ENERGY AUDIT - 2024

T. K. M. COLLEGE OF ARTS AND SCIENCE KOLLAM

Re-accredited by NAAC with "A++" Grade

ACKNOWLEDGEMENTS

We extend our heartfelt gratitude to T. K. M. College of Arts and Science for granting us the opportunity to undertake and complete this Energy Audit for the year 2024. We deeply appreciate the unwavering support and cooperation of all staff members, whose contributions, including vital input data and assistance with measurements, were instrumental in the successful completion of this project. A special note of thanks is reserved for the college's Energy Audit Team members for their invaluable guidance and collaboration throughout the study.

Internal Energy Audit Committee:

No:	Name	Designation
1.	Dr. Fairoos C.	Asst. Professor, Dept. of Physics, TKM College of Arts and Science
2.	Dr. Mohamed Musthafa K.	Librarian, TKM College of Arts and Science
3.	Dr. Baiju V.	Asst. Professor, Dept. of Mechanical Engineer, TKM College of Engineering

Yours faithfully,

Electrical Safety & Energy Auditor

CONTENTS

---

1. Objective

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 reports containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energy consumption."

The objectives of an energy audit can vary from one plant to another. However, an energy audit is usually conducted to understand how energy is 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. In T. K. M. College, as per the request, we have assessed the energy consumption and saving opportunities in the present scenario. The Energy Audit was defined to meet the following objectives:

- Conduct a simple Walk-Through audit or observation of the energy consumption of electrical appliances within the T. K. M. College of Arts and Science building.
- Review and analyze energy usage history to create a baseline for which savings can be measured in the audited building.
- Determine what can be done to reduce energy consumption throughout the buildings and what options are available for system improvements if funding is available.
- Identify and evaluate measures that could improve the environmental performance of the buildings/wards and provide recommendations.

2. Scope of Study

2.1. Electricity Consumption and Electricity Billing

Electrical Equipment:

Electrical parameters such as voltage, current, power factor, kW, and frequency were measured for all significant energy-consuming equipment (fans, lighting, pumps, air conditioners, etc.) using a power analyzer. These measurements not only identify inefficiencies in individual equipment but also help in determining the overall energy distribution across the facility. Special attention was given to equipment with high operating hours and fluctuating loads, which significantly influence the facility's energy consumption profile.

Electricity Bill:

A detailed summary of the past year's monthly electricity consumption and billing data was compiled. This includes:

- Analysis of monthly and annual trends in energy usage (in kWh).
- Identification of peak demand periods and corresponding cost implications.
- Breakdown of energy consumption for different categories of equipment or processes.
- Recommendations to optimize energy consumption patterns, focusing on reducing Maximum Demand and improving the Power Factor to minimize demand charges.
- Suggestions for adopting renewable energy sources and energy-efficient technologies to achieve long-term cost savings.

2.2. Preparation of Report

The report provides a detailed **Energy Profile** of the facility, including:

- A breakdown of energy consumption by major equipment, processes, and utilities, presented in a clear and visually intuitive manner using charts or graphs.
- Identification of high-energy-consuming areas to prioritize efficiency improvements.
- Assessment of historical energy consumption data to establish benchmarks for future monitoring and comparison.

Additional features of the report include:

- Environmental impact analysis, including the estimated reduction in carbon footprint through proposed energy-saving measures.
- A summary of potential renewable energy integration, such as solar PV systems or wind turbines, to further reduce dependency on non-renewable energy sources.

2.3. Methodology and Time Scale

The methodology adopted for the energy audit is a systematic approach that ensures a thorough evaluation of energy usage and opportunities for savings. The steps include:

- **Historical Energy Data Analysis:** Examining past energy usage to identify trends, inefficiencies, and opportunities for improvement.
- **Detailed Equipment Analysis:** Evaluating the performance and energy consumption of critical equipment, with a focus on underperforming or outdated systems.
- **Power Quality Analysis:** Measuring parameters such as voltage stability, harmonic distortions, and load imbalances to assess and improve the facility's power quality.
- **Operational Practices Monitoring:** Observing day-to-day practices to identify energy wastage due to improper usage or lack of standard operating procedures.
- **Energy Conservation Opportunities:** Identifying practical measures such as upgrading to energy-efficient equipment, process optimization, and behavioral changes to reduce energy consumption.
- **Cost-Benefit Analysis and Implementation Plan:** Proposals include detailed cost estimates, payback period calculations, and implementation timelines for energy-saving measures.

