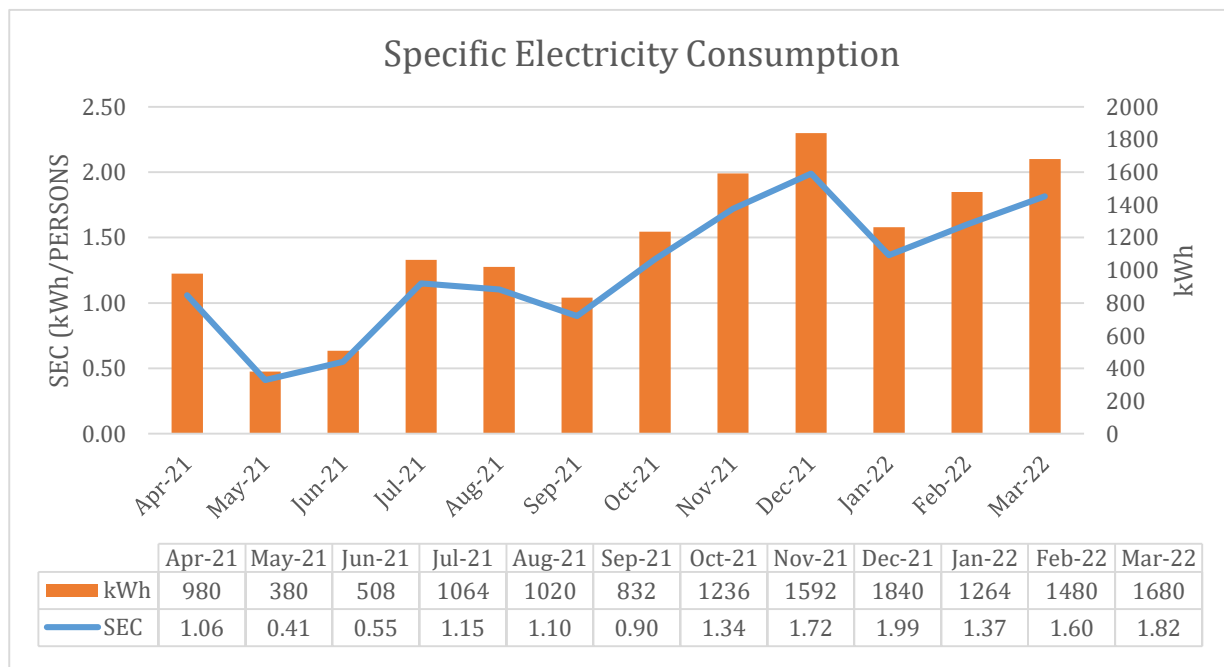


FIGURE 12: SPECIFIC ELECTRICITY CONSUMPTION (KWH/PERSONS)

