



ENERGY AUDIT REPORT

ST MICHAEL'S COLLEGE

CHERTHALA

Executed by



2024



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Bureau of Energy Efficiency,
Government of India.



Empanelled Energy Auditor: EMCEEA-0211F,
EMC (Energy Management Centre-Kerala)

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ST. MICHAEL'S COLLEGE
CHERTHALA





Energy Audit Report
St. Michael's College, Cherthala
Report No: EA 1112
2024 January



Empaneled Accredited Energy Auditor, AEA 33
Bureau of Energy Efficiency
Government of India



Empaneled Energy Auditor, EMCEEA-0211F,
Energy Management Centre
Government of Kerala.



Authorized Energy Auditor, GEDA/ENC/EAC: Autho/2014/8/103/2316,
Gujarat Energy Development Agency
Government of Gujarat



Empaneled Energy Auditor, India SME Technology Services Ltd
A joint Venture of SIDBI, SBI, Indian Bank, Oriental Bank of
Commerce & Indian Overseas Bank

About OTTOTRACTIONS

OTTOTRACTIONS, established in 2005, is a distinguished organization with a proven track record and extensive expertise in the fields of energy, engineering, and environmental services. As the first Accredited Energy Auditor from Kerala, OTTOTRACTIONS specializes in conducting Mandatory Energy Audits in Designated Consumers, in accordance with the Energy Conservation Act-2001. Acknowledging its outstanding contributions, the Government of Kerala has recognized and commended OTTOTRACTIONS. In 2009, the organization was honored with the prestigious "The Kerala State Energy Conservation Award" for its exemplary performance as an Energy Auditor. OTTOTRACTIONS takes pride in its commitment to quality, holding ISO 9001-2015, ISO 17020-2012, and ISO 14001-2015 certifications. These certifications underscore the organization's dedication to delivering high-quality services in energy, engineering, and environmental sectors.

Acknowledgment

We extend our sincere gratitude to the administration and staff of St. Michael's College, Cherthala, for the privilege of collaboration. Their timely assistance was instrumental in the successful completion of the audit and the subsequent preparation of this report.

We would like to express our appreciation for the diligent efforts and commitments of all individuals who contributed to the development of this report. Their invaluable support has been crucial to the successful outcome of this endeavor.

A special note of thanks goes to the audit team for their unwavering dedication throughout the audit process. Their bona fide efforts have significantly contributed to the success of this project.

We also want to recognize and appreciate the efforts of our consultants, engineers, and backup staff for their unwavering dedication in bringing this report to fruition.

Thank you,

B V Suresh Babu
Accredited Energy Auditor (AEA 33),
Bureau of Energy Efficiency
Government of India

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Certification

This is to certify that

The data collection has been carried out diligently and truthfully;

All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorised and no tampering of such devices has occurred;

All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts;

Adequate training provided to personnel involved in daily operations after implementation of recommendations; and

The energy audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and Intervals of Time for the Conduct of Energy Audit) Regulations, 2010.

SURESH BABU B V
ACCREDITED ENERGY AUDITOR (AEA 33)
BUREAU OF ENERGY EFFICIENCY
GOVERNMENT OF INDIA

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Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Michael's College, Cherthala					
SI No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 3 No's T8 (40W) Lamps to 18W LED Tube	0.01	0.004	27.06	63
2	Energy Saving in Lighting by replacing existing 6 No's T12 (55W) Lamps to 18W LED Tube	0.02	0.01	21.54	159
3	Energy Saving by replacing existing 147 No's in-efficient ceiling fans with Energy Efficient Five star fans	4.41	0.17	303.69	2766
4	Installation of 25kWp Solar Power Plant	13.75	4.551	36.26	34219
	Total	18.19	4.74	97.14	37207
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					

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1

Introduction

A detailed energy audit was conducted at St. Michael's College by OTTOTRACTIONS in January 2024. The audit revealed several energy-saving opportunities aimed at enhancing the facility's energy efficiency. OTTOTRACTIONS, an Accredited Energy Auditor of the Bureau of Energy Efficiency and an Empaneled Energy Auditor of the Energy Management Centre, Government of Kerala, carried out the assessment.