The Scope of Work includes

The energy audit covers:

- Comprehensive analysis of **electrical, mechanical, and thermal energy systems**.
- Assessment of the facility's **lighting and HVAC systems** to identify modernization opportunities.
- Evaluation of the efficiency of **pumps, motors, and compressors**.
- Recommendations for **smart energy management systems** for real-time monitoring and control.
- Feasibility study for **renewable energy integration** tailored to the facility's energy requirements and constraints.

The goal of the audit is to provide actionable insights and practical solutions for reducing energy consumption, minimizing operational costs, and promoting sustainable practices.

3. Energy Audit- Executive Summary

Below are some recommendations based on general observations carried out throughout the T. K. M. college building. The recommendations are categorized with A being the most urgent where immediate actions are needed to be executed (first or second week of receiving this report). B can be 1 to 2 months after receiving this report, while C will depend on the availability of funds.

S. No.	**Category- A**	**Category- B**	**Category- C**
1.	Implement energy conservation measures by identifying and disconnecting vampire loads (devices that consume power even when not in active use, such as rechargeable equipment, computers, and other electronics with standby modes). Ensure these devices are isolated or unplugged when not in operation to minimize unnecessary energy consumption.	Establish an Energy Efficiency and Conservation (EE&C) Steering Committee to spearhead initiatives aimed at promoting and managing energy efficiency and conservation within the campus. The committee should comprise representatives from key departments, including administration, facilities management, and student bodies, ensuring diverse perspectives and collective responsibility.	Remove unnecessary lights or reduce the number of lights per location
2.	Isolate or unplug any faulty air conditioners identified within the building (e.g., units running but not producing cold air) and ensure regular servicing of air conditioner units on a quarterly basis.	Remove the air conditioner if the room is very poorly sealed (i.e. if the room has no seals on the door and frequently opens at times).	Replace old existing outdoor air conditioner units with efficient ones (if funding is available).

3	Proper maintenance of Solar Rooftop Power Plants ensures efficiency, longevity, and maximum energy output. This includes regular cleaning of panels to remove dirt and debris, inspecting for physical damage, and monitoring system performance to identify issues like shading or component failure. Key components such as inverters, batteries, and electrical connections should be routinely checked and maintained. Annual professional inspections and managing shading from vegetation are essential, along with keeping maintenance records to ensure reliable, sustainable energy generation.	Conduct a survey to find locations to install more solar power plants	Installation of Rooftop Solar Photovoltaic System(With or without subsidy)

4. Introduction

4.1. About T. K. M. College of Arts and Science

Since its establishment in 1965 under the auspices of the TKM College Trust, T.K.M. College of Arts and Science has stood as a renowned center of learning in Kollam. Accredited with a B+ grade in 2004, the college reached new heights with an A grade (CGPA 3.13) in 2013 and attained the highest accolade of A++ (CGPA 3.67) during the 3rd cycle of accreditation on September 6, 2022.

The college is dedicated to empowering students through education, fostering academic excellence, character building, and holistic development. Life at TKM College of Arts and Science offers a vibrant and inclusive environment that nurtures students' academic, artistic, cultural, and creative talents. The institution embraces diversity, catering to the needs of students from all walks of life, and continually adapts to meet evolving challenges by redefining programme outcomes and equipping students with essential skills for the future.

Core values such as honesty, moral integrity, compassion, faith, and a relentless pursuit of academic excellence form the foundation of the institution. Guided by the principles of learning, sharing, and caring, the college prepares students to become transformative agents of progress in society.

Currently, TKM College of Arts and Science offers ten undergraduate and six postgraduate programmes under the aided scheme, along with three research centers in English, Chemistry, and Physics to support academic exploration. Certificate courses, add-on programmes, and continuing education initiatives provide interdisciplinary exposure and enhance students' employability.

Social service and extension activity clubs foster responsible citizenship through diverse initiatives. Special practices like bridge courses and remedial classes support students with varying academic needs, while activities such as peer teaching, group learning, projects, seminars, and industrial visits develop their skills at multiple levels. The institution is committed to equity and inclusiveness, with a special focus on the well-being and empowerment of girl students.

