ENERGY AUDIT REPORT

RAJAGIRI COLLEGE OF MANAGEMENT AND APPLIED SCIENCES

KAKKANAD

Executed by

OTTOTRACTIONS
Energy-Engineering-Environment

2023-24

OTTOTRACTIONS
Energy - Engineering - Environment

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Empanelled Accredited Energy Auditor: EmAEA-33
Bureau of Energy Efficiency,
Government of India.

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

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Energy Audit Report

Rajagiri college of Management & Applied Sciences, Kakkanad

Report No: EA 1126
2023-24

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 an organization with proven track record and knowledge in the field of energy, engineering, and environmental services. They are the first Accredited Energy Auditor from Kerala for conducting Mandatory Energy Audits in Designated Consumers as per Energy Conservation Act-2001. Government of Kerala recognized and appreciated OTTOTRACTIONS by presenting its prestigious “The Kerala State Energy Conservation Award” for the best performance as an Energy Auditor. Ottotractions is an ISO 9001-2015, ISO 17020-2012 and ISO 14001-2015 Certified organization, which ensures the quality of its services.

Acknowledgment

We were privileged to work together with the administration and staff of Rajagiri college of Management & Applied Sciences, Kakkanad .We are grateful to them for the timely help extended to complete the audit and bringing out this report.

With gratitude, we acknowledge the diligent effort and commitments of all those who have helped to bring out this report.

We also take this opportunity to thank the bona-fide efforts of audit team for unstinted support in carrying out this audit.

We thank our consultants, engineers and backup staff for their dedication to bring this report.

Thank you.

For OTTOTRACTIONS

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

Contents

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

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
Rajagiri College of Management and Applied Sciences.					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 6 No's T8 (40W) Lamps to 18W LED Tube	0.02	0.01	20	95
2	Energy Saving by replacing existing 236 No's in-efficient ceiling fans with Energy Efficient Five star fans	7.08	0.77	110.45	6706
	Total	**7.10**	**0.78**	**65.12**	**6801**
(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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Introduction

A detailed energy audit has been carried out at Rajagiri college of Management & Applied science, Kakanad by OTTOTRACTIONS in February 2024. During the energy audit energy saving opportunities has been identified to help improving energy efficiency of the facility. OTTOTRACTIONS is an Accredited Energy Auditor of Bureau of Energy Efficiency and Empaneled Energy Auditor of Energy Management Centre, Government of Kerala.

This energy audit report complies with the clauses in *Energy Conservation Act, 2001* on mandatory energy audit (**Form 4** [refer regulation 6(2)] guidelines for preparation of energy audit report) and complies with the G.O (Rt) No.2/2011/PD dated 01.01.2011 issued by Government of Kerala on mandatory energy audit.

1.1. General Building details and descriptions

Rajagiri College of Management and Applied Sciences, Kakkanad is a vision of the Sacred Heart Province of Carmelites of Mary Immaculate (CMI) Congregation, the first indigenous Catholic religious congregation in India. The institution marked its inception in the year 2005 and is modelled on the dream and vision of Saint Kuriakose Elias Chavara, the founder of CMI Congregation and a social reformer of 19th century. Celebrating its crystal jubilee the college aims at the formation of future leaders who intellectually, spiritually and morally champion the cause of justice, love, truth and peace. It is situated at the Rajagiri Valley campus which is beautifully landscaped on the banks of Chithrapuzha and Kadamprayar. The campus takes

pride in its proximity to major industrial and technological establishments. Affiliated to Mahatma Gandhi University, the college offers two post graduate programmes and ten undergraduate programmes in Commerce, Management, Computer Science, Animation and English.

Led by Dr. Laly Mathew, Principal, the college fosters a dedicated learning environment with a team of sixty-six faculty members across five departments. Supported by 18 administrative staff members, the college's vision is to transform individuals into well-rounded and ideal human beings. Upholding its mission, Rajagiri strives to empower students to become responsible citizens equipped with intellectual, social, and environmental awareness.

Occupancy Details	
Particulars	2023-24
Total Students	1856
Staffs	100
Total Occupancy of the college	1956

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 P, Data Analyst
7. Anjana B S, Project Assistant

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Building description

The energy audit has been carried out at Rajagiri college of Management & Applied Sciences, Kakkanad.The following is the baseline data of this building.