This energy audit report adheres to the stipulations outlined in the Energy Conservation Act of 2001, specifically focusing on mandatory energy audits (Form 4 [refer regulation 6(2)] guidelines for the preparation of energy audit reports). Additionally, it aligns with the Government of Kerala's directive, as per G.O (Rt) No.2/2011/PD dated 01.01.2011, mandating energy audits.

1.1. General Building details and descriptions

St. Michael's College, Cherthala essentially epitomizes the lofty pedagogical mission of the Diocese of Alappuzha which has been devoting long years to the grooming of erudite citizens for the nation by imparting value-based education materialised through the selfless service of committed and dedicated group of visionaries. The college is situated on the highway, 18 kms north of Alappuzha town, silhouetted against the captivatingly verdant scenery. The sprawling campus of the college with its solemn and serene air is a magnificent sight to behold from the national highway – NH 66. However, the grandeur duly adorns the prime institute under the Diocese of Alappuzha. As the well-deserved outcome of the determined effort of the stalwarts of

the Diocese, a long-treasured dream found its realization in this citadel of knowledge which took its birth on 19 June 1967. The construction of the infrastructure began in the middle of July 1964 itself and the foundation stone was blessed by His Excellency Bishop Michael Arattukulam and was laid by the then Vicar General Msgr. Silverious Jackson. Pledging its loyalty and coalescence, the community joined this noble endeavour quite enthusiastically by setting apart their 'Kettuthengu' to give their mite towards the construction of the college. The pace of progress in its development was duly accelerated by the proper guidance of Msgr. Joseph Thekkepalackal and the institution was initially named as 'St. Michael's Institute'. The college chapel that was built opposite to the college in 1973 later grew into a fullfledged parish church.

Occupancy Details					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Students	1121	1098	1137	1179	1177
Staffs	58	58	53	58	60
Total Occupancy of the college	1179	1156	1190	1237	1237

For calculating specific energy consumption, the total built-up area is considered.

Energy audit team

The Energy Audit team is listed below. Besides this list various domine experts also participated in this project.

1. Suresh Babu B V, Accredited Energy Auditor, AEA 33
2. B. Zachariah, Chief Technical Consultant
3. Abin Baby, Project Engineer
4. Jomon J S, Project Engineer
5. Vishnu S S, Project Engineer
6. Reshma S B, Data Analyst
7. Anjana B S, Project Assistant

2

Facility Description

The energy audit has been carried out at St. Michael's College, Cherthala. The following is the baseline data of this building.

BASELINE DATA SHEET FOR GREEN AUDIT							
1	Name of the Organisation	St. Michael's College, Cherthala					
2	Address (include telephone, fax & e-mail)	St. Michael's College, Cherthala, Mayithara P.O, Alappuzha Dt. PIN: 688539 Phone: 0478 2822387, 2810387(Principal) Email: michaelscherthala@gmail.com					
3	Year of Establishment	1967					
4	Name of building and Total No. of Electrical Connections/building	St. Michael's College (8)					
5	Total Number of Students	Boys	-	Girls	-	Total	1177
6	Total Number of Staff	60					
7	Total Occupancy	1237					
8	Total area of green cover	60%					
9	Type of Electrical Connection	HT	0	LT	8		
10	Total Connected Load (kW)	-					
11	Average Maximum Demand (KVA)	-					
12	Total built up area of the building (M ²)	9600					
13	Number of Buildings	3					

14	Average system Power Factor	-					
15	Details of capacitors connected	Nil					
16	Transformer Details (Nos., kVA, Voltage ratio)	TR 1					
		0					
17	DG Set Details (kVA)	DG1	DG2	DG3	DG4	DG5	Remarks
		62.5					
18	Details of motors	Rating		Nos.		Remarks	
		5 to 10		3			
		10 to 50					
		Above 50					
19	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	Installed Solar power plant and Solar street lights, Installed biogas plant, Energy conservation projects and Rain water harvesting					
20	Contact Person & Telephone number	Dr. Manoj Parameswaran					
		9400562122					



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Energy and Utility system description