The Trust

The TKM College Trust has profoundly impacted the academic landscape of the State of Kerala since its inception in 1956 by the late visionary industrialist cum educationalist Janab Thangal Kunju Musaliar. It has embarked upon a series of unparalleled initiatives to blaze new trails of progress and transformation in society through education. In tune with the changing global environment, the TKM College Trust is expanding its horizons of knowledge by networking itself with leading universities and educational institutions across the globe. The Trust continues its journey of excellence in providing quality education thereby empowering young men and women to help them realize their self-worth, potential, skills, and qualities as human beings.

The Trust has the heritage of upholding firmly the values nurtured by the Founder. Today, the Trust has seven top-ranking centers of learning comprising TKM College of Engineering, TKM College of Arts and Science, TKM Institute of Management, TKM Institute of Technology, TKM School of Communication and Information Technology, TKM Centenary Public School, and TKM Higher Secondary School. Of these, the TKM Centenary Public School was established in 1997 to mark the Birth Centenary Celebrations of Janab Thangal Kunju Musaliar.

A journey down the alleys of history reveals the innumerable jewels that the TKM College Trust has added to its crown. Over the years, the Trust has pushed the frontiers of knowledge further by extending its ambit to various fields of education from playschool to technical institutes to doctoral research centers.

Vision:

- Pursue excellence in academic and non–academic avenues, with a sense of civic consciousness and social commitment

Mission:

5. Promote holistic education that enhances employability and life skill development
6. Cultivate a spirit of intellectual creativity and inquisitiveness
7. Nurture philanthropic attitude among the various stakeholders of the institution
8. Develop the institution into an academic center catering to diverse socio-cultural groups, especially the marginalized sections.

Name	**T. K. M. College of Arts and Science**
Address	**WJ8M+9R8, Karicode, Peroor, Kollam, Kerala 691005**
E-Mail	**tkmarts@gmail.com**
Phone	**0474 271 2240**
Type of Building	**Educational Institute**
Annual Working days	**210**
Shift	**09:00 AM to 04:00 PM**

9. Electricity Consumption Analysis

9.1. Electrical Energy Consumption

The electricity consumption and billing details of T. K. M. College of Arts and Science is given.

Power Supply Company	**K. S. E. B.**
Consumer No.	**1145644002894**
Supply Voltage	**415 V**
Billing Period	**Monthly**
Tariff	**LT 6A Three Phase**
Connected Load (kW)	**76**
Average Units Consumed per Month (kWh)	**9253**
Fixed Charges	**Rs. 5005**
Average Monthly Bill	**Rs.49,440**
Average Rate in Rs.	**6.1**

10. Summary of Loads

6.1. Light Load

Floor/Area	Location	Equipment	Wattage	Count	Total Watt
Ground Floor	DST- FIST Funded Chemistry Research Lab-1	LED Tube	20	2	40
	DST- FIST Funded Chemistry Research Lab-1	LED Tube	20	3	60
	BSc Chemistry Lab	LED Tube	20	9	240
		Fluorescent Tube	20	3	
	Biochemistry Lab	LED Tube	20	11	220
	Microbiology Lab	LED Bulb	8	10	80
	MSc Chemistry Final Year Class	LED Tube	20	2	40
	MSc Chemistry Previous Year Class	LED Tube	20	2	40
	Department of Chemistry	LED Tube	20	2	40
	MSc Chemistry Research Lab	LED Tube	20	11	220
	Office	LED Tube	20	1	20
		LED Bulb	8	4	32
		Fluorescent Tube	20	14	280
	IQAC Room	LED Tube	20	3	120
		LED Bulb	8	4	32
		CFL	14	1	14
	Audit Room	LED Tube	20	3	60
		CFL	14	1	14
	Student Help Desk	LED Tube	20	2	40
	Conference Hall	LED Tube	20	8	160
	Examination Room	LED Tube	20	8	160
	Principal Office	LED Tube	20	2	40

	Department of English	LED Tube	20	2	40
	A21	LED Tube	20	2	40
	A22	LED Tube	20	4	80
	A23	LED Tube	20	4	80
	A24	LED Tube	20	3	60
	A25	LED Tube	20	4	80
	A26	LED Tube	20	4	80
	A29	LED Tube	20	2	40
	A30	LED Tube	20	4	80
	A31	LED Tube	20	2	40
	A32	LED Tube	20	2	40
	A33	LED Tube	20	2	40
	Corridor	LED Tube	20	14	280
		CFL	14	1	14
	Civil Service Academy	LED Tube	20	6	120
		LED Bulb	8	1	8
	E2	LED Tube	20	2	40
	E3	LED Tube	20	4	80
	E4	LED Tube	20	2	40
	Security Room	LED Tube	9	3	27
	Seminar Hall	LED Tube	20	6	120
	B36	LED Tube	20	4	80
	B35	LED Tube	20	2	40
	B34	LED Tube	20	4	80
	B29	LED Tube	20	4	80
	B28	LED Tube	20	4	80
	B27	LED Tube	20	4	80