BASELINE DATA SHEET FOR GREEN AUDIT											
1	Name of the Organisation	Rajagiri College of Management and Applied Sciences.									
2	Address (include telephone, fax & e-mail)	Rajagiri College of Management and Applied Sciences,Rajagiri valley P.O, Kakkanad, Kochi - 682039									
3	Year of Establishment	2005									
4	Name of building and Total No. of Electrical Connections/building	Rajagiri College of Management and Applied Sciences (1)									
5	Total Number of Students	Boys	1010	Girls	846	Total	1856				
6	Total Number of Staff	100									
7	Total Occupancy	1956									
8	Total area of green cover	80%									
9	Type of Electrical Connection	HT	0	LT	1						
10	Total Connected Load (kW)	68									
11	Total built up area of the building (M^2)	9560									
12	Number of Buildings	1									
13	Average system Power Factor	0.99									
14	Transformer Details (Nos., kVA, Voltage ratio)	TR 1	-								
15	DG Set Details (kVA)	DG1	DG2	DG3	DG4	DG5	Remarks				
		62.5	-	-	-	-					
16	Details of motors	Rating		Nos.		Remarks					
		5 to 10		2							
17	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	Installed Solar power plant, Energy conservation projects, Rain water harvesting									
18	Contact Person ,Telephone number & Email	Joby Jacob									
		9895167004									
		office@rajagiricollege.edu.in									

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Energy and utility system description

3.1.1 Electricity

The institution procures electricity from Kerala State Electricity Board (KSEB) through an LT feeder. Details regarding this connection are provided below. Additionally, the campus utilizes a 62.5 kVA diesel generator and a grid-tied solar power plant with a capacity of 182 kWp.

Electricity Connection Details		
Rajagiri College of Management and Applied Sciences.		
1	Name of the Consumer	Rajagiri College of Management and Applied Sciences.
2	Annual Electricity Consumption (kWh)	42116

3.2. Thermal Energy / Transportation

The college maintains a fleet of eight buses for student transportation. Exploring alternative fuel options for these buses and the on-site diesel generator could enhance the college's power input redundancy.

Diesel Consumption Details				
Year	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
23-24	3600	350.00	3950	378015

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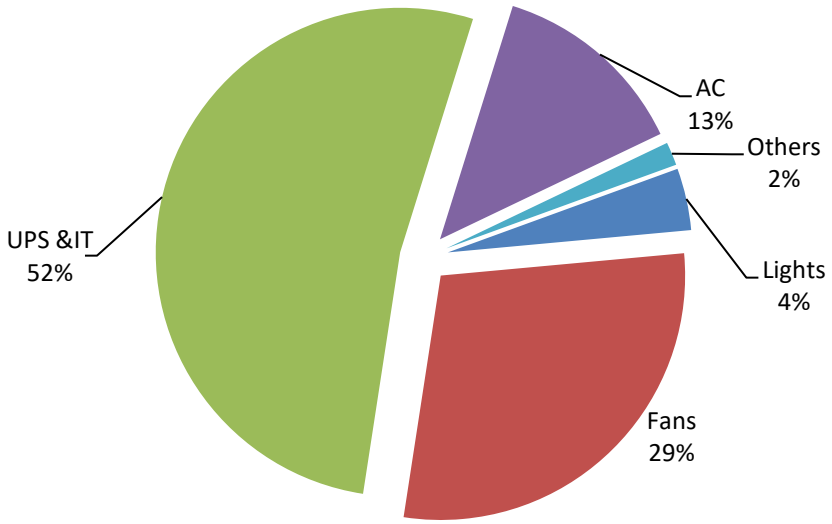
Energy Balance



Fans account for 29% of the overall energy consumption in this facility, while lighting utilizes 4%, UPS and IT contribute 52%, and other miscellaneous uses constitute 2%. Additionally, 13% of the total energy is consumed by air conditioning systems.

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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 tests

5.2.1. Electrical System

The average unit cost of electricity is **11.47 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	**2023-24**	**Connected Load (kW)**
PCC 10	42116	68

Diesel

The college operates a 62.5 kVA diesel generator. The details of Diesel consumption are given below.

Electricity Generated through DGs			
Year	Generator in L	kWh /yr	Cost in Rs
23-24	350	1050.0	33495

Biogas

Biogas Consumption				
	m^3	$kCal/m^3$	Daily production kCal	Annual production (kCal)
Biogas plant 1	0.75	3500	2625	577500

LPG

LPG is consumed in the Canteen.