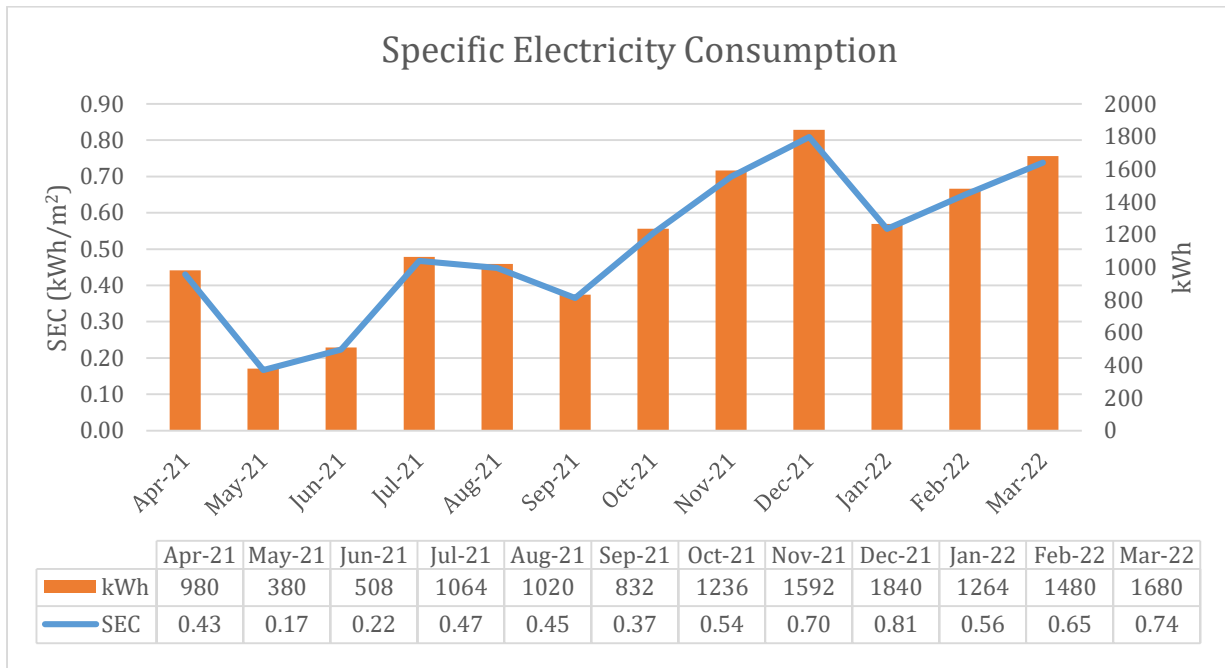


FIGURE 13: SPECIFIC ELECTRICITY CONSUMPTION (KWH/AREA)

IV. UNINTERRUPTIBLE POWER SUPPLY (UPS)

UPS are provided at different building for labs and office. Details of the UPS are given below:

TABLE 10: UPS DETAILS

Floor	Location	UPS		Battery	
		Make	KVA	Make/Type/no's	V/Ah
Ground	Room-108	Hykon	3	Exide/4 no's	12/200
First	Office	Hykon	2	Hykon/SMF/4 no's	12/80
	Office	Power Zen	2	Solar/SMF/4 no's	
	Exam control room	Exwell	1	Exwell	12/100
Second	Seminar hall	Hykon	5	ON & ON/Tubular/7 no's	12/50
	Dept. Arabic	Igatech	3	SMF/8 no's	12/150
	Room-305		7	SMF/8 no's	

- Suggestions**
- i. Proper ventilation should be provided for UPS and batteries.
 - ii. UPS room should be kept neat and clean.
 - iii. Petroleum jelly should be applied to the battery terminals for better life.

II. LPG CONSUMPTION ANALYSIS

The LPG is used in canteen and college hostel. The details of the LPG consumption in the last academic year are given in the table below.

TABLE 11: ANNUAL LPG CONSUMPTION

Sl. No	Particulars	Annual consumption (kg)	Calorific value (TOE)
1	Ladies Hostel	426	0.45
2	Canteen	511.2	0.54
Total		937	0.99

III. WOOD CONSUMPTION ANALYSIS

The wood is used in college hostel for cooking purpose. The details of the wood consumption in the last academic year are given in the table below.

TABLE 12: ANNUAL WOOD CONSUMPTION

Sl. No	Particulars	Annual consumption (kg)	Calorific value (TOE)
1	Ladies Hostel	278	0.097
Total		278	0.097

IV. PETROL CONSUMPTION ANALYSIS

The Petrol is used as fuel in generator. The details of the Petrol consumption in the last academic year are given in the table below.

TABLE 13: ANNUAL PETROL CONSUMPTION

Sl. No	Particulars	Annual consumption (kg)	Calorific value (TOE)
1	Generator	22.5	0.018
Total		22.5	0.018

MEASURED DATA

The measured parameters which we taken at the audit period at the college energy meter is tabulated below:

TABLE 14: MEASURED DATA

Parameters Checked	Test Point	Readings Recorded	Normal Range at the branch
Voltage at incoming Panel (V)	L1-L2:	416	322 to 440
	L2-L3:	417	322 to 440
	L1-L3:	384	322 to 440
	L1-N:	240.1	186 to 254
	L2- N	240.5	186 to 254
	L3-N:	221.6	186 to 254
	N-E:	1.2	06 V at the farthest load point.
Current Reading at incoming Panel (I)	L1:	6	
	L2:	11.6	
	L3:	26	
	N:	16.00	
Power Consumed per phase (kW)	L1:	1.44	
	L2:	2.78	
	L3:	5.75	
Frequency of supply (Hz)	L-N:	50	47.5 to 50.5

GENERATOR

Generator used in the college as backup supply. The following table gives the basic details of generator in the facility.

TABLE 15 DG DETAILS

Sl. No	Generator Details		
	Rated kVA	Make	Fuel
1	1.6	Honda	Petrol

RENEWABLE ENERGY

The Sun is an inexhaustible, reliable and non-polluting source of power. Since the inception of life on earth, the only energy that was available came from the sun. The time is now approaching when mankind will again depend upon the sun as dominant energy source. The fossil fuels are depleting at a rapid rate. A growing worldwide concern for conservation of energy has reignited the interest in ecologically sustainable materials, processes and sources of energy. The advantages of solar power are:

- The solar energy is more evenly distributed in the world than wind or bio-mass.
- It is well proven and demonstrated technology
- It promises to be most cost effective renewable power at high volumes.