First Floor	B26	LED Tube	20	2	40
	Department of Mathematics	LED Tube	20	1	20
		Incandescent	60	1	60
	B25	LED Tube	20	2	40
	B24	LED Tube	20	2	40
	Computer Lab-1	LED Bulb	9	1	9
		Fluorescent Tube	40	16	640
	B22	LED Tube	20	2	40
	B21	LED Tube	20	2	40
	Mathematical Computational Lab	LED Tube	20	4	80
	Computer Lab-2	LED Tube	20	4	80
	Department of Commerce	LED Tube	20	4	80
	B10	LED Tube	20	2	40
	B11	LED Tube	20	2	40
	B4	LED Tube	20	1	20
	B6	LED Tube	20	2	40
	Computational Physics Lab	Fluorescent Tube	40	3	120
		LED Tube	20	1	20
Second Floor	C1	LED Tube	20	4	80
	Department of Botany	LED Tube	20	1	20
	Molecular Biology Lab	LED Tube	20	1	20
	Instrumentation Room	LED Tube	20	4	80
	C10	LED Tube	20	3	60
	C13	LED Tube	20	2	40
	C14	LED Tube	20	2	40
	C15	LED Tube	20	2	40
	C15	LED Tube	20	2	40

	C16	LED Tube	20	2	40
	C17	LED Tube	20	2	40
	C18	LED Tube	20	2	40
	C19	LED Tube	20	2	40
	C20	LED Tube	20	2	40
	C21	LED Tube	20	2	40
	C22	LED Tube	20	2	40
	C23	LED Tube	20	2	40
	Department of Humanities	CFL	1	28	28
	Zoology Lab	LED Tube	20	4	80
	Unnamed Classroom	LED Tube	20	4	80
	Library	LED Tube	20	47	940
		LED Bulb	9	3	27
		Flood Light	30	1	30
		Fluorescent Tube	40	23	920
	Auditorium	LED Bulb	9	35	315
	Women Waiting Room	LED Tube	20	5	100
		Fluorescent Tube	34	3	102
	NCC Girls Room	Fluorescent Tube	34	2	68
	NCC Boys Room	Fluorescent Tube	34	2	68
	Canteen	LED Tube	20	4	80
	Physical Education Room	LED Tube	20	3	60
	Physical Education Building-Veranda	Fluorescent Tube	34	2	68
		LED Tube	20	1	20
	Co-operative Society Store	Fluorescent Tube	34	1	34
	Hostels	LED Bulb	8	10	80

		LED Tube	20	73	1460
Block -1	UGC- Hostel	Led bulb	9	36	324
		led tube	20	25	500
		Street light	24	3	72
		CFL	9	9	81
		Fluorescent Tube	40	69	2760
Block -2	UGC- Hostel	Led bulb	9	12	108
		led tube	20	20	400
		Street light	24	2	48
		CFL	9	10	90
		Fluorescent Tube	40	34	1360
Block -3	UGC- Hostel	Led bulb	9	155	1395
		led tube	20	15	300
		Street light	24	6	144
		CFL	9	8	81
		Fluorescent Tube	40	31	1240
RUSA Research Block	D1	Led bulb		-	
		LED Tube	20	4	80
	D2	Led bulb	-	-	
		LED Tube	20	2	40
	D3	Led bulb	-	-	
		LED Tube	20	2	40
	D4	Led bulb	20	2	40
		LED Tube	-	-	
	D5	Led bulb	-	-	
		LED Tube	20	2	40
	D6	Led bulb	-	-	
		LED Tube	20	2	40