3.1.1 Electricity

Electricity is purchased from KSEB under Eight LT Connections, the details are given below. A 65.5kVA Diesel Generators are in operation at this campus

Electricity Connection Details		
St. Michael's College, Cherthala		
1	Name of the Consumer	St. Michael's College, Cherthala
2	Tariff	LT-6A/Ndom
3	Consumer Numbers	1155209003214, 1155200018399, 1155208020126, 1155207021332, 1155201018481
4	Connected Load Total (kW)	-
5	Annual Electricity Consumption (kWh)	31831

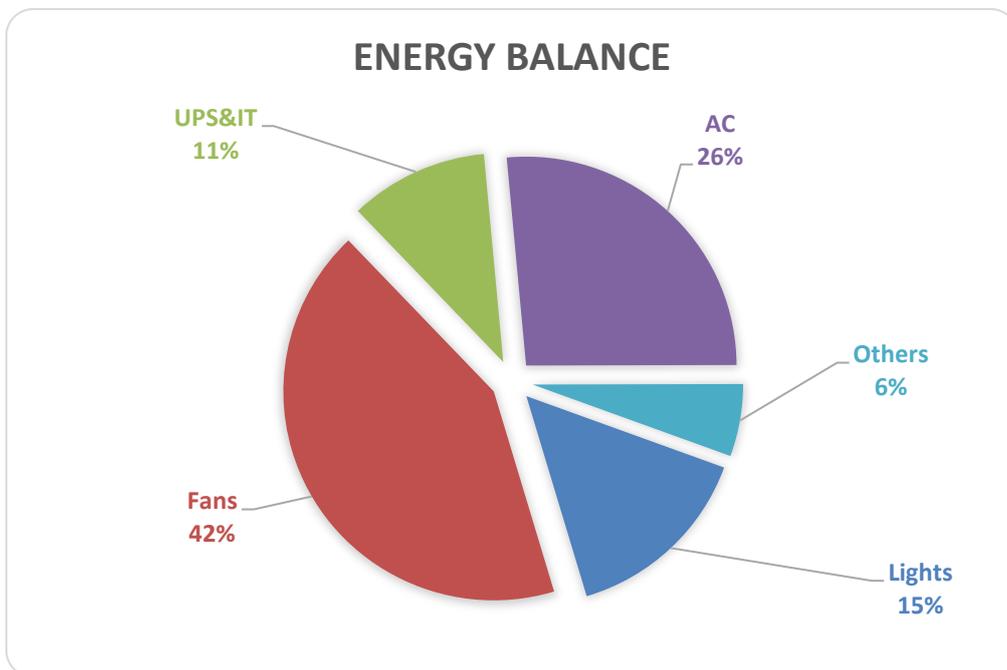
3.2. Thermal Energy / Transportation

No buses are employed by the college for transportation purposes. The canteen utilizes LPG and natural gas for cooking, while diesel is employed to power the Diesel Generators.

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Energy Balance



In this facility, the breakdown of energy consumption reveals that fans contribute to 42%, lighting utilizes 15%, UPS and IT uses 11%, miscellaneous uses make up 6%, and air conditioning systems account for the remaining 26% of the total energy consumption.

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Performance evaluation of major utilities and process equipment's /systems.

5.1. List of equipment and process where performance testing was done.

5.1.1. Electrical System

5.1.2. Lighting & Fans

5.2. Results of performance testing

5.2.1. Electrical System

The average unit cost of electricity is **6.3 Rs/kWh**. This is taken as the basis for the financial analysis of electrical energy efficiency projects. The information on average energy consumption is taken from the historical electricity bill analysis.

Annual Electricity Consumption (kWh)					
Consumer No	2018-19	2019-20	2020-21	2021-22	2022-23
1155209003214	38424	15502	8761	16953	18462
1155200018399	1987	802	453	877	955
1155208020126	5962	2406	1360	2631	2865
1155207021332	662	267	151	292	318
1155201018481	19212	7751	4381	8476	9231
TOTAL	66248	26728	15106	29229	31831

Diesel

The campus is equipped with a 62.5 kVA Diesel Generator. Details regarding diesel consumption are provided below.