LPG Consumption Details	
Particulars	2022-23
No Cylinders	10
LPG Consumption in kg (in Canteen)	190.0
Total in kg	190.0

Base Line Energy Data		
Rajagiri College of Management and Applied Sciences.		
		2023-24
1	Electricity KSEB (kWh)	42116
2	Electricity DG (kWh)	1050
3	Electricity Solar, Off grid (kWh)	0
4	Electricity (KSEB + DG + Off grid) kWh	43166
5	Electricity Solar Grid Tied (kWh)	232505
6	Diesel (L)	3950.0
7	LPG (kg)	190.0
8	Biogas generated/year (kg)	123.75

Energy Consumption Profile		
Sl No	Fuel	2023-24
		kCal
1	Electricity	37122760
2	Diesel	41475000
3	LPG	2280000
4	Biogas	577500
Total		81455260

Lighting

Sl.No	Location	Lights		
		T8	LED-T	LED-R
1	BA English Triple Main	2	6	2
2	BA Animation and Graphic Design		8	1
3	BBA	2	6	
4	BCA		6	2
5	BCOM Computer applications		6	
6	BCOM Finance and taxation	1	6	4
7	BCOM Logistics Management		6	1
8	BCOM Marketing	1	8	
9	MCOM Finance and Taxation		8	
10	MA Graphic Design		8	6

Lux Measurement

Sl.No	Location	Avg
1	BA English Triple Main	112
2	BA Animation and Graphic Design	123
3	BBA	121
4	BCA	146
5	BCOM Computer applications	164
6	BCOM Finance and taxation	153
7	BCOM Logistics Management	159
8	BCOM Marketing	164
9	MCOM Finance and Taxation	144
10	MA Graphic Design	123

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Energy efficiency in utility and process system

The specific energy consumption or Energy Performance Index (EPI) is normally taken as the ratio of total energy consumed to the total are of building.

OTTOTRACTIONS- ENERGY AUDIT		
Rajagiri College of Management and Applied Sciences.		
Energy Performance Index (EPI)		
Sl No	**Particulars**	2023-24
1	Total building area (m^2)	9560
2	Annual Energy Consumption (kCal)	81455260
3	Annual Energy Consumption (kWh)	94715
4	Total Energy in Toe	8.15
5	Specific Energy Consumption kWh/m^2	9.91

The Energy Performance Index (EPI) is

9.91 kWh/m^2

The EPI of 2023-24 may be taken as benchmark.

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Evaluation of energy management system

Energy management policy

An Energy Management Policy is available in the campus

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 KSEBL regularly.
- Better operating practices regarding appliances and fixtures should be taught to the staff.

7.3. Best Practices

- The premises of the campus are lit by Solar lights
- Electric charging points are installed in the campus
- Separate Cycle parking area for promoting sustainable mobility
- Have solid Waste management program.
- Have different social and environmental clubs

- E-waste on campus is managed by an external agency.
- Conducted Energy Conservation Training Programs.

7.5 Suggested Strategic Initiatives for 2024-25

- 100 percent LED Campus
- Energy Meter near the Charging Station at the Parking Lot.
- Integrated Energy Management System
- Incorporation of courses to promote sustainability
- Shared Facilities of the college

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Energy Conservation Measures and Recommendations

Executive Summary					
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	Total	**7.10**	**0.78**	**65.12**	**6801**
(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 Code 1	
Energy Saving in Lighting by replacing existing 6 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
6 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	6
Total load (kW)	0.24
Annual Energy Consumption (kWh)	173
Expected Annual Energy saving for replacing all fittings (kWh)	95
Cost of Power	11.48
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)	19.80

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 236 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 236 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	236
Total load (kW)	18.88
Annual Energy Consumption (kWh)	18125
Expected Annual Energy saving, for total replacement(kWh)	6706
Cost of Power (Rs)	11.47
Annual saving in Lakhs Rs (1st year)	0.77
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	7.08
Simple Pay Back (in Months)	110.45

Technical Supplements

Rajagiri College of Management and Applied Sciences.												
Sl.No	Location	Lights			Fans		IT		UPS	AC		Others
		T8	LED-T	LED-R	CF	BLDC	PC	Printer	5 kVA	1 TR	1.5TR	Lcd proj
1	BA English Triple Main	2	6	2	28	2	5	1				
2	BA Animation and Graphic Design		8	1	27		40	1	1		2	1
3	BBA	2	6		22	2	15	1				1
4	BCA		6	2	22		15	1				1
5	BCOM Computer applications		6		18	2	44	1	1	1	1	1
6	BCOM Finance and taxation	1	6	4	22	1	16	1				
7	BCOM Logistics Management		6	1	24		50	1	1			
8	BCOM Marketing	1	8		27	1	12	1				
9	MCOM Finance and Taxation		8		28		12	1				1
10	MA Graphic Design		8	6	18	4	52		2		2	1

Electricity Bill Details (2023-24)		
Name of the Consumer		Rajagiri College of Management and Applied Sciences.
Month	kWh	Total amount to be paid (Rs)
Mar	2997	33267
Apr	2667	32804
May	2221	25542
Jun	3840	43392
Jul	2412	27256
Aug	4462	52205
Sep	4907	56921
Oct	3583	41921
Nov	4028	44308
Dec	3706	42990
Jan	3285	37121
Feb	4008	45290