	D8	Led bulb	-	-	
		LED Tube	20	2	40
Total wattage from light load					19.87 kW

6.2. Fan Load

Floor/Area	Location	Equipment	Wattage	Count	Total Watt
Ground Floor	DST- FIST Funded Chemistry Research Lab-1	Ceiling Fan	53	2	106
	Biochemistry Lab	Ceiling Fan	53	2	106
		Pedestal Fan	80	2	160
		Exhaust Fan	42	2	84
	Microbiology Lab	Ceiling Fan	53	1	53
	MSc Chemistry Final Year Class	Ceiling Fan	53	2	106
	MSc Chemistry Previous Year Class	Ceiling Fan	53	2	106
	Department of Chemistry	Ceiling Fan	53	4	212
	MSc Chemistry Research Lab	Ceiling Fan	53	2	106
		Exhaust Fan	42	3	126
	Office	Ceiling Fan	53	11	583
		Exhaust Fan	80	2	160
	IQAC Room	Pedestal	80	1	80
	Audit Room	Ceiling Fan	53	2	106
	Conference Hall	Ceiling Fan	53	2	106
	Examination Room	Ceiling Fan	53	2	106
	Principal Office	Ceiling Fan	53	2	106
	Department of English	Ceiling Fan	53	5	265

	A21	Ceiling Fan	53	2	106
	A22	Ceiling Fan	53	2	106
	A23	Ceiling Fan	53	2	106
	A24	Ceiling Fan	53	3	159
	A25	Ceiling Fan	53	4	212
	A26	Ceiling Fan	53	4	212
	A29	Ceiling Fan	53	3	159
	A30	Ceiling Fan	53	4	212
	A31	Ceiling Fan	53	2	106
	A32	Ceiling Fan	53	2	106
	A33	Ceiling Fan	53	2	106
	Civil Service Academy	Ceiling Fan	53	3	159
	E2	Ceiling Fan	53	2	106
	E3	Ceiling Fan	53	4	212
	E4	Ceiling Fan	53	4	212
First Floor	Security Room	Pedestal Fan	80	1	80
	Seminar Hall	Ceiling Fan	53	6	318
	B35	Ceiling Fan	53	2	106
	B34R	Ceiling Fan	53	4	212
	B29	Ceiling Fan	53	2	106
	B28	Ceiling Fan	53	2	106
	B27	Ceiling Fan	53	2	106
	B26	Ceiling Fan	53	2	106
	B35	Ceiling Fan	53		
	Department of Mathematics	Ceiling Fan	53	2	106
	B25	Ceiling Fan	53	2	106
	B24	Ceiling Fan	53	2	106

	Computer Lab-2	Ceiling Fan	53	3	159
	B22	Ceiling Fan	53	2	106
	B21	Ceiling Fan	53	2	106
	Mathematical Computational Lab	Ceiling Fan	53	2	106
	Computer Lab-1	Ceiling Fan	53	2	106
	Department of Commerce	Ceiling Fan	53	4	212
	B10	Ceiling Fan	53	2	106
	B11	Ceiling Fan	53	2	106
	B4	Ceiling Fan	53	2	106
	B6	Ceiling Fan	53	1	53
	Computational Physics Lab	Wall Fan	50	2	100
Second Floor	C1	Ceiling Fan	53	2	106
	Department of Botany	Ceiling Fan	53	2	106
		Pedestal Fan	80	1	80
	Molecular Biology Lab	Ceiling Fan	53	2	106
	Instrumentation Room	Ceiling Fan	53	2	106
	C10	Ceiling Fan	53	2	106
	C11	Ceiling Fan	53	1	53
	C12	Ceiling Fan	53	1	53
	C13	Ceiling Fan	53	2	106
	C14	Ceiling Fan	53	2	106
	C15	Ceiling Fan	53	2	106
	C16	Ceiling Fan	53	2	106
	C17	Ceiling Fan	53	2	106
	C18	Ceiling Fan	53	2	106
	C19	Ceiling Fan	53	2	106
	C20	Ceiling Fan	53	2	106