Electricity Generated through DGs			
Year	Generator	kWh /yr	cost
	in L		in Rs
18-19	766	2296.5	75019
19-20	968	2903.7	94855
20-21	493	1480.4	48360
21-22	411	1231.7	40235
22-23	1043	3128.5	102199

LPG

LPG is consumed in Canteen, Hostel and laboratory operations

LPG Consumption Details					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
No Cylinders in Canteen	22	20	10	19	21
No Cylinders in Hostel	35	36	5	43	44
No Cylinders in Lab	2	2	1	2	2
Canteen/Lab LPG Consumption in kg	1121	1102	304	1216	1273
Total in kg	1121	1102	304	1216	1273

Solar Power Plant

A solar power plant with a capacity of 20 kWp has been installed on this campus.

Solar Power Plant Off Grid						
Location	Capacity (kWp)	2018-19	2019-20	2020-21	2021-22	2022-23
		Annual generation (kWh)				
Roof Top	10	12775	12775	12775	12775	12775
	10	0	12775	12775	12775	12775
Total	20	12775	25550	25550	25550	25550

Biogas

A biogas plant with a capacity of 2m³ has been installed to manage biodegradable waste, and the produced biogas is utilized in the kitchen.

Biogas Consumption				
	m3	kcal/m3	Daily production kCal	Annual production (kCal)
Biogas plant 1	2	3500	7000	1540000
				1540000

Lighting

SI.No	Locations	Lights					
		LED-T	LED - 40W	LED-sq(40W)	LED B	T8	T12
1	Top						2
2	Manager Room	2			4		
3	Lab	10					
4	IQAC	10					
5	Seminar Hall				14		
6	Conference Room	6					
7	Class x 4	12					
8	Zoology Lab	5					
9	English Department	3					
10	Botany Lab						4
11	Office	4					
12	Auditorium	2	5				
13	Canteen	2		5			
14	Class x 6	12					
15	Class x 4	16					
16	Chemistry Department						
17	Lab			10			
18	Class x 8	24					
19	Fitness Centre	2			3	2	
20	Physics Department	2					
21	Economics Department	3					
22	Riffle Club	5			35		
23	Library	13				1	
Total		133	5	15	56	3	6

Lux Measurement

Sl.No	Location	Avg
1	Manager Room	112
2	Lab	123
3	IQAC	80
4	Seminar Hall	80
5	Conference Room	153
6	Zoology Lab	164
7	English Department	123
8	Botany Lab	97
9	Office	123
10	Auditorium	133
11	Chemistry Department	123
12	Lab	125
13	Fitness Centre	88
14	Physics Department	97
15	Economics Department	123
16	Riffle Club	125
17	Library	133

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Energy Performance Index

The specific energy consumption is typically calculated by dividing the total energy consumed by the entire building by the total floor area. This metric is valuable in assessing the efficiency of a building's energy use, providing a standardized measure that accounts for the energy demands relative to the space it occupies. By considering both energy consumption and building size, specific energy consumption offers a more nuanced understanding of a structure's energy efficiency, facilitating comparisons and the identification of areas for potential improvement in resource utilization.

OTTOTRACTIONS- ENERGY AUDIT						
St. Michael's College, Cherthala						
Energy Performance Index (EPI)						
Sl No	Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
1	Total building area (m ²)	9600	9600	9600	9600	9600
2	Annual Energy Consumption (kCal)	83386852	60680228	39885202	62761365	68854574
3	Annual Energy Consumption (kWh)	96961	70558	46378	72978	80063
4	Total Energy in Toe	8.34	6.07	3.99	6.28	6.89
5	Energy Performance Index kWh/m ²	10.10	7.35	4.83	7.60	8.34

The Energy Performance Index (EPI) is

8.34 kWh/m²

The EPI of 2022-23 may be taken as benchmark.

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TOTAL	66248	26728	15106	29229	31831

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Evaluation of energy management system

Energy management policy

While there is currently no established written energy policy, an existing environmental policy encompasses energy conservation efforts. Below is a draft of an energy management policy that the management may choose to adopt and display within the plant to inspire and motivate the staff.