The solar energy potential in India is immense due to its convenient location near the Equator. India receives nearly 3000 hours of sunshine every year, which is equivalent to 5000 trillion kWh of energy. The College have installed off -grid solar plant of 5 kW on Maths Block.



FIGURE 14: SOLAR INSTALLATION - MATHS BLOCK

ANNEXURE - 1

I. ENERGY SAVING PROPOSAL - 1

REPLACEMENT OF CEILING FANS IN THE OFFICE WITH ENERGY EFFICIENT BLDC FANS

Background

A BLDC fan takes in AC voltage and internally converts it into DC using SMPS. The main difference between BLDC and ordinary DC fans is the commutation method. A commutation is basically the technique of changing the direction of current in the motor for the rotational movement. In a BLDC motor, as there are no brushes, so the commutation is done by the driving algorithm in the Electronics. The main advantage is that over a period, due to mechanical contact in a brushed motor the commutators can undergo wear and tear, this thing is eliminated in BLDC Motor making the motor more rugged for long-term use. To explain, BLDC technology in simpler terms, BLDC uses a combination of Permanent Magnets and Electronics to achieve the kind of efficiency and performance, it delivers. A BLDC fan composes of 3 main components: - 1. Stator 2. Rotor 3. Electronics

Proposal

Replace the ceiling fans with BLDC in the as per preference of operating hours as office areas, staff rooms, classrooms and in hostels the calculation for the savings is given in the table.

TABLE 16: EC PROPOSAL 1

Particulars	Units	Replacement with BLDC fan	
		College	Hostel
Existing Ceiling Fans	Watts	70	70
Proposed BLDC Fans	Watts	28	28
Difference in Wattage	Watts	42	42
Avg No: of working hours/day	Hrs.	7	12
No: of working days per year (Average)	Days	210	210
Number of Fans operating	Nos	1470	2520
Energy Saving per Annum	kWh/annum	140	30
Cost per kWh	Rs/kWh	8,644	3,175
Annual Financial Savings	Rs/annum	7.15	7.87
Cost of BLDC Fans	Rs/no	61,802	24,989
Investment for Fans	Rs	3,500	3,500
Simple Payback period	Months	490,000	105,000
SUMMARY			
Annual unit savings	kWh/annum	11,819	
Total savings	Rs/annum	86,791	
Total investment	Rs	595,000	
Payback period	Months	82	

II. ENERGY SAVING PROPOSALS – 2

REPLACEMENT OF FLUORESCENT TUBES WITH ENERGY EFFICIENT LED LIGHTS

BACKGROUND

The present light fittings are mainly been the LED and fluorescent light of different ratings. Replacement of Fluorescent lights (T8, T12) to be done in phase manner with LED lights.

PROPOSAL

By replacing the light fitting with LEDs as per preference of operating hours in the class rooms, hostel, office area, faculty rooms, kitchen and in canteen of appropriate ratings the power consumption will reduce considerably by approximate 50% with the present operating hours. The calculation for the savings, approximate investment cost and payback period is given in the table below.

TABLE 17: EC PROPOSAL 2

Particulars	Units	College	
		T12	T8
Power of Fluorescent lights	Watts	40	36
Power of proposed LED tube	Watts	20	20
Difference in Wattage	Watts	20	16
Operating hours per day	Hrs./day	5	5
No: of working days per year (Average)	Nos	210	210
No: of working hours per annum	Hrs.	1050	1050
Number of Lights operating	Nos	53	56
Annual Consumption for Fluorescent lights	kWh	2226	2117
Annual Consumption for LED lights	kWh	1113	1176
kWh Saving per Annum	kWh/annum	1113	941
Cost per kWh (Average)	Rs/kWh	7.15	7.15
Annual Financial Savings	Rs/annum	7958	6727
Cost of LED light	Rs	250	250
Investment for LED lights	Rs	13250	14000
Simple Payback period	Months	20	25
SUMMARY			
Annual unit savings	kWh	2054	
Total savings	Rs	14685	
Total investment	Rs	27250	
Payback period	months	22	

ANNEXURE 2

CONNECTED ELECTRICAL LOADS

I. COLLEGE

➤ Light and Fan load

TABLE 18: LIGHT AND FAN LOADS – COLLEGE

Particulars	Ceiling fan	Wall fan	Pedestal fan	T5	T8	T12	LED TL	LED	LED	LED	CFL	CFL	CFL	Incandescent lamp
Watts	70	60	60	28	36	40	20	50	9	5	10	18	42	60
Nos	180	4	1	12	56	53	125	5	52	15	1	6	2	19
kW	12.60	0.24	0.06	0.34	2.02	2.12	2.50	0.25	0.47	0.08	0.01	0.11	0.08	1.14
Total	22.01													