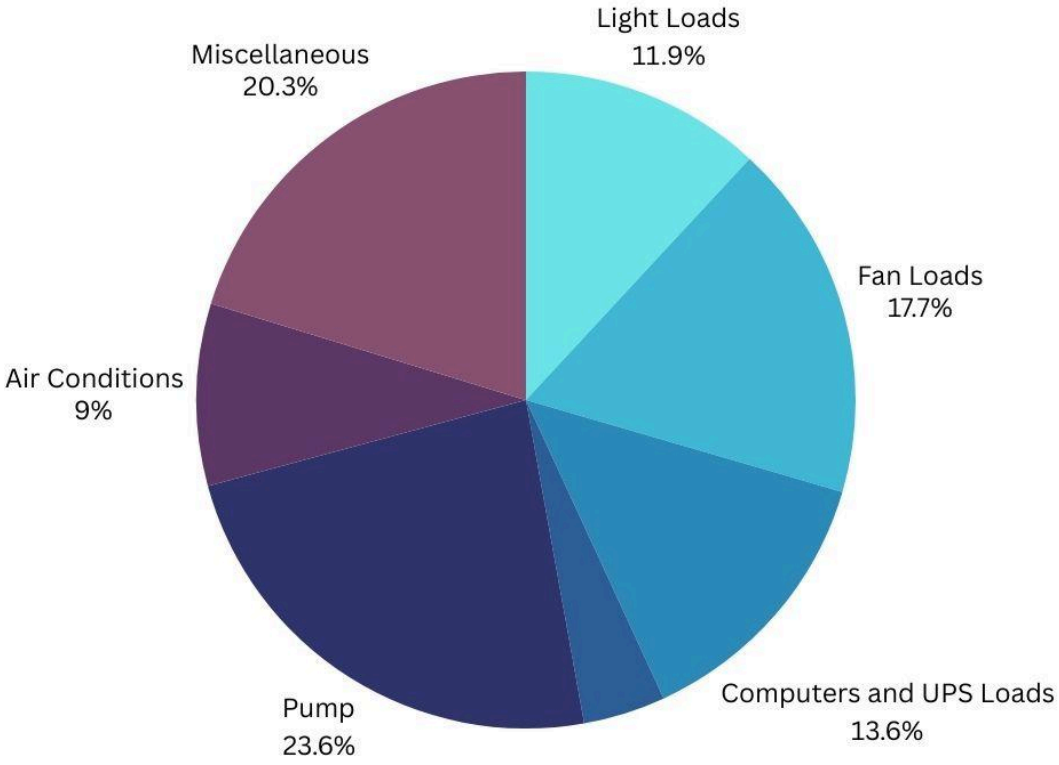
	C21	Ceiling Fan	53	2	106
	C22	Ceiling Fan	53	2	106
	C23	Ceiling Fan	53	2	106
	Department of Humanities	Ceiling Fan	53	2	106
	Zoology Lab	Ceiling Fan	53	4	212
	Library	Ceiling Fan	53	21	1113
		Wall Fan	50	4	200
		Exhaust Fan	50	1	50
	Auditorium	Ceiling fan	53	41	2173
	Women Waiting Room	Ceiling Fan	53	1	53
	NCC Girls Room	Ceiling Fan	53	1	53
	NCC Boys Room	Ceiling Fan	53	1	53
	Canteen	Ceiling Fan	53	3	159
	Physical Education Room	Ceiling Fan	53	1	53
		Wall Fan	50	1	50
	Co-operative Society Store	Ceiling Fan	53	1	53
	Hostels	Ceiling Fan	53	65	3445
		Pedestal Fan	80	1	80
		Exhaust Fan	40	4	160
Block-1	UGC Hostel	Ceiling Fan	60	45	2700
Block- 2	UGC Hostel	Ceiling Fan	60	51	3060
Block- 3	UGC Hostel	Ceiling Fan	60	88	5280
RUSA Block	D1-D8	Ceiling fan	60	22	1320
Total wattage from fan load					29.56 kW

6.4. Summary of Power Consumption

The details of the load connected in the college are given below:

S. No.	Particulars	Total Load (kW)
1	Light Loads	19.87
2	Fan Loads	29.56
3	Computers and UPS Loads	22.80
4	Amplifier and Projector Loads	6.76
5	Pump	39.538
6	Air Conditions	15
7	Miscellaneous	33.92
Total		167.44

Connected Loads in %


Light Loads
11.9%
Fan Loads
17.7%
Computers and UPS Loads
13.6%
Pump
23.6%
Air Conditions
9%
Miscellaneous
20.3%

11. Energy Conservation Measures and Recommendations

Energy Saving Proposal-1:

REPLACEMENT OF CEILING FANS WITH ENERGY EFFICIENT BLDC FANS

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 rotational movement. In a BLDC motor, there are no brushes, so the computation 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 or super fan consists of 3 main components: - 1. Stator 2. Rotor 3. Electronics.

Proposal:

Replace conventional Ceiling Fans with Super Fans. A conventional fan takes approximately 53 watts of power per hour, Whereas a super fan takes only 35 watts per hour. As T. K. M. College of Arts and Science uses a large number of fans on a regular basis, the proposal will make large differences in the case of energy savings.