**ST. MICHAEL'S COLLEGE,
CHERTHALA**

ENERGY POLICY

(Draft)

We are committed to optimally utilize various forms of energy in a cost effective manner to effect conservation of energy resources. We are committed to conserve the energy which is a scarce resource with the requisite consistency in the efficiency, effectiveness in the cost involved in the operations and ensuring that production quality and quantity, environment, safety, health of people are maintained. We are also committed to increase the renewable energy share of the total energy we use.

We are also committed to monitor continuously the saving achieved and reduce its specific energy consumption by minimum of 2% every year.

Date -----

Head of the Institution

7.1. Energy management monitoring system

- **Energy Management Cell** has to be constituted with an objective to revise action plan for energy conservation thereby reducing the production cost.
- Energy conservation tips/ posters are displayed in crucial points.
- Use of renewable energy has to be encouraged.

7.2. Training to staff responsible for operational and Documentation.

- The staff and students need to be made more aware of the importance of energy saving and management.
- Log books shall be maintained to record Electricity Consumption and Diesel consumption.
- Meter reading shall be taken and compared with KSEB regularly.
- Better operating practices regarding appliances and fixtures should be taught to the staff.

7.3. Best Practices

- Have solid Waste management program
- Conducted Green Audit.
- Have different social and environmental clubs
- Installed LED bulbs
- Installed Solar Street Lights and solar power plants in the campus
- Conducted Energy Conservation Training Programs
- Installed Biogas plant.

8

Energy Conservation Measures and Recommendations

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Michael's College, Cherthala					
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1	Energy Saving in Lighting by replacing existing 3 No's T8 (40W) Lamps to 18W LED Tube	0.01	0.004	27.06	63
2	Energy Saving in Lighting by replacing existing 6 No's T12 (55W) Lamps to 18W LED Tube	0.02	0.01	21.54	159
3	Energy Saving by replacing existing 147 No's in-efficient ceiling fans with Energy Efficient Five star fans	4.41	0.17	303.69	2766
4	Installation of 25kWp Solar Power Plant	13.75	4.551	36.26	34219
	Total	18.19	4.74	97.14	37207
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 3 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
3 numbers of T8(40 W) lamps were identified during the energy audit field survey in the facility. During discussion with officers it is observed that the average utility of these fittings are of 30%.	
Proposed System	
The existing T8 may be replaced to LED Tube of 18W in phased manner and the savings will be of 55% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	3
Total load (kW)	0.12
Annual Energy Consumption (kWh)	115
Expected Annual Energy saving for replacing all fittings (kWh)	63
Cost of Power	6.30
Annual saving in Lakhs Rs (1st year)	0.00
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.01
Simple Pay Back (in Months)	27.06

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 6 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
6 numbers of T12(55 W) lamps were identified during the energy audit field survey in the facility. During discussion with officers it is observed that the average utility of these fittings are of 30%.	
Proposed System	
The existing T12 may be replaced to LED Tube of 18W in phased manner and the savings will be of 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	6
Total load (kW)	0.33
Annual Energy Consumption (kWh)	238
Expected Annual Energy saving for replacing all fittings (kWh)	159
Cost of Power	6.30
Annual saving in Lakhs Rs (1st year)	0.01
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.02
Simple Pay Back (in Months)	21.54

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 147 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 147 numbers of ceiling fans installed in the facility with minimum 8 hrs a day operation. All are conventional type and most of them are very old.	
Proposed System	
There is an energy saving opportunity in replace the existing fans with new five star labelled fans. The five star labelled fans give a savings up to 30% with higher service value (air delivery/watt).	
Financial Analysis	
Annual working hours (hrs)	2400
Total numbers of ordinary fans	147
Total load (kW)	10.29
Annual Energy Consumption (kWh)	9878
Expected Annual Energy saving, for total replacement(kWh)	2766
Cost of Power (Rs)	6.30
Annual saving in Lakhs Rs (1st year)	0.17
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	4.41
Simple Pay Back (in Months)	303.69