➤ Other Loads

TABLE 19: OTHER LOADS – COLLEGE

Particulars	Projector	3 in 1 Printer	PC	Printer	Xerox	Fridge	Exhaust fan	TV	Water cooler	Incinerator	Mixer
Watts	100	350	120	250	650	165	50	120	120	1500	746
Nos	7	4	105	8	7	1	12	8	6	1	1
kW	0.7	1.4	12.6	2	4.55	0.165	0.6	0.96	0.72	1.5	0.746
Total	25.94										

➤ AC

TABLE 20: AC – COLLEGE

floor	location	Type	Make	Capacity	Star	Power consumption	Year of manufacture	EER	Nos	Total Consumption(W)
Ground	Audio visual library	Split	LG	1.5	5	1465	2016	3.6	2	2930
	Class room-108	Split	Voltas	1	5	1250		3.6	1	1250
First	IQAC	Split	Voltas	1.5	3	1614		3.2	1	1614
	Office	Split	Lloyd	0.75		859			1	859
	Principal room	Split	Voltas	2	3	2051	2016	3.1	1	2051
Second	Seminar hall	Tower	Voltas	2	2	2084	2017	3	1	2084
		Split	Voltas	1.5	5	1454		3.5	7	10178
	Edu sat room-307	Split	Lloyd	2	3	2005	2015	3.1	2	4010
Total(kW)										25

II. HOSTEL

➤ Light and Fan load

TABLE 21: LIGHT AND FAN LOADS - LADIES HOSTEL

Particulars	Ceiling fan	T5	LED TL	LED	CFL
Watts	70	28	20	9	42
Nos	32	8	43	11	1
kW	2.24	0.22	0.86	0.10	0.04
Total	3.47				

➤ Other Loads

TABLE 22: OTHER LOADS - LADIES HOSTEL

Particulars	Fridge	Exhaust fan	TV	Mixer	Grinder
Watts	165	50	120	746	1500
Nos	1	9	1	1	1
kW	0.165	0.45	0.12	0.746	1.5
Total	2.98				

ANNEXURE-3

I. ABBREVIATIONS

AVG	:	Average
BEE	:	Bureau of energy efficiency
CO ₂	:	Carbon dioxide
KSEB	:	Kerala State Electricity Board.
DB	:	Distribution Board
EC	:	Energy Conservation
IEEE	:	The Institute of electrical and electronics engineers
IS	:	Indian Standard
kL	:	kilo Liter
KSEBL	:	Kerala State Electricity Board Limited
KVA	:	kilo Volt Ampere
kVAh	:	kilo volt Ampere Hour
kVAr	:	kilo volt ampere
kW	:	kilo Watts
kWh	:	kilo watt hour
LT	:	Low tension
MAX	:	Maximum
NSS	:	National Service Scheme
SLD	:	Single Line Diagram


II. REFERENCES:

- Handbook on energy audit and environment management by TERI.
- Bureau of Energy Efficiency (BEE) books for certification of Energy Auditors & Managers.



III. CERTIFICATES


I. BEE Accreditation Certificate



BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: **EA-7597**

Accreditation Registration No.: **AEA-0275**



Certificate of Accreditation

This is to certify that Mr./Ms..... **Santhosh. A** having its trade/registered office at **Kerala** has been given accreditation as accredited energy auditor. The certificate shall be effective from **2nd** day of **November, 2017**


The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. **0275** in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this **12th** day of **February, 2018**


Secretary,
Bureau of Energy Efficiency
New Delhi

II. EMC Empanelment certificate



Energy Management Centre - Kerala (Department of Power, Govt of Kerala)

CERTIFICATE OF EMPANELMENT

This is to certify that M/s.Athul Energy Consultants Pvt Ltd(4/2, Capital Legend Building, Korapath Lane, Rouund North, Thrissur)is empanelled as Energy Audit firm in Energy Management Centre Kerala to conduct mandatory energy audit as per Government of Kerala G.O (Rt) No.2/2011/PD dated 01.01.2011.

Empanelment No:
EMCEEA-0811F-3

Scope/Area	Building	Industry -Electrical	Industry Thermal
	Yes	Yes	Yes

This empanelment is valid up to 01/02/2024

Issuing Date: 02/02/2021

Place: Thiruvananthapuram

Director,
Energy Management Centre - Kerala