Cost of installation: Price of 35 Watt standard Super Energy Efficient Fan is Rs. 3,000.00*/- (Approximately)

*Source-http://smehorizon.sulekha.com/india-s-first-remote-controlled-superfan-launched_fmcg-viewsitem_10256

Replacement cost of 250 conventional fans with Super Energy Efficient Fan = 250x3,000

= Rs. 7,50,000/-

Savings Analysis:

The replacement of a conventional fan (most of them are very old) with super fan saves (70-35) = 35 Watt. Assuming, every conventional fan remains ON for 6 hours (on an average) per day, or, 180 hours per month. So, energy savings per month will be 35x180 = 6,300 Wh = 6.3 kWh.

Average energy charge as per electricity bill = Rs. 6 per unit.

So, monthly savings= 6.3x6 = Rs. 37.8/- for one replacement So, yearly savings for 250 replacements = 250x37.8x12= Rs. 113400/-

Payback period:

We know, Payback Period = $Initial\ Investment\ \div\ Savings\ per\ year$

$$= \frac{75000}{113400} = 6.61\ years$$ = 6 years and 7 months (Approximately)

Energy Saving Proposal-2:

Proposal for Installation of a 20 kW Solar On-Grid System

Solar Photovoltaic (SPV) technology offers a sustainable and efficient solution to meet our energy demands. It has several advantages, including:

- **Global Accessibility:** Solar energy is more uniformly distributed worldwide compared to other renewable sources like wind or biomass.
- **Proven Technology:** SPV systems are a well-established and reliable technology.
- **Cost-Effectiveness:** With increasing adoption, solar energy promises to become the most economical renewable power source.

India, owing to its strategic location near the Equator, has immense solar energy potential. The country receives approximately 3000 hours of sunshine annually, translating to nearly 5000 trillion kWh of energy.

At T. K. M. College of Arts and Science, we already utilize solar energy through a rooftop SPV system comprising an 1890 WP solar module, a 3.75 KVA Solar PCU, and four 150 AH C10 solar tubular batteries. To further enhance our green energy initiatives, we propose the installation of a 20 kW solar on-grid system.

This proposed system, designed as a rooftop installation, integrates seamlessly with the existing electrical infrastructure and will serve as an additional source of renewable energy for the campus.

A summary of the proposal is provided below:

Particulars	**Values**
Proposed System	20 kW
Average Energy Consumption	80 kWh/day
Average Energy Consumption in a Year	24000 kWh/ Yr
Average utility electricity cost	Rs. 8.15/-
Annual Financial Savings	Rs. 195600/-
Investment on the project	Rs. 12,00000/-
Payback Period	75 months

References:

1. BEE energy audit books
2. CEA regulations of grid connectivity-2007
3. IEEE Std. 519-1992.
4. National lighting code - 2010

Phone : 0474 - 2712240
Fax : 0474 - 2711817
E-mail : tkmarts@gmail.com
P.B.No. : 1300
Website : www.tkmcas.ac.in

T.K.M. COLLEGE OF ARTS & SCIENCE

KOLLAM - 691005 (Kerala State)

REACCREDITED BY NAAC with A++ GRADE (CGPA-3.67)

Ref: 499A/2023/TKMCAS Date 15/06/2023

Office Order

Subject: Constitution of ENERGY AUDIT TEAM

To ensure effective energy management and conservation within the institution, an Energy Audit Team is hereby constituted. The following members are appointed as part of the Energy Audit Team for conducting the energy audit in the institution:

1. Dr. Baiju V,
   Assistant Professor, Department of Mechanical Engineering,
   TKM College of Engineering, Kollam, Mob: 9895937476,
   Email: baiju@tkmce.ac.in

2. Dr. Sadiq A.
   Professor, Department of Mechanical Engineering, TKM College of Engineering, Kollam, Mob. 9497361282, Email: sadiq@tkmce.ac.in

3. Dr. Mohamed Musthafa K.
   Librarian, T. K. M. College of Arts and Science

4. Dr. Fairoos C.
   Asst. Professor, T. K. M. College of Arts and Science

5. Vinayak S.
   Physics Lab Asst, T. K. M. College of Arts and Science

6. M. Sc Physics Students,
   T. K. M. College of Arts and Science

PRINCIPAL

Copy to:
1. Members Concerned
2. Office File
3. Notice Board

T.K.M. COLLEGE OF ARTS & SCIENCE KERALA KOLLAM - 691005