Energy Saving Proposal	
Installation of 25kWp Solar Power Plant	
Existing Scenario	
There is a good potential of solar power electricity generation. The availability of sunlight is very high. There are some canopies available in the proposed site, but by having proper trimming of trees this may be avoided. If the SPVs are placed on the roof top it will help in improving RTTV (Roof Thermal Transmittance Value) of the building.	
Proposed System	
It is proposed to have a Solar Power Plant of 25 kW at the beginning stage. The state and central government is pushing and giving good assistance to the installation. It can be installed as an internal grid connected system which is much cheaper than off grid system. Now days the technology provides trouble free grid interactive and connected system. The installation will provide 25yrs trouble free generation with only 20% efficiency loss at the 25th year.	
Financial Analysis	
Proposed Solar installed Capacity (kW)	25
Total average kWh per day expected (3.5kWh/day average)	93.75
Total annual Generating Capacity (kWh)	34219
Cost of energy generated annually Lakhs Rs	4.55
Investment required (INR lakh)(Approx)	13.75
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	113.78

General recommendations for energy saving

Install Occupancy Sensors: Implement occupancy sensors in classrooms, offices, and common areas to automatically control lighting and HVAC systems based on room occupancy. This ensures that energy is only consumed when needed.

Upgrade Lighting Systems: Switch to energy-efficient LED lighting throughout the campus. LEDs not only use less energy but also have a longer lifespan, reducing maintenance costs.

Promote Natural Lighting: Encourage the use of natural light by optimizing building layouts and designs. Use skylights, large windows, and light-colored walls to maximize daylight and reduce the need for artificial lighting.

Regular Maintenance of HVAC Systems: Schedule regular maintenance for heating, ventilation, and air conditioning (HVAC) systems. Clean filters, check for leaks, and ensure that the systems operate efficiently.

Implement Energy-Efficient Appliances: When upgrading appliances or equipment, choose energy-efficient models. Look for ENERGY STAR ratings for computers, printers, vending machines, and other campus equipment.

Educate and Engage the Community: Raise awareness about energy conservation among students, faculty, and staff. Encourage responsible energy use and provide tips on how individuals can contribute to saving energy.

Establish Energy-Saving Policies: Develop and enforce energy-saving policies, such as turning off lights and electronic devices when not in use. Incorporate these policies into campus culture through education and awareness campaigns.

Optimize Temperature Settings: Set thermostats to energy-efficient temperatures. Encourage individuals to dress appropriately for the weather and use personal fans or heaters when needed instead of adjusting the thermostat.

Implement Smart Building Technologies: Invest in smart building technologies that can optimize energy use based on real-time data. This may include advanced building management systems and automated controls.

Utilize Renewable Energy Sources: Consider incorporating renewable energy sources, such as solar panels or wind turbines, to generate clean energy for the campus.

Promote Sustainable Transportation: Encourage the use of sustainable transportation options, such as biking, walking, or carpooling. Provide bike racks and support public transportation initiatives.

Conduct Regular Energy Audits: Schedule periodic energy audits to identify areas for improvement and track energy consumption patterns over time.

Implementing a combination of these strategies can contribute to significant energy savings on a college campus.

Technical Supplements

St. Michael's College, Cherthala															
SI.No	Locations	Lights						Fans				IT		AC	
		LED-T	LED - 40W	LED-sq(40W)	LED B	T8	T12	CF	WF	PF	EF	Projector	PC	1.5 TR	
1	First floor	Top					2								
2		Manager Room	2			4			2						1
3		Lab	10						6						
4		IQAC	10						4						2
5		Seminar Hall				14									6
6		Conference Room	6												2
7		Class x 4	12						16						
8		Zoology Lab	5						4						
9		English Department	3						3						
10		Botany Lab					4		8						
11		Office	4						4		1			4	
12		Auditorium	2	5					19						
13		Canteen	2		5				6						
14		Class x 6	12						12						
15		Class x 4	16						24				4		
16	Ground	Chemistry Department						3	1						
17		Lab			10				1		4				

18	Class x 8	24						24						
19	Fitness Centre	2			3	2		5					13	
20	Physics Department	2						3						
21	Economics Department	3						4					2	
22	Riffle Club	5			35				4					1
23	Library	13				1			4				4	2
Total		133	5	15	56	3	6	147	10	1	4	4	